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Intelligent fetal monitoring and decision support in the management of labour

by

Robert Duncan Falconer Keith

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Abstract

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The condition of the fetus during labour is inferred from the continuous plot of fetal heart rate and uterine contractions (cardiotocogram, CTG). This can be difficult to interpret which results in both unnecessary intervention and a failure to intervene when necessary causing potentially preventable neurological damage and mortality. Conventional computing approaches have not been successful in addressing these problems. This is perhaps because the correct interpretation of fetal condition requires physiological knowledge, considerable practical experience and knowledge of the specific patient.

The work described in this thesis is concerned with the investigation of artificial intelligence techniques to assist in the interpretation of fetal condition and advise on labour management. A fundamental investigation examined the performance of five types of scalp electrodes for obtaining the fetal electrocardiogram (ECG), from which heart rate is derived, and examined the factors which hamper fetal ECG data acquisition. New methods were developed to classify the important features from the CTG and included an investigation using neural networks. Other CTG features were classified using novel numerical algorithms developed closely with experts. An expert system, guided by a database of rules obtained from experts, was used to process and interpret changes in the CTG features by taking account of patient specific information. This hybrid approach was adopted to improve performance and reliability.

After two internal evaluations had found the system obtained a performance comparable with local experts, an extensive external validation was undertaken. This study involved 17 experts from 16 leading centres within the UK. Each expert and the system reviewed 50 cases twice, at least one month apart which contained those considered most difficult to interpret selected from a database of 2400 high risk labours. A novel method was developed to present all the relevant clinical information in a way which approximated the clinical situation. The reviewers scored each 15 minutes of recording according to the concern they had for the fetus and the management they considered appropriate. In this respect, this is the first reported study to examine the performance of expert obstetricians in the management of labour. A new method was derived to measure the agreement between the scores obtained and is applicable to other areas where it is required to measure the similarity between time related sequences. This study found that the experts agreed well and were consistent in their management of the cases. The system was indistinguishable from the experts, except it was more consistent, even when used by an engineer with little knowledge of labour management.

This study has shown that expertise in fetal monitoring is achievable in which case the current evidence suggests that this is not being adequately transferred to clinicians. The challenge remains to formulate a method to effectively transfer knowledge to the labour ward and thereby address the real and practical problems which face fetal monitoring today. This study demonstrates that intelligent systems could provide the vehicle to achieve this.

I dedicate this work to the memory of my father, Bradley Kenneth Keith with a hope that he always believed it possible. I know he would have had some interesting comments to make and I sadly miss the opportunity of discussing them with him.

I also dedicate this work to my mother for always being there, and to my wife Michelle for her unwavering support, patience and most of all her encouragement throughout this work.

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Development of an intelligent decision support tool for the management of labour. 26th British Congress of Obstetrics and Gynaecology. Manchester, UK. 7-10 July, 1992.

An intelligent decision support tool for the management of labour. VIIIth International Congress The fetus as a patient. Oulu, Finland. 15-18 September, 1992.

Expert systems in medicine. Society for the Study of Fetal Physiology. 20th Annual Meeting. Plymouth, UK. 16-19 May, 1993.

Signed ..... R Keith .....

Date 10th September 1993

"The world of reality is a world of limitations"

Gilbert Keith Chesterton (1874-1936).

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Chapter 1

Introduction to the management of labour.

1.1 The stress of labour.

Labour is a very special and emotional experience, but it is also a particularly stressful time for those involved. For the mother, changes occur in her body which are stressful and can be painful. The uterine contractions, which occur irregularly and often painlessly during the pregnancy, become progressively more frequent and more painful during labour and their timing cannot be influenced voluntarily. In the normal first stage of labour, the contractions cause the cervix to dilate from closed, to a diameter of 10 centimetres, to allow the descent of the fetus. This is likely to take several hours to complete but in hospital usually lasts no longer than 12 hours for a woman expecting her first baby. During the early part of labour the pain may not be severe but towards the end of the first stage as the cervix reaches full dilatation, it can become extremely painful indeed.

The fetus begins its descent down the birth canal during the second stage of labour as the resistance offered by the cervix has been overcome. The nature of the pain experienced here is different from that of the first stage. With each contraction, the mother takes a deep breath and bears down with all the force of her abdominal muscles. Each contraction forces the fetal presenting part down onto the pelvic floor. However, during the intervals between contractions, the pelvic floor at first pushes the fetus back up again. After being pushed down many times by the contractions and slipping back during the intervals, a time is reached when the fetus is stationary. Now, with each contraction and expulsive effort, the head moves slowly down and becomes more visible.

The stress of labour experienced by the mother is perhaps the most obvious to appreciate, but for the fetus, labour is a particularly stressful time for which it has had to evolve some sophisticated defence mechanisms to protect itself. The life-line for the fetus is the umbilical cord which carries to it oxygen-rich blood and carries away CO_2 and other by-products. During each contraction, blood flow to the placenta is inhibited and the umbilical cord can be occluded. This prevents the arrival of oxygenated blood causing short periods of hypoxaemia (lack of oxygen in the blood) and preventing the release of CO_2.

The time between contractions is therefore essential for allowing the placental circulation to be re-established. As the contractions become more frequent, the time for recovery reduces and the fetus will accumulate CO_2. If the circulation is further inhibited, then the fetus will become hypoxic (lack of oxygen in organs) which will be exacerbated with low maternal blood pressure and insufficient umbilical blood flow. The level of hypoxia is monitored by fetal chemoreceptors located in the major blood vessels which stimulate the sympathetic nervous system causing preferential blood distribution (and therefore oxygen distribution) to the essential organs; the heart, brain, adrenal glands and placenta. In addition, there is also an increase in the levels of circulating catecholomenes; adrenaline and noradrenaline, which raise the heart rate and increase cardiac output. With persisting hypoxia, a critical time will

come when the oxygen level and blood flow to an organ are no longer sufficient for aerobic cellular metabolism. At this point reserves of glycogen stored principally in the myocardium and liver will be broken down as glucose by a process called glycogenolysis. This is metabolised anaerobically (without oxygen) and will provide the energy required to maintain organ function. The by-product of glycogenolysis is lactic acid which is taken up by buffering in the haemoglobin. The fetus can only maintain anaerobic metabolism for a limited time which is dependent on the level of glycogen reserves it began with and the capacity of the buffering system. This means that the growth retarded fetus, with small stores of glycogen, is particularly vulnerable to hypoxia during labour. Continued hypoxia will eventually exhaust the supply of glycogen and the production of lactic acid will overcome the buffering systems, whereupon the fetus will develop a metabolic acidosis. With a decreasing pH comes a non-linear increase in the concentration of noxious free hydrogen ions which are the agents responsible for tissue damage. Below a pH of 7.0, the enzyme systems are inhibited and further falls will lead to brain damage and eventually death (Kjellmer, 1988).

The mother and fetus are not the only parties for which labour can be stressful. It can also be a difficult time for the clinician who is charged with the responsibility of caring for not one, but two patients. In this respect, the role for the obstetrician and midwife is unlike that of any other medical speciality. The ideal conclusion for both mother and fetus is a normal vaginal delivery. This is the goal for the clinical staff too, but events can occur where an assisted delivery becomes necessary. For the mother, an operative intervention may be required if she becomes exhausted, if the presentation of the fetus is unfavourable, the fetus is large or if the cervix does not reach full dilatation. The comparative risks for the mother during labour have been dramatically reduced over the last century, which means that today she is at little risk in a hospital environment. However, for the fetus, the risks in labour are considerably greater.

The management of labour is an intensive care situation. Events can occur rapidly which require clear decision making, swift action and considerable skill. The task for the obstetrician is often to judge whether intervention is required, which for the fetus, is determined when fetal stress becomes fetal distress. On the one hand, unnecessary intervention for the fetus responding appropriately to the stress of labour is undesirable; an unnecessary caesarean section (CS) places the mother at higher risk and commits her to a major operation which reduces her chances of having normal childbirth for subsequent children. On the other hand, operative intervention is imperative for the distressed fetus who becomes at risk of sustaining neurological damage or mortality.

This dilemma has been appreciated since early times and indicates the need to monitor the condition of the fetus in some way, throughout labour.

1.2 Fetal monitoring during labour.

The goal for the obstetrician is to manage labour with minimal intervention without jeopardising the safety of the fetus. Prior to the 1960's, the only method to assess the condition of the fetus was by intermittent auscultation, where a trumpet-like device was positioned on the maternal abdomen and the beating of the fetal heart listened to. The clinician would count the number of fetal heart beats audibly detected in a period of time and express this figure as the average number of beats per minute. This would be noted in relation to contractions and persistent prolonged falls in rate acted upon.

The electrical activity of the fetal heart is described by the fetal electrocardiogram (ECG) which was first recorded by Cremer in 1906 superimposed upon the maternal electrocardiogram. During the 1960s, the emergence of relatively low cost computing power meant that the fetal ECG could be processed in real time.

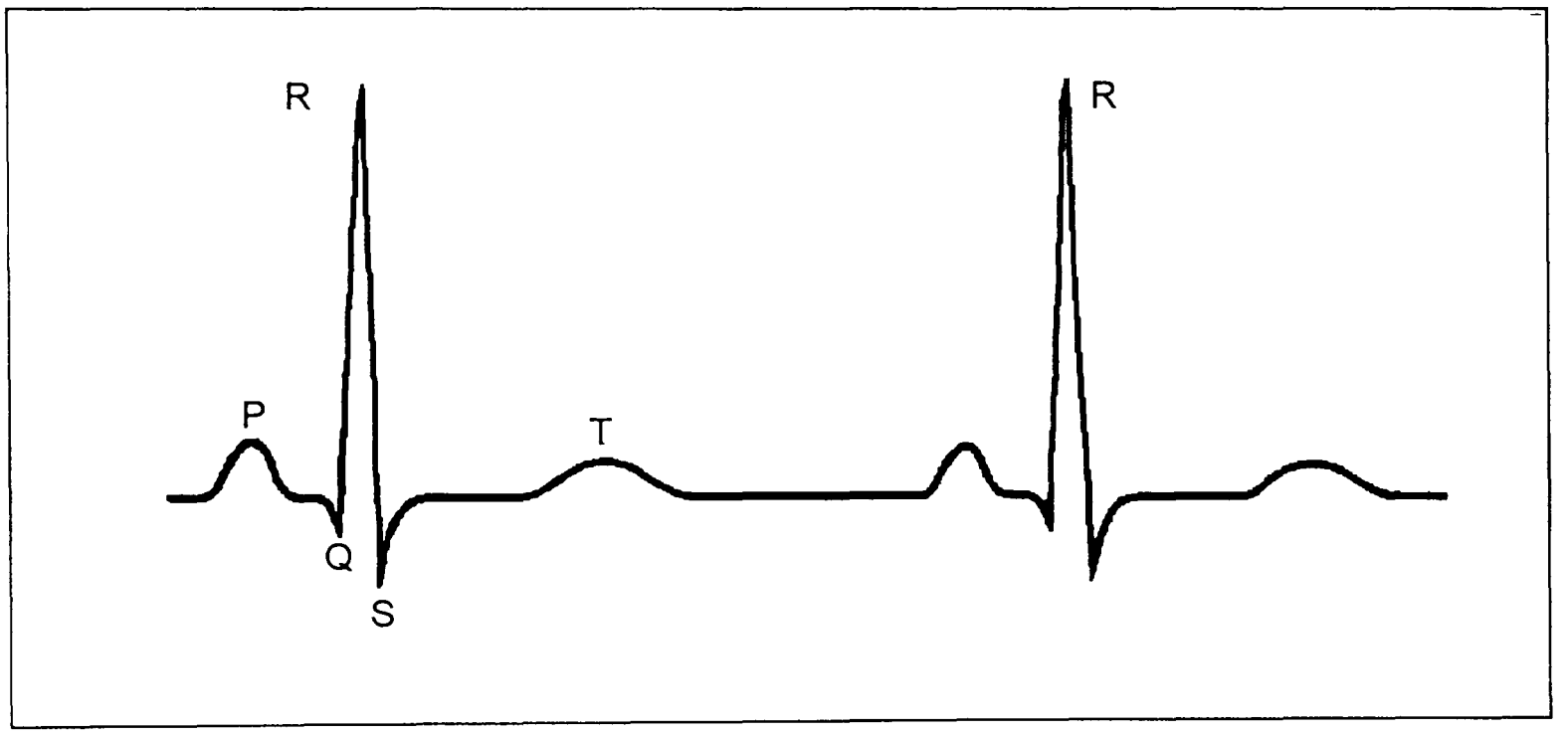


Figure 1.1: The ECG waveform.

The ECG waveform is shown in figure 1.1 and like the adult, each complex represents a heart beat and is made up of the P, Q, R, S, and T waves. The P wave represents the nervous stimulus which causes the polarised muscle cells of the heart to depolarise to form the QRS wave as they contract during the beat. The ST waveform and T wave, represent the active phase of the cardiac cycle and involve the repolarisation of the heart cells ready for the next stimulus. The fetal ECG is obtained from an electrode attached to the fetal scalp (fetal scalp electrode, FSE) and are described in more detail in chapter 2.

Each fetal heart beat can therefore be identified with each ECG complex. The R-wave is usually taken as the point of reference as it is the most prominent feature and therefore the

most accurately detected. The time between successive ECG complexes, the R-R interval, is the measurement from which the instantaneous heart rate (beats per minute) can be calculated using equation 1.1.

$$heart\ rate = \frac{60}{R_2(t) - R_1(t)} \tag{1.1}$$

Where, $R_1(t)$ and $R_2(t)$ represent the timings of two successive R waves expressed in seconds. The average fetal heart rate at term is approximately 140 bpm which has an equivalent R-R interval of approximately 0.43 seconds.

The development of this technique meant that it became possible to record the fetal heart rate continuously and more accurately than by intermittent auscultation which has the further disadvantage of being labour (human resources rather than childbirth!) intensive. Methods were also developed which allowed the continuous recording of the uterine contractions to be made which when plotted simultaneously with the fetal heart rate, comprise the cardiotocogram or CTG.

The equation which relates heart rate to R-R interval has interesting properties. To refer to this measure as 'heart rate' is misleading because 'rate' implies frequency. This measure is not the number of heart beats actually occurring in unit time, it simply indicates the number of heart beats which would have occurred in unit time if the single R-R interval used to derive the measure was periodic; which it is not. The timing between heart beats is seldom constant as it is continuously influenced by a highly sophisticated control system, governed by the sympathetic nervous system which seeks to reduce the interval between beats and the parasympathetic nervous system which seeks to increase the interval. The heart rate measure obtained from this equation has a non-linear, inverse relationship to the physiological variable from which it is derived. The reasons for adopting this measure rather than the actual physiological measurement are probably historical and reflect a reluctance on the part of clinicians to change from the units of measure they were used to (beats per minute), to unfamiliar units (seconds). Conceptually too, it is easy for clinical staff to visualise in terms of beats per minute. Obviously transforming the physiological variable in this way will considerably alter the profile of the resultant plot but this could have been corrected with a non-linear axis. Although this was proposed, such a scale was not adopted perhaps because a non-uniform scale is confusing or possibly it was for aesthetic reasons. The implications of introducing this transformation of the physiological variable, given the profound modification it makes to the features contained within the plot, has never been investigated.

The first clinically usable cardiotocograph was developed in 1968 by Hammacher in collaboration with Hewlett-Packard (Hammacher, 1969). Figure 1.2 shows a segment of CTG recording where the upper trace is the fetal heart rate expressed in beats per minute and the lower trace indicates the uterine contractions. The time base for the plot can be varied but is usually 1cm per minute in the UK, Europe and Australasia and 3cm per minute in the USA.

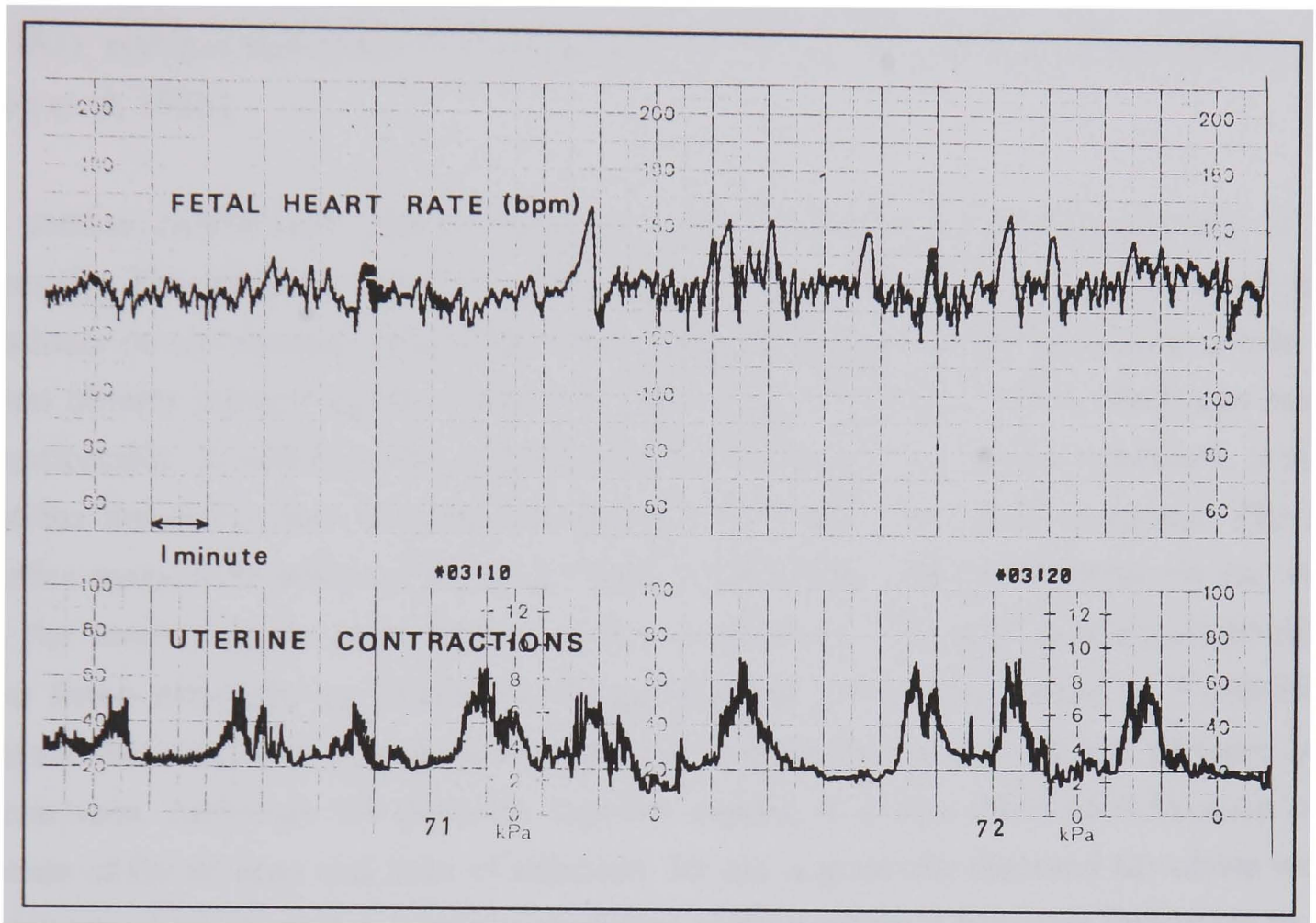


Figure 1.2: The cardiotocogram (CTG).

The CTG was rapidly introduced into clinical practice, without extensive clinical trials and quickly became the accepted standard by which the condition of the fetus during labour was monitored. Although the objectives were never clearly defined, it was hoped that continuous fetal heart rate monitoring would better identify the compromised fetus and thereby reduce or prevent stillbirth and neurological handicap resulting from birth asphyxia.

1.2.1 Current methods for obtaining the cardiotocogram.

The most accurate and preferred method for obtaining the fetal heart rate is from the fetal ECG. The ECG is obtained from an electrode inserted via the vagina to pierce the fetal presenting part following the rupture of the membranes. However, this method by definition is invasive and the signals it obtains can be difficult to analyse. This is considered more fully in Chapter 2.

The fetal heart rate may also be derived using ultrasound techniques where a transducer is secured in position on the maternal abdomen using a belt. A continuous beam of ultrasound is transmitted through the mother to the fetal heart. As the fetal heart is continuously moving, the frequency of the reflected waves undergo a Doppler shift. These changes in frequency are interpreted by the receiving equipment and the instantaneous heart rate is calculated. This method can be used prior to membrane rupture and is non-invasive. However, ultrasound is a less accurate method for obtaining the fetal heart rate (Lawson et al, 1983), and it is also easier to inadvertently record the maternal heart rate (Amato, 1983; Divon et al, 1985) .

The uterine contractions can be recorded using transducers applied invasively or non-invasively. The simplest and most common method is achieved using an external strain transducer or tocodynamometer secured in place on the maternal abdomen with a belt. This system obtains inferior signals as the belt may need to be tightly fitted which can become uncomfortable. In addition, this method cannot be calibrated to measure pressure, it simply identifies the occurrence of contractions which is adequate for most purposes. The most accurate measure is achieved invasively with a fluid filled catheter inserted via the vagina into the uterine cavity upon rupture of the membranes. This uses a pressure transducer either fitted externally or located in the catheter tip. With this method, it is possible to calibrate the system to accurately measure the uterine tone as well as the pressure of the contractions. Although this provides superior signals, it is less often used because of the expense of the devices and risks of infection. Its use is generally reserved for obese women or women who have had a previous caesarean section where it becomes important to have an accurate measure of uterine pressure to minimise the risk of the contractions rupturing the uterus along the scar.

In the UK, approximately one third of women receive continuous monitoring, in the USA it is nearer half (Westgate et al, 1993). The decision to monitor continuously is taken if the patient is considered at higher risk than normal, although many would argue that all those in labour are high risk. Continuous monitoring would be commenced for example, if the woman was receiving an epidural, required drugs to augment labour, had diabetes, high blood pressure, a previous CS, was post mature, or where the fetus was large or small for dates. Those that are not continuously monitored will have intermittent auscultation.

1.2.2 Interpretation of the cardiotocogram.

The important features of the CTG are shown in figure 1.3.

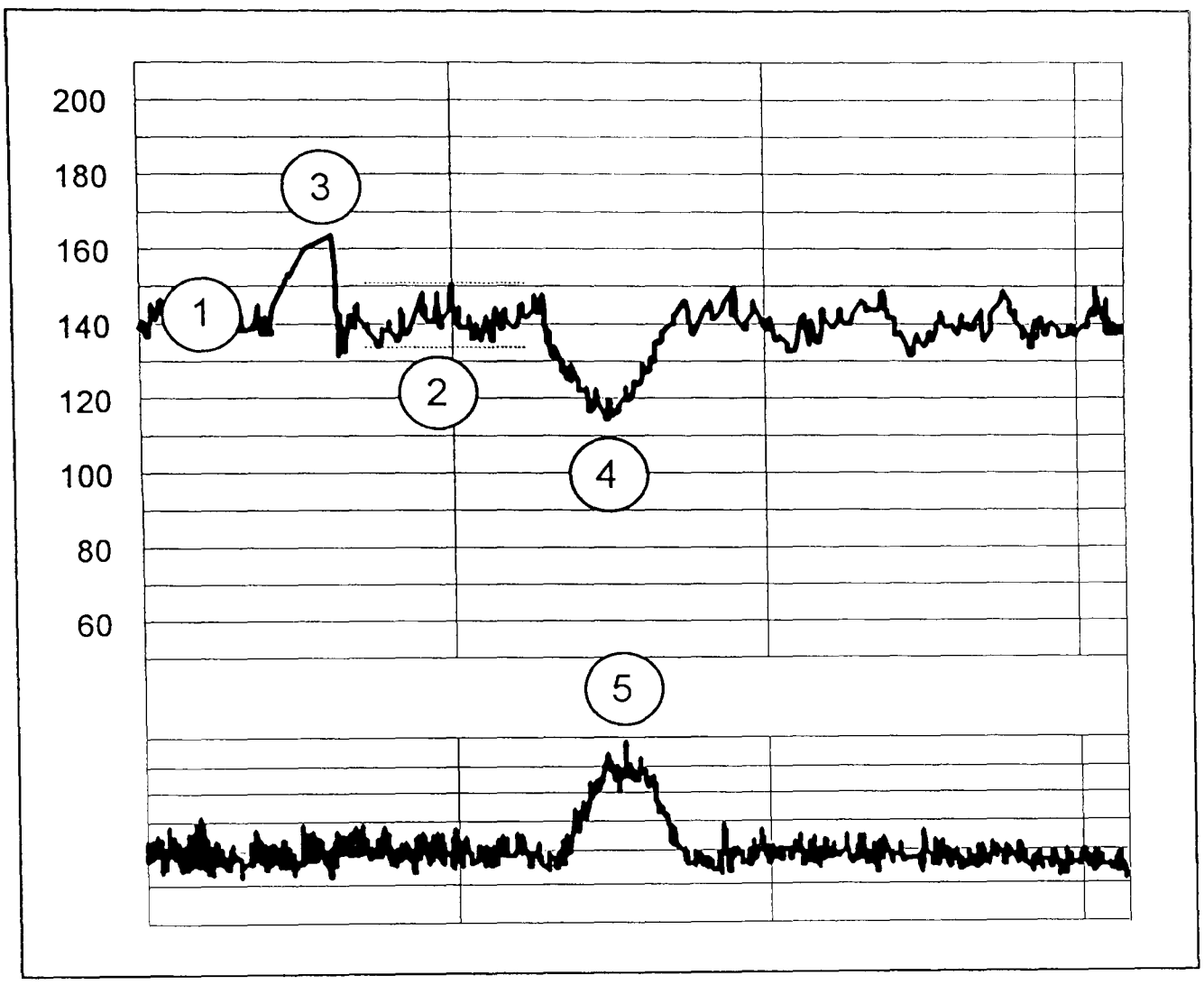


Figure 1.3: Features of the cardiotocogram.

The features labelled in figure 1.3 are,

1. Baseline heart rate; this is the heart rate value about which the heart rate pattern fluctuates. The baseline heart rate in figure 1.3 is 140 bpm.

2. Heart rate variability; this refers to the peak to peak amplitude of the high frequency perturbations about the baseline.

3. Accelerations in heart rate; relatively long term transient increases in heart rate from the baseline. The presence of accelerations is regarded as encouraging.

4. Decelerations in heart rate; relatively long term transient decreases in heart rate from the baseline which are normally associated with the contractions.

5. Location and frequency of contractions. These are important to identify because they provide information of the mothers progress and more importantly, they indicate the

times at which the fetus is subjected to the greatest stress. This gives valuable information of the fetuses capability to respond to stress and it is here that one would first expect to find signs of fetal compromise.

There have been several notable attempts by the pioneers of cardiotocography to classify the features of the CTG and standardise on its interpretation.

1. Caldeyro-Barcia's classification of decelerations.

The classification methodology suggested by Caldeyro-Barcia was first introduced in 1963 (Caldeyro-Barcia et al, 1963) and was later updated in 1966 (Caldeyro-Barcia et al, 1966). Central to this methodology was the classification of decelerations which used the relationship between the relative time of the lowest point of a deceleration and the peak of the associated contraction. Decelerations were classified into two categories:

(a) Type 1 decelerations.
This type was described as a temporary deceleration of the fetal heart rate during a contraction of the uterus, with an average lag time of 3.5 secs and standard deviation, 7.5 secs. It was said that this type of deceleration was seen after the membranes had ruptured and the fetal head was engaged.

(b) Type 2 decelerations.
This deceleration continued after the uterine contraction was complete. The average lag time was 41 seconds with standard deviation, 11 seconds. This type of deceleration was said to occur significantly more frequently when the child was entwined with the umbilical cord or where the feto-maternal blood-gas exchange was reduced.

This classification was then put into the context of the other features in the CTG to indicate the condition of the fetus. This is represented in table 1.1.

Type 1 deceleration	Type 2 deceleration	Fetal heart rate (bpm)	Fetal condition
sometimes	no	143	Normal
no	no	165	Initial fetal acidosis
no	present	> 165	Severe fetal acidosis
no	overlap	60 - 100	Critical
no	no	< 100	Critical

Table 1.1: Classification of the CTG according to Caldeyro-Barcia.

2. Hammacher's classification of heart rate variability.

Hammacher made the important contribution to CTG interpretation by attempting to classify heart rate variability, the high frequency fluctuations in heart rate about the baseline (Hammacher, 1967, 1969; Hammacher et al, 1968). The classification considered two aspects of the variability; the peak to peak amplitude and the number of oscillations per minute which are shown in figure 1.4.

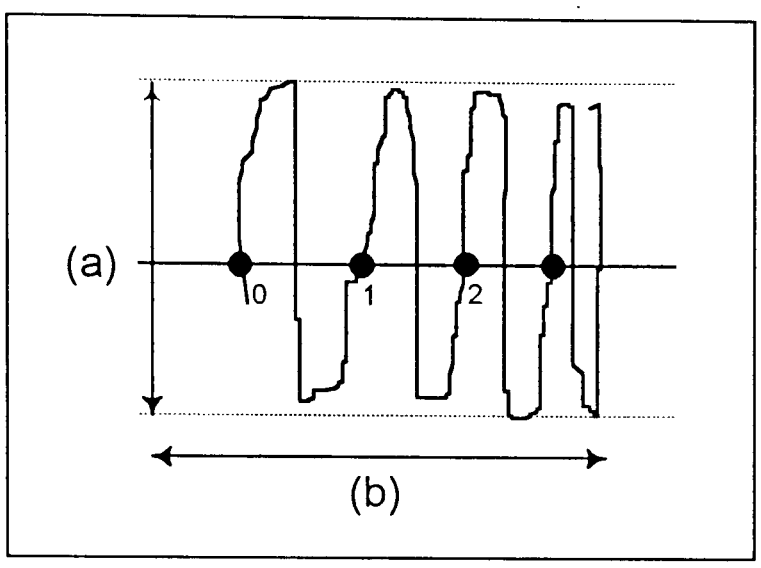


Figure 1.4: Classification of heart rate variability.

(a) Peak-peak amplitude.

The peak-peak amplitude was measured in beats per minute and was classified according to table 1.2.

Type	Amplitude (bpm)	Classification
1	< 5	Silent
2	$\geq 5 < 10$	Reduced
3	$\geq 10 < 25$	Undulatory
4	≥ 25	Saltatory

Table 1.2: Classification of heart rate variability - peak-peak amplitude.

(b) Oscillations per minute.

The number of oscillations were counted per minute and classified according to table 1.3.

Type	Oscillations per minute	Classification
a	≤ 2	Slow
b	> 2 but < 6	Middle
c	≥ 6	Fast

Table 1.3: Classification of heart rate variability - oscillations per minute.

The overall classification of heart rate variability was then obtained by considering each of the 12 possible combinations of the two measures.

Although Hammacher proposed that the classification of variability be comprised of 2 indicators, today it is generally the amplitude of variations that is taken as important. The number of oscillations are seldom used because they are difficult to assess visually and are thought not to contain additional information.

3. Hon's classification.

Ed Hon perhaps made the greatest single contribution to fetal monitoring with his pioneering work in the 1950's and 1960s. He first devised a method for classifying the CTG in 1958, which has been refined and updated throughout the years (Hon, 1958, 1959, 1963, 1967, 1968; Hon and Quilligan, 1967).

(a) Baseline heart rate.

This was classified into 5 categories as described in table 1.4,

Baseline heart rate (bpm)	Classification
> 180	Marked tachycardia
> 160 - 180	Moderate tachycardia
120 - 160	Normal
100 - 119	Moderate bradycardia
< 100	Marked bradycardia

Table 1.4: Hon's classification of baseline heart rate.

These ranges have subsequently been modified so that today, the current wisdom is that a marked bradycardia is < 90 bpm, moderate bradycardia is of the range, > 90 to < 110 bpm and the normal range is from 110 - 160 bpm.

(b) Decelerations.
Decelerations were classified into 3 main categories; early, late and variable, according to their shape and timing in relation to contractions.

Early decelerations; when the deceleration was congruent to an accompanying uterine contraction and the onset of deceleration and contraction were simultaneous, the deceleration was classified as an early deceleration.

Late decelerations; when the deceleration was congruent with an accompanying uterine contraction, but the onset of the deceleration lagged the onset of the contraction, the deceleration was classified as a late deceleration.

Variable deceleration; when the shape of the deceleration was different from the shape of the accompanying contraction, the deceleration was classified as a variable deceleration. In addition, variable decelerations could be further classified as severe if they dropped below the baseline by greater than 60 bpm, dropped below 60 bpm, or lasted longer than 60 seconds (the so called 'rule of sixties').

General comments.

These various classification methods have not standardised CTG interpretation. In fact it could be argued that the opposite was true. For example, some obstetricians will refer to decelerations as early, late and variable, others will refer to them as type 1 or type 2 and some will mix them up. However, the classification of decelerations proposed by Caldeyro-Barcia were recently described as "archaic", whereas the classification according to Hon were considered more suitable (Neilson, 1993). Several attempts have been made to improve CTG classification (Caldeyro-Barcia et al, 1974; Zuspan et al, 1979; Rooth et al, 1987) and guidelines have been recommended (American College of Obstetricians & Gynecologists, 1972), but again without the desired success. However, it has been found that these classifications and guidelines have been difficult to apply which is perhaps because they are subjective. For example, how late does a deceleration have to be to be classified as late? The CTG is a dynamic waveform and seldom maintains a particular classification. Abnormalities are frequently not persistent. These methods also do not assist the clinician with their subsequent management, for example, during a bradycardia (baseline < 90 bpm) in the first stage of labour; should the clinician always deliver immediately by emergency CS?

The classification of Hon and the classification of variability by Hammacher (amplitude only) generally form the basis of the methods applied today. They provide a useful description of the features but they do not allow a straight forward interpretation of the CTG. The heart rate changes seen in the CTG are often physiological in origin rather than pathological and as such, mirror the complex fetal compensatory mechanisms at work. A variable deceleration, for example, can result from the compression of the umbilical cord during a contraction which reduces the venous blood flow. Consequently, there is a decreased demand for blood to be pumped, so the heart rate reduces. When the contraction is over and the blood flow returns, the heart rate rapidly returns back to normal. Problems are not necessarily indicated by the presence of decelerations, but can develop as a consequence of them; if the decelerations become too frequent then the time between contractions becomes insufficient to re-establish blood flow which begins the familiar cycle which ultimately leads to fetal distress. In addition, consider heart rate variability which provides important information regarding the functioning of the central nervous system. These fluctuations are caused by the mechanisms which seek to increase heart rate and the mechanisms which seek to decrease it, antagonising each other. However, a reduced variability may not be abnormal, because surprisingly perhaps, the fetus has sleep cycles during labour in which the heart rate variability is naturally reduced.

The bottom line is that for the intrapartum CTG, an abnormal feature is not an abnormal occurrence. The correct interpretation of the CTG depends on an appreciation of the fetal physiological factors that influence heart rate changes which are inter-related and require considerable skill and experience to distinguish from pathological changes. This point is absolutely fundamental to understanding the difficulties associated with fetal monitoring.

1.3 The management of labour.

It has been mentioned that labour is an intensive care situation in which events can occur very rapidly. It is therefore essential that the clinical staff charged with the care of the patient are extremely vigilant.

The patient is placed in the continuous care of the midwives who will call the junior doctor on duty if there are perceived problems. It is then the junior doctor who decides whether the perceived situation warrants a consultation with a more senior colleague which is usually the Registrar, or Senior Registrar. In turn the Registrar can seek further advice from the Consultant. This management structure is represented in figure 1.5.

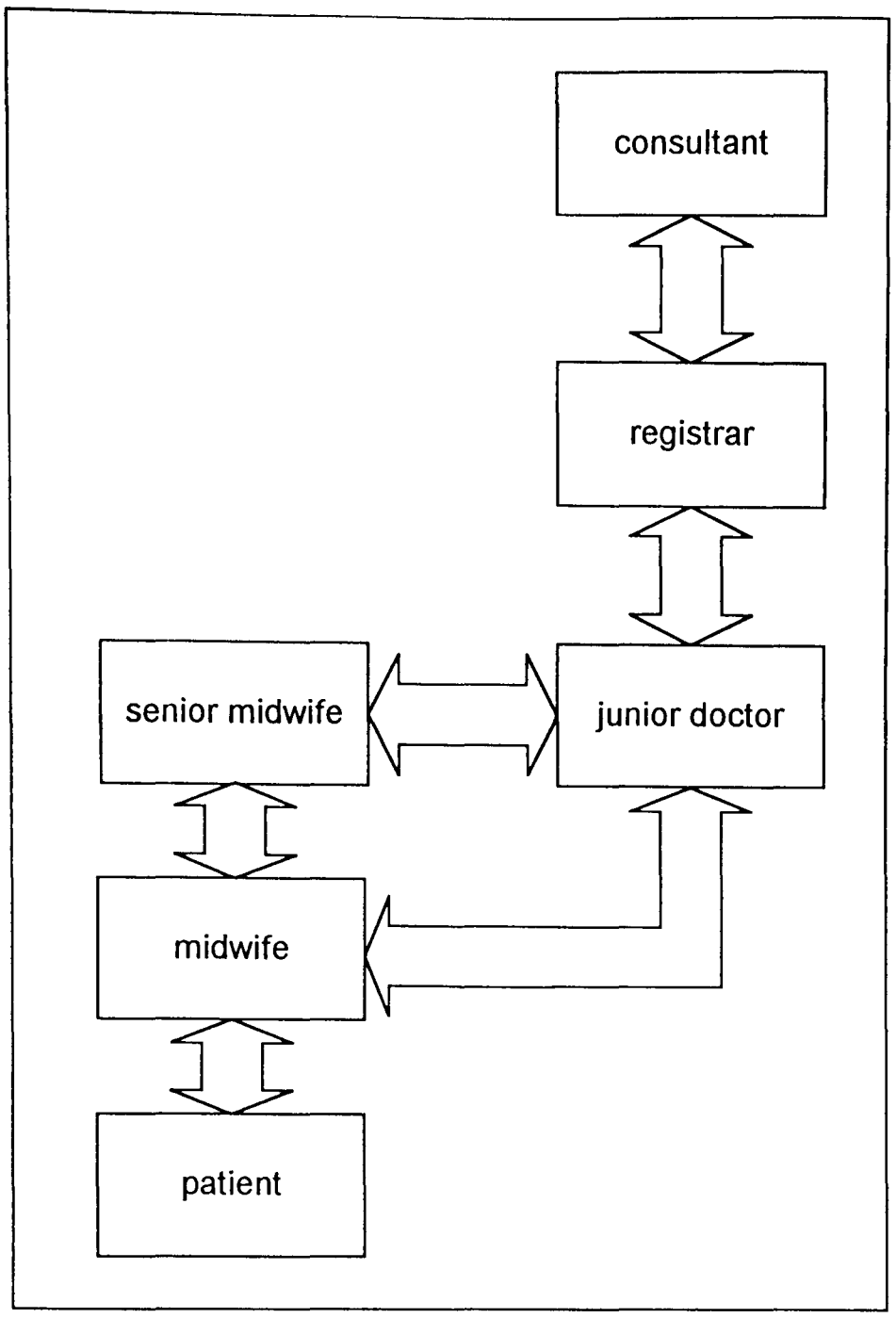


Figure 1.5: The structure of clinical staff for labour management.

It can be appreciated that this structure has potential weaknesses. In the first place, the patient is furthest removed from the most experienced clinician, the Consultant. But perhaps the most serious weakness of this structure, is that the care of the patient depends on the most junior of staff, the midwife and junior doctor who may have little experience. They are relied upon to first form an assessment of the patient (mother and fetus) on which they decide whether more senior staff should be called.

1.3.1 Fetal blood sampling.

Where the evidence from the CTG is inconclusive but where it gives rise to significant concerns for the fetus then additional information can be obtained from a fetal blood sample (FBS). The pH of the blood gives an indication of the metabolic state of the fetus. The blood is obtained by passing an endoscope via the cervix and then using a very small blade to make an incision into the fetal scalp, or bottom if in the breech presentation. A drop of blood is drawn into a long fine capillary tube which can be analysed using a specialist piece of equipment. If the pH is greater than 7.25 then there is no evidence to suggest

hypoxia at this time. A pH of 7.20 and lower is significant in the first stage of labour. In the second stage of labour when there are concerns for the fetus, a FBS may not be obtained if the baby can be delivered simply with forceps, but it may still be used when the fetal presentation is unfavourable.

Whilst continuous monitoring using the CTG is widely used in the UK, the facilities required for fetal blood sampling are not always available (Johnson et al, 1990).

1.3.2 Perinatal outcome.

It is important to assess the condition of the baby at birth (referred to as perinatal outcome) to establish how well it has coped with labour. This is particularly difficult to do as no single physiological variable provides an accurate indication. Physiologists and obstetricians do seem to be standardising on three variables as being important in defining perinatal outcome. Two of these variables are the cord arterial pH and Base Deficit in the extra-cellular fluid (BDecf), which indicate whether the baby is acidotic (pH) and whether the acidosis has a significant metabolic component (BDecf). These are both measured from a sample of blood obtained from the umbilical artery after birth but before the detachment of the placenta. The third variable is the Apgar score which is a subjective indication of the condition of the baby measured at 1 minute, 5 minutes and sometimes 10 minutes after birth. This is a score in the range of 0 to 10 where 10 indicates the extremely vigorous baby and 0 indicates the baby without visible signs of life. The scoring method is shown in table 1.5.

	Score		
Vital Sign	0	1	2
Heart rate	absent	less than 100 bpm	more than 100 bpm
Respiratory effort	absent	slow, irregular	good, crying
Muscle tone	limp	some limb flexion	active
Response to stimulus	nil	grimace	vigorous cry
Colour	blue, pale	body pink, limbs blue	pink

Table 1.5: The Apgar scoring system to assess perinatal outcome.

All hospitals in the UK record Apgar scores but not all have the facilities to record blood gas analysis and fewer still have the inclination (Johnson et al, 1990), but this situation is changing as it is realised that Apgar scores, by themselves, are not sufficiently accurate (Westgate, 1993). Indeed, none of the three variables are accurate by themselves but when used together they can obtain a reasonable indication of fetal condition, especially at the extremes of the measures. For example, most would accept that a baby born vigorous (Apgar high) with an arterial pH > 7.20 (without acidosis) has no evidence of distress and that a baby born depressed (low Apgar) with a significant metabolic acidosis (pH < 7.05, BDecf ≥ 12) could be described as compromised. As one moves from the extremes and into the grey area, then one becomes less certain of the assessment. Consider babies born with acidosis for example (pH < 7.05). All babies with pH < 7.05 but without a significant metabolic component may not be compromised. Indeed in some cases, the very fact that a baby has mounted such a defence to cope with the stress of labour could indicate the contrary. On the other hand some babies born with pH > 7.05 can still be compromised. These may have become compromised as a result of a severe insult sometime before labour began or may be simply deficient in glycogen (growth retarded babies) and unable to sustain anaerobic metabolism (which produces lactic acid and reduces pH).

1.4 The impact of continuous fetal monitoring.

Continuous electronic fetal heart rate monitoring (EFM) was introduced into clinical practice after research had shown, outside the rigours of a randomised trial, that heart rate changes correlated with indicators of fetal hypoxia; specifically, intrapartum fetal death, fetal blood pH and Apgar scores (Kelly et al, 1973; Paul and Hon, 1974). The first prospective randomised trial comparing continuous intrapartum fetal monitoring with intermittent auscultation in the clinical situation, was undertaken by Haverkamp in 1976, sometime after its wide spread introduction (Haverkamp et al, 1976). This study was not able to find a significant benefit in the clinical setting when using EFM compared with auscultation carried out at 15 minute intervals during the first stage of labour and at 5 minute intervals during second. In addition, a subsequent study of the children involved in the trial was unable to show any long term benefits of EFM either (Langendoer et al, 1980).

Critics have pointed out that the numbers involved in this study were small (242 in EFM group, 241 in intermittent auscultation group) and predicted that with larger numbers, the benefits of EFM would become apparent (Parer, 1979). However, since this first study, other notable studies from around the world have compared continuous monitoring with intermittent auscultation and have broadly come to the same conclusions. The combined total of four of the most significant studies was (890 + 13,000 + 34,995 + 246) 49,131 patients (Wood et al, 1981; MacDonald et al, 1985; Leveno et al, 1986; Luthy et al, 1987).

Haverkamp and colleagues also found that continuous monitoring increased operative intervention. The inclusion of fetal blood sampling reduced, but did not remove the excess intervention in the continuous fetal monitoring group (Haverkamp et al, 1979). These studies have been substantiated. It has been found that when used on its own, EFM quadruples intervention (Grant, 1992a) and when used with fetal blood sampling it doubles unnecessary intervention compared with intermittent auscultation (Grant, 1992b). In the USA, the national CS rate was 4.5% of all deliveries prior to the introduction of continuous monitoring, after which this figure rose to 12.5% in 1975 and in 1979 was close to 20%. Currently in the USA, the figure is over 30% in most hospitals. In the UK, the current average is between 10% - 15% but can be as high as 25% in some hospitals. There is also a knock on effect for those women who have a CS because they become far more likely to have another CS for subsequent children.

The impact of continuous fetal monitoring has also increased litigation. A study examined the cases contained in the files of Action for Victims of Medical Accidents which had resulted in stillbirth, perinatal or neonatal death, or long term mental or physical handicap (Vincent et al, 1991). Out of 34 cases, the CTGs in over half were misinterpreted or not acted upon. In 17 cases, junior doctors failed to recognise fetal distress and managed a delivery they did not have the experience to deal with. In the USA, litigation has reached disproportionate levels and the fear of litigation contributes to the high levels of unnecessary intervention.

The litigation climate which surrounds fetal monitoring during labour was best described by an eminent defence lawyer during a recent closed meeting convened at the behest of the Department of Health. The lawyer's argument is perhaps a little unscientific in places but was based on his considerable experience and knowledge of the area. It took the following form:

- The conventional wisdom is that 1500 babies are born each year in the UK with cerebral palsy (The Spastics Society).

- The total population of cases with cerebral palsy is in excess of 50,000, although 70,000 is frequently quoted.

- It is conventional wisdom amongst neurologists that 8% - 15% of these patients have a lesion attributable to birth injury but that such figures tend to be reached on the basis of surveys of clinical notes, which can be self-serving. In the cold light of day before a hostile forum it can be much harder to prove that there is no peri-partum event to explain why a particular child has been born damaged. It was considered that the overwhelming majority of cases have a claim either against the obstetrician or against those who subsequently looked after them until proven otherwise. This did not mean that the case

was not resistible, but that it was good enough to get a Legal Aid Certificate.

- It was considered that on balance, half the cases with cerebral palsy were likely to make a claim and that of this half, half would be successful.

- A baby born today will not expect to get to court for 5 years. In which time, with modest inflation, the average level of compensation will be £1 million.

- Therefore, the total settlements for the total population of cases with cerebral palsy is,

$$\frac{70,000}{4} \times £1 million = £17.5 billion$$

- and the settlements for the new arrivals per year is,

$$\frac{1500}{4} \times £1 million = £350 million$$

- The lawyer concluded that at this current rate, within a period 5 to 10 years, the NHS would be spending more on the damages and costs of lawyers in dealing with the consequences of adverse obstetric results, than it was spending on the whole of obstetrics.

- As an equally reasonable second stage proposition, the lawyer suggested that within about 25 years, as much would be spent on these settlements as is currently spent on the whole of the NHS.

The important factor here is that this money for compensation comes directly from the NHS budget and not as one may suspect, from contingency funds.

Another worrying aspect of fetal monitoring is that experts do not agree well (low inter-agreement) and are inconsistent (low intra-agreement) in their interpretation of the CTG. This has been the finding of studies which examined the antenatal CTG where the fetus is unstressed (Gagnon et al, 1993; Lotgering et al, 1982; Trimbos and Keirse, 1978). In a study supported by the European Community (Donker, 1991), 13 cases of which 9 were intrapartum recordings, were considered by 21 European experts assembled on a Greek island. This study specifically examined the experts' ability to describe the CTG features present in selected segments from the cases. At the end of the segment, the experts were asked to predict the perinatal outcome. The study found little consistency or agreement in the experts' classification of most of the CTG features, nor in their prediction of outcome. Another study involved the retrospective audit of selected cases by the Consultants of a leading teaching hospital in the UK (Barratt et al, 1990). This study too found that there

was significant disagreement between the auditors in the recommended management of these cases. In addition, when presented with identical information at a different time, the auditors were inconsistent in 25% of the cases. Whilst the design and statistical analysis of some of these studies (Gagnon et al, 1993; Donker, 1991) could be criticised, their general findings would be difficult to refute; the CTG is an imprecise measure of fetal compromise.

1.5 Computerised interpretation of the cardiotocogram.

It was because of the difficulties associated with the interpretation of the CTG that significant attempts were made to computerise the process. With such an approach, it was considered that at least an objective and consistent interpretation would be obtained.

1.5.1 The Maeda System.

Kazuo Maeda of Japan began forming his ideas for automatic assessment of the fetus during labour in 1969 (Maeda et al, 1969). A computerized system was developed which extracted features from the CTG and scored them according to their perceived relevance in diagnosing fetal distress. If the combined score passed a pre-defined threshold then fetal distress was indicated.

The system first established the baseline heart rate and heart rate variability. Accelerations were defined as transient increases in heart rate with an amplitude of at least 12 bpm for longer than 12 seconds. Decelerations were defined as transient decreases in heart rate of at least 20 bpm for 30 seconds. Further parameters were then calculated to enable a classification of the type of deceleration to be made. The presence of features were then scored according to table 1.6 (Maeda, 1990).

Feature	Measure	Score
Baseline heart rate	110-160	1
	160-180	1
	< 110	3
	> 180	3
Deceleration duration	> 60 s	3
Deceleration amplitude	> 50 bpm	2
Deceleration minimum heart rate	< 100 bpm	2
Recovery time of deceleration	> 40 s	3
Lag time of deceleration with contraction	> 40 s	3
Shape of deceleration	Deceleration with no acceleration	2
	W-shaped Deceleration	4

Table 1.6: Maeda's classification of the cardiotocogram.

The sum of the fetal heart rate scores was found for each 5 minutes of monitoring. This score was then used to calculate the fetal distress index using the classification described in table 1.7.

Parameter	Measure	Index
Fetal heart rate score	10 - 19	1
Fetal heart rate score	> 20	2
Baseline heart rate	> 160 for > 30 minutes	1
	110 - 120 for 10-30 minutes	1
	110 - 120 for > 30 minutes	2
	< 100	3
Variability loss		1
Decelerations	Late	1
	Deep and persistent	3

Table 1.7: Maeda's interpretation of the CTG.

This index was assessed for every 15 minutes of monitoring. A score of 0 was considered normal and suggested no fetal compromise. A score of 1 indicated that further monitoring was required, 2 points were considered 'suspicious' and 3 points or more indicated a diagnosis of fetal distress (Maeda, 1980). Variations on this scoring system have also been published in recent times (Bedrich and Zdenek, 1990).

1.5.2 The System 8000.

The System 8000 (Dawes et al, 1991a) is a monitor designed for the antenatal assessment of the fetus and has been developed for commercial use. The interpretation of the antenatal CTG is recognised as a far easier task as the fetus is not subjected to the stress of labour. The same features are identified, but generally speaking, the presence of any abnormality gives cause for concern.

The development of this system has been well reported with specific mention of the methods used to extract the CTG features. The algorithms for baseline heart rate estimation, from which other features are defined, have been detailed (Dawes et al, 1981) and compared (Dawes et al, 1982). Methods to classify variability and their relevance to the antenatal trace have also been examined (Henson et al, 1983; Dawes et al, 1990, 1991b). Accelerations were defined as transient increases above the baseline by more than 10 bpm for at least 15 seconds. Decelerations were defined as a fall in heart rate of more than 20 bpm for at least 30 seconds, or a fall of 10 bpm for greater than 1 minute (Dawes et al, 1991a). There are no scoring systems associated with this monitor. Its purpose is to objectively extract and quantify features seen on the antenatal trace and display the findings.

1.5.3 The Natali system.

The development of the Natali system began in the 1970's by Krause, in what was East Germany (Krause, 1990). The approach here was similar to Maeda's except that an internal contraction transducer was used rather than an external belt. Detailed measurements of parameters extracted from the cardiotocogram were made and combined to calculate an index obtained from a discriminative function based on a mathematical model.

Each heart rate parameter had an associated coefficient (a(1) to a(10)) associated with it which was proportional to the parameters' supposed importance in assessing fetal condition. A calculated index in the range 0 - 60 corresponded to a normal CTG, between 61 - 100 indicated declining fetal condition and over 100 that there were signs of hypoxia whereupon an alarm sounded.

These systems consider the CTG in isolation and do not attempt to support decision making. Consequently, they represent sophisticated alarm systems which draw the attention of clinical staff to the abnormal CTG. Although these systems have been developed over a period of 10 - 15 years they have not been submitted to a clinical assessment from which their effectiveness could be established and a system to interpret the CTG during labour is not commercially available.

1.6 Summary of the current status of continuous fetal monitoring.

1. The CTG has not lead to an improvement in the steadily falling perinatal mortality rate and there has been no change in the incidence of cerebral palsy and handicap over the same period (Jarvis et al, 1985).

2. The range of false positive abnormalities present in the CTG are thought to range from 33% (Gabert et al, 1976) to 80% (Schifrin and Dame, 1972) and make the CTG difficult to interpret.

3. There are significant levels of unnecessary operative intervention (Haverkamp et al, 1979).

4. There are a significant number of cases with potentially preventable neurological damage and mortality associated with birth asphyxia (Vincent et al, 1991).

5. The litigation and compensation in cases which are judged to have been damaged or lost as a result of birth asphyxia is reaching alarming proportions (Vincent et al, 1991).

6. In 10 to 15 years of development, a computer solution has not been demonstrated to agree with experts or accurately identify fetal compromise during labour.

7. Experts find it difficult to agree and be consistent in their interpretation of the CTG alone (Donker, 1991).

The evidence appears irresistible and it is not surprising that some have formed the opinion that there is little value in continuous fetal heart rate monitoring. And yet, the CTG has not been abandoned. On the contrary, it is used routinely in virtually all maternity units in the western world.

1.7 A proposed hypothesis to explain the current status of fetal monitoring.

The first important point to bear in mind when developing a possible hypothesis to explain the current status of fetal monitoring, is that the machines used to obtain the CTG are recorders and not monitors. The monitor is the clinician who interprets the recording. This is an important distinction because it implies that the standards in fetal monitoring are limited not only by the variables that are used to indicate fetal distress but also by the ability of the clinical staff who interpret them.

The assumption implied throughout the development of continuous fetal monitoring is that the interpretation of the CTG is easy. This is so because it has been left to the most inexperienced staff to interpret the CTG for which there is currently no formal training. How would the current status of fetal monitoring be interpreted if it were instead assumed that the interpretation of the CTG was difficult and could only be mastered by a few of the most experienced clinicians? Here, if CTG interpretation were left to the most inexperienced, then would it not be likely that incorrect interpretations would be made which would lead to both unnecessary interventions and a significant incidence of birth asphyxia. In addition, this assumption may also explain why experts involved in the pioneering work of the CTG were able to establish a correlation with hypoxia, and why this has been difficult to reproduce on the labour ward. One can only speculate on the results of a trial which compared the management of labour solely by those most experienced with current practise.

That is not to say that the CTG contains all the information required to identify the compromised fetus because the evidence from the studies which examine expert inter- and intra-variability suggest that it does not. It could be that the reason the experts were not able to agree highly and be consistent was that they were not provided with all the information they would normally have and that the studies were not conducted in a similar way to the clinical situation. A more cynical view would be that the reason the experts did not agree and were not consistent was because they were not experts. This becomes more plausible if the interpretation of the CTG is assumed to be very difficult; here, it is likely to be those with most experience and still practising who are the true experts rather than those at the pinnacle of their careers who may be far removed from the labour ward. However, the development of the alternative hypothesis does not depend on this cynical view, but it does depend on the two following assumptions,

1. The interpretation of the CTG is difficult and requires considerable experience and physiological knowledge to extract all the relevant information.

2. The CTG is an essential, but not the only source of important information which determines the appropriate management of labour.

With these assumptions a model to illustrate the process of labour management can be derived which could explain the current status of fetal monitoring without concluding that it has little value.

1. The goal for fetal monitoring is to accurately distinguish the normal group of fetuses (those responding appropriately to the stress of labour) from the abnormal group (those that become compromised). This goal is illustrated in figure 1.6 which shows the 2 groups separated. If these groups overlapped to form a 'grey area', then it would indicate that for some cases, the condition of the fetus was uncertain.

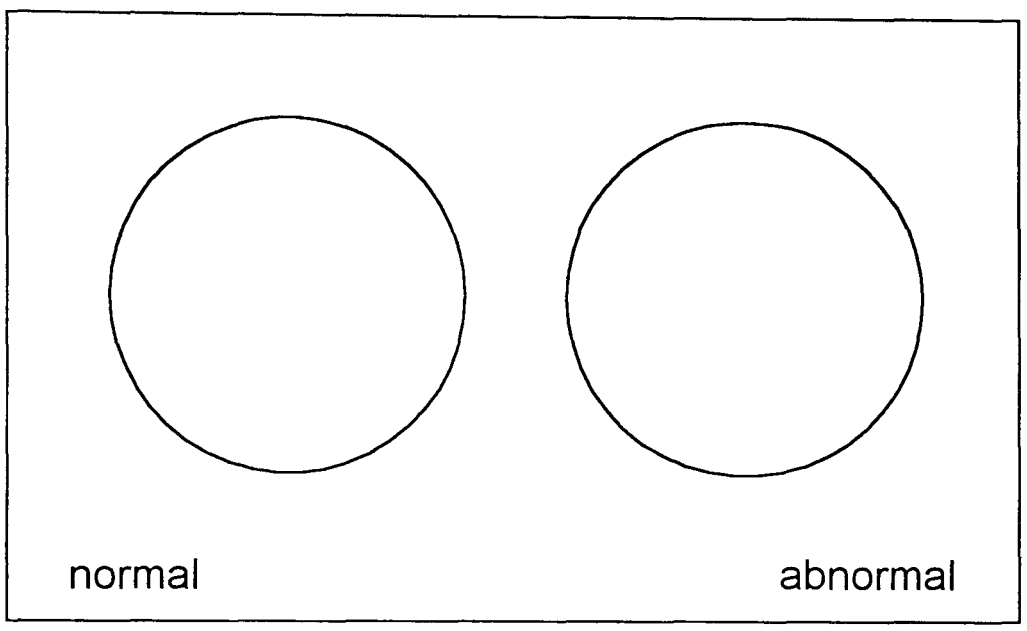
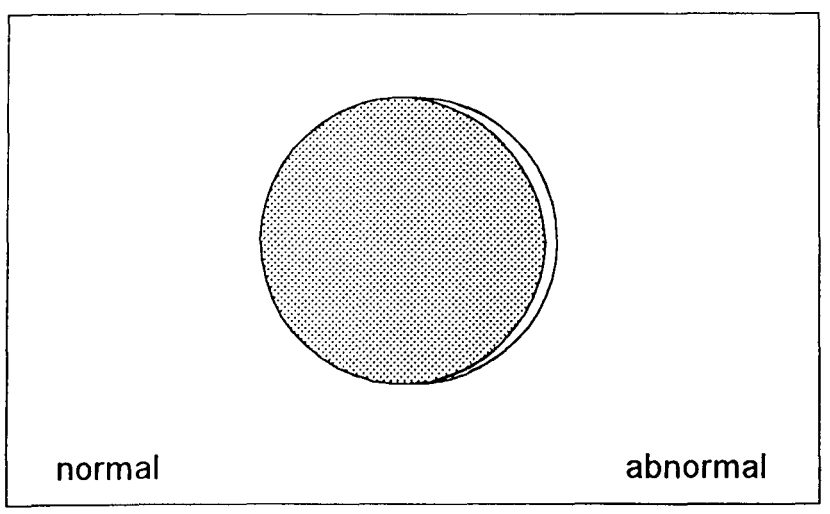
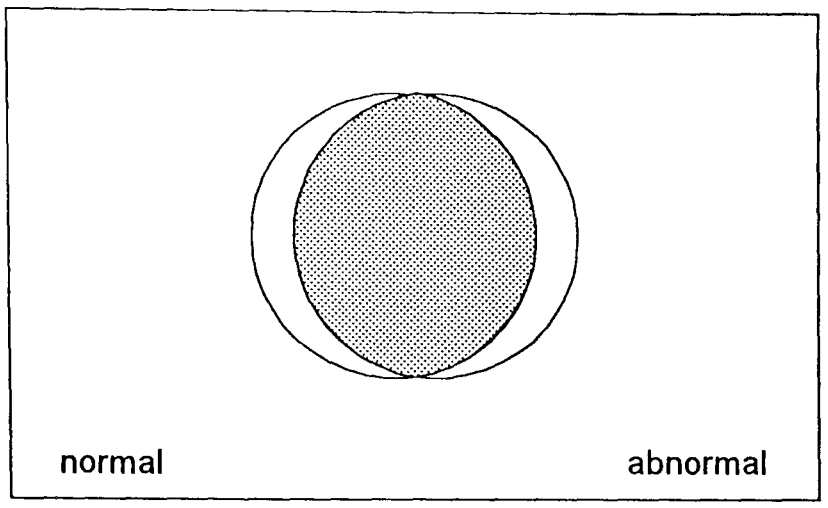


Figure 1.6: The goal for fetal monitoring.

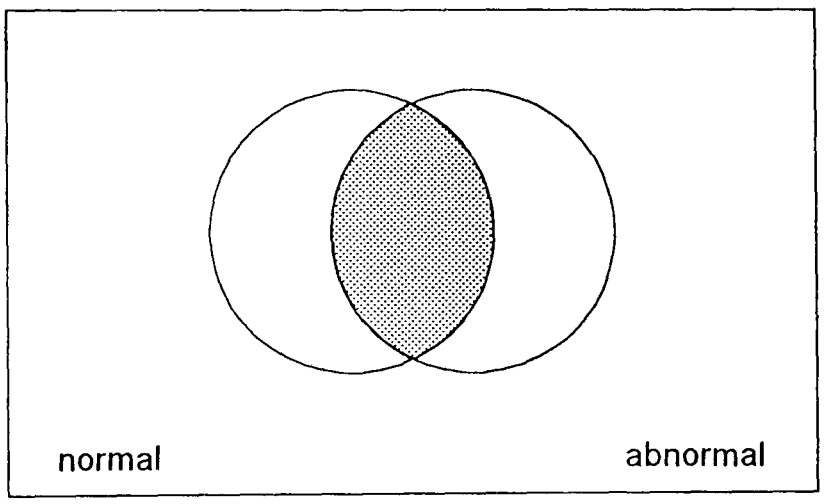
2. Without any form of monitoring only the most abnormal of cases could be expected to be identified. Therefore without monitoring, the vast majority of cases which include all the normals and virtually all the abnormals, would remain in an overlapping grey area where the condition of the fetus could not be determined accurately.



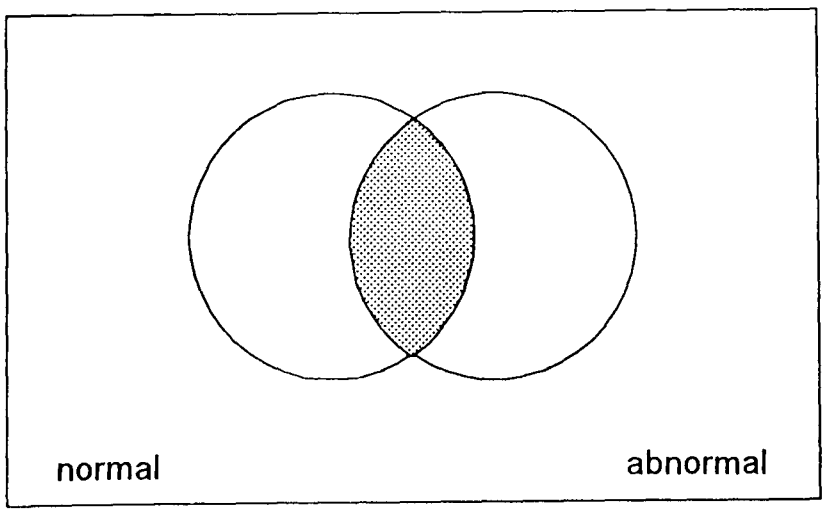
3. If the CTG were used by the untrained and inexperienced then they would be expected to identify some of the normals and some of the abnormals, but for the vast majority of cases, their interpretation would be inaccurate.



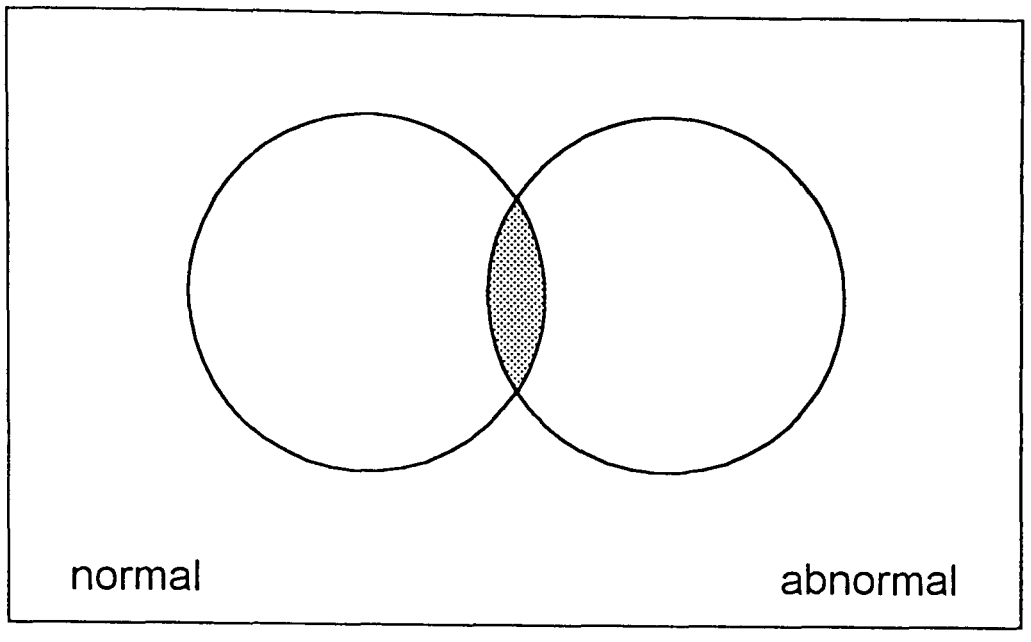
4. Experts, using the CTG alone, would be able to better separate the groups using their experience and physiological knowledge. However, there would still remain a significant 'grey area' where the condition of the fetus could not be accurately determined.



5. If experts had the complete patient information which included the patients obstetric history and details of the specific labour, then the groups would be further separated.



6. Finally, If experts interpreted the CTG using their experience and physiological knowledge, had the complete patient information and could obtain additional information with fetal blood sampling then the groups could become almost separated leaving only a small proportion of cases where the condition of the fetus is uncertain.



1.7.1 The case for an intelligent system to assist in labour management.

This model offers an alternative interpretation of the current status of fetal monitoring which does not denigrate its value.

This model predicts that a conventional computing approach which attempts to identify fetal compromise using only information obtained from the CTG will be unsuccessful. This is because even if it were able to match the expert in this, it would not be able to accurately identify the compromised fetus because it would not consider all the important information.

Importantly, this model suggests that the compromised fetus can be accurately identified by an expert in CTG interpretation, with knowledge of fetal physiology, the specific patient and an option to obtain additional information from a fetal blood sample. If this is the case then experts, when given this information, should tend to agree and be consistent in the management of labour. In addition, if this knowledge could be formalised then the model also suggests that an intelligent system which embodied this expertise could agree with experts and could help clinical staff in their management of labour.

1.8 Objectives.

The objectives for this study were to establish whether,

1. The expert knowledge required for labour management could be accurately formalised.

2. Experts could agree and be consistent in the management of labour.

3. An intelligent system could be developed to obtain a performance in labour management comparable with experts.

1.9 Outline of the Thesis.

Chapter 2 examines the acquisition of the fetal electrocardiogram from which heart rate is derived. It has been found that this signal is difficult to obtain reliably and is often of poor quality which can hamper monitoring. The purpose of this work was to identify the factors which contribute to this and suggest methods for improving the quality of the signal.

Chapters 3 and 4 describe the development of an intelligent system for the management of labour. Chapter 3 considers the suitability of numerical algorithms and artificial neural networks for feature extraction from the cardiotocogram. Chapter 4 describes the development of the expert system which after evaluation, was integrated with the feature extraction methods to form the complete intelligent system.

Chapter 5 describes the evaluation and validation of the system. The system was evaluated at two key stages in its development by internal experts before being subjected to a validation study which involved 17 experts from 16 of the leading centres in fetal monitoring in the UK. This study examines whether experts can agree and be consistent in the management of labour and whether the system can attain a comparable performance.

Chapter 6 presents the detailed mathematical and statistical techniques used to analyse the results of the validation study described in chapter 5. In particular, it describes the derivation of a method to calculate the agreement in the management of labour between two reviewers and further shows how this may be applied to measure the statistical significance of the results.

Chapter 7 presents a review of the thesis and discusses the validation study results. It also suggests the likely role for the system in a strategy to improve fetal monitoring and considers future development.

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Chapter 2

Optimising the acquisition of the fetal electrocardiogram.

2.1 Introduction.

The fetal electrocardiogram (ECG) is obtained from an electrode (fetal scalp electrode, FSE) attached to the fetal scalp or bottom when the fetus is in the breech position. The quality of the fetal ECG waveform obtained by the electrode is inconsistent and is often poor which can hamper monitoring. A study was undertaken to examine the performance of five FSEs and to investigate the nature of the fetal ECG they obtained. This will identify ways in which the acquisition of the signal could be improved (Westgate et al, 1990; Keith et al, 1990). The five electrodes considered in the investigation were; the single spiral Corometrics (Corometrics Medical Systems Inc. USA), single spiral Cetro (Cetro AB, Sweden), the double spiral Hewlett-Packard (Hewlett-Packard Medical, UK) and the Copeland reusable and Copeland disposable (Surgicraft Ltd, UK) electrodes.

The objectives for the study were to,

1. Examine the physical characteristics of the electrodes.
2. Undertake a randomised trial to assess the clinical performance of the electrodes.
3. Analyse the signals obtained by the electrodes.
4. Examine the affect of the electrodes on the ECG.

2.2 The physical characteristics of fetal scalp electrodes.

The term fetal scalp electrode, which perhaps implies a single electrode, is a little confusing because these devices actually comprise two electrodes. The first electrode pierces the fetal presenting part to obtain the fetal ECG which is measured differentially with respect to the second electrode, also located in the head of the device, which makes contact with the vagina via cervical secretions and amniotic fluid. An alternative configuration which is thought to obtain an ECG insensitive to fetal head rotation as the baby moves down the birth canal, has also been suggested (Lindecrantz et al, 1988). Here the fetal ECG is measured differentially with respect to an additional electrode attached to the mother's thigh. The former method is used routinely to obtain an ECG suitable for heart rate calculation.

There are two types of FSEs; the spiral types which have a helical or double helical piercing electrode, and the Copeland types which have a semicircular hook (figure 2.1).

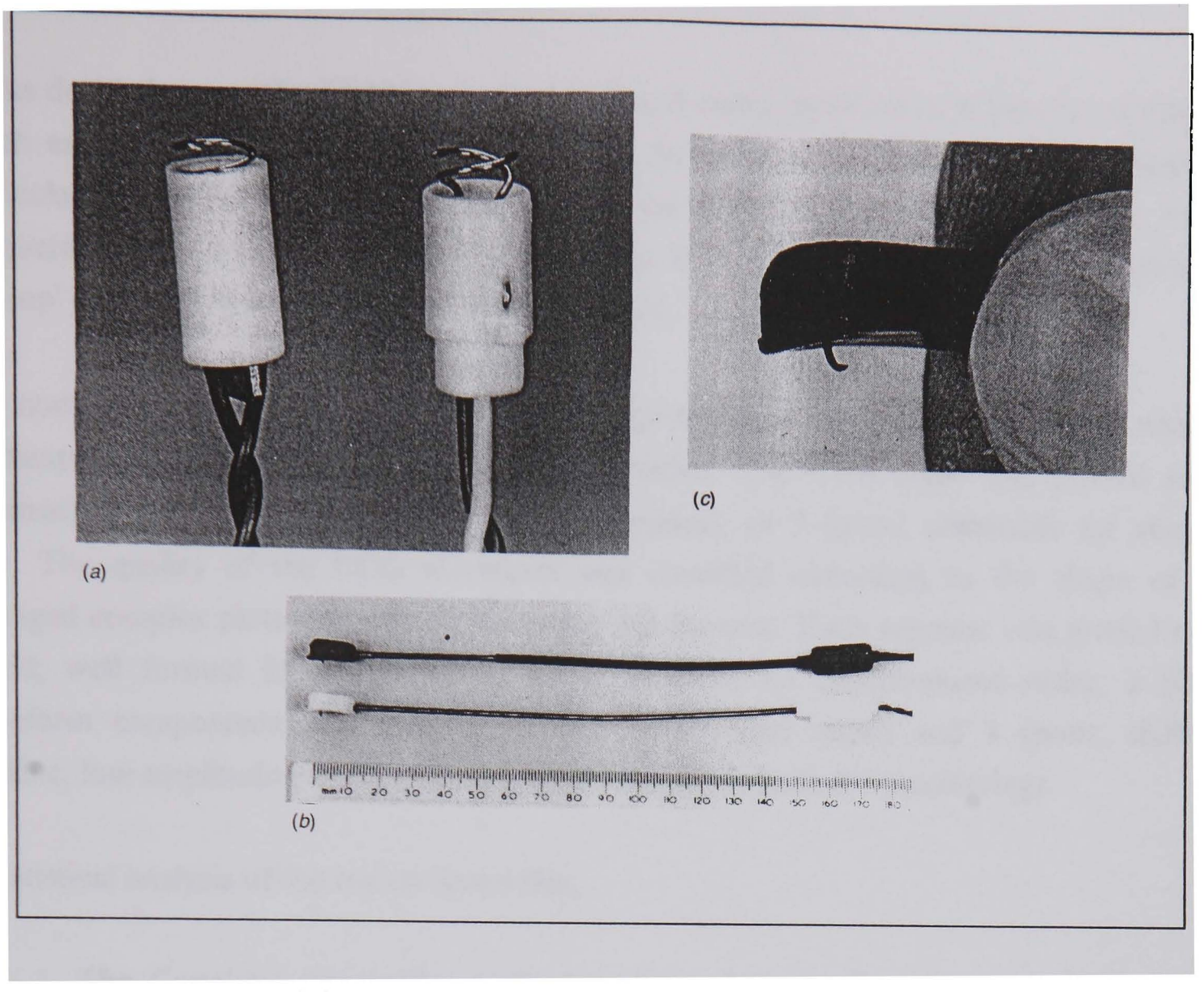

Figure 2.1: Spiral and Copeland FSEs.
(a) Single (left) and double (right) spiral FSEs. (b) Copeland reusable (lower) and disposable (upper) FSEs. (c) Copeland FSE head showing the semicircular piercing electrode held in a half open position.

2.3 The clinical performance of fetal scalp electrodes.

A clinician investigated the clinical performance of the FSEs in a randomised trial. Ten of each of the five electrode types were applied randomly to 50 women in labour after the decision to monitor the patient had been taken by labour ward staff and informed patient consent had been obtained. Only new electrodes of each type were used. All spiral and most Copeland electrodes were applied by the clinician and the remainder were applied by experienced midwives.

The fetal ECG was processed by a ST ANalyser (STAN), Cinventa AB, Sweden. This system is unlike those currently used to monitor labour as in addition to recording the CTG, the STAN also provides on-line analysis of the ST segment of the fetal ECG waveform (Rosen and Lindecrantz, 1989). The STAN filters the raw ECG signal for ST-waveform analysis between 0.05 Hz (1st order high pass, passive filter) and 100 Hz (4th order active, Butterworth low pass filter), and for heart rate analysis between 4 and 26 Hz. The signal is digitised to 8 bits at a sampling frequency of 500 Hz. These specifications were confirmed prior to the start of the study.

It was decided to use the STAN recorder because it could interface to a 'lap-top' computer which enabled the digitised ECG to be stored. In addition, as ST waveform analysis is particularly sensitive to signal quality, it allowed the clinician to better identify poor, adequate and good periods of ECG recording. In 20 of the 50 cases chosen at random, a 'lap-top' computer was interfaced to a single STAN.

The complete STAN CTG and ECG complex printouts, were divided up into 30 minute segments and subjectively assessed by the clinician. The CTG trace was graded as 1 (optimal), 2 (fair; adequate for monitoring purposes), or 3 (poor; unsuitable for clinical use). The quality of the ECG waveform was classified according to the shape of an averaged complex plotted by the STAN every 2-3 minutes. Each segment was graded as 1 (good; well formed ECG complexes, stable baseline, no superimposed noise, 2 (fair; waveform components well defined, some superimposed noise) and 3 (poor; shifting baseline, low amplitude signal, noise superimposed, inadequate for monitoring).

A statistical analysis of the results found that,

1. The Copeland disposable electrodes obtained a significantly ($\alpha = 0.05$) lower proportion of grade 1 CTG epochs compared with the Hewlett-Packard, Cetro and Corometrics electrodes.
2. Both Copeland electrode types obtained a significantly ($\alpha = 0.05$) lower proportion of grade 1 ECG complexes and a significantly higher proportion of grade 3 complexes than either the Hewlett-Packard, Cetro or Corometrics electrodes.

2.4 Quantitative analysis of the signals obtained by fetal scalp electrodes.

A study was undertaken to investigate the principal factors which affect the quality of the signals obtained by fetal scalp electrodes. This study extended the clinical investigation and examined the 20 stored raw ECG signals. The objectives were to,

1. Identify the types of noise in the signals.
2. Examine the signal characteristics obtained during grade 1, 2 and 3 periods of ECG recording.
3. Compare the signals obtained by each electrode type.

The signals obtained from the Corometrics and Cetro single spiral electrodes were merged to form a single group termed 'single spiral electrodes' because of their similar construction and clinical performance.

2.4.1 Identification of noise types.

A visual review of the 20 stored records identified the various types of noise and interference which were apparent in the ECG signal.

1. Baseline Shift.

This type of interference has been well documented (Greene, 1987; Kirk and Smith, 1986). If the ECG is only required to obtain a measure of heart rate which requires the detection of the R-wave, then this noise can be removed with suitable bandpass filtering to obtain a stable baseline (figure 2.2a). However, if the ECG is required to analyse the lower frequency variables within the waveform (i.e. the ST-waveform) then removing the baseline is difficult (Froning et al, 1987) as the minimum ECG frequency component of interest is 0.05 Hz (American Heart Association, 1975). This lower limit prevents the filtering of low frequency noise which results in a moving baseline, termed baseline shift on which the ECG is superimposed. This can have amplitudes many times that of the ECG signal (figure 2.2b) and when extreme, can cause saturation in the data acquisition system (figure 2.2c). The first component to be affected will usually be the analogue to digital converter (ADC). For a successful conversion to take place, the analogue signal voltage is required to remain within a certain range (0 - 5 Volts for the STAN). If the analogue signal is amplified above this upper range then the ADC will saturate and the ECG will be lost. If the baseline shift becomes severe it can saturate the amplifiers and active analogue filters, which can then take a considerable time to recover (up to 30 seconds) because of their large capacitance's.

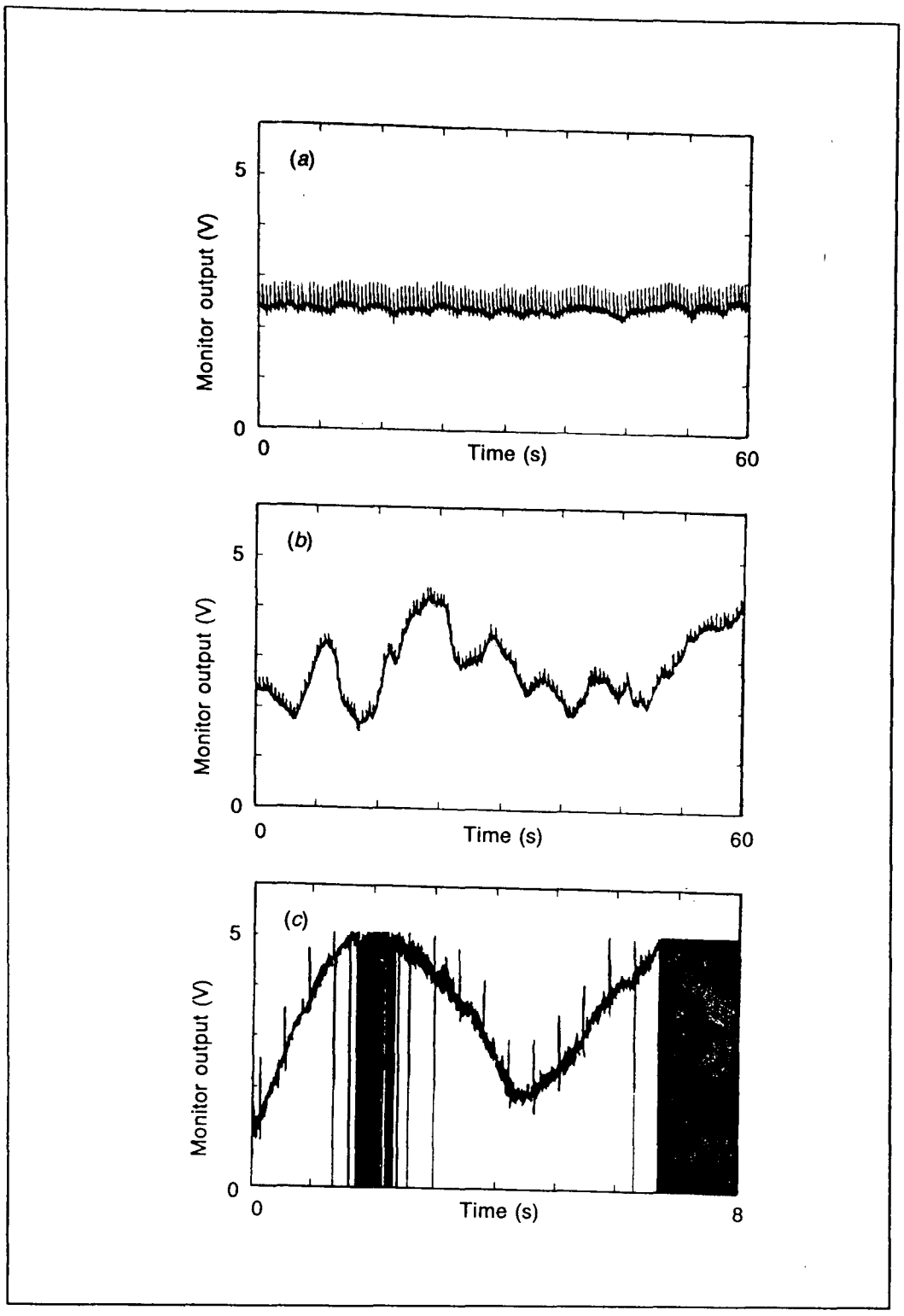

Figure 2.3: Baseline shift and ADC saturation.
(a) A stable baseline, (b) large baseline shifts, (c) Signal saturation caused by severe baseline shifts.

2. Mains interference.

There are two methods for removing mains interference; notch filtering (analogue or digital) in the frequency domain (Van Alste and Schilder, 1985; Proakis and Manolakis, 1988) and adaptive filtering in the time domain (Widrow et al, 1975). The STAN used adaptive filtering prior to data storage (Rosen and Lindecrantz, 1989) and so only low levels of mains interference were expected to be found in the saved data.

3. Signal drop-out

This final parameter was identified during the visual review. It was observed that the ECG was sometimes lost and the signal would drop to some low, non-zero value which it would maintain for up to 20 seconds (10,000 samples).

2.5 Signal analysis.

An analysis of 12 of the 20 stored data records was undertaken. These comprised 3 recordings for each electrode group (single spirals, Hewlett-Packard double spiral, Copeland reusable and Copeland disposable) to examine the presence of the artefacts and their effect upon the quality of the signal. The selected records were considered by the clinician to contain a fair representation of the signal quality obtained by the different electrode groups.

2.5.1 Filter design.

It was proposed to develop three finite impulse response (FIR) digital filters to obtain the baseline frequencies, the mains frequency and the QRS wave frequencies from which the power of each signal could be measured. These measures could then be combined to obtain the QRS signal to baseline noise ratio and the QRS signal to mains noise ratio.

Filter specifications.

Baseline filter: Pass band 0 to 0.5 Hz with transition width, $\Delta f = 1.5$ Hz.

Mains filter: Pass band 49 to 51 Hz with transition width, $\Delta f = 2$ Hz.

QRS wave filter: Pass band 4 to 45 Hz with transition width, $\Delta f = 2$ Hz.

All filters were required to have a maximum pass band ripple of, $A_p = 0.5$ dB and a minimum attenuation of, $A_S = 30$ dB.

In digital signal processing, the number of coefficients, N, required to realise a digital FIR filter is approximately given by equation 2.1 (Bellanger, 1989).

$$N \approx \tfrac{2}{3}\log_{10}\left(\frac{1}{10\,\delta_p\,\delta_s}\right)\frac{F_s}{\Delta f} \qquad (2.1)$$

Where,

F_S is the sampling frequency.

Δf is the transition width between pass band and stop band.

δ_p is given by $A_p = 20\log_{10}(1+\delta_p)$ which for $A_p = 0.5$ dB = 0.05925

δ_s is given by $A_s = 20\log_{10}(\delta_s)$ which for $A_S = -30$ dB = 0.0316

The filters were required to have a narrow transition width, Δf, in the order of 2 Hz, to ensure that only the frequencies of interest were obtained from each filter. Using equation 2.1, with a sampling frequency, $F_S = 500$ Hz, the number of filter coefficients, N required to obtain the required filter response is approximately 289 which was considered impractical. To overcome this the sampling frequency was reduced by a signal processing technique called decimation (Crochiere and Rabiner, 1979).

Decimation of sampling frequency.

The process of decimation reduces the sampling frequency of a signal, x(n), by an integer factor, M, where x(n) has a sampling period T_1 and a sampling frequency $F_1 = 1/T_1$. The decimated signal, y(n), will have a sampling period T_2 and sampling frequency $F_2 = 1/T_2$, which can be expressed as equation 2.2.

$$\frac{T_2}{T_1} = M = \frac{F_2}{F_1} \tag{2.2}$$

x(n) is a full band signal, that is, its spectrum is non-zero for all frequencies in the range $f \leq F_1/2$. To reduce the sampling frequency without incurring aliasing errors, it is first necessary to filter the signal, x(n), with a low pass filter that approximates the ideal characteristic,

$$H(\omega) = \begin{cases} 1, \omega < \pi/M \\ 0, otherwise \end{cases}$$

The sampling rate reduction is then achieved by forming the sequence, y(m) by saving only every Mth sample of the filtered output.

The ECG sampling frequency, F_S = 500 Hz, was reduced by a decimation factor of M = 4, to 125 Hz which meant the desired ECG filter responses could be obtained using a practical number of coefficients (N < 100).

The total power, P, was obtained for each extracted signal using equation 2.3,

$$P = 10\log_{10} \frac{1}{n}\sum_{i=0}^{n-1}(x(i)-\mu)^2 \qquad (dB) \tag{2.3}$$

Where, x(i) is the ith sample, n is the total number of samples, and μ is the mean of the samples.

Calculation of the QRS Wave Voltage.

The QRS wave voltage also gives a good indication of signal quality. Ideally the QRS voltage, and therefore the ECG, should be large to ensure it can be accurately resolved. However, this is limited by the baseline shift which causes saturation. A high quality signal would be characterised by a high QRS wave amplitude with low baseline shift. A poor quality signal would be characterised by a low QRS wave voltage with high baseline shift.

The root mean squared voltage (rms) of the QRS wave at the electrode was calculated from the output of the QRS wave extraction filter using equation 2.4.

$$QRS_{rms} = \frac{5}{255.G}\sqrt{\frac{1}{n}\sum_{i=0}^{n-1}(x(i)-\mu)^2} \qquad (Volts) \qquad (2.4)$$

Where, 5/255 is the voltage represented by one least significant bit (5 volts full scale at 8 bit resolution), n is the number of data points, x(i) is the ith data point and μ is the mean of the samples. G is the overall voltage gain of the STAN which could be manually set by clinical staff to 1024, 2048, 4096 and 8192. The gain had a default setting of 2048 and all changes in the setting were automatically saved in the data file.

2.5.2 Signal saturation.

It was found that signal saturation was characterised by the sample values occupying the range $0 < x_i < 15$, or, $240 < x_i < 254$ (254 is the maximum allowed sample value by STAN) with rapid switching between the ranges (figure 2.3(c)). An algorithm was developed to identify these periods lasting longer than 50 samples (0.1 seconds). A period of saturation was considered over when 250 consecutive samples in the unsaturated range were detected.

2.5.3 Signal drop-out.

Signal drop-out was identified when the signal maintained a constant non-zero value in the non-saturated range ($15 \leq x_i \leq 240$) for greater than 100 samples (0.2 seconds).

2.5.4 Software implementation.

The algorithms were implemented using the C-programming language. A flow diagram of the developed software is shown in figure 2.4 and the source code is presented in appendix A. The software analysed the fetal ECG data in 30 second epochs (15,000 samples). The data was displayed and the amount of saturation and signal drop-out were measured. If both were 0, then the software continued the analysis by decimating the sampling frequency from 500 Hz to 125 Hz. The mains frequency, baseline and QRS waves were then extracted and the signal to noise ratios and the QRS wave rms voltage were calculated and saved to disk.

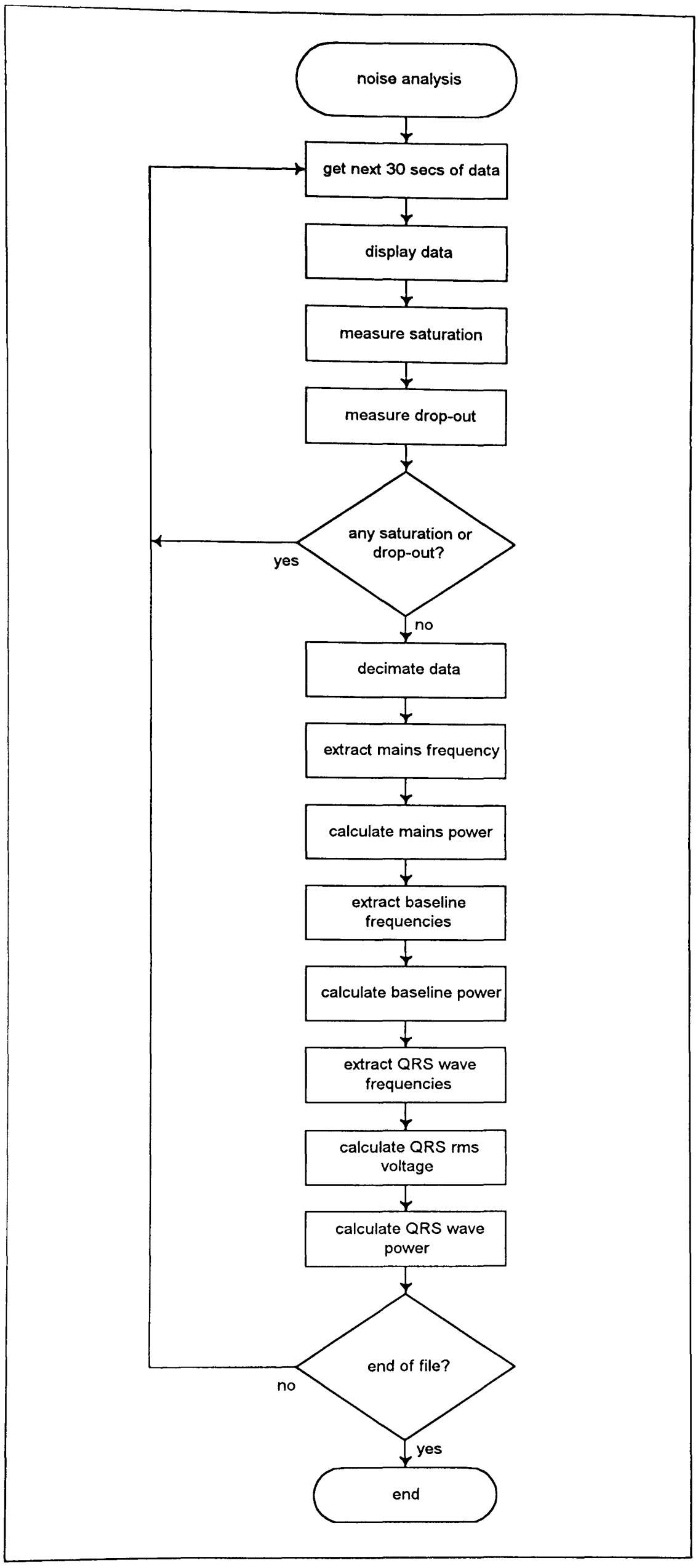

Figure 2.4: Flow diagram of noise analysis software.

2.5.5 Results analysed according to the clinical grading.

During the clinical study, the clinician had identified the periods in the 12 data records for which the ECG was considered, grade 1 (good), grade 2 (adequate) and grade 3 (poor). For each grading, the quantitative results from the analysed epochs were averaged irrespective of the electrode type. This was to investigate the differences in the analysed parameters of the signals between the different classifications. The results for the data records are shown in table 2.1 where μ is the mean and σ^2 is the variance of the given parameter for each grading.

	Grade 1		Grade 2		Grade 3	
	$\mu(1)$	$\sigma^2(1)$	$\mu(2)$	$\sigma^2(2)$	$\mu(3)$	$\sigma^2(3)$
QRS / baseline power ratio (dB)	-9.60	3.08	-14.6	4.43	-16.30	4.13
QRS / mains noise power (dB)	14.04	3.94	9.12	4.89	10.04	5.42
QRS wave amplitude (μV rms)	51.14	27.48	43.76	27.63	29.12	20.82
Saturation (average secs/min)	2.35	3.20	8.17	7.40	16.80	12.75
Drop-out (average secs/min)	0.75	0.95	1.07	1.53	1.64	1.96

Table 2.1: Results grouped according to ECG grading

A statistical analysis of these results was applied using the one way analysis of variance test (ANOVA) which was available in commercial software called, 'Minitab' V.7, that ran on a Prime mainframe computer. The null hypothesis was; the signals obtained for each ECG grading were the same, i.e., $\mu(1) = \mu(2) = \mu(3)$. This was tested at the, $\alpha = 0.01$, level of significance.

It was found that,

A period of grade 1 ECG recording had significantly,

1. Higher QRS/baseline signal to noise ratio than grade 2 and grade 3 periods.
2. Higher QRS/mains signal to noise ratio than either grade 2 or grade 3 periods.
3. Greater QRS wave amplitude than grade 3 periods.
4. Less signal saturation than grade 2 and grade 3 periods.

A period of grade 2 ECG recording had significantly,

1. Lower QRS/baseline signal to noise ratio than grade 1 periods.
2. Lower QRS/mains signal to noise ratio than grade 1 periods.
3. Less signal saturation than grade 3 periods.

A period of grade 3 recording had significantly,

1. Lower QRS/baseline signal to noise ratio than grade 1 periods.
2. Lower QRS/mains signal to noise ratio than grade 1 periods.
3. Smaller QRS wave voltage than grade 1 periods.
4. Greater signal saturation than either grade 1 or grade 2 periods.

2.5.6 Results analysed according to electrode type.

The results from the analysed ECG data were also grouped according to the electrode type, irrespective of the grading given by the clinician. This was to investigate which electrodes obtained the best quality signals in terms of the signal parameters being considered. The means, μ and standard deviations, σ, of each parameter measured for each electrode type are shown in table 2.2.

	Single spirals		Hewlett-Packard		Copeland reusable		Copeland disposable	
	μ(ss)	σ^2(ss)	μ(hp)	σ^2(hp)	μ(cr)	σ^2(cr)	μ(cd)	σ^2(cd)
QRS / baseline noise ratio (dB)	-8.22	2.49	-9.21	4.34	-13.72	3.60	-16.68	4.37
QRS / mains noise ratio (dB)	16.16	0.74	14.45	4.64	12.04	4.14	11.05	1.87
QRS wave amplitude (μV rms)	49.51	7.11	67.58	25.20	25.28	6.14	21.31	7.51
Saturation (average secs/min)	3.52	4.99	5.71	7.80	5.75	7.13	14.48	11.36
Drop-out (average secs/min)	0.67	0.72	0.62	0.91	1.59	1.13	0.97	1.08

Table 2.2: Signal analysis results grouped according to electrode type

A one way analysis of variance was applied to these results using a similar method as previously described. The null hypothesis was that the signal parameters measured for each electrode have the same means, $\mu(ss) = \mu(hp) = \mu(cr) = \mu(cd)$. This was tested at the $\alpha = 0.01$ level of significance. It was found that,

Single spiral electrodes have significantly,

1. Higher QRS/baseline signal to noise ratio than all other electrode types.
2. Higher QRS/mains signal to noise ratio than all other electrode types.
3. Greater QRS wave amplitude than both Copeland electrodes.
4. Lower signal saturation than other electrode types.

Hewlett-Packard double spiral electrodes have significantly,

1. Higher QRS/baseline signal to noise ratio than both Copeland types.
2. Higher QRS/mains signal to noise ratio than both Copeland types.
3. Greater QRS wave amplitude than other electrode types.
4. Lower signal saturation than Copeland disposable electrodes.

Copeland reusable electrodes have significantly,

1. Higher QRS/baseline, signal to noise ratio than Copeland disposable electrodes.
2. Higher QRS/mains signal to noise ratios than Copeland disposable electrodes.
3. Greater QRS wave amplitude than Copeland disposable electrodes.
4. Lower signal saturation than Copeland disposable.

Copeland disposable electrodes have significantly,

1. Lower QRS/baseline, signal to noise ratio than other electrode types.
2. Lower QRS/mains signal to noise ratio than other electrode types.
3. Smaller QRS wave amplitude than other electrode types.

2.6 Measurement of the electrode frequency responses.

It has been suggested that the frequency bandwidth of interest for the ECG is, 0.05 - 100 Hz (American Heart Association, 1975). The frequency response of the 5 FSEs were measured over this range in an in-vitro experiment represented in figure 2.5.

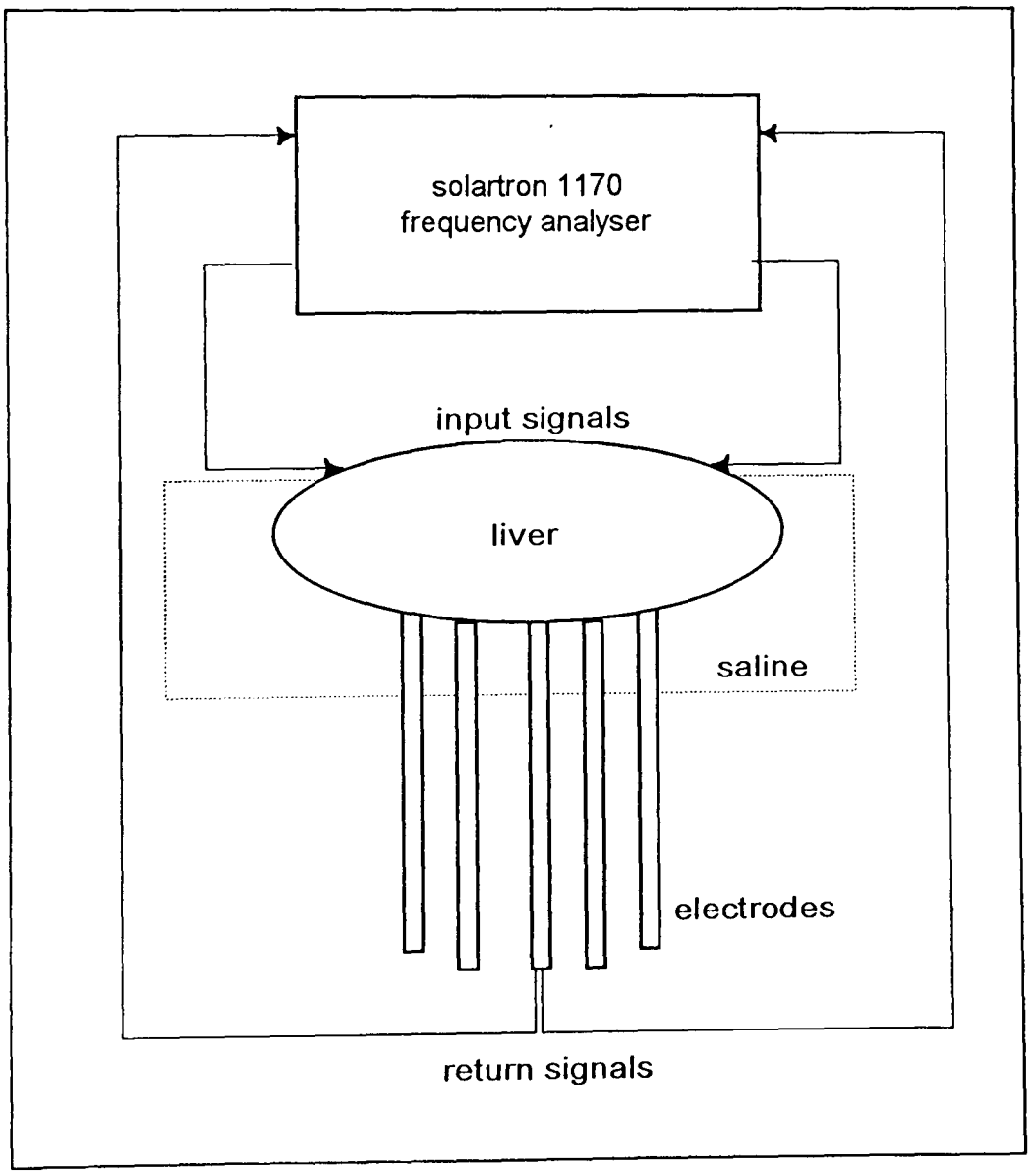

Figure 2.5: Experiment to obtain the electrodes frequency responses.

To simulate the electrode/tissue interface, a fresh pigs liver was immersed to a depth of 1 cm in a saline bath and the electrodes were optimally attached to the lower lobe of the liver by the clinician. Sinusoidal signals (1 Volt pk-pk) from a Solartron 1170 frequency response analyser, with frequencies in the range 0.01 to 200 Hz were introduced into the liver using hypodermic needles. The signal obtained by the electrode under test was then fed back to the Solartron for analysis. The Solatron and CTG recorders have similar input characteristics with near infinite input impedences provided by an active buffering stage.

2.6.1 Results

Over the range 0.01 - 200 Hz (70 frequencies in all) the gain and phase of the signal obtained by each electrode was recorded. A maximum phase change of 14° was measured which was considered negligible (Copeland reusable). The frequency responses obtained are shown in figure 2.6.

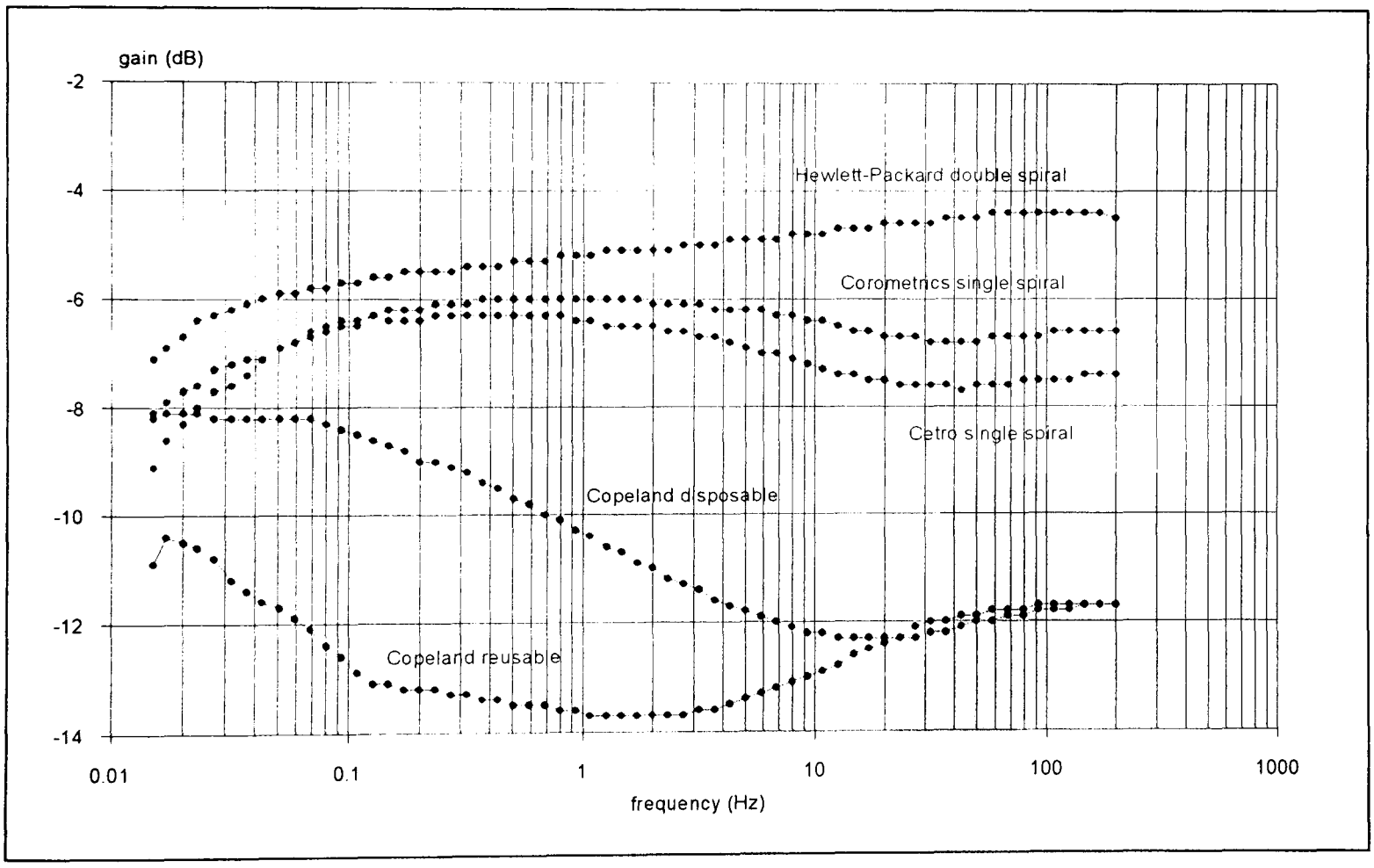

Figure 2.6: The frequency responses of the FSEs.

As expected, the signals from the Solartron analyser were attenuated by the impedance of the liver and fluids. Interestingly, the relative attenuations between the electrodes were different. The Hewlett-Packard double spiral electrode obtained a higher amplitude signal than the single spiral electrodes, which in turn obtained larger signals than either of the Copeland types. The frequency characteristics of the electrodes fell largely into two groups; the responses obtained for the spiral FSEs approached the ideal, being nearly flat within the frequency band of interest (0.05 - 100 Hz). The Copeland FSEs attenuated the whole signal

more than the spirals, and had a non-linear response, which attenuated higher frequency components 4 to 8 dBs more than the very low frequency components. This response is undesirable because it would accentuate the baseline shift frequencies.

2.7 Quantitative effects of the electrode frequency responses on the electrocardiogram.

The implications of the electrodes' frequency response on the ECG shape in the time domain was investigated. The fetal ECG could not be used for this study because it cannot be obtained without a fetal scalp electrode. Consequently, the signal would be modified by the electrode used during data collection. To overcome this, the ECG was collected from four neonates within 1 hour of birth which have an ECG similar to the fetus. Precordial silver/silver-chloride skin electrodes were used which minimally affect the ECG. Two digital filters were designed to have the same frequency response as the Copeland reusable and the Corometrics single spiral electrodes. These electrodes were chosen as they represented the two different frequency response groups observed in figure 2.6. The neonatal ECGs were then passed through the electrode filter models and the outputs compared.

2.7.1 Filter design using the frequency sampling method.

The electrode frequency response models were designed using the frequency sampling method (Proakis and Manolakis, 1988; Lockhart and Cheetham, 1989). This technique requires that the frequency responses be sampled linearly. The accuracy of the model is dependent upon the number of samples taken. The values obtained are regarded as discrete Fourier transform (DFT) coefficients from which the filter coefficients for the desired response can be obtained using the inverse discrete Fourier transform (IDFT).

The frequency samples are obtained by sampling the desired frequency response which is given by $H_d(e^{j\omega})$ at N points, ω_k, for k = 0, 1, 2, ... N-1, uniformly spaced around the unit circle such that,

$$\omega_k = \frac{2\pi k}{N}$$

Sampling the desired frequency response at these frequencies gives,

$$H(k) = H_d(e^{j\omega})\big|_{\omega=\omega_k}$$

$$H(k) = H_d(e^{j2\pi k/n})$$

These samples are regarded as DFT samples from which the frequency coefficients, h(n), can be calculated using the IDFT (equation 2.5).

$$h(n) = \frac{1}{N}\sum_{k=0}^{N-1} H(k)e^{2\pi nk/N} \quad \text{where n = 0, 1, ..., N-1.} \qquad (2.5)$$

2.7.2 Implementation of the frequency sampling method to obtain the electrode frequency response models.

The frequency sampling method required that the electrode frequency responses be sampled linearly with frequency and then normalised to the sampling frequency, F_S which was 1000 Hz. This would mean that some of the lower frequency features within the Copeland reusable response would be normalised to very narrow widths indeed (figure 2.7).

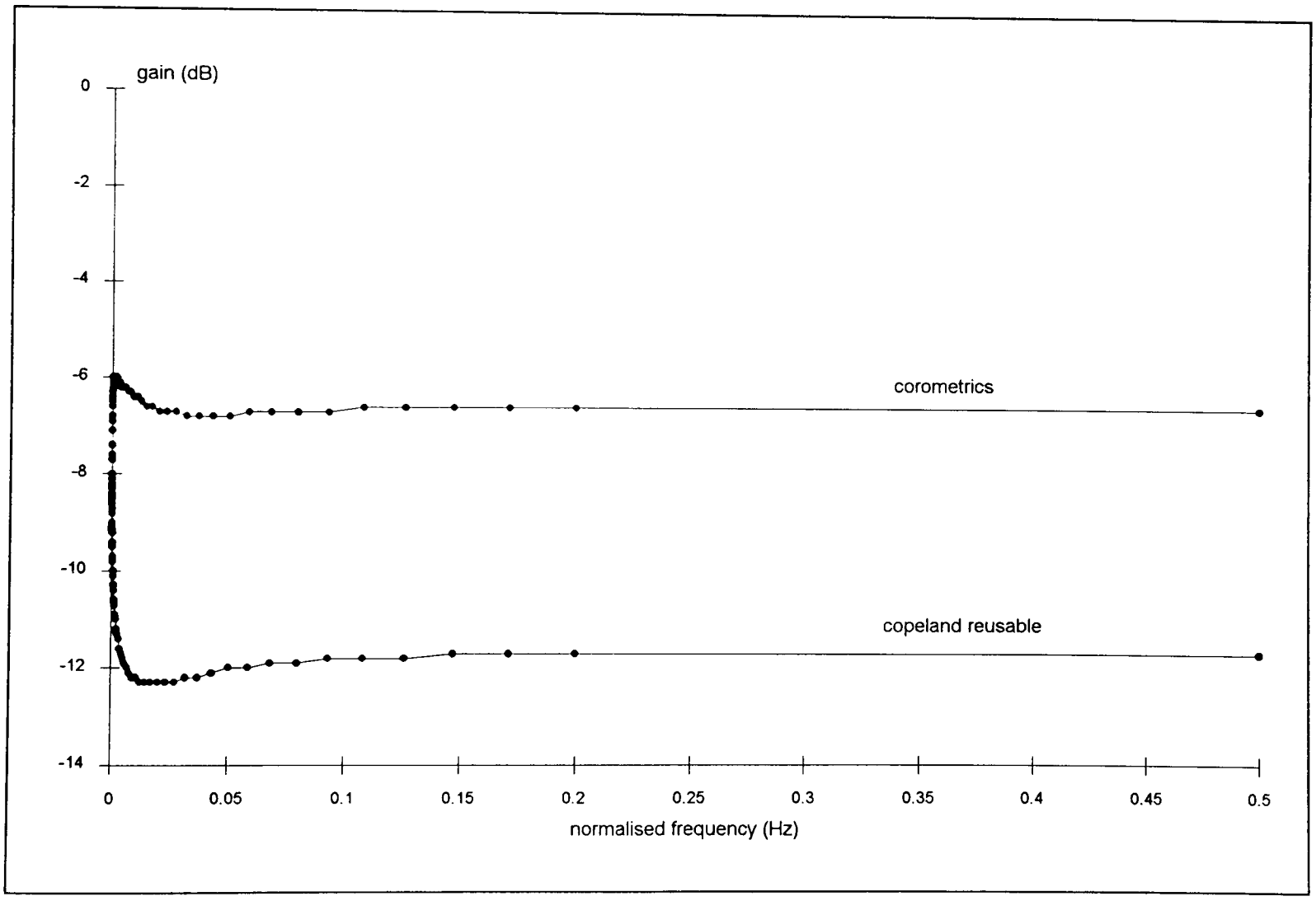

Figure 2.7: Electrode frequency responses on a linear scale normalised to 1000 Hz.

The peaked region between 0.01 Hz and 0.07 Hz, for example would have a normalised width of just 0.00006 Hz, which would require an impractical number of samples to obtain an accurate model. For this reason the sampling frequency of the neonatal ECG data was

decimated by a factor of M = 4, from 1000 Hz to 250 Hz using the same procedure as previously described (section 2.4.1). The frequency response curves normalised to the decimated sampling frequency, F_S = 250 Hz are shown in figure 2.8.

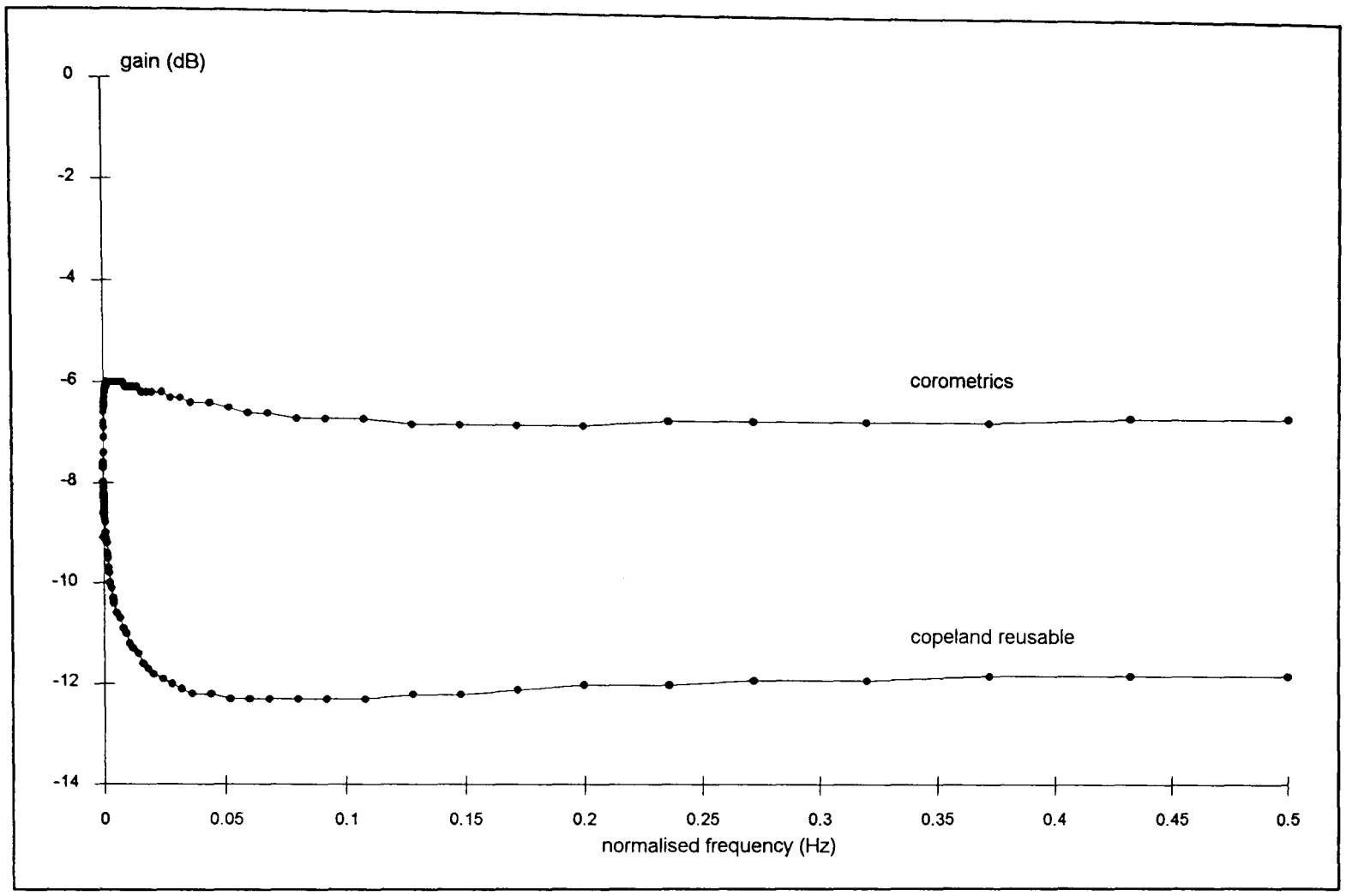

Figure 2.8: Electrode frequency responses normalised to 250 Hz

The frequency responses were sampled at intervals of 0.002 Hz to obtain 251 samples for each electrode. These were then converted back from decibels to obtain 251 DFT coefficients. Software was designed to implement the IDFT to produce 513 filter coefficients which were truncated using the Hamming window. This high number of coefficients was necessary to realise the still narrow features. As a check, the frequency response of the calculated coefficients was obtained using a commercial signal processing package, Interactive Laboratory System (ILS) (Signal Technology Inc. California USA 1987) and is shown in figure 2.9. A visual comparison of modelled frequency responses (figure 2.9) and the actual frequency response (figure 2.8) confirmed that the electrode frequency characteristics had been accurately modelled.

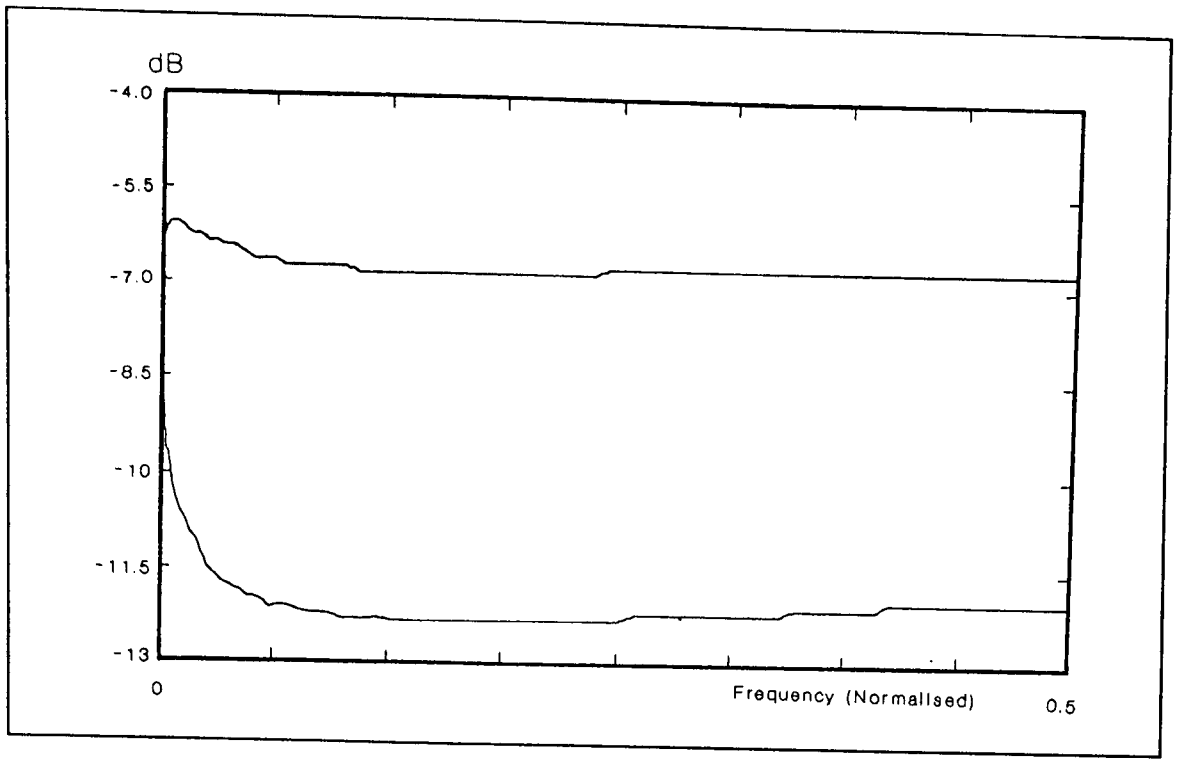

Figure 2.9: Electrode Frequency Response Models

2.7.3 Results.

The derived filter coefficients were convolved with the decimated neonatal ECG data to simulate the effects of the electrodes (figure 2.10).

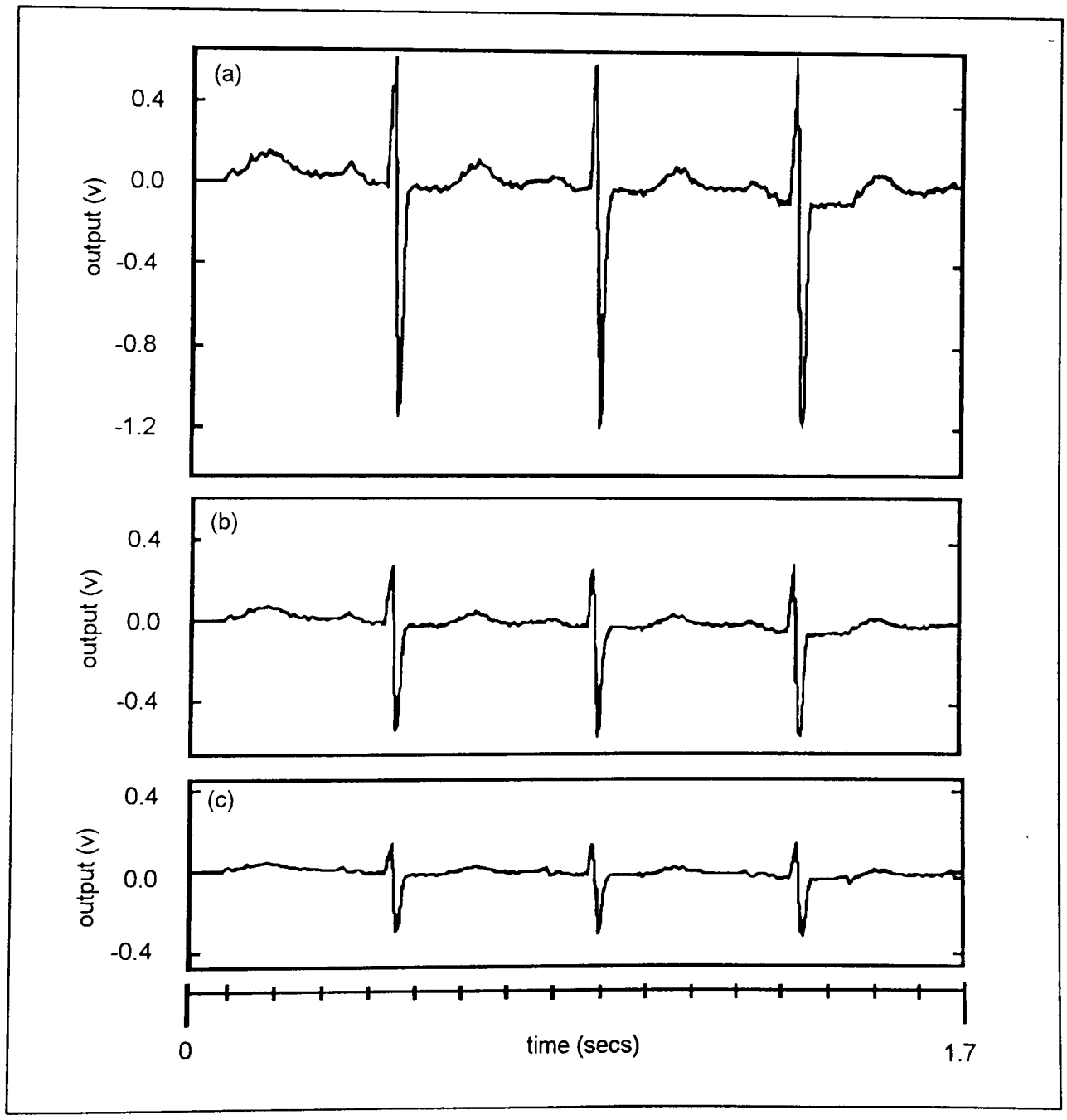

Figure 2.10: Electrode simulation results

Figure 2.10(a) shows a segment of neonatal ECG signal before filtering. Figure 2.10(b) shows the effects of filtering this segment with the Corometrics model and figure 2.10(c) shows the effects after filtering with the Copeland reusable model. As expected, visual examination shows that both electrode models attenuated the signal, which was due to the impedance of the liver and fluids during the original experiment. The results show that the signal filtered with Copeland reusable model was 54% of the peak to peak amplitude of the Corometrics model. While there did not appear to be any major changes in the overall waveform shapes, there did appear to be modifications in the P and T wave regions associated with the Copeland FSE.

2.8 Spectral analysis of the fetal electrocardiogram.

The location of the spectral bands of the QRS, R, P and T waves within the fetal ECG were investigated. This was to examine further the effects of the non-linear electrode frequency responses on the specific regions of the ECG complex.

Six fetal ECG records, obtained using single spiral electrodes, were reviewed. When a period of grade 1 (good) recording was found, software was implemented to decimate the sampling frequency of the data from 500 Hz to 125 Hz. For each record, an averaged ECG complex was obtained using 20 consecutive complexes which improved the signal to noise ratio (Sheild and Kirk, 1981; Kirk and Smith, 1986).

Several conventional methods were considered to obtain the bandwidth of the QRS, R, P and T wave regions within a given averaged ECG complex, but because of the discontinuous nature of the averaged waveform and the small number of data points making up each region, these methods were not suitable. Therefore, a slightly unconventional method was devised; 11 low pass and 10 high pass digital FIR filters were designed.

1. Low pass filters.

   The cut-off frequency ranged from 5 to 55 Hz in 5 Hz intervals.

   Transition width, $\Delta f = 5$ Hz.

   Minimum stop band attenuation, $A_S = 30$ dB.

   Maximum pass band ripple, $A_p = 0.5$ dB.

2. High pass filters.

   The cut-off frequency ranged from 1 to 10 Hz in 1 Hz intervals.

   Transition width, $\Delta f = 1$ Hz.

   Minimum stop band attenuation, $A_S = 30$ dB.

   Maximum pass band ripple, $A_p = 0.5$ dB.

The six averaged ECG complexes were passed through each filter and the filtered data values obtained from the 21 filters were saved. The un-filtered complexes were then displayed and the QRS, R, P and T waves were visually identified. The data values making up each identified region were then compared to the corresponding data values of each of the filtered regions.

The premise for the following analysis was that there would only be a significant difference between an un-filtered region and corresponding filtered region if the given filter had removed some of the important frequencies; there would be no difference in the values if the filter had been ineffectual. To assess when a significant difference had occurred a statistical method was employed. This made use of the fact that if a filter had had no effect, then if the un-filtered sample values were plotted against the corresponding filtered values, then a straight line would be obtained with gradient, $\beta = 1$ and intercept, $\alpha = 0$ ($y = x$).

The un-filtered data together with each filtered data set in the different regions of interest were considered as paired data-sets. Normal regression analysis assumes that for each fixed sample, x(i) (un-filtered data), the conditional density of the corresponding random variable, xf(i) (filtered data), has a normal distribution. This condition is valid because if a filter had no effect then the only difference between the un-filtered and filtered samples would be random noise effects. For a given paired data set, regression analysis allowed a straight line to be fitted where the estimated gradient, $\hat{\beta}$ is given by equation 2.6.

$$\hat{\beta} = \frac{\sum_{i=1}^{N} x(i)\,xf(i) - \frac{1}{N}\sum_{i=1}^{N} x(i)\sum_{i=1}^{N} xf(i)}{\sum_{i=1}^{N}(x(i))^2 - \frac{1}{N}\left(\sum_{i=1}^{N} x(i)\right)^2} \qquad (2.6)$$

$$\text{and where the intercept, } \hat{\alpha} = \overline{xf(i)} - \hat{\beta}\,\overline{x(i)} \qquad (2.7)$$

for i = 1, 2, ... N

where,

$\hat{\beta}$ is the estimated gradient.

$\hat{\alpha}$ is the estimated intercept.

x(i) is the ith un-filtered data sample.

xf(i) is the ith filtered data sample.

N is the total number of data pairs.

The random variables, t_α and t_β, can then be generated from equations 2.6 and 2.7 to have

the statistical t-distribution with N-2 degrees of freedom (Freund and Walpole, 1987).

The null hypothesis for a given set of paired data samples was that the filter had no effect ($x(i) = xf(i)$) and when plotted a straight line with gradient, $\beta = 1$, and intercept, $\alpha = 0$, would be obtained. The alternative hypothesis was that the filter had removed some of the important frequencies ($x(i) \neq xf(i)$) and when plotted a straight line with $\beta \neq 1$ or $\alpha \neq 0$ would be obtained. The significance level for this test was 0.05.

To illustrate the procedure, consider figure 2.11.

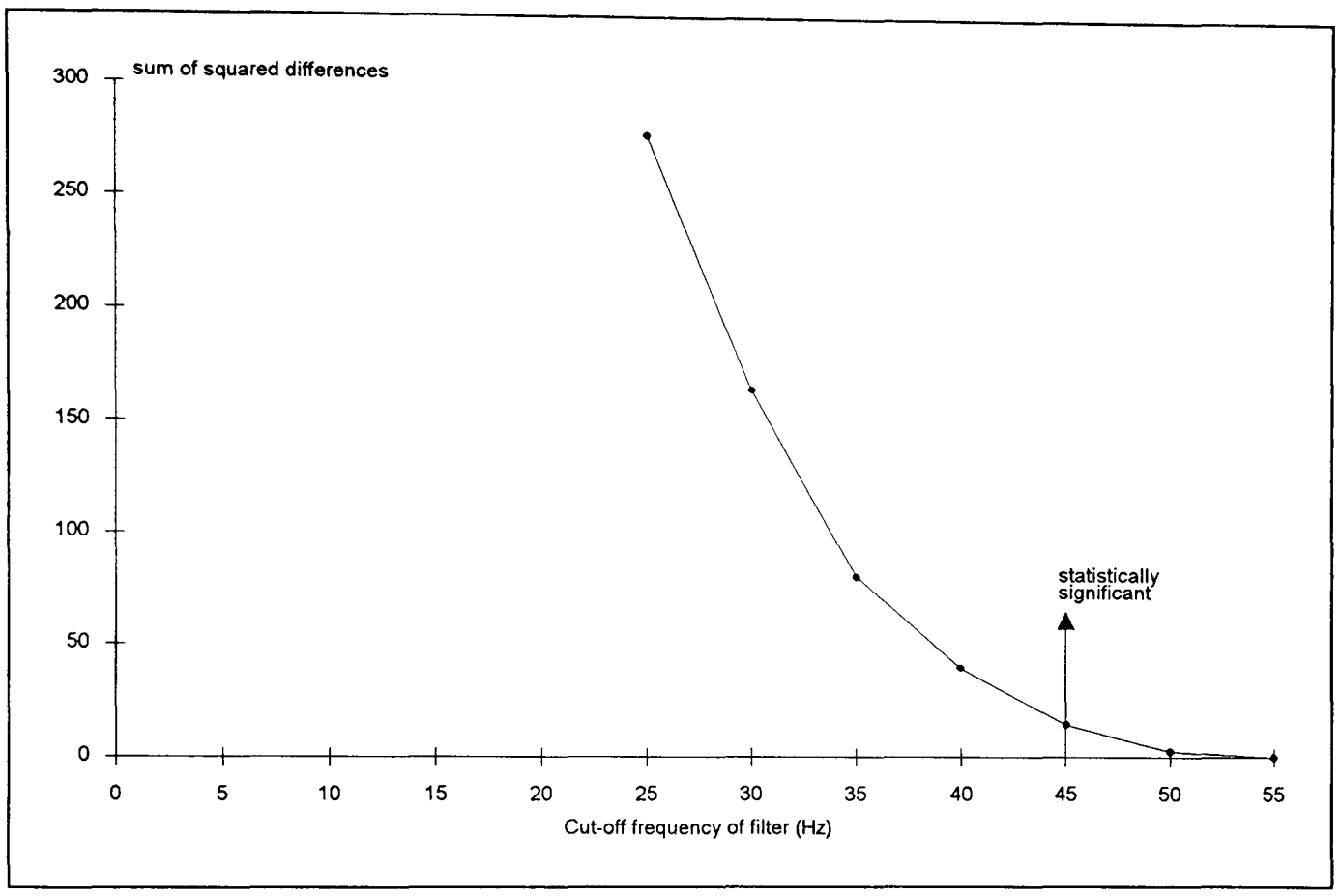

Figure 2.11: Low Pass Filtering Effects on QRS Wave.

Figure 2.11 shows how the sum of the squared differences between an un-filtered and filtered QRS wave increases as the cut-off frequency of the low pass filter is reduced. When the filter cut-off frequency was 45 Hz, the differences between the un-filtered and filtered data were statistically significant. Therefore, the upper frequency of interest for this QRS wave was 50 Hz because this was the highest filter cut-off frequency not to significantly affect the waveform. The lowest frequency of interest was found in a similar way using the high pass filters.

This procedure was carried out for the QRS, R, P and T waves of all 6 averaged ECG complexes. The averaged results for each region are summarised in table 2.3.

	Lower band		Upper band	
	mean (Hz)	standard deviation	mean (Hz)	standard deviation
QRS - wave	1.8	0.9	48.3	2.4
R - wave	4.2	0.7	49.8	2.1
P - wave	0.7	0.4	22.5	4.8
T- wave	-	-	11.7	2.4

Table 2.3: The averaged frequency bands of the QRS, R, P and T waves.

The lower band of the T-wave could not be found because all the high-pass filters used significantly modified this region. The lowest cut-off frequency used was 1 Hz, so the lower T-wave frequency of interest must be below this. The measured frequency bands were then plotted on the electrode frequency response curves to indicate the regions of the fetal ECG likely to be modified by a non-linear electrode frequency response (figure 2.13).

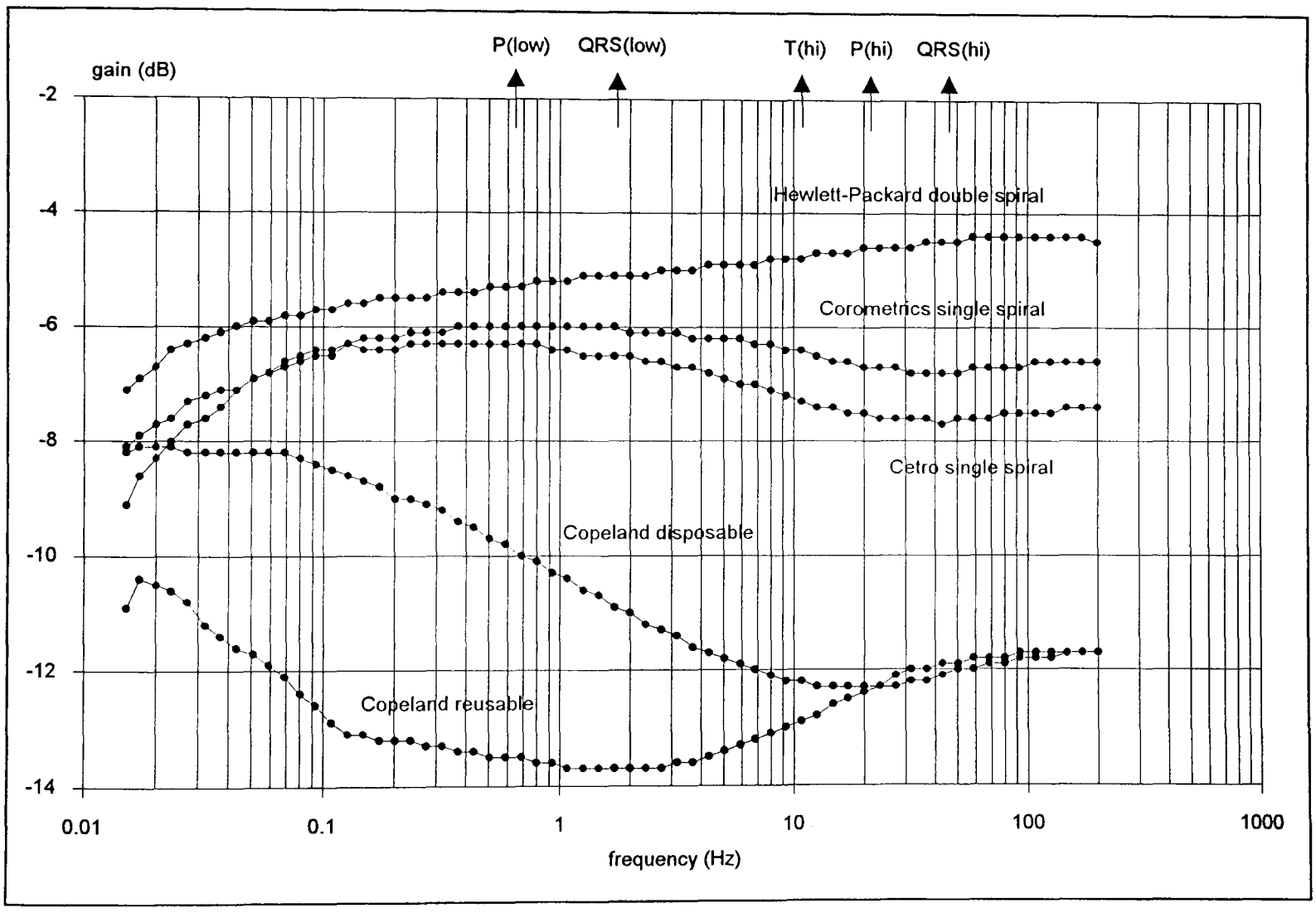

Figure 2.12: Electrode frequency responses with ECG frequency bands indicated.

Figure 2.12 shows that the near flat frequency response of the spiral electrodes are unlikely to significantly modify the ECG. However, the non-linear frequency responses of the Copeland electrodes are likely to modify all regions of the ECG, but particularly the P and T waves.

2.9 Discussion and recommendations.

There has only been one previous reported comparison of spiral and Copeland electrodes (Nickelsen et al 1989). This compared clinically the Copeland disposable and Corometrics FSEs for heart rate monitoring only and found no differences in complication rates which is in agreement with the randomized clinical trial of this study.

The factors which influence the quality of ECG recording have been investigated. It was found that the signal associated with a good period of recording has significantly higher QRS amplitude, lower baseline shift and lower saturation rates than other grades. Conversely, the signals obtained during a poor period of recording have significantly lower QRS wave amplitude, higher baseline shift and higher levels of signal saturation. Interestingly, the only significant difference between an adequate period and a poor period, was the signal saturation caused by very large baseline shifts. This suggests that it was baseline shift (and in the extreme, saturation) which largely determines the quality of fetal ECG recording.

If the ECG is only required for heart rate calculation using the R-wave, then the baseline shift can be removed from an unsaturated signal with suitable bandpass filtering. This study suggests that the R-wave bandwidth is 4 - 50 Hz. A more selective range may be preferred to further reduce baseline shift and mains interference at the expense of smaller R-waves. However, with a flat baseline, these could be subsequently amplified. If the ECG is required for waveform analysis then the frequency range of interest is taken as 0.05 - 100 Hz, consequently baseline shifts cannot easily be removed. This frequency range was recommended by the American Heart Committee some time ago and relates to the specification for a chart recorder required to record the adult ECG which can be obtained with a more stable baseline (American Heart Association, 1975). The validity of this lower frequency for the fetal ECG has never been established. When a fetal ECG complex is extracted for analysis from the continuous signal, it may be that this lower limit is excessive and could be increased as it is difficult to image how signals with a period of 20 seconds (0.05 Hz) could significantly influence an ECG complex which lasts less than half a second except to raise or lower the isometric reference. This would be especially true if successive ECG complexes were averaged as this process has an inherent filtering effect of their own. However, until work is undertaken to establish the minimum bandwidth for the fetal ECG these guidelines should be adhered to.

The difficulty in fetal ECG data acquisition is to suitably amplify the signal without allowing baseline shifts to move outside the ADC window causing signal saturation. The STAN recorder digitised the ECG to 8-bit resolution which meant the sampled data had a range 0 - 255. This range may be too narrow for the ECG to be adequately resolved for waveform analysis without risking saturation. If 12 bit resolution were used (sample range 0 - 4095)

then the ECG could be suitably resolved and the risks of saturation considerable reduced.

This study also examined the suitability of fetal scalp electrodes for obtaining the fetal ECG. The Hewlett-Packard double spiral FSE was found to have a near ideal frequency response and obtained the highest amplitude ECGs. However, in the clinical situation these electrodes are difficult to apply which makes their recording quality inconsistent. This was substantiated by the quantitative analysis which found a large standard deviation associated with the QRS wave collected by this electrode type. The Copeland electrodes are difficult to attach optimally, obtain smaller ECGs and have increased baseline shift. In addition their frequency response was found to be non-linear which accentuates the baseline shift and modifies all regions of the ECG, but in particular the P and T waves. The problems associated with these electrodes may in part be caused by their long semi-rigid design and method of attachment. This can be seen in figure 2.13 which shows an X-ray of a woman in early labour with a Copeland electrode attached to the fetal scalp.

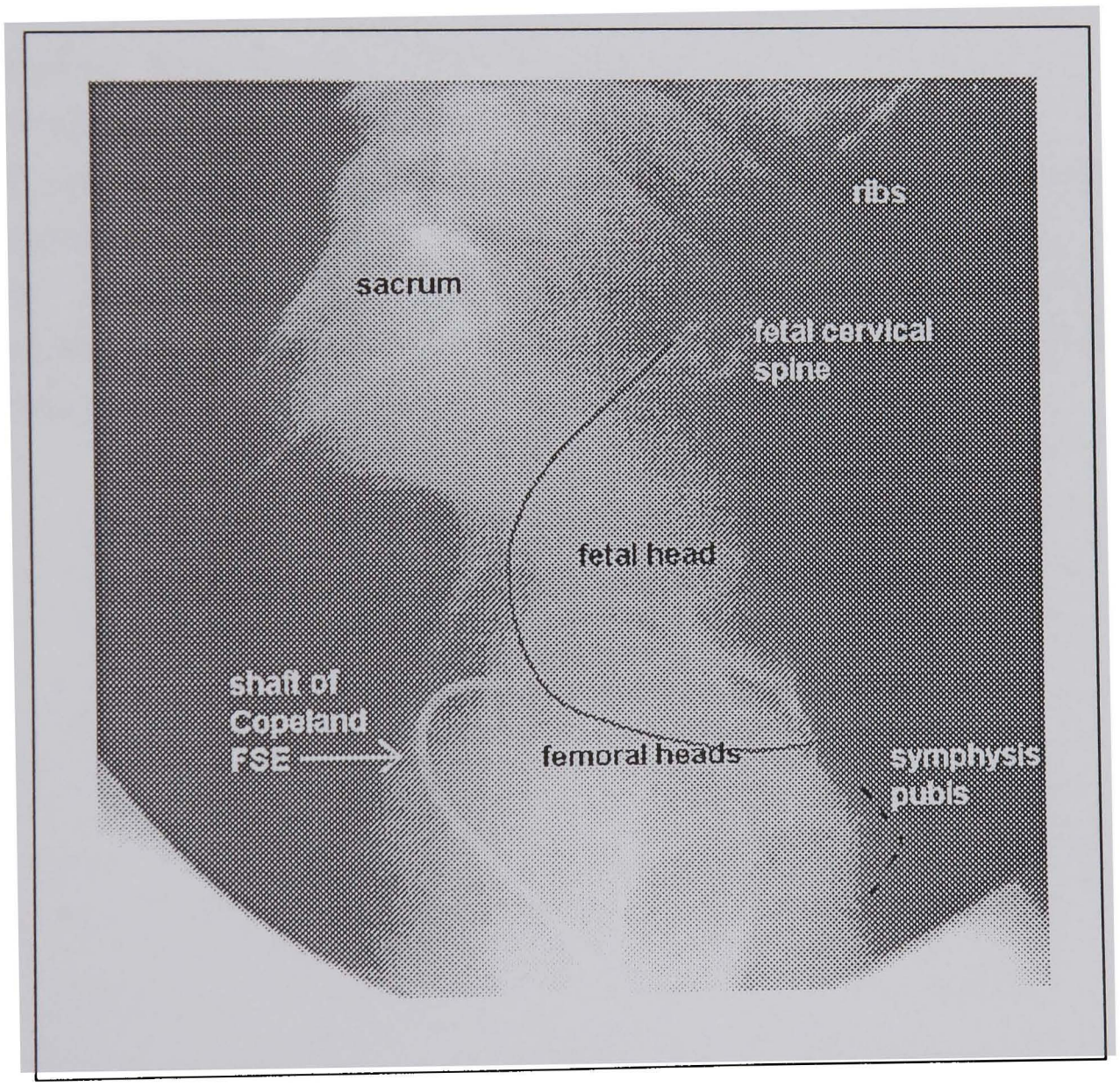

Figure 2.13: X-ray showing the attachment of the Copeland electrode.

Notice that the sprung shaft of the Copeland electrode is flexed which causes the electrode head to move with maternal movements which is likely to increase baseline shift.

The single spiral electrodes obtained an ECG with twice the amplitude of the Copeland types and also had a near ideal frequency response. Clinically, these electrodes are the easiest to apply optimally and provide a secure, consistent attachment to the fetus and are therefore the fetal scalp electrodes considered most suitable for obtaining the fetal ECG.

The fetal ECG is routinely used to calculate heart rate but research shows that there may be additional important information to be obtained from other variables within the waveform (Greene, 1983, 1987; Murray, 1986; Rosen, 1986). The findings of this study have important implications for this research because they suggest the causes of inadequate signal quality can be addressed if care is taken in the design of the data acquisition system for which the minimum recommended requirements are,

1. Single spiral fetal scalp electrode.
2. ADC resolution of 12 bits to ensure adequate waveform resolution with low risk of saturation from excessive baseline shifts.
3. Sampling frequency of 500 Hz.
4. Mains filter: Either adaptive or twin 'T' notch filter.
5. ECG bandwidth for waveform analysis of 0.05 - 100 Hz .
6. ECG bandwidth for heart rate of 4 Hz - 50 Hz maximum. A more selective range may be preferred.
7. Signal quality assessment; if the acquisition system could monitor the ECG then automatic gain control could be used to optimally amplify the digitised signal and minimise saturation.

Chapter 2 summary.

The nature of the fetal electrocardiogram (ECG) as obtained by 5 commonly available fetal scalp electrodes (FSEs) was investigated. These electrodes fall broadly into two groups; spiral electrodes which have a single or double helical spike to pierce the fetal presenting part, and Copelands which use a hook. 10 of each electrode were used to record the ECG from 50 patients in labour of which 20 were digitised and stored. The clinician visually reviewed the paper printouts from the cases and subjectively graded the periods of recording as good, adequate and poor.

The objectives for the study were to,

1. Identify the types of noise which influence the recording quality.
2. Analyse the signals obtained by the electrodes.
3. Examine the affect of the electrodes on the ECG.

The types of noise which were thought to influence the quality of the signal were low frequency baseline shifts, mains interference, signal saturation and signal drop-out. It was found that the principal factor which determined signal quality was baseline shift which, when extreme, caused signal saturation. The frequency of this noise is within the bandwidth of the ECG and so cannot be easily removed. It was found that the spiral electrodes obtained significantly ($\alpha = 0.05$) lower levels of baseline shift and signal saturation than the Copeland types.

The frequency responses of the electrodes were obtained in an in-vitro experiment which simulated the electrode/tissue interface. The spiral electrodes were found to have a frequency response which approached the ideal, being relatively flat in the frequency band of interest. The Copeland electrodes were found to have a non-linear response which attenuated the signals more than the spirals and accentuated baseline shifts. These frequency responses were modelled to investigate the time domain implications. It was found that spiral electrodes obtain signals with twice the amplitude of the Copelands. The frequency bands of the important features of the ECG were obtained and it was found that the non-linear frequency responses of the Copeland electrodes were likely to modify all features, but particularly the lower frequency P and T-waves.

This study suggests that the effects of baseline shift can be reduced with careful consideration to the design of the data acquisition system and by using a single spiral electrode.

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Chapter 3

Development of an intelligent system for labour management:

Feature extraction from the cardiotocogram.

3.1 Introduction.

The conceptual model from which the intelligent system for labour management was based is shown in figure 3.1.

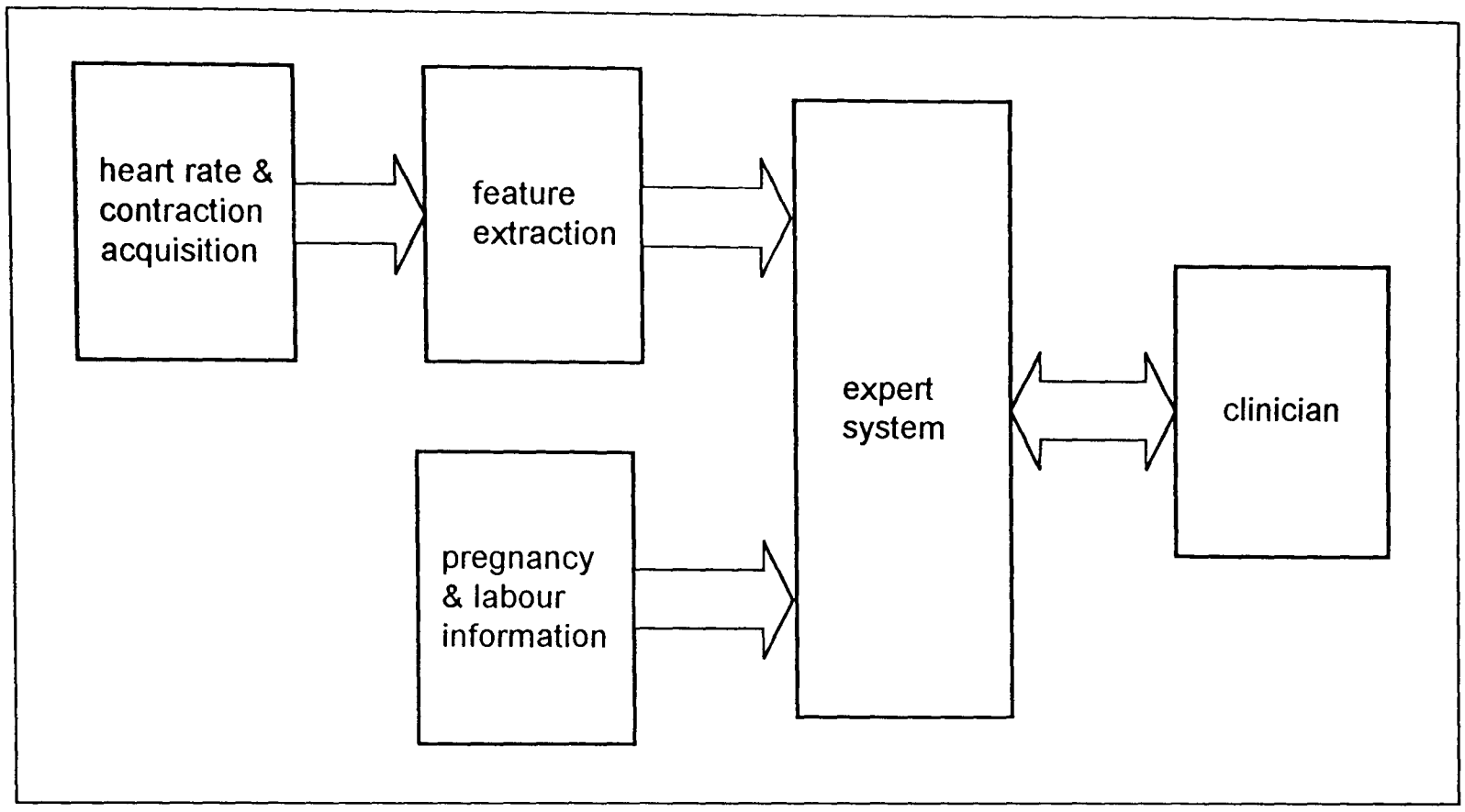

Figure 3.1: Conceptual model of an intelligent system for labour management.

It was proposed to obtain the fetal heart rate and uterine contraction signals from a conventional intrapartum CTG recorder. These signals would pass through a process of feature extraction to obtain the important information. This, together with the information pertaining to the specific pregnancy and labour would then be processed by an expert system.

The approach adopted throughout this investigation was to attempt to produce a system which extracted and processed information in the same way and at the same level of performance as the expert obstetrician. Experts can be difficult to identify especially in an area such as obstetrics where the clinicians' performance is not monitored. The criteria used to identify the obstetric expert were therefore subjective. However it was considered important to apply two conditions for accepting an individual as an expert.

1. The clinician must be experienced and still practising on the labour ward.
2. The clinician should be regarded as 'expert' by their peers and superiors.

In addition, the success of the project would require that experts be open, articulate, motivated and be aware of, and want the possible benefits an intelligent system could bring

to the labour ward. It was also felt that the success of the project would depend on the contributions of more than one expert.

The development of the system was undertaken along two main paths; the methods for feature extraction from the CTG and the expert system, which were later merged to form the complete system. This chapter considers the methods developed for feature extraction.

The features of the cardiotocogram.

The features within the CTG which are thought to reflect fetal condition have been described in detail in chapter one. The key features are:

1. Baseline heart rate; about which the heart rate pattern fluctuates.
2. Heart rate variability; the amplitude of high frequency perturbations about the baseline.
3. Accelerations in heart rate; relatively long term transient increases in heart rate from the baseline.
4. Decelerations in heart rate; relatively long term transient decreases in heart rate from the baseline, classified according to their size and timing in relation to uterine contractions.
5. Frequency and timing of contractions.

An additional important parameter is a measure of the quality of the heart rate and contraction signals.

3.2 Feature extraction using artificial neural networks.

It was previously recognised that the performance of the system would depend on its ability to extract and classify features from the CTG in the same way and at the same level of performance as experts. Previous attempts to automate the feature extraction process have used empirical methods (Krause, 1990; Maeda, 1990; Dawes et al, 1991). Detailed studies have not been published to demonstrate how closely these methods compare with the experienced clinician. In contrast, artificial neural networks (NNs) are trained by experts using examples representative of the problem and so do not depend on empirically derived means. This may allow them to perform at a level comparable with experts. It was for these reasons that it was decided to investigate how NNs might be implemented to extract and

classify complex features from the CTG and compare their performance with experts and conventional algorithms (Keith et al, 1993).

3.2.1 The backpropagation neural network.

The backpropagation NN model was used for these investigations and is shown in figure 3.2. This NN is a feed-forward, fully connected network with one input layer, (h), one hidden layer of nodes, (i), and an output layer of classification nodes, (j). All investigations were performed on an 80486 microprocessor based personal computer. The software was developed in the C-programming language and is given in appendix B.

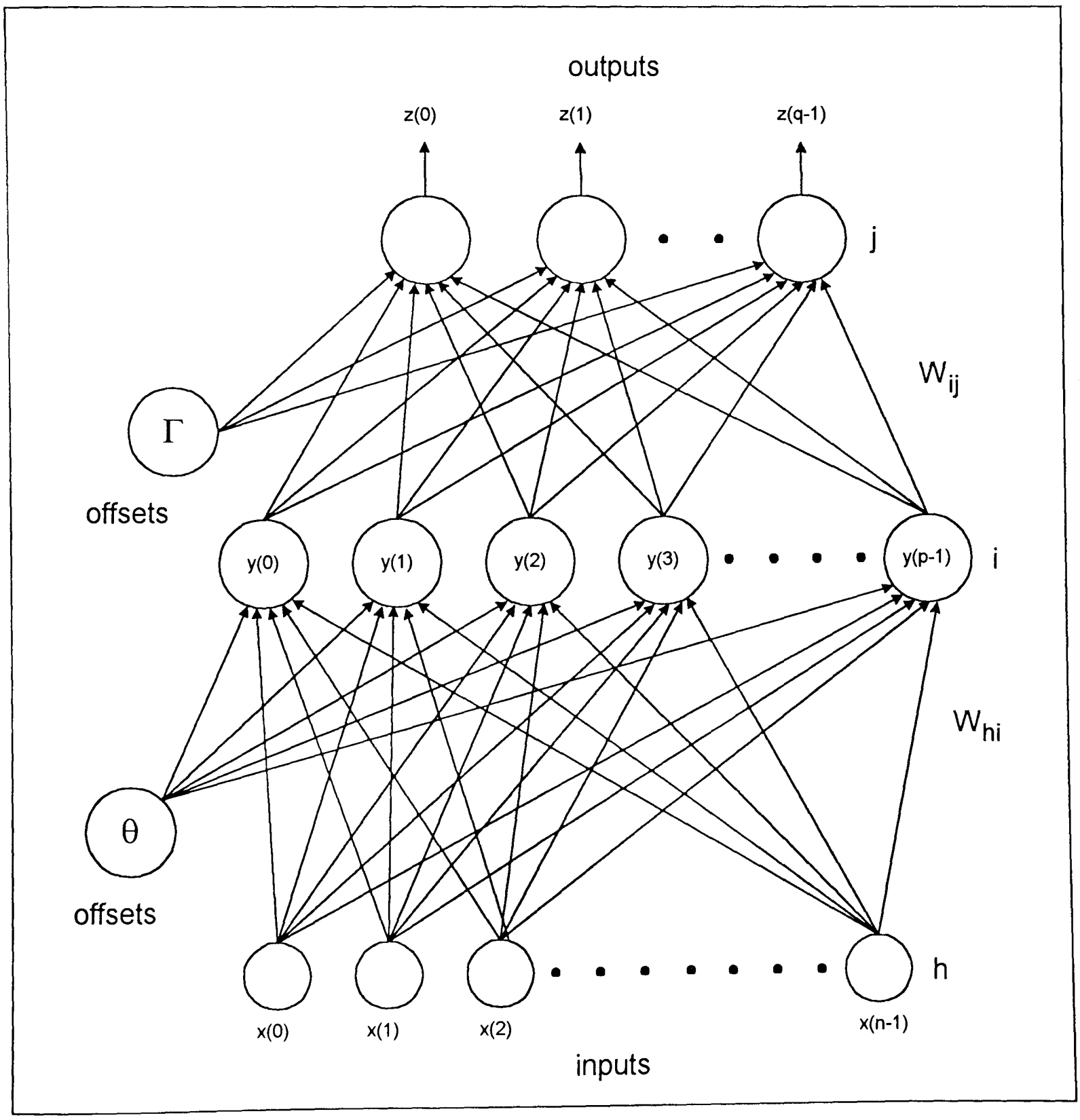

Figure 3.2: The backpropagation neural network model.

General description of operation.

The input matrix, X(h) = [x(0), x(1), x(2) ... x(n-1)], is formed from the sampled input data to be classified and is presented to the input layer, h, of the NN. Each node of the hidden layer, i, receives a signal associated with each input sample, modified by the interconnecting weight, W_{hi}. The signals received at each node are summed and an offset, θ_{hi}, is added. A threshold function, f(x), is applied to the sum total to produce a nodal output, y(i), in the range 0 to 1 (figure 3.3).

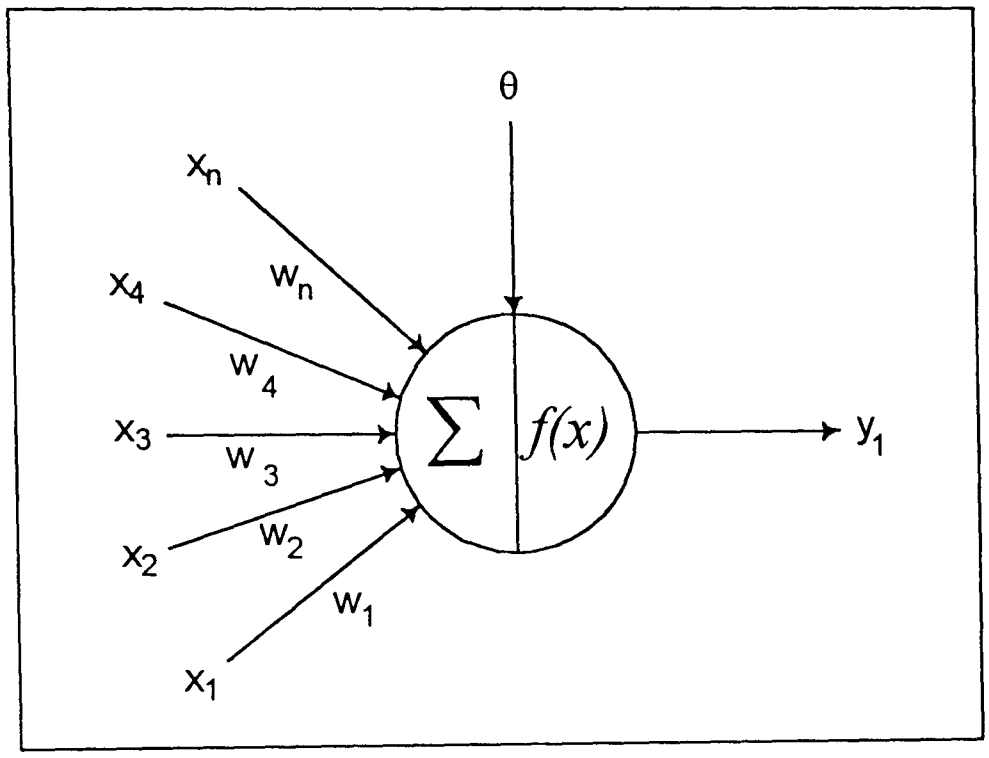

Figure 3.3: A processing element or node.

The operation of the node is described mathematically by equation 3.1.

$$y = f(\sum_{i=1}^{n} w_i x_i - \theta) \tag{3.1}$$

Where the thresholding function, f(x), is usually taken as the sigmoid function described by equation 3.2.

$$f(x) = \frac{1}{1+e^{-x}} \tag{3.2}$$

which is shown graphically in figure 3.4.

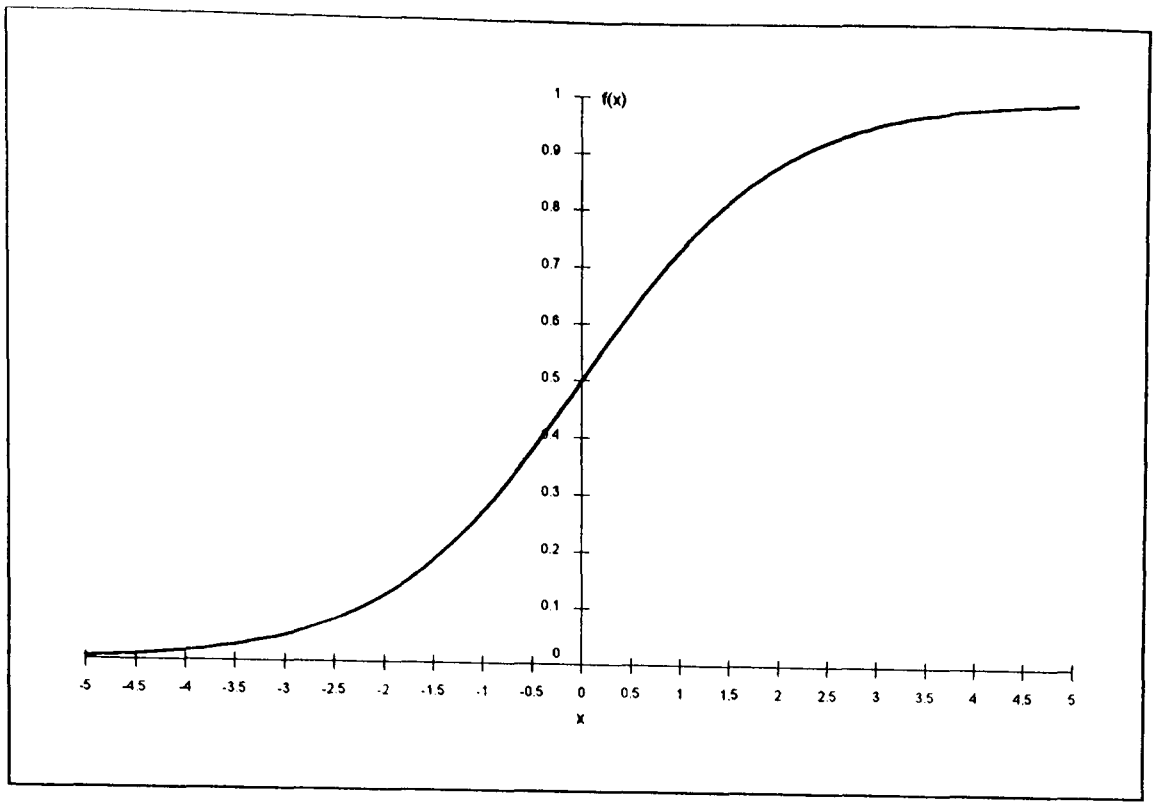

Figure 3.4: Sigmoid threshold function.

The hidden layer matrix, Y(i) = [y(0), y(1), y(2) ... y(p-1)], is processed in a similar way through the next layer of weights, W_{ij}, to form the output matrix, Z(j) = [z(0), z(1), z(2), ... z(q-1)]. The NN is trained to generate a specific output pattern when a specific feature is present in the input data.

Training the backpropagation neural network.

Artificial neural networks, unlike conventional approaches, are trained rather than programmed. Programming would take the form of attempting to understand and formalise the expert knowledge into a set of procedures and rules which could then be directly implemented by a computer.

A backpropagation NN is trained using a comprehensive library of examples compiled and classified by a domain expert. The interconnection weights, W_{hi} and W_{ij}, are firstly randomised to signed non-zero values. A training example is selected from the library at random and processed through the NN. A measure of the error between the actual output pattern achieved and the desired output pattern is calculated. A small change proportional to the error and specified by the backpropagation learning algorithm (Rumelhart et al, 1986), is made to the weights to bias the network towards the desired output response. The process of selecting an example and biasing the weights is repeated many times until the NN approaches a global solution where the output error for a high proportion of the examples is small and lies within a previously defined limit. At this point the NN is said to have converged and the learning process is complete. The performance of the NN can then by assessed by comparing its classification of 'unseen' examples with experts. The backpropagation algorithm is now described.

The backpropagation algorithm.

1. Random values are assigned to all the interconnection weights, W_{hi} and W_{ij}, and to each of the offsets, θ_i and Γ_j.

2. The input pattern matrix, X(h) = [x(0), x(1), x(2) ... x(n-1)], and the desired output pattern matrix, D(j) = [d(0), d(1), ... d(q-1)], form the pattern pair which are presented to the network. For pattern classification, the outputs are generally made binary.

3. The input pattern matrix, X(h), is filtered through the interconnection weights, W_{hi}, using equation 3.3, for all, p, middle layer nodes.

$$y(i) = f(\sum_{h=0}^{n-1} x(h)w_{hi} + \theta_i) \tag{3.3}$$

Where, y(i) is the activation value of the ith middle layer node, θ_i is the ith middle layer offset value, and f(x) is the logistic sigmoid threshold function described in equation 3.2.

4. The middle layer output matrix, Y(i), is filtered through the interconnection weights, W_{ij}, using equation 3.4, for all q output nodes.

$$z(j) = f(\sum_{i=0}^{p-1} y(i)w_{ij} + \Gamma_j) \tag{3.4}$$

Where z(j) is the activation value of the jth output node and Γ_j is the jth output node offset value.

5. The error between the computed output and the output desired by the expert is found with equation 3.5, for all q output nodes.

$$\varepsilon_j = z(j)(1-z(j))(d(j)-z(j)) \tag{3.5}$$

Where d_j is the output for node j desired by the expert and ε_j is the computed error of the jth output node.

6. The error for each middle node output, relative to each ε_j is calculated using equation 3.6, for all p middle nodes.

$$\varepsilon_i = y(j)(1-y(j))\sum_{j=0}^{q-1} w_{ij}\varepsilon_j \tag{3.6}$$

Where q is the number of output nodes and ε_i is the computed error associated with the ith middle node.

7. Each interconnection weight between the middle layer and output layer are modified by equation 3.7,

$$w_{ij}(t+1) = w_{ij}(t) + \alpha \varepsilon_j y(i) + \mu(w_{ij}(t) - w_{ij}(t+1)) \qquad (3.7)$$

Where the learning rate gain term, α, is in the range, $0 < \alpha < 1$. This parameter prevents the network from oscillating due to large adjustments in the weights and thereby helps the network slowly converge to a general solution for all input patterns in the training set. The momentum term, μ, is used to speed up the learning process by adding a proportion of the previous weight adjustment to the present change. The rationale for this term takes the following form. For each interconnection weight, the desired weight solution lies in a certain particular direction from random starting position. The continued presentation of input data leads the value of the weight to be modified with a velocity. By adding a proportion of the previous weight change, a given weight is effectively accelerated towards its final solution thus improving the learning time.

8. The offset values for the output layer are adjusted by equation 3.8, for all q outputs.

$$\Gamma_j(t+1) = \Gamma_j(t) + \alpha \varepsilon_j + \mu(\Gamma_j(t) - \Gamma_j(t-1)) \qquad (3.8)$$

9. The weights of the interconnections between the inputs and middle layer are adjusted by equation 3.9, for all p middle nodes.

$$w_{hi}(t+1) = w_{hi}(t) + \alpha \varepsilon_i x_h + \mu(w_{hi}(t) - w_{hi}(t-1)) \qquad (3.9)$$

10. The middle layer offsets are adjusted with equation 3.10, for all p middle nodes.

$$\theta_j(t+1) = \theta_j(t) + \alpha \varepsilon_j + \mu(\theta_j(t) - \theta_j(t-1)) \qquad (3.10)$$

11. The process is then repeated from step 2 until the global error of the network becomes sufficiently low.

Once training is complete the network weights are saved. The NN can then be used to classify 'unseen' data by forming the input matrix, X(h), and processing this through the saved weights, W_{hi} and W_{ij}, using equations 3.3 and 3.4, to form the output classification matrix Z(j).

An observation regarding the backpropagation learning algorithm.

In steps 5 and 6, an assessment of the error in the NN output was obtained using equations 3.5 and 3.6, which took the form,

$$\varepsilon_j = z(j)(1-z(j))(d(j)-z(j))$$

These equations have some properties which on the face on it appear rather strange. The roots of the equation which determines the error, ε_j, are given when an output, z(j), is 0 or 1, or when the output equals the desired output, d(j). This last root seems reasonable. However, the roots when, z(j) = 0 and z(j) = 1 are independent of the desired output. This suggests that when an output is actually 0, but is desired to be 1, the error is 0. Similarly, when z(j) = 1 and d(j) = 0. An explanation of this anomaly could not be found and so it was investigated. Consider the graph of y = z(1 - z) (with roots z = 0 and z = 1) for the range 0 < z < 1, which corresponds to the range of the NN output shown in figure 3.5.

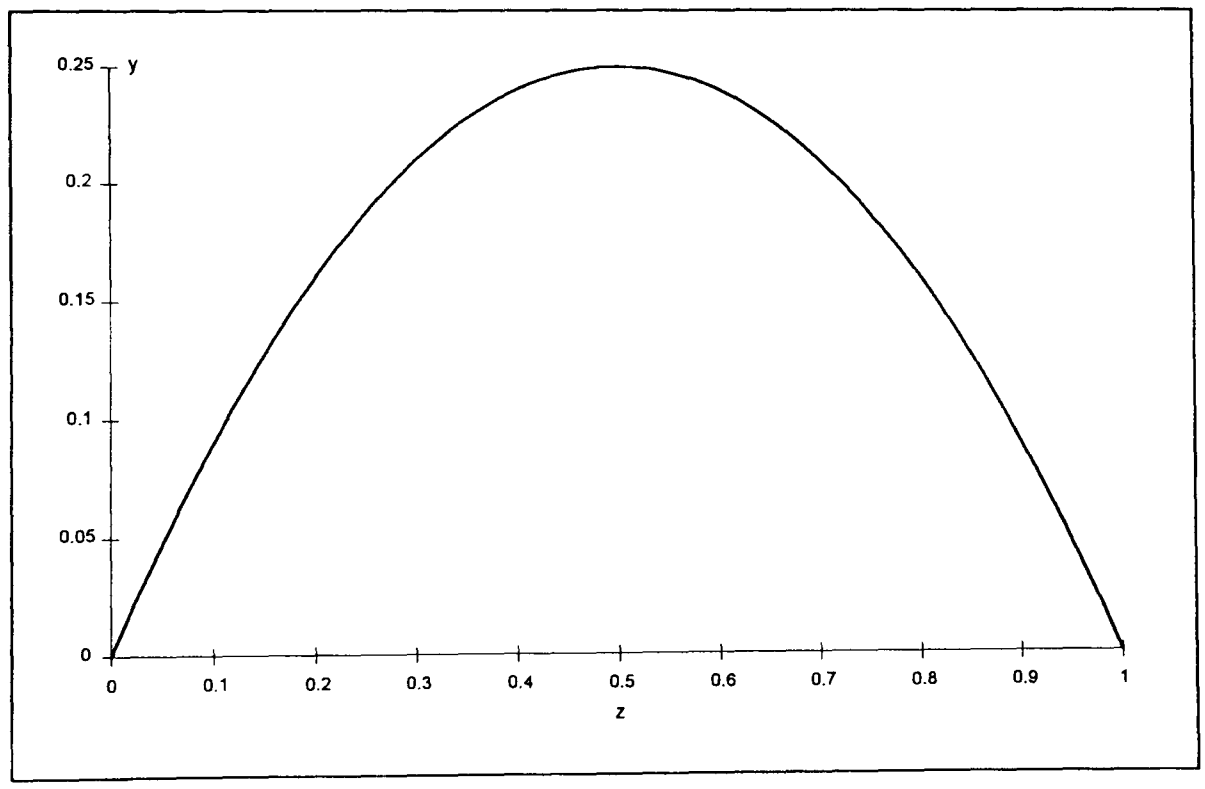

Figure 3.5: The contribution of the nodal output (z) to the error function.

This graph attains a maximum value of y = 0.25 when z = 0.5. This represents the value of z which produces the maximum modification to the weights. This is interesting because it will be recalled from figure 3.4 which described the sigmoid threshold function, that the output of a node is 0.5 when the sum of its inputs is 0. If the weights of the NN are well randomised before training commences then the sum of the inputs will be 0 and the

conditions for maximum weight adjustment are fulfilled. As training continues, the weights will be adjusted to produce nodal outputs tending to the desired values, 0 or 1. But to which extreme the output tends will depend on the training examples themselves. Therefore, the situation should never arise when the output, z(j), is 1 but is desired to be 0 (similarly for z(j) = 0 and d(j) = 1). This condition could only conceivably be reached as a result of inconsistencies in the training set. This finding suggests that if the inconsistencies are few, they will make little difference to training because their measured error will be 0 and will lead to no weight adjustment. In this way, the NN will tend to the majority view. This finding also highlights the importance of the randomisation process of the NN weights. If large values are assigned then it becomes more likely that the sum of the inputs to a node will be, less than -3 or greater than 3 which would be enough to saturate the node to either 0 or 1 (figure 3.4). If this happened then training times could become much longer than necessary if a saturated node was desired to be the opposite polarity. To prevent this, all investigations began with the weights of the NN randomised to small, signed values ($-0.01 < w < 0.01$) to ensure that the sum at all nodes did not cause saturation and tended to the conditions for maximum weight adjustment at the start of training.

Selective data presentation strategy.

The training times for the backpropagation NN can become excessively long for large training sets. To overcome this, a data selection strategy, (Allred and Kelly, 1990) was incorporated into the backpropagation algorithm. This enhancement improves learning times by modifying the network weights only for those input examples which produce large output errors. No adjustment is made for those examples which produce outputs 'close' to the desired output. Specifically, a threshold variable λ was assigned, $\lambda = 0.75$

A training example was selected and processed through the NN. For each output, j, the absolute error, e_j, between the actual output and the desired output was calculated using equation 3.11.

$$e_j = |z(j) - d(j)| \tag{3.11}$$

An adjustment of the weights was performed when any output error was $> \lambda$.

When the error, e_j, for 90% of the training examples was less than λ, the threshold was reduced to 75% of its previous value and the process repeated. This cycle was continued until $\lambda \leq 0.1$ (when for 90% of the training set, every output required to be 1 was actually ≥ 0.9, and every output required to be 0 was actually ≤ 0.1), whereupon the data selection strategy was abandoned and a weight adjustment was made for every training example.

3.2.2 The exclusive OR problem.

A 3 layer NN with any dimensions (limited to the available memory) was implemented in the C - programming language and was validated by considering the exclusive OR (XOR) problem proposed by Rumelhart et al, (1986). The XOR truth table for two binary inputs is shown in table 3.1,

Input A	Input B	Output
0	0	0
0	1	1
1	0	1
1	1	0

Table 3.1: The exclusive OR truth table.

The minimum NN configuration required to solve this problem is a NN with 2 inputs, 2 hidden nodes and 1 output (dimensions 2 x 2 x 1). A NN with these dimensions was trained to solve the XOR problem using the developed software. The training curve obtained is shown in figure 3.6, where the average error between the actual output and the desired output was plotted for each 1000 random presentations or epoch.

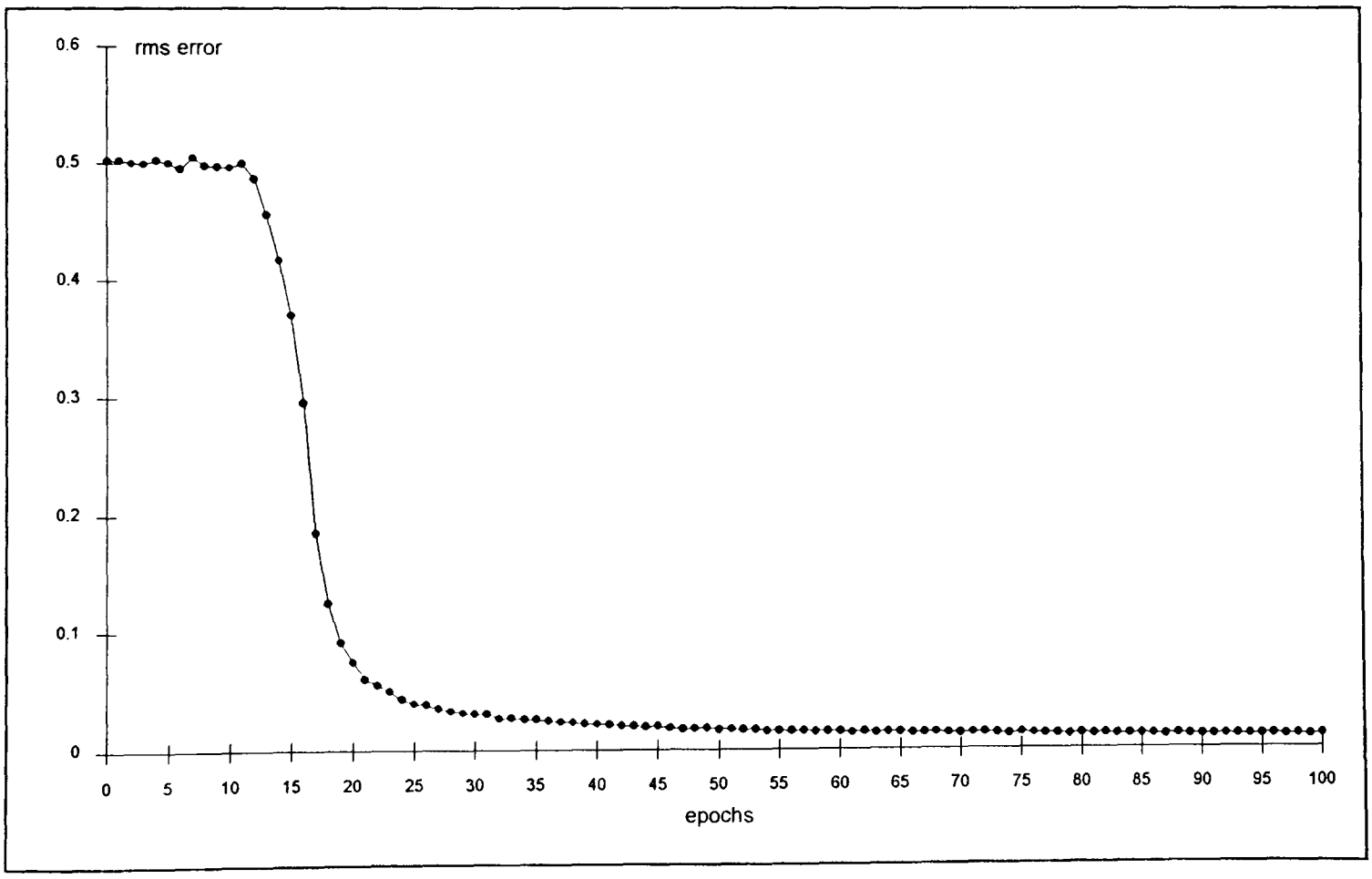

Figure 3.6: NN Learning Curve for solving the XOR Problem.

The averaged error at the output begins at 0.5, which confirms that the weights were suitably randomised. There was little change in the output error for the first 10,000

presentations (10 epochs) during which the weights are adjusted from their very small starting values to the larger values required for the solution. After this point, the output error falls rapidly as the NN converges to the final solution. From 25,000 presentations onwards, there is only a 5% error between the actual output and the desired output after which further convergence is small and slow. The state of the NN weights after 100 training epochs are shown in figure 3.7 and can be used to verify that this is a correct NN solution for the XOR problem.

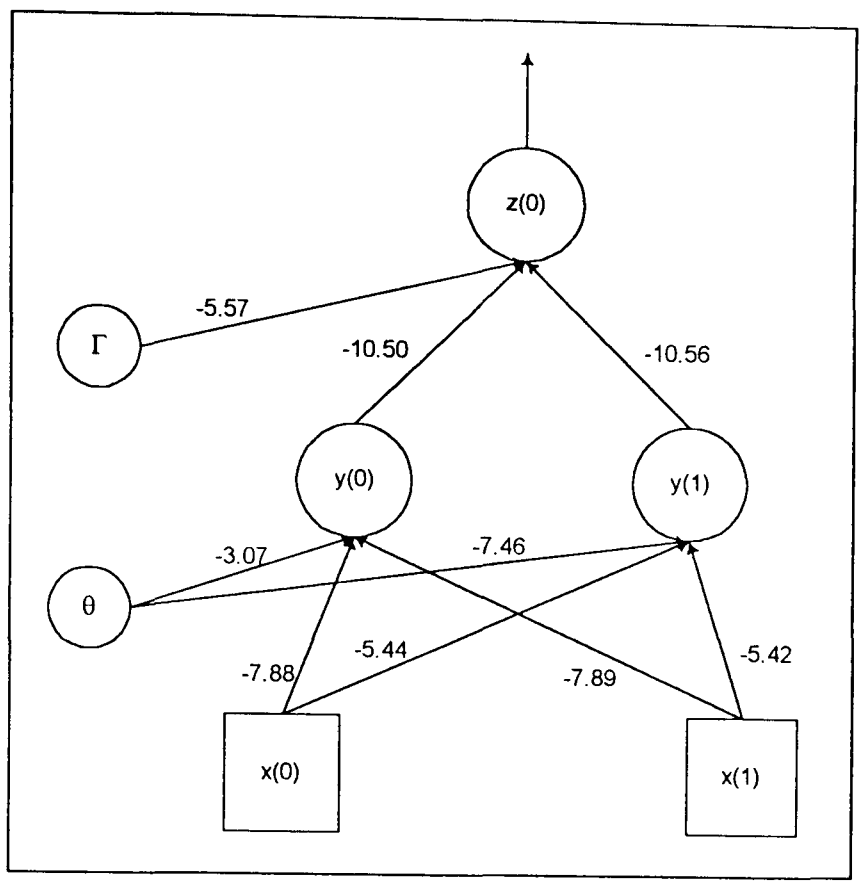

Figure 3.7: Neural network solution to XOR problem.

3.3 A neural network to classify the complete cardiotocogram.

3.3.1 Method.

The first investigation involving NNs was to attempt to mimic the way CTGs are assessed by clinicians. It was proposed to train a single NN to fully classify all features from segments of CTG simultaneously. As certain features can last several minutes, the minimum clinically useful segment length was considered to be 5 minutes.

The contraction channel had a sampling frequency of 1 Hz, which gave 300 samples per 5

minute segment. The fetal heart rate varies so the number of samples per segment was not constant. If an average heart rate of 200 beats per minute were assumed (the highest likely), then 1000 samples per 5 minute segment would be obtained. Direct use of this data would require 1300 NN inputs, an impractical size. This data was therefore compressed by producing an averaged sample pair (1 heart rate sample and 1 contraction sample) for each 4.444 seconds of recording. This was a convenient figure as sample pairs were already averaged in intervals of 2.222 seconds for display purposes. Thus, for each 4.444 second interval a heart rate and contraction sample pair were produced, which gave 68 pairs or 136 data values for each 5 minute segment (figure 3.8).

A visual assessment of the averaged data showed that this averaging process altered the clinical interpretation of the high frequency heart rate variability which was therefore unsuitable for classification with this NN. It did not modify the clinical interpretation of any other feature. The expert classified the remaining three features of the CTG (baseline heart rate, accelerations in heart rate and decelerations in heart rate) into the sub-classes shown in figure 3.8 which required 11 output nodes. For each segment presented to the NN, one baseline output node was desired to be 1.0 (with the remaining nodes = 0), to indicate the range in which the baseline heart rate lies. A similar approach was used to classify decelerations. The presence of accelerations was indicated when the associated output node was 1.0. The number of middle nodes chosen was 20 to produce the largest size NN that could be simulated on our computer. The dimensions for the network were therefore 136 x 20 x 11 (figure 3.8).

The training set.

Compiling the training set is unquestionably the most important stage in the development of a NN solution. The training set must fully represent the entire problem, because otherwise the NNs performance may become unpredictable for patterns not included. This could result in the NN being unable to classify some patterns, or more seriously (bearing in mind the proposed application) erroneously classifying others. To address this problem, software was developed to allow an expert to extract 50,000 x 5 minute segments of CTG from a large database stored on optical disc media. However, it was considered that even a training set this large was unlikely to encompass all possible patterns.

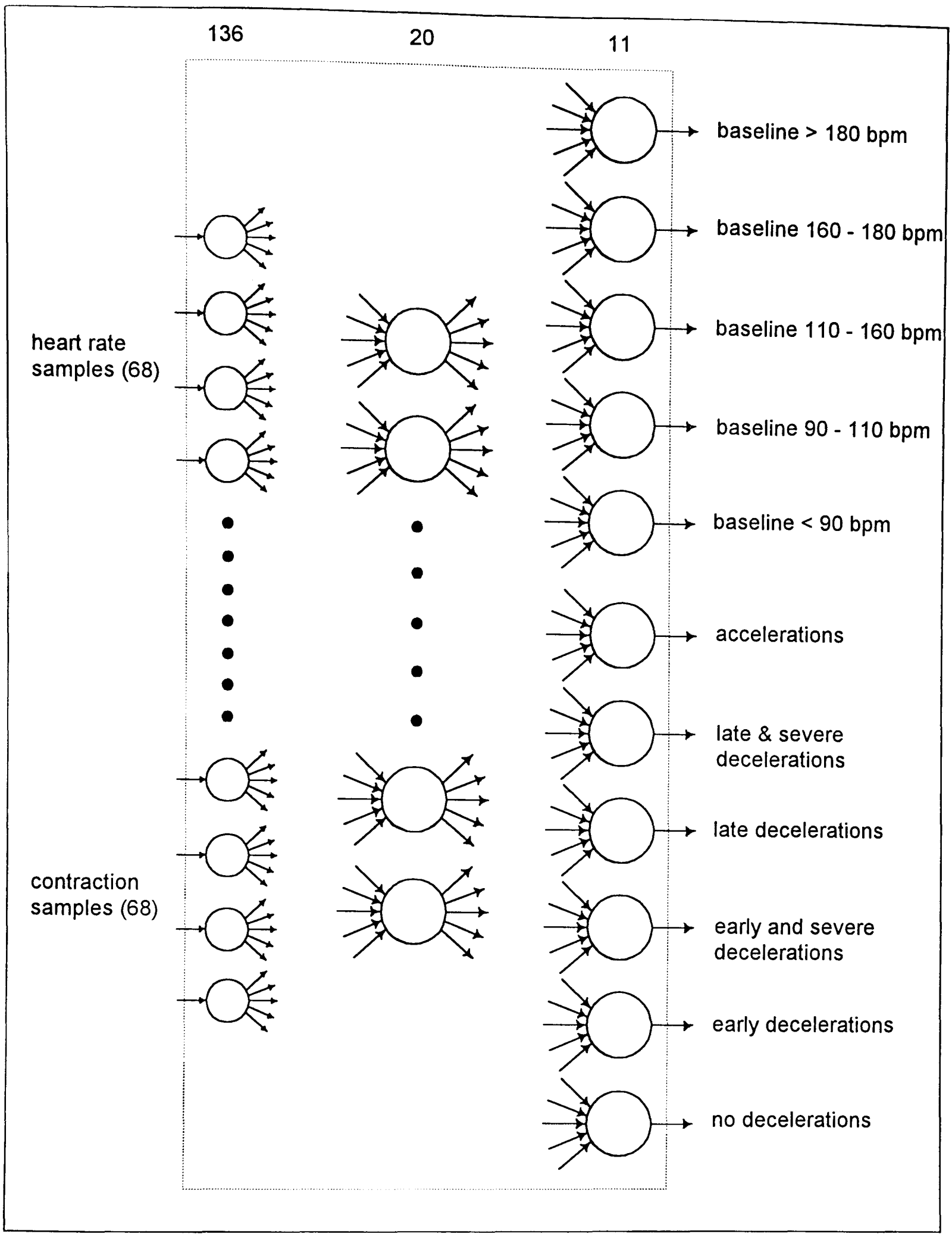

Figure 3.8: Neural network configuration for complete classification of the CTG.

3.3.2 Results.

The NN was trained on this data for 2 months continuously which represented over 100,000,000 data presentations. However, the network made little progress toward convergence even though the data selection algorithm was incorporated. Training was therefore terminated. This suggested that the problem in its current form was unsuitable for a NN solution and pre-processing was required to break the problem down into smaller, more manageable sub-tasks.

3.4 A neural network to classify the magnitude and timing of heart rate decelerations.

3.4.1 Method.

The problem was reduced by training a NN to classify just the magnitude and timing of heart rate decelerations in relation to uterine contractions, which have been shown to be the most difficult features to classify (Lindegaard, 1992). The same input configuration as the previous approach was used together with 15 middle nodes and the 5 output deceleration classification nodes (136x15x5) as shown previously in figure 3.8. A training set of 1300 potential decelerations in heart rate were created by the expert, where a potential deceleration was defined as a transient departure below the baseline of more than 5 beats per minute for greater than 5 seconds. To add a degree of consistency to the task, the heart rate samples forming a deceleration were centralised to the NN heart rate inputs as shown in figure 3.9.

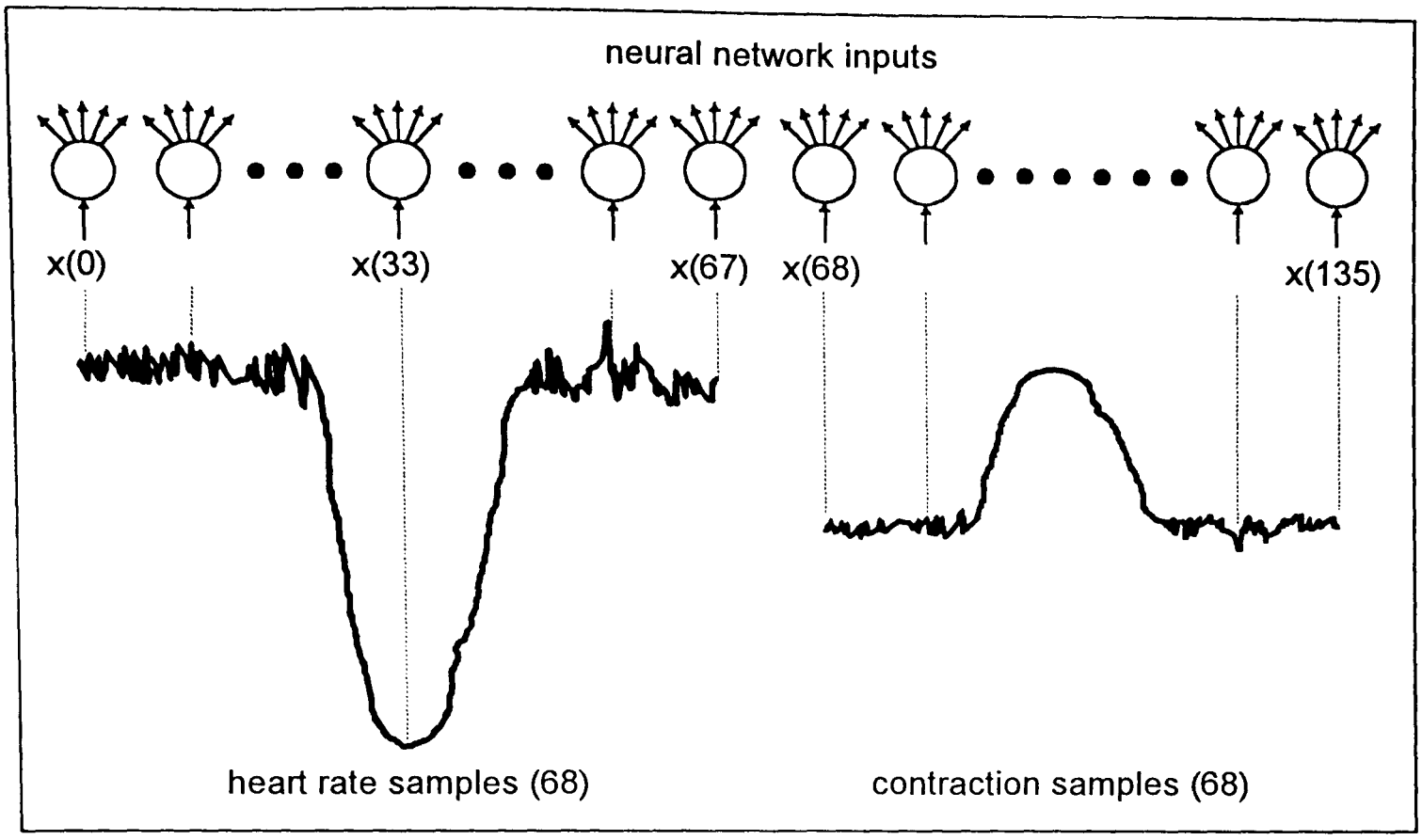

Figure 3.9: Centralisation of heart rate samples to neural network inputs.

3.4.2 Results.

The NN was trained until there was less than a 1% error between the expert classification and the NN classification for 90% of the examples. The training curve obtained is shown in figure 3.10. Convergence was achieved in approximately 24 hours.

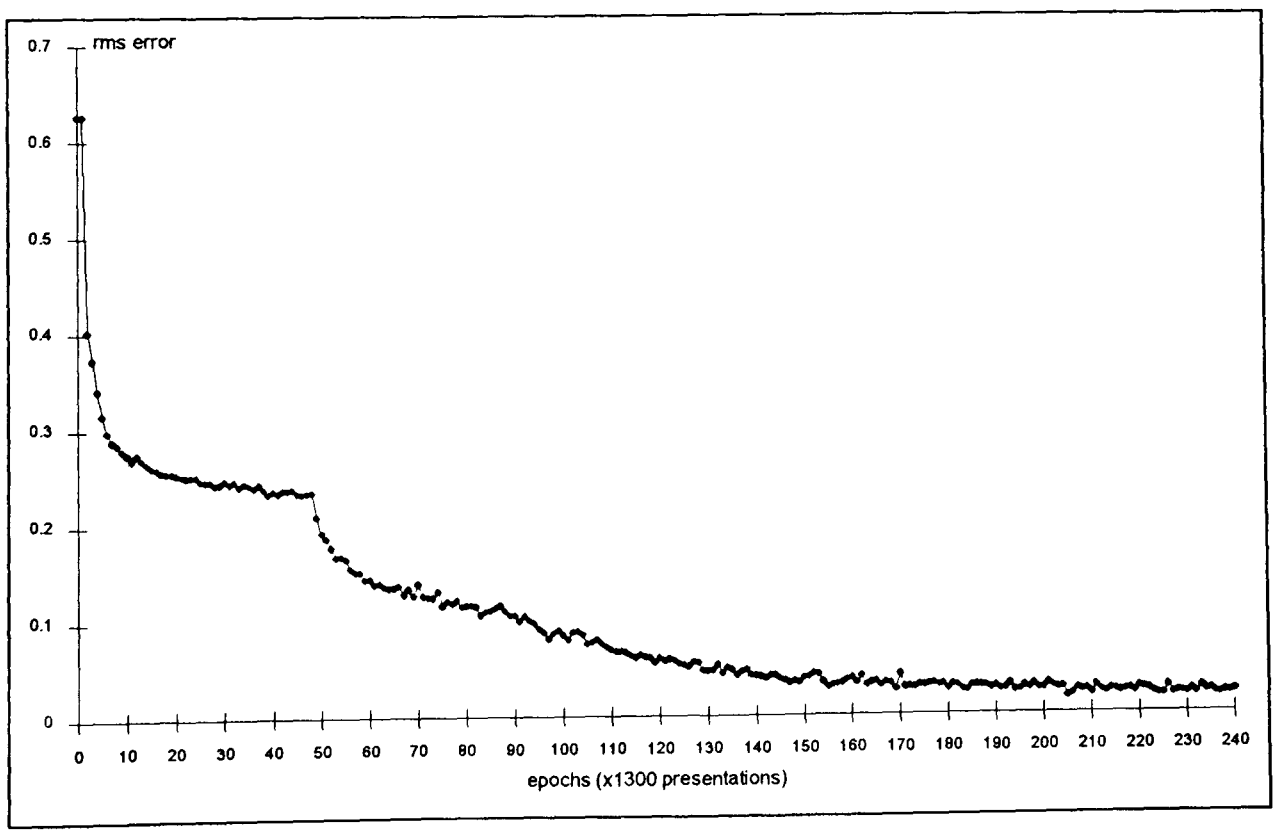

Figure 3.10: Training curve for classifying the magnitude and timing of decelerations.

The performance of the NN was assessed by an expert from a visual review of the NN's classification of decelerations within 56 previously 'unseen' labour recordings. The expert concluded that the NN performed well when the quality of the data recording was good. However, when the contraction data was of poor quality or absent, the NN performed poorly. This approach was considered of little practical use as clinically the signal quality during labour is inconsistent and often results in the contraction trace being poorly formed. This investigation indicated the difficulties of using actual data samples as input to the NN and suggested further pre-processing of the input data was required

3.5 A neural network to classify the magnitude of decelerations.

3.5.1 Method.

A NN using pre-processed input data was trained to classify the magnitude of decelerations only. In practice, the timing of a deceleration in relation to the contractions would have to be subsequently classified by an algorithm. The selective data presentation algorithm was unnecessary because the training times were short.

Previous computerised approaches to identify decelerations (Krause, 1990; Maeda, 1990; Dawes et al, 1991) have largely been based on the relationship between the depth below the baseline heart rate and the duration of the feature, figure 3.11.

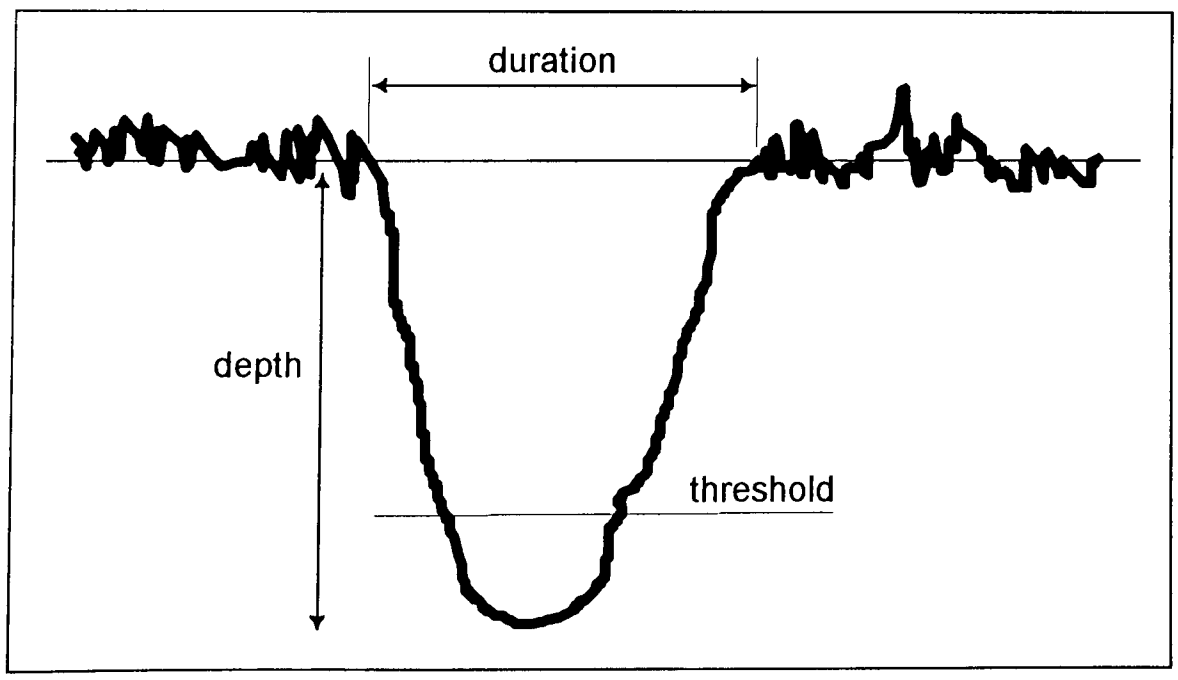

Figure 3.11: Conventional model for classifying the magnitude of decelerations.

The System 8000, (Oxford Medical Ltd, Abingdon, Oxford, UK) is the only commercially available computerised antenatal monitor which performs automatic feature extraction from the antepartum CTG. During labour, the CTG is a far more complex and is more difficult to interpret. The antepartum CTG is recorded over an interval of 20-30 minutes when the mother is relaxed and the fetus is not stressed. Put simply, if any abnormal features appear then there is cause for concern. Although the interpretation of the 2 waveforms are different, some of the features are similar, for example decelerations. The System 8000 identifies *decelerations* as those transient departures which fall below the baseline for more than 20 bpm for more than 30 seconds, or by more than 10 bpm for more than 1 minute. An identified *deceleration* is then further classified as *'large'* (or *'severe'*) if the area is greater than 20 lost beats (Dawes et al, 1991). The suitability of this algorithm to make the initial classification of a deceleration was investigated by comparing the classifications of 1,000 examples by the System 8000 algorithm and two experts independently. The experts made the same classification for 86.1% of the features. The algorithm however, made the same classification as the experts for only 60.4% and 55.8% of the features respectively. It was likely that the relatively poor agreement between the System 8000 algorithm and the experts could in part, reflect the need for a more sophisticated classification model for features occurring during labour. An extension of the classification model was therefore proposed and is shown in figure 3.12.

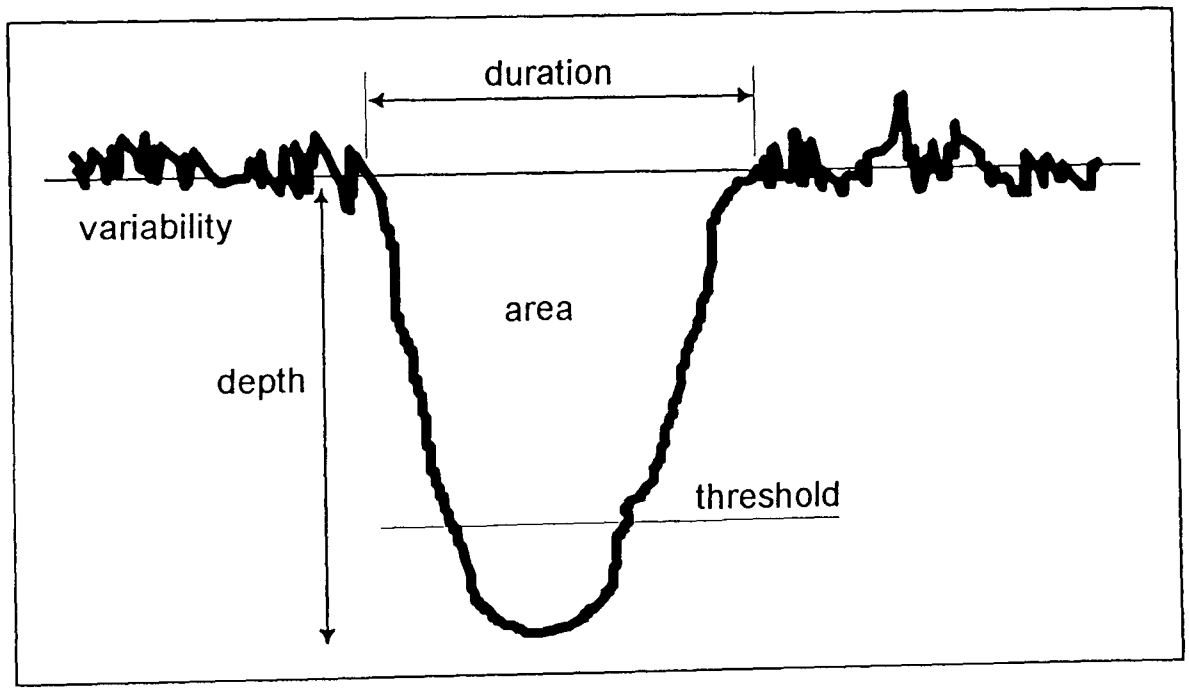

Figure 3.12: Extended model for classifying the magnitude of decelerations.

The area of a deceleration is used by the System 8000 algorithm to further classify *decelerations* as *severe decelerations*. It was the opinion of experienced clinicians that this shape information may also be important for making the initial classification. The heart rate variability was also thought to be important, as it was considered that during episodes of high variability the thresholds for classifying decelerations may need to be increased and during episodes of decreased variability, they may need to be reduced.

An algorithm was developed to identify possible decelerations and measure the four variables, area, depth, duration and variability which were used as the inputs to a NN. The NN required 3 outputs to classify the feature as either, *not a deceleration*, *a deceleration*, or a *severe deceleration*. A training set of 456 examples, evenly distributed across the three classifications, was compiled and classified by an expert. Selection was based on the requirement to broadly cover the different sizes and shapes of decelerations.

3.5.2 Optimising the number of middle layer nodes.

Defining the optimal number of middle nodes to incorporate in a NN is not obvious. Therefore 10 NNs with dimensions 4 x n x 3, where n = 1 to 10, were trained separately on this data. Each network was allowed to train for 1,000,000 random presentations of the examples, which represented approximately 2193 presentations of each example. The percentage number of examples classified correctly was recorded for every 456 random presentations, or epoch. A correct classification was achieved when the output required to be 1 was actually greater than 0.9, and the outputs required to be 0 were less than 0.1. When training was halted, the mean and variance of the percentage number of correctly classified training examples from the last 10 epochs were calculated for each of the 10 NNs and are shown in table 3.2.

Number of middle nodes (n)	mean (%)	variance
1	29.6	6.55
2	78.3	15.34
3	78.1	21.45
4	79.6	16.45
5	82.1	2.37
6	84.3	4.74
7	83.5	3.26
8	83.4	2.25
9	83.7	3.77
10	82.9	5.16

Table 3.2: Mean and variance of correct classifications made during the last 10 epochs of training for NNs with 1 to 10 middle nodes.

NN_1 (where subscript 1 denotes the number of middle nodes), achieved only 29.6% correct classifications for the training set and so was unsuitable. The remaining networks fell into two groups; NN_2 to NN_4 have high variances compared to NN_5 to NN_{10} which implies they had formed a less stable solution. A one way analysis of variance showed that there were no significant ($\alpha = 0.05$) differences in the mean number of examples classified correctly by NN_5 to NN_{10}. Hence NN_5 was identified as optimal, as it achieved

convergence with the fewest middle nodes and was therefore the most computationally efficient.

3.5.3 Test of generalisation.

The classification of decelerations is subjective and so there are no 'gold standards' to assess the performance of NN_5 to correctly classify 'unseen' examples. For this reason, the performance of NN_5 and the System 8000 algorithm were compared with human interpretation. Six reviewers were recruited; two experienced senior registrars who interpret the CTG daily who were considered experts, an experienced research midwife, a midwifery Sister, a locum Consultant obstetrician/gynaecologist with previous labour ward experience and an engineer who had no experience in CTG classification.

Each reviewer independently viewed on a computer screen 232, 15 minute sections of heart rate recording, in which a possible deceleration was highlighted. However, unknown to the reviewers, these 232 sections of recording actually contained 116 unique examples which were presented twice. The 116 different examples were presented consecutively and then re-presented in a randomised sequence.

Each participant was asked to classify the magnitude of the 232 decelerations as, *not a deceleration*, *a deceleration*, or a *severe deceleration*. These examples were also presented to the NN_5 and the System 8000 algorithm. The NN_5 was deemed to have successfully classified a feature when 1 output only was greater than 0.8 and two outputs were less than 0.2.

3.5.4 Results.

NN_5 classified all 232 decelerations. Table 3.3 shows the level of agreement (as a percentage) between the experts, the System 8000 and the NN_5 as well as each reviewer's consistency. For example, reviewer C consistently classified 79.3% of the examples and agreed with 73.7% of reviewer B's classifications.

	A	B	C	D	E	F	8000	NN_5
A	89.7	81.0	74.5	65.1	56.9	62.9	56.5	75.0
B	81.0	97.0	73.7	72.9	58.6	58.2	68.9	81.9
C	74.5	73.7	79.3	60.8	56.5	60.8	56.0	75.4
D	65.1	72.9	60.8	84.5	59.1	55.2	68.1	58.6
E	56.9	58.6	56.5	59.1	76.7	49.1	52.6	54.3
F	62.9	58.2	60.8	55.2	49.1	65.5	38.8	54.7
8000	56.5	68.9	56.0	68.1	52.6	38.8	100	46.6
NN_5	75.0	81.9	75.4	58.6	54.3	54.7	46.6	100

Table 3.3: The reviewers agreement.

Reviewers A, B and C, the senior registrars and research midwife respectively, all had a high level of internal and external consistency which demonstrates their expertise for this task. Reviewer D the engineer, had a high level of internal consistency but with rather lower inter-agreement. The System 8000 algorithm did not agree particularly well with any reviewer. NN_5 however, shows a high level of agreement with A, B and C, and little agreement with D, E and F or with the System 8000 algorithm.

The poor performance of the System 8000 algorithm was investigated. Table 3.4 shows the breakdown in classifications made by observer B, the most consistent expert and the algorithm.

	System 8000		
Reviewer B	Not Deceleration	Deceleration	Severe Deceleration
Not Deceleration	92.9	2.8	4.2
Deceleration	54.5	36.6	8.9
Severe Deceleration	0.0	6.0	94.0

Table 3.4: Breakdown of classifications between expert B and System 8000 algorithm.

The algorithm agreed well with reviewer B for the classification of *not decelerations* and *severe decelerations*. However, the algorithm only agreed with 36.6% of the features classified by B as *decelerations*; 54.5% of the features classified as *decelerations* by B were classified as *not decelerations* by the algorithm. These results were consistent for A and C. This insensitivity may result from the initial requirement that a feature is a *deceleration* only if the heart rate falls below the baseline by more than 20 bpm for more than 30 seconds, or by more than 10 bpm for more than one minute. It was found that the performance of algorithm could be improved if the initial classification was taken as a fall in fetal heart rate

of more than 10 bpm below the baseline for more than 15 seconds with an area greater than 5 lost beats. The subsequent classification for *severe decelerations* was unchanged. Comparing this modified algorithm with the other reviewers obtains the results in table 3.5.

	Reviewer							
	A	**B**	**C**	**D**	**E**	**F**	**8000**	**NN_5**
Modified System 8000 algorithm	72.1	76.7	70.0	73.3	52.6	48.3	63.4	72.4

Table 3.5: Agreement table with modified System 8000 algorithm.

This modified System 8000 algorithm obtained a more general solution to the problem. It obtained good agreement with, A, B and C, the NN_5 and interestingly, with D (the engineer). The NN_5 agreed with reviewers A, B and C but especially with B, the reviewer who classified the training set. It may be that the algorithm could be further improved if the heart rate variability preceding the feature were also taken into account.

3.6 Discussion of the suitability of neural networks for feature extraction.

Three investigations have examined different ways in which NNs might be implemented to extract features from the CTG during labour. The first investigation was unsuccessful in training a NN to simultaneously extract and classify all features of interest from a segment of averaged raw data samples. This was perhaps because of the numerous patterns possible and the lack of consistency in the relative positioning of these features within each segment. The second approach reduced these problems by training a NN to classify a single feature, again using averaged raw data samples as input. A numerical algorithm was used to identify the possible features in the waveform which were then presented to the NN with the same relative input positioning to ensure a degree of consistency. This approach produced a solution for the training samples but when tested on 'unseen' data, it was found to be unable to classify features during periods of poor signal quality.

The most effective implementation was obtained when a numerical algorithm identified a possible feature and pre-processed the data to quantify the important parameters which then formed the input to the NN. This method was able to obtain a solution with a performance comparable with experts. In addition, this approach had the advantage of reducing the NN dimensions and ensured that only meaningful information was presented.

It is important that some care is exercised when using NNs in sensitive applications such as

clinical decision support. The examples chosen to train a NN will largely determine its eventual performance. If the training set does not contain a comprehensive representation of the problem domain, then the NN will either be unable to classify certain future examples or more seriously, perhaps even classify some examples wrongly. Once trained, the network must be tested on a second set encompassing the full range of possible examples to ensure its safe future operation.

The application of a single NN on its own, for high level tasks such as suggesting clinical actions, may also be unsuitable. This lies in the fact that they are conceptually 'black boxes' which produce an output in response to a mathematical manipulation of a given input. It is this property which makes NNs desirable because it removes the need to formulate expert knowledge. However, this process also precludes an explanation of the reasoning which led to a certain course of action being recommended.

This study suggested a hybrid approach would be the most suitable implementation for the intelligent fetal monitoring system. Numerical algorithms could be used to extract features and subsequent algorithms or small NNs could then be used for classification.

3.7 Baseline heart rate estimation.

There are two features associated with the baseline fetal heart rate. The first is the dynamic baseline reference waveform which can be drawn through the data and about which other features are classified. The second, which can be obtained from the reference waveform, is a single value which represents the general proximity of the waveform. Consider figure 3.13 for example.

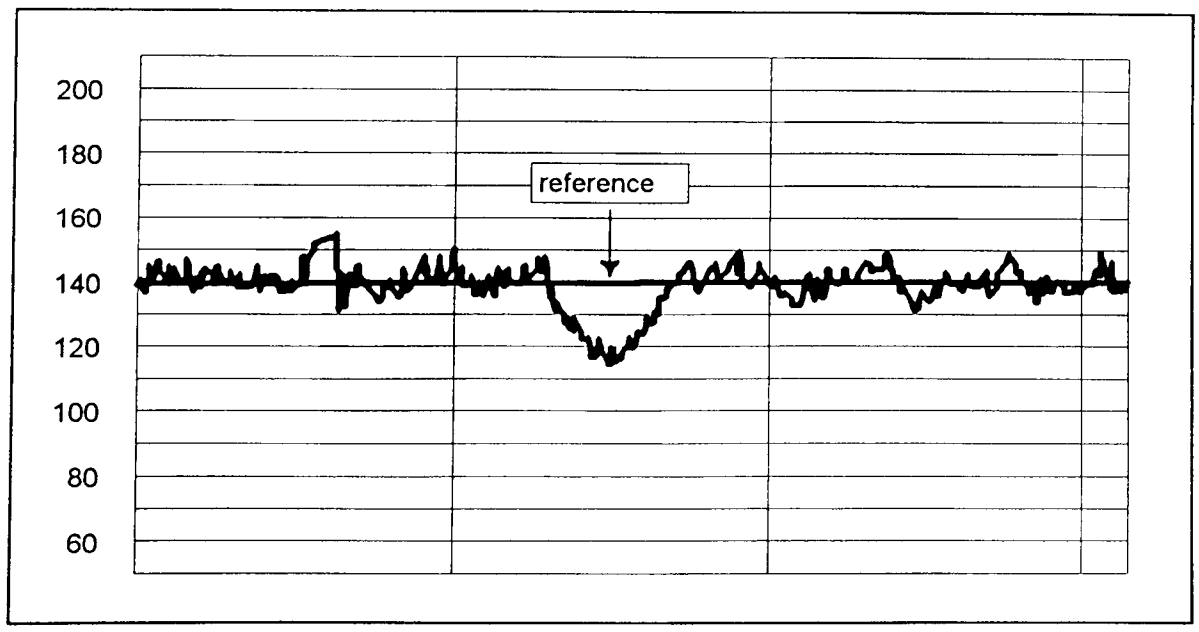

Figure 3.13: Baseline heart rate estimation.

Figure 3.13 shows the imaginary reference waveform drawn through the heart rate pattern which has a baseline heart rate of 140 bpm. This reference line is fundamental to the correct interpretation of the CTG because the classification of other features depend upon it. It will also be noted from figure 3.13, that the baseline is unaffected by the large deceleration in the centre of the recording. This is one of its most important properties.

There are certain patterns where it can be difficult to establish the precise location of the baseline heart rate. Consider figure 3.14 for example. Does this pattern have a baseline > 160 bpm (baseline 1) or is it approximately 110 bpm (baseline 2)?

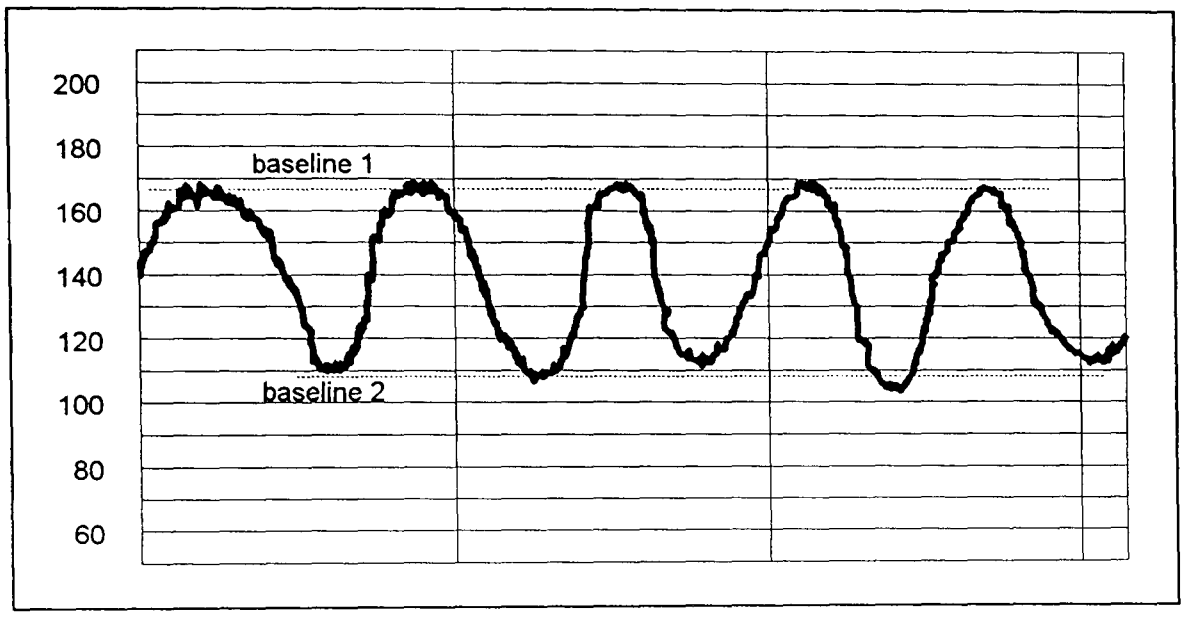

Figure 3.14: Unstable baseline heart rate.

If greater than 160 bpm, then this CTG contains decelerations. On the other hand if the baseline were taken as 110 bpm, then the features would be classified as accelerations. The difficulty is that the subsequent management of the case may depend on which interpretation is accepted. In reality, this pattern would be recognised as abnormal by virtue of the fact that the baseline is so unstable and it may be argued that this pattern does not have a baseline. But this example demonstrates that the algorithm required to obtain the baseline heart rate must be accurate and robust, otherwise all subsequent classifications and interpretation could be misleading.

It became clear from consultation with experts that when they assess baseline, they tend to look for the periods when the heart rate is most stable and join these together with an imaginary line. The stable periods are those to which the eye is most naturally drawn. In figure 3.13 it was simple to draw this line because despite some short lived deviations, the heart rate was most stable at 140 bpm. In figure 3.14, the heart rate pattern was seldom stable but the periods of greatest stability occurred at the peaks and troughs. As there were two regions of relative stability, it was difficult to decide which to accept.
Periods of stability are indicated by the average heart rate about which the given recording

fluctuates. However, this is not the mean of samples because this would be influenced greatly by large deviations. The fact that the baseline is not influenced by transient departures above or below it, suggested that the best approximation would be given by the most 'fashionable' value, or the modal average. An algorithm was developed to calculate the baseline heart rate using this approach and took the following form.

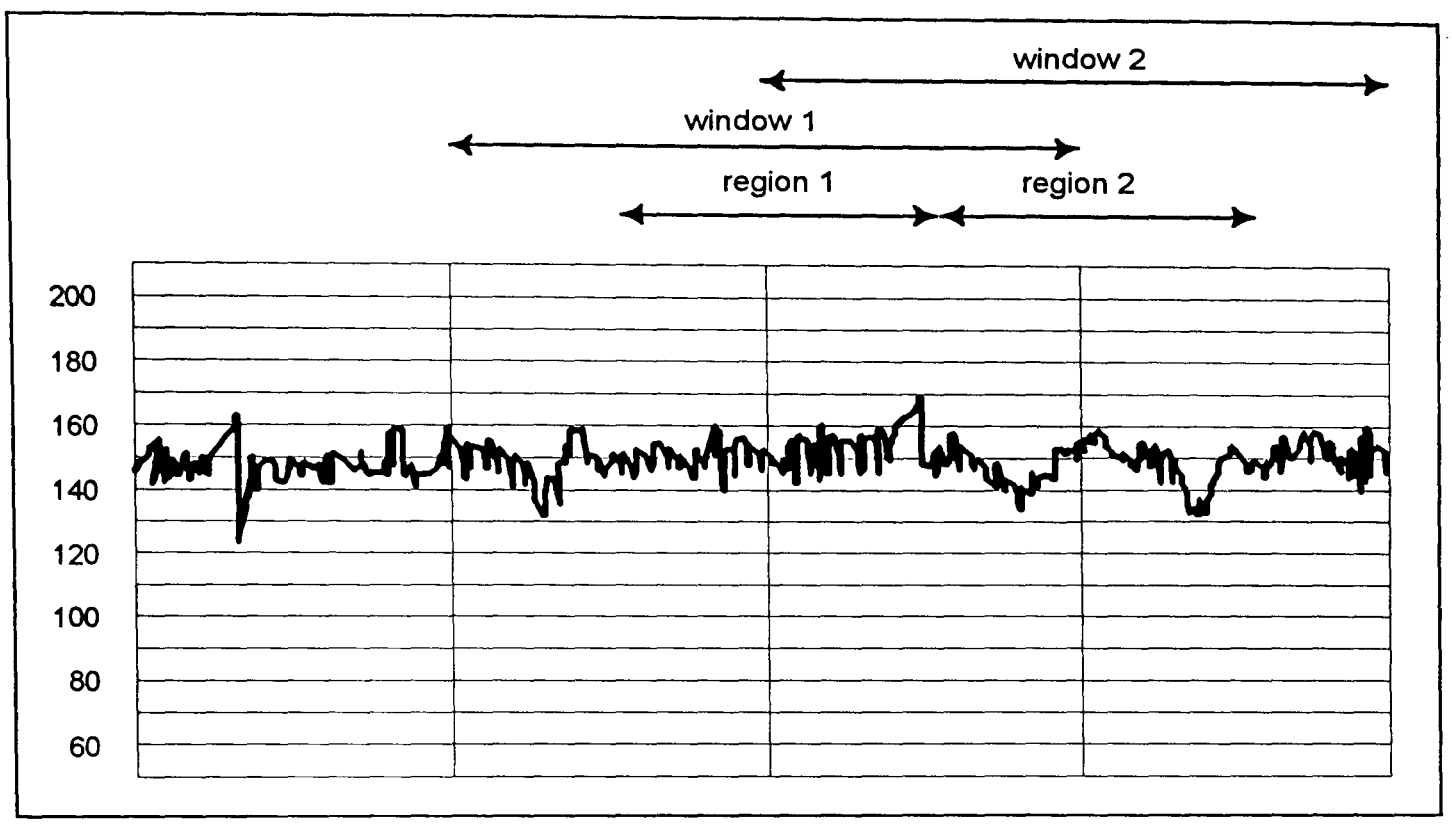

Figure 3.15: Baseline heart rate estimation.

With reference to figure 3.15, consider the baseline for region 1, a 5 minute period of recording.

1. The statistical frequency distribution of the heart rate data samples contained in the 10 minute window, window 1, was formed (figure 3.16). This window overlapped region 1 by 2.5 minutes at each end. This improved the algorithm because it allowed the baseline value for region 1 to be influenced by past and 'future' samples.

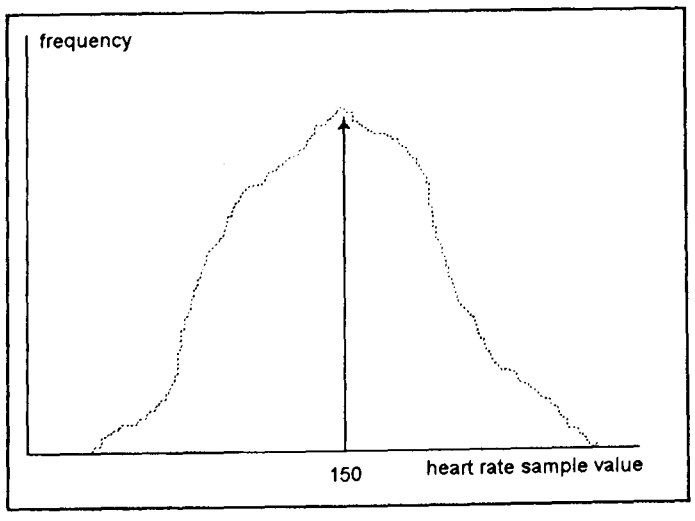

Figure 3.16: Statistical frequency distribution of heart rate values.

The number of samples, x_i, with a heart rate value, hr, is given by,

$$\sum_{i=1}^{N} x_i(hr)$$

Where N is the total number of samples in the window and, i = 1, 2, ... N.

2. The frequency distribution considered heart rates between 1 and 210 bpm (although heart rates of less than 50 bpm were not expected). The most densely populated range of heart rate values was identified; the sum of the number of heart rate values in the ranges $1 \leq hr < 10$, $2 \leq hr < 11$, ..., $201 \leq hr < 210$, were found. The range which contained the greatest number of samples was taken as the range in which the baseline was most likely to be found. This process is described by equation 3.12.

$$modal\ range_{hr \rightarrow hr+9} = \max\left[\sum_{hr}^{hr+9} \sum_{i=1}^{N} x_i(hr)\right] \qquad (3.12)$$

Where, hr = 1, 2, ... 201.

3. The modal heart rate of this modal range gives the baseline value for region 1. The process would then be repeated for region 2.

This procedure was adopted in preference to simply taking the mode of the entire frequency distribution for two reasons.

1. Noise in the form of short-lived signal drop-out maintains a constant non-zero value which is likely to be the modal value.

2. The heart rate pattern fluctuates about the baseline, but a heart rate value need not equal the baseline value. Therefore, the total number of heart rates equal to the baseline could be few and not necessarily the modal value.

The baseline can change from region to region. If this change is large, it could indicate fetal compromise. Under these circumstances, the algorithm would be required to respond quickly.

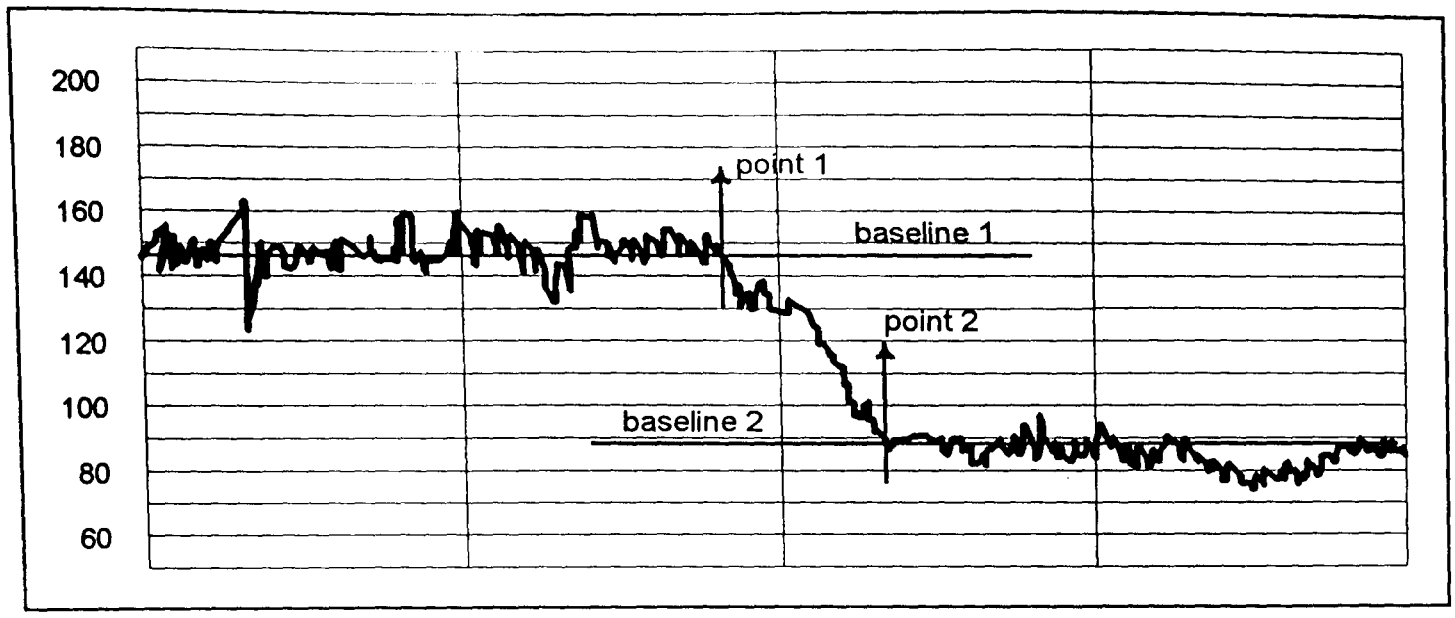

Figure 3.17: A baseline change.

In figure 3.17, the heart rate pattern falls from baseline 1 (> 140 bpm) to baseline 2 (< 90 bpm). Here, the algorithm was designed to identify point 1, where the heart rate diverges from baseline 1 and, point 2, where the heart rate converges to baseline 2. With these points identified, the equation of the line joining them was found which was taken as the transitional baseline heart rate.

3.8 Heart rate accelerations.

An acceleration is a relatively long-lived transitory increase in fetal heart rate from the baseline. The complete event can last up to several minutes but is often less. Several definitions for classifying accelerations have been suggested (Hon, 1968; Krebs et al, 1979; Dawes et al, 1982), which all rely on the model shown in figure 3.18. This considers the relationship between the duration of the feature with its maximum departure above the baseline.

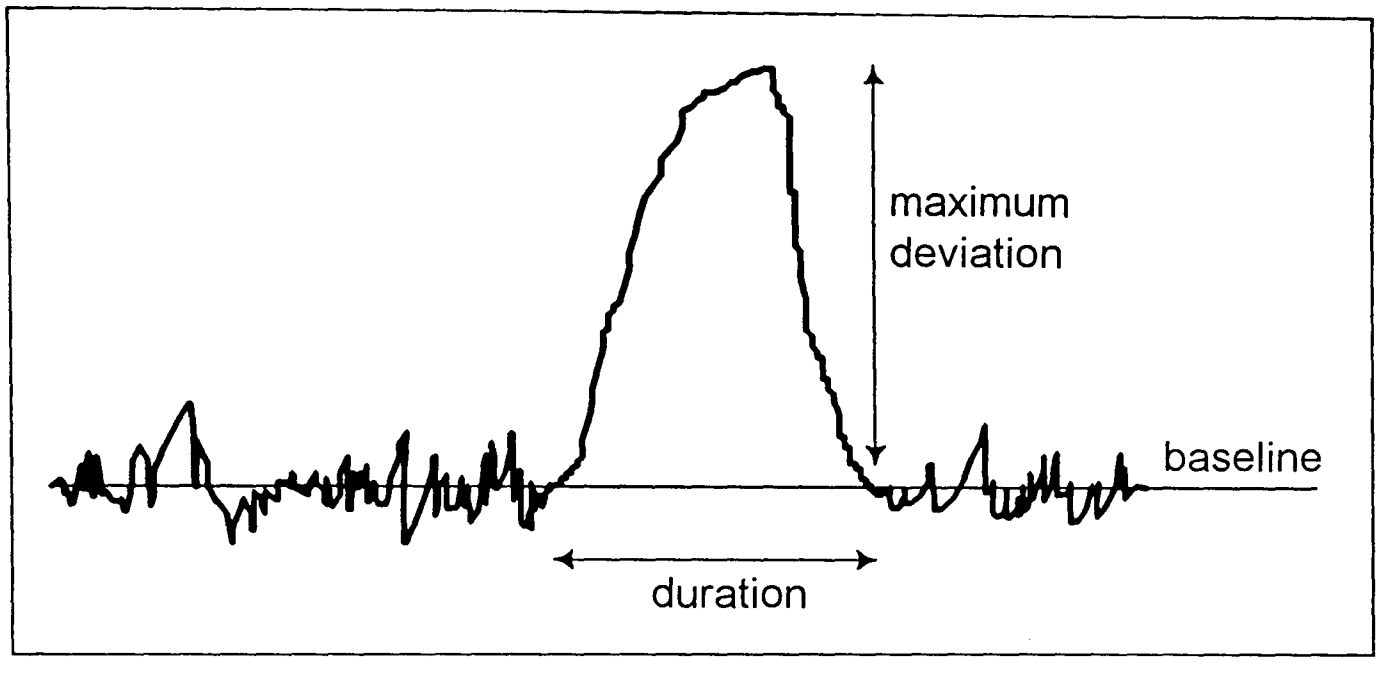

Figure 3.18: Classification model for accelerations.

The suitability of this model was investigated to establish whether it could be used to classify accelerations similarly to experts. 500 transient departures of at least 3 bpm above the baseline with a duration of at least 5 seconds, were classified as either, *not acceleration* or *acceleration,* by 2 experts independently. The experts agreed with each other for 88.3% of their classifications. The duration and maximum deviation above the baseline were plotted for the classified features. The features classified by one expert as *not accelerations* are shown in figures 3.19 and those classified as *accelerations* are shown in figure 3.20.

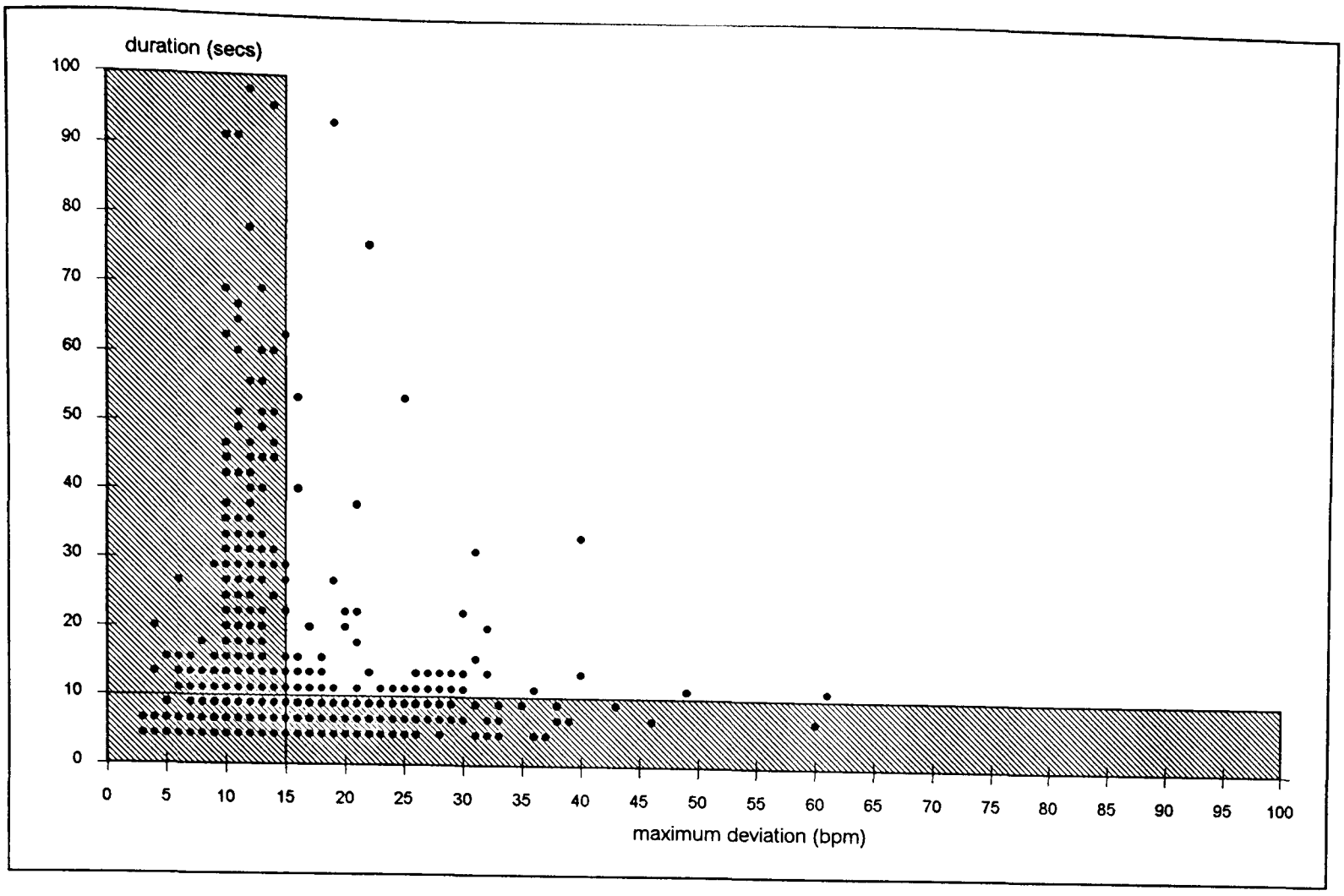

Figure 3.19: Features classified as *not accelerations* by 1 expert.

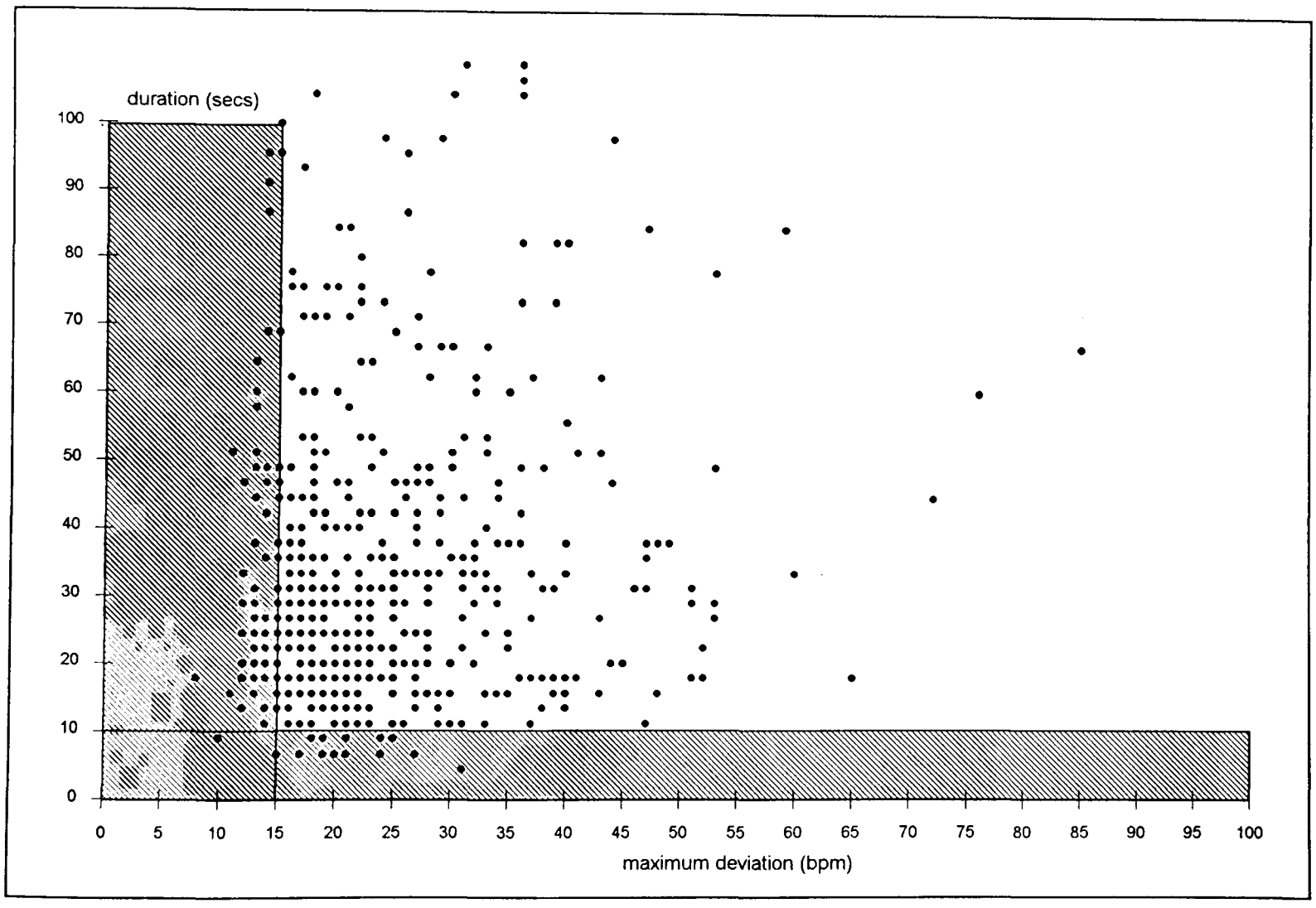

Figure 3.20: Features classified as *accelerations* by expert 1.

It was found that an agreement of 82.2% could be obtained with this expert if the threshold used in the classification model for the maximum deviation above the baseline was 15 bpm and the threshold for the duration was 10 seconds. The rejection region using these thresholds is indicated by the shaded area of the graphs. The features classified as *not accelerations* by expert 1 in figure 3.19 which fall outside the shaded region, are those that would be incorrectly classified using the proposed thresholds. Similarly in figure 3.20, the features classified as *accelerations* which fall inside the shaded region are those which would be incorrectly classified. These graphs do not give the most accurate representation of the density of classified features as those with the same deviation and duration are plotted on top of one another. However, the average agreement with both experts using this criteria was found to be 80.1% which was considered acceptable.

3.9 Heart rate variability.

Fetal heart rate variability is taken as the amplitude of irregular fluctuations about a baseline during stable recording between accelerations and decelerations. The baseline here, is not necessarily the baseline described in 3.7. It could be a local baseline specific to the region of stable recording being considered. The collective classification of all stable regions within a given segment of recording would then provide the overall heart rate variability classification.

The developed algorithm considered the CTG in 15 minute segments. All accelerations and decelerations were first identified and excluded from the analysis. A one minute assessment window was passed over the remaining stable data. For each complete one minute of recording, the data within the window was considered to perturb about a local baseline given by the straight line equation, $y = \beta x + \alpha$, where y_i is the heart rate associated with the x_{ith} data sample. This method is represented in figure 3.21.

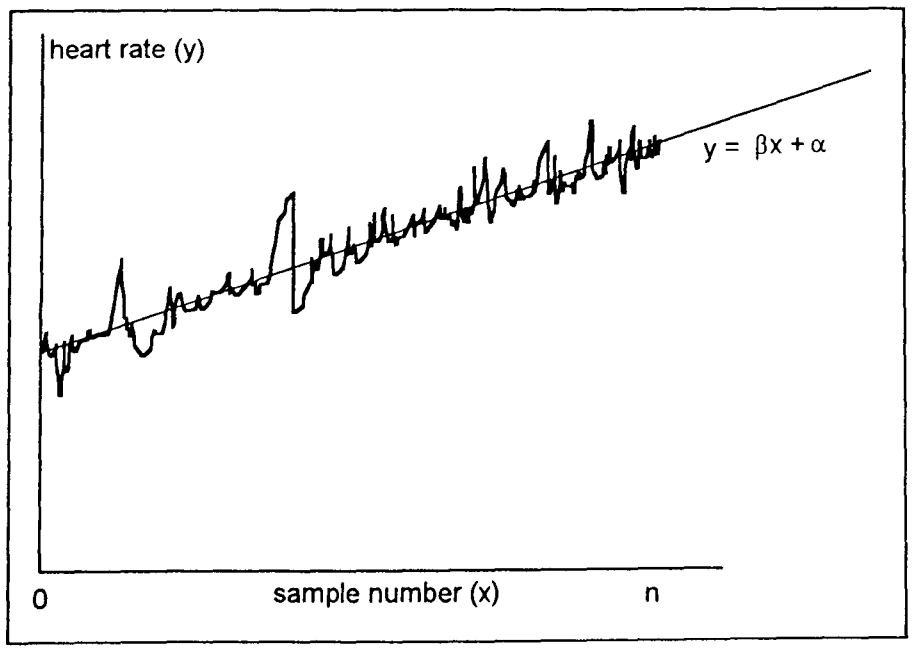

Figure 3.21: Heart rate variability model.

The equation of this local baseline was found using regression analysis (equation 3.13),

$$\beta = \frac{\sum_{i=0}^{n-1}(x_i y_i) - \frac{1}{n}\sum_{i=0}^{n-1} x_i \sum_{i=0}^{n-1} y_i}{\sum_{i=0}^{n-1}(x_i)^2 - \frac{1}{n}(\sum_{i=0}^{n-1} x_i)^2} \qquad (3.13)$$

and $\alpha = \bar{y} - \beta\bar{x}$

where n is the number of data samples in the one minute epoch.

The equation of the local baseline was then subtracted from the heart rate samples to transform the data about a zero baseline (figure 3.22).

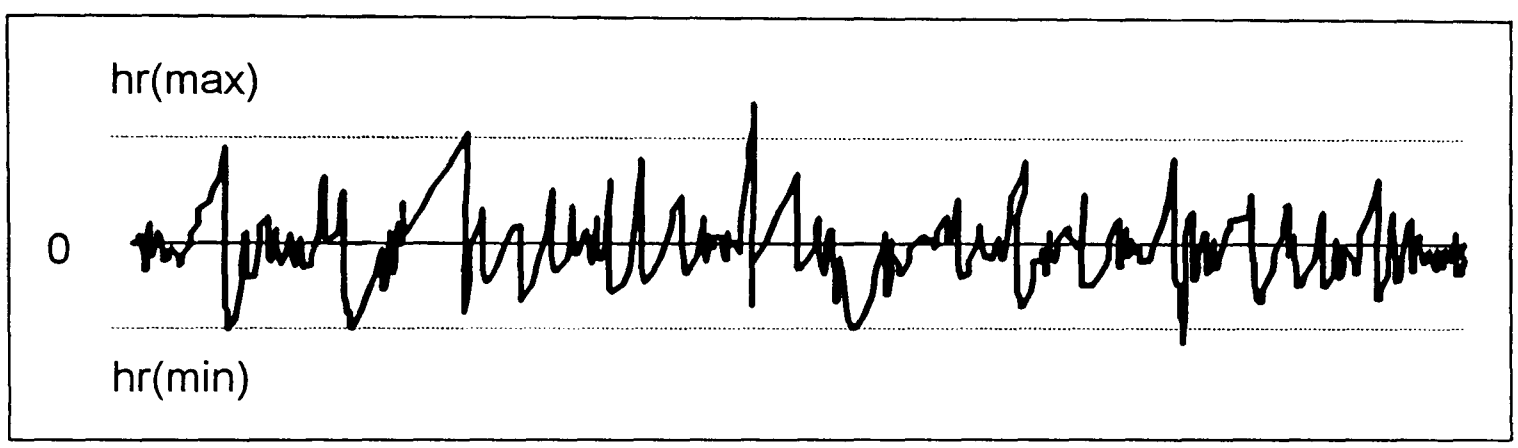

Figure 3.22: Heart rate data with local baseline removed.

The frequency distribution of these transformed samples was then constructed and the heart rate at the 5th percentile was taken as hr(min) and heart rate at the 95% was taken as hr(max). These were used in preference to the absolute maximum and minimum values to reduce the risk of a spurious data samples giving a false representation of the deviation. The difference between these heart rates gave the heart rate variability, hrv (equation 3.14).

$$\text{hrv} = \text{hr(max)} - \text{hr(min)} \qquad (3.14)$$

This was symbolically represented based on the classifications of previous studies (Low et al, 1971; Krebs, 1979), shown in table 3.6.

Variability (bpm)	Classification
0 - 2	Absent
3 - 5	Reduced
6 - 25	Normal
> 25	Increased

Table 3.6: Classification of heart rate variability.

The heart rate variability was measured for all one minutes epochs free from accelerations and decelerations within a 15 minute segment of CTG. A histogram of the classifications was plotted (figure 3.23).

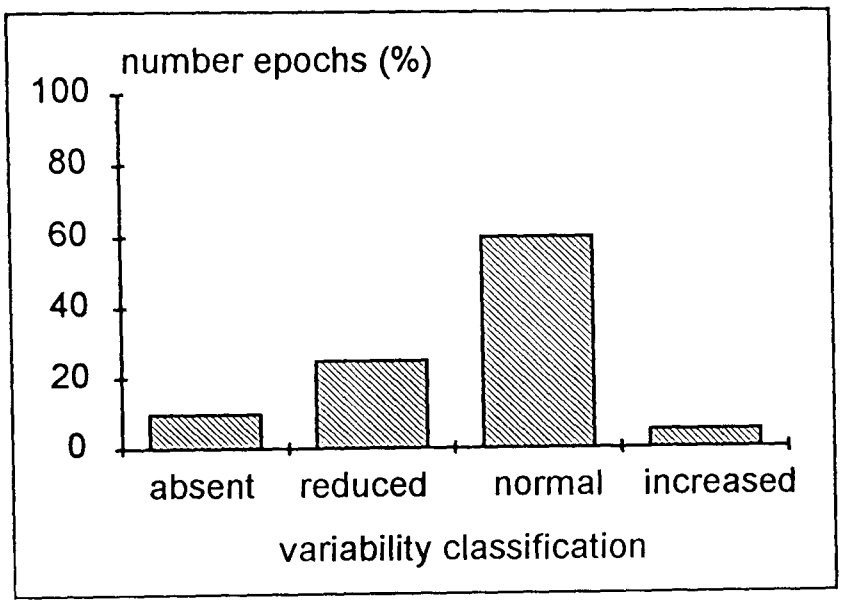

Figure 3.23: Histogram of variability classifications.

It was first believed that the overall classification of the histogram would be given by the heart rate variability for which the most epochs were classified (the modal classification). This interpretation was compared with an expert during a review of 10 labours but was found to be unsuitable. A more complex set of rules were required to interpret the histogram which were developed during a second review (figure 3.24).

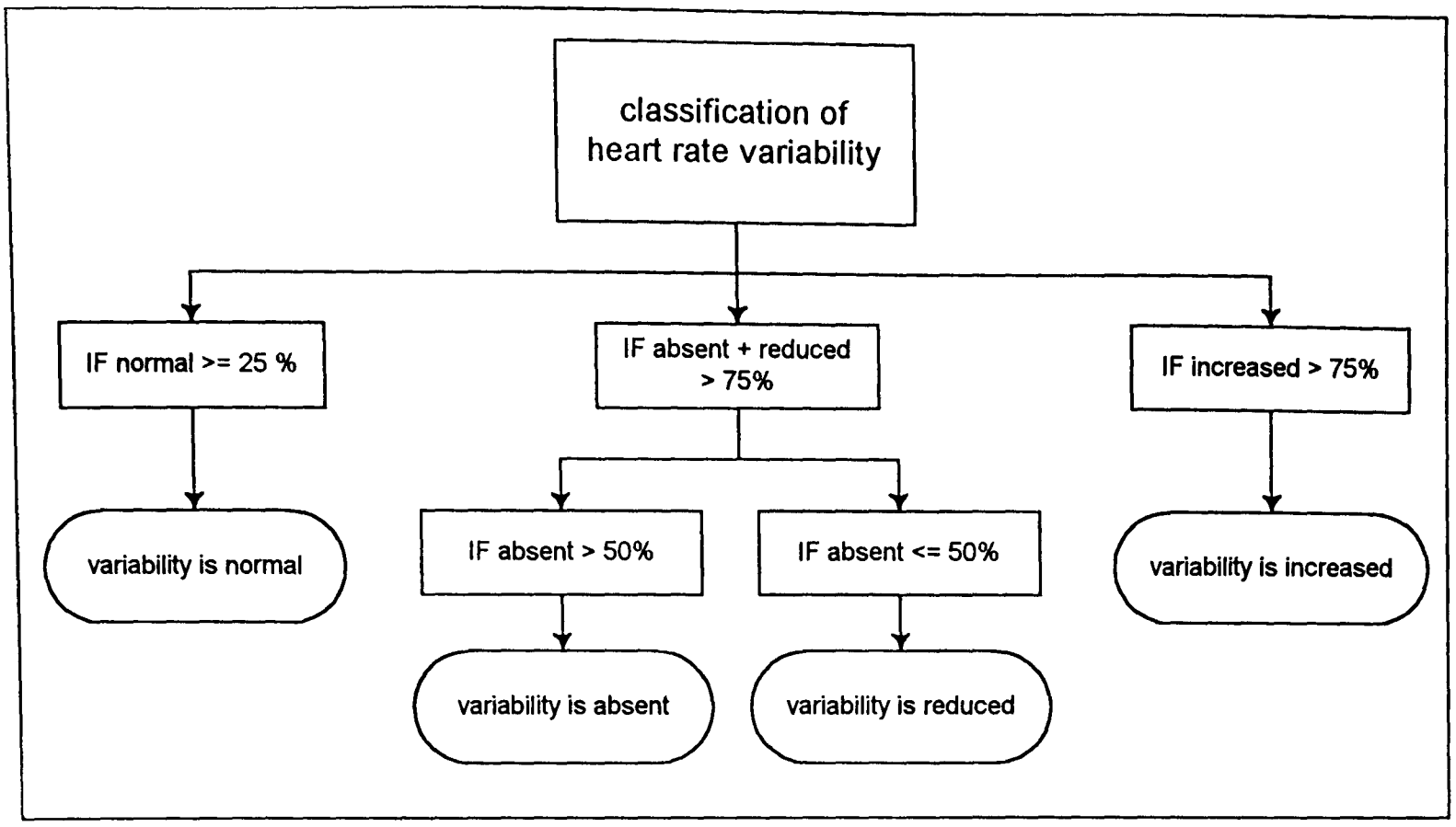

Figure 3.24: Rules to interpret the variability histogram.

It would be possible for a situation to arise where the histogram could not be classified using these rules; for example, if 20% of epochs were normal, 20% were absent, 20% were reduced and 40% were increased. This situation would be extremely unlikely as it requires both increased and absent variability to occur in the same 15 minutes of recording. However, if this did happen then the variability would be classified as inconclusive.

3.10 Contractions.

The location and magnitude of the contractions are important for classifying the relative timing of heart rate decelerations as well as for monitoring the administration of drugs used to augment labour.

Contractions were identified using a similar approach as that for obtaining the baseline heart rate and accelerations. Firstly a reference signal was established (figure 3.25).

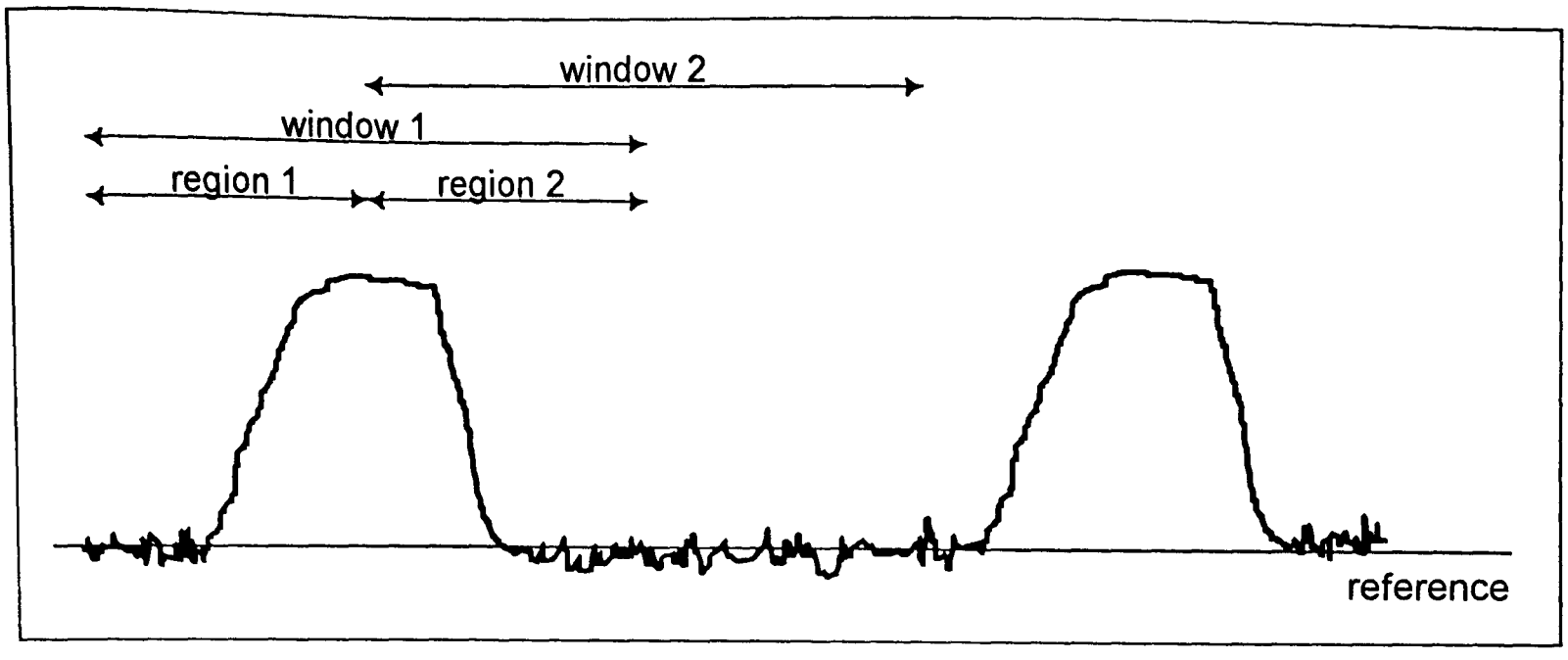

Figure 3.25: Fitting the contraction ground level.

The reference level for region 1, of length 1 minute, was obtained by representing the data samples in window 1 (2 minutes), in a statistical frequency distribution. The reference value was taken as the 5th percentile of this distribution. This, rather than the minimum value, was used to reduce the risk of noise samples being incorrectly taken as the reference signal. A similar process identified the reference level in region 2. The model used to classify contractions is shown in figure 3.26.

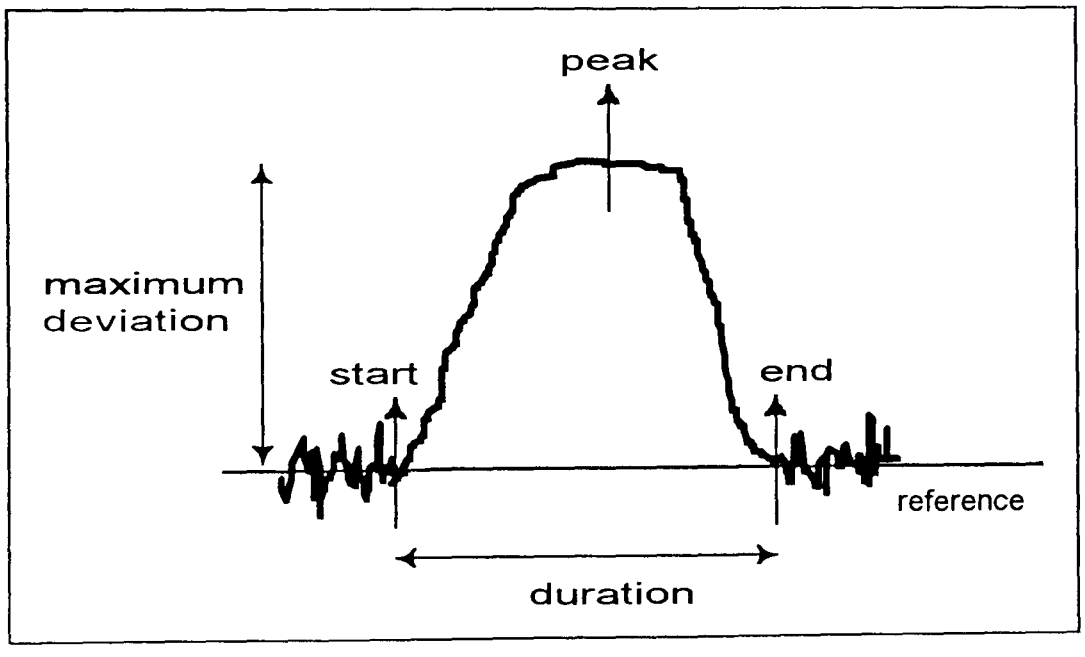

Figure 3.26: The contraction model.

The contraction samples had been digitised to 8 bit resolution (0 to 255). For a feature to be identified as a contraction, the maximum deviation above the reference had to be greater than 25,

$$x(i) > \text{reference} + 25$$

Where x(i) is a contraction sample and the duration of the feature had to be longer than 20 seconds. The start of the contraction was recognised when, x(i) > reference + 5, for 3

seconds. The end of contraction was identified when x(i) < reference + 5, for 3 seconds. This period was chosen to ensure that the true beginning and end of the contraction had been identified as opposed to a transitory noise spike which may be sufficient to cross the reference line and thereby lead to incorrect detections. This figure is clearly arbitrary but was found to be suitable during evaluation.

The peak of the contraction was taken as the maximum data value between the start and end of the contraction. The algorithm is represented in greater detail in figure 3.27.

If a heart rate deceleration was detected, then the timing of this event was related to the contraction signal to determine whether the deceleration occurred simultaneously or lagged a contraction. If the deceleration's minima lagged the contraction peak by greater than 20 seconds then the deceleration was termed 'late', otherwise the deceleration was termed 'early or variable'.

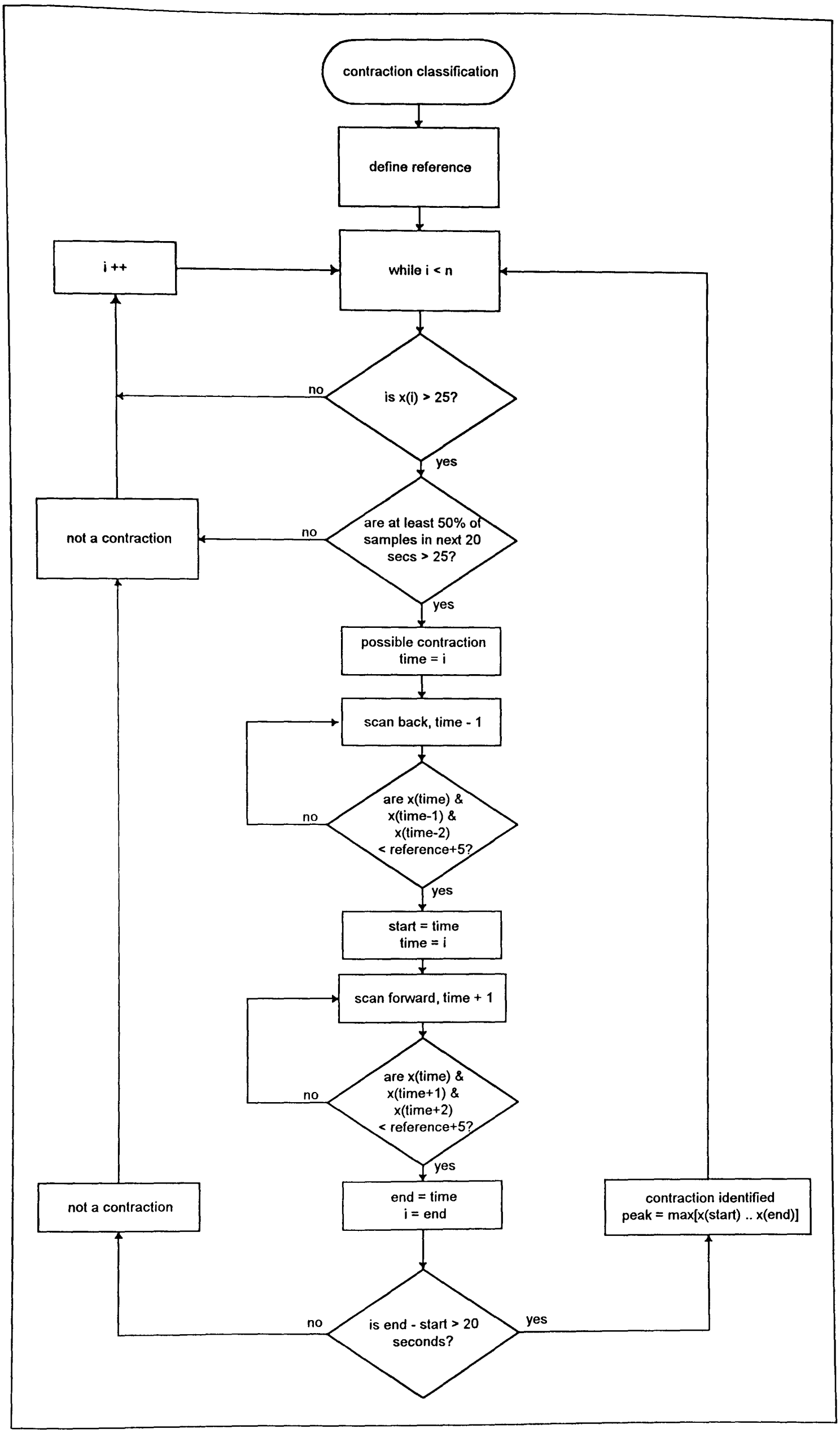

Figure 3.27: Contraction identification algorithm.

3.11 Signal quality.

3.11.1 Heart rate data.

The recording equipment recorded the time measured in milli-seconds, between successive heart beats. All measurements made during each minute of recording were stored in one minute data bins. If all heart beats had been detected, the sum of the timing measurements in a given data bin would equal one minute or 60,000 ms. This fact was used to obtain an indication of the heart rate signal quality. If the sum of these measures was, > 54,000 ms (90%), then the data bin was considered to have good quality data. If the sum of the measures was between 80% - 90%, then the data quality was considered adequate and if the sum of the measures was < 80% then the data quality was considered poor. These thresholds were clearly arbitrary, but they provided a reasonable assessment. A collective classification of the last 10 minutes of recording was made using the rules,

IF (all assessments in last 5 minutes were good)
THEN signal quality is GOOD.
IF (all assessments in last 5 minutes were adequate)
THEN signal quality is ADEQUATE
IF (all assessments in last 5 minutes were poor)
THEN signal quality is POOR

IF (number of good + number of adequate assessments in last 10 minutes > 8)
THEN signal quality is GOOD
IF (number of good + number of adequate assessments in last 10 minutes > 5 & ≤ 8)
THEN signal quality is ADEQUATE
IF(number of good + number of adequate assessments in last 10 minutes ≤ 5)
THEN signal quality is POOR

3.11.2 Contraction data.

It was found that when the contraction data was absent or of poor quality, the signal obtained was small and did not vary much above the reference level. The graphs in figure 3.28 show the likely statistical frequency distributions of the variations above the reference, δ, for good, adequate and poor quality data. Where,

$$\delta = \text{sample value - reference}$$

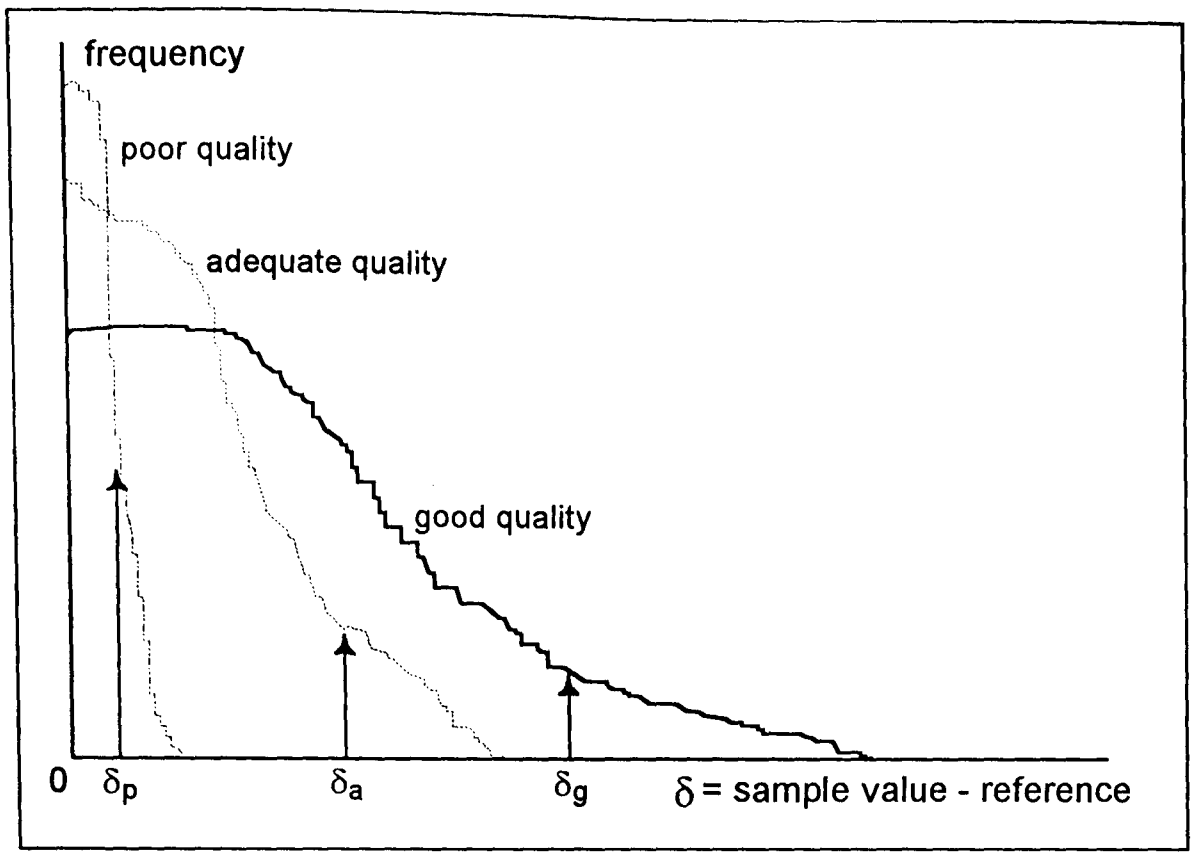

Figure 3.28: Statistical frequency distributions of δ (δ = sample value - reference) for good, adequate and poor contraction signal quality.

The values, δ_p, δ_a, and δ_g,indicate the 90th percentile point of the distribution of δ. It was found that an indication of good quality data was obtained when $\delta_g > 40$, adequate quality when, $40 \geq \delta_a > 25$, and poor signal quality when $\delta_p \leq 25$. These were represented as a green, amber and red light respectively by the user interface. The flow diagram for this algorithm is shown in figure 3.29.

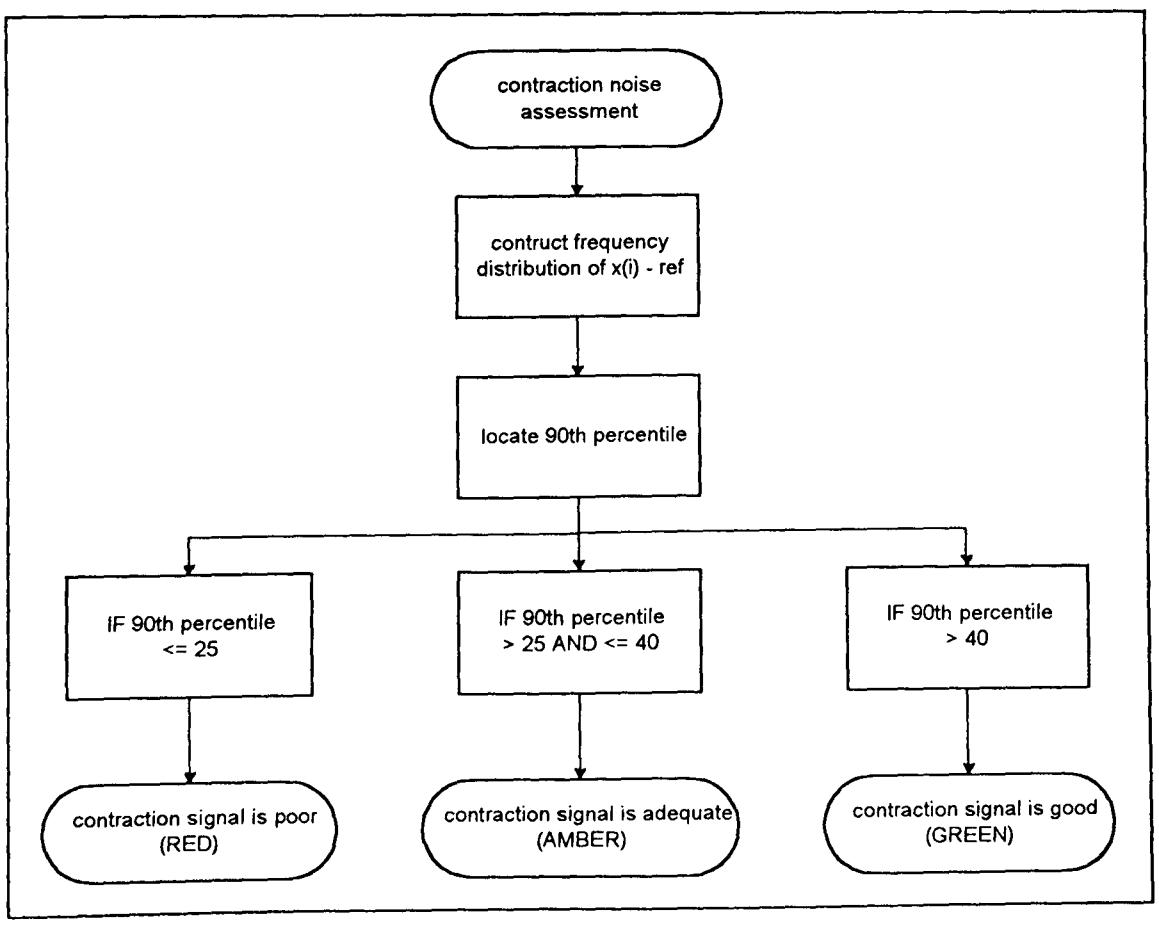

Figure 3.29: Rules to interpret the contraction signal quality.

Chapter 3 summary.

It was proposed to obtain the fetal heart rate and uterine contraction signals from a conventional intrapartum CTG recorder. These signals would pass through a process of feature extraction to obtain the important information. This, together with the information pertaining to the specific pregnancy and labour would then be processed by an expert system.

Chapter 3 describes the development of methods to extract the features from the cardiotocogram. These methods were later incorporated into the intelligent system. The important features were considered to be baseline heart rate, heart rate variability, accelerations, decelerations and the location of contractions. In addition, it was considered important to measure the signal quality of the heart rate and contraction data.

The performance of the system would depend on its ability to classify features from the CTG similarly to experts. An investigation was undertaken to assess the suitability of artificial neural networks (NNs) for feature extraction as they can be trained by experts to recognise patterns in data. This study found NNs suitable for feature extraction when the problem was reduced to small, well defined tasks and numerical algorithms were used to pre-process the raw data before it was applied to the NNs. A NN with optimised dimensions was used in this way to classify the magnitude of decelerations, a feature clinicians find particularly difficult. The NN was compared with six reviewers which included two CTG experts. The experts were consistent (89.7% and 97.0%) and agreed well with each other (81.0%) whereas the non-experts agreed less well. The NN was found to agree well with the experts (75.0% and 81.9%)

Earlier attempts to fully classify the raw CTG using a single NN were unsuccessful because of the large number of possible data patterns. A simplified approach to classify the magnitude and timing of decelerations was also unsuitable when contraction data was of poor quality or absent.

The extraction and classification of the remaining features was accomplished using numerical algorithms developed closely with experts. In each case these methods were found to compare well with experts.

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Chapter 4

Development of an intelligent system for labour management:

The expert system.

4.1 Introduction.

The development of the expert system was based on the general model shown in figure 4.1.

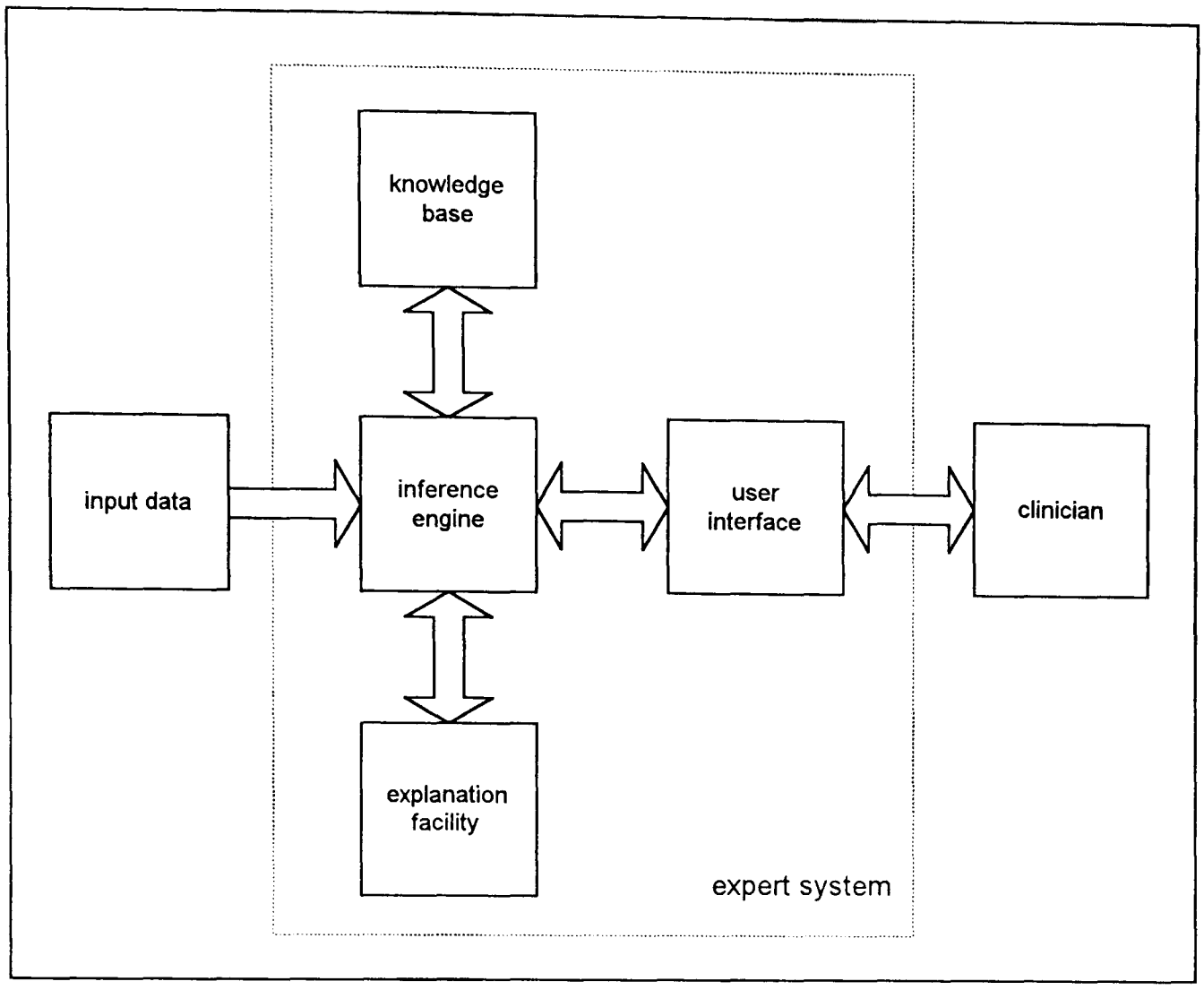


Figure 4.1: The expert system.

The features extracted from the CTG discussed in chapter 3, together with the relevant clinical information, form the input data to the expert system. This information is known as the short term or dynamic knowledge, which is processed by the inference engine. The inference engine reasons with this information by applying long term knowledge represented as rules in the knowledge base to infer facts regarding the input data. These facts ultimately lead to conclusions or recommended actions which are then communicated to the user in a meaningful way via the user interface. If the inference engine requires further information in order to prove certain rules, then it can ask questions of the user. Alternatively, if the user wished to know how certain conclusions were reached, then the explanation facility could elucidate on the rules which were proved true and led to the recommended action.

There were 5 stages to the development of the expert system.

1. Knowledge elicitation.
2. Knowledge representation.
3. Expert system implementation.
4. Expert system evaluation and combined system evaluation.
5. Combined system validation.

The evaluation and validation examined the performance of the system at the key stages in its development. These are discussed in chapter 5.

4.2 Knowledge elicitation.

The acquisition of knowledge, if handled inappropriately, can be a major constraint in the development of expert systems (Cullen and Bryman, 1988). Methods for knowledge elicitation are continually being developed and reviewed (Neale, 1988) and practical strategies have been well documented (Boose, 1984; Davies and Hakiel, 1988; Diaper, 1989). The two strategies which have emerged as the most useful for developing expert systems are, the *fast prototyping* and the *evolutionary methods* (Hayward, 1987). Fast prototyping seeks to acquire knowledge from experts during generally unstructured interviews. This leads to the rapid development of a working, if limited, expert system. The prototype system can then be used to demonstrate the knowledge base to the experts and thereby act as a focus for discussion. This would stimulate the experts to recommend further refinements to the existing knowledge and also identify areas which required extending. The evolutionary method involves developing the expert system over a longer period of time. For this strategy, the knowledge is represented in a non-system form such as logic diagrams, tree diagrams, or semantic nets to stimulate feedback.

For our application, it was decided to use a combination of these methods. In the first place, knowledge elicitation was carried out with two experienced obstetricians in relatively unstructured, interactive group sessions. All members of the group knew one another well and did not feel inhibited (or intimidated!) which was considered an advantage. It has been found that this type of approach generates more accurate data with a greater quantity of ideas than other approaches. This has been attributed to the synergism created by the experts sharing their thoughts (Meyer and Booker, 1991). It has also been shown from a comparison of elicitation methods, that the interactive group method produces a greater quantity of ideas and higher member satisfaction than any other approach (Seaver, 1976). Each session was conducted, where possible, with flexible time constraints and each member present (including the engineers) was free to contribute at will. All sessions were

tape recorded and a full transcript was later produced. Four questions were considered during these sessions which were given to the experts prior to the first meeting.

Question 1: Ignoring the possible constraints of technology, what conceptually do you wish to see at the end of this project? For example,

- How and what information should pass from the system to the user?
- What role should it play in managing labour?
- Who would use the system?

Question 2: Convey in outline form only, the procedure you adopt in managing labour. For example,

- When is fetal heart rate monitoring started?
- How often is the CTG assessed and by whom?
- Who are the people involved in the management of labour?

Question 3: Write down in any convenient form (such as rules, decision trees, diagrams or sketches) how you interpret the CTG. How often should this be done?

Question 4: Select several CTG records which represent various categories of patients. Highlight the sections of significance and explain why you consider them important.

The first session discussed questions 1 and 2 and led to the conceptual model discussed in chapter 3 (section 3.1, figure 3.1). Five further sessions which lasted a total of 15 hours took place during which questions 3 and 4 were discussed. The transcript produced in session 2 is shown in appendix C. At the end of these meetings it was considered that sufficient information had been obtained to allow the essential aspects of the knowledge to be formalised and implemented in a small expert system based on the fast prototype model. This expert system contained approximately 150 rules and was written in Prolog software and is discussed in 4.4. It was decided to develop this limited system to confirm that the essentials of labour management could be accurately represented and to serve as a stimulus for the experts to indicate areas they considered required modification. An evaluation of this system was undertaken (Ifeachor et al, 1991) and is discussed in chapter 5 (section 5.3). This evaluation demonstrated the feasibility of an expert system for labour management which allowed an evolutionary model to then be adopted. Over a period of two years the system was extended and modified in line with expert recommendations until it was considered ready to be compared with independent experts.

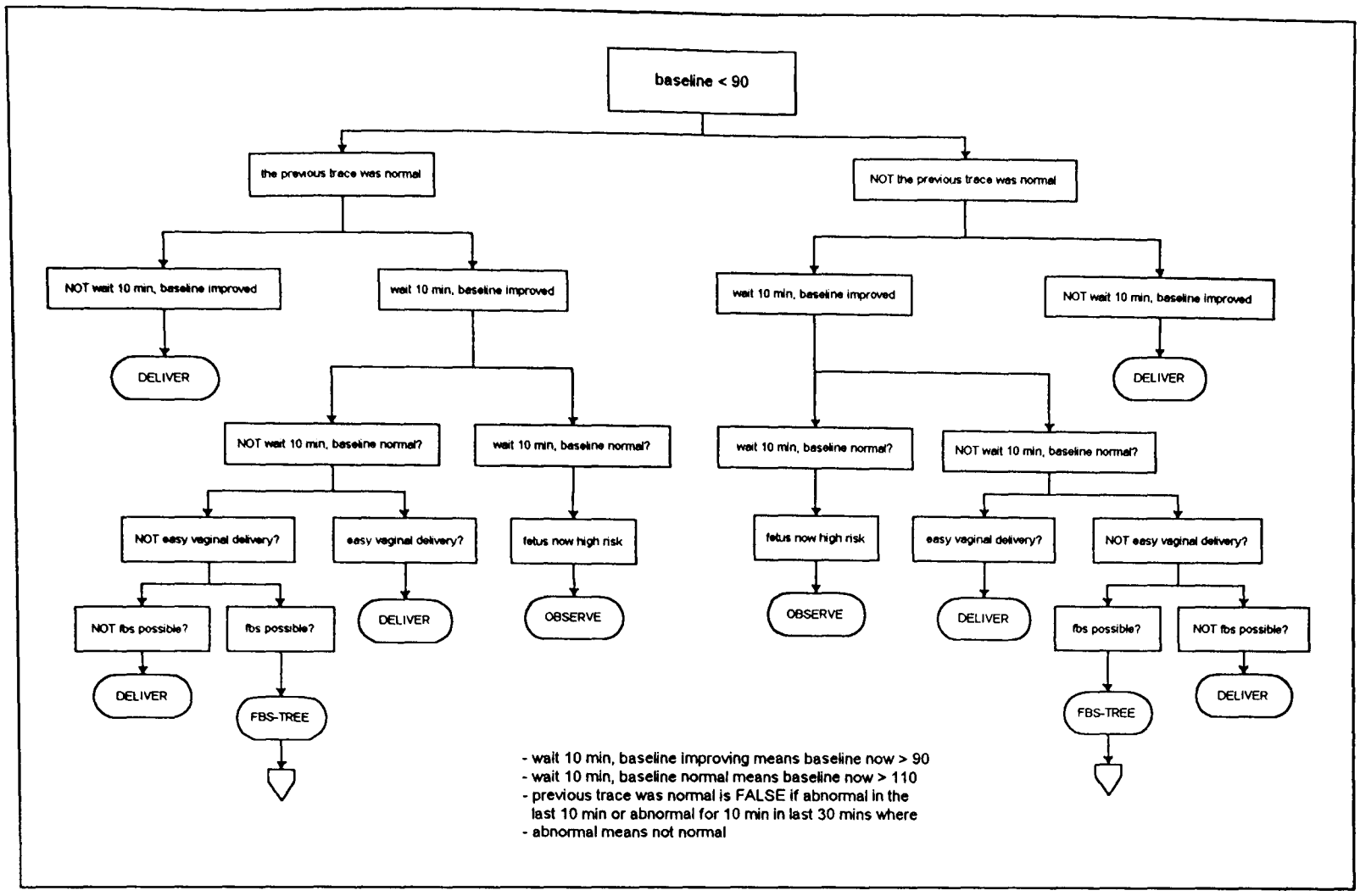


Figure 4.3: Baseline less than 90 bpm knowledge tree.

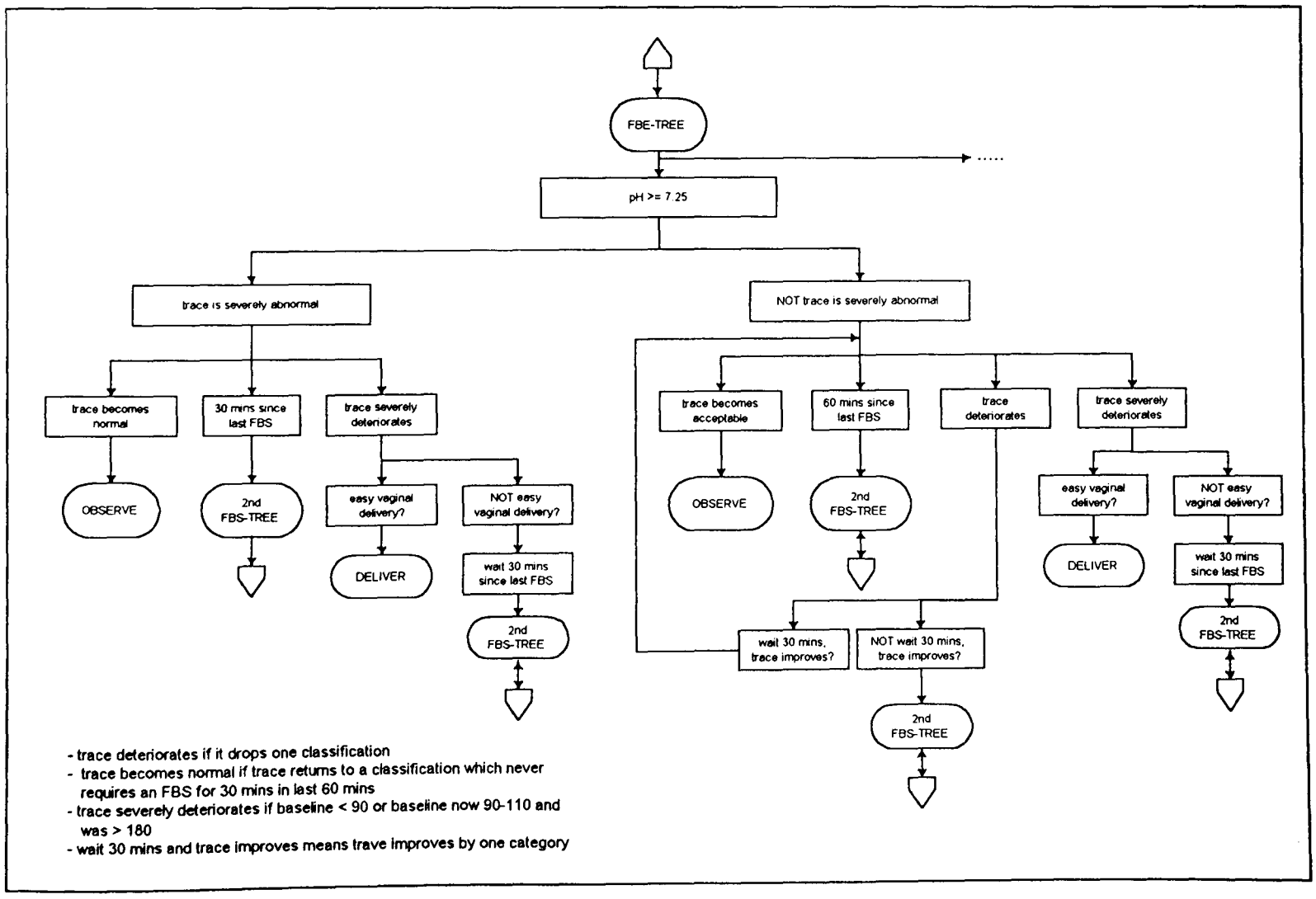


Figure 4.4: Fetal blood sample tree (a); pH ≥ 7.25.

4.3 Knowledge representation.

The most useful representation of the knowledge was found to be in the form of decision tree diagrams. These provided a structure for the knowledge as well as the means for the experts and the engineer to readily discuss specific aspects of the knowledge and suggest refinements.

The current state of the knowledge is represented in appendix D and selected branches are shown in figures 4.3, 4.4 and 4.5. Figure 4.3 shows the knowledge required to manage labour when the baseline fetal heart rate falls below 90 bpm, which is a serious event. Figures 4.4 and 4.5, shows how fetal blood sampling has been incorporated into the system's decision making. The key to interpreting the knowledge tree is given in figure 4.2. Each branch begins with an assessment of the CTG and ends with a conclusion or recommended action.

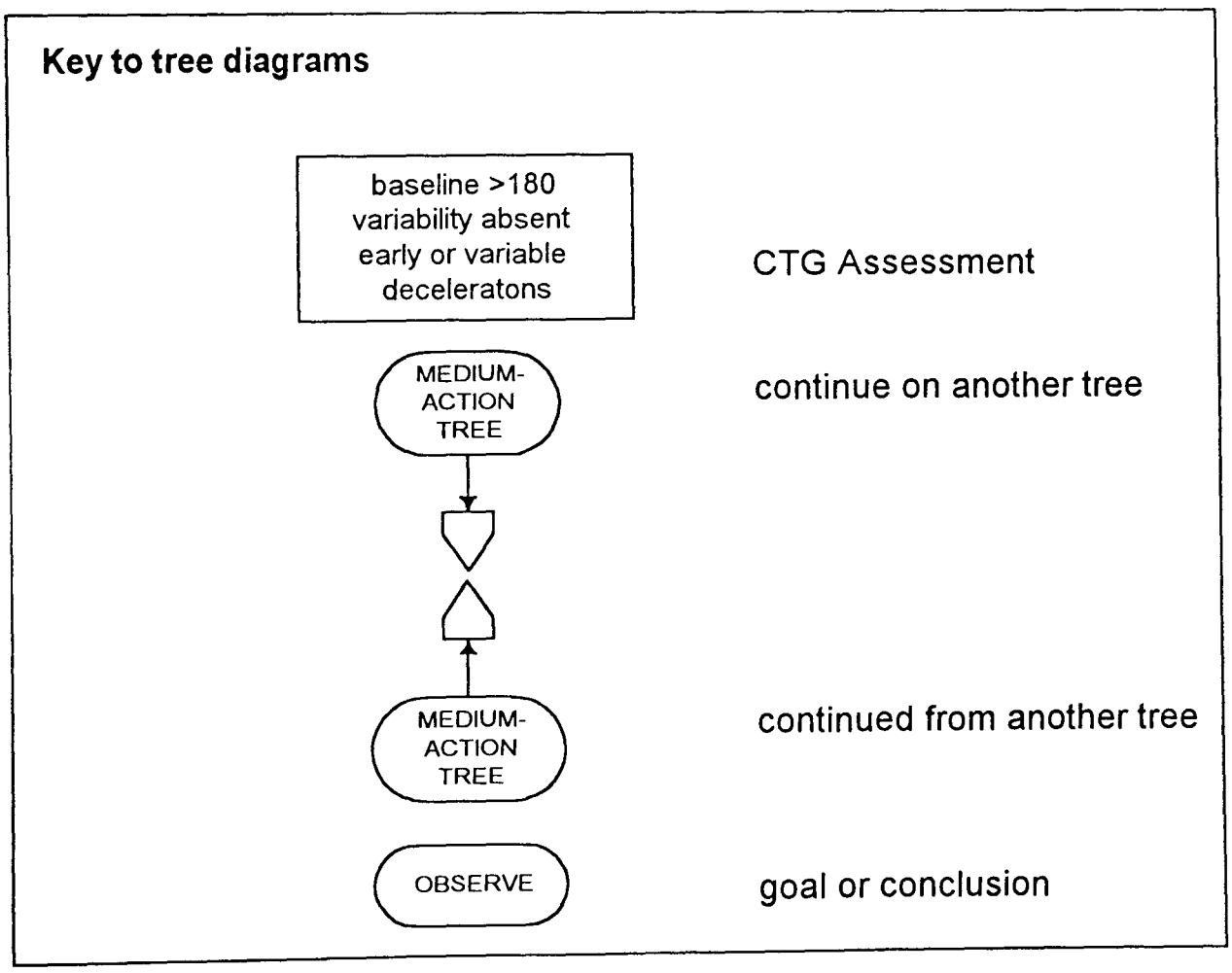
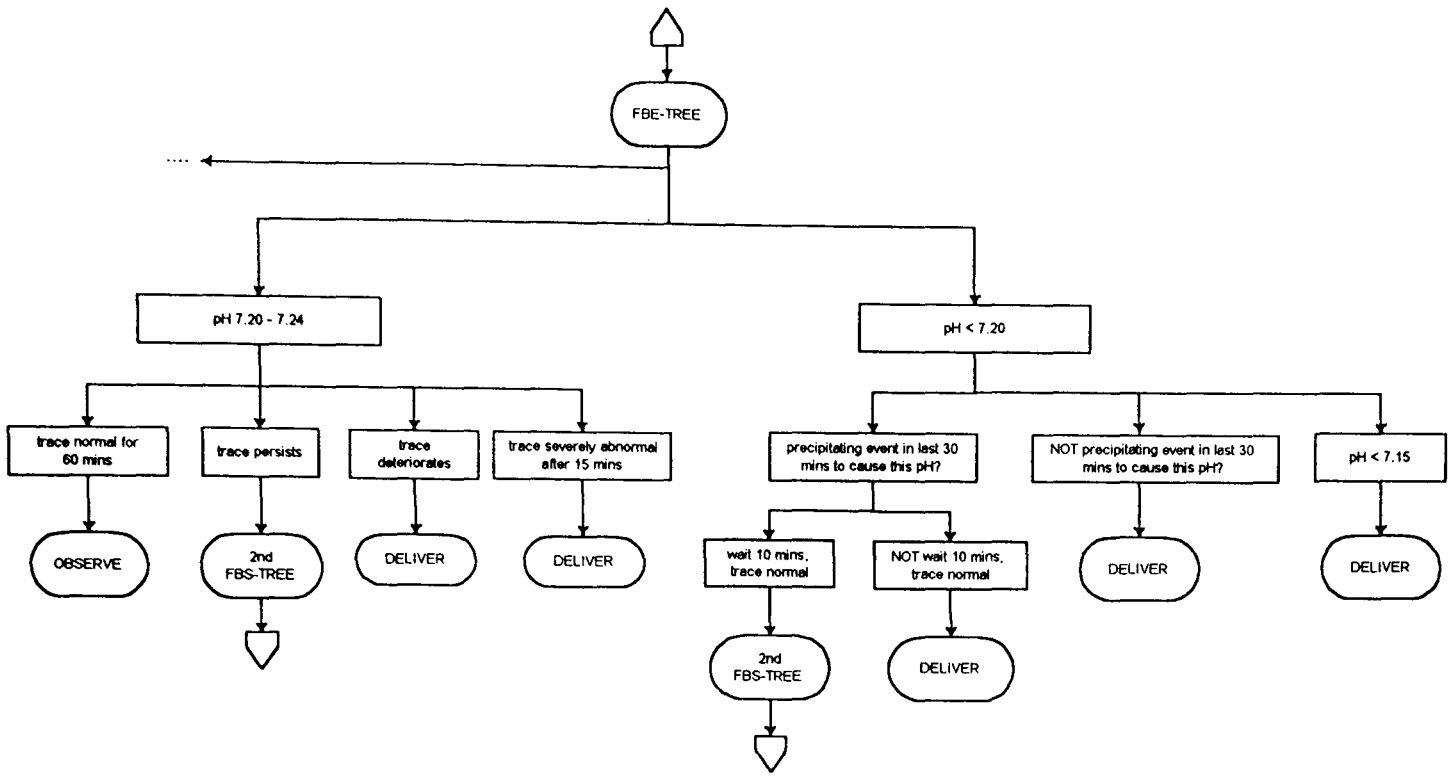


Figure 4.2: Key to knowledge tree.



- trace deteriorates if it drops one classification
- trace normal for 60 mins if trace does not deteriorate in first 30 mins and is completely normal for second 30 mins
- trace persists if not normal for 60 mins and trace not deteriorated and trace not severely abnormal after 15 mins

- a precipitating event in the last 30 mins which could have caused the low pH would be a severe bradycardia or severe decelerations in the last 15 mins without any previously

Figure 4.5: Fetal blood sample tree (b); pH < 7.25.

4.4 System implementation.

4.4.1 The knowledge base.

The knowledge described by the decision trees was represented in the form of production rules which took the following form.

Rule(*rule number*, *head*, *tail*, [*conditions*])

The rule number identified the rule. The rule head indicated the current position in the knowledge tree and the rule tail indicated the position in the tree to be moved to if the associated conditions were proved true. If a condition was proved false, then the rule was false and an alternative rule with the same head was searched for. When a rule was proved true, progress had been made towards a goal, whereupon the rule tail became the new head and a new rule was searched for with this head. This procedure continued until a goal at the end of a branch was found. To illustrate this process, consider the following example which attempts to identify an animal based on its description.

Some facts regarding animals are,

1. IF an animal,
   is warm blooded AND suckles its young AND has hair,
   THEN the animal is a mammal.
2. IF a mammal,
   swims in the sea AND is the largest creature on Earth,
   THEN the mammal is a blue whale.
3. IF a mammal,
   walks on two legs AND drives a car,
   THEN the mammal is a human.
4. IF a human,
   has babies,
   THEN the human is a woman.

These facts can be written concisely as the following production rules,

Rule(1, animal, mammal, [is warm blooded],[suckles its young], [has hair])
Rule(2, mammal, blue whale, [swims in sea],[largest creature on Earth])
Rule(3, mammal, human, [walks on two legs],[drives a car])
Rule(4, human, woman, [has babies])

In the same way, each position in the labour management tree was assigned a unique identifier. The principal node at the foot of the tree was identified as 'heart_rate'. Consider the tree in figure 4.3 which considers the management required when the baseline heart rate falls below 90 bpm.

Some facts which relate to this are,

1. IF heart_rate,
   is less than 90 bpm,
   THEN baseline < 90.
2. IF baseline < 90,
   the previous trace was normal AND NOT after 10 mins the baseline has improved,
   THEN DELIVER.

which can be written concisely as,

rule(1, heart rate, baseline < 90, [1])
rule(2, baseline < 90, Deliver, [2][3])

cond(1, the baseline is < 90 bpm)
cond(2, the previous trace was normal)
cond(3, NOT after 10 mins the baseline has improved)

The rules obtained for the entire knowledge base were obtained in this way and can be found in appendix E.

4.4.2 Development of the inference engine.

The inference engine is the heart, or perhaps more precisely, the brain of an expert system. Its role is to prove rules and establish facts concerning the dynamic knowledge using the long term knowledge formed in the knowledge base. Its ultimate goal is to arrive at the end of a branch where an action can be recommended.

The expert system was first implemented as a fast prototype model written in Prolog software. The source code can be found in appendix F. This language was chosen because it has been designed to allow expert systems to be developed simply and quickly. However, it was found that Prolog had some serious draw-backs which, it was felt, would be difficult to overcome. Prolog is a high level language which can efficiently manipulate symbolic knowledge. Its limitations are that it provides few low level operations such as memory management, mathematical functions and data manipulation. These operations would be

essential in the full system which incorporated automatic feature extraction as these require a low-level language such as 'C'. A possible solution to the problem would have been to develop the expert system in Prolog and the feature extraction algorithms in 'C' and interface the two. However, it was considered that this approach would be difficult to manage and would not be sufficiently flexible to allow free movement of data. A second possible solution involved commercial software in the form of expert system shells which have been available for some time. These contain the fully developed constituent parts of the expert system except for the rule base which is developed for the specific application. This approach can obtain a usable system very quickly. The expert system shells available at the time were reviewed but no shell was found to be flexible enough to allow the simple integration of the feature extraction methods.

It was decided that the development of the system could best be achieved if the feature extraction algorithms and the expert system were both written in the C-programming language. This would allow the two main parts of the system to be merged into one software package to give maximum flexibility, low level control and efficient data flow. This approach did mean that an inference engine would need to be developed in a language that was perhaps not best suited for the task, but this approach was considered the best compromise. The developed inference engine algorithm is shown in figure 4.30 and the software developed in 'C' is given in appendix G.

The signal quality of the heart rate data had to be at least adequate before the inference engine was allowed to proceed. If the quality was unsatisfactory then the inference engine concluded that the quality of signal was too poor for monitoring purposes and suggested that the scalp electrode or ultra sound transducer be reapplied. If just the contraction signal quality was poor, then the expert system was still able to make some limited inferences regarding the CTG.

It will be recalled that a rule was represented as; rule(*rule number*, *head*, *tail*, [*conditions*]) where the head indicated the current position in the knowledge tree and the tail pointed to the next position to move to if the conditions were proved true. When the inference engine was invoked, the current head was set to 'heart_rate'. This is starting position for the inference engine algorithm (figure 4.6) and represents the foundation upon which all branches were connected. Some facts would have already been established prior to running the inference engine, for example those conditions associated with feature extraction. If any condition had been proved *true* then the associated condition number would be stored in the, YES[], array. Similarly, if a condition had been proved *false*, then its condition number was stored in the, NO[], array. With reference to figure 4.6, the inference engine algorithm then continued,

1. The knowledge base was searched and a rule was obtained with a head the same as the current head. The rule was then split into its constituent parts; rule number, head, tail and dependent conditions.
2. The, NO[], array was checked to see if any of these conditions had been previously proved *false*, in which case the current rule could not be *true* and was abandoned in favour of another rule with the same current head. This procedure continued until a rule was found which had not been previously proved *false*. If all rules with the current head were *false*, then no solution was possible which indicated a gap in the knowledge had been discovered. This was useful during testing.
3. If none of the conditions were to be found in the, NO[], array then the procedure next checked to see if any conditions were known to be *true* by examining the, YES[], array.
4. If a condition was not in YES[], nor in NO[], then the condition must be proved. Some conditions could be proved by the inference engine automatically, others would need to be proved for the inference engine by a clinician. A database was developed which contained a list of all the conditions the inference engine could prove itself. Associated with each entry was the software required to obtain the proof. As an example consider, cond(67, the previous trace was normal). The inference engine would attempt to prove this condition by executing the software associated with condition 67, which examined the classifications made for previous segments of recording. If these were normal then the condition was *true*, otherwise it was *false*.
5. If the condition was not listed in the database then it indicated that its proof could not be obtained automatically and must be sought from the user. An example of such a condition would be, cond(55, is an easy forceps delivery possible?)
6. If the condition was proved *false* here, then the algorithm returned to step 1 where a new rule was found with the same current head.
7. If all conditions were found to be *true* then the rule must be *true,* in which case progress had been made towards a goal, whereupon the tail became the new current head and the algorithm returned to step 1.
8. If at least one rule had been proved *true* and no rules existed in the knowledge base with the new current head, then a goal had been reached. These goal states were represented in the rule tail as 'goal_X' where X was the goal number. Each goal number had a specific message which was revealed in a pop-up window on the computer screen for example,

> Goal 34. There is reduced variability with no accelerations. However, this has not persisted long enough to warrant further action.
>
> I recommend you continue to observe this case.

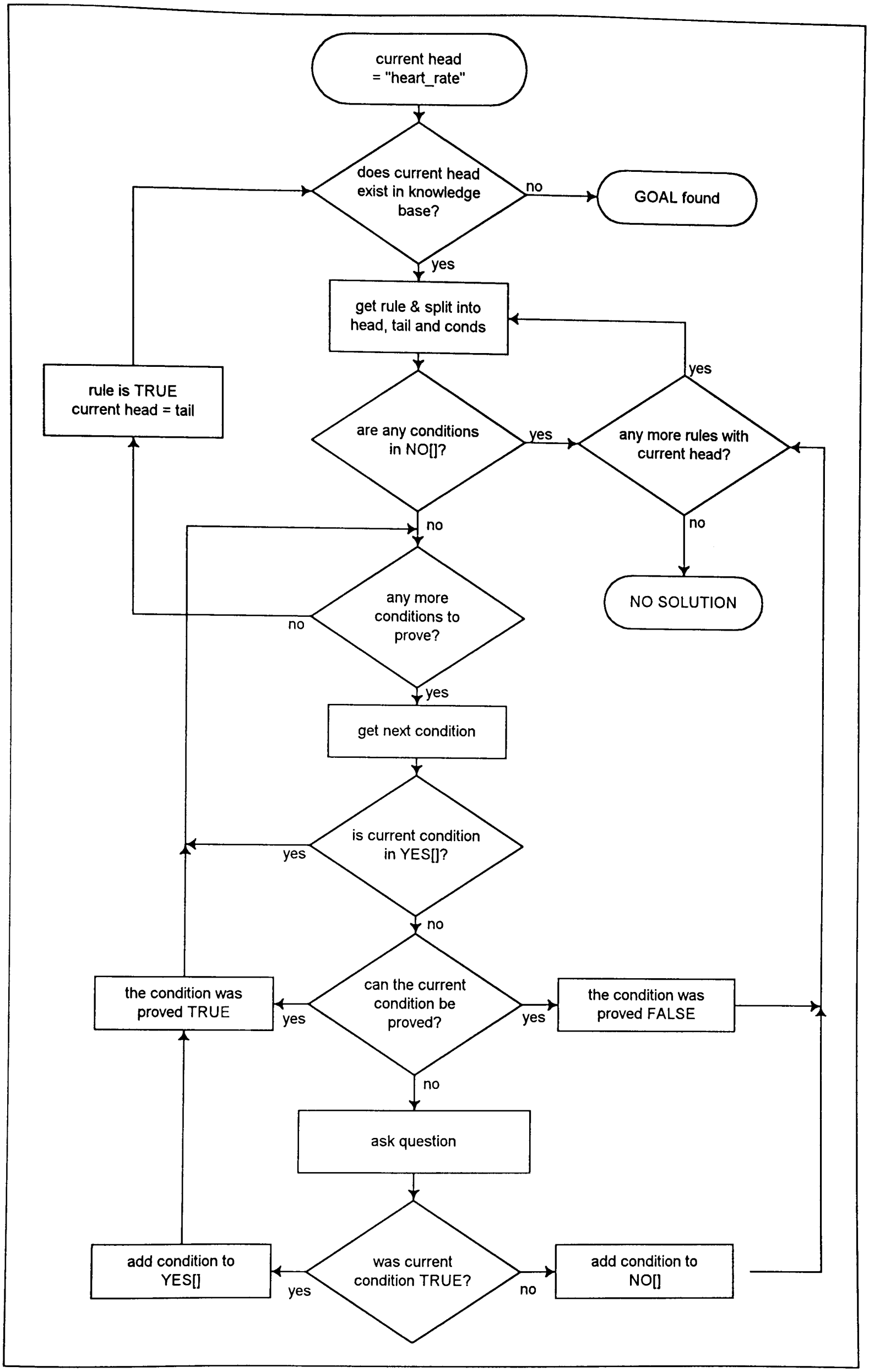


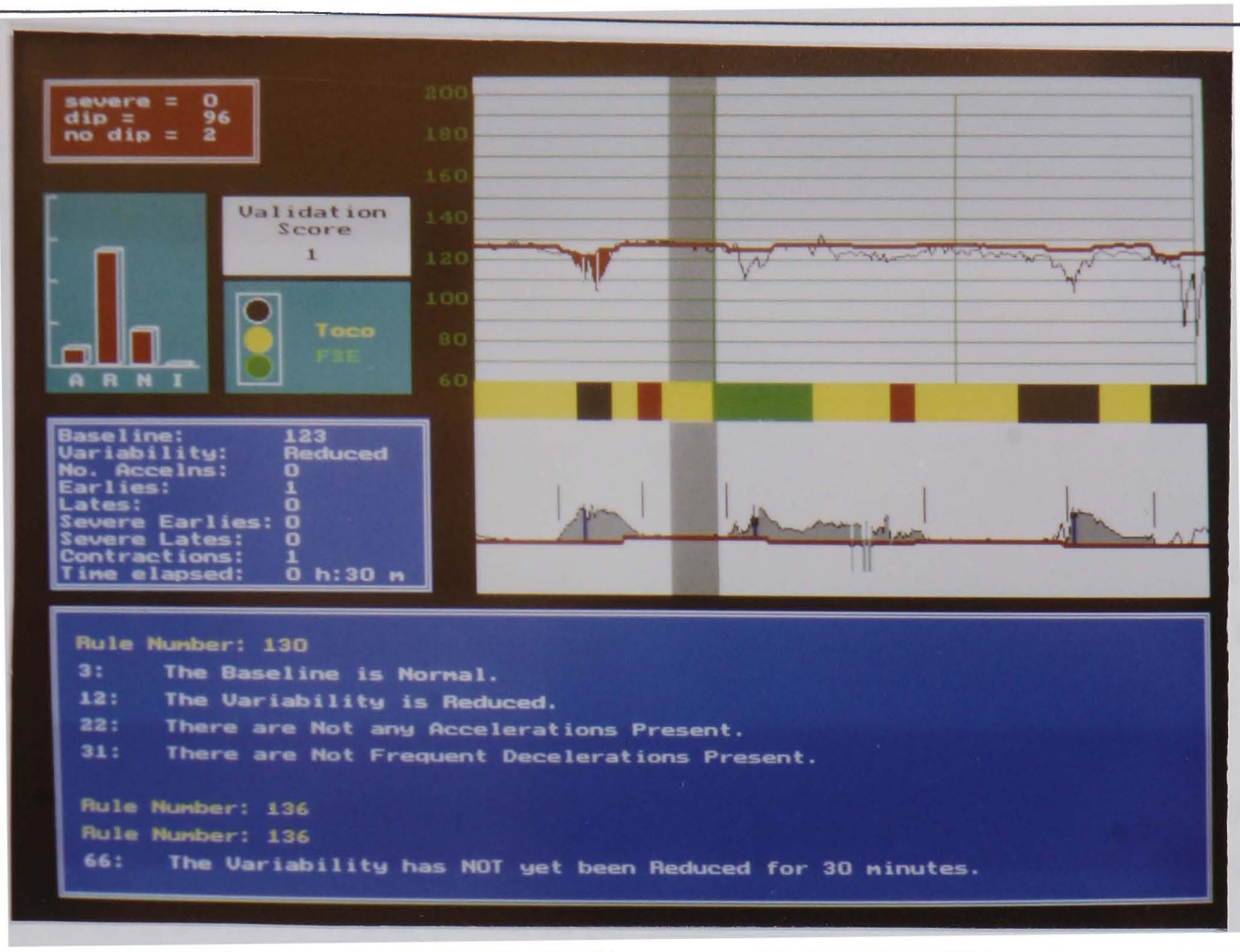
Figure 4.6: The inference engine.

4.4.3 The explanation facility.

The explanation facility was implemented in a limited form. It identified the rules and conditions which had been proved true and had led to the given action being recommended. The rule number was given with the associated condition numbers and a detailed explanation of what each condition was. This allowed the path taken by the expert system through the tree to be tracked and was also useful for testing.

4.4.4 The user interface.

The current system is a prototype system which has been implemented on a personal computer. The user interface has been designed to be informative to those involved in the system's development but is not adequate for use by clinical staff. All data entry was achieved using the keyboard. The system's output was displayed on the computer screen and presented the results from each feature extraction algorithm as well as messages from the expert system. When the expert system had reached a goal or conclusion, the associated message was displayed as a pop-up window. The output display is shown in figure 4.7.



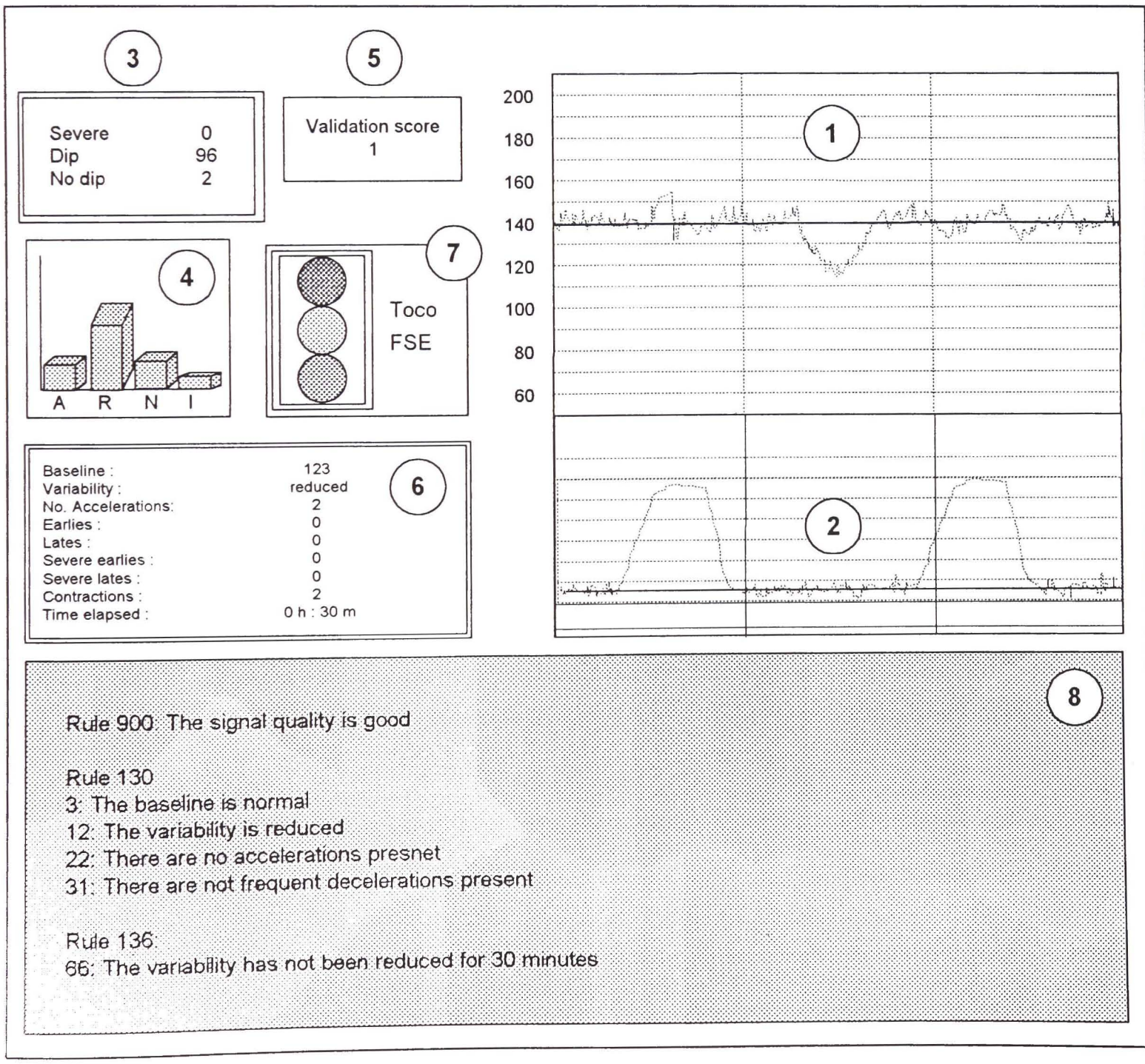


Figure 4.7: The user interface.

Key:

1. Heart rate data; the most recent 15 minutes of heart rate recording was plotted with the calculated baseline shown and any features classified as accelerations or decelerations indicated.

2. Contraction data; this was plotted with the calculated reference level shown and the start, peak and end of each detected contraction indicated.

3. Neural network output; the neural network classified the magnitude of decelerations as *severe*, *deceleration (dip)*, and *not deceleration (not dip)*. Each output ranged from 0 - 100% where an output value > 80% indicated a successful classification.

4. Variability classification; the histogram used for the heart rate variability calculation was plotted to indicate the percentage number of 1 minute epochs which had absent (A), reduced (R), normal (N) and increased (I) variability.

5. Validation protocol score; this number was printed for every 15 minutes of recording and indicated the concern the system had for the fetus. This score was used during the validation of the system, discussed in Chapter 5 (section 5.3).

6. CTG assessment; an assessment of the CTG together with the current record time was displayed and updated for every 5 minutes of recording .

7. Signal quality; the quality of the heart rate and contraction data was expressed in a traffic light display where a red light indicated poor signal quality.

8. The expert system; the explanation facility was the output of the expert system which detailed the rules and conditions which had led to a recommendation.

4.5 System integration.

The system was developed in two modules; the feature extraction module and the expert system. These were designed to be easily integrated to form the combined intelligent system as represented in figure 4.8.

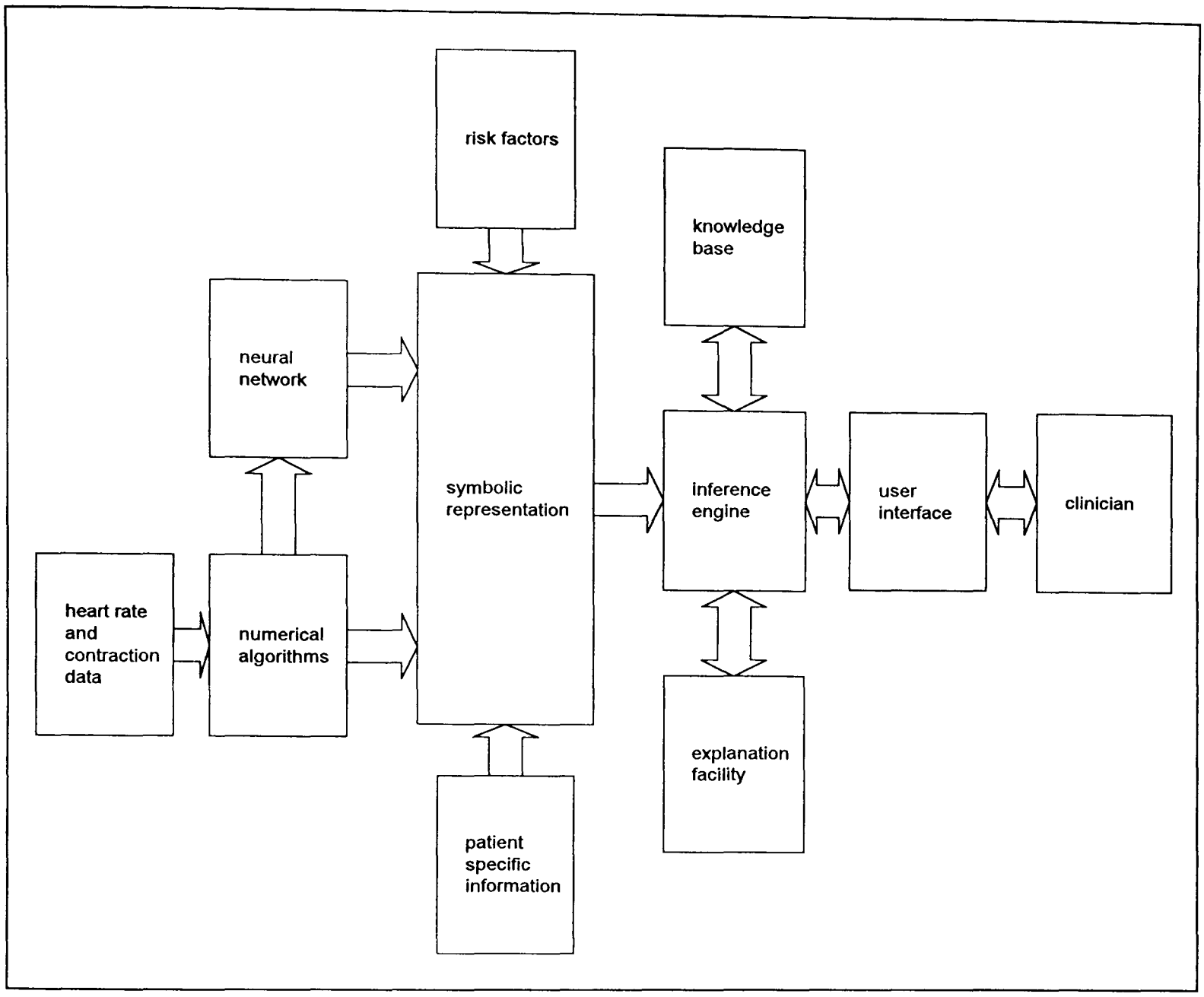


Figure 4.8: The complete system diagram.

This is a hybrid system which utilises the strengths of various techniques used in applied artificial intelligence. The important features were extracted from the CTG using numerical algorithms which were classified using additional algorithms and a neural network. These features, together with the patient specific information (mother and fetus), formed the dynamic knowledge which was symbolically represented using obstetric terminology (e.g. reduced variability, late decelerations etc.). This was then processed by an expert system which applied long term knowledge in the form of production rules represented in the knowledge base to infer facts and relationships which ultimately lead to actions being recommended.

4.5.1 Software control.

The system software was written in the C-programming language using the modular form represented in figure 4.9 and was implemented on an IBM compatible, Intel 80486DX microprocessor based personal computer. The system manager module controlled the flow of data from data collection, data processing through to data output. The other modules were independent of each other but shared common data which, for each 15 minutes of recording included;

1. Heart rate data.
2. Contraction data.
3. Baseline heart rate waveform. The calculated waveform about which accelerations and decelerations were referenced.
4. Deceleration map. The location of decelerations relative to the 15 minute window.
7. Acceleration map. The location of accelerations relative to the 15 minute window.
8. CTG assessment. An assessment of the last 5 minutes of recording. This was a global structure array which took the form,

```
typedef struct
{
   int      baseline_heart_rate;
   char     heart_rate_variability;
   int      number_accelerations;
   int      number_early_mild_decs;
   int      number_late_severe_decs;
   int      number_contractions;
   int      contraction_noise_assessment;
   int      heart_rate_noise_assessment;
   char     CTG_classification;
}
features;

features segment[240];
```

Where '*segment*' is an array of 240 '*features*' structures, which can hold an assessment of 20 hours of recording.

This combined system underwent a preliminary evaluation by comparing its recommended management of 30 labours with 3 experts from Plymouth (Keith et al, 1993) and is described in chapter 5 (section 5.3). This study found the complete system obtained a performance comparable with the experts and was therefore ready for a rigorous external validation. This study compared the system with 17 experts from 16 leading centres in fetal monitoring around the UK and is described in chapter 5 (section 5.4).

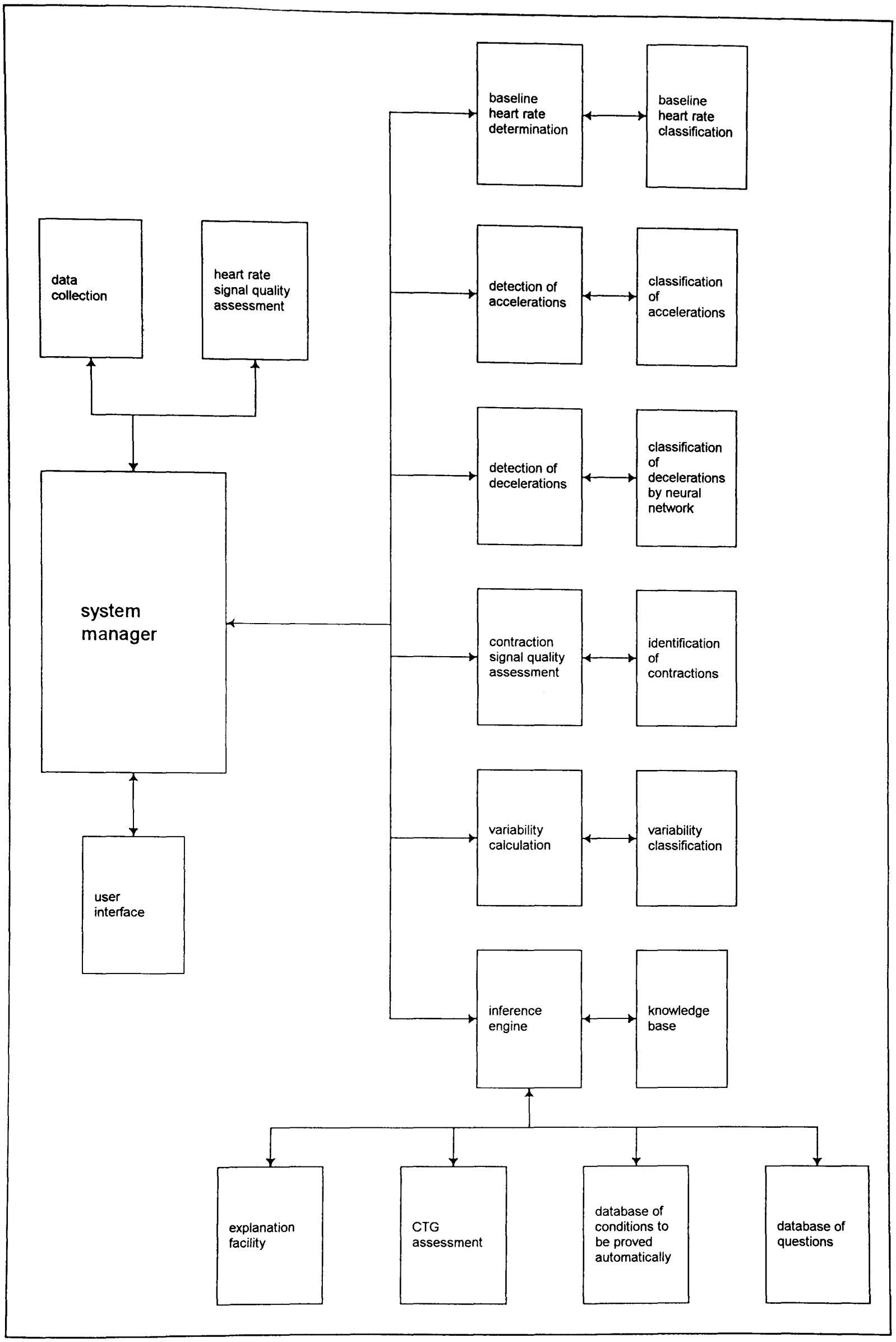


Figure 4.9: System control.

Chapter 4 summary.

Chapter 4 described the development of the expert system module of the intelligent system. Initially, knowledge elicitation took place with two expert obstetricians. From these discussions it was possible to quickly develop a limited expert system. This was used to stimulate the experts to recommend further refinements to the existing knowledge and to also identify areas which required extending. The performance of this prototype system was compared with one of the experts and demonstrated the feasibility of representing expert knowledge for labour management (Ifeachor et al, 1991). This prototype was developed using Prolog software which minimised development time. However, this language was not suitable for the final implementation of the expert system which interfaced to the feature extraction methods. This implementation required the advantages of a low-level language such as 'C' and so the expert system was redesigned. Over a period of two years, the knowledge was refined and represented in tree diagrams and converted into production rules to form the knowledge base. The feature extraction methods described in chapter 3 were integrated with the expert system to obtain the complete intelligent system.

This combined system was a hybrid which utilised the strengths of various techniques used in applied artificial intelligence. The features were extracted from the CTG using numerical algorithms and were classified with additional algorithms and a neural network. These features, together with the patient specific information, formed the dynamic knowledge which was symbolically represented using obstetric terminology (e.g. reduced variability, late decelerations etc.). This dynamic knowledge was then processed by the expert system which applied long term knowledge in the form of the production rules represented in the knowledge base to infer facts and relationships which ultimately lead to actions being recommended.

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Chapter 5

Evaluation and validation of the system.

5.1 Introduction.

Evaluation and validation are recognised as the most important aspects in the development of intelligent systems (O'Keefe et al, 1987; O'Leary et al, 1990). Objective assessment at the end of each major stage of development is vital for examining the system's limitations, strengths and weaknesses, which provides valuable feedback and helps shape future work. This process was considered especially important for a system applied to the sensitive area of fetal monitoring. The following examinations were proposed to assess the system for labour management at the important stages in its development.

1. Evaluation of the expert system.
2. Internal evaluation of the integrated system.
3. External validation of the system.
4. Internal clinical trial.
5. External randomised trial.

Stages 1, 2 and 3 are described in this thesis. These compare the system with domain experts to determine the accuracy of the embedded knowledge and the validity of the system's advice. The outcome of these investigations would indicate whether stages 4 and 5, which examine the impact of the system in the clinical situation, were viable.

5.2 Preliminary evaluation of the expert system.

5.2.1 Introduction.

A limited expert system was quickly developed after the knowledge elicitation sessions had identified the essential aspects of labour management. This was developed in Prolog software and is described in chapter 4 (section 4.4). The automatic methods for feature extraction from the CTG were not incorporated. Instead, a description of the important features was provided by a midwife. The purpose of this expert system was to provide feedback and define areas for future development. This system was then evaluated by comparing its performance with one of the experts principally involved in its development. The objectives were to establish whether it was feasible to formalise expert knowledge for labour management. This work was presented at an international conference and published in full in the refereed conference proceedings (Ifeachor et al, 1990).

5.2.2 Method.

A group of 31 patient records which had received medical intervention, in the form of at least fetal blood sampling, were chosen randomly from our database. This intervention indicated that at some stage during each labour there existed some concerns for the fetus. Each record was examined retrospectively but blind to outcome by the clinical expert, CE, and a midwife using the expert system, ES.

The CTGs from these cases were assessed in 10 minute segments. As automatic feature extraction had not been incorporated, the midwife was asked to describe 4 features of the CTG to the ES for each 10 minute segment. If required, the ES asked the midwife for further patient specific information and then would recommend a course of action to be taken which the midwife noted. The action recommended by the expert system, the CE and the clinical action taken during labour were subsequently compared.

5.2.3 Results.

The condition of the baby at birth in each case was assessed using the acid base status of the cord artery and vein together with Apgar scores measured at 1, and 5 minutes.

The breakdown of fetal blood sampling carried out or recommended in the 31 cases is given in table 5.1 and the overall results are given in table 5.2.

Number of FBS done per case	Number of cases done clinically	Number of cases recommended by CE	Number of cases recommended by ES
1	18	7	3
2	10	5	6
3	3	4	4
Totals	31	16	13

Table 5.1: Breakdown of fetal blood sampling.

	Number of cases clinically	Number of cases recommended by CE	Number of cases recommended by ES
Number fetal blood samples	31	16	13
Operative delivery	15	13	12
Number of babies with cord artery pH < 7.15	8	2*	2*
Number of babies with Apgar score ≤ 7 at 5 minutes	6	2*	2*

Table 5.2: Summary of results.

* These represent the likely number assuming the recommended actions had been taken clinically.

This study found that;

1. In the 31 cases where at least 1 FBS was obtained clinically, less than half were recommended by the clinical expert (15 cases out of the 31 prevented) and the expert system (18 out of 31 cases prevented). These reductions would not have adversely affected perinatal outcome as the babies involved were delivered with a good outcome.
2. Both the CE and ES did not recommend intervention in the same three cases for which an operative delivery for diagnosed fetal distress was carried out clinically. As the actual outcome in these cases were not consistent with fetal compromise, the recommended actions of the CE and ES were more appropriate.
3. The CE and ES recommended an extra fetal blood sample in the same three cases which would have allowed an earlier detection of fetal distress and an earlier operative delivery by up to 60 minutes. This may have led to an improvement in perinatal outcome.
4. In a further case, an operative delivery was recommended by both the CE and ES but was not performed clinically.
5. An extra FBS was recommended by the CE in 2 cases and by the ES in 3 cases (the same 2 + 1) than was obtained clinically.

From a subsequent review of the cases, it was considered that the small differences between the CE and ES had resulted from differences in the visual interpretation of the CTG.

5.2.4 Discussion.

In this preliminary evaluation of 31 cases where intervention had occurred clinically, it was found that the performance of the prototype expert system was comparable with the clinical expert's. This demonstrated the feasibility of formalising expert knowledge for labour management. Compared with the actions taken clinically, both the clinical expert and expert system specified a lower intervention rate in the form of fetal blood sampling (< 50%) and

operative delivery (20%). In addition, both recommended earlier delivery in the same 4 cases which may have resulted in an improvement in outcome as measured by the cord artery pH and Apgar score at 1 and 5 minutes. However, no fetus in the cases considered had a particularly poor outcome.

5.3 Preliminary evaluation of the integrated system.

5.3.1 Introduction.

This evaluation took place after the expert system had been redesigned and integrated with the automatic feature extraction methods. The purpose of this investigation was to establish whether the combined system could manage labour with a performance comparable with experienced clinicians in Plymouth who had not previously been involved in the development of the system. This study formed the basis of a journal paper which has been accepted for publication (Keith et al, 1993).

5.3.2 Method.

A randomised trial in Plymouth had previously assembled the case notes and CTGs, and measured the outcomes for 2400 labours over a period of 18 months. During the trial, a computer was connected to a single intrapartum recorder at bedside which digitised and recorded the CTGs from 300 labours. One hundred of these cases contributed to the development of the feature extraction methods used by the system. From the remaining 200 cases, the 9 cases which had clinical intervention for 'fetal distress' (fetal blood sampling and/or operative delivery) were selected together with a further 21 cases selected randomly.

The clinical decisions taken in these 30 cases were compared with those recommended in a retrospective review of the cases by the system and 3 experienced clinicians (A, B and C) who were considered to be experts. Experts A and C had not previously been involved in the system's development. The reviewers assessed the cases independently, blind to outcome and with no knowledge of the system's recommendations or each others. The CTGs were exposed in 15 minute segments and each reviewer was asked to make an assessment of the condition of the fetus based on the newly-revealed segment, the previous recording and the clinical information known at the time. They were then asked to specify an appropriate course of management; continue with the labour, obtain a FBS, or request operative delivery. It was not possible for any reviewer to see future segments before the present segment had been assessed. The reviewers were made aware of any additional

information gained from clinical actions (i.e. fetal blood sampling) if they too had specified the same action.

The consistency of reviewer A was also assessed in a second assessment (A2) of the same cases five months later with the case order randomised. Reviewers B and C took part in a discussion of the results of the first assessment and were thus too familiar with the cases to make their subsequent review useful.

5.3.3 Results.

In 18 cases, no action was taken clinically nor was recommended by any reviewer nor the system. For these cases, the mean cord artery pH was 7.26 ($\sigma = 0.07$) and the vein pH was 7.35 ($\sigma = 0.06$). The one minute Apgar score was 8 or more in 16 cases, 6 in one case and 5 in the other. The five minute Apgar scores were 9 or 10 in all cases. These measures indicated that a good outcome had been obtained and that intervention was unnecessary.

The 12 remaining cases where intervention occurred clinically, or was recommended by the system or a reviewer, are shown in table 5.3. The mean cord artery pH was 7.19 ($\sigma = 0.08$) and vein was pH 7.27 ($\sigma = 0.08$). These measures were not significantly different from the non-intervention group, although the trend was towards a lower pH.

	Fetal blood samples						Operative delivery						Perinatal outcome					
													Cord blood pH		Base deficit		Apgar	
Case	Sys	A	A2	B	C	Clin	Sys	A	A2	B	C	Clin	artery	vein	artery	vein	1'	5'
1	2	1	1	2	2	2	cs	cs	cs	cs	cs	cs	7.21	7.31	3.1	7.1	7	10
2	1	1	1	1	0	1	cs	cs	cs	cs	-	cs	-	7.26	-	7.1	7	9
3	1	0	0	0	1	0	-	-	-	-	-	-	7.26	7.29	1.2	2.8	6	8
4	0	0	0	0	1	0	-	-	-	-	-	-	7.13	7.21	8.8	10.0	8	9
5	1	0	0	1	0	1	for	for	for	for	for	-	7.07	7.27	7.4	7.0	9	9
6	0	0	0	0	0	1	-	-	-	-	-	-	7.29	7.36	4.6	4.1	7	9
7	0	0	0	0	0	0	for	for	for	for	for	for	7.23	7.33	1.8	0.9	6	9
8	0	0	0	0	0	0	for	for	for	for	for	-	-	7.12	-	11.2	9	9
9	0	0	0	0	2	2	-	-	-	-	-	-	7.27	7.36	0.9	1.1	8	9
10	1	1	0	1	1	0	cs	cs	cs	cs	cs	cs	7.07	7.12	7.2	5.2	3	8
11	0	0	0	0	0	2	-	-	-	-	-	-	7.20	7.38	3.5	4.0	8	9
12	2	2	1	2	2	2	cs	cs	cs	cs	cs	cs	-	7.29	-	3.9	9	9

Table 5.3: Results from preliminary evaluation of the system.
This table details the interventions and outcomes for the 12 cases, of the 30, where intervention took place clinically or was recommended by a reviewer or the system. Where, sys = system, Clin = clinical action, cs = caesarean section and for = forceps.

1. In no case, of the 30, did the system recommend an action not also recommended by an experienced reviewer.

2. All reviewers and the system recommended an operative delivery in the same three cases with lowest cord pH's (cases 5, 8 and 10); in cases 5 and 8, a forceps delivery was recommended 30 and 50 minutes respectively, before a spontaneous vaginal delivery occurred. In case 10, a FBS was recommended by all reviewers and the system (except A2) 40 minutes before the CTG severely deteriorated and an emergency caesarean section was performed.

3. Operative intervention was recommended in the same 7 cases by the system and all reviewers within ± 1 segment (15 minutes), with one exception. The CTG in this case (case 2), revealed an unstable baseline heart rate from the start of the recording. The system and reviewers A and B, interpreted this recording as a normal baseline with decelerations whilst reviewer C alone, interpreted the trace as a low baseline with accelerations. On the basis of their interpretation, all except C recommended a FBS that was obtained clinically and found to have a pH of 7.15 indicating that immediate delivery by caesarean section was necessary. This case was a good illustration of the importance of correctly determining the baseline heart rate which is essential for the correct classification of periodic changes and therefore fetal condition.

The actions recommended by the system, the reviewers, and the actual clinical management of the 30 cases were further compared. An agreement in management was considered to occur when all recommendations for fetal blood sampling and recommendations for operative delivery were specified within ± 1 segment (15 minutes). The number of case agreements out of 30 formed on this basis, are shown in table 5.4.

	Number of agreements				
	System	A1	B	C	Clinical
System	-	27	29	25	22
A1	27	-	28	25	22
B	29	28	-	24	23
C	25	25	24	-	21
Clinical	22	22	23	21	-

Table 5.4: The reviewers agreement matrix.

The actions recommended by reviewer A in his two reviews (A1 and A2) were compared and found to be entirely consistent in both action and timing in 28 out of 30 cases. The

inconsistencies occurred in cases 10 and 12 and arose from differences in fetal blood sampling. However, for these cases, reviewer A still recommended operative delivery in the same 15 minute segment as in the first review.

5.3.4 Discussion.

The integrated system achieved good agreement with 3 experienced clinicians for reviews of 30 complete labours. Every action recommended by the system was also recommended by at least one experienced reviewer. The highest level of agreement was with reviewer B whose knowledge has been principally incorporated into the system. However, the system also agreed well with the recommended management of reviewers A and C, who although from the same Unit, had not previously been involved in the development of the system.

This limited study also found that the experienced reviewers tended to agree in their management of the labours and expert A was entirely consistent in his recommendations for operative intervention. There was less agreement between the actual clinical actions taken on the labour ward and those recommended by the reviewers.

5.4 Validation of the system.

5.4.1 Introduction.

The possible limitation of a single centre developing a system of this type in isolation was recognised. Therefore, it was decided to invite the assistance of 17 practising experts from 16 leading centres in fetal monitoring within the UK, to assist in a study to validate the system. A letter was sent to the Head of Department of each centre inviting their collaboration. If agreeable, they were asked to nominate an individual regularly involved in the interpretation of the CTG and the management of labour who they regarded as expert.

5.4.2 Objectives.

The objectives for this study were to

1. Compare the recommended management of the system with the 17 experts in a large number of cases to establish if the system could manage labour with a performance comparable with experts.

2. Investigate whether experts could agree on the management of labour.

3. Investigate whether the experts could be consistent in labour management.

4. Establish whether the management of the system was independent of the user's obstetric knowledge.

5.4.3 Method.

The case notes and CTGs were obtained for 50 cases selected from a database of 2400 high risk labours in which the perinatal outcome had been measured by both cord blood gas analysis and Apgar scores. None of the cases had previously been reviewed by the system. The number of cases chosen was considered the maximum that an expert could review in a single day. The cases included a wide range of outcomes, from the birth asphyxiated to the very normal. This study was intended to fully test the ability of the experts and the system and to that end, the 50 cases contained the cases considered to be the most difficult in the database. The minimum length of CTG recording was 2 hours, the maximum was 15 hours and the average was 6 hours. A summary of these cases is given in table 5.5 which details the actual mode of delivery and the measured perinatal outcome.

Case	Mode of Delivery			Perinatal Outcome					
				Cord Artery		Cord Vein		Apgar scores	
	Vaginal	Forceps	C-section	pH	BDecf	pH	BDecf	1'	5'
1		•		7.18	6	7.29	4	9	9
2			•	7.32	1	7.36	2	9	9
3		•		6.93	17	7.12	10	4	9
4		•		7.20	5	7.29	4	5	9
5		•		7.21	4	7.30	3	5	9
6			•	6.96	14	7.00	10	4	9
7	•			6.97	8	7.14	8	2	8
8		•		7.25	4	7.31	6	8	9
9			•	7.03	13	7.10	13	5	7
10			•	7.05	5	7.12	6	3	7
11	•			-	-	7.17	6	9	9
12	•			7.28	3	7.39	3	9	9
13			•	7.28	3	7.32	4	5	9
14	•			7.25	0	7.32	1	5	9
15	•			6.87	16	7.09	13	5	7
16			•	7.05	-	7.13	7	7	9
17			•	-	-	7.21	1	6	9
18			•	-	-	7.35	3	9	9
19		•		7.15	5	7.23	3	9	9
20	•			7.06	3	7.08	5	6	9
21	•			7.25	10	7.42	2	9	9
22	•			7.19	4	7.24	6	5	9
23			•	7.30	0	7.37	0	8	9
24			•	7.17	2	7.22	4	6	9
25	•			6.87	17	6.96	18	6	7
26	•			6.95	7	7.13	4	6	9
27	•			-	-	7.25	5	9	9
28		•		6.97	7	7.10	6	5	9
29			•	7.13	4	7.20	6	6	6
30	•			6.88	22	6.97	15	6	9
31	•			7.25	0	7.37	0	9	9
32			•	7.15	10	7.21	10	6	9
33	•			7.31	0	7.38	2	8	9
34		•		7.14	7	7.20	5	4	7
35			•	6.81	11	7.20	-	3	8
36		•		7.07	4	7.30	1	4	9
37		•		7.19	7	7.22	6	8	9
38	•			7.04	11	7.08	11	3	6
39	•			7.38	8	7.40	6	9	9
40			•	7.25	3	7.27	6	7	9
41	•			6.97	12	7.06	7	9	9
42		•		7.29	-2	7.34	-1	9	9
43			•	7.13	5	7.17	5	7	9
44			•	7.11	8	7.15	7	6	9
45		•		7.22	4	7.36	0	9	9
46	•			7.23	2	7.29	4	9	9
47	•			-	-	7.39	1	9	9
48		•		7.20	4	7.25	3	6	7
49	•			7.35	-1	7.43	3	8	10
50	•			7.32	-1	7.39	0	9	9

Table 5.5: Mode of delivery and perinatal outcome in the 50 cases used for validation.

The objectives for this study meant that its design would need to be carefully conceived to simulate, so far as possible, the clinical situation. Close attention to detail would be required to ensure that the experts had all the relevant clinical information they would need to indicate how they would have managed a given case. It was also important to ensure that this information was presented at the appropriate time during each review. In this way, the experts would have no more and importantly, no less advantage over the clinician actually managing these cases on the labour ward. The information which was considered important included the CTG, a synopsis of each patient's obstetric history, the specific events that occurred during each labour and importantly, an option to obtain further information on the condition of the fetus with a fetal blood sample.

The experts could not review the CTGs from the selected cases directly as they were legal documents and contained annotations made by clinical staff during the labour. To overcome this, each 30 minutes of CTG recording were photocopied and the annotations removed using white paint. These were then re-photocopied, cut out and stuck together to reform a continuous recording. A red line was drawn and numbered on the CTGs to indicate every 15 minute segment which acted as the time reference for each case. With the case notes, all the relevant clinical details were written on the trace within the appropriate time markers. These details represented the clinical information an obstetrician would normally be aware of if actually managing the cases, for example, the administration of drugs and anaesthetics, the cervical dilatation measured during vaginal examinations, the decent and presentation of the baby, the colour of the amniotic liquor etc. The CTGs were then rolled up and stored. A synopsis of each patient's obstetric history was then compiled from the case notes. This synopsis, together with the labour events and perinatal outcome for each case are presented in appendix H.

Two graphs were also constructed for each case. The first plotted the cervical dilatation over the duration of the labour using the data recorded from vaginal examinations. The second graph plotted the estimated fetal blood sample pH for every segment of recording which were obtained as follows. All cases had blood gas analysis at birth so the end point of each graph was fixed. If any blood samples were obtained clinically, then these were plotted and the intermediate points interpolated. If no FBS were taken during the labour, the graph prior to the end point was estimated by 2 obstetricians from a knowledge of the end point and an interpretation of the CTG.

The experts were working in hospitals all over the UK (figure 5.1). The location of the hospitals were split into 4 regions; the South, Scotland, the North-West and North-East. Four workers from Plymouth were given the responsibility of visiting the experts in each area. Two sets of the CTGs and clinical data were compiled which meant that any two workers could be visiting the experts at any one time.

Figure 5.1: The location of the centres.

5.4.4 Study protocol.

Each expert reviewed the 50 cases twice, at least one month apart. The reviews were independent and blind to perinatal outcome and no expert had a knowledge of any other expert's identity. The cases were presented to all experts in the same sequence but the sequence was randomly changed between the two reviews and the cases were reassigned with different identifying numbers.

A method was devised to simulate the clinical situation by revealing the CTGs (with the labour events written in the appropriate segments) from a sealed opaque box in 15 minute segments (figure 5.2). This method prevented an expert seeing future segments before the current segment had been commented upon and also prevented them from estimating the length of the CTG which would have provided a clue to the length of the labour.

The experts scored each segment according to the concern they had for the fetus and the management they considered most appropriate. The scores they could assign were,

Score	Comment
1	I am not concerned for this fetus.
2	I have concerns for this fetus, but they are not sufficient to request a FBS. I may take some remedial action (specify).
3	I am sufficiently concerned to request an FBS or if possible, a simple vaginal delivery.
4	The information I have leads me to be seriously concerned for this fetus. I am not going to recommend immediate delivery although I am thinking delivery and will do so if things deteriorate further.
5	I am so concerned for this fetus that I want immediate delivery.

Scoring sheets were provided to allow the experts to record their score for each segment. In addition, space was provided alongside each entry for the experts to note any comments they wished to make for example, why they had recommended a particular score, what remedial action they would have taken if they had been managing the labour etc. The review of each case was concluded when either the CTG ended or a score was reached which permitted delivery (5 or 3 in the second stage). If an expert requested an FBS in a given segment (score 3) then the referee could provide a result secretly read from the FBS graph. In the same way, if an expert considered a vaginal examination was appropriate to check on progress, then the referee could provide a measure of the cervical dilatation. The aim for the experts, as in the clinical situation, was to achieve minimal intervention without jeopardising the safety of the fetus.

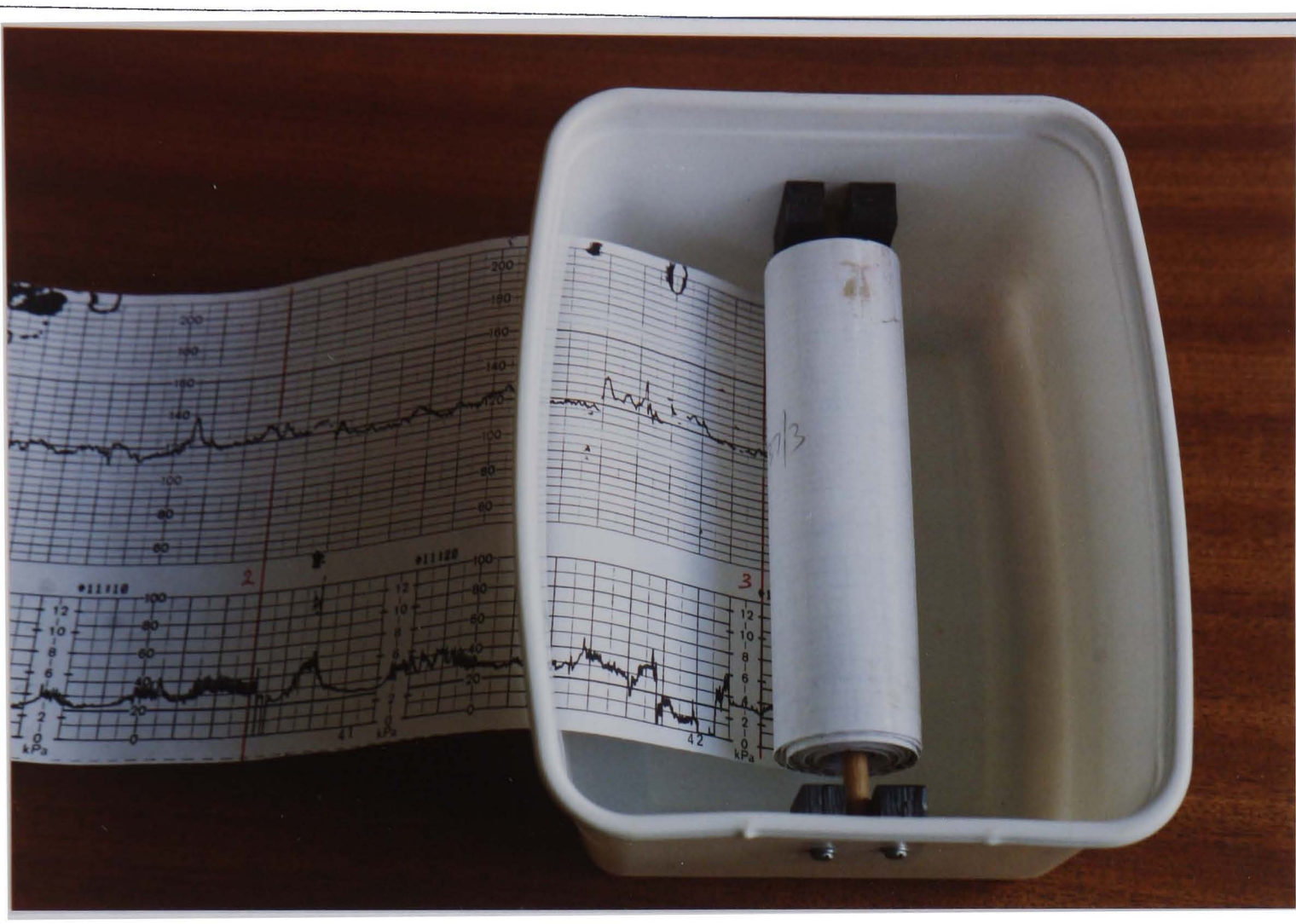

Figure 5.2: The method for revealing the cardiotocograms.

To ensure that each review took place under similar conditions, guidelines were produced for the referees and the reviewers which they read before each review commenced.

Reviewers instructions.

- The CTGs will be revealed to you in 15 minute segments.
- All labour information is contained on the CTG.
- If you wish an FBS or a VE, the referee will provide you with a result on which you may base your subsequent management.
- Score each segment according to how concerned you are for the fetus. A score may carry with it a management procedure.

Score	Comment
1	I am not concerned for this fetus.
2	I have concerns for this fetus, but they are not sufficient to request an FBS. I may take some remedial action (specify).
3	I am sufficiently concerned to request an FBS or if possible, a simple vaginal delivery.
4	The information I have leads me to be seriously concerned for this fetus. I am not going to recommend immediate delivery although I am thinking delivery and will do so if things deteriorate further.
5	I am so concerned for this fetus that I want immediate delivery.

- You may score each segment as you wish, there are no restrictions.
- Each case review shall end when either the CTG runs out or you reach a score which permits delivery (3 or 5).

Note.

1. We are not particularly interested in decisions to deliver purely for "failure to progress". If you feel you would have delivered for this reason, but are not particularly concerned for the fetus (score 1 or 2), then make a note of this and continue with the case.

2 Colour of liquor is stated at the time of SROM or ARM. Unless specifically mentioned, assume no change has occurred in colour during the course of labour.

3. Fetal growth is judged to be normal unless specifically stated otherwise.

4. The point at which an FSE is applied is marked on the CTG, until then the heart rate is derived using ultrasound.

Referees instructions.

- Present the reviewer with the practice case. This is to be treated as a real case although the reviewer should be informed that it is a practice.
- After the practice case, the cases must be presented in the correct order.
- The reviewer is to read each case history prior to each case review.
- The referee must secretly load each CTG into the opaque box to prevent giving an indication of the trace length to the reviewer and must pull out the trace from the box.
- The reviewer shall record their own scores and comments, but the referee must observe this.
- The reviewer may record any comments they wish but do ensure that all FBS and VE results are recorded. Record also the case time at which they asked for it as they may require this information later. Take this time as the "end of segment time".
- Assume an easy vaginal delivery is possible when the woman is 10cm dilated (on graph). At this point, a concern score of 3 represents an easy vaginal delivery and the case review is concluded.
- Each case review is complete either when the CTG runs out or the reviewer reaches a permitted delivery score (3 or 5).
- We want all 51 cases to be reviewed (including the practice case). However, if time runs out we need an absolute minimum of 31 cases .

5.4.5 The system's review.

The CTGs from these cases had not been digitised at the time they were recorded and so a method was required to extract the fetal heart rate and uterine contraction data from the paper CTGs. This was accomplished using a Hewlett-Packard flat-bed colour scanner. Each 30 minutes of CTG recording (of which there was some 300 hours in total) was scanned as a black and white drawing (i.e. no grey scales). This format made use of a threshold filter within the scanner software to obtain an image made up of pixels represented by 0 or 1 (black or white). The threshold was set to ensure the heart rate and contraction tracings were obtained and the background was rejected. Each 30 minute image was viewed and edited to remove all noise and clinical annotations. The 'cleaned' image was then saved in the TIFF image format (tagged image file format, V.5.0). During scanning, a template was used to ensure that the scanning region was precisely to the edges of the CTG paper. With the boundaries of the image known, the relative location of the required data within the image was identified. The heart rate and contraction data samples could now be identified as the black dots within each white scan line. As the correspondence between each scan line and the original CTG were known, it became a simple matter to develop software to extract and scale the required data and save it in a binary file format required by the system. Test

patterns were used to confirm that this method was accurate and every extracted 30 minute epoch was displayed on a computer screen and visually compared to the original CTG.

It was required to directly compare the system's recommended management of the cases with the experts. This was achieved by coding each node in the knowledge tree with the appropriate protocol score, prior to the commencement of the study. The system then displayed this score for each 15 minute segment of recording.

The system reviewed each case twice, with a different operator for each review. The role of the operator was to provide the additional case information and estimates of FBS results when requested by the system. In the first review the operator was an engineer who understood obstetric terminology. In the second review, the operator was an obstetrician not previously involved in the development of the system. The reviews were independent and the operators had no knowledge of each others results.

The scores recorded by the experts and the system for each case were entered in a spreadsheet. All entries were double checked by two workers to ensure they had been accurately entered. The spreadsheet obtained for case 1 is shown in table 5.6 and the remainder can be found in appendix H. The experts were coded, A to Q inclusive and the system was coded, S, with each of the two reviews identified as 1 and 2. Two sets of plausible random numbers were also generated for each case, denoted by R1 and R2. These will be considered in detail later, but their purpose was to indicate the likely results of a reviewer randomly assigning their scores. In addition, the actual clinical actions in the cases were also entered where possible.

It will be recalled from the protocol that a score of 3 represented a request for a FBS if recorded during the first stage of labour and an easy forceps delivery if recorded during the second stage. These actions were scored similarly because a simple forceps delivery and a FBS were considered to be equal interventions. However in reality, a simple forceps delivery cannot always be obtained in which case a FBS may still be preferred before attempting a difficult forceps delivery. The experts could not be told whether a forceps delivery was likely to be easy or difficult because this depended on many factors including the descent and orientation of the baby. These details were not recorded in the clinical notes and so if the reviewers reached a protocol score of 3, it was always assumed a simple forceps delivery was possible. In the spreadsheets, scores of 3 in the second stage were distinguished from FBSs by re-coding them as 6 but as they were considered to be similar interventions, they were left unchanged during the numerical analysis.

	SEGMENT																																																										
REVIEWER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
A1	2	2	2	2	3	2	2	2	2	4	6																																																		
A2	1	1	1	2	2	2	2	3	1	2	2	4																																																
B1	1	2	2	2	3	2	2	1	1	4	4	6																																																
B2	1	2	2	2	3	2	1	1	2	2	6																																																	
C1	1	1	1	2	2	2	2	2	2	2	6																																																	
C2	1	2	1	2	2	2	2	2	2	2	6																																																	
D1	1	1	1	2	2	2	1	1	1	1	2	2																																																
D2	1	2	1	2	2	2	2	2	2	2	2	2																																																
E1	2	2	2	2	3	2	2	2	2	2	6																																																	
E2	2	2	2	2	3	2	2	2	2	2	2	2																																																
F1	1	1	1	1	1	1	1	1	1	1	1	1																																																
F2	1	1	1	1	1	1	1	1	1	1	2	2																																																
G1	2	2	2	2	2	2	2	2	2	3	2	2																																																
G2	2	2	2	2	2	2	2	2	2	3	2	2																																																
H1	2	2	2	2	3	2	2	2	2	2	2	6																																																
H2	2	2	2	2	2	2	2	2	2	2	2	6																																																
I1	2	2	2	3	2	2	2	1	2	2	2	4																																																
I2	2	2	2	3	2	2	2	2	2	2	2	6																																																
J1	2	2	2	3	2	2	2	2	2	2	2	2																																																
J2	2	3	2	2	2	3	2	2	2	2	6																																																	
K1	1	2	2	2	3	2	2	2	2	2	6																																																	
K2	1	2	2	2	3	2	2	3	2	2	4	4																																																
L1	1	2	2	3	2	2	2	2	2	6																																																		
L2	2	2	2	3	2	2	2	1	3	2	6																																																	
M1	1	1	1	1	1	1	1	1	1	1	1	1																																																
M2	1	1	1	1	2	1	1	1	1	1	2	2																																																
N1	1	2	1	2	2	2	2	2	2	2	2	6																																																
N2	2	2	2	2	2	3	2	2	2	4	4	6																																																
O1	2	2	3	1	1	1	1	1	2	2	2	6																																																
O2	2	3	1	1	2	2	2	1	2	2	6																																																	
P1	1	1	1	2	2	2	2	1	2	6																																																		
P2	1	1	2	2	2	1	1	2	1	2	2	2																																																
Q1	2	2	2	2	2	2	2	2	2	2	2	6																																																
Q2	2	2	2	2	2	2	2	2	2	2	2	2																																																
S1	1	2	2	2	2	3	2	2	2	6																																																		
S2	1	2	2	2	2	3	2	2	2	6																																																		
R1	2	3	4	3	2	2	2	1	1	1	1	1																																																
R2	1	1	1	2	1	1	1	1	1	1	1	1																																																
Clinical	0	0	0	0	0	0	0	0	0	3	0	6																																																

Table 5.6: Recorded scores for case 1.

5.5 Validation results.

The objectives for this study were to investigate whether an intelligent system could be developed to obtain a comparable performance to experts in the management of labour and whether experts, when given all the relevant information, could largely agree and be consistent. To examine this, it was necessary to investigate the following;

1. **Analysis of the recorded scores.**
   To establish how similarly and consistently the experts and the system managed the 50 labours.

2. **Cases where a caesarean section was recommended.**
   To assess the similarity and consistency of the experts in recommending a CS and whether the system could obtain a similar performance.

3. **Fetal blood sampling rates and second stage interventions.**
   To obtain additional information on the intervention rates of the system and experts.

4. **Cases which obtained a poor outcome clinically.**
   To establish whether the system and experts could have avoided cases which achieved a poor outcome clinically.

5. **Cases which obtained a good outcome clinically.**
   To establish the levels of unnecessary operative intervention specified by the system and the experts.

5.5.1 The distribution of scores recorded by the experts and the system.

The frequency of each reviewer's scores were found and shown in table 5.7. Second stage interventions were re-coded as 6 to separate them from fetal blood samples (score 3). The mean of the experts' frequencies was calculated and are also shown. The experts were labelled A to Q inclusive. The system is labelled S and the plausible random numbers R. The two reviews were denoted by 1 and 2.

Reviewer	Frequency of scores					
	1	2	3	4	5	6
A1	366	535	87	45	20	5
A2	494	535	62	21	17	7
B1	404	322	82	113	27	10
B2	434	346	84	86	25	14
C1	601	292	63	34	18	17
C2	574	379	77	26	17	20
D1	582	347	71	15	20	15
D2	476	455	61	31	18	13
E1	371	515	94	12	21	15
E2	305	606	77	14	19	12
F1	719	269	47	17	17	8
F2	706	265	50	23	18	12
G1	441	600	43	24	15	11
G2	356	592	41	106	16	10
H1	391	408	74	17	25	14
H2	416	488	71	4	24	14
I1	438	573	76	13	16	9
I2	364	640	82	7	16	17
J1	285	613	81	24	18	13
J2	453	486	65	23	19	13
K1	629	283	77	21	17	14
K2	693	241	69	57	17	12
L1	459	487	86	6	18	18
L2	517	432	60	25	18	16
M1	623	501	29	0	10	6
M2	508	570	47	0	12	13
N1	391	542	57	82	16	16
N2	419	526	69	61	16	18
O1	487	390	92	11	20	14
O2	564	422	88	0	16	18
P1	533	489	34	28	17	7
P2	503	539	42	10	16	9
Q1	171	545	0	195	16	12
Q2	54	635	0	279	15	12
S1	685	356	35	30	11	10
S2	674	366	34	29	11	10
R1	462	431	67	41	12	4
R2	495	429	68	30	8	6
$\overline{X}$ (experts)	463	467	63	42	18	13

Table 5.7: Frequency distribution of the recorded scores.

Table 5.7 allowed some preliminary inferences to be made regarding the management recommended by the experts and the system. The average number of fetal blood samples (FBS) per expert review was 63. 7 experts in 9 reviews, requested 80 or more, of which 2 experts (E and O) requested more than 90; an average approaching 2 FBSs per case. In contrast, 5 experts (F, G, M, P and Q) requested 50 or less FBSs in each review; an average of less than one per patient. Of these, expert Q recommended no FBS in either review. In terms of consistency, for 6 experts the difference between the number of FBSs requested in their reviews was less than 5. However, for 2 experts (A and L) the difference in their requests for fetal blood sampling between their reviews was 25 or more. A detailed analysis of FBS rates can be found in section 5.5.4.

The average number of recommendations for immediate CS was 18 per review. 6 experts (A, B, D, E, H and O) recommended 20 or more and of these, 4 experts (A, B, E and O) also requested high numbers of FBS (> 80). Expert M can be identified as a low interventionist. He requested fewer FBSs than most and recommended the least number of CSs.

It is interesting to identify the potential low and high interventionists, but at this stage it is not possible to say which camp have adopted the most appropriate strategy. If the high interventionists consistently identified the compromised fetus early, then there is an argument for their management. However, if the high interventionists performed no better than low interventionists in this respect, then there is an argument against them. The converse in true of the low interventionists. If they had not intervened sufficiently to be able to identify the compromised fetus, then their strategy is inappropriate. On the other hand, if the low interventionists performed as well as the high interventionists in this, then their strategy is preferred.

The argument comes down to accuracy and balance. Accuracy in terms of being able to consistently identify the compromised fetus, and balance in terms of minimising interventions. In this respect, it may be that the remaining experts' strategy is best, that of moderate intervention. This story will unfold.

Expert Q stands out as being quite different from the other experts. He has scored a comparatively low number of 1's, requested no FBSs in either review, and scored a disproportionate number of 4's. In terms of consistency, expert Q was relatively consistent in the number of CSs recommended but was inconsistent in scoring 1's, 2's and 4's. However, these differences in scoring do not tell us whether expert Q performed better or worse or indifferent from the others. This will become apparent with further tests.

The system did not obtain the highest nor the lowest frequency in any score. However its distribution does seem skewed towards the lower scores (less-intervention) compared to the

majority of experts. The plausible random numbers obtained frequencies close to the mean frequencies which confirmed that the numbers were generated with the same probability distribution as the experts' scores.

5.5.2 Analysis of agreement.

A method was derived to measure the agreement between any two reviewer's sequences of scores for a given case. **As this derivation is slightly involved, it is presented in detail in chapter 6.** This measure obtains a value of 100% for perfect agreement and 0% when there is no similarity. The agreement was calculated for all pairs of reviews and were formed in an agreement table for each case. The table obtained for case 1 is shown in table 5.8 and the complete set is given in appendix H. The diagonal, from top left to bottom right represents the calculated agreement of each sequence with itself and confirms that for identical sequences, the agreement measure scores 100%. Table 5.9 can be interpreted as follows. The agreement measured between expert I's first review, I1, and expert A's first review, A1, was 82%. Similarly, the measured agreement between I1 and the system's first review, S1, was 66% and for Q1 and H2 it was 100%.

Table 5.8: The agreement table obtained for case 1.

REVIEWER	A1	A2	B1	B2	C1	C2	D1	D2	E1	E2	F1	F2	G1	G2	H1	H2	I1	I2	J1	J2	K1	K2	L1	L2	M1	M2	N1	N2	O1	O2	P1	P2	Q1	Q2	S1	S2	R1	R2
A1	100	69	96	84	69	71	37	42	86	62	31	32	70	70	82	68	82	80	60	79	86	86	82	82	31	35	66	96	71	69	67	39	68	43	82	82	48	33
A2	69	100	78	61	68	67	52	52	60	52	46	48	69	69	63	63	75	55	42	61	62	92	59	67	46	50	65	82	52	58	70	52	63	50	68	68	27	47
B1	96	78	100	75	61	62	32	31	74	48	28	29	57	57	74	61	87	72	46	69	75	91	69	73	28	31	61	97	66	61	57	32	61	31	69	69	42	30
B2	84	61	75	100	80	81	58	59	98	81	50	53	78	78	95	79	77	93	78	87	99	68	93	93	50	56	79	73	86	78	78	60	79	59	93	93	59	53
C1	69	68	61	80	100	99	71	75	80	58	62	65	92	92	78	93	60	78	58	69	82	55	79	77	62	68	96	62	73	81	96	72	93	72	79	79	31	63
C2	71	67	62	81	99	100	69	76	82	60	61	64	94	94	80	95	62	80	60	70	83	55	79	79	61	67	97	63	75	82	95	72	95	74	79	79	32	62
D1	37	52	32	58	71	69	100	92	53	68	92	95	68	68	55	68	49	55	68	44	55	31	52	46	92	99	71	29	56	57	71	97	68	88	52	52	41	94
D2	42	52	31	59	75	76	92	100	60	76	81	86	76	76	62	76	51	62	76	50	61	34	58	49	81	89	78	33	56	59	71	95	76	97	58	58	39	83
E1	86	60	74	98	80	82	53	60	100	83	44	47	80	80	98	81	77	95	80	89	99	68	94	93	44	50	80	75	84	78	76	56	81	62	94	94	59	47
E2	62	52	48	81	58	60	68	76	83	100	57	61	63	63	84	63	70	81	97	73	82	54	77	68	57	65	62	48	69	59	54	72	63	78	77	77	68	61
F1	31	46	28	50	62	61	92	81	44	57	100	97	57	57	46	57	42	46	57	36	46	26	44	38	100	95	62	24	54	50	63	88	57	75	44	44	38	99
F2	32	48	29	53	65	64	95	86	47	61	97	100	62	62	49	62	44	49	61	38	49	27	46	41	97	99	66	26	57	54	65	93	62	80	46	46	36	95
G1	70	69	57	78	92	94	68	76	80	63	57	62	100	100	74	88	59	74	63	69	79	56	80	81	57	65	86	59	69	77	92	72	88	78	80	80	35	60
G2	70	69	57	78	92	94	68	76	80	63	57	62	100	100	74	88	59	74	63	69	79	56	80	81	57	65	86	59	69	77	92	72	88	78	80	80	35	60
H1	82	63	74	95	78	80	55	62	98	84	46	49	74	74	100	84	79	97	81	87	97	69	87	87	46	52	83	74	87	76	68	58	84	63	87	87	60	49
H2	68	63	61	79	93	95	68	76	81	63	57	62	88	88	84	100	65	84	63	70	80	52	72	74	57	65	98	63	79	78	82	72	100	78	72	72	34	60
I1	82	75	87	77	60	62	49	51	77	70	42	44	59	59	79	65	100	82	73	71	77	88	74	74	42	46	64	84	77	71	55	50	65	53	66	66	62	44
I2	80	55	72	93	78	80	55	62	95	81	46	49	74	74	97	84	82	100	84	86	94	64	90	89	46	53	83	70	93	86	68	58	84	63	80	80	67	49
J1	60	42	46	78	58	60	68	76	80	97	57	61	63	63	81	63	73	84	100	72	79	48	80	71	57	65	62	44	77	70	54	72	63	78	70	70	76	61
J2	79	61	69	87	69	70	44	50	89	73	36	38	69	69	87	70	71	86	72	100	89	67	85	85	36	42	68	70	83	85	65	47	70	51	84	84	67	39
K1	86	62	75	99	82	83	55	61	99	82	46	49	79	79	97	80	77	94	79	89	100	69	95	92	46	52	80	74	83	78	78	58	80	61	95	95	58	49
K2	86	92	91	68	55	55	31	34	68	54	26	27	56	56	69	52	88	64	48	67	69	100	68	73	26	29	52	92	57	54	55	33	52	34	68	68	41	28
L1	82	59	69	93	79	79	52	58	94	77	44	46	80	80	87	72	74	90	80	85	95	68	100	95	44	49	72	65	82	85	80	55	72	58	90	90	66	47
L2	82	67	73	93	77	79	46	49	93	68	38	41	81	81	87	74	74	89	71	85	92	73	95	100	38	44	72	69	84	86	79	48	74	50	87	87	61	40
M1	31	46	28	50	62	61	92	81	44	57	100	97	57	57	46	57	42	46	57	36	46	26	44	38	100	95	62	24	54	50	63	88	57	75	44	44	38	99
M2	35	50	31	56	68	67	99	89	50	65	95	99	65	65	52	65	46	53	65	42	52	29	49	44	95	100	69	28	58	56	68	95	65	83	49	49	39	95
N1	66	65	61	79	96	97	71	78	80	62	62	66	86	86	83	98	64	83	62	68	80	52	72	72	62	69	100	62	78	79	85	74	98	76	72	72	33	63
N2	96	82	97	73	62	63	29	33	75	48	24	26	59	59	74	63	84	70	44	70	74	92	65	69	24	28	62	100	60	56	56	31	63	34	71	71	32	26
O1	71	52	66	86	73	75	56	56	84	69	54	57	69	69	87	79	77	93	77	83	83	57	82	84	54	58	78	60	100	93	66	58	79	57	66	66	67	54
O2	69	58	61	78	81	82	57	59	78	59	50	54	77	77	76	78	71	86	70	85	78	54	85	86	50	56	79	56	93	100	78	56	78	58	65	65	67	52
P1	67	70	57	78	96	95	71	71	76	54	63	65	92	92	68	82	55	68	54	65	78	55	80	79	63	68	85	56	66	78	100	70	82	67	80	80	31	64
P2	39	52	32	60	72	72	97	95	56	72	88	93	72	72	58	72	50	58	72	47	58	33	55	48	88	95	74	31	58	56	70	100	72	92	55	55	40	92
Q1	68	63	61	79	93	95	68	76	81	63	57	62	88	88	84	100	65	84	63	70	80	52	72	74	57	65	98	63	79	78	82	72	100	78	72	72	34	60
Q2	43	50	31	59	72	74	88	97	62	78	75	80	78	78	63	78	53	63	78	51	61	34	58	50	75	83	76	34	57	58	67	92	78	100	58	58	40	79
S1	82	68	69	93	79	79	52	58	94	77	44	46	80	80	87	72	66	80	70	84	95	68	90	87	44	49	72	71	66	65	80	55	72	58	100	100	46	47
S2	82	68	69	93	79	79	52	58	94	77	44	46	80	80	87	72	66	80	70	84	95	68	90	87	44	49	72	71	66	65	80	55	72	58	100	100	46	47
R1	48	27	42	59	31	32	41	39	59	68	38	36	35	35	60	34	62	67	76	67	58	41	66	61	38	39	33	32	67	67	31	40	34	40	46	46	100	41
R2	33	47	30	53	63	62	94	83	47	61	99	95	60	60	49	60	44	49	61	39	49	28	47	40	99	95	63	26	54	52	64	92	60	79	47	47	41	100

It was proposed to examine the nature of the agreement results obtained by the experts and the system using two statistical tests.

1. **The kappa coefficient of inter-rater agreement.**
   This measure compares inter-rater agreements and examines the significance of measured agreement in excess of that which could have been expected by chance.

2. **The Kruskal-Wallis one-way analysis of variance by ranks.**
   This non-parametric statistic examines the characteristics of more than 2 distributions to establish whether any differences in the distributions represent genuine population differences or whether the variations are those to be expected from random samples of similar populations. This test will establish if any expert or the system obtained lower levels of agreement than any of the other reviewers for a given case.

The application of these statistics are relatively complex and so are summarised in this chapter but presented in detail in chapter 6 (section 6.5).

Did the experts or system obtain an average agreement in any case significantly better than, or worse than expected by chance?

For each case, the mean agreement the system scored with the experts, o(system), and the mean agreement the experts scored with each other, o(experts), were obtained and are shown in table 5.9. These were expressed as kappa statistics which test the null hypothesis that neither the experts, nor the system, obtained agreements significantly different from those expected by chance. Two alternative hypothesis were considered.

1. If the agreement reached significance and was less than expected by chance then it was concluded that there was significant disagreement.

2. If the agreement reached significance and was greater than expected by chance then it concluded that there was significant agreement.

Although two alternative hypothesis have been formed, the test was one-tailed because each predicts the direction of the agreement. In this test, the region of rejection should not be too small to prevent a measure of agreement from reaching significance (in either direction) when the number segments, n, scored in a case was small. Therefore the significance level was chosen as $\alpha = 0.1$. **The detailed calculations for this test are given in chapter 6 (section 6.5.1).**

Case	Segments (n)	Measured agreement	
		o (experts)	o (system)
1	12	68.1	71.5
2	45	43.7	44.7
3	47	52.2	54.8
4	20	57.9	57.4
5	26	58.7	63.4
6	10	92.1	91.6
7	28	67.8	76.6
8	16	76.5	63.6
9	7	80.5	76.2
10	9	64.4	70.2
11	16	80.6	65.2
12	19	55.7	62.4
13	56	59.4	65.1
14	16	65.0	61.7
15	20	66.3	67.9
16	47	44.0	52.1
17	20	57.7	46.7
18	36	66.6	66.6
19	15	59.1	57.2
20	23	75.0	81.2
21	16	90.6	92.0
22	20	66.3	67.9
23	52	70.0	73.3
24	11	64.0	52.4
25	14	80.4	76.8
26	31	75.9	76.9
27	8	79.1	75.9
28	26	69.5	73.0
29	52	84.5	79.0
30	11	63.9	49.4
31	16	97.1	97.6
32	17	49.8	40.2
33	15	76.2	75.3
34	23	74.9	78.7
35	9	81.5	72.8
36	38	63.7	64.9
37	59	65.8	63.4
38	14	81.3	29.1
39	27	90.8	91.9
40	11	57.7	38.7
41	15	63.6	61.7
42	17	61.7	54.5
43	19	83.1	76.2
44	20	64.8	31.8
45	14	68.7	73.0
46	34	78.4	81.8
47	20	92.5	92.4
48	38	65.0	46.0
49	29	89.2	92.3
50	28	88.0	91.3

Table 5.9: Statistical significance in the measures of agreement for each case.
The average agreement the system scored with the experts, o(system), and the average agreement the experts scored with each other, o(experts), was calculated for each case. These were expressed as kappa values, which were referred to the standard normal tables to test the significance agreement above chance.

it was found that,

1. The average agreement the experts scored with each other was significantly better than was expected by chance in 31 cases.

2. The average agreement the system scored with the experts was significantly better than was expected by chance in 29 cases.

3. The experts significantly disagreed in the management of 1 case (case 2).

4. The system disagreed with the experts in the management of 2 cases (38 and 44).

Did each expert and the system manage each case similarly?

Unlike the previous test which considered average agreements, this test considered the agreement measures obtained by the experts and the system on an individual basis. If an expert had managed a case differently from the other experts, then they would have obtained lower measures of agreement. If the system did not embody expertise then it would be expected to obtained lower measures of agreement with the experts than the experts obtained with each other.

The Kruskal-Wallis analysis of variance test was used to establish if the agreements each reviewer obtained for a given case were similar to other reviewers. **This test is given in detail in chapter 6 (section 6.5.2).** For each reviewer, the number of cases (and reviews) in which the majority of other experts obtained significantly higher agreement was found and is represented in table 5.10. The level of significance for this test was $\alpha = 0.05$.

Reviewer	Number Cases	Number Reviews
A	6	7
B	16	22
C	6	7
D	3	3
E	1	1
F	5	6
G	2	2
H	9	13
I	1	1
J	11	11
K	2	2
L	3	3
M	7	9
N	4	4
O	4	4
P	5	6
Q	28	36
System	5	10

Table 5.10: The number of cases and reviews where each reviewer obtained significantly lower agreements than the majority.

It was found that;

1. The system obtained significantly lower agreement than the majority of experts in 5 cases of the 50.

2. Most experts obtained significantly lower agreement than the majority of reviewers in 5 cases or less.

3. Experts B, H, J and Q, obtained significantly lower agreements than the majority of reviewers most often.

4. Expert Q deserves special mention here because in over half the cases, he obtained significantly lower agreements than the majority.

This test identified those who have managed cases differently from the majority but by itself it does not separate the good performers from the poor performers. It may be that for some cases, those with lower agreements have managed the labours better than the rest.

The results obtained for the system are encouraging because in 45 out of 50 cases, the level of agreement that the system achieved with the experts was not significantly lower than the experts achieved with each other.

Overall, did each expert and the system agree well with the other experts and were they consistent?

Each reviewers average agreement with the other experts (inter-agreement) and consistency (intra-agreement) was calculated. These measures were used to determine whether each expert and the system was able to agree and be consistent in excess of that expected by chance.

The agreement the system obtained with the experts for each of its reviews, S1 and S2, was averaged over all 50 cases. Similarly for each expert review, the average agreement with the remaining experts was found. These are shown in table 5.11 in the column $\overline{O}_{inter}$. The average of all inter-expert agreements was obtained to give a single measure of the overall inter-expert agreement, $\overline{Ex}$ and the agreement that the two sets of plausible random numbers obtained with the experts was found. The average consistency of each reviewer and the plausible random numbers was taken as the agreement measured between their 2 reviews of each case, averaged over the 50 cases . This is shown in table 5.11 under the column $\overline{O}_{intra}$.

These results were then expressed as kappa values and used to test the null hypothesis that no expert, nor the system, obtained an average agreement significantly different from that expected by chance. Two alternative hypothesis were considered;

1. If a reviewer's average agreement reached significance and was less than chance then it was concluded that the reviewer had significantly disagreed with the other experts in the management of the 50 cases.

2. If a reviewer's average agreement reached significance and was greater than expected by chance then it concluded that the reviewer had significantly agreed with the management of the other experts in the 50 cases.

The total number of segments, n, the experts scored was 1129 and the level of significance was chosen to be, $\alpha = 0.01$. **The analysis of this test is given in chapter 6 (section 6.5.3).**

Reviewer	$\overline{O}_{inter}$	$\overline{O}_{intra}$
A1	69.61	76.42
A2	73.06	
B1	60.67	78.68
B2	65.18	
C1	71.94	80.00
C2	72.71	
D1	73.13	82.32
D2	73.61	
E1	73.76	82.10
E2	73.35	
F1	66.87	81.20
F2	70.92	
G1	73.40	77.28
G2	70.66	
H1	64.23	78.62
H2	69.76	
I1	73.85	89.04
I2	74.69	
J1	68.93	73.18
J2	72.32	
K1	73.60	81.00
K2	72.04	
L1	73.92	83.16
L2	73.37	
M1	66.02	84.18
M2	70.05	
N1	70.94	82.56
N2	71.48	
O1	69.32	78.44
O2	74.10	
P1	70.01	81.58
P2	72.60	
Q1	59.54	74.16
Q2	56.80	
S1	67.14	99.16
S2	67.51	
$\overline{Ex}$	70.19	80.23
$\overline{Ran}$	47.1	50.24

Table 5.11: Each reviewers average inter- and intra-agreement.

The analysis of these results found;

Inter-agreement results.

1. All experts and the system obtained an average agreement significantly better than expected by chance. For the most part (with the exception of Q1 and Q2) these results were highly significant ($p < 0.0000003$).

2. The system's average inter-agreement was within the range of the experts' agreement.

3. Expert Q obtained much the lowest inter-agreement. For his second review, this was only just significantly above that expected by chance.

4. The plausible random numbers significantly disagreed with the experts.

Intra-agreement.

5. The system and the experts obtained a consistency significantly better than could have been expected by chance. Again, these results were highly significant.

6 The system achieved almost perfect consistency (99.16%).

7 The average expert intra-agreement was 80.23% but of these, expert I stood out as being the most consistent (89.04%) and experts Q and J were the least consistent (74.16% and 73.18% respectively).

8 The intra-agreement of the plausible random numbers was not significantly different from that expected by chance (50.24%).

5.5.3 Analysis of decisions to obtain delivery by caesarean section.

There were 31 cases in which at least one expert or the system recommended immediate operative intervention by caesarean section (CS). It was important to examine these cases in detail to establish whether,

1. The system recommended CS when necessary.
2. The system recommended CS unnecessarily.
3. The timing of the system's recommendations was comparable with the experts.
4. The experts agreed (inter and intra) on the cases which should have CS delivery.
5. The experts agreed (inter and intra) on the timing of interventions.

Table 5.12 summarises the actions taken in the 31 cases where at least one reviewer recommended delivery by CS. Each main column heading may be interpreted as follows;

Expert assessment,

- The number of experts recommending delivery by CS in the specific case (max. = 17).
- The number of expert reviews recommending delivery by CS (max. = 34).
- The average segment number ($\overline{segment}$) in which the experts' decisions were taken.

System assessment,

- The operative intervention, if any, the system recommended.
- The segment number in which the system recommended an operative intervention.

Clinical outcome,

- The cord arterial blood gas analysis at birth which includes the pH and Base Deficit of the extra-cellular fluid (BDecf). The babies here with poorest outcomes are those with significant metabolic acidosis ($pH < 7.05$ and $BDecf \geq 12$). A detailed assessment of the cases related to outcome can be found in 5.5.6.

Case	Expert Assessment			System Assessment		Clinical Outcome	
	Number of Experts	Number of Reviews	$\overline{segment}$	Action	Segment	Cord artery pH	Cord artery BDecf
2	12	18	23.9	none	-	7.32	1
3	15	26	33.5	C/S	41	6.93	17
4	3	4	11.8	none	-	7.20	5
5	7	10	20.6	forceps	26	7.21	4
6	17	33	8.1	C/S	8	6.96	14
7	7	9	25.4	none	-	6.97	8
9	17	34	4.6	C/S	6	7.03	13
10	17	32	4.2	C/S	3	7.05	5
12	4	5	6.2	none	-	7.28	3
13	9	15	51.1	none	-	7.28	3
14	1	1	7	none	-	7.25	0
15	2	3	12.0	none	-	6.87	16
16	17	33	35.2	none	-	7.05	-
17	17	34	12.3	C/S	14	-	-
18	3	4	26.5	none	-	-	-
19	17	34	9.5	C/S	11	7.15	5
22	2	3	12.0	none	-	7.19	4
23	1	2	17.0	none	-	7.30	0
24	16	30	9.4	none	-	7.17	2
28	1	1	3.0	forceps	25	6.97	7
29	17	34	50.4	C/S	51	7.13	4
32	14	26	14.1	none	-	7.15	10
34	5	6	18.7	forceps	20	7.14	7
35	17	34	7.1	C/S	8	6.81	11
37	16	26	46.0	forceps	57	7.19	7
38	17	31	13.1	none	-	7.04	11
40	17	31	8.7	C/S	5	7.25	3
41	3	4	9.8	none	-	6.97	12
43	16	32	15.7	C/S	14	7.13	5
44	17	33	16.3	none	-	7.11	8
48	16	27	33.2	C/S	29	7.20	4

Table 5.12: Summary of cases recommended for caesarean section.

Assessment of each reviewer's recommendations for CS on a case by case basis.

The cases where each reviewer, in at least one of their reviews, recommended immediate delivery by CS were identified. A table for each reviewer was constructed which detailed the intra- and inter- agreement their decisions had received. These tables obtained for expert I, Q and the system are shown in tables, 5.13, 5.14 and 5.15 respectively. The tables for all reviewers are presented in appendix J.

A Guide to interpreting the tables. Consider the table compiled for expert I on the following page. The major headings are,

Case number. Lists all the case numbers where expert I recommended delivery by CS in at least one review.

Intra-agreement. Identifies,

1. The cases where expert I, recommended a CS in both reviews.
2. The relative timing in segments, δ_t, between the decisions in the two reviews.

For example, in case number 10, expert I, recommended a CS in both reviews and the relative timing between these recommendations was 2 segments (30 minutes).

Inter-agreements.

Overall agreements identifies,

1. The number of other experts who recommended a CS in the same case.
2. The number of expert reviews recommending a CS in the same case.

For example, in case 19, 13 other experts in 24 reviews also recommended a CS.

Timing of agreements.

1. This heading is split into two. The first half relates to the CS recommended in expert I's first review, I1, and the second half relates to the CS recommended in expert I's second review, I2. An empty set indicates that a CS was not recommended in that particular review. Each half considers the following;

(a) How many of the other experts' recommendations for CS fell within $\pm$ 1 segment of expert I's recommendation, how many were $\pm$ 2 segments away and how many were within $\pm$ 4 segments but were further than $\pm$ 2 segments.

(b) If the system too had recommended a CS in the given case, the time, δ_t System, gives the relative difference in timing between expert I's recommendation and the system's.

Case Number	INTRA - AGREEMENT		INTER - AGREEMENTS									
			OVERALL - AGREEMENTS		TIMING OF AGREEMENTS							
					Agreement with C/S specified in I1				Agreement with C/S specified in I2			
	Was a C/S specified in both reviews ?	δ_t Intra - agreement (segs)	Num. other experts recommending C/S max = 16	Num. reviews recommending C/S. Max = 32	Num. other reviews with C/S within (segs)			δ_t System (segs)	Num. other reviews with C/S within (segs)			δ_t System (segs)
					±1	±2	±4		±1	±2	±4	
3	YES	0	14	24	11	4	3	2	11	4	3	2
6	YES	0	16	31	31	0	0	0	31	0	0	0
9	YES	0	16	32	23	9	0	1	23	9	0	1
10	YES	2	16	30	19	3	7	0	15	10	5	2
16	YES	0	16	31	5	0	3	-	5	0	3	-
17	YES	1	16	32	14	5	8	2	17	0	5	1
19	YES	0	13	24	11	4	9	2	11	4	9	2
24	YES	0	15	28	17	5	3	-	17	5	3	-
29	YES	0	16	32	30	2	0	0	30	2	0	0
32	NO	-	13	25	-	-	-	-	8	8	8	-
35	YES	0	16	32	29	3	0	2	29	3	0	2
37	NO	-	15	25	3	15	0	-	-	-	-	-
38	YES	0	16	29	24	5	0	-	24	5	0	-
40	YES	1	16	29	6	6	17	2	7	9	13	3
43	YES	1	15	30	25	4	1	2	23	4	3	1
44	YES	2	16	31	14	12	4	-	14	8	7	-
48	YES	0	15	25	6	1	15	9	6	1	15	9

Table 5.13: Detailed assessment of the cases recommended for CS by expert I.

Case Number	INTRA - AGREEMENT		INTER - AGREEMENTS									
			OVERALL - AGREEMENTS		TIMING OF AGREEMENTS							
					Agreement with C/S specified in Q1				Agreement with C/S specified in Q2			
					Num. other reviews with C/S within (segs)				Num. other reviews with C/S within (segs)			
	Was a C/S specified in both reviews ?	δ_t Intra - agreement (segs)	Num. other experts recommending C/S max = 16	Num. reviews recommending C/S. Max = 32	±1	±2	±4	δ_t System (segs)	±1	±2	±4	δ_t System (segs)
2	YES	6	11	16	1	2	2	-	0	2	2	-
3	NO	-	14	25	1	1	0	36	-	-	-	-
5	YES	12	6	8	0	0	0	-	2	1	1	-
6	YES	0	16	31	31	0	0	0	31	0	0	0
9	YES	1	16	32	26	5	1	2	23	9	0	1
10	YES	3	16	30	19	4	6	0	10	7	13	3
12	NO	-	3	4	1	0	2	-	-	-	-	-
13	YES	3	8	13	0	0	3	-	1	0	0	-
14	NO	-	0	0	0	0	0	-	-	-	-	-
16	YES	1	16	31	1	1	0	-	1	1	0	-
17	YES	2	16	32	6	3	2	7	9	1	17	5
18	NO	-	2	3	0	0	2	-	-	-	-	-
23	YES	8	0	0	0	0	0	-	0	0	0	-
29	YES	1	16	32	30	2	0	1	30	2	0	0
35	YES	0	16	32	25	5	2	1	25	5	2	1
37	NO	-	15	25	-	-	-	-	4	1	0	-
38	NO	-	16	30	-	-	-	-	5	12	13	-
40	NO	-	16	30	-	-	-	-	7	4	10	1
44	NO	-	16	32	14	9	7	-	-	-	-	-
48	NO	-	15	26	-	-	-	-	15	1	8	5

Table 5.14: Detailed assessment of the cases recommended for CS by expert Q.

Case Number	INTRA - AGREEMENT		INTER - AGREEMENTS							
			OVERALL - AGREEMENTS		TIMING OF AGREEMENTS					
					Agreement for C/S of S1			Agreement for C/S of S2		
	Was a C/S specified in both reviews ?	δ_t Intra - agreement (segs)	Num. other experts recommending C/S max = 17	Num. reviews recommending C/S. Max = 34	Num. other reviews with C/S within (segs)			Num. other reviews with C/S within (segs)		
					±1	±2	±4	±1	±2	±4
3	YES	0	15	26	9	5	4	9	5	4
6	YES	0	17	33	33	0	0	33	0	0
9	YES	0	17	34	21	5	8	21	5	8
10	YES	0	17	32	20	4	7	20	4	7
17	YES	2	17	34	11	8	3	16	5	8
19	YES	0	14	26	10	6	9	10	6	9
29	YES	0	17	34	32	2	0	32	2	0
35	YES	1	17	34	11	16	7	27	5	2
40	YES	0	17	31	7	3	6	7	3	6
43	YES	0	16	32	18	7	6	18	7	6
48	YES	0	16	27	0	0	1	0	0	1

Table 5.15: Detailed assessment of the cases recommended for CS by the system.

Summary of the assessment of each reviewers recommendations for CS.

1. The system recommended a CS delivery in the same 11 cases in both reviews.

2. The median number of cases that the experts recommended for CS in the first review was 18. The minimum was 10 (expert M) and the maximum was 26 (expert B).

3. The median number of cases that the experts recommended for by CS in the second review was 17. The minimum was 12 (expert M) and the maximum number was 24 (experts B and H).

4. The median number of cases in which the experts were consistent in recommending CS in both their reviews was 15 and the modal value was 15. The range was between 9 and 24.

5. Overall, four experts recommended CS in the same number of cases in both their reviews; four recommended more cases in their second review; 9 recommended less cases in their second review.

6. The system recommended the second lowest number of CS.

Inter- and intra-agreement in decisions to deliver by CS.

Inter-agreement

If a reviewer recommended a CS in a given case, a measure of the agreement for this decision could be represented by the total number of other expert reviews that also recommended delivery by CS. This figure was obtained for each reviewer and then normalised by the total number of other expert reviews which could have recommended this decision. For the experts this total was 32, and for the system and plausible random numbers, the total was 34. This measure of agreement for a reviewer's decision to deliver by CS in a given case is expressed in equation 5.1.

$$CS\ agreement = \frac{Number\ of\ reviews\ recommending\ delivery\ by\ CS}{Total\ number\ of\ reviews} \times 100\% \qquad (5.1)$$

This figure was averaged over all the cases in which a given expert (or the system) recommended a CS. These figures are shown for each reviewer in table 5.16.

Intra-agreement.

An assessment of each reviewer's intra-agreement was made by comparing the total number of distinct cases where a CS was recommended in at least one review, with the number of cases where a CS was consistently recommended. This measure is represented in equation 5.2.

$$Intra-agreement = \frac{number\ cases where\ CS\ was\ consistently\ recommended}{total number\ of\ distinct\ cases where\ a\ CS\ was\ recommended} \times 100\% \quad (5.2)$$

These figures are also shown in table 5.16.

	INTRA -			INTER-
Reviewer	Total Number of distinct cases with decisions for CS	Number cases consistent between reviews	Intra-agreement (%)	Average inter-agreement (%)
A	21	15	71	76
B	27	23	85	63
C	20	15	75	81
D	20	18	90	82
E	22	18	82	77
F	19	16	84	82
G	19	12	63	83
H	25	24	96	67
I	17	15	88	90
J	21	16	76	78
K	19	15	79	85
L	19	17	89	84
M	13	9	69	95
N	17	15	88	87
O	20	16	80	79
P	18	15	83	90
Q	20	11	55	68
System	11	11	100	92
Random No.	19	1	5	32

Table 5.16: Intra- and inter agreement in decisions to deliver by CS.

Inter- and intra-agreement in the timing of decisions to deliver by CS.

It was also important to compare the relative timings of the decisions to deliver by CS to establish whether the system recognised fetal compromise at the same time as the experts. A comparison of the experts' decision times would help identify those who were consistent.

Inter agreement.

In each case where a given reviewer recommended delivery by CS, the total number of other expert reviews deciding the same action within ±1 segment, ±2 segments and ±4

segments of the given review's decision was found. This total was then normalised by dividing by the total number of reviews recommending CS in the given case. This measure is given by equation 5.3.

$$Inter\text{-}timing\ agreement = \frac{number\ of\ reviews\ recommending\ CS\ within\ the\ given\ time\ frame}{total\ number\ of\ reviews\ recommending\ CS} \times 100\% \quad (5.3)$$

An average value for each reviewer over all the cases where they recommended delivery by CS was found and is shown in table 5.17.

Interpretation of table 5.17.

Take reviewer C for example. In all the cases where she recommended delivery by CS, an average of 59% of all other expert reviews also recommending the same action, did so within ±1 segment (15 minutes) of her decision; 74% did so within ±2 segments; and 86% did so within ±4 segments (1 hour).

Expert	Average number of reviews recommending a CS within ± 1 seg (%)	Average number of reviews recommending a CS within ± 2 segs (%)	Average number of reviews recommending a CS within ± 4 segs (%)
A	52	69	86
B	42	61	78
C	59	74	86
D	49	67	84
E	51	67	84
F	55	66	80
G	58	71	85
H	37	52	74
I	58	74	90
J	56	68	84
K	55	72	84
L	61	74	87
M	51	66	82
N	53	67	84
O	53	66	81
P	55	70	83
Q	46	57	71
System	53	67	82
Random No.	13	23	38

Table 5.17: Inter-agreement in the timing of CS.

Intra-agreement

For each reviewer, the average time difference in segments, $\overline{\delta}_t$, was calculated between their CS decision points in the cases where they consistently recommended CS. The standard deviation, σ_t, in timings was also found. This data is represented in table 5.18.

Interpretation of table 5.18.

Consider expert D for example. Expert D consistently recommended delivery by CS in 18 cases. The average difference $\overline{\delta}_t$, between the timings in her two reviews was 2.8 segments and the standard deviation was 3.76 segments,

Expert	Number of cases	$\overline{\delta}_t$	σ_t
A	15	1.5	1.31
B	23	2.3	3.34
C	15	1.7	2.29
D	18	2.8	3.76
E	18	2.0	2.77
F	16	4.6	8.40
G	12	1.6	2.06
H	24	3.3	4.67
I	15	0.5	0.72
J	16	3.3	6.60
K	15	3.9	8.89
L	17	2.6	6.43
M	9	1.1	1.37
N	15	0.9	0.72
O	16	4.0	7.47
P	15	0.8	0.83
Q	11	3.3	3.62
System	11	0.3	0.62
Random No.	1	24	-

Table 5.18: Intra-agreement in the timing of CS.

Summary of results in cases where the decision to deliver by CS was taken.

The system.

1. The system consistently recommended delivery by CS in 11 cases. This was within the range of the experts, but was lower than all but 2 experts (M and Q).

2. On average, 92% of all expert reviews also recommended delivery by CS in these cases.

3. The majority of expert decisions were within 1 segment (15 minutes) of the system's decision and two thirds were within 2 segments (30 minutes). This was comparable with most experts.

4. The system was highly consistent in the timing of CS in its two reviews ($\bar{\delta}_t$ = 0.3 segments).

5. There were 7 cases where the majority of expert reviews recommended CS but the system recommended either no action or later delivery by forceps (cases 2, 16, 24, 32, 37, 38 and 44). It was considered important to establish whether the system's decisions here were reasonable. A discussion of these cases can be found in 5.5.8.

The experts.

6. For the cases recommended for CS by 14 of the 17 experts, > 75% of all other expert reviews also recommended the same action. Experts B, H and Q obtained less agreement than most (63%, 67% and 68%, respectively).

7. Expert H consistently recommended delivery by CS in 24 of 25 cases (96%) in both reviews and was the most consistent expert in this respect. Three experts were more inconsistent than most (A, G and Q). Of these, expert Q was consistent in only 11 out of 20 cases (55%).

8. Most experts agreed closely in the timing of CS. However, experts B, H and Q obtained lower agreement for the timing of their decisions.

9. From an examination of the cases where each expert consistently recommended CS in both their reviews, it was found that 11 experts obtained an average difference in timing between their reviews of less than ±3 segments. Of these, 7 were less than ±2 segments and remarkably, 3 experts (I, N and P) obtained an average timing difference of less than 1 segment.

The plausible random numbers.

10. As expected, the random numbers obtained little inter- or intra- agreement in either the cases recommended for CS or in the timing of decisions.

5.5.4 Fetal blood sampling rates.

For each review, the total number of patients recommended for an FBS and the total number of FBS requests made was found. This was used to examine whether,

1. The system had FBS rates comparable with experts.
2. All experts had similar FBS rates.
3. The experts were consistent in the cases they recommended for FBS.

This data is summarised in table 5.19.

Review 1		
Reviewer	Num. FBS	Num. Cases
A1	83	33
B1	82	37
C1	62	28
D1	71	34
E1	94	36
F1	47	26
G1	43	25
H1	74	36
I1	76	35
J1	81	42
K1	77	33
L1	86	37
M1	29	18
N1	57	28
O1	92	40
P1	34	20
Q1	0	0
System 1	35	18
Random 1	67	33

Review 2		
Reviewer	Num. FBS	Num. Cases
A2	60	29
B2	83	38
C2	77	34
D2	61	27
E2	77	30
F2	50	27
G2	41	25
H2	71	34
I2	82	37
J2	65	35
K2	69	29
L2	60	29
M2	47	23
N2	69	34
O2	88	38
P2	42	28
Q2	0	0
System 2	34	17
Random 2	68	32

Table 5.19: Fetal blood sampling rates for each reviewer.

The consistency of each reviewer's fetal blood sampling decisions was investigated. The total number of inconsistent cases a reviewer recommended for an FBS can be given by equation 5.4.

$$\text{number cases inconsistent} = (n_t - n_1) + (n_t - n_2) \qquad (5.4)$$

Where, n_t is the number of distinct cases in which a FBS was recommended in either review, n_1 is the number of cases recommended in the first review and n_2 is the number recommended in the second review. This figure can be interpreted as the number of cases recommended for FBS in the first review but not the second + the number of cases recommended for FBS in the second review but not the first. The results are shown in table 5.20.

Reviewer	n_1	n_2	n_t	Inconsistencies
A	33	29	33	4
B	37	38	40	5
C	28	34	37	12
D	34	27	34	7
E	36	30	37	8
F	26	27	31	9
G	25	25	29	8
H	36	34	38	6
I	35	37	40	8
J	42	35	44	11
K	33	29	34	6
L	37	29	38	10
M	18	23	25	9
N	28	34	36	10
O	40	38	43	6
P	20	28	30	12
Q	0	0	0	0
System	18	17	18	1
Random	33	32	41	17

Table 5.20: The consistency of each reviewer in requesting FBS.

Summary of results in cases where the decision to obtain FBS was taken.

The system.

1. The system recommended 35 FBSs in review 1 and 34 in review 2 from 18 and 17 patients respectively. Only one expert requested a fewer number of FBSs (expert Q).

2. The case in which the system was inconsistent is discussed in 5.5.8.

The experts.

3. Expert Q was significantly different from the other experts in deliberately not requesting a single FBS in either review.

4. There was a wide variation in the numbers of patients the experts considered required a FBS in any one review. Apart from expert Q, the lowest was 18 of the 50 patients (expert M1) and the highest was 40 (expert O1).

5. There was also a wide variation in the numbers of FBS the experts requested in any one review. Apart from expert Q, the minimum was 29 (expert M1) and the maximum was 94 (expert E2).

6. The experts were also relatively inconsistent between their two reviews in specifying the cases they considered required an FBS.

The plausible random number generator

7. As expected, the plausible random numbers were consistent in the numbers of FBS requested (67 and 68) in each review, but were inconsistent in specifying the cases to obtain the FBSs from.

5.5.5 Interventions in the second stage of labour.

It was decided to investigate the reviewers second stage interventions to establish whether;

1. The system's intervention rate was comparable with that of the experts.
2. The experts had similar intervention rates.
3. The experts and the system were consistent in the cases they recommended for intervention in the second stage of labour.

A similar analysis to that for FBS rates was undertaken. The total number of second stage interventions was found for each reviewer in each of their reviews. This data is shown in table 5.21.

Review 1	
Reviewer	Num. Interventions
A1	4
B1	10
C1	16
D1	15
E1	15
F1	8
G1	11
H1	14
I1	9
J1	13
K1	14
L1	18
M1	6
N1	16
O1	14
P1	7
Q1	12
System 1	10
Random 1	4

Review 2	
Reviewer	Num. Interventions
A2	7
B2	14
C2	20
D2	13
E2	12
F2	12
G2	10
H2	14
I2	17
J2	13
K2	12
L2	16
M2	13
N2	18
O2	18
P2	9
Q2	12
System 2	10
Random 2	6

Table 5.21: Interventions in the second stage of labour.

A measure of the inconsistencies for a given reviewer was obtained in a similar way to that for the FBS results, using equation 5.5.

$$\text{number cases inconsistent} = (n_t - n_1) + (n_t - n_2) \qquad (5.5)$$

Where here, n_t is the total number of distinct cases where second stage intervention was recommended, n_1 is total recommended in review 1 and n_2 is the total in review 2. This data is presented in table 5.22 for each reviewer.

Reviewer	n_1	n_2	n_t	Inconsistencies
A	4	7	11	11
B	10	14	15	6
C	16	20	21	6
D	15	13	15	2
E	15	12	15	3
F	8	12	13	6
G	11	10	13	5
H	14	14	15	2
I	9	17	17	8
J	13	13	17	8
K	14	12	15	4
L	18	16	20	6
M	6	13	14	9
N	16	18	19	4
O	14	18	18	4
P	7	9	12	8
Q	12	12	15	6
System	10	10	10	0
Random	4	6	10	10

Table 5.22: The inconsistencies of each reviewer second stage interventions.

Summary of second stage interventions.

The system.

1. The system consistently recommended 10 cases for intervention during the second stage of labour. This was well within the range of the experts.

The experts.

2. Experts, D and H were the most consistent experts with 2 inconsistencies between the recommendations of their first and second reviews.

3. Expert A was the most inconsistent. In no case did he recommend intervention in the second stage in both reviews.

The plausible random number generator

4. As expected, the plausible random numbers requested a similar number of interventions in each review (4 and 6) but was entirely inconsistent in the cases it recommended.

5.5.6 Intervention in cases with poor perinatal outcome.

The cases discussed here are those where there was evidence to suggest a degree of fetal compromise at delivery. An investigation of these cases will determine whether;

1. The system managed these cases appropriately.
2. The experts managed these cases appropriately.
3. The system and experts performed similarly.

The point was made in chapter 1 (section 1.3.2) that there is no precise measure of outcome. At present, perinatal outcome is assessed using a combination of 3 variables;

- Apgar scores; a subjective score from 0 to 10 where 0 indicates no vital life signs, calculated by clinical staff at 1, 5 and sometimes 10 minutes after delivery.
- Cord blood gas analysis; the pH and base deficit in the extracellular fluid (BDecf) of a sample of blood taken from the cord artery immediately after birth.

Three graded categories of poor outcome will be considered beginning with the most serious.

1. **Birth asphyxia.**
   The most severe category for which there is substantial evidence of fetal compromise. This group was characterised by cord arterial pH < 7.05 and BDecf ≥ 12 and Apgar score at 5 minutes ≤ 7. There were 3 cases in the study and intervention in these cases can be considered necessary.

2. **Severe metabolic acidosis.**
   These cases had a severe metabolic acidosis but had an acceptable 5 minute Apgar score. This group was characterised by cord arterial pH < 7.05 and BDecf ≥ 12 and Apgar score at 5 minutes > 7 (4 cases).

3. **Acidosis.**
   These cases have acidosis but without a significant metabolic component. They are characterised by cord pH < 7.05 but BDecf < 12 (5 cases).

These cases are summarised in table 5.23 and are identified by their case number. The actions taken by the 17 experts are described for each review separately. The system managed these cases consistently and its recommended actions are described.

	Case number	Review 1			Review 2			System's recommendation
		No. of experts recommending			No. of experts recommending			
		CS	Forceps	No Action	CS	Forceps	No Action	
Birth asphyxia	9	17	0	0	17	0	0	C/S
	15	2	1	14	1	1	15	No Action
	25	0	17	0	0	15	2	Forceps
Severe metabolic acidosis	3	14	3	0	12	5	0	C/S
	6	17	0	0	16	0	1	C/S
	30	0	13	4	0	15	2	No Action
	41	3	9	5	1	13	3	No Action
Acidosis	7	7	0	10	2	3	12	No Action
	26	0	10	7	0	11	6	No Action
	28	1	14	2	0	16	1	Forceps
	35	17	0	0	17	0	0	C/S
	38	15	0	2	16	0	1	No Action

Table 5.23: Summary of the experts' and system's actions in cases with poor outcome.

The experts' and the system's management was considered for each group separately and is presented in tables 5.24, 5.25 and 5.26.

Experts	Number of cases where intervention was recommended (max 3)	
	Review 1	Review 2
A	2	1
B	3	3
C	2	2
D	2	2
E	2	2
F	2	2
G	2	2
H	3	3
I	2	2
J	2	2
K	2	1
L	3	2
M	2	2
N	2	2
O	2	2
P	2	2
Q	2	2
System	2	2
Clinical	1	

Table 5.24: Operative intervention in the cases with birth asphyxia (3 cases).

Experts	Number of cases where intervention was recommended (max 4)	
	Review 1	Review 2
A	3	4
B	3	4
C	4	4
D	4	4
E	4	4
F	2	4
G	4	4
H	4	4
I	3	4
J	3	4
K	4	3
L	4	4
M	3	3
N	4	3
O	4	4
P	3	2
Q	3	3
System	2	2
Clinical	2	

Table 5.25: Operative intervention in cases with significant metabolic acidosis (4 cases).

Experts	Number of cases where intervention was recommended (max 5)	
	Review 1	Review 2
A	1	2
B	3	3
C	4	5
D	5	4
E	5	4
F	4	4
G	5	4
H	5	4
I	3	4
J	5	3
K	3	2
L	5	5
M	2	4
N	4	4
O	5	5
P	3	4
Q	2	4
System	2	2
Clinical	2	

Table 5.26: Operative intervention in the cases with acidosis (5 cases).

Summary of results in cases with poor perinatal outcome.

The system.

1. The system recommended necessary operative intervention in the same number of cases with birth asphyxia as the majority of experts (2 out of 3).

2. The system consistently recommended operative delivery in one case of birth asphyxia which received no intervention in clinical practice.

3. The system was within the range of the experts' operative interventions in the significant metabolic acidosis and acidosis groups.

4. The system recommended no action in 2 cases (cases 41 and 30), which resulted in significant metabolic acidosis, whereas the majority of experts consistently recommended intervention during the second stage of labour.

5. The system did not recommend operative intervention in 2 cases which resulted in acidosis (cases 26 and 38). The majority of experts recommended operative intervention in case 38 by CS and intervention during the second stage in case 26.

6. Both the system and the majority of experts did not recommend intervention in case 15 which resulted in birth asphyxia.

The cases where the system recommended no action are discussed in 5.5.8.

The experts.

1. 2 experts (B and H) consistently recommended operative intervention in all cases with birth asphyxia.

2. In one of their reviews, 2 experts (A and K) failed to detect 2 of the 3 cases of birth asphyxia.

3. Expert H obtained a remarkable performance by recommending operative intervention in all 12 cases which resulted in poor outcome in her first review, and all but one case (with simple acidosis) in her second.

5.5.7 Intervention in cases with good clinical outcome.

There were 11 cases which obtained good outcome (cord artery pH > 7.20) after a normal vaginal delivery. Operative intervention in these cases was unnecessary. These cases were investigated to establish whether either the system or the experts recommended unnecessary operative intervention. Table 5.27 summarises these cases and indicates for each case, the experts' and the system's recommended actions.

Outcome	Case Number	Review 1 No. of experts recommending			Review 2 No. of experts recommending			System Recommendation
		C/S	Forceps	No Action	C/S	Forceps	No Action	
Good	12	3	2	12	2	9	6	No action
	14	1	6	10	0	5	12	No action
	21	2	1	14	1	1	15	No action
	22	0	0	17	0	0	17	No action
	31	0	0	17	0	0	17	No action
	33	0	2	15	0	0	17	No action
	39	0	0	17	0	1	16	No action
	46	0	3	14	0	1	16	No action
	47	0	0	17	0	0	17	No action
	49	0	0	17	0	0	17	No action
	50	0	1	16	0	1	16	No action

Table 5.27: Intervention in cases with good clinical outcome.

The level of each reviewers operative intervention in these cases is shown in table 5.28.

Expert	No. of cases where operative intervention was recommended			
	Review 1		Review 2	
	C/S	Forceps	C/S	Forceps
A	0	0	0	1
B	2	1	1	2
C	0	1	0	3
D	0	1	0	1
E	0	1	1	0
F	1	0	0	1
G	0	1	0	1
H	1	0	1	2
I	0	0	0	1
J	0	3	0	1
K	0	1	0	1
L	0	2	0	1
M	0	0	0	0
N	0	0	0	1
O	0	1	0	1
P	0	0	0	0
Q	2	0	0	1
System	0	0	0	0

Table 5.28: Each reviewers unnecessary operative intervention.

Summary of results in cases with good perinatal outcome.

The system.

1. The system recommended no unnecessary intervention in cases with good outcome.

The experts.

1. Experts M and P consistently recommended no operative intervention in cases with good outcome.

2. Experts, H and Q each recommended 2 unnecessary CSs. Expert H also recommended 2 unnecessary second stage interventions and expert Q recommended 1 unnecessary second stage intervention.

3. Expert B recommended 3 unnecessary CS deliveries and 3 unnecessary interventions during the second stage.

5.5.8 Case discussion.

Four tests have identified that the management recommended by the system was different (not necessarily worse) to the majority of experts in 14 cases. In addition, the system, along with the majority of experts, did not identify a case which resulted in birth asphyxia (case 15). These cases are discussed in detail here and are summarised in table 5.29 along with the identifying tests. **A general discussion of the system's and experts' performance is presented in chapter 7.**

1. Analysis of the levels of agreement obtained compared to the experts.
2. Cases recommended for caesarean section (CS).
3. Cases with poor clinical perinatal outcome, split into three groups (birth asphyxia, metabolic acidosis and acidosis).
4. Fetal blood sampling rates (FBS).

	Identified Cases														
Test	2	8	11	15	16	17	24	26	30	32	37	38	41	44	48
ANOVA		•	•									•		•	•
CS	•				•		•			•	•	•		•	
Birth asphyxia				•											
Metabolic acidosis									•				•		
Acidosis								•				•			
FBS						•									

Table 5.29: Cases identified for discussion.

The 15 identified cases were investigated to determine whether the systems management was in any way inappropriate.

Cases with poor outcome.

Case 15 - Birth asphyxia.

The system consistently did not recommend intervention in this case which resulted in birth asphyxia. However, nor did 14 of the experts. The mother involved made excellent progress through labour; her cervix dilated from 3cm to 10 cm (fully) in approximately 4 hours. No fetal blood samples were obtained during the labour but from an interpretation of the CTG and knowing the outcome, two experienced clinicians considered that this baby started to become compromised during the second stage of labour. When second stage began, the arterial pH was adjudged to be approximately 7.20. After a second stage lasting 45 minutes, the baby was delivered with birth asphyxia. This is an extremely unusual case which has been reviewed during a meeting of international physiologists and various study groups. The heart rate changes were very subtle. The fact that only two experts consistently recommended intervention shows that it would have been difficult to prevent a poor outcome in this case. This baby did however recover satisfactorily.

Cases 26 30, 38 and 41.

None of these cases had operative intervention clinically. In cases 30 and 38 there occurred a gross baseline change from a slight tachycardia (> 160 bpm) to a bradycardia between 95 and 100 bpm which prompted the experts to recommend immediate intervention. The system identified these heart rate changes but was not seriously concerned (score 2) as the rule for action under these circumstance requires the baseline to fall below 90 bpm. In cases 26 and 41, a severe bradycardia occurred (baseline < 90) in the second stage of labour for which the system considered recommending immediate emergency delivery (score 4). This was the point where the experts recommended their interventions. Delivery occurred in these cases, very soon after the heart rate changes.

It can be noted from these cases which obtained a poor outcome clinically that the system;

1. Did not react as quickly during the second stage of labour as the experts; the system does not make a distinction between the first and second stage in terms of the time it allows abnormalities to persist before recommending intervention.

2. The system did not interpret a rapid baseline fall from slight tachycardia to slight bradycardia as a severely abnormal event. The experts did and identifies a gap in the system's knowledge.

Cases where the majority of reviews recommended delivery by CS but the system recommended either no action or a later delivery by forceps.

Case 2.

There was significant expert disagreement in the management of this case. This was due to the considerable variation in the recommended timing of CS. The average timing was in the 23rd segment, the first was in segment 2 (expert H in both reviews) and the final recommendation was in segment 44. Five FBS were obtained clinically throughout the labour but none were less than 7.24 after which this baby was delivered by CS. The reasons given clinically were a falling fetal scalp pH combined with poor progress in labour. The outcome at birth was entirely normal with cord artery pH of 7.32, BDecf of 1 and 1 minute Apgar score 9. The system also requested 5 FBS but because the pH never fell below the normal range it did not recommend operative intervention.

The lady in this case made poor progress through labour which, coupled with an abnormal CTG, was enough to lead the experts to deliver by CS. The system's recommendations seem reasonable because there was no evidence of fetal compromise.

Case 16

There was a high variation in the recommended timing of CS by the experts. The averaged timing was in the 35th segment with the first recommended in the 16th segment and the last in the 47th. The system identified the CTG as abnormal and recommended 5 FBS. However, as each result was normal the system acknowledged that the CTG was abnormal but as the pH was normal and stable it decided to recommend no further FBS nor intervention. The period between the last recommended FBS and the end of recording was 4 hours 15 minutes which could be considered as too long under these circumstances. Clinically, a normal FBS result of 7.25 was obtained 1 hour before delivery by CS. The decision to deliver by CS was taken because of the fetal scalp pH and poor progress in labour. The cord artery pH was 7.05 and BDecf was 7 which is close to the definition of acidosis (pH < 7.05). The Apgars were 7 and 9 at 1 and 5 minutes.

Case 24

There was good expert agreement for delivery by CS in this case. 16 experts in 30 reviews (max 17 experts and 34 reviews) recommended a CS in the 9th segment of a CTG 10 segments long. The system was considering operative delivery (score 4) by CS on the 9th and 10th segment. Clinically, the decision was taken to deliver by CS because the CTG was abnormal early in labour with the cervix just 4cm dilated. The cord artery pH was 7.17 with a BDecf of 2 and Apgars 6 and 9. The system's interpretation was similar to the experts and if this CTG had continued in a similar fashion, the system would have recommended CS.

Case 32

There was good agreement amongst the experts in this case with 14 experts in 26 reviews recommending delivery by CS on average in the 14th segment. However, 3 experts did not recommend CS in either of their reviews and a further 2 experts recommended a CS in one review. The system had identified a deterioration in the trace reaching a protocol score of 2 for the final two segments (16 and 17) but did not recommend intervention. Clinically the baby was delivered by CS with cord artery pH of 7.15, BDecf of 10 and Apgars 6 and 9 at 1 and 5 minutes. The decision was taken because of a low scalp pH early in labour (cervix 4cm).

Case 37

Most experts recommended CS and did so in two distinct timings which coincide with two episodes of bradycardia from which the fetus made a good recovery both times. The first period of bradycardia occurred in segments 35 and 36 which caused 6 experts in 7 reviews to recommend CS. The second episode occurred in segments 50 and 51 and led to the remaining experts who recommended a CS to do so. The system recognised both events as very abnormal and reached a protocol score of 4 on both occasions which indicated that it was considering delivery. But as the trace recovered to satisfactory, no further action was recommended. One and a half hours after this second event the trace again deteriorated albeit to a less serious extent than previously. Because of the previous episodes, the system recommended immediate delivery, which because the cervix was fully dilated was by forceps. This was also the view in 5 expert reviews. Clinically too, a forceps delivery took place. The cord arterial pH was 7.19 and BDecf was 7 and Apgars were 8 and 9 at 1 and 5 minutes. With such an outcome, it could reasonably be argued that the system managed this case more effectively than the majority of experts who recommended CS.

Case 44

All experts recommended intervention in this case close to the end of the recording when in clinical practice a CS took place. The system had been registering slight concerns but these were not sufficient to recommend intervention. The system's recommendations were different from the experts but it is difficult to say which were more appropriate as the clinical outcome was not poor (cord artery pH of 7.11)

ANOVA analysis by ranks.

Apart from cases 38 and 44 previously discussed, the ANOVA test identified 3 further cases where the system had significantly lower agreement than the experts.

Case 8.

The median agreement the system scored with the experts was 65%. There were only minor differences between the system's management and the experts'. Most experts requested an

FBS around segments 7, 8 and 9 whereas the system recommended no intervention. In the final segment, where clinically a forceps delivery was performed, the system was considering immediate delivery (score 4). Most of the experts also did not recommend intervention. The clinical outcome was good and so the system's management was appropriate.

Case 11.

The median agreement with the experts was 65%. The system recommended a FBS in segment 2 but no expert did. However, several did so later. The system considered immediate delivery (score 4) in the final segment and several of the experts recommended intervention. The baby was actually delivered normally with a satisfactory outcome and the system's management was appropriate.

Case 48.

The median agreement with the experts was 50%. A severe bradycardia occurred in this case in segments 6 and 7. The system responded by considering immediate delivery (score 4) as did most experts. Two expert reviews recommended immediate CS. In segments 25 - 28 the CTG again became abnormal. The system recommended a CS in segment 29 because of the deteriorating CTG and the fact that a severe bradycardia had previously occurred. Most experts recommended delivery by CS some 1 hour after the system.

FBS test

Case 17.

The system was inconsistent in its management of this case. In segment 13, most experts recommended a CS. At this time, the system recognised the abnormal CTG and asked whether this baby was considered high risk. The operator in the first review replied No to which the system recommended a FBS followed immediately by CS. The operator in the second review replied Yes and the system recommended immediate CS without requesting a FBS. This inconsistency came from the fact that some time before, the CTG showed abnormal heart rate changes. The obstetrician considered these significant and so considered the baby to be at high risk whereas the engineer did not. The difference between the system's decisions to deliver by CS was 2 segments and both decision points were within the range of the experts.

Chapter 5 summary.

Chapter 5 described the evaluation and validation of an intelligent system to assist in the management of labour.

The formulated expert knowledge was implemented in an expert system and then evaluated in a study which compared the management of the system with the collaborating expert in a retrospective review of 31 labours. This study found that the system compared favourably with the expert; compared to clinical practice, both would have reduced fetal blood sampling (50%) and unnecessary operative intervention. In addition, both recommended earlier intervention in the same 4 cases which may have improved outcome. This study demonstrated that expert knowledge could be formulated for this difficult task. This work was presented at an international conference and published in full in the refereed conference proceedings (Ifeachor et al, 1990).

The automatic feature extraction methods were combined with the expert system. An evaluation of the full system was undertaken to compare the recommendations of the system with 3 experienced obstetricians from Plymouth. This study found that the system obtained good agreement with the clinicians; every action recommended by the system was also recommended by at least one other clinician. This study concluded that not only could the system agree with the collaborating expert, but in these cases, it could also agree with the management of 2 other clinicians not previously involved in the development of the system. This work has formed the basis of a journal paper which has been accepted for publication (Keith et al, 1993).

The possible limitation of a single centre developing this type of system in isolation was recognised. 17 experienced clinicians from 16 leading centres in fetal monitoring within the UK, took part in the validation of the system. The CTGs and associated clinical data of 50 cases with a range of outcomes were selected from a database of 2400 high risk labours. These 50 cases contained those considered to be most difficult to interpret. Each case was reviewed by the experts twice, one month apart to establish their consistency. Each CTG was contained in an opaque box and revealed in 15 minute segments. The relevant obstetric history was made known before each case was reviewed and any relevant events during the labour were made known at the appropriate time. Each reviewer scored every 15 minute segment according to a protocol to reflect the concern they had for the fetus. The task for each expert was to manage each labour with minimal intervention without jeopardising the safety of the fetus. The system reviewed the cases twice with 2 different operators working independently; one obstetrician and one engineer. A method was devised to measure the agreement in terms of labour management between any two sequences of scores recorded for a case. This derivation is presented in chapter 6. Kappa statistics which measure

agreement in excess of that expected by chance, together with the Kruskal-Wallis one way analysis of variance by ranks were used to analyse the agreements.

It was found that;

The experts.

1. All experts obtained an agreement with each other significantly better than could have been expected by chance. The average inter-agreement was 70%.
2. All experts were consistent significantly in excess of that which could have been expected by chance. The average intra-agreement was 80%.
3. There was significant ($\alpha = 0.1$) inter-expert disagreement in just 1 case (case 2).
4. In the cases recommended for CS by 14 experts, at least 24 of the other 32 expert reviews also recommended delivery by CS.
5. In the 31 cases where at least one expert recommended a CS, the majority of other experts who also recommended delivery by CS did so within $\pm$ 1 segment (15 minutes) and two thirds did so within $\pm$ 2 segments.
6. The majority of experts recommended operative intervention in 10 out of the 12 cases with acidosis (pH < 7.05) at delivery.
7. The majority of experts did not recommend operative intervention in cases which obtained a normal delivery with good outcome, except in 1 case in the second review where 9 out of 17 experts recommended intervention in the second stage.

The system.

1. The system agreed with the experts well and significantly in excess of chance (67%, $\alpha = 0.01$, $p < 0.0000003$).
2. In 45 cases, the level of agreement the system achieved with the experts was not significantly lower than the experts achieved with each other.
3. The actions recommended by the system were highly consistent (99%, $\alpha = 0.01$), even when used by someone with no labour ward experience.
4. The system recommended delivery by CS in 11 cases. On average more than 31 of the 34 expert reviews also recommended CS delivery in these cases. The majority of these experts did so within $\pm$ 1 segment (15 minutes) of the system's recommendation and two thirds did so within $\pm$ 2 segments (30 minutes).
5. The system identified as many of the birth asphyxiated cases as the majority of experts and 1 more than was acted upon clinically.
6. The system recommended no unnecessary intervention in the cases with good outcome (spontaneous vaginal delivery and pH > 7.20) which was better than all but two of the experts.

The findings from the validation study were both positive and conclusive. The experts were able to agree and be consistent in the management of labour and the system was able to obtain a performance which made it indistinguishable from the experts.

Chapter 5 references.

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Chapter 6

Derivation of a measure of agreement and the application of statistical hypothesis tests.

6.1 Introduction.

This chapter presents the mathematical derivation of the measure used to assess the agreement between the sets of scores recorded during the validation study (chapter 5, section 5.4). In addition, the application of statistical tests which consider various hypotheses regarding the significance of the measured agreements is presented. The results involving this measure have been previously summarised in chapter 5 (section 5.5.2) but are reported in detail here.

6.2 Derivation of a measure to assess agreement in labour management.

The scores that each reviewer recorded for a given case represents how they would have managed the labour. The scores obtained for case 1 are shown in chapter 5, table 5.6 and the complete set of scores for the 50 cases are given in appendix H.

A single measure was required to indicate the agreement between any two given reviewers recommendations. Put formally, a measure of the agreement between 2 time dependent, discrete sequences, A(t) and B(t), was required such that when they were identical they scored a maximum agreement of 1.0 and when there was no similarity, they scored 0. If the length of each sequence was N then A(t) and B(t) can be represented by equation 6.1.

$$\begin{aligned} A(t) &= [a(1), a(2), a(3), \ldots\ldots a(N)] \\ B(t) &= [b(1), b(2), b(3), \ldots\ldots b(N)] \end{aligned} \qquad (6.1)$$

A measure of the agreement between A(t) and B(t), termed the cross agreement coefficient, Cac(A,B), would simply be given by equation 6.2.

$$Cac(A,B) = \sum_{t=1}^{N} g(t) \qquad where\ g(t) = \begin{cases} 1, when\ a(t) = b(t) \\ 0, otherwise \end{cases} \qquad (6.2)$$

If the values a(t) and b(t) were in the range, 1 to s *say,* then this same measure of agreement could be obtained by representing the relationship between a(t) and b(t) in an agreement matrix, M(A,B), such that,

M(A,B) =

a(t) \ b(t)	1	2	3	.	.	s
1	1	0	0	0	0	0
2	0	1	0	0	0	0
3	0	0	1	0	0	0
.	0	0	0	1	0	0
.	0	0	0	0	1	0
s	0	0	0	0	0	1

Here, the cross agreement coefficient would be given by the sum of the individual mappings of a(t) and b(t) represented by equation 6.3.

$$Cac(A,B) = \sum_{t=1}^{N} M_{a(t),b(t)} \qquad t = 1, 2, 3, \ldots N. \tag{6.3}$$

However, this expression is dependent not only on the similarities between A(t) and B(t), but also on the sequence length, N. A measure independent of the sequence length could be obtained if the cross agreement coefficient were normalised to the maximum agreement score possible. This is given when A(t) = B(t) and would equal the total number of scores, N. This maximum agreement could also be obtained using the agreement matrix with the substitution A(t) = B(t).

M(A,A) =

a(t) \ a(t)	1	2	3	.	.	s
1	1	0	0	0	0	0
2	0	1	0	0	0	0
3	0	0	1	0	0	0
.	0	0	0	1	0	0
.	0	0	0	0	1	0
s	0	0	0	0	0	1

This maximum agreement measure will be termed the auto agreement coefficient, Aac(), and for A(t), this is given by equation 6.4.

$$Aac(A) = Cac(A,A) = \sum_{t=1}^{N} M_{a(t),a(t)} \tag{6.4}$$

For the method developed so far, Cac(A,B) = Cac(B,A) and Aac(A) = Aac(B), and the normalised agreement between A(t) and B(t) is given by equation 6.5.

$$Agreement\,(A,B) = \frac{Cac(A,B)}{Aac(A)} = \frac{\sum_{t=1}^{N} M_{a(t),b(t)}}{\sum_{t=1}^{N} M_{a(t),a(t)}} \tag{6.5}$$

Now consider the situation where the lengths of A(t) and B(t) are allowed to differ. Here, Aac(A) ≠ Aac(B). A combined measure of the auto agreement would be given by, Aac(A) + Aac(B) but for the situation where the sequences were identical, the combined auto agreement would be a factor of 2 greater than the cross-agreement and would consequently limit the measure to a maximum of 0.5. This could be overcome by equation 6.6.

$$Agreement\,(A,B) = \frac{2.\,Cac(A,B)}{Aac(A)+Aac(B)} = \frac{2\sum_{t=1}^{N} M_{a(t),b(t)}}{\sum_{t=1}^{N} M_{a(t),a(t)} + \sum_{t=1}^{P} M_{b(t),b(t)}} \qquad (6.6)$$

Where, N is the length of sequence A(t) and P is the length of sequence B(t).

Equation 6.6 is now valid whilst Cac(A,B) = Cac(B,A). A more general form of the equation which does not depend on this could be obtained if the combined cross agreement coefficient were represented by Cac(A,B) + Cac(B,A). Substituting this gives equation 6.7.

$$Agreement\,(A,B) = \frac{Cac(A,B) + Cac(B,A)}{Aac(A)+Aac(B)} = \frac{\sum_{t=1}^{N} M_{a(t),b(t)} + \sum_{t=1}^{P} M_{b(t),a(t)}}{\sum_{t=1}^{N} M_{a(t),a(t)} + \sum_{t=1}^{P} M_{b(t),b(t)}} \qquad (6.7)$$

6.2.1 Derivation of a weighted agreement matrix.

In the development of the agreement measure so far, a relationship between a(t) and b(t) was assumed which gave rise to the identity agreement matrix. But this relationship may not be appropriate for all applications. Consider, for example the scores obtained in the validation study. The protocol was restricted to allow the experts to record a score in the range 1 to 5 for each 15 minute segment which gives the following identity matrix,

M(A,B) =

a(t) \ b(t)	1	2	3	4	5
1	1	0	0	0	0
2	0	1	0	0	0
3	0	0	1	0	0
4	0	0	0	1	0
5	0	0	0	0	1

It was found that each expert scored an average of 2129 segments. But as expected, these scores were not evenly distributed; in fact, on average the experts attached a score of 1 or 2

(which translates to not intervening in the labour) to 87.3% of the segments reviewed. If the identity matrix were used, the agreement measure would be biased in favour of the experts because they scored the large majority of segments just two of five values. In addition, the identity matrix assumes that an agreement between two experts scoring 5 (emergency CS) is as significant as when they both score a 1 (non-intervention), when clearly the implications are profoundly different. Therefore, this matrix does not adequately represent the specific case of labour management.

An appropriate matrix could be derived according to some consensus obtained with clinicians but such an approach would justifiably be open for criticism because it is entirely subjective. An alternative, more objective approach must be found.

Digital signal processing approach.

Correlation is a very important technique used in signal processing to measure the similarities between two signals. Here, the correlation between two sequences with zero lag, is given by the sum of the products of the corresponding pairs of points.

$$r_{AB} = \sum_{t=1}^{N} a_t . b_t$$

This process can be represented in the agreement matrix as,

M(A,B) =

a(t) \ b(t)	1	2	3	4	5
1	1	2	3	4	5
2	2	4	6	8	10
3	3	6	9	12	15
4	4	8	16	20	24
5	5	10	15	20	25

However, this matrix is also unsuitable for our specific application. For example, the agreement given when a(t) = 1 and b(t) = 5 (and vice versa) is 5. This combination of scores represents the widest clinical difference, but with this matrix, they would represent a greater agreement than when the scores were identical and both equal to 1 or 2.

Cost benefit analysis approach.

A different approach would be to consider the cost implications of certain actions. The financial costs involved in managing labour have been calculated (Clark, 1991); to record the CTG costs £21.00 and to obtain a FBS costs a further £22.00. To intervene with

forceps could cost up to £773.00 and by CS, £1560.00. However the implications for the patient (mother and fetus) are also important but would be more difficult to quantify.

A probabilistic approach.

The problem with the identity matrix is that it rewards equally an agreement for scores of 1 which is bound to occur often, as it does for scores of 5 which occur rarely. To expand, the protocol instructed that a case review be terminated when a score permitting delivery was reached (5 and under certain circumstances 3). Consequently, the maximum number of 5's an expert could have recorded in their 2 reviews of 50 cases was 100. On the other hand, an expert could have recorded a score of 1 for every possible segment which would amount to a maximum total of 2376. Clearly, a score of 5 is far more significant than a score of '1' and implies the agreement matrix should be biased towards the less common scores. Table 6.1 shows the combined frequency distribution of the experts' recorded scores.

Score	1	2	3	4	5	Total
Frequency	15749	15864	2562	1427	607	36,209
Probability	0.43496	0.43812	0.07076	0.03941	0.01676	1
Significance	2	2	14	25	60	

Table 6.1: Combined frequency distribution of the experts scores.

These frequencies show the bias of the scoring towards the lower scores. This bias could be equalised if the significance of each score were found. The probabilities of the different scores, a(t), are given by equation 6.8 and shown in table 6.1.

$$p\{a(t)\} = \frac{frequency\,of\,score(a)}{Total\,number\,of\,scores} = \frac{\sum a}{N} \qquad (6.8)$$

The significance of each score was taken as the approximate inverse of the probability and results in the following agreement matrix,

M(A,B) =

a(t) \ b(t)	1	2	3	4	5
1	2	0	0	0	0
2	0	2	0	0	0
3	0	0	14	0	0
4	0	0	0	25	0
5	0	0	0	0	60

These figures were discussed with clinicians and they agreed that this agreement matrix represented a fair reflection of the clinical implications of each protocol score.

6.2.2 Measuring partial agreement.

The partial agreement between different scores.

The matrix derived so far only attributes an agreement to those segments scored identically. However, the difference between two different scores given for the same segment may not represent complete agreement, but it may not represent complete disagreement either. This is currently the case and indicated by the zero values given to the off-diagonal mappings. For certain combinations of scores it may be appropriate to attribute a value greater than zero to indicate a partial agreement. These values would of course be subjective, but they should be reasonable to reflect the true partial agreement that exists. Two conditions were imposed before the partial agreements were derived.

1. Given the scores, a(t) and b(t), recorded for segment, t; if $a(t) \neq b(t)$ then the partial agreement should be less than when $a(t) = b(t)$.

2. The agreement matrix should be symmetrical about the agreement diagonal, $M\{a(t) = b(t)\}$ such that the partial agreement, $M_{a(t)b(t)} = M_{b(t)a(t)}$.

With these conditions in place, consider the partial agreements, where $a(t) \neq b(t)$ for reviewers A and B.

Partial agreements involving a score of 1.

- The agreement given to $a(t) = 1$ and $b(t) = 2$ should be high. If reviewer A scored a labour throughout, 1, and B scored it throughout, 2, then clinically, the labours were managed similarly as no interventions were recommended. Condition 1 requires a partial agreement should be < 2, so let it be 1.5.
- No other partial agreement involving a score of 1 seems appropriate as these (3, 4, and 5) involve intervention or a high level of concern.

These assignments are represented in the following agreement matrix,

M(A,B) =

a(t) \ b(t)	1	2	3	4	5
1	2	1.5	0	0	0
2	1.5	2			
3	0		14		
4	0			25	
5	0				60

Partial agreements involving a score of 2.

- A partial agreement with a(t) = 2 and b(t) = 3 is appropriate as both recognise some concern. But this should be less than when a(t) = 1 and b(t) = 2, as the clinical difference is greater. If the partial agreement should be < 1.5, let it be 1.
- No other partial agreement involving a score of 2 seems valid as these (4 and 5) involve very high levels of concern.

M(A,B) =

a(t) \ b(t)	1	2	3	4	5
1	2	1.5	0	0	0
2	1.5	2	1	0	0
3	0	1	14		
4	0	0		25	
5	0	0			60

Partial agreement involving a score of 3.

- A measure of agreement for a(t) = 3 and b(t) = 4 is reasonable as both indicate significant levels of concern. This must be less than 14, so let it be 10.
- There is also some agreement in a(t) = 3 and b(t) = 5 as both represent intervention. However, these scores represent the difference between an intervention to obtain further information and immediate emergency delivery. As such, the partial agreement should be relatively low and less than the partial agreement given for a(t) = 3 and b(t) = 4. Let this partial agreement be 5.

M(A,B) =

a(t) \ b(t)	1	2	3	4	5
1	2	1.5	0	0	0
2	1.5	2	1	0	0
3	0	1	14	10	5
4	0	0	10	25	
5	0	0	5		60

Partial agreement involving a score of 4.

- A measure of agreement for, a(t) = 4 and b(t) = 5 is reasonable as both scores relate to emergency delivery. This should be less than 25, so let this agreement be 20.

M(A,B) =

a(t) \ b(t)	1	2	3	4	5
1	2	1.5	0	0	0
2	1.5	2	1	0	0
3	0	1	14	10	5
4	0	0	10	25	20
5	0	0	5	20	60

Partial agreement in the timing of decisions.

The agreement matrix permits a partial agreement between two different scores given for the same segment. In certain situations, for a given segment score a(t), there may also exist a partial agreement in the adjacent sores b(t-1), b(t+1), b(t-2), b(t+2), etc. To illustrate the point consider example 6.1 which examines hypothetical scores which could have been obtained in the study.

Example 6.1.

	Segment					
	1	2	3	4	5	6
A(t)	2	2	2	3	5	
B(t)	1	2	2	2	3	5

Using equation 6.7,

$$Agreement\ (A,B) = \frac{Cac(A,B) + Cac(B,A)}{Aac(A) + Aac(B)} = \frac{\sum_{t=1}^{N} M_{a(t),b(t)} + \sum_{t=1}^{P} M_{b(t),a(t)}}{\sum_{t=1}^{N} M_{a(t),a(t)} + \sum_{t=1}^{P} M_{b(t),b(t)}}$$

with the statistically weighted matrix gives,

Aac(A) = 2+2+2+14+60 = 80
Aac(B) = 2+2+2+2+14+60 = 82
Cac(A,B) = 1.5+2+2+1+5+0 = 11.5
Cac(B,A) = 1.5+2+2+1+5+0 = 11.5

and substituting gives,

$$agreement(A,B) = \frac{11.5+11.5}{80+82} = 0.142\ or\ 14.2\%$$

This low agreement measure does not reasonably reflect the closeness of the clinical actions. Expert A and expert B have both been concerned for the fetus which promoted them to recommend a FBS immediately followed by a CS. The experts did not recommend these actions at the same time, but they did recommend them just 1 segment (15 minutes) apart. If either expert's recommendations had been adopted clinically, the patient would have been managed very similarly indeed which is not reflected with an agreement of 14.2%.

Example 6.1 makes the case that a partial agreement should be allowed between a(t) and b(t-1), b(t+1) etc. (and vice versa). A measure which allowed partial temporal agreement between 2 sequences, A(t) and B(t) at time t would be obtained by equation 6.9.

$$\max\{w(0)M_{a(t)b(t)}, w(1)M_{a(t)b(t+1)}, w(1)M_{a(t)b(t-1)}, \ldots\ldots, w(+\mathrm{T})M_{a(t)b(t+\mathrm{T})}, w(-\mathrm{T})M_{a(t)b(t-\mathrm{T})}\} \qquad (6.9)$$

which can be written concisely as equation 6.10.

$$\max_{\tau=0}^{\tau=\mathrm{T}}\{W(t-\tau).M_{a(t)b(t-\tau)}\} \qquad \text{for } \tau = 0, \pm1, \pm2, \pm3, \ldots. \pm\mathrm{T} \qquad (6.10)$$

Equation 6.10, effectively allows individual scores to shift by τ sample points in either direction to find the position of maximum agreement. A weighting function, W(t-τ), was incorporated to reduce the partial temporal agreement as the relative time between similar scores increases. It was decided that no partial agreement should be given for scores $\geq$ 1 hour apart ($\pm$ 4 segments). The choice of weighting function is clearly arbitrary but a cosine function was considered most appropriate. This function is given by equation 6.11.

$$W(t-\tau) = \cos\frac{\pi\tau}{8} \qquad \text{for } \tau = 0, \pm1, \pm2, \pm3 \qquad (6.11)$$

and is illustrated in figure 6.4.

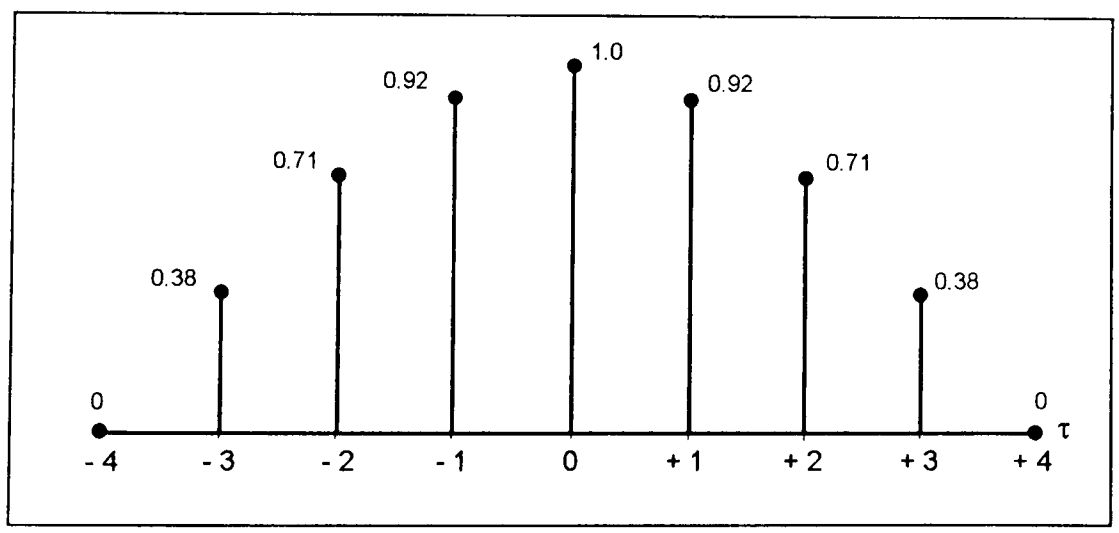

Figure 6.4: The window function used for temporal partial agreement.

The suitability of this window was discussed with clinicians and considered reasonable as it gives a high temporal partial agreement for $\tau = \pm1$, and rolls off at a desirable rate to 0.

Substituting this into equation 6.3 obtains the cross agreement function between A(t) and B(t) as equation 6.12.

$$Cac(A,B) = \max_{\tau=-3}^{\tau=+3}\{W(t-\tau).\sum_{t=1}^{N} M_{a(t),b(t-\tau)}\} \tag{6.12}$$

Substituting this into equation 6.7 obtains the agreement equation 6.13.

$$Agreement(A,B) = \frac{\max_{\tau=-3}^{\tau=+3}\{w(t-\tau).\sum_{t=1}^{N} M_{a(t),b(t-\tau)}\} + \max_{\tau=-3}^{\tau=+3}\{w(t-\tau).\sum_{t=1}^{P} M_{b(t),a(t-\tau)}\}}{\sum_{t=1}^{N} M_{a(t),a(t)} + \sum_{t=1}^{P} M_{b(t),b(t)}} \tag{6.13}$$

This equation retains the desirable properties of equation 6.7; It has a maximum value of 1.0 for identical sequences which will always be the case so long as the maximum weighting in the weighting function, W(t - τ), is 1.0.

Example 6.2.

Consider the operation of equation 6.13 for the same sequences considered in example 6.1.

	Segment					
	1	2	3	4	5	6
A(t)	2	2	2	3	5	
B(t)	1	2	2	2	3	5

The calculation of the auto agreement coefficients remain unchanged,

Aac(A) = 2 + 2 + 2 + 14 + 60 = 80

Aac(B) = 2 + 2 + 2 + 2 + 14 + 60 = 82

The cross agreement coefficient Cac(B,A) is given by,

Cac(A,B) = max{1.0*1.5, 0.92*2, 0.71*2, 0.38*2} +
max{1.0*2, 0.92*1.5, 0.92*2, ...} +
max{1.0*2, 0.92*2, 0.92*1, 0.71*1.5, 0.71*1, ...} +
max{1.0*1, 0.92*1, 0.92*14, 0.71*2, 0.71*5} +
max{1.0*5, 0.92*0, 0.92*60, ...}

Cac(A,B) = 0.92*2 + 1.0*2 + 1.0*2 + 0.92*14 + 0.92*60

Cac(A,B) = 73.92

Similarly,

Cac(B,A) = 0.92*1.5 + 1.0*2 + 1.0*2 + 0.92*2 + 0.92*14 + 0.92*60

Cac(B,A) = 75.42

and,

$$Agreement\{A(t),B(t)\} = \frac{Cac(A,B)+Cac(B,A)}{Aac(A)+Aac(B)} = \frac{73.92+75.42}{80+82} = 0.922 = 92.2\%$$

This measure of 92.2% reflects a more appropriate measure of agreement than was previously achieved (14.2%).

6.2.3 Summary of a measure to assess agreement in labour management.

A measure of the agreement between two sequences A(t) and B(t), normalised to the maximum agreement was derived. This measure considered the weighted and partial agreements between A(t) and B(t) according to an agreement matrix, $M_{A,B}$ and allowed partial temporal agreement for close temporal scoring using a window function W(t-τ). This measure of agreement is given by,

$$Agreement(A,B) = \frac{\max_{\tau=0}^{\tau=\pm T}\{w(\tau).\sum_{t=1}^{N} M_{a(t),b(t+\tau)}\} + \max_{\tau=0}^{\tau=\pm T}\{w(\tau).\sum_{t=1}^{P} M_{b(t),a(t+\tau)}\}}{\sum_{t=1}^{N} M_{a(t),a(t)} + \sum_{t=1}^{P} M_{b(t),b(t)}}$$

Where $M_{A(t),B(t)}$ was derived for the application of labour management and is given by,

M(A,B) = a(t) \ b(t)

a(t) \ b(t)	1	2	3	4	5
1	2	1.5	0	0	0
2	1.5	2	1	0	0
3	0	1	14	10	5
4	0	0	10	25	20
5	0	0	5	20	60

and where a cosine weighting function to measure temporal partial agreements was proposed.

$$W(\tau) = \cos\frac{\pi\tau}{8}$$

for τ = 0, ±1, ±2, ±3

6.3 Derivation of the statistical distribution of agreement.

A method has been proposed to measure the agreement between any 2 given experts (or the system) for the management of labour. It could be that the proposed method is overly generous or perhaps even harsh which may bias the measured agreement towards high or low values. The question put another way is, what is the significance of a measured agreement? is a value of 80%, good? is a measure of 20% bad? Is the measure so biased that high agreement is inevitable?

These questions were addressed by considering the statistical parameters which described the distribution of the agreement measure. These parameters were,

1. The measure of agreement that could be expected by chance, E[X] or μ.
2. The variation of the expected random chance agreements, Var[X] or σ^2.

With these parameters it would be possible to statistically test the significance of the measured agreements to investigate whether the experts and the system have performed worse than, no different from, or better than could have been expected by chance.

6.3.1 Derivation of the expected chance agreement.

To calculate the chance expected agreement at time t, it is necessary to assume that the length of sequences are infinite such that;

1. Edge effects are negligible. Edge effects occur at the beginning and end of the sequences because a partial agreement is given for the range of the weighting function, t-3 to t+3. When t = 0, 1 or 2 the number of adjacent scores which can be considered for a partial temporal agreement is reduced as scores before t = 0 do not exist. Similarly for the end of the sequence.

2. The validation protocol allowed the experts to conclude their review if they reached a score of 5 (caesarean section) or 3 in the second stage of labour (possible forceps delivery). For the derivation of the expected value it is assumed that sequences do not terminate when these conditions are met.

The *expected value* of a random variable, X, is the mean of the probability distribution and is written E[X] or μ. This is defined for a given probability distribution,

X	x(1)	x(2)	x(3)	.....	x(n)
Probability	p(1)	p(2)	p(3)	.....	p(n)

as,

$$\mu = E[X] = \sum_{i=1}^{n} p(i).x(i)$$

The expected value in the measurement of agreement is given by equation 6.14.

$$E[A,B] = \frac{E[Cac(A,B)] + E[Cac(B,A)]}{E[Aac(A)] + E[Aac(B)]} \qquad (6.14)$$

With a symmetrical matrix and two sequences of equal length then, E[Cac(A,B)] = E[Cac(B,A)] and E[Aac(A)] = E[Aac(B)], this can be rewritten as equation 6.15.

$$E[A,B] = \frac{E[Cac(A,B)]}{E[Aac(A)]} \qquad (6.15)$$

where, $E[Cac(A,B)] = E[Cac(B,A)] = E[\max_{\tau=0}^{\tau=\pm T}\{w(\tau).\sum_{t=1}^{P} M_{b(t),a(t+\tau)}\}]$

and, $E[Aac(A,B)] = E[Aac(B,A)] = E[\sum_{t=1}^{P} M_{a(t),a(t)}]$

and where the mapping matrix M(A,B) and weighting function W(t-τ) are,

M(A,B) =

a(t) \ b(t)	1	2	3	4	5
1	2	1.5	0	0	0
2	1.5	2	1	0	0
3	0	1	14	10	5
4	0	0	10	25	20
5	0	0	5	20	60

$$W(t-\tau) = \cos\frac{\pi\tau}{8}$$

for τ = 0, ±1, ±2, ±3 which gives, w(0) = 1.000, w(1) = 0.924, w(t) = 0.707 and w(3) = 0.383

Calculation of the expected chance agreement, E[Cac(B,A)].

It has been established that the experts recorded their scores with the overall probability distribution (to 3 d.p.);

Score (n)	1	2	3	4	5
Probability p(n)	0.435	0.438	0.071	0.039	0.017

Strategy.

Let A(t) and B(t) at time t, be represented by,

A(t)	a(t-3)	a(t-2)	a(t-1)	a(t)	a(t+1)	a(t+2)	a(t+3)
B(t)	b(t-3)	b(t-2)	b(t-1)	b(t)	b(t+1)	b(t+2)	b(t+3)

and the agreement measure given by,

$$max\{w(t)M_{b(t)a(t)}, w(t-1)M_{b(t)a(t+1)}, w(t+1)M_{b(t)a(t-1)}, w(t-2)M_{b(t)a(t-2)},$$
$$w(t+2)M_{b(t)a(t+2)}, w(t-3)M_{b(t)a(t-3)}, w(t+3)M_{b(t)a(t+3)}\}$$

Where a(t) and b(t) are scores, 1, 2, ... 5, and w(t±τ) are the cosine window coefficients. The maximum agreement is always when b(t) = a(t). However, when b(t) ≠ a(t) the adjacent scores may provide a higher weighted agreement. The following algorithm was proposed to derive the chance expected agreement.

Step 1. assume a particular score for b(t).

Step 2. for each b(t), consider the possible scores for a(t).

Step 3. for each a(t), examine the possible adjacent scores which could achieve a higher agreement than, w0.M{b(t), a(t)}.

repeat for each possible score of b(t)

Step 1. Assume b(t) = 1.

The probability that b(t) = 1 is p(1). If this event happens then the ways of achieving agreement with A(t) are shown in table 6.2,

A(t)	Agreement	Rank (r)
a(t) = 1	w(0).M(1,1) = 2	1
a(t) = 2	w(0).M(1,2) = 1.5	3
a(t±1) = 1	w(1).M(1,1) = 1.84	2
a(t±1) = 2	w(1).M(1,2) = 1.38	5
a(t±2) = 1	w(2).M(1,1) = 1.42	4
a(t±2) = 2	w(2).M(1,2) = 1.065	6
a(t±3) = 1	w(3).M(1,1) = 0.76	7
a(t±3) = 2	w(3).M(1,2) = 0.57	8
a(t±τ) = 3, 4, or 5	w(τ).0 = 0	9

Table 6.2: The possible agreements with A(t) when b(t) = 1.

These agreements were first ranked from the highest agreement measure (rank, r(1)) to the lowest, with ties given the same ranking.

Step 2. Consider each possible value of a(t),

2.1 Consider when a(t) = 1.

This has ranking = 1 and if it occurs will always be the maximum agreement. As such, the adjacent segments are not considered. The probability that this event will occur by chance is p(b(t) = 1) * p(a(t) = 1). Thus, the expected chance agreement of this event is given by,

$$E[1,1,r(1)] = w(0).M(1,1).p(1).p(1)$$

2. 2 Consider when a(t) = 2.

Here r(1), (a(t) = 1) cannot occur as it is assumed that a(t) = 2. From table 6.2 this event achieves an agreement ranked r(3) meaning it will be the maximum agreement so long as rank r(2) does not occur (a(t±1) ≠ 1). The probability that rank r(2) will not occur is prob{a(t±1) ≠ 1} = $(1 - p(1))^2$. The expected chance agreement of this event is,

$$E[1,2,r(3)] = w(0).M(1,2).p(1).p(2).p(\overline{rank\ r(2)})$$
$$E[1,2,r(3)] = w(0).M(1,2).p(1).p(2).(1-p(1))^2$$

Step 3. Consider higher agreements with adjacent scores.

3.1 a(t) = 2, rank r(2)

When a(t) = 2, rank r(2) is always the maximum agreement. This occurs when either a(t+1) = 1 or a(t-1) = 1 which has the probability {1 - $(1 - p(1))^2$}. The expected chance agreement is given by,

$$E[1,2,r(2)] = w(1).M(1,1).p(1).p(2).(1-(1-p(1))^2)$$

Aside.

To illustrate the derivation of $\{1 - (1 - p(x))^2\}$ consider a 6 sided dice, thrown three times. An analogous event is the probability of rolling a '6' on either the first, t(1), or third, t(3), throw which can be written p{t(1) = '6' or t(3) = '6'}. This event can equally be expressed as 1 - {the probability of not throwing a '6' on the first throw AND not throwing a '6' on the third throw}, which can be written,

$$\{1 - (p(t(1) \neq \text{'6' and } t(3) \neq \text{'6'}))\}$$
$$= \{1 - (1 - p(\text{'6'})) * (1 - p(\text{'6'}))\}$$
$$= \{1 - (1 - p(\text{'6'}))^2\}$$

or for the general case this is written $\{1 - (1 - p(x))^2\}$

It should be noted that this probability is ***not*** *$p('6') + p('6') = 2.p('6')$.*

2.3 Consider when a(t) = 3.

This event achieves 0 agreement and is ranked r(9). If this event occurs, then $a(t) \neq 1$ and $a(t) \neq 2$, thus ranks r(1) and r(3) cannot occur. There are 6 other events where the scores adjacent to a(t) would be > r(9). These are, r(2), r(4), r(5), r(6), r(7) and r(8).

3.1 a(t) = 3, rank r(2).

If a(t) = 3, then rank r(2) is the maximum agreement possible and occurs when either, a(t+1) = 1 or a(t-1) = 1, which has the probability $\{1 - (1 - p(1))^2\}$. The expected chance agreement is given by,

$$E[1,3,r(2)] = w(1).M(1,1).p(1).p(3).(1-(1-p(1))^2)$$

3.2 a(t) = 3, rank r(4).

This event will be the maximum if rank r(2) does not occur. The expected chance agreement is,

$$E[1,3,r(4)] = w(2).M(1,1).p(1).p(3).(1-(1-p(1))^2).p(\overline{rank\ r(2)})$$
$$E[1,3,r(4)] = w(2).M(1,1).p(1).p(3).(1-(1-p(1))^2).(1-p(1))^2$$

3.3 a(t) = 3, rank r(5).

This event will be the maximum if ranks r(2) and r(4) do not occur. The expected chance agreement is,

$$E[1,3,r(5)] = w(1).M(1,2).p(1).p(3).(1-(1-p(2))^2).p(\overline{rank\ r(2)}).p(\overline{rank\ r(4)})$$
$$E[1,3,r(4)] = w(2).M(1,1).p(1).p(3).(1-(1-p(1))^2).(1-p(1))^2.(1-p(1))^2$$

The algorithm then continues ....

Step 3 considers the expected agreements for ranks r(6), r(7) and r(8).

Then, Step 2 is continued by considering when a(t) = 4 and a(t) = 5. **Step 3** is carried out for each score.

Then, back to **step 1** which next assumes b(t) = 2 and so on.

This derivation was too lengthy to obtain by hand and so the algorithm was implemented in software and is given in appendix I. This algorithm gives the total expected chance agreement of b(t) with a(t-3) .... a(t+3), when b(t) = 1, as,

$$E[Cac(1,A)] = E[1,1\ r(1)] + E[1,2\ r(2)] + E[1,2\ r(3)] + E[1,3\ r(2)] + E[1,3\ r(4)] + E[1,3\ r(5)] + E[1,3\ r(6)] + E[1,3\ r(7)] + E[1,3\ r(8)] + \ldots\ldots + E[1,5\ r(8)]$$

$$\underline{E[Cac(1,A)] = 0.802745}$$

and the total expected chance agreement of Cac(B,A) as,

$$E[Cac(B,A)] = E[Cac(1,A)] + E[Cac(2,A)] + E[Cac(3,A)] + E[Cac(4,A)] + E[Cac(5,A)]$$

$$E[Cac(B,A)] = 0.802745 + 0.809399 + 0.419290 + 0.309097 + 0.152503$$

$$\underline{E[Cac(B,A)] = 2.493}$$

The expected chance auto-agreement coefficient Aac(A) = Aac(B) is,

$$Aac(B) = Aac(A) = \sum_{a(t)=1} M\{a(t),a(t)\}.p(a(t))$$

$$\underline{Aac(A) = Aac(B) = 4.728}$$

Which gives the normalised chance expected agreement as,

$$E[A,B] = \frac{Cac(A,B)}{Aac(A)} = \frac{2.493}{4.728}$$

$$\underline{E[A,B] = 0.527 = 52.7\%}$$

This derived figure was checked by measuring the chance agreement between 2 random sequences, using a random number generator with a probability distribution of scores (1,2, .. 5) equal to the experts. Each sequence was of length, N = 1000, and 30,000 pairs were generated for which the agreements were measured. The random number generator had a periodicity of 2^{32}. The chance agreement expressed as a percentage was plotted against the frequency distribution normalised to f_{max} and is shown in figure 6.1. The recorded frequencies outside this range were all zero.

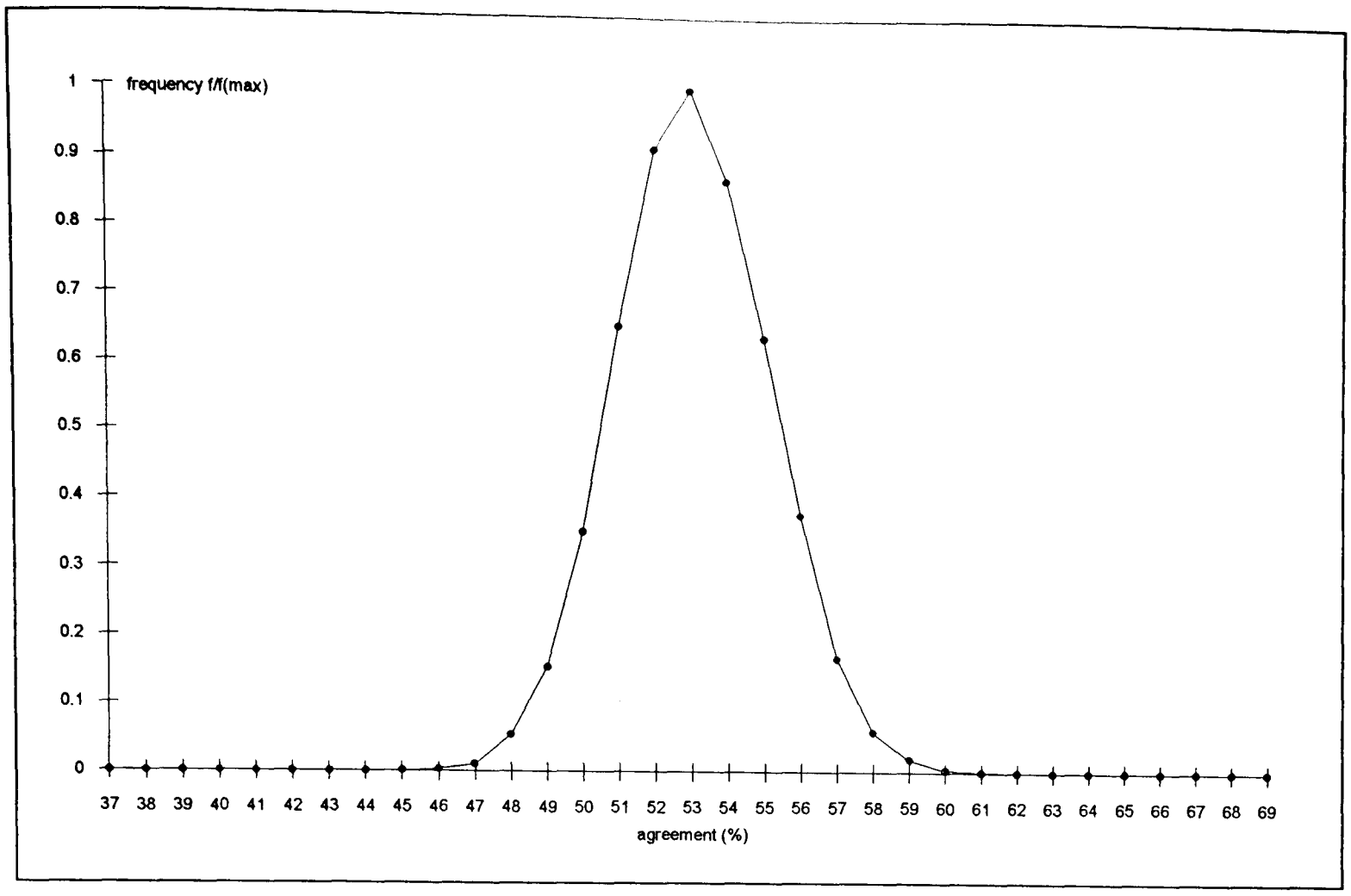

Figure 6.1: The distribution of random agreements.

This distribution is approximately normally distributed with mean 53.0%.

This confirms the approach for the derivation of the expected agreement, μ, but it will be recalled that the derivation relied on two simplifications, which briefly restated are; edge effects were negligible and sequences never terminated prematurely. The validity of these simplifications were investigated by considering the agreement which could be obtained from plausible random numbers.

Two sets of plausible random numbers which obeyed the study protocol were generated for each of the 50 cases and are shown on the score tables in appendix H as R1 and R2. The distribution of generated scores were confirmed to have the same probability distribution as the experts scores. The average agreement over the 50 cases was calculated to be 50.9% which is 3.4% lower than that derived with simplifications. This confirms that the simplifications do not overly effect the derived measure.

6.3.2 Derivation of the expected variance, σ^2 .

The variance of a probability distribution is given by,

$$\text{variance} = \sum p(i).(x-\mu)^2$$

The variance Var(X) has the symbol σ^2 and is the expected value of the square of the deviation from the mean, $E[X - \mu]^2$. This can be simplified, $\sigma^2 = E[X^2] - \mu^2$
The expected value, μ, has been derived. The value of $E[X^2]$ was derived with a similar strategy to that used for E[X]. Where now,

$$E[(A,B)^2] = \frac{E[Cac(A,B)^2]}{E[Aac(A)^2]}$$

The algorithm in appendix I was modified to obtain this value which was found to be,

$$E[(A,B)^2] = 0.502 \; or \; 50.2\%$$

This gives,

$$\sigma^2 = 0.502 - 0.527^2$$
$$\underline{\underline{\sigma^2 = 0.224}}$$

6.4 Statistical tests to investigate agreement.

It was proposed to examine the nature of the agreement results obtained by the experts and the system using two statistical tests.

1. **The kappa coefficient of inter-rater agreement.**
   This measure compares inter-rater agreements and examines the significance of measured agreement in excess of that which could have been expected by chance.

2. **The Kruskal-Wallis one-way analysis of variance by ranks.**
   This non-parametric statistic examines the characteristics of more than 2 distributions to establish whether any differences in the distributions represent genuine population differences or whether the variations are those to be expected from random samples of similar populations.

6.4.1 The kappa coefficient measure of inter-rater agreement.

The kappa statistic was first proposed by Cohen (1960) and has been adapted to allow partial scoring agreements (Cohen, 1968). Much work in this area has been done by Landis and Koch (1977) and an informative text is given by Fleiss (1981). The kappa statistic is given by equation 6.16.

$$kappa = \frac{o - e}{1 - e} \tag{6.16}$$

Where, o, is the observed or measured agreement and, e, is the level of agreement the raters could have achieved by chance. The numerator, o - e, is therefore the observed agreement in excess of that which could have been expected by chance and the denominator, 1 - e, is the maximum agreement the raters could have achieved in excess of random chance. The kappa statistic has desirable features; it reaches a maximum of 1.0 for perfect agreements, scores 0 when the agreement is equal to that expected by chance, and is less that 0, when the agreement is less than that expected by chance. The exact lower limit depends on the given application, but if the measured agreement takes the range 0 to 1, where 0 indicates no agreement, then the minimum value of kappa is -e / (1 - e) which is -1 when e = 0.5. It has been possible to derive the expected value, $E[o] = \mu_o = e$, for the agreement measures and so the proposed form of the kappa equation becomes equation 6.17.

$$kappa = \frac{o - \mu_o}{1 - \mu_o} \tag{6.17}$$

In has been suggested (Donker, 1991; Fleiss, 1981) that ranges have been characterised from which kappa values can be interpreted; it was stated that kappa values "larger than 0.75 may be interpreted to represent excellent agreement beyond that which could be achieved by chance alone, values below 0.40 may be interpreted to represent poor agreement beyond chance, and values between 0.40 and 0.75 may be interpreted to represent fair to good agreement beyond chance." This classification was suggested by both authors to reflect the original ranges proposed by Landis and Koch (1977). In fact this is misleading. The original classification of kappa made Landis and Koch was,

Kappa statistic	**Strength of Agreement**
< 0.00	Poor
0.00 - 0.20	Slight
0.21 - 0.40	Fair
0.41 - 0.60	Moderate
0.61 - 0.80	Substantial
0.81 - 1.00	Almost perfect

There are clearly differences between these interpretations, particularly in the low kappa scores. This possibly indicates the dangers of adopting linguistic variables to describe data.

In fact, Landis and Koch did not intended for their classification to be taken as universal, as implied by Donker (1991). In their original article the authors state that, "these divisions are clearly arbitrary", and were intended to, "provide useful benchmarks" for the discussion of a specific example presented in their paper. This example considered 2 sets of data, where the

number of samples was, n = 149 and 69. It may be that the proposed benchmarks were applicable for their example but it does not seem reasonable that benchmarks could be considered as universal indicators. The significance of any statistic, kappa included, will depend on the population distribution from which it was sampled and most importantly, the number of classifications or scores considered. For example, an average kappa of 0.8 measured for n = 3 does not in any way carry the same significance as a kappa of 0.8 when n = 1000. The preferred approach would be to test the significance of a measure using conventional statistical sampling theory. This approach will now be developed formally.

In simple random sampling, if X(1), X(2) ... X(n) are n random samples observed from a population distribution whose mean is, μ, and variance is, σ^2, then X(1), X(2) ... X(n), are independent random variables, each of which has the same distribution as the parent population. If $\overline{X}$ is the mean of such a sample of size n, then it can be shown that,

$$E[\overline{X}] = \mu$$

$$Var[\overline{X}] = \frac{\sigma^2}{n}$$

The standard deviation of the sampling distribution of means is called the standard error of the mean and is given by,

$$\textit{standard error of the mean, s.e.} = \frac{\sigma}{\sqrt{n}}$$

The mean, μ_O, and variance, σ_o^2, of the chance agreements have been found and may be used to derive, the mean μ_K, and variance, σ_k^2 of the distribution of kappa. These kappa parameters could then be used to test various hypotheses regarding a measured mean kappa agreement, $\overline{k}$, in the usual way by referring the quantity,

$$Z = \frac{\overline{K} - \mu_k}{\sigma_k/\sqrt{n}} = \frac{\overline{K}}{s.e.(\overline{k})} \qquad (as\ \mu_k = 0) \qquad (6.18)$$

to the standard Normal tables. Where, n, is the number of segments and s.e.($\overline{k}$) is the standard error of the means of kappa.

Derivation of the expected kappa value, μ_k and expected variance, σ_k^2.

In order to calculate the mean, μ_k, and variance, σ_k^2 we must consider the transformation of μ_O and σ_o^2 represented in equation 6.17 as,

$$k = \frac{o - \mu_o}{1 - \mu_o}$$

In statistical expectation, the general linear transformation of a random variable X, by the constants, a and b is given by.

$$E[bX + a] = bE[X] + a = b\mu + a \qquad (6.19a)$$

$$Var[bX + a] = b^2 Var[X] = b^2\sigma^2 \qquad (6.19b)$$

Kappa is given by, $k = \frac{o - \mu_o}{1 - \mu_o}$

For the mean, μ_k,

$$\mu_k = E[K] = \tfrac{1}{1-\mu_o} E[o - \mu_o]$$

$$= \tfrac{1}{1-\mu_o} \cdot \{E[o] - \mu_o\}$$

$\mu_k = E[K] = 0$ (since E[o] = μ_o)

For the variance, σ_k^2

$$\sigma_k^2 = Var[K] = Var\left[\frac{o - \mu_o}{1 - \mu_o}\right] = Var\left[\frac{o}{1 - \mu_o} - \frac{\mu_o}{1 - \mu_o}\right]$$

which is in the form var[bX + a] and using (6.19b) gives,

$$\sigma_k^2 = Var[K] = \frac{\sigma_o^2}{(1 - \mu_o)^2}$$

and substituting for σ_o^2 and μ_o gives,

$$\sigma_k^2 = \frac{0.224}{(1 - 0.527)^2} = 0.998$$

6.4.2 The Kruskal-Wallis one-way analysis of variance by ranks.

The Kruskal-Wallis one-way analysis of variance by ranks is a test for deciding whether c independent samples are from different populations (Kruskal, 1952; Kruskal and Wallis, 1952). This is a popular statistical test and has been described in general texts (Lehmann, 1975; Hettmansperger, 1984). This test determines whether the variations between random samples are no more than one would expect from samples obtained from the same population, or whether the variations are large enough to signify that the samples are in fact from different populations. If θ_j is the median of the jth sample, then this statistic tests the null hypothesis that the sample medians are all equal $\theta_1 = \theta_2 = .. = \theta_c$ against the alternative hypothesis that at least two medians are different $\theta_i \neq \theta_j$ for some samples i and j. The samples are first cast into a table where each column represents each sample.

Group				
1	2	•	•	c
X(1,1)	X(1,2)	•	•	X(1,c)
X(2,1)	X(2,2)	•	•	X(2,c)
•	•	•	•	•
X(n(1),1)	•			X(n(c),c)
	X(n(2),2)			

Where X_{ij} is the datum for the ith observation in the jth group and, n(j), is the number of observations in the jth group.

The next step is to replace each of the N observations, N = n(1) + n(2) + ... + n(c), with their overall ranking. That is, all of the observations from the c samples are ranked as a single series. The smallest score is replace by rank 1, the next by rank 2 and the largest by rank N. The sum of the ranks is then found for each column from which the column average can be found. This test makes use of the fact that if the samples were drawn from identical populations, the average rank of each column should be similar, whereas, if the samples were drawn from different distributions, with different medians, then the average ranks would differ. The Kruskal-Wallis statistic (KW) is computed using equation 6.20.

$$KW = \frac{12}{N(N+1)} \sum_{j=1}^{c} n(j)(\overline{R}_j - \overline{R})^2 \qquad (6.20)$$

Where c = number of samples or groups,
n(j) = the number of observations in the jth group,
N = the total number of observations,
R_j = sum of the ranks in the jth group,
$\overline{R}_j$ = average of the ranks of the jth group,
$\overline{R}$ = average of the ranks for the combined samples.

When there are more than c = 3 groups, and when the number of observations in each group, $n_j > 5$, then sampling distribution of KW approximates the chi-squared, χ^2, distribution with degrees of freedom, df = c - 1.

When ties occur between two or more scores, each score is given the mean of the ranks for which they tie. As ties influence the KW statistic, it is corrected by dividing equation 6.20 by equation 6.21.

$$1 - \frac{\sum_{i=1}^{g}(t_i^3 - t_i)}{N^3 - N} \tag{6.21}$$

where g = number of groupings of different tied ranks,
t_i = number of tied ranks in the ith grouping.

The corrective effect is often negligible when no more than 25% of observations tie.

If, KW, reaches significance, it indicates that at least one of the groups is different from at least one of the others. It does not indicate which ones are different, nor does it indicate how many are different. This information can subsequently be found by considering the null hypothesis that, the medians of any 2 given groups, u and v, are the same, $\theta_u = \theta_v$, against the alternative hypothesis, that the medians are different, $\theta_u \neq \theta_v$. This is achieved by obtaining the differences of the mean of the ranks, $|\overline{R}_u - \overline{R}_v|$, for all groups. When the sample size is large, these differences are approximately normally distributed. However, since there are a large number of differences, and because the differences are not independent, the comparison technique requires adjustment. If KW reaches significance at the, α level, then the significance of individual pairs of differences are tested using the inequality of equation 6.22.

$$|\overline{R}_u - \overline{R}_v| \geq z_{\alpha/c(c-1)} \sqrt{\frac{N(N+1)}{12}\left(\frac{1}{n_u} + \frac{1}{n_v}\right)} \tag{6.22}$$

Where, $z_{\alpha/c(c-1)}$ is the value from the unit normal distribution above which lies α/c(c - 1).

6.5 Application of statistical hypothesis tests.

6.5.1 Did the experts or system obtain an average agreement in any case significantly better than, or worse than expected by chance?

For each case, the mean agreement the system scored with the experts, o(system), and the mean agreement the experts scored with each other, o(experts), was obtained. The case length, n, was taken as the total number of 15 minute segments in each case. The kappa values, k(system) and k(expert), were then obtained with equation 6.17. These kappa values were used to test the null hypothesis that neither the experts, nor the system, obtained agreements significantly different from those expected by chance and two alternative hypothesis were considered.

1. If the agreement reached significance and was less than expected by chance, then it was concluded that there was significant disagreement.

2. If the agreement reached significance and was greater than expected by chance then it concluded that there was significant agreement.

Although two alternative hypothesis have been formed, the test was one-tailed because each predicts the direction of the agreement. In this test, the region of rejection should not be too small to prevent a measure of agreement from reaching significance (in either direction) when the number segments, n, scored in a case was small. Therefore the significance level was chosen as, $\alpha = 0.1$. It has been found that the sampling distribution of the means of kappa is normally distributed with $\mu_k = 0$ and $\sigma_k^2 = 0.998$. This allows us to refer equation 6.18.

$$z = \frac{\bar{k}}{\sigma_k / \sqrt{n}} \tag{6.18}$$

to the standard normal tables. The results obtained are shown in table 6.3.

Case	Segments (n)	Measured agreement		*kappa*		Z values	
		o (experts)	o (system)	k (experts)	k (system)	z (experts)	z (system)
1	12	68.1	71.5	0.33	0.40	1.15	1.39
2	45	43.7	44.7	-0.19	-0.17	-1.28	-1.14
3	47	52.2	54.8	-0.01	0.05	-0.07	0.34
4	20	57.9	57.4	0.11	0.10	0.49	0.45
5	26	58.7	63.4	0.13	0.23	0.66	1.18
6	10	92.1	91.6	0.83	0.82	2.63	2.60
7	28	67.8	76.6	0.32	0.50	1.70	2.65
8	16	76.5	63.6	0.50	0.23	2.00	0.92
9	7	80.5	76.2	0.59	0.50	1.56	1.33
10	9	64.4	70.2	0.25	0.37	0.75	1.11
11	16	80.6	65.2	0.59	0.26	2.36	1.04
12	19	55.7	62.4	0.06	0.21	0.26	0.92
13	56	59.4	65.1	0.14	0.26	1.05	1.95
14	16	65.0	61.7	0.26	0.19	1.04	0.76
15	20	66.3	67.9	0.29	0.32	1.30	1.43
16	47	44.0	52.1	-0.18	-0.01	-1.24	-0.07
17	20	57.7	46.7	0.10	-0.13	0.45	-0.58
18	36	66.6	66.6	0.29	0.29	1.74	1.74
19	15	59.1	57.2	0.13	0.10	0.50	0.39
20	23	75.0	81.2	0.47	0.60	2.26	2.88
21	16	90.6	92.0	0.80	0.83	3.21	3.33
22	20	66.3	67.9	0.29	0.32	1.30	1.43
23	52	70.0	73.3	0.37	0.44	2.67	3.18
24	11	64.0	52.4	0.24	-0.01	0.80	-0.03
25	14	80.4	76.8	0.58	0.51	2.17	1.91
26	31	75.9	76.9	0.49	0.51	2.73	2.85
27	8	79.1	75.9	0.56	0.49	1.59	1.39
28	26	69.5	73.0	0.36	0.43	1.84	2.20
29	52	84.5	79.0	0.67	0.56	4.84	4.05
30	11	63.9	49.4	0.24	-0.07	0.80	-0.23
31	16	97.1	97.6	0.94	0.95	3.77	3.81
32	17	49.8	40.2	-0.06	-0.26	-0.25	-1.07
33	15	76.2	75.3	0.50	0.48	1.94	1.86
34	23	74.9	78.7	0.47	0.55	2.26	2.64
35	9	81.5	72.8	0.61	0.43	1.83	1.29
36	38	63.7	64.9	0.23	0.26	1.42	1.61
37	59	65.8	63.4	0.28	0.23	2.16	1.77
38	14	81.3	29.1	0.60	-0.50	2.25	-1.87
39	27	90.8	91.9	0.80	0.83	4.17	4.32
40	11	57.7	38.7	0.11	-0.30	0.37	-1.0
41	15	63.6	61.7	0.23	0.19	0.89	0.74
42	17	61.7	54.5	0.19	0.04	0.78	0.17
43	19	83.1	76.2	0.64	0.50	2.80	2.18
44	20	64.8	31.8	0.26	-0.44	1.17	-1.97
45	14	68.7	73.0	0.34	0.43	1.27	1.61
46	34	78.4	81.8	0.54	0.61	3.16	3.56
47	20	92.5	92.4	0.84	0.84	3.76	3.76
48	38	65.0	46.0	0.26	-0.14	1.61	-0.86
49	29	89.2	92.3	0.77	0.84	4.15	4.53
50	28	88.0	91.3	0.75	0.82	3.98	4.35

Table 6.3: Statistical significance in the measures of agreement for each case.
The average agreement the system scored with the experts, o(system), and the average agreement the experts scored with each other, o(experts), was calculated for each case. These were expressed as kappa values, k(system) and k(experts), which were referred to the standard normal tables to obtain, z(system) and z(experts) to test the level of agreement above chance.

At the $\alpha = 0.1$ level of significance the critical value of, z, from the standard normal tables is, $z = 1.27$. If for a given case, $z \leq -1.27$, then it was concluded that the average agreement was significantly less than expected by chance and represented disagreement. If, $z \geq 1.27$, then the average agreement was significantly better than expected by chance and if, $-1.27 \leq z \leq 1.27$, then the average measured agreement was not significantly different from that expected by chance. So from table 6.3 it can be found that,

1. The average agreement the experts scored with each other was significantly better than was expected by chance in 31 cases.

2. The average agreement the system scored with the experts was significantly better than was expected by chance in 29 cases.

3. The experts disagreed with each other in the management of 1 case (case 2).

4. The system disagreed with the experts in the management of 2 cases (38 and 44).

6.5.2 Did each expert and the system manage the cases similarly?

Unlike the previous test which considered average agreements, this test considered the agreement measures of the experts and the system obtained on an individual basis.

If an expert had managed a case differently from the other experts, then they would have obtained lower measures of agreement. If the system did not embody expertise then it would have obtained lower measures of agreement with the experts then they obtained with each other.

For each case, each review (A1, A2, B1, ... , S2) was compared with all 36 reviews (not including the random numbers). However, 2 comparisons for each review need not be considered here; the first is obviously the reviews agreement with itself (e.g. A1 with A1 = 100%) and the second is the inter-reviewer agreement (e.g. A1 with A2 = 69%) which will be considered later. Therefore, each of the 36 reviews has a set of 34 measures of agreement with other reviewers. These are the rows and columns in each agreement table (chapter 5, section 5.5.2, table 5.8 and appendix H). The Kruskal-Wallis test was used to establish if all sets for a given case contained similar levels of agreement. If this test reached significance then it indicated that at least 2 sets were significantly different. Here, the set with the higher agreement would represent the management preferred by the other reviewers and the lower set would represent the management least preferred. A measure of the performance of each reviewer could be obtained by considering the number of cases for which they obtained a significantly lower set of agreements than at least one other reviewer.

For each case considered separately, the null hypothesis was that; there was no difference in the levels of agreements that each reviewer obtained. The alternative hypothesis was that at least two reviews differed in the levels of agreement they obtained. The total number of agreements per case, N = 36 x 34 = 1224. The significance level was chosen to be, α = 0.05. Since the sample sizes exceed 5, the sampling distribution of the Kruskal-Wallis statistic, KW, approximates the chi-squared, χ^2, distribution with degrees of freedom, df = c - 1 = 35 for the number of groups, c. This significance level and degrees of freedom gives a critical value for KW = 50.96.

It was found that the KW statistic reached significance in all 50 cases which implied that in each case there were at least 2 reviewers with different levels of agreement measures.

The next stage was to investigate for each reviewer in each case, whether any other reviewer obtained a significantly higher level of agreement. This was achieved by rearranging equation 6.22 to obtain equation 6.23 to specifically test whether a given reviewer, u, has significantly lower agreements than another reviewer, v.

$$\overline{R}_u \geq \overline{R}_v + z_{\alpha/c(c-1)} \sqrt{\frac{N(N+1)}{12}\left(\frac{1}{n_u}+\frac{1}{n_v}\right)} \qquad (6.23)$$

for each reviewer u, and every combination of other reviews v, where,

$\overline{R}_u$ = average of the ranks of the uth group,
$\overline{R}_v$ = average of the ranks of the vth group,
$\alpha/c(c - 1) = 0.05/36(36 - 1) = 0.00004$, which gives,
$z_{0.00004} = 3.95$ from the standard normal tables.
$n_u = n_v$ = the number of measures in each group = 34
N = 36 x 34 = 1224.

Substituting these values reduces the inequality to,

$$\overline{R}_u \geq \overline{R}_v + 338.64 \qquad (6.24)$$

For each reviewer, the cases were found where at least one other review had obtained a significantly higher level of agreement. These were represented into tables which are given in appendix J. The results obtained for expert A are shown in table 6.4.

- The cases where expert A obtained a significantly lower agreement for his recommended management than at least one other reviewer.
- The median agreement the reviewer obtained in the specific case is shown as θ.

- The reviews which obtained a significantly higher agreement are identified.
- The total number of reviews which obtained significantly higher agreements for the specific case is shown.

case	review	θ	Reviews which have significantly higher agreement	total
4	A1	46	E1 E2 G1 I2 J2 K1 L1 O1 O2	9
9	A2	73	A1 B2 C1 F1 F2 G1 I1 I2 K2 L1 L2 M2 N2 O1 O2 P2	16
11	A1	68	A2 B2 C1 C2 D1 E1 E2 F2 G1 H1 I1 I2 K1 L1 M2 N2	16
20	A1	64	C2 D1 D2 E1 E2 H1 H2 K1 N1 N2 O2 P2 S1 S2	14
21	A1	68	A2 B1 B2 C1 C2 D1 D2 E1 E2 F1 F2 G1 G2 H1 H2 I1 I2 J2 K1 K2 L1 L2 M1 M2 N1 N2 O1 O2 P1 P2 S1 S2 S1 S2	32
23	A1	75	A2	1
25	A2	72	B2 D1 D2 E1 E2 G1 H2 J1 J2 K1 L1 L2 M1 N1 N2	15
27	A2	52	A1 B2 C1 C2 D1 D2 E1 E2 F1 F2 G1 H1 H2 I2 J2 K1 K2 L1 L2 M2 N1 O1 O2 P2 Q1	25
28	A1	63	B2 D1 E1 E2 F2 G1 G2 I1 J2 K2 L2 M2 N2 O1 O2 P2 Q1 S1 S2	19
29	A2	83	D2 L2	2
30	A1	42	A2 D1 D2 E1 H2 J2 L1 L2 M1 M2 O2 P1	12
34	A1	56	A2 C2 D1 D2 E1 E2 G1 H2 I1 I2 K2 L1 L2 M1 M2 O2 P2 S1 S2	19
35	A1	70	A2 D1 D2 E1 E2 G1 H1 I2 J1 J2 K2 L1 N2 O2	14
37	A1	50	C2 D2 H2 L1 L2 O1	6
38	A1	70	C1 C2 D1 D2 E1 E2 I1 I2 N2	9
39	A1	89	B1 B2 C1 D1 D2 E1 E2 F1 F2 G1 G2 H2 I1 I2 J2 K1 K2 L1 L2 M1 M2 N2 O1 P1 P2 S1 S2	27
39	A2	85	B1 B2 C1 D1 D2 E1 E2 H2 I1 I2 J2 K1 L1 L2 O1 P1 P2 S1 S2	19
50	A2	64	A1 B1 B2 C1 C2 D1 D2 E1 E2 F1 F2 G1 G2 H2 I1 I2 J1 J2 K1 K2 M1 M2 N1 O2 Q1 S1 S2	27

Table 6.4: Cases where expert A obtained lower agreement than at least one other reviewer.

It can be seen from table 6.4, that the majority of other reviews (> 17) obtained significantly higher agreements than either expert A's first review, A1, or second review, A2, in 6 cases (21, 27, 28, 34, 39, 50) and 7 reviews. The results obtained for all experts and the system are expressed in this way in table 6.5.

Reviewer	Number Cases	Number Reviews
A	6	7
B	16	22
C	6	7
D	3	3
E	1	1
F	5	6
G	2	2
H	9	13
I	1	1
J	11	11
K	2	2
L	3	3
M	7	9
N	4	4
O	4	4
P	5	6
Q	28	36
System	5	10

Table 6.5 **The number of cases and reviews where each reviewer obtained significantly lower agreements than the majority.**

It was found that;

1. The system obtained significantly lower agreement than the majority of reviewers in 5 cases of the 50.

2. Most experts obtained significantly lower agreement than the majority of reviewers in 5 cases or less.

3. Experts B, H, J and Q, obtained significantly lower agreements than the majority of reviewers most often.

4. Expert Q deserves special mention here because in over half the cases, he obtained significantly lower agreements than the majority.

This test, by itself may not separate the good performers from the poor performers, although it contributes valuable evidence towards this. It may be that for some cases, those with lower agreements have managed the labours better than the rest.

The results obtained for the system are encouraging because in 45 out of 50 cases, the level of agreement that the system achieved with the experts was not significantly lower than the experts achieved with each other.

6.5.3 Assessment of each reviewers overall inter- and intra-agreement.

Each reviewers average agreement with the other experts (inter-agreement) and consistency (intra-agreement) was calculated. These measures were used to determine whether each expert and the system was able to agree and be consistent in excess of that expected by chance.

The agreement the system obtained with the experts for each of its reviews, S1 and S2, was averaged over all 50 cases. Similarly for each expert review, the average agreement with the remaining experts was found. The average of all inter-expert agreements was obtained to give a single measure of the overall inter-expert agreement, $\overline{Ex}$. In addition, the agreement that the two sets of plausible random numbers obtained with themselves and with the experts was found. The average consistency of each reviewer and the plausible random numbers was taken as the agreement measured between their 2 reviews of each case, averaged over the 50 cases. These results were then expressed as kappa values.

These kappa values were used to test the null hypothesis that no expert, nor the system, obtained an average agreement significantly different from that expected by chance. Two alternative hypothesis were considered;

1. If a reviewer's average agreement reached significance and was less than chance then it was concluded that the reviewer had significantly disagreed with the other experts in the management of the 50 cases.

2. If a reviewer's average agreement reached significance and was greater than expected by chance then it concluded that the reviewer had significantly agreed with the management of the other experts in the 50 cases.

Although two alternative hypothesis have been formed, the test was one-tailed because each predicts the direction of the outcome. The total number of segments, n, the experts scored was large, n = 1129. The level of significance was chosen to be, $\alpha = 0.01$. The sampling distribution of the means of kappa has been found to be normally distributed with $\mu_k = 0$ and $\sigma_k^2 = 0.998$. This allows equation 6.18,

$$z = \frac{\overline{k}}{\sigma_k / \sqrt{n}} \qquad (6.18)$$

to be referred to the standard normal tables. The inter-agreement results are presented in table 6.6, the intra-agreement results are shown in table 6.7.

Inter-agreement			
Reviewer	$\overline{o}_{inter}$	$\overline{k}_{inter}$	z
A1	69.61	0.36	12.12
A2	73.06	0.43	14.48
B1	60.67	0.17	5.72
B2	65.18	0.26	8.75
C1	71.94	0.41	13.80
C2	72.71	0.42	14.14
D1	73.13	0.43	14.48
D2	73.61	0.44	14.81
E1	73.76	0.45	15.15
E2	73.35	0.44	14.81
F1	66.87	0.30	10.10
F2	70.92	0.39	13.13
G1	73.40	0.44	14.81
G2	70.66	0.38	12.79
H1	64.23	0.24	8.08
H2	69.76	0.36	12.12
I1	73.85	0.45	15.15
I2	74.69	0.46	15.49
J1	68.93	0.34	11.45
J2	72.32	0.41	13.80
K1	73.60	0.44	14.81
K2	72.04	0.41	13.80
L1	73.92	0.45	15.15
L2	73.37	0.44	14.81
M1	66.02	0.28	9.43
M2	70.05	0.37	12.46
N1	70.94	0.39	13.13
N2	71.48	0.39	13.13
O1	69.32	0.35	11.78
O2	74.10	0.45	15.15
P1	70.01	0.37	12.46
P2	72.60	0.42	14.14
Q1	59.54	0.14	4.71
Q2	56.80	0.09	3.03
S1	67.14	0.30	10.10
S2	67.51	0.31	10.44
$\overline{Ex}$	70.19	0.37	12.46
$\overline{Ran}$	47.1	-0.12	-4.04

Table 6.6: Each reviewers average inter-agreement.

The average inter-agreement was calculated for the experts, the system and the plausible random numbers, $\overline{o}_{inter}$. This was expressed as a kappa value, $\overline{k}_{inter}$ from which the z value from the standard normal tables was obtained.

Intra-agreement			
Reviewer	$\overline{o}_{intra}$	$\overline{k}_{intra}$	z
A	76.42	0.50	16.83
B	78.68	0.55	18.52
C	80.00	0.58	19.53
D	82.32	0.63	21.21
E	82.10	0.62	20.87
F	81.20	0.60	20.20
G	77.28	0.52	17.50
H	78.62	0.55	18.52
I	89.04	0.77	25.92
J	73.18	0.43	14.48
K	81.00	0.60	20.20
L	83.16	0.64	21.55
M	84.18	0.67	22.56
N	82.56	0.63	21.21
O	78.44	0.54	18.18
P	81.58	0.61	20.54
Q	74.16	0.45	15.15
S	99.16	0.98	32.99
$\overline{Ex}$	80.23	0.58	19.53
$\overline{Ran}$	50.24	-0.05	-1.68

Table 6.7: Each reviewer's average intra-agreement (consistency).

The average intra-agreement was calculated for the experts, the system and the plausible random numbers, $\overline{o}_{intra}$. This was expressed as a kappa value, $\overline{k}_{intra}$ from which the z value from the standard normal tables was obtained..

At the $\alpha = 0.01$ level of significance the critical value of z from the standard normal tables is $z = 2.32$. If a reviewer obtained $z \leq -2.32$ then it was concluded that, on average, the reviewer disagreed with the other experts. If $z \geq 2.32$ then the reviewer's average agreement was significantly better than expected by chance and if $-2.32 \leq z \leq 2.32$ then the average measured agreement was not significantly different from that expected by chance. From tables 6.6 and 6.7 it can be found that;

Inter-agreement results.

1. All experts and the system obtained an average agreement significantly better than expected by chance. For the most part (with the exception of Q1 and Q2), these results were highly significant; a z value of > 5.0 for instance has an associated probability, $p < 0.0000003$.

2. The system's average inter-agreement was within the range of the experts' agreement.

3. Expert Q obtained much the lowest inter-agreement. For his second review, this was only just significantly above that expected by chance.

4. The plausible random numbers disagreed with the experts.

Intra-agreement.

5. The system and the experts obtained a consistency significantly better than could have been expected by chance. Again, these results were highly significant.

6 The system achieved almost perfect consistency ($\overline{o}_{intra} = 99.16\%$, $\overline{k}_{intra} = 0.98$)

7 The average expert intra-agreement was 80.23% but of these, expert I stood out as being the most consistent (89.04%) and experts Q and J were the least consistent (74.16% and 73.18% respectively).

8 The intra-agreement of the plausible random numbers was not significantly different from that expected by chance (50.2%). This confirms the derivation of the expected chance agreement.

Chapter 6 summary.

Chapter 6 described the detailed mathematical and statistical techniques used to analyse the scores recorded by the experts and the system in the validation study (chapter 5, section 5.4). A novel method was designed to calculate the agreement between 2 time related, discrete sequences such that when they were identical they scored a maximum agreement of 100% and when there was no similarity, they scored 0. A partial agreement for different scores occurring at the same time was given as well as a partial agreement for similar scores with close temporal proximity. The application of this technique is not restricted to the analysis of the scores obtained from the validation study; the method has inherent flexibility which would allow it to be applied to any problem where it was desired to measure the similarity between discrete time related sequences.

The statistical distribution of the agreement measure was found to be normal with mean, μ_O = 52.7% and variance, σ_o^2 = 0.224. This distribution was transformed into kappa statistics with μ_K = 0 and σ_k^2 = 0.998 to test the statistical significance of a calculated agreement in excess of that expected by chance.

The Kruskal-Wallis one way analysis of variance by ranks was used to analyse the levels of agreement obtained by each review for the management of a given case. This test identified reviewers who obtained significantly lower agreements than the majority for their management of labour.

A synopsis of the results obtained by these tests can be found in the summary for chapter 5.

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Chapter 7

Discussion and Conclusions.

7.1 Review.

This thesis began with an investigation of the factors which influence the quality of the fetal electrocardiogram (ECG), the primary signal from which heart rate is derived. This study found that the ECG was most seriously affected by low frequency baseline shifts. For heart rate calculations, which requires the accurate detection of the R-wave, these effects can be reduced with suitable bandpass filtering. The R-wave was found to have a bandwidth of 4 - 50 Hz. A bandwidth of 4 - 45 Hz reduced the R-wave amplitude by 3% but as this moves the upper frequency away from the mains frequency (50 Hz), it may be more desirable. Baseline shifts can become so severe that they cause saturation during pre-amplification prior to filtering which prevents signal analysis. It was found that the choice of fetal scalp electrode was important in reducing this possibility. The single spiral type was found to obtain signals with lower baseline noise and signal saturation more reliably than any other types considered (Copeland reusable, Copeland disposable and Hewlett-Packard double spiral). This finding has special importance for research work involving the analysis of ECG variables other than heart rate. The suggested bandwidth for the continuous recording of the ECG is 0.05 - 100 Hz. This lower limit means that baseline shifts cannot be easily removed from the signal with high pass filtering. However, it was argued that when analysis is concerned only with ECG complexes extracted from the continuous waveform, this lower frequency may be excessive. This may be especially true when successive ECG complexes are averaged.

The primary investigation of this thesis described the development, evaluation and validation of an intelligent system for labour management. The cardiotocogram, (CTG) provides a continuous visual recording of the fetal heart rate and uterine contractions from which an assessment of fetal condition during labour can be inferred. Considerable expertise is required to interpret the complex changes seen on this recording to accurately distinguish the fetus coping appropriately with the stress of labour from the compromised fetus. It is now accepted that difficulties in CTG interpretation can lead to unnecessary operative intervention and importantly, a failure to intervene when necessary. This is one of the major factors in infants who sustain potentially preventable neurological damage or mortality resulting from asphyxia during birth. Over the past 10 years, computer systems have been developed to attempt to provide quantitative heart rate analysis to overcome the inconsistencies of visual interpretation but have had little success. This is perhaps because the correct assessment of fetal condition depends not only on heart rate changes but also on considerable physiological knowledge, the specific patient history (mother and fetus) and expert clinical opinion. An intelligent system which embodies this expertise could be more successful.

The intelligent system conceived was developed closely with experts in Plymouth and during 2 limited internal evaluations, it was found that the knowledge required for labour management could be formalised and implemented and that the system could manage labour with a performance comparable with internal experts. The possible limitations of a single centre developing this type of system in isolation was recognised. The validation of the system compared the management of the system with 17 experts from 16 leading centres in fetal monitoring within the UK. Fifty cases were selected from a database of 2400 high risk labours. Each expert reviewed the cases twice, independently and blind to perinatal outcome at least 1 month apart. No expert had a knowledge of the other participating experts' identity. The objectives for this study were to investigate whether the;

1. System could manage labour with a performance comparable with the experts.
2. The experts could agree on the management of labour.
3. The experts could be consistent in the management of labour.

The evidence obtained from this study was both positive and conclusive. The system was found to be indistinguishable from the experts, except it was more consistent. The experts obtained good agreement with each other and reached a high level of consistency. This work demonstrates the potential for an intelligent system for labour management.

7.2 Discussion of the system's performance.

It was found that,

1. The system agreed with the experts well and significantly in excess of that expected by chance (67%, kappa = 0.31, $\alpha = 0.01$, $p < 0.0000003$).
2. In 45 cases, the level of agreement the system achieved with the experts was not significantly lower than the experts achieved with each other.
3. The actions recommended by the system were highly consistent (99%, kappa = 0.98, $\alpha = 0.01$) when used by two operators independently of which one was an engineer with no labour ward experience.
4. The system recommended delivery by CS in 11 cases. On average, more than 31 of the 34 expert reviews of these cases also recommended CS delivery. The majority of these did so within $\pm$ 1 segment (15 minutes) of the system's recommendation and two thirds did so within $\pm$ 2 segments (30 minutes).
5. The system identified as many of the cases which had birth asphyxia at delivery as the majority of experts and 1 more than was acted upon clinically.
6. The system was within the range of the experts interventions in cases in the poor outcome group ($pH < 7.05$).

7. The system recommended no unnecessary intervention in the cases with good outcome (spontaneous vaginal delivery and pH > 7.20) which was better than all but two of the experts.

However, although within the range of experts for all measures considered and therefore indistinguishable from the experts, the system did recommend fewer FBS and fewer CS than most. In addition, the system was different from the majority of experts in the management of four cases of which two would have been delivered with acidosis (pH < 7.05) and two would have had a significant metabolic acidosis (pH < 7.05 and BDecf ≥ 12).

The examination of the system's management of these cases which obtained a poor outcome (chapter 5, section 5.5.8) found that unlike the majority of experts, the system did not react as quickly to signs of fetal compromise during the second stage of labour and did not interpret a rapid fall in baseline heart rate from slight tachycardia (160-180 bpm) to slight bradycardia (90-110 bpm) as the severely abnormal event that it was.

If acidosis is the condition to be avoided at birth (because there is some doubt that on its own it is) (Johnson et al, 1990) then it would be necessary to modify two rules in the system for it to achieve the management of the majority of experts in these four cases. The knowledge tree regarding baseline changes less than 90 bpm (chapter 4, section 4.3, figure 4.3), would need to be modified to;

(i) **If** (Baseline < 90) **or** (Baseline > 180 and drops < 160) **or**
(Baseline > 160 and drops < 110) **Then**
activate this part of the tree.

(ii) **If** (i) and (in second stage of labour) **Then**
recommend intervention.

It is of interest that these four cases with acidosis did not receive intervention in clinical practice. As these cases could be considered to have had a poor outcome, the question is, was it desirable that the system should have recommended intervention? Unfortunately, the answer is not clear. On the one hand, none of these babies had signs of neurological damage which may support the argument that intervention was unnecessary. On the other hand, the majority of babies who do sustain neurological injury do have acidosis. This implies that if acidosis at birth could be prevented then cases with neurological damage would be reduced. However, there are two mechanisms which cause two forms of acidosis, termed respiratory acidosis and metabolic acidosis. Respiratory acidosis is caused from an accumulation of CO_2 resulting from a reduction of blood flow across the placenta which is inhibited by contractions. An accumulation of CO_2 is normal and stimulates the baby to take its first

breath when born. But when the accumulation of CO_2 is severe, it can cause the baby to be born depressed. However, this situation can be quickly corrected and is not in itself an indication that the baby has become hypoxic (O_2 deprivation in organs) which is a requirement for asphyxia and neurological damage. Metabolic acidosis is caused by the production of lactic acid, which is produced when the fetus switches to anaerobic metabolism as a result of hypoxia. This process involves the breakdown of glycogen reserves stored principally in the liver and heart. Anaerobic metabolism is a natural defence mechanism but one that the fetus can only sustain for a limited period. Once the glycogen reserves are exhausted, then if hypoxia continues, tissue damage will occur and ultimately the fetus will be lost. So, should a significant metabolic acidosis be the condition at birth to be avoided? Anaerobic metabolism allows the fetus to survive the ordeal of a difficult labour after which the fetus will recover. Nevertheless, it seems dangerous to allow the fetus to approach the situation where its reserves become threatened and is put at considerable risk. In terms of the management of these cases, there is know way of knowing how much in reserve the fetus has which determines the maximum time the obstetrician has before an operative delivery is imperative. The problem is further complicated because even when the decision for operative delivery has been taken, it takes time to obtain. This argument suggests that a significant metabolic acidosis at birth should be avoided which is indicated when the base deficit in the extracellular fluid reaches 12 mmol/l (Siggaard Andersen, 1974). However, some care is required when assigning thresholds because there are always exceptions. The growth retarded fetus for instance may become compromised but have small reserves of glycogen and therefore may be incapable of sustaining anaerobic metabolism for any length of time. Consequently lactic acid may not be produced in sufficient quantities to indicate a significant metabolic acidosis by this definition.

Where does this leave the system? Of the four cases with acidosis, two cases had significant metabolic acidosis (cases 30 and 41). The system would have recommended intervention in both cases only if both of the proposed rule changes had been implemented. However, the inclusion of these rule changes would mean that the system would also have recommended operative delivery in the two cases with respiratory acidosis where intervention could be regarded as unnecessary. It is important that the system should be regarded as safe and so on balance it is likely to be considered that two cases operatively delivered with respiratory acidosis is an acceptable price to ensure that two cases with a significant metabolic acidosis are delivered in good time. The system should be perceived as slightly but not overly defensive and should err on the side of caution otherwise it will not instil confidence in clinical staff which is perhaps the most important factor in determining the eventual success of the system. These rules would be simple to implement and would not alter the management recommended by the system in any other case. The merits of these changes will be discussed with physiologists and obstetricians before they are implemented.

It was also found that the system did not recommend a CS in several cases where the majority of experts did, but where there was little evidence to suggest fetal compromise. Several of these cases were also delivered by CS clinically. It could be argued that as these cases did not result in a poor outcome that the experts' recommendations were inappropriate and that the system's recommendations are preferred. However, this could be a mistaken view. Consider the analogy that for the fetus, labour is like a steeple chase. The fetus enters the race as labour commences but the length of the race is unknown, as are the number of hurdles that are required to be jumped, represented by the contractions. These variables are determined in most cases by the mother and how quickly she progresses through labour. In some cases she can stop making progress in which case an end may not be possible without assistance. The obstetrician can influence the end of the race with the administration of drugs to speed up labour or by intervening operatively. The effect of these drugs is to increase the number of hurdles, make them higher and shorten the space between them. At certain points during the race, the obstetrician will make an assessment as to whether the fetus is likely to get to the end of the race in a reasonable condition. Many factors will weigh in the obstetrician's mind; where in the race we are, how quickly progress has been made to date, how much of the race remains, the present condition of the fetus and the estimated condition of the fetus if the race were allowed to run its course. The true expert will assess the situation with great skill. This analogy suggests that the obstetrician need not wait for the fetus to become compromised before an operative intervention is recommended and justified. This approach has the advantage that it gives time to plan the operative delivery without the need to resort to emergency procedures. The disadvantage is that it could be considered a gamble because unless one is particularly skilful, some women will receive operative intervention unnecessarily. To illustrate this, consider expert H; in case 15, expert H alone consistently recommended operative intervention, but the evidence she obtained from FBS results, which were also obtained by many of the other experts at the same time, did not suggest the fetus was as yet compromised. In clinical practice this case eventually delivered spontaneously but was birth asphyxiated. In case 22 however, expert H consistently recommended delivery by CS, again when the FBS results she obtained did not suggest fetal compromise. Here the gamble did not pay off because the baby actually went to be born spontaneously and had a good outcome.

The system has not so far been developed with this approach to labour management. Instead it waits for evidence of fetal compromise before recommending action. But it has been discussed that fetal decompensation can occur very rapidly and so in a way, the system is perhaps gambling too. It is assuming that if compromise does occur that clinical staff are on hand to expedite delivery quickly. It may be desirable for the system to be modified in a limited way to adopt an approach similar to the experts. However, the role for the system should principally be to identify fetal compromise but it could also warn staff when it considered it unlikely that a particular labour would achieve a good outcome at the current

rate of progress and stage in labour. The scenario for such a recommendation would be for example, a woman presenting early in labour considered to be high risk with an abnormal, but not severely abnormal CTG. In this case, it may be considered that there was little chance of obtaining a normal delivery with a normal outcome, and therefore little point in waiting for the CTG to deteriorate to severely abnormal before recommending delivery.

7.3 An assessment of the experts' performance.

This study also investigated whether nominated experts could agree and be consistent in the management of labour. It was discussed in chapter 1 that several studies have been undertaken to investigate agreement and consistency in CTG interpretation but few have been concerned with the intrapartum CTG and fewer still have incorporated specific case information. In addition, no previously reported study has obtained the complete relevant case information, devised a method for presenting the cases similarly to clinical practice and provided an option to obtain a fetal blood sample. For these reasons, this is the first study which seeks to investigate whether experts can agree and be consistent in the management of labour. This study found that;

1. All experts obtained an agreement with each other significantly better than could have been expected by chance. The average inter-agreement was 70%.
2. All experts were consistent significantly in excess of that which could have been expected by chance. The average intra-agreement was 80%.
3. There was significant ($\alpha = 0.1$) inter-expert disagreement in just 1 case (case 2).
4. In the cases recommended for CS by 14 experts, at least 24 of the other 32 expert reviews also recommended delivery by CS.
5. In the 31 cases where at least one expert recommended a CS, the majority of other experts who also recommended delivery by CS did so within $\pm$ 1 segment (15 minutes) and two thirds did so within $\pm$ 2 segments.
6. The majority of experts recommended operative intervention in 10 out of the 12 cases with acidosis (pH < 7.05) at delivery.
7. The majority of experts did not recommend operative intervention in cases which obtained a normal delivery with good outcome, except in 1 case in the second review where 9 out of 17 experts recommended intervention in the second stage.

However, the majority of experts did not recommend intervention in one case which was born birth asphyxiated. In addition there was disagreement and inconsistency in the cases recommended for FBS.

The majority of experts obtained results consistent with this summary, however, four experts obtained results that were conspicuous from the majority and were considered in greater detail.

Expert Q.

Expert Q was considerably different from the other experts in almost all respects. He scored 5 times as many segments with a protocol score of '4' than the average and 4 times fewer segments as '1'. This indicated that he was so concerned for the fetus that he was considering operative intervention 5 times as often as the other experts and he was only satisfied that there was no cause for concern for a quarter of the time compared to the average. If this expert had actually been managing these cases he would have found little time to relax and would have spent much time getting ready to whizz the bed out of the labour ward and into theatre. The most significant factor in the distribution of expert Q's scoring was that he never requested a fetal blood sample, which was his choice. The differences in his scorings perhaps would also explain why for 28 cases and 36 of his reviews, expert Q obtained a lower agreement for his management than the majority of the other experts. It could also explain why his inter-agreement with the other experts was the lowest and barely above that which could have been expected by chance (review 1, 59.5%, kappa = 0.14; review 2, 56.8%, kappa = 0.09). These points, by themselves do not indicate that expert Q managed these cases inappropriately. On the contrary, if he was able to attain a similar performance as the other experts in other respects, then there would be considerable evidence to suggest that he was able to extract all the information he required to manage labour from the CTG alone, without needing to intervene to obtain a FBS. This would demonstrate that he was different from the others by virtue of the fact that he was the most expert. But in fact, expert Q was the second most inconsistent expert in his scoring and was the most inconsistent in the cases he recommended for CS; in 9 cases, he either recommended a CS in his first review and not his second, or in his second review and not his first. He performed as well as the majority of experts in recommending intervention in cases with birth asphyxia, but he was more inconsistent and recommended lower intervention than most in cases with acidosis. He also recommended 2 unnecessary CSs and a second stage intervention in cases which clinically went on to have a normal delivery with good outcome.

To summarise expert Q's performance; he did not agree well with the other experts, was inconsistent, recommended CS intervention in cases with normal outcome but performed as well as the majority in cases with birth asphyxia. At first glance, one seems bound to conclude that expert Q is not an expert. The strongest evidence for this would seem to be his inconsistencies and interventions in cases with good outcomes.

Whilst it is possible that expert Q is not an expert, this does not seem likely because he is one of the most experienced of the experts; he is actively involved in teaching CTG interpretation, he has written books on the subject and gives frequent lectures. He is actively involved on the labour ward on a daily basis almost to the irritation of his juniors (personal admission). He is also considered eminent and is frequently asked for an expert opinion in cases which come to litigation.

There may be an alternative explanation for expert Q's performance which lies in the fact that he did not recommend a single FBS. The question is, why did he refuse to request a FBS when he knew it would obtain additional information to better identify the cases to deliver operatively? The answer is perhaps that he believed his powers of CTG interpretation were sufficiently good to remove the need.

The summary of expert Q's performance sounds remarkably similar to the established view regarding the current status of fetal monitoring discussed in chapter 1 which have led many to question the value of the CTG. However, in chapter 1, an alternative model was proposed to illustrate that although the CTG may be imprecise when taken in isolation, if used by an expert with detailed case information and an option to obtain further information from a FBS, it would tend to lead experts to agree and be consistent in their management by allowing the compromised fetus to be more accurately identified. This model predicted the findings of this study and significantly, it also predicts the results of expert Q. His experience and expertise in CTG interpretation were sufficient to identify the birth asphyxiated cases as well as most of the other experts. But his expertise in CTG interpretation was not a sufficient substitute for the additional information that could be obtained from fetal blood sampling. He was able to consistently identify the very compromised fetus but only at the expense of inconsistent and unnecessary operative interventions. By not obtaining additional information from a FBS his accuracy was reduced.

Importantly, if this model is correct then it predicts that a conventional computer solution to identify the compromised fetus during labour based on the CTG alone, will not be accurate. Expert Q performed less well than the other experts when considering the CTG together with patient information. A conventional computing approach which considered only the information obtained from the CTG, is likely to achieve a performance somewhat inferior to expert Q and would fall short of the performance demonstrated by the other experts and the system. This probably explains why previous attempts to computerise the CTG interpretation have not been successful.

Expert H.

Many of the results obtained for expert H were similar to expert Q. She obtained a relatively low agreement with the majority of other experts (review 1, 64.2%, kappa = 0.24; review 2, 69.8%, kappa = 0.36) and she recommended delivery by CS in two cases and second stage interventions in a further two cases which obtained a normal delivery with good outcome. Expert H also recommended the second highest number of CS deliveries. However, Expert H consistently recommended operative delivery in all cases which were delivered birth asphyxiated or with significant metabolic acidosis and consistently recommended operative intervention in all cases with respiratory acidosis except one which was identified in one review but not in the other. She was the most consistent expert in the cases she recommended for CS with only 1 out of 25 recommendations inconsistent.

As expert H was highly consistent, she demonstrates her expertise. However, because of her low inter-agreement, she is clearly working with different objectives than the other experts. Expert H can be regarded as a high interventionist. It seems she is working to a policy which regards a high CS rate as preferable to acidosis at birth. Many obstetricians would try to emulate this approach. Expert A for example, recommended a similar number of cases for CS delivery (21) but was inconsistent in 6 cases and only recommended operative intervention in 6 out of 12 cases with acidosis in his first review and 7 out of 12 in his second. It would be difficult indeed for many to implement the policy of high intervention to prevent acidosis with quite the accuracy of expert H. It is because of this effectiveness that many obstetricians would describe expert H as the most expert of the experts. She would have consistently avoided all but 1 of the cases with respiratory acidosis and all cases born with significant metabolic acidosis or birth asphyxia, which included case 15, for which only one other expert consistently recommended intervention.

Expert M

In contrast, expert M is of the low interventionist school. He recommended the fewest cases for CS and requested the fewest fetal blood samples (apart from expert Q!). Expert M consistently recommend no intervention in cases which obtained a normal delivery with good outcome. However, expert M would have allowed more cases to be born with acidosis than the majority but would not have allowed more cases to be born birth asphyxiated than the majority. For expert M, it seems the emphasis is on avoiding unnecessary intervention at the expense of some acidosis. It could be argued that expert M is the most expert of the experts because he recommends lowest intervention and he prevents the same number of birth asphyxiated cases as most of the other experts. However, some would argue with the same reasoning as that previously applied to the system, that

expert M is risking more than most by accepting a higher level of acidosis in preference to preventing unnecessary intervention.

Expert I.

Expert I is the experts' expert. She obtained the highest agreement for her management (review 1, 73.9%, kappa = 0.45; review 2, 74.7%, kappa = 0.46) and she was highly consistent (89.0%, kappa = 0.77). In addition, she received the second highest agreement for the cases she recommended for CS. The precision in her timing of CS recommendations between her 2 reviews was also remarkable because the average difference in her timings was less than 1 segment (15 minutes). She intervened in cases with poor outcome similarly to the majority of experts and only recommended 1 second stage intervention in a case with a normal delivery and good outcome. It is because she was the most consistent and is agreed with most often, that it could be argued that expert I was the most expert of the experts.

Expert I seems to represent the views of the majority of experts and it is of significance that it was this expert for which the system obtained its highest agreement (72.6%, kappa = 0.42).

The plausible random numbers.

The two sets of plausible random numbers were generated to investigate the results one would expect to obtain if the management of labour was not patient specific. The random scores were generated to have the same average distribution as the experts and obeyed the rules of the protocol. If the management of labour was not specific then it would be expected that random numbers would obtain results similar to the experts. If however, the management of labour was specific to the patient, then it would be expected that the random numbers would agree with each other no better than expected by chance and considerably worse than the experts agreed with each other. It was found that the random numbers;

1. Disagreed significantly with the experts (47.1%, kappa = -0.12, $\alpha = 0.01$).
2. Did not agree with each other significantly in excess of that expected by chance (50.2%, kappa = -0.05, $\alpha = 0.01$)
3. Were inconsistent in all but 1 of the 19 cases recommended for CS
4. Obtained a lower agreement than the experts obtained with each other in the cases recommended for CS.

These are the results one would expect from the experts if they were inconsistent and could not agree in the management of labour. Clearly these results are somewhat different than those obtained from the experts. The fact that the random numbers have not agreed significantly better or worse than expected by chance, supports the derived measure for the expected chance agreement described in chapter 6.

7.4 Some personal observations.

The evidence obtained from cases which result in litigation for injury or death sustained from birth asphyxia, suggests that for what ever reason, that the standards of fetal monitoring which can be reached, are not always obtained. The consequences can be tragic and made more so because they are sometimes preventable. This was the stimulus for one of the experts to suggest to me during the validation study that, "would it not be better that all high risk pregnancies should be delivered by caesarean section"? The suggestion was made to provoke a discussion and I willingly obliged. My first reaction was that, on the face of it, this appeared to be a rather shocking and crass suggestion, but financially the argument has credibility. The costs of one prevented litigation settlement would pay for approximately 1000 CSs. Indeed, this argument has manifested itself, albeit indirectly, in the USA where litigation is extensive and is feared by clinicians, with the consequence that as many as one third of all deliveries in some units are by CS (Banta and Thaker, 1979). However, despite the high CS rate, litigation is not falling (Symonds, 1991) and babies continue to be born damaged from birth asphyxia (Nelson, 1991). But the reason this argument seems so unreasonable is that it resigns itself to the conclusion that sub-standard monitoring is inevitable and cannot be improved in any way other than to avoid labour altogether.

It seems that fetal blood sampling is used to arbitrate in cases where the information obtained from the CTG is not clear. Some experts recommended fetal blood sampling considerably more than others which would seem to indicate that they were either more defensive or were not as confident in their interpretation of the CTG as those with low FBS rates. But could not a strategy be conceived whereby the need to record the CTG was removed and fetal blood sampling carried out periodically throughout high risk labour? Not for at least one of the experts involved in the study who described fetal blood sampling as a, "pain in the neck for midwives, a pain in the back for doctors, a pain in the head for the baby and a pain somewhere else for the mother." Few would deny that fetal blood sampling is undesirable and its use should be minimised which again would be addressed in part, if labour ward staff were highly skilled in CTG interpretation.

7.4.1 Improving the standards of fetal monitoring.

The results obtained from the validation study would seem to suggest that the standards of fetal monitoring can be improved. If this is the case then how could this be done?

1. More senior staff could become more involved on the labour ward; their role would perhaps be to make themselves aware of the cases currently in labour and to oversee that the appropriate standard of care was being maintained. They could do this discretely if central monitoring techniques were employed, which are available and allow cases to be reviewed without further interfering with the patient. This may help because it could reduce the responsibility given to junior staff who are often those closest to the patient and are required to form a judgement as to whether more senior staff should be called. When visiting an expert's home during the validation study, I was introduced to his method for keeping tabs on the labour ward; his fax machine. He demonstrated to me that he was able to telephone the clinician on the labour ward and ask for a patients CTG to be faxed to him which allowed him to discuss the case. This technique has also been suggested by one of the Consultants in Plymouth but the idea was not taken up.

   In at least one of the hospitals I visited, the routine care of all patients in labour was transferred to one of two Consultants with recognised expertise. Either one of the Consultants was present on the labour ward and could deal with any complications as they arose. The involvement of more senior staff on the labour ward is likely to help improve standards but it seems unlikely that this expertise will be available for all monitored births day and night.

2. Better training of medical staff; currently, clinical staff are not formally trained in CTG interpretation. Junior midwives and junior doctors are expected to learn from those more experienced who in turn have relied on the informal guidance of others. It would seem, would it not, that in some instances this process may result in the blind leading the blind, leading the blind. With this approach, it is difficult to assess the quality of the training staff have received which may range from anywhere between excellent to non-existent. A more consistent approach to ensure that all receive an adequate standard of training would be to formalise training in CTG interpretation prior to their involvement on the labour ward. This is likely to improve standards, but if CTG interpretation is difficult then it may not be possible for all clinical staff to fully master the techniques required.

3. Intelligent systems to advise on labour management; the possibility has been demonstrated in this study that current CTG recorders could one day, be transformed

into true fetal monitors which could assist clinical staff in their decision making. This is supported by the validation study where it was found that an engineer guided by the system obtained a performance comparable with the experts. The role of such a system could be as a safety net to address the limitations of the proposals discussed above and thereby provide a high standard of monitoring both day and night.

7.5 Future development of the system.

7.5.1 CTG Feature extraction methods.

The devised feature extraction methods enabled the system to obtain a performance in labour management comparable with experts. This was because the methods were developed closely with experts and were designed to be flexible to allow the experts to shape the classification criteria. This was a rather different approach to the problem than the conventional computing approaches where the classification criteria were made without reference to the experienced clinician but using thresholds derived empirically. There are however, some areas of feature extraction which could be improved.

Further development of the baseline algorithm is recommended because its correct interpretation is key to the interpretation the other heart rate features. The rare problem of the unstable baseline discussed in chapter 3 (section 3.7) cannot be reliably solved by the baseline algorithm in its current form. There are several ways in which this problem could be tackled. The first step would be to make the algorithm aware of when the unstable baseline situation exists. This would be characterised when the distribution of heart rate samples become bi-modal, indicating two baselines were possible. The algorithm must then decide which is the correct modal heart rate to except, the upper or the lower value? This dilemma could be resolved from an examination of previous segments of recording when the baseline was stable. The modal value closest to this stable value could then be taken. But resolving the problem of an unstable baseline at the commencement of monitoring where previous analysis was unavailable, would also need to be considered.

An alternative approach may come from the fact that during unstable periods, technically there is no baseline heart rate and as such it is an abnormal event. It could be that the most abnormal classification that could be made from the trace would be the most appropriate to use. Alternatively, the algorithm could be developed to recognise unstable baselines and simply classify these periods as abnormal and refer the expert system to the knowledge tree which handles 'abnormal' traces.

whether the trend is gradually upwards or downwards. This may give additional information regarding how the fetus was responding.

Present methods obtain a measure of heart rate variability during stable periods of recording between accelerations and decelerations within a 15 minute segment. However, this requires that at least one minute of stability exists, which is a fair assumption for most cases (indeed no case has been reviewed where this has not occurred). However, important information is also contained in the variability within decelerations. If a curve fitting algorithm were applied to fit the decelerations, the heart rate samples could be transformed upon a zero baseline from which a measure could be obtained using the current method.

The system currently identifies the location of contractions for the classification of heart rate decelerations only. But the location of contractions are also important for monitoring the administration of oxytocins, the drugs used to stimulate the uterus and augment labour. A problem associated with these drugs is that they can be over administered which leads to contractions becoming too frequent. This is particularly stressful for the fetus which relies on the period between contractions for recovery. If a fetus got into trouble as a result of hyperstimulation, then the system in its current form may advise an operative delivery. In practice the clinician may feel that the fetus would be able to recover if the drug dosage were reduced or stopped. This in turn, may possibly allow the fetus to be delivered normally.

As the system already obtains the information required to monitor contractions, it would be a relatively simple matter to extend the knowledge base to monitor the frequency of contractions.

7.5.2 Monitoring the progress of labour.

The progress of labour is assessed from the rate at which the cervix dilates which is normally 1cm per hour. This information is plotted on a graph by the midwife to enable an assessment of the woman's progress to be made. Sometimes, a woman can fail to make adequate progress which may be corrected with the use of drugs as previously discussed.

The current cervical dilatation and progress of labour are also important for determining the appropriate management when there are concerns for the fetus. This was illustrated in the steeple chase analogy. In addition, the validation study found that the second stage of labour, especially when the mother was pushing, influenced the management of the experts. They were much more inclined to request intervention when signs of fetal compromise were

apparent. The system did not make a distinction between the first and second stages of labour and was consequently slower to react.

These findings have identified an important area for the system to be extended and indicate that the management of labour cannot be regarded as discrete tasks. It seems it is a complete package which relies on information obtained from a variety of sources including the CTG, fetal blood sampling, progress of labour and administration of drugs etc, all of which are inter-related and collectively influence management.

7.5.3 On-line development.

The system has been developed to function using previously recorded data and as such operates off-line. It considers cases retrospectively and handles processing demands sequentially which is not appropriate for operation on the labour ward. To operate on-line, the system will be required to handle processing demands in 'parallel'. For example, a clinician may wish to obtain information from the system which may take several minutes. During this time data will have been collected and it is important that it is analysed quickly.

This represents a significant development but the development time could be reduced if the system were implemented in a programming environment which already managed processes in 'parallel'. The most successful of these is Microsoft Windows, for which versions of the most popular programming languages, such as 'C' have been adapted to be used with. This approach would mean that the system's algorithms would require little further modification. The main area for development would be the user interface and explanation facility. The feasibility of this approach has been demonstrated in a separate project undertaken by our group in partnership with a commercial company. Here an expert system was developed to interface to a blood gas analyser to provide an interpretation of the measurements obtained and to store this information in a database. This system is currently on trial in the clinical environment and is proving to be very successful.

7.5.4 Commercial exploitation.

If the system can be demonstrated to reduce unnecessary intervention and reduce birth asphyxia on the labour ward then its potential impact world wide could be enormous. It could reduce the numbers of damaged babies and could save Health Departments millions in prevented compensation payments and also make savings by reducing unnecessary CSs which can cost up to £1560 per delivery (Clark, 1991). The system could also be of considerable valuable to underdeveloped countries where fetal monitoring expertise is

unavailable. However, the potential benefits do not minimise the obstacles which could prevent the system becoming viable.

The effectiveness must first be demonstrated in the clinical situation during a carefully controlled randomised trial. This would compare clinical practice with and without the system in an independent centre. This remains the acid test for the system. These trials are expensive and would be difficult to fund without a commercial partner.

The system will also need to be acceptable to the user, because ultimately, if the clinical staff do not like the system then it will not matter how good it is, it will fail. Furthermore, there is likely to be a natural reticence towards any system which purports to be 'intelligent'. This could be overcome if handled with care, as the role for the system should be regarded as an advisor to the clinician who would remain in control. This can be achieved with the current system design because the knowledge has been represented into rules. When an action is suggested, the clinician will be able to ask why? and the system would be able to explain. If the clinician found fault in the systems explanation then they would be free to follow their own inclination.

A UK company who have experience in fetal monitoring have expressed an interest in the system. They manufacture antepartum and intrapartum CTG recorders and have recently released a personal computer based central monitoring system which also archives clinical record information. This system runs on a network which means that our system could be easily integrated and would have access to all the information it would require. This network approach seems the most suitable implementation for the system even if this particular commercial venture was not forthcoming. A patent application has been made.

7.5.5 A suggested work plan for the immediate future.

A proposed work plan which will take the system from its current position to be ready for a clinically controlled randomised trial in an external centre is represented in figure 7.1.

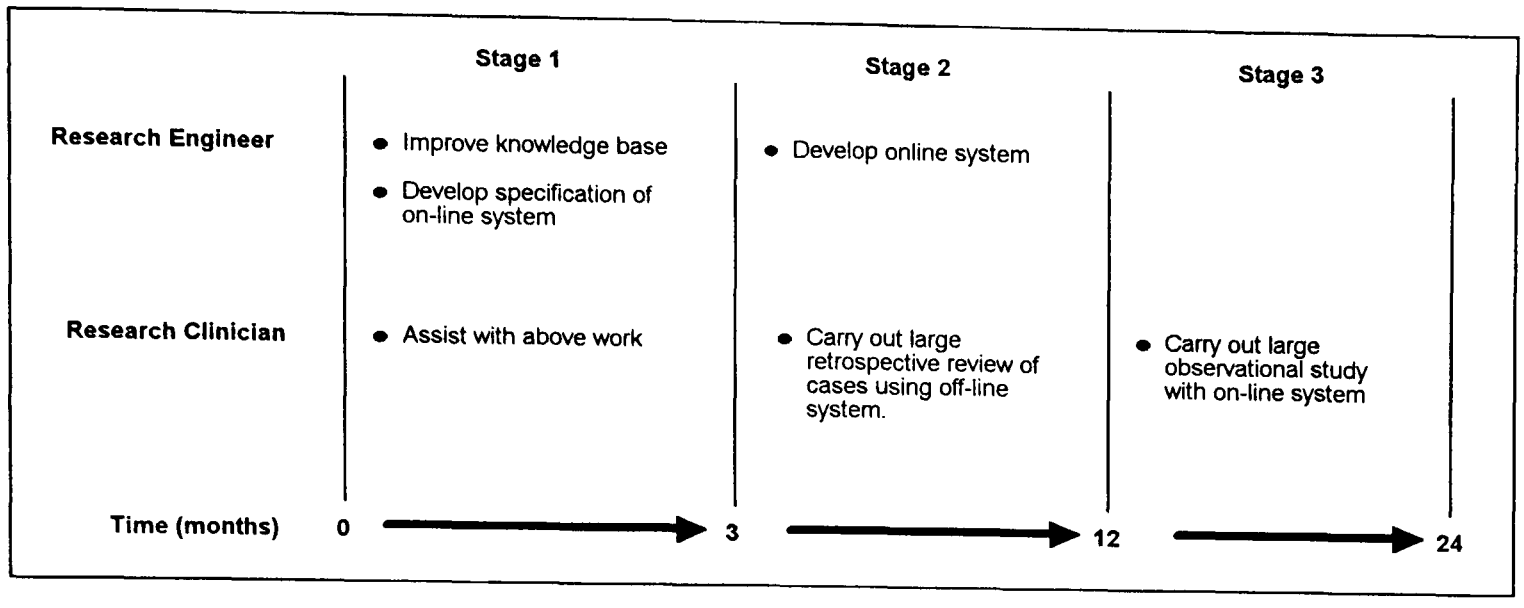

Figure 7.1. Proposed future work programme.

Stage 1. Extend the system in accordance with the findings of the validation study. The process of incorporating the changes in the embodied knowledge will require assistance from an experienced research clinician to reformulate the rules which make up the knowledge structure.

Next, the functional requirements for the on-line system will be obtained. This system will need to be reliable and user friendly to allow non-technical staff to interact with it efficiently.

Stage 2. The aim is to further develop the system to make it capable of working reliably *on-line,* in the labour ward. The user interface will be developed which is a requirement for stage 3.

In parallel, a research clinician should undertake a study to examine the performance of the system using many cases to fully assess the limitations of the system and identify improvements which the engineer can incorporate. A large number of cases are required to ensure that the system encounters sufficiently diverse examples for it to be fully tested. The cases collected which are considered difficult to interpret could be presented to external experts for review. In addition, difficult cases could also be obtained from other hospitals. These are not required to have been previously digitised, as a method, described in chapter 5 (section 5.4.5), has been devised to extract the data from paper traces.

Stage 3. This investigation would carefully examine the performance of the system on the labour ward in a trial lasting a year where approximately 900 cases would be monitored. The *on-line* system could function with its recommendations blind to clinicians. Each case could be subsequently analysed independently during the study by the research clinician and any difficult traces could be referred to external experts. On completion of the study the clinician could examine the fetal blood sampling rates and operative deliveries (actual and recommended) and compare these to perinatal outcome to see how the system was likely to have effected clinical decision making.

This information would then be used to assess whether the system was viable and likely to be acceptable to clinical staff. If the results from this study were promising then the system would be ready to undergo a clinical randomised trial.

7.6 Looking further into the future.

There are currently two areas of current research in Plymouth which may have implications for the future development of the system.

7.6.1. New methods for fetal monitoring.

Research has been underway for some time to identify a single variable which accurately indicates fetal condition that can be obtained reliably and with relative ease during labour. If such a variable were found it would have the potential to revolutionise fetal monitoring. But the inaccessibility of the fetus means that it is difficult to obtain physiological measurements with any degree of reliability. The existence of a single variable to indicate fetal condition seems unlikely to be found, which means the CTG is here to stay (Neilson, 1993). It has been discussed that the CTG, by itself is not accurate. The addition of fetal blood sampling improves accuracy but has undesirable properties. Its principal limitation is that it is intermittent. The pH can fall rapidly which could be missed, especially in the second stage of labour.

The oxygen saturation of the blood can be measured from changes in electromagnetic radiation as it passes through body tissue. This technique is routinely used to measure the oxygen saturation in patients during surgery and its application to the fetus is being investigated (Johnson, 1991). However, the location and inaccessibility of the fetus presents this method with certain difficulties, principally, what do you shine the electromagnetic radiation through? An electrode has been developed which can be positioned along side the fetal head. A light source is transmitted into the fetal head of which a proportion of

radiation is reflected back to a sensor located next to the source. The difficulties with this method involve ensuring the electrode remains correctly positioned and that the signal source does not shine directly into the sensor. At present these difficulties mean that the technique is too unreliable for routine clinical use and its effectiveness has yet to be demonstrated in a randomised trial. If this method is to be used with the CTG, then it also has the disadvantage of requiring an additional electrode to be introduced via the vagina.

The variable which is currently showing greatest promise is the ST-waveform of the fetal ECG and the changes which occur in it during hypoxia, (Greene, 1987).

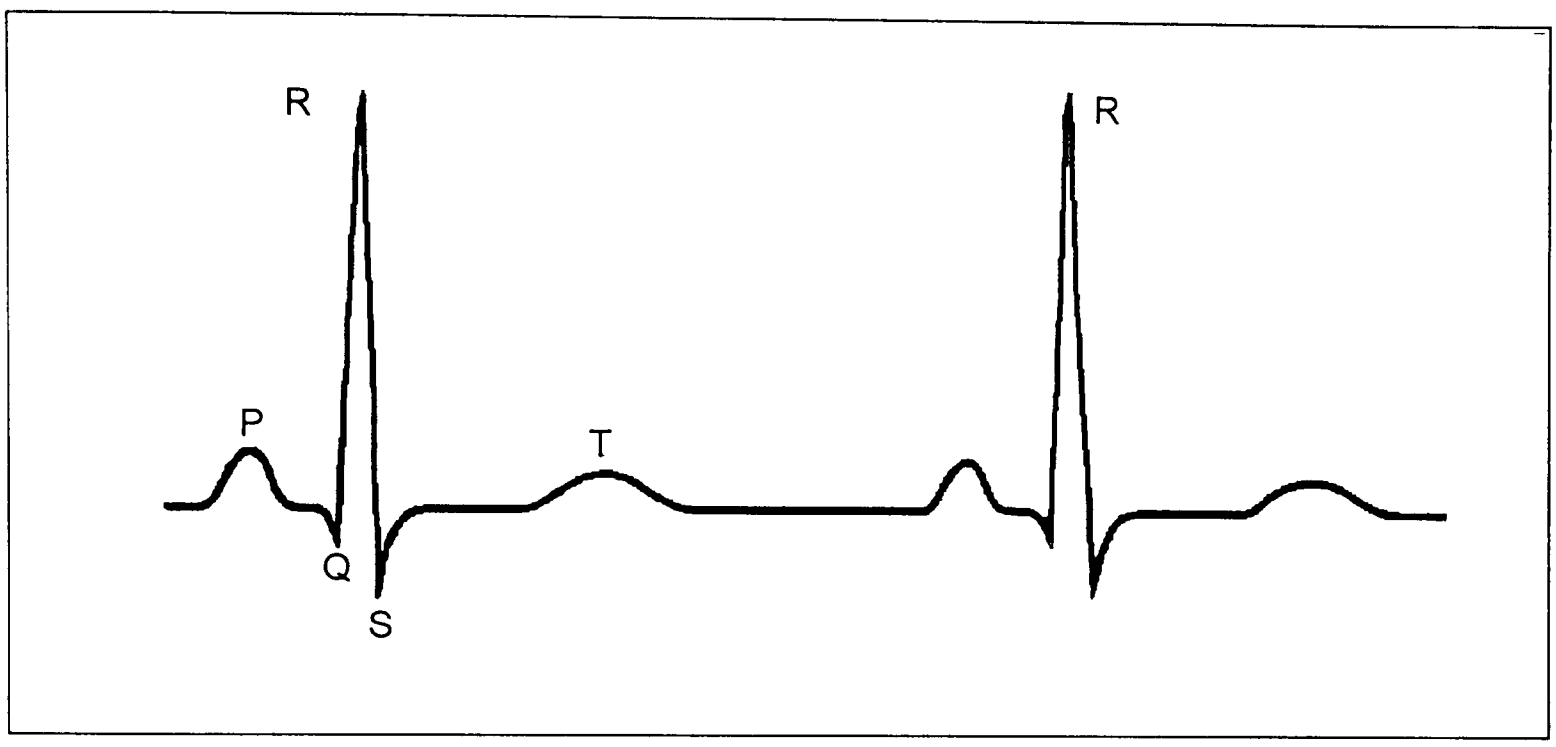

Figure 7.2: The ECG waveform.

The ECG waveform is shown in figure 7.2 and has been described in chapter 1. Like the adult, the fetal ECG is made up of the P, Q, R, S, and T waves. The ST waveform and T wave represent the active phase of the cardiac cycle and involves the repolarisation of the heart cells ready for the next stimulus. The adult ECG is used routinely for diagnosis purposes and in particular for stress tests during exercise. It is during these times of stress that changes occur in the ST waveform. It has been found that in the fetus too, this can provide additional clinically useful information.

It has been discussed that when the fetus becomes hypoxic it can switch to anaerobic metabolism by breaking down glycogen reserves. The by-product of this process is lactic acid but is also potassium ions. These can cause changes in the heart muscle cell membrane potentials which alter the shape of the ST waveform. Therefore changes in the ST waveform can provide continuous information on the metabolic functioning of the fetus.

The main advantage with the ST waveform is that it is available from the same signal source as that used to obtain heart rate. The processing of the ST waveform is computationally more demanding than heart rate but as was shown in chapter 2, if a single spiral electrode is used and precautions are taken in the design of the data collection system, then these difficulties can be overcome.

The clinical effectiveness of this technique has also been demonstrated in a randomised trial which compared conventional CTG monitoring, with CTG monitoring together with ST waveform analysis, (Westgate, 1992). This study was able to show that by including an analysis of the ST waveform, operative intervention was reduced by half without affecting outcome.

The advantage of the rule based approach adopted for the system is that the knowledge can be easily modified and updated to include information obtained from new techniques.

7.6.2 Reasoning with uncertainty.

A possible limitation with the current form of the systems knowledge is that it is 'crisp'; it relies on facts which can either be true, or false. Measures in the natural world are seldom in this form, they are usually shades of grey.

Research is underway in Plymouth, to investigate whether the performance of the system could be improved by incorporating inexact or approximate reasoning. The most promising method for representing this approach seems to be, fuzzy set theory or fuzzy logic as it is often called (Zadeh, 1975a, 1975b, 1975c). This theory considers membership functions to assess how much evidence there is that a set of conditions are associated with a certain grouping. For example, the system in its current form considers the heart rate to be a tachycardia when it is greater than 160 bpm. This means that it would consider 161 bpm as a tachycardia, but would consider 159 bpm as normal. Fuzzy theory takes a different view. It would regard a baseline heart rate of 175 bpm to almost certainly be a member of the fuzzy-set of tachycardias. It would regard a baseline of 161 bpm as having significant but less evidence that it was a member of this set and similarly some, but less evidence for a baseline of 159 bpm.

7.7 Final conclusions.

The findings of this study were both positive and conclusive and as such challenge the view which questions the value of the CTG. In was recognised that the CTG when considered in isolation may indeed be an inaccurate test of fetal condition, but this study has shown that when experts apply their physiological knowledge and clinical experience and have access to all the relevant information, they can distinguish the compromised fetus from the fetus coping appropriately with labour with a high degree of accuracy.

The epigram at the start of this thesis is the conclusion to which it has been brought because for fetal monitoring, "the world of reality *is* a world of limitations". A single variable is unlikely to be found which accurately measures the condition of the fetus and is simple to obtain and reliable. However, this study has shown that despite the current limitations, expertise is achievable and suggests that the problems associated with fetal monitoring are more related to the transfer of knowledge to clinicians rather than the techniques they employ. The challenge remains to formulate a method to effectively transfer expertise to the labour ward and thereby address the real and practical problems which face fetal monitoring today. This thesis demonstrates that intelligent systems may provide the vehicle to achieve this.

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Appendix A

C - language software for analysis of the fetal electrocardiogram.

/* ANALYSE */

/* Program to assess the quality of ECG records stored on optical disk */
/* collected using different scalp electrodes. */

/* Written by Robert D.F. Keith */

```
#include <stdio.h>
#include <stdlib.h>                          /*** libraries to include *********/
#include <bios.h>
#include <graphics.h>

#include <math.h>
#define CLS printf("%c[2J",27)
                                    /** ANSI escape sequences to set **/
                                    /* up the clear screen command & **/
                                    /* the text, background colours ***/

#define SETCOLOUR printf("%c[1m%c[44m%c[36m",27,27,27)
#define INPUTCOLOUR printf("%c[1m%c[44m%c[37m",27,27,27)
#define RESET printf("%c[0m",27)  /********* reset the screen *******/

#define BLUE_SCREEN setbkcolor(9)
#define WHITE setcolor(15)
#define LT_BLUE setcolor(9)                  /* graphics screen definitions ****/
#define CYAN setcolor(11)                    /* setcolor sets the draw colour **/
#define RED setcolor(4)                      /* setbkcolor sets screen colour **/
#define YELLOW setcolor(14)
#define GREY setcolor(7)
#define SOLID_LINE setlinestyle(0, 0, 1)    /*** solid thin draw line *******/
#define DASHED_LINE setlinestyle(3, 0, 3)   /*** dashed thick line **********/
#define THICK_LINE setlinestyle(0, 0, 2)    /*** solid medium line **********/
                                           /* NOTE middle 0 has no effect **/
                                           /* for these linestyle options **/
#define TRUE 1                              /* definition for use with flags*/
#define size 15120

FILE *fp;                                  /* file pointer */
FILE *rwave;                               /* pointer to file rwave.dat *****/
FILE *base;                                /* pointer to file bline.dat *****/
FILE *mains;                               /* pointer to file mains.dat *****/
FILE *power;
FILE *snr;
FILE *spike;
FILE *drop_sat;

FILE *totals;

int data[15120], *pa;
int hours, minutes, seconds, hrs, mins, secs, g_driver, g_mode;
int file_flag;

int saturation_total;
int num_20sec_blks, num_5sec_blks;
int total_num_20sec_blks = 0;
int total_num_5sec_blks = 0;
float saturation_so_far = 0;
int drop_out;
float drop_out_so_far = 0;
int number_spikes;
int spikes_so_far = 0;
int power10;
int power20;
int power30;
int power40;

float stage1_coeff[12], stage2_coeff[70], decimated_data[4000],
      mains_coeff[72], baseline_coeff[96], rwave_coeff[72], x2[100];

float temp_array[500], mains_power, bline_power, rwave_power;
float baseline_snr, mains_snr;
```

```
float time = 0;

char file_name[30], scale[50];

/****************************** GLOBAL VARIABLES ************************/

/* INT */
/* hours, minutes seconds = time of data section within the data array *****/
/* hrs, mins, secs is the time associated with the display scales **********/
/* g_driver & g_mode are variables which, after using detectgraph(), *******/
/* correspond to the graphics driver and mode set on the computer **********/
/* file_flag is set when file pointer is at eof ***************************/

/* CHAR */
/* file_name is the string containing the name of the file *****************/
/* scale is the string holding the x axis time scale and is variable *******/
/* size is the constant associated with how much data is loaded into data **/
/* array. This represents just over 30 secs (30.24) for display purposes ***/

/* FLOAT */
/* stage1_coeffs & stage2_coeffs are arrays holding the coefficients for ***/
/* the decimation process. Decimated_data is an array holding the results **/
/* of the decimation, ie the decimated data. mains_coeff, baseline_coeff, **/
/* and rwave_coeff are the arrays which hold the coefficients which extract*/
/* the mains component, baseline and rwave signal respectively from the ****/
/* decimated data. x2 holds the results of filter operations - a scratch   */
/* array if you like. Tmp_array holds the filtered data ie either the mains*/
/* extracted data, or the baseline data or the rwave filtered data prior to*/
/* to calculation of the signal to noise ratios. */

/************************************************************************/

/****************************** MAIN PROGRAM ****************************/

main()
{
int option, flag, i, analysis_flag, fd, g, loops, s, jump;
char alpha, beta;
int v = 0;
float x_axis;
long old_time = 0;
long new_time = 0;

assign_coeffs();                          /** read decimation coeffs array */
BEGINNING:                                /*** for use with goto statement */

SETCOLOUR;                                /******* set up the screen *******/
get_file_info();                          /**** prompt for file info *******/
                                         /** seek the data start position **/
get_data();                               /* load raw data in array "data" **/

if(file_flag == TRUE)                     /** if an eof encountered *********/
      {
      errors(1);                         /*** print error message **********/
      goto BEGINNING;                    /***** go back to BEGINNING *******/
      }

RESET;                                   /****** reset the screen **********/
detectgraph(&g_driver, &g_mode);          /* finds out the graphics driver */
initgraph(&g_driver, &g_mode, "");        /* & sets up screen accordingly **/
g_mode = EGAHI;
display_data();                           /** display data *****************/
getch();                                  /** wait for a key to be pressed */
closegraph();                             /****** close down the graphics **/
flag = 0;                                 /* flag set on exit option *******/
analysis_flag = 0;
while(flag != TRUE)
      {
      SETCOLOUR;                          /**** set cyan text **************/
      CLS;                                /********** set blue screen ******/
      file_flag = 0;
      option = options();
      if(option == 'z')                   /****** zoom data ****************/
            {
             initgraph(&g_driver, &g_mode, "");
             display_data();
             zoom_data();
```

```
        closegraph();
        }
if(option == 's')                       /*********** scroll data *********/
       {
       initgraph(&g_driver, &g_mode, "");
       g_mode = EGAHI;
       scroll_data();
       if(file_flag == TRUE)      /****** loop until quit **********/
              {
              closegraph();
              fclose(fp);
              errors(2);          /** scroll past eof **************/
              hours = 0;
              minutes = 0;
              seconds = 0;
              fp = fopen(file_name,"rb");
              get_data();
              continue;           /***** display next 30 secs ******/
              }
       closegraph();
       }

if(option == 't')                       /****** time jump *****************/
       {
       fclose(fp);                  /***** close all open streams *****/
       fp = fopen(file_name,"rb");
       seconds = 0;
       jump = (60 * hours) + minutes;
       for(s = 0; s < (2 * jump) + 1; s++)
              {
              get_data();

              if(file_flag == TRUE)
                     {
                     errors(3);          /** time jump past eof *********/
                     hours = 0;
                     minutes = 0;
                     seconds = 0;
                     fclose(fp);
                     fp = fopen(file_name,"rb");
                     get_data();
                     closegraph();
                     goto BEGINNING;
                     }
              }
       RESET;
          initgraph(&g_driver, &g_mode, "");
       display_data();
       getch();
       closegraph();
       }
if(option == 'v')
       {
       closegraph();
       v = 0;
       while(TRUE)
              {
              for(i = (v*500); i < (500*(v+1)); i++)
                     printf("%d\n", data[i]);
              beta = getch();
              if(beta == 'q')
                     {
                     break;
                     }
              else
                     {
                     v++;
                     continue;
                     }
              }
       }
if(option == 'c')                       /**** new data file ***************/
       {
       fcloseall();
       goto BEGINNING;              /***** get new file info **********/
       }
if(option == 'a')
```

```
{
printf("how many sections to be analysed\t");
scanf("%d", &loops);
old_time = biostime(0, old_time);
CLS;
   initgraph(&g_driver, &g_mode, "");
file_flag = 0;
g = 0;
power10 = 0;
power20 = 0;
power30 = 0;
power40 = 0;
x_axis = 0;
open_files();
do
       {
       cleardevice();
       display_data();
       saturation();
       signal_drop_out();
       rwave_power = 0;
       baseline_snr = 0;
       bline_power = 0;
       mains_snr = 0;
       mains_power = 0;
       if(saturation_total == 0 && drop_out == 0)
              {
              delete_line(10);
              YELLOW;
              outtextxy(150,10, "Decimation in progress");
              decimate();
              filter_coeffs();
              delete_line(10);
              YELLOW;
              outtextxy(150,10, "Mains extraction in progress");
              extract_mains();
                    delete_line(10);
              YELLOW;
              outtextxy(150,10, "Baseline extraction in progress");
              extract_baseline();
                    delete_line(10);
              YELLOW;
              outtextxy(150,10, "R wave extraction in progress");
              extract_rwave();
              delete_line(10);
              YELLOW;
              outtextxy(150,10, "Power calculations in progress");
              calculate_mains_power();
              calculate_bline_power();
              calculate_rwave_power();
              calculate_sig_to_noise();
              if(bline_power <= 10)
                     {
                     power10++;
                     }
              if(bline_power > 10 && bline_power <= 20)
                     {
                     power20++;
                     }
              if(bline_power > 20 && bline_power <= 30)
                     {
                     power30++;
                     }
              if(bline_power > 30)
                     {
                     power40++;
                     }
       }
detect_spikes();
results_to_file(x_axis);
set_up_scales();
g++;
    x_axis = x_axis + 0.5;

if(g == loops)
       {
       analysis_flag = TRUE;
```

```
                        }
                    get_data();
                    if(file_flag == TRUE)
                        {
                        analysis_flag = TRUE;
                        }
                    }
                    while(analysis_flag != TRUE);

                    new_time = biostime(0, new_time);
                    time = new_time - old_time;
                    totals = fopen("\\totals.rdf", "w");
                    totals_to_file();
                    fcloseall();
                    closegraph();
                    RESET;
                    CLS;
                    exit(1);
                    }

        if(option == 'e')                    /****** exit program *************/
                {
                flag = TRUE;
                closegraph();
                RESET;                      /******* reset screen to B/W ******/
                CLS;
                fcloseall();                /******* closeall open streams ****/
                }
        }
}
/*************************************************************************/


/****************************** GET FILE INFO ****************************/
get_file_info()
{
RESET;                                       /******* reset the screen *******/

while (TRUE)                                 /* endless loop broken when *****/
{                                            /* a file has been successfully */
                                          /* opened.
CLS;                                         /* clear screen - makes blue ****/
SETCOLOUR;                                   /* set screen and text colour ***/
CLS;
printf("\n\tName of STAN data file (full DOS path)? \n");

INPUTCOLOUR;                                 /* change text colour ***********/
printf("\n\t");                              /*********** move cursor ********/
scanf("%s",&file_name);                      /****** get file name ***********/

if ((fp = fopen(file_name,"rb")) == NULL)    /* returns NULL on unsuccessful */
        {                                   /*** fopen ***/
        errors(4);                          /*** print error message 4 ******/
        continue;                           /***** re-prompt for file name **/
        }
else
        {
        break;                              /* if open successful exit loop */
        }
}

SETCOLOUR;                                   /* change text colour ***********/
CLS;                                         /* make screen blue *************/
hours = 0;
minutes = 0;
seconds = 0;
}
/*************************************************************************/
/********************** GET DATA FROM STAN FILE ****************************/
/** This function will get bytes from a STAN file, strip out the markers ***/
/***** and store the data in an array length 30000 (30 seconds worth) ******/

get_data()
{
int sample,offset;
                                        /* sample = current data value ****/
```

```
pa = &data[0];                                  /* Set pointer to start of array  */
offset = 0;                                     /*** offset position for array ****/

START:                                          /****** Label for GOTO useage *****/

sample = get_sample();                          /********* get next sample ********/
if(file_flag == TRUE)                           /** set when file pointer at eof **/
       {
       return;                                 /***** test for eof ***************/
       }
if (sample != 255) goto START;                  /** loop until a "255" is found ***/

sample = get_sample();                          /********* get next sample ********/
if(file_flag == TRUE)                           /** set when file pointer at eof **/
       {
       return;                                 /*************** test for eof *****/
       }
if (sample != 1) goto START;                    /* if sample = 1 then raw data ****/
                                               /* is to follow ********************/

do                                              /**** loop until array = size *****/
                                               /**** OR until next "255" in file */
       {
       sample = get_sample();                   /********** get next sample *******/

       if(file_flag == TRUE)                    /** set when file pointer at eof **/
              {
              return;                          /** test for eof ******************/
              }
       if (sample == 255)
              {
              goto START;                      /***** a "255" = end of raw data */
              }
       else
              {
              *(pa+offset) = sample;           /**** data[offset] = sample ******/

              offset++;
              }
       }
while (offset != size);
}
/*****************************************************************************/

/******************************** GET SAMPLE *********************************/
/******* Will get the next 8 bit data sample from the input file ***********/
get_sample()
{
unsigned int d_num;
int test;

test = feof(fp);                                /* feof = 0 if pointer at eof ****/
if(test != 0)                                   /***** when eof detected *********/
       {
       file_flag = TRUE;                       /**** set eof flag to true *******/
       fcloseall();                            /***** close all open streams ****/
       closegraph();                           /***** close down the graphics ***/
       return(0);                              /***** return 0 to sample ********/
       }
d_num = getc(fp);                               /* get 8 bit character from file */
return (d_num);
}
/*****************************************************************************/
/********************************** ERRORS ***********************************/
/********** function to print out an error message ***************************/
errors(int num)
{
SETCOLOUR;                                      /** set text colour to cyan ******/
CLS;                                            /******* make text screen blue ***/

if(num == 1)                                    /*** if entered time is past eof */
       {
       printf("\n\tError 1: End of file in %s. Please re-enter\n",file_name);
       }

if(num == 2)                                      /* scrolling takes pointer past eof
*/
```

```
        {
        printf("\n\tError 2: You have scrolled to the end of the file\n");
        }

if(num == 3)                                                    /* on a time jump
*******************/
        {
        printf("\n\tError 3: Incorrect time entry: The file is not that long\n");
        }

if(num == 4)                                                    /**** unsuccessful opening of file
**/
        {
        printf("\n\tError 4: File %s does not exist\n",file_name);
        }
INPUTCOLOUR;

printf("\n\tPress any key to continue");
getch();
}
/*************************************************************************/

/****************************** DISPLAY DATA ****************************/
display_data()
{
int x_cord,y_cord;
char option;

set_up_screen();                        /**** colours, windows & text ****/

moveto(50,300-data[0]);                         /** move CP to first data point **/

draw(1,28);                             /* from start & every 28th point */

display_scales(30, 0);                          /** scale for 30 secs of data ****/
WHITE;                                  /***** draw colour = WHITE *******/
outtextxy(250, 310, "Time [hr:min:sec]");
outtextxy(26,30, "No. Bits");
}
/*************************************************************************/

/****************************** ZOOM DATA ****************************/
zoom_data()
{
int zoom_area;

delete_line(400);                       /****** delete line 400 **********/
select_option();                        /** draw zoom option sections ****/
scanf("%d", &zoom_area);                /****** get area to zoom *********/

cleardevice();                          /***** clear graphics screen *****/
set_up_screen();                        /**** colours, window & text *****/
delete_line(310);                 /***** delete current scales *****/
moveto(50,300-data[0+((zoom_area-1)*3000)]);
                                  /* move CP to first zoom point ***/

draw(zoom_area,4);                      /**** draw from start of zoom ****/
                                  /** section every 4th data point */

display_scales(6, zoom_area);           /** zoom section 6 secs long *****/
WHITE;
outtextxy(250, 310, "Time [hr:min:sec]");
outtextxy(26,30, "No. Bits");
getch();                                /****** wait for response ********/

}
/*************************************************************************/

/****************************** SET UP SCREEN ****************************/
set_up_screen()
{
int length;
div_t x;

BLUE_SCREEN;                                    /**** light blue background ******/

CYAN;                                           /**** draw colour = cyan *********/
```

```
THICK_LINE;                                          /***** line thickness = 2 ********/
rectangle(50,45,590,300);                            /****** draw graph boarder *******/

outtextxy(40,295,"0");                               /******* Y axis scales ***********/
outtextxy(25,45, "255");
GREY;                                                /****** draw colour = grey *******/
rectangle(0, 460, 630, 480);                         /*** draw box for program info ***/
setfillstyle(1, 7);                                  /**** set solid grey fill style **/
floodfill(10, 470, 7);                               /**** fill in box area in grey ***/
WHITE;                                               /**** draw colour = white ********/
length = strlen(file_name);                          /**** find number characters *****/
x = div(length,2);                                   /**** divide by 2 (centre text) **/
outtextxy((315 - (x.quot*8)), 360, file_name); /*(centre-(no. chars*width) */
RED;                                                 /***** draw colour = red *********/
outtextxy(5, 467, "Program: Analyse.");
outtextxy(365, 467, "Written by R.D.F. Keith June 1990.");
}
/*****************************************************************************/

/****************************** DISPLAY SCALES ***************************/
display_scales(int i, int zoom_area)
{
int length;
CYAN;                                                /****** draw colour = cyan *******/
delete_line(310);                                    /*** delete previous scales ******/
if(i == 30)                                          /* scaling for data 30 secs long */
       {
       hrs = hours;
       mins = minutes;
       secs = seconds;
       join_strings(hrs, mins, secs);     /** concat strings to get time$ **/
       outtextxy(50,310,scale);           /*** display start time **********/

       secs = (seconds + 30);             /******* find end time ***********/
       time_check();                      /******* convert to base 60 ******/
       join_strings(hrs, mins, secs);     /** concat strings to get time$ **/
       length = strlen(scale);            /*** find out length of string ***/
       outtextxy(590 - (length * 8) ,310,scale); /*right justify end scale*/
       }

if(i == 6)                                           /* scaling for data 6 secs long **/
       {
       secs = seconds + ((zoom_area - 1) * 6); /* time of section start ***/
       mins = minutes;
       hrs = hours;
       time_check();                      /****** convert to base 60 *******/
       join_strings(hrs, mins, secs);     /** concat strings to get time ***/
       outtextxy(50, 310, scale);         /** display start time of section*/

       secs = secs + 6;                   /** find end time of section *****/
       time_check();                      /** convert to base 60 ***********/
       join_strings(hrs, mins, secs);     /** concat strings to get end $ **/
       length = strlen(scale);            /*** find length of end string ***/
       outtextxy(590 - (length  * 8),310, scale);  /* right justify scale */
       }
}
/*****************************************************************************/

/****************************** TIME CHECK *********************************/
/* Convert scale times to base 60 */

time_check()
{
if(secs > 59)
       {
       secs = (secs - 60);
       mins = (mins + 1);
       if(mins > 59)
              {
              mins = (mins - 60);
              hrs = (hrs + 1);
              }
       }
}
/*****************************************************************************/
```

```
/******************************** JOIN STRINGS ******************************/
/* Joins hour$, minute$ and second$ together to form the axis scale string */

join_strings(int hrs, int mins, int secs)
{
char hour[5], minute[20], second[20];

itoa(hrs, hour, 10);                          /* convert int. (base 10)*/
itoa(mins, minute, 10);                       /* to a string ***********/
itoa(secs, second, 10);
strcpy(scale, hour);                          /* copy hour$ to scale$ **********/
strcat(scale,":");                            /* append scale$ with ':' ********/
strcat(scale,minute);                         /* append scale$ with minute$ ****/
strcat(scale,":");                            /* append scale$ with ':' ********/
strcat(scale,second);                         /* append scale $ with second$ ***/
}
/*****************************************************************************/

/******************************** DRAW ***************************************/
draw(int section, int step)
{
int x_cord,y_cord;

WHITE;                                        /*** draw colour = white *********/
SOLID_LINE;                                   /*** solid line thickness = 1 ****/

for(x_cord = 1; x_cord < 540; x_cord++)       /** for each x coordinate ********/
      {

      y_cord = 300 - data[((section - 1)*3000) + (step*x_cord)];

            /***************** NOTE ***********************/
/* 300 = offset, section = area for zoom; =1 for no zoom, no.  points per **/
/* zoom section = 3000 (6 secs), step = 28 for 30 sec display or = 4 for ***/
/* 6 sec display */
            /**********************************************/
      lineto((x_cord+50), y_cord);      /* draw from CP to new coord *****/
      }
}
/*****************************************************************************/

/******************************** DELETE LINE ********************************/
delete_line(int line_no)
{
int colour,i;

colour = getcolor();                          /* find out previous draw colour */
LT_BLUE;                                      /* draw colour = light blue ******/
setfillstyle(0,9);                            /* set solid fill in light blue **/

rectangle(0,line_no,640,line_no+8);           /* draw rect. over line to del. **/
                                            /* 8 = char height in pixels *****/
floodfill(2,line_no+1,9);                     /* fill the line with light blue */
setcolor(colour);                             /* return to original draw colour*/
}
/*****************************************************************************/

/******************************** SELECT OPTION ******************************/
select_option()
{
int i;

YELLOW;                                       /***** draw colour = yellow ******/
outtextxy(50,400, "select section for zoom");
DASHED_LINE;                                  /* dashed line thickness = 3 *****/
line(50+108,45,50+108,300);
line(50+216,45,50+216,300);
line(50+324,45,50+324,300);                   /***** section partitions ********/
line(50+432,45,50+432,300);
SOLID_LINE;                                   /****** solid line ***************/
outtextxy(104, 35, "1");
outtextxy((104+108), 35, "2");
outtextxy((104+216), 35, "3");
outtextxy((104+324), 35, "4");              /******* print section numbers ****/
outtextxy((104+432), 35, "5");
}
```

```
/*****************************************************************************/
/********************************* OPTIONS ***********************************/
/******* options menu *********/

options()
{
char ch;
printf("\n\tSelect option:\n");
printf("\n\tZoom data");
INPUTCOLOUR;
printf("\t (z)\n");
SETCOLOUR;
printf("\n\tScroll data");
INPUTCOLOUR;
printf("\t (s)\n");
SETCOLOUR;
printf("\n\tTime jump");
INPUTCOLOUR;
printf("\t (t)\n");
SETCOLOUR;
printf("\n\tAnalyse data");
INPUTCOLOUR;
printf("\t (a)\n");
SETCOLOUR;
printf("\n\tChange file");
INPUTCOLOUR;
printf("\t (c)\n");
SETCOLOUR;
printf("\n\tView samples");
INPUTCOLOUR;
printf("\t (v)\n");

SETCOLOUR;
printf("\n\tExit Program");
INPUTCOLOUR;
printf("\t (e)\n");
printf("\n");
printf("\tOption:");
INPUTCOLOUR;
printf("\t ");
ch = getch();
SETCOLOUR;
CLS;
if(ch == 's')                              /** scroll option sub-menu ********/
        {
        INPUTCOLOUR;
        printf("\n\t----------------- SCROLL OPTION ----------------\n");
        SETCOLOUR;
        printf("\n\tAt any time during scroll option you can:\n");
        printf("\n\tNext frame");
        INPUTCOLOUR;
        printf("\t(any)\n");
        SETCOLOUR;
        printf("\n\tZoom data");
        INPUTCOLOUR;
        printf("\t(z)\n");
        SETCOLOUR;
        printf("\n\tQuit option");
        INPUTCOLOUR;
        printf("\t(q)\n");
        printf("\t\n");
        printf("\t\nPress any key to Continue");
        getch();
        }

if(ch == 't')                              /** time jump sub-menu ************/
        {
        INPUTCOLOUR;
        CLS;
        printf("\n\t--------------- TIME JUMP OPTION ---------------\n");
        SETCOLOUR;
        printf("\n\tNumber of hours from start of file\n");
        printf("\n\tHours = ");
        INPUTCOLOUR;
        scanf("%d",&hours);

        SETCOLOUR;
```

```
        printf("\n\tNumber of minutes from start of file\n");
        printf("\n\tMinutes = ");
        INPUTCOLOUR;
        scanf("%d",&minutes);
        }
return(ch);
}
/*****************************************************************************/

/****************************** SCROLL DATA ******************************/
scroll_data()
{
int flag;                                   /**** set when quit option taken **/
char ch;

flag = 0;
initgraph(&g_driver, &g_mode, "");
while(flag != TRUE)
        {
        set_up_scales();
        get_data();                         /** get next 30 secs of data *******/
        if(file_flag == TRUE)               /***** check for eof ***************/
                {
                return;
                }
        display_data();                     /* display data ********************/
        ch = getch();                       /**** get option *******************/

        if(ch == 'z')
                {
                zoom_data();
                }
        if(ch == 'q')
                {
                flag = TRUE;               /** quit scroll option *************/
                }
cleardevice();                              /** clear graphics screen **********/
    }
}
/*****************************************************************************/

/****************************** SET UP SCALES ****************************/
set_up_scales()
{
seconds = seconds + 30;                 /* set secs for start of next 30s */
if(seconds > 59)                        /* convert to base 60 *************/
        {
        seconds = seconds - 60;
        minutes = minutes + 1;
        }
if(minutes > 59)
        {
        minutes = minutes - 60;
        hours = hours + 1;
        }
}
/*****************************************************************************/

/****************************** ASSIGN COEFFS ****************************/
assign_coeffs()
{
int i,k;
float dum;

        /* Because of the symmetry associated with the coeffs, it */
        /* is only necessery to define half the values. */
        /* coeff[0] = coeff[N], coeff[1] = coeff[N-1] etc. */

        /******* Coefficients for first stage of decimation *******/

        stage1_coeff[0] = 0.0065417;     stage1_coeff[1] = 0.0079029;
        stage1_coeff[2] = -0.037461;     stage1_coeff[3] = -0.049154;
        stage1_coeff[4] = 0.14579;stage1_coeff[5] = 0.42665;

        /*************************************************************/
```

```
k = 5;
for(i = 6; i < 12; i++)                          /* 2nd half of coeff assignment ***/
       {
       stage1_coeff[i] = stage1_coeff[k];
       k--;                                     /* there are 12 coeffs in stage 1 */
       }

       /* Same comments apply for coeffs for second stage */

       /******* Coefficients for second stage of decimation ********/

       stage2_coeff[0] = -2.8901e-4;     stage2_coeff[1] = -5.4028e-4;
       stage2_coeff[2] = 0.0007343;      stage2_coeff[3] = 5.9946e-4;
       stage2_coeff[4] = -6.7544e-4;     stage2_coeff[5] = -0.0012811;
       stage2_coeff[6] = 6.1129e-04;     stage2_coeff[7] = 0.0020902;
       stage2_coeff[8] = -1.5175e-4;     stage2_coeff[9] = -0.0030269;
       stage2_coeff[10] = -8.3217e-4;    stage2_coeff[11] = 0.0038906;
       stage2_coeff[12] = 0.0024733;     stage2_coeff[13] = -0.0043998;
       stage2_coeff[14] = -0.0048125;    stage2_coeff[15] = 0.0041845;
       stage2_coeff[16] = 0.007763;      stage2_coeff[17] = -0.0028237;
       stage2_coeff[18] = -0.011071;     stage2_coeff[19] = -1.1437e-4;
       stage2_coeff[20] = 0.014294;      stage2_coeff[21] = 0.0050329;
       stage2_coeff[22] = -0.016783;     stage2_coeff[23] = -0.012297;
       stage2_coeff[24] = 0.017664;      stage2_coeff[25] = 0.022302;
       stage2_coeff[26] = -0.015726;     stage2_coeff[27] = -0.035741;
       stage2_coeff[28] = 9.005899e-4;   stage2_coeff[29] = 0.054545;
       stage2_coeff[30] = 0.0069628;     stage2_coeff[31] = -0.085984;
       stage2_coeff[32] = -0.049684;     stage2_coeff[33] = 0.17928;
       stage2_coeff[34] = 0.41453;

       /*********************************************************/
k = 34;
for(i = 35; i < 70; i++)                         /* 2nd half of coeff assignment ***/
       {
       stage2_coeff[i] = stage2_coeff[k];
       k--;                                     /* there are 70 coeffs in stage 2 */
       }
}
/*************************************************************************/

/********************************* DECIMATE ******************************/

/*** The decimation factor is 4 and the number of stages is 2. ************/
/*** function reduces the sampling frequency from 500 to 125 Hz and so *****/
/** reduces the max freq. of interest to 62.5 Hz. This decimated data will */
/** will be used to calculate the power of the mains interference and the **/
/** power associated with the base-line drift ****************************/

decimate()
{
float x1[20], ytemp;

int decimation_factor_for_1, decimation_factor_for_2, z, j, i, k,
    coeffs_in_1, coeffs_in_2;
int count1, count2;

coeffs_in_1 = 11;                                /* N - 1 coeffs in stage 1 ********/
coeffs_in_2 = 69;                                /* N - 1 coeffs in stage 2 ********/
decimation_factor_for_1 = 2;
decimation_factor_for_2 = 2;
count1 = decimation_factor_for_1;
count2 = decimation_factor_for_2;
i = 0;                                           /** array offset for data[] *******/
z = 0;                                           /**  "     " for decimated_data[] */

for(j = 0; j < 20; j++)
       {
       x1[j] = 0;
       }
for(j = 0; j < 80; j++)                          /* initialise arrays to 0 *********/
       {
       x2[j] = 0;
       }
```

```
while(i != size)                                    /* exit when data decimated*/
        {

        for(j = 1; j <= coeffs_in_1; j++) /* shuffle data down in stage1 ***/
                {                                   /* array and insert latest value */
                k = coeffs_in_1 - j + 1;   /* in x[0]. The oldest value *****/
                x1[k] = x1[k-1];          /* falls off the end *************/
                }
        x1[0] = data[i];

        count1--;
        if(count1 != 0)                             /* get next point and repeat *****/
                {
                i++;
                continue;
                }

        ytemp = 0;

        /* multiply each array location and add result **********/
        /* to previous result for all elements in stage1 array. */

        for(j = 0; j <= coeffs_in_1; j++)
                {
                ytemp = ytemp + (stage1_coeff[j] * x1[j]);
                }
        /*****************************************************/

        count1 = decimation_factor_for_1;

        for(j = 1; j <= coeffs_in_2; j++)  /* shuffle for stage2 array *****/
                {
                k = coeffs_in_2 - j + 1;
                x2[k] = x2[k-1];
                }
        x2[0] = ytemp;                              /** insert newest value *********/

        ytemp = 0;
        count2--;

        if(count2 != 0)                            /***** get next data point ********/
                {
                i++;
                continue;
                }

        count2 = decimation_factor_for_2;

        for(j = 0; j <= coeffs_in_2; j++)  /* multiply each array location */
                {                                   /* and add to previous result ***/
                ytemp = ytemp + (stage2_coeff[j] * x2[j]);
                }

        decimated_data[z] = ytemp;          /* decimated data point *********/
        /*printf("%f\n",decimated_data[z]);*/
        i++;
        z++;                                        /** increment array offsets *****/
        continue;
        }
}
/*************************************************************************/

/***************************** ASSIGN FILTER COEFFS ************************/
filter_coeffs()
{
int k, i;
        /******** 50 Hz extraction filter coefficients ***********/

        mains_coeff[0] = -0.0090713;     mains_coeff[1] = -0.0071267;
        mains_coeff[2] = 0.0076893;      mains_coeff[3] = -0.0078048;
        mains_coeff[4] = 0.0061224;      mains_coeff[5] = -0.002653;
        mains_coeff[6] = -0.00133;       mains_coeff[7] = 0.0040765;
        mains_coeff[8] = -0.0044633;     mains_coeff[9] = 0.0027741;
        mains_coeff[10] = -5.9713e-4;    mains_coeff[11] = -1.4045e-4;
        mains_coeff[12] = -0.0014514;    mains_coeff[13] = 0.0043484;
        mains_coeff[14] = -0.0059049;    mains_coeff[15] = 0.0033575;
```

```
        mains_coeff[16] = 0.0041591;      mains_coeff[17] =  -0.014311;
        mains_coeff[18] = 0.021959;       mains_coeff[19] = -0.021438;
        mains_coeff[20] = 9.793199e-3;    mains_coeff[21] = 0.010739;
        mains_coeff[22] = -0.032445;      mains_coeff[23] = 0.045108;
        mains_coeff[24] = -0.04051;       mains_coeff[25] = 0.017113;
        mains_coeff[26] = 0.017972;       mains_coeff[27] = -0.051012;
        mains_coeff[28] = 0.0672;         mains_coeff[29] = -0.057417;
        mains_coeff[30] = 0.023052;       mains_coeff[31] = 0.023563;
        mains_coeff[32] = -0.06384;       mains_coeff[33] = 0.080726;
        mains_coeff[34] = -0.066283;      mains_coeff[35] = 0.0255505;

        /*********************************************************/
k = 35;
for(i = 36; i < 72; i++)                    /* 2nd half of coeff assignment ***/
        {
        mains_coeff[i] = mains_coeff[k];
        k--;                                /* 72 coeffs in 50hz_coeff ********/
        }

        /************* Baseline extraction coefficients ***********/

        baseline_coeff[0] = -0.025121;     baseline_coeff[1] = 0.00399952;
        baseline_coeff[2] = 0.0038247;     baseline_coeff[3] = 0.0037413;
        baseline_coeff[4] = 0.003744;      baseline_coeff[5] = 0.0038122;
        baseline_coeff[6] = 0.0039513;     baseline_coeff[7] = 0.0041396;
        baseline_coeff[8] = 0.0043829;     baseline_coeff[9] = 0.0046684;
        baseline_coeff[10] = 0.0049972;    baseline_coeff[11] = 0.0053575;
        baseline_coeff[12] = 0.0057547;    baseline_coeff[13] = 0.0061706;
        baseline_coeff[14] = 0.0066223;    baseline_coeff[15] = 0.0070841;
        baseline_coeff[16] = 0.0075798;    baseline_coeff[17] = 0.008091;
        baseline_coeff[18] = 8.567101e-3;  baseline_coeff[19] = 9.146199e-3;
        baseline_coeff[20] = 0.0096813;    baseline_coeff[21] = 0.010214;
        baseline_coeff[22] = 0.010749;     baseline_coeff[23] = 0.011297;
        baseline_coeff[24] = 0.011854;     baseline_coeff[25] = 0.012407;
        baseline_coeff[26] = 0.012953;     baseline_coeff[27] = 0.013491;
        baseline_coeff[28] = 0.014014;     baseline_coeff[29] = 0.014525;
        baseline_coeff[30] = 0.015022;     baseline_coeff[31] = 0.015502;
        baseline_coeff[32] = 0.015971;     baseline_coeff[33] = 0.016417;
        baseline_coeff[34] = 0.016849;     baseline_coeff[35] = 0.017258;
        baseline_coeff[36] = 0.017627;     baseline_coeff[37] = 0.017992;
        baseline_coeff[38] = 0.01832;      baseline_coeff[39] = 0.018616;
        baseline_coeff[40] = 0.018882;     baseline_coeff[41] = 0.019117;
        baseline_coeff[42] = 0.01933;      baseline_coeff[43] = 0.019503;
        baseline_coeff[44] = 0.019639;     baseline_coeff[45] = 0.019743;
        baseline_coeff[46] = 0.019808;     baseline_coeff[47] = 0.019842;

        /*********************************************************/

k = 47;
for(i = 48; i < 96; i++)                    /* 2nd half of coeff assignment ***/
        {
        baseline_coeff[i] = baseline_coeff[k];
        k--;                                /* 96 coeffs in baseline_coeff */
        }

        /************** R wave extraction coefficients ************/

        rwave_coeff[0] = 0.0026578;       rwave_coeff[1] = -0.0075544;
        rwave_coeff[2] = 0.0273;          rwave_coeff[3] = 0.0097524;
        rwave_coeff[4] = 0.0027689;       rwave_coeff[5] = 0.013144;
        rwave_coeff[6] = 9.3757e-4;       rwave_coeff[7] = 0.0075557;
        rwave_coeff[8] = 0.012592;        rwave_coeff[9] = -0.0024583;
        rwave_coeff[10] = 0.012202;       rwave_coeff[11] = 0.0060547;
        rwave_coeff[12] = -0.0046728;     rwave_coeff[13] = 0.01384;
        rwave_coeff[14] = -0.0054332;     rwave_coeff[15] = -0.004492;
        rwave_coeff[16] = 9.418799e-3;    rwave_coeff[17] = -0.019357;
        rwave_coeff[18] = -0.0020781;     rwave_coeff[19] = -0.0031937;
        rwave_coeff[20] = -0.031494;      rwave_coeff[21] = 0.0005579;
        rwave_coeff[22] = -0.024179;      rwave_coeff[23] = -0.037034;
        rwave_coeff[24] = -5.707e-5;      rwave_coeff[25] = -0.051089;
        rwave_coeff[26] = -0.031424;      rwave_coeff[27] = -8.895001e-3;
        rwave_coeff[28] = -0.079171;      rwave_coeff[29] = -9.998999e-3;
        rwave_coeff[30] = -0.033802;      rwave_coeff[31] = -0.10254;
        rwave_coeff[32] = 0.042121;       rwave_coeff[33] = -0.10817;
        rwave_coeff[34] = -0.11582;       rwave_coeff[35] = 0.53442;
        /*********************************************************/
```

```
k = 35;
for(i = 36; i < 72; i++)                          /* 2nd half of coeff assignment ***/
       {
       rwave_coeff[i] = rwave_coeff[k];
       k--;                                      /* 72 coeffs in rwave_coeff */
       }
}
/*****************************************************************************/

/****************************** EXTRACT MAINS ********************************/
extract_mains()
{
int i, j, k, z, n, g;
float y;
n = 71;                                           /* number of coeffs - 1 **********/

if ((mains = fopen("\\mains.dat", "w")) == NULL)
{                                                 /* if can't open mains.dat*/
printf("cannot open mains.dat");                  /* print error message ****/
getch();                                          /* wait for response ******/
}

for(j = 0; j < 100; j++)                          /* make coeff array = 0 ***/
       {
       x2[j] = 0;
       }
i = 0;                                            /* set array offsets = 0 **/
z = 0;

while(i < 3800)                                    /* 3800 points ***********/
       {
       for(j = 1; j <= n; j++)
              {
              k = n - j + 1;                      /* shuffle array *********/
              x2[k] = x2[k-1];
              }
       x2[0] = decimated_data[i];
       /*printf("%f\n",decimated data[i]);*/
       y = 0;
       for(j = 0; j <= n; j++)                    /* calc new point ********/
              {
              y = y + (mains_coeff[j] * x2[j]);
              }
       temp_array[z] = y;
       z++;
       if(z == 380)
              {
              for (g = 0; g < 380; g++)           /* print array to file ***/
                     {
                     fprintf(mains, "%f\n", temp_array[g]);
                     }
              z = 0;
              }
       i++;
       }
fclose(mains);
}
/*****************************************************************************/

/***************************** EXTRACT BASE-LINE *****************************/
extract_baseline()
{
int i, j, k, z, n, g;
float y;
n = 95;                                           /* number of coeffs - 1 **********/

if ((base = fopen("\\bline.dat", "w")) == NULL)
{                                                 /* if can't open bline.dat*/
printf("cannot open bline.dat");                  /* print error message ****/
getch();                                          /* wait for response ******/
}

for(j = 0; j < 100; j++)                          /* make coeff array = 0 ***/
       {
       x2[j] = 0;
       }
```

```
i = 0;                                                  /* set array offsets = 0 **/
z = 0;

while(i < 3800)                                          /* 3800 points ***********/
       {
       for(j = 1; j <= n; j++)
              {
              k = n - j + 1;                          /* shuffle array *********/
              x2[k] = x2[k-1];
              }
       x2[0] = decimated_data[i];
       /*printf("%f\n",decimated_data[i]);*/
       y = 0;
       for(j = 0; j <= n; j++)                          /* calc new point ********/
              {
              y = y + (baseline_coeff[j] * x2[j]);
              }
       temp_array[z] = y;
       z++;
       if(z == 380)
              {
              for (g = 0; g < 380; g++)                /* print array to file ***/
                     {
                     fprintf(base, "%f\n", temp_array[g]);
                     }
              z = 0;
              }
       i++;
       }

fclose(base);
}
/*****************************************************************************/

/****************************** EXTRACT R-WAVE ******************************/
extract_rwave()
{
int i, j, k, z, n, g;
float y;

n = 71;                                                 /* number of coeffs - 1 **********/

if ((rwave = fopen("\\rwave.dat", "w")) == NULL)
{                                                       /* if can't open mains.dat*/
CLS;
printf("cannot open rwave.dat");                        /* print error message ****/

getch();                                                /* wait for response ******/
return;
}
for(j = 0; j < 100; j++)                                /* make coeff array = 0 ***/
       {
       x2[j] = 0;
       }
i = 0;                                                  /* set array offsets = 0 **/
z = 0;

while(i < 3800)                                          /* 3800 points ***********/
       {
       for(j = 1; j <= n; j++)
              {
              k = n - j + 1;                          /* shuffle array *********/
              x2[k] = x2[k-1];
              }
       x2[0] = decimated_data[i];
       /*printf("%f\n",decimated_data[i]);*/
       y = 0;
       for(j = 0; j <= n; j++)                          /* calc new point ********/
              {
              y = y + (rwave_coeff[j] * x2[j]);
              }
        temp_array[z] = y;
       z++;
       if(z == 380)
              {
              for (g = 0; g < 380; g++)                /* print array to file ***/
                     {
```

```
                    fprintf(rwave, "%f\n", temp_array[g]);
                    }
                z = 0;
                }
        i++;
        }
fclose(rwave);
}
/*****************************************************************************/

/************************* CALCULATE MAINS POWER ****************************/
calculate_mains_power()
{
int i;
float mains_total, mains_mean, squared_total, mean_squared;


mains_total = 0;
squared_total = 0;

if ((mains = fopen("\\mains.dat", "r")) == NULL)
        {                                           /* if can't open mains.dat*/
        printf("cannot open mains.dat");            /* print error message ****/
        getch();                                    /* wait for response ******/
        return;
        }
              /***** LOAD IN MAINS DATA *****/

for(i = 0; i < 3800; i++)
        {
        fscanf(mains, "%f\n", &decimated_data[i]);
        }
                /***** CALCULATE MEAN *****/

for(i = 300; i < 3800; i++)
        {
        mains_total = mains_total + decimated_data[i];
        }

mains_mean = mains_total / 3500;

                /***** SUBTRACT MEAN *******/

for(i = 300; i < 3800; i++)
        {
        decimated_data[i] = decimated_data[i] - mains_mean;
        }
               /***** SQUARE SAMPLES ******/

for(i = 300; i < 3800; i++)
        {
        decimated_data[i] = decimated_data[i] * decimated_data[i];
        }
              /***** CALCULATE MEAN OF SQUARES *****/

for(i = 300; i < 3800; i++)
        {
        squared_total = squared_total + decimated_data[i];
        }
mean_squared = squared_total / 3500;
mains_power = 10 * log10(mean_squared);
fclose(mains);
}
/*****************************************************************************/

/************************ CALCULATE BASE LINE POWER ************************/
calculate_bline_power()
{
int i;
float bline_total, bline_mean, squared_total, mean_squared;
bline_total = 0;
squared_total = 0;
if ((base = fopen("\\bline.dat", "r")) == NULL)
        {                                           /* if can't open mains.dat*/
        printf("cannot open bline.dat");            /* print error message ****/
        getch();                                    /* wait for response ******/
        return;
```

```
        }
                /***** LOAD IN BASE LINE DATA *****/
for(i = 0; i < 3800; i++)
        {
        fscanf(base, "%f\n", &decimated_data[i]);
        }
                  /***** CALCULATE MEAN *****/

for(i = 300; i < 3800; i++)
        {
        bline_total = bline_total + decimated_data[i];
        }

bline_mean = bline_total / 3500;
                  /***** SUBTRACT MEAN *******/

for(i = 300; i < 3800; i++)
        {
        decimated_data[i] = decimated_data[i] - bline_mean;
        }
                 /***** SQUARE SAMPLES ******/

for(i = 300; i < 3800; i++)
        {
        decimated_data[i] = decimated_data[i] * decimated_data[i];
        }
               /***** CALCULATE MEAN OF SQUARES *****/

for(i = 300; i < 3800; i++)
        {
        squared_total = squared_total + decimated_data[i];
        }
mean_squared = squared_total / 3500;
bline_power = 10 * log10(mean_squared);
fclose(base);
}

/*************************************************************************/
/************************* CALCULATE R-WAVE POWER ************************/
calculate_rwave_power()
{
int i;
float rwave_total, rwave_mean, squared_total, mean_squared;

rwave_total = 0;
squared_total = 0;

if ((rwave = fopen("\\rwave.dat", "r")) == NULL)
        {                                          /* if can't open mains.dat*/
        printf("cannot open rwave.dat");           /* print error message ****/
        getch();                                   /* wait for response ******/
        return;
        }
               /***** LOAD IN BASE LINE DATA *****/

for(i = 0; i < 3800; i++)
        {
        fscanf(rwave, "%f\n", &decimated_data[i]);
        }
                  /***** CALCULATE MEAN *****/

for(i = 300; i < 3800; i++)
        {
        rwave_total = rwave_total + decimated_data[i];
        }
rwave_mean = rwave_total / 3500;

                  /***** SUBTRACT MEAN *******/

for(i = 300; i < 3800; i++)
        {
        decimated_data[i] = decimated_data[i] - rwave_mean;
        }
                 /***** SQUARE SAMPLES ******/

for(i = 300; i < 3800; i++)
```

```
        {
        decimated_data[i] = decimated_data[i] * decimated_data[i];
        }
                /***** CALCULATE MEAN OF SQUARES *****/

for(i = 300; i < 3800; i++)
        {
        squared_total = squared_total + decimated_data[i];
        }
mean_squared = squared_total / 3500;
rwave_power = 10 * log10(mean_squared);
fclose(rwave);
}
/*************************************************************************/

/***************** CALCULATE SIGNAL TO NOISE RATIOS ***********************/
calculate_sig_to_noise()
{
baseline_snr = rwave_power - bline_power;
mains_snr = rwave_power - mains_power;
}
/*************************************************************************/

/******************************** SATURATION ******************************/
saturation()
{
int i;
int saturation_min = 15;
int saturation_max = 240;
int saturation_local;
int p, sat_flag;

num_20sec_blks = 0;
num_5sec_blks = 0;
saturation_local = 0;
saturation_total = 0;
i = 0;
p = 0;

while(i < 15120)
        {
        if(data[i] < saturation_min || data[i] > saturation_max)
                {
                saturation_total++;
                saturation_local++;
                i++;
                continue;
                }
        else
                {
                if(saturation_local < 50)
                        {
                        i++;
                        saturation_local = 0;
                        continue;
                        }
                if(saturation_local >= 50)
                        {
                        p = 0;
                        while(TRUE)
                                {
                                i++;
                                p++;
                                if(i == 15120)
                                        {
                                        saturation_local = saturation_local + p;
                                        saturation_total = saturation_total + p;
                                        check_sat_blocks(saturation_local);
                                        saturation_local = 0;
                                        break;
                                        }
                                if(data[i] < 20 || data[i] > 220)
                                        {

                                        saturation_local = saturation_local + p;
                                        saturation_total = saturation_total + p;
                                        break;
```

```
                        }
                    if(p == 250)
                        {
                        check_sat_blocks(saturation_local);
                        saturation_local = 0;
                        p = 0;
                        break;
                        }
                    }
                i++;
                }
            }
        }
check_sat_blocks(saturation_local);
saturation_local = 0;
total_num_5sec_blks = total_num_5sec_blks + num_5sec_blks;
total_num_20sec_blks = total_num_20sec_blks + num_20sec_blks;
saturation_so_far = saturation_so_far + saturation_total;
}
/*****************************************************************************/

/************************* CHECK SATURATION BLOCKS *************************/
check_sat_blocks(int block_size)
{
if(block_size > 10000)
        {
        num_20sec_blks++;
        }
if(block_size > 2500 && block_size < 10000)
        {
        num_5sec_blks++;
        }
}
/*****************************************************************************/

/******************************** DETECT SPIKES ****************************/
detect_spikes()
{
int i, p, total, mean, count, spike_count;
int spike_flag;
i = 0;
count = 0;
total = 0;

while(count < 126)
        {
        total = 0;
        i = 0 + (count * 120);
        for(p = 0; p < 120; p++)
                {
                total = total + data[i];
                i++;
                }
        mean = total / 120;
        i = 0 + (count * 120);

        for(p = 0; p < 120; p++)
                {
                data[i] = abs(data[i] - mean);
                i++;
                }
        count++;
        }
i = 0;
spike_count = 0;
number_spikes = 0;
spike_flag = 0;

while(i < 15120)
        {
        if(data[i] <= 50 )
                {
                i++;
                continue;
                }
        if(data[i] > 50)
                {
```

```
                while(TRUE)
                        {
                        spike_count++;
                        i++;
                        if(i == 15120 || data[i] < 50)
                                {
                                break;
                                }
                         }
                if(spike_count < 10 && i < 15020)
                        {
                        for(p = 0; p < 100; p++)
                                {
                                i++;
                                if(data[i] > 50)
                                        {
                                        spike_flag = TRUE;
                                        }
                                }
                        if(spike_flag != TRUE)
                                {
                                number_spikes++;
                                }
                        }
                spike_count = 0;
                spike_flag = 0;
                }
        i++;
        }
spikes_so_far = spikes_so_far + number_spikes;
}
/*************************************************************************/

/****************************** SIGNAL DROP OUT ***************************/
signal_drop_out()
{
int i, previous, count;
i = 0;
previous = 0;
drop_out = 0;
count = 0;
while(i < 15120)
        {
        previous = data[i];
        i++;
        if(data[i] != previous)
                {
                i++;
                continue;
                }
        while(TRUE)
                {
                count++;
                previous = data[i];
                i++;
                if(data[i] != previous)
                        {
                        i++;
                        break;
                        }
                }
        if(count > 100)
                {
                drop_out = count;
                }

        count = 0;
        }
drop_out_so_far = drop_out_so_far + drop_out;
}
/*************************************************************************/

/****************************** TOTALS TO FILE ****************************/
totals_to_file()
{
fprintf(totals, "\n");
fprintf(totals, "Results for %s\n", file_name);
```

```
fprintf(totals, "\n");
time = time / (18.2 * 60);
if(time < 0)
        {
        time = time + 1440;
        }
fprintf(totals,"Program execution time = %.0f minutes\n", time);
saturation_so_far = saturation_so_far / 500;
fprintf(totals, "total saturation = %.0f seconds\n", saturation_so_far);
fprintf(totals, "number 20 second blocks = %d\n",
        total_num_20sec_blks);
fprintf(totals, "number 5 second blocks = %d\n",
        total_num_5sec_blks);
drop_out_so_far = drop_out_so_far / 500;
fprintf(totals, "total drop out = %.0f seconds\n",
        drop_out_so_far);
fprintf(totals, "total number of spikes = %d\n",
        spikes_so_far);
fprintf(totals, "number baseline power levels less than 10 dB = %d\n",
power10);
fprintf(totals, "number baseline power levels between 10 and 20 dB = %d\n",
        power20);
fprintf(totals, "number baseline power levels between 20 and 30 dB = %d\n",
        power30);
fprintf(totals, "number baseline power levels greater than 30 dB = %d\n",
        power40);
}
/*************************************************************************/

/********************************* OPEN FILES ****************************/
open_files()
{
power = fopen("\\power.rdf", "w");
spike = fopen("\\spike.rdf", "w");
drop_sat = fopen("\\dropsat.rdf", "w");
snr = fopen("\\snr.rdf", "w");
}
/*************************************************************************/
```

```
/****************************** RESULTS TO FILE **************************/
results_to_file(float x_axis)
{
fprintf(power, "%3.1f\t%2.2f\t%2.2f\t%2.2f\n", x_axis,
      bline_power, mains_power, rwave_power);
fprintf(snr, "%3.1f\t%2.2f\t%2.2f\n", x_axis, baseline_snr, mains_snr);
fprintf(spike, "%3.1f\t%d\n", x_axis, number_spikes);
fprintf(drop_sat, "%3.1f\t%d\t%d\n", x_axis,
      drop_out, saturation_total);
}
/*************************************************************************/
```

Appendix B

C- software implementation of a three layer backpropagation neural network.

/* NEURAL NETWORK */

/* ROBERT D. F. KEITH JUNE 1991 */

// Implementation of a 3 layer, fully connected, feed-forward,
// Backpropagation Neural Network which utilises speeding up algorithms

```
#include <stdio.h>
#include <stdlib.h>                          /*** libraries to include *****/
#include <math.h>
#include <string.h>
#include <conio.h>

#define TRUE                1
#define FALSE               0
#define INPUTS              4
#define HIDDEN_LAYER        10
#define OUTPUTS             1

#define MOMENTUM    0.7
#define CLOSE_THRESHOLD   0.04
#define LOOP_MAX    1000000
#define CLS clrscr()
void load();

int h,i,j;

float input[INPUTS];
float desired_output[OUTPUTS];
float error_max=0, error_E=0, perc_close=0, number_close = 0;
float magic_alpha = 0.75;

FILE *fp;
FILE *rms_file;
FILE *in_file;
/***** EPOCH *******/
float epoch = 456;
long file_position[456];
char option, file_path[100];
int number, num_less_01=0;
int first_time_flag = TRUE, dir_flag = FALSE, input_flag = FALSE;
float outputs_close = 0;   /* to assess how many outputs are close to desired*/
float perc_outputs_close;
int file_open_flag = FALSE;   /* for load() */
int ran_flag = FALSE;
int z;
int ran_num=0;
float rate = 0.3;

main()
{
  float weights_v[INPUTS][HIDDEN_LAYER];
  float prev_weights_v[INPUTS][HIDDEN_LAYER];
  float weights_w[HIDDEN_LAYER][OUTPUTS];
  float prev_weights_w[HIDDEN_LAYER][OUTPUTS];
  float v_offset[HIDDEN_LAYER];
  float prev_v_offset[HIDDEN_LAYER];
  float w_offset[OUTPUTS];
  float prev_w_offset[OUTPUTS];
  float middle_node[HIDDEN_LAYER];
  float output_node[OUTPUTS];
  float d[OUTPUTS];
  float e[HIDDEN_LAYER];
  float temp_var;
  float local_error, rms_error, rms_total=0, rms_epoch=0, loop=0;
  int  flag, loop_flag, key, x_axis=0;
  unsigned long rms_loop = 0;
  char test;
  int output_tester;
  flag = FALSE;
```

```
/* ++++++++++++++++++++ LOAD IN DATA ++++++++++++++++++++++++++++ */
      /***************** V WEIGHTS ****************/
      fp = fopen("v.dat","rt");
      for(h=0; h < INPUTS; h++)
      {
            for(i=0; i < HIDDEN_LAYER; i++)
                  {
                  fscanf(fp,"%f",&weights_v[h][i]);
                  }
      }
      fclose(fp);
      /****************** PREV V WEIGHTS **********/
      fp = fopen("pre_v.dat","rt");
      for(h=0; h < INPUTS; h++)
      {
            for(i=0; i < HIDDEN_LAYER; i++)
                  {
                  fscanf(fp,"%f",&prev_weights_v[h][i]) ;
                  }
      }
      fclose(fp);
      /****************** W WEIGHTS **************/
      fp = fopen("w.dat","rt");
      for(i=0; i < HIDDEN_LAYER; i++)
      {
            for(j=0; j < OUTPUTS; j++)
                  {
                  fscanf(fp,"%f",&weights_w[i][j]) ;
                  }
      }
      fclose(fp);
      /****************** PREV W WEIGHTS **********/
      fp = fopen("pre_w.dat","rt");
      for(i=0; i < HIDDEN_LAYER; i++)
      {
            for(j=0; j < OUTPUTS; j++)
                  {
                  fscanf(fp,"%f",&prev_weights_w[i][j]);
                  }
      }
      fclose(fp);
      /****************** V OFFSETS **************/
      fp = fopen("v_off.dat","rt");
      for(i=0; i < HIDDEN_LAYER; i++)
      {
            fscanf(fp,"%f",&v_offset[i]);
      }
      fclose(fp);
      /****************** PREV V OFFSETS **************/
      fp = fopen("pre_voff.dat","rt");
      for(i=0; i < HIDDEN_LAYER; i++)
      {
            fscanf(fp,"%f",&prev_v_offset[i]);
      }
      fclose(fp);
      /****************** W OFFSETS **************/
      fp = fopen("w_off.dat","rt");

      for(j=0; j < OUTPUTS; j++)
      {
            fscanf(fp,"%f",&w_offset[j]);
      }
      fclose(fp);
      /****************** PREV W OFFSETS **************/
      fp = fopen("pre_woff.dat","rt");
      for(j=0; j < OUTPUTS; j++)
      {
            fscanf(fp,"%f",&prev_w_offset[j]);
      }
      fclose(fp);
/* ++++++++++++++++++++ FINISHED LOADING ++++++++++++++++++++++++++ */
fcloseall();
/************************ PROGRAM START *****************************/
rms_file = fopen("c:\\rms.dat", "wt");
loop_flag = TRUE;
randomize();
in_file = fopen("c:\\data\\jenny\\ac_ptr.dat", "rt");
```

```
for(j = 0; j < 400; j++)
        {
        fscanf(in_file, "%ld ", &file_position[j]);
        // printf("%d \n", file_position[j]);
        }
fclose(in_file);
in_file = fopen("c:\\data\\jenny\\train_ac.dat", "rt");
while(loop_flag == TRUE)
{
load();
        /****************** CALC MIDDLE NODE VALUES *************/
for(h = 0; h < INPUTS; h++)
{
        for(i = 0; i < HIDDEN_LAYER; i++)
        {
                middle_node[i] = middle_node[i] + (input[h] * weights_v[h][i]);
        }
}
for(i = 0; i < HIDDEN_LAYER; i++)
{
        middle_node[i] = middle_node[i] + v_offset[i];
        if(middle_node[i] >= -15 && middle_node[i] <= 15)
        middle_node[i] = 1.0 / (1 + (exp(-1.0 * middle_node[i])));
        if(middle_node[i] < -15)
                middle_node[i] = 0.000000;
        if(middle_node[i] > 15)
                middle_node[i] = 1.00000;
}
        /****************** CALC OUTPUT NODE VALUES ***********/
for(i = 0; i < HIDDEN_LAYER; i++)
{
        for(j = 0; j < OUTPUTS; j++)
        {
                output_node[j] = output_node[j] + (middle_node[i] *
weights_w[i][j]);
        }
}
for(j = 0; j < OUTPUTS; j++)
{
        output_node[j] = output_node[j] + w_offset[j];
        if(output_node[j] >= -15 && output_node[j] <= 15)
                output_node[j] = 1.0 / (1 + (exp(-1.0 * output_node[j])));
        if(output_node[j] < -15)
                output_node[j] = 0.000000;
        if(output_node[j] > 15)
                output_node[j] = 1.00000;
}
error_max = 0;
for(j = 0; j < OUTPUTS; j++)
        {
        error_E = (desired_output[j] - output_node[j]) * (desired_output[j]
                - output_node[j]);
                if(error_E > error_max)
                error_max = error_E;
        }
if(error_max < (magic_alpha * magic_alpha))
        number_close++;
if((error_max >= (magic_alpha * magic_alpha))|| (magic_alpha <= 0.01))
{
        /************* CALC ERROR IN OUTPUTS d[j]'s ***********/
for(j = 0; j < OUTPUTS; j++)
{
        d[j] = output_node[j] * (1 - output_node[j]) * (desired_output[j] -
        output_node[j]);
}
        /************* CALC ERROR IN MIDDLE LAYER e[i]'s ******/
for(i = 0; i < HIDDEN_LAYER; i++)
{
        local_error = 0;
        for(j = 0; j < OUTPUTS; j++)
        {
                local_error = local_error + (weights_w[i][j] * d[j]);
        }
        e[i] = middle_node[i] * (1 - middle_node[i]) * local_error;
}
        /************** ADJUST THE W WEIGHTS ******************/
for(i = 0; i < HIDDEN_LAYER; i++)
```

```
{
        for(j = 0; j < OUTPUTS; j++)
        {
        temp_var = weights_w[i][j];
        weights_w[i][j] = weights_w[i][j] + (rate * d[j] * middle_node[i])
              +(MOMENTUM*(weights_w[i][j]-prev_weights_w[i][j]));
        prev_weights_w[i][j] = temp_var;
        }
}
        /************** ADJUST THE W OFFSETS ******************/
for(j = 0; j < OUTPUTS; j++)
{
        temp_var = w_offset[j];
        w_offset[j] = w_offset[j] + (rate * d[j]) + (MOMENTUM * (w_offset[j] -
        prev_w_offset[j]));
        prev_w_offset[j] = temp_var;
}
        /************** ADJUST THE V WEIGHTS ******************/
for(h = 0; h < INPUTS; h++)
{
        for(i = 0; i < HIDDEN_LAYER; i++)
        {
        temp_var = weights_v[h][i];
        weights_v[h][i] = weights_v[h][i] + (rate * input[h] * e[i]) +
              (MOMENTUM * (weights_v[h][i] - prev_weights_v[h][i]));
        prev_weights_v[h][i] = temp_var;
        }
}
        /***************** ADJUST THE V OFFSETS ****************/
for(i = 0; i < HIDDEN_LAYER; i++)
{
        temp_var = v_offset[i];
        v_offset[i] = v_offset[i] + (rate * e[i]) + (MOMENTUM * (v_offset[i] -
        prev_v_offset[i]));
        prev_v_offset[i] = temp_var;
}
}
        /************** CALC ROOT MEAN SQUD ERROR AT OP'S ******/
        rms_error=0;
        for(j = 0; j < OUTPUTS; j++)
        {
        rms_error = rms_error + ((desired_output[j] -
                    output_node[j])*(desired_output[j] - output_node[j]));
        }
        rms_error = rms_error/OUTPUTS;
        rms_error = sqrt(rms_error);
        rms_total = rms_total + rms_error;
        rms_error = 0;
        /******* CALC TO SEE IF EXAMPLE CLOSE TO DESIRED RESPONSE *****/
        output_tester = 0;
        for(j = 0; j < OUTPUTS; j++)
              if((desired_output[j] - output_node[j])* (desired_output[j] -
         output_node[j]) >= CLOSE_THRESHOLD )
                    output_tester = 1;
        if(output_tester == 0)
              outputs_close++;
if(rms_loop == epoch)
        {
        ran_flag = FALSE;
        randomize();
        x_axis++;
        rms_epoch = rms_total/rms_loop;
        perc_close = number_close*100 /rms_loop;
        number_close = 0;
        perc_outputs_close = (outputs_close*100)/rms_loop;
        outputs_close = 0;
        fprintf(rms_file,"%d\t%.4f\n", x_axis, perc_outputs_close);
        if(perc_close >= 91.0 && magic_alpha > 0.01)
              {
              magic_alpha = magic_alpha * 0.75;
              if(magic_alpha < 0.01)
                    magic_alpha = 0.01;
              }
        rms_total = 0;
        rms_loop = 0;
        }
key = kbhit();
```

```
if(key != 0)
{
        option = getch();
        if(option == 'p')
                {
                if(flag == FALSE)
                        flag = TRUE;
                else
                        flag = FALSE;
                }
        if(option == 'i')
                {
                if(input_flag == FALSE)
                        input_flag = TRUE;
                else
                        input_flag = FALSE;
                }
        if(option == 'f')
                printf("%s\n", file_path);

        if(option == 'q')
                {
                loop_flag = FALSE;
                }
}
if(flag == TRUE)
        {
        printf("\n");
        //getch();
        for(z = 0; z < OUTPUTS; z++)
                printf("%.0f  des = %.0f  act = %f  rms = %.4f close = %.3f
                alpha = %.3f\n", loop, desired_output[z], output_node[z],
                        rms_epoch, perc_outputs_close, magic_alpha);
        }
rms_loop++;
loop++;
if(loop - LOOP_MAX >=0)
        {
        fcloseall();
        CLS;
        break;
        }
}
/************************* PROGRAM END ******************************/

/* ++++++++++++++++++++++++ SAVE DATA ++++++++++++++++++++++++++++ */
fcloseall();
        /***************** V WEIGHTS ****************/
        fp = fopen("v.dat","wt");
        for(h=0; h < INPUTS; h++)
        {
                for(i=0; i < HIDDEN_LAYER; i++)
                        {
                        fprintf(fp,"%f ",weights_v[h][i]);
                        }
        }
        fclose(fp);
        /****************** PREV V WEIGHTS **********/
        fp = fopen("pre_v.dat","wt");

        for(h=0; h < INPUTS; h++)
        {
                for(i=0; i < HIDDEN_LAYER; i++)
                        {
                        fprintf(fp,"%f ",prev_weights_v[h][i]) ;
                        }
        }
        fclose(fp);
        /****************** W WEIGHTS **************/
        fp = fopen("w.dat","wt");

        for(i=0; i < HIDDEN_LAYER; i++)
        {
                for(j=0; j < OUTPUTS; j++)
                        {
                        fprintf(fp,"%f ",weights_w[i][j]) ;
                        }
```

```
}
fclose(fp);
/****************** PREV W WEIGHTS **********/
fp = fopen("pre_w.dat","wt");

for(i=0; i < HIDDEN_LAYER; i++)
{
       for(j=0; j < OUTPUTS; j++)
              {
              fprintf(fp,"%f ",prev_weights_w[i][j]);
              }
}
fclose(fp);
/****************** V OFFSETS **************/
fp = fopen("v_off.dat","wt");

for(i=0; i < HIDDEN_LAYER; i++)
{
       fprintf(fp,"%f ",v_offset[i]);
}
fclose(fp);
/****************** PREV V OFFSETS **************/
fp = fopen("pre_voff.dat","wt");

for(i=0; i < HIDDEN_LAYER; i++)
{
       fprintf(fp,"%f ",prev_v_offset[i]);
}
fclose(fp);
/****************** W OFFSETS **************/
fp = fopen("w_off.dat","wt");
for(j=0; j < OUTPUTS; j++)
{
       fprintf(fp,"%f ",w_offset[j]);
}
fclose(fp);
/****************** PREV W OFFSETS **************/
fp = fopen("pre_woff.dat","wt");
for(j=0; j < OUTPUTS; j++)
       {
              fprintf(fp,"%f ",prev_w_offset[j]);
       }
       fclose(fp);
/* ++++++++++++++++++++++++ FINISHED SAVING ++++++++++++++++++++++ */
fcloseall();
}
/* load for dip classification */
void load()
{
char file_num_str[15];
int seek_ptr;
while(TRUE)
       {
       ran_num = random(400);
       if(ran_num >=0 && ran_num < 400)
              break;
       }
       // printf("%d ", ran_num);
       if(ran_num >= 0 && ran_num < 200)
              {
              desired_output[0] = 1.000;
              }
       if(ran_num >= 200 && ran_num < 400)
              {
              desired_output[0] = 0.000;
              }
       fseek(in_file, file_position[ran_num], 0);
       fscanf(in_file, "%f ", &input[0]);
       fscanf(in_file, "%f ", &input[1]);
       fscanf(in_file, "%f ", &input[2]);
       fscanf(in_file, "%f ", &input[3]);
 if(input_flag == TRUE)
      printf("%f %f %f %f\n",input[0],input[1],input[2],input[3]);
}
```

Appendix C

A transcript from a knowledge elicitation session.

Transcript from knowledge elicitation session 2

24th October 1990

Attending: Engineers
E Ifeachor,
R Keith,
Experts
J Westgate,
J Smith.

Key: 1 second pause = .
2 second pause = .. and so on
separation - = unfinished statement
Speaker is indicated by surname initial

Discussion of questions 3 and 4

I Question 3 is er where we wanted you to write down in any convenient form, eg rules, decisions, tree diagrams, whatever, how you actually score the EC - the um heart rate, how do you analyse them, how do you interpret them, you may use diagrams or rule whatever .... the other pointis how often is this done, how regularly do you .. scorethe ECG or the heart rate pattern really, you have already drawn some diagrams of something

W Yeah, I have, I have drawn some diagrams ....

I Do you want to talk us through that or its entirely up to you, want to er

W Well . I mean- . I think what I do is look at the thing and just- the first thing that I notice, the baseline heart rate whether its er, and the normal range is sort oflike 110 to 160 and that's the first thing that catches my eye, oh you know, where is it situated and then, and then, the next thing I notice is the variability, how much does it squiggle up and down um and thats the first thing that catches my eye, and the I sort of say well are there any accelerations on it and then are there any decelerations on it, and if there are when do they occur and then I look at the contraction channel at that stage to see how frequently the contractions are and then I sort of have a basic opinion in my head as to whether this is normal, ah .... well probably if I've just been called to look at it, then, as a CTG then I may not if its plum normal, I may just go and ask those other things just to sort of- just to make sure everything is progressing well because there must be some reason they called you, or if I'm in a room just reviewing and- er at hand over time or something, and that's er that's the sort of scheme

I When you say you look at the er um CTG, to see- to look at the baseline and so on, these are usually long pieces of paper running through, (JW yep) do you look at every. minute of it or (JW no I usually ah-) 5 minute, what do 60 you do

W Probably um look over at least .. the current 20 to 30 minutes and then I will look back as well, with what Jeremy and I were saying, you always look back to what was happening at the start depending on how long the trace is, so you may sit there and unfold the stuff just like this (visual demonstration with CTG trace) quickly and say yeah yeah that's normal that's normal that's normal and this is normal .... this is normal here, you've got

a little bit of a problem here but I'm not really worried because this was so normal .... yes you do have to, if I'm coming to review something as a registrar then I would always look at the whole- I look at the immediate trace and I look at the rest of the trace as well ....

I What do you look at um, because when I look at some of these waveforms, some of these heart rate patterns, .. I can see a very rapid change over a very short interval in time, does that mean anything? I mean if it doesn't persist for some time does that matter at all? ..

W Well, it depends what- (EI if you suddenly see a dip, a dip there back again or something) a sudden, a sudden 1 deceleration I wouldn't . necessarily be very concerned about, again I would want to look at what's been before and I would want to know .... if there had been a vaginal examination or she's been sick or been on the bed pan or epidural top up 20 minutes ago, I want to know what kindof dip it was

I Do you want to add anything to this er Jeremy?

S I think exactly the same um . the first thing I look at is as Jenny, that's to determine, there are a couple of patterns which will necessitate instant action which is normally a reflex action but that's rare, so the rest of the time then, I try to relate what I've been called to see to a clinical event exactly as Jenny described ... having got all that information .. if things arn't intending to proceed you then look for, I look for a trend .. and then the trend I relate to the pattern of labour, for example, in a very rapid labour you can sort of get a trend .... if the trend matches what I would expect then we carry on or do whatever action but again using all the things Jenny said

I Very similar to Jenny (JW yeah JS yes), you talked about the ranges or the range of the baseline, 110 to 160 I believe .... if it is for example 160 .. all the time-

W If its 160 all the time I will need to say ok what's the rest of it like, ah but essentially a higher baseline would make me want to say um what's the temperature of the 60 of the woman in labour, has she got an epidural in and how long has it been in, because we know that women with an epidural for long time will get hotter .. as they get hotter they get far-, higher pulse rate the baby gets hotter and puts its heart rate up so . um I want to know-, sometimes um high baseline rate is just an indication of a hot baby and a hot mother or sometimes its the beginning sign of um I wouldn't say hypoxic changes but along those lines and so I want to know if there's anything else that makes me worried about this baby, is there meconium ah . ye know um dips, what's the variability like, so I want to know all those things and I want to look back . with the trace to try and decide- .. I think an uncomplicated heart rate of 160 or a 170- . when I mean uncomplicated I mean theres no dips in it or (EI yes) anything, then I'm quite happy for that to continue as it is but if it was what we call a complicated tachycardia with some late decelerations, then I think that's, that's one of the, one of the patterns of the trace where you think, well I think I better perhaps take a closer look at this and if its been persistent then I will want to do a fetal blood sample ....

I It seems to me that ah regardless of what the heart rate is doing the the decelerations, the dips- are they, are they the warning signs, are those things, when they occur, you keep talk about dips (JW umm) is that-

W Well, I think that, I think heart rate tells a little, the basal heart rate tells you a little bit but I'm not, I don't get overly up tight about basal heart rate unless its at the extremes . the variability I think, I think's important

I It ought to vary, you know is that-

W The um, the actual, how much the beat- what we call the beat to beat, short term variability, the little jitter on the paper .... that's important but there are a lot of things that affect, that drugs, pethidine will knock that, sometime an epidural will make that go flat, sometimes the babies asleep so it will go flat . and I think decelerations, I don't get upset with early decelerations .. variable decelerations, that depends what they're like and late decelerations, I think you have to take some notice of them if they've been persistent, I don't think you could ignore um 40 minutes of late decelerations ....

I What would you say was the er bit that-, we've talked about the various things you look at, but I want toexplore a little bit more . where you have .. 'cause you could categorise babies or patients into, shall we say three categories . the very normal ones the the obviously abnormal ones (JW mm) and the bits in between which are a 60bit uncertain, what, what would trigger your mind and say this baby is definitely abnormal or something is abnormal ...

W The abnormal baby?

S And this on the CTG is it?

I On the CTG yes, how would you, how would you define that, what, what would you look for in a CTG to make you say ah! that babies abnormal clearly ..

S An overal abnormality is the most important thing rather than any one individual feature, the thing I'd say about dips is dips are one of the few things on a trace that are never good news ....

I Prolonged dips or-

S Any dip is never really good news where as all other variables, all other features of a trace really relate to good news, dips are the odd man out there, but having said that they very seldom are bad news but that's why dips are singled out .. they're never good news

W For example, on an antenatal trace, on someone not in labour, a dip is definitely bad news, I mean a dip is abnormal(JS certainly within this stable-) in that category, but yeah I'd agree with that 'cos dips I think dips are not goo- although there's a very good reasons for dips

S They may be good news in the sense they may tell you the woman is fully, or a multip of seven but that's, that's very much sort of fine tuning where, where you say good to a dip but that's just to be naughty a bit, by and large a dip should be regarded as not good news but on the other hand it's certainly not always bad news, but it is something that needs assessment . which is why I said I tend to look at a trend because if you've got a situation that may be bad and it seems to be getting more obvious then it probably is

W Yeah I mean, if I just walked into a room and looked at a trace I would go eeek! if the heart rate was say 70 (JS mm)

I For how long?

W If it had been 70 for, I think probably longer than 3 . minutes with no variability, so it's a sudden g-dom! like that (JS yes yes) I would go eek!

S Particularly if that was at the end of a trend (JW that's 60 right) if it was an isolated feature within a good trace you would say eek what's the reason, but you wouldn't go eek I have to do something now

W Exactly, if you saw a trace with lots of decelerations and a nasty pattern before had caught your eye and you saw this clunk! (visual, indicating extreme sudden drop in heart rate) then you say you know you must do something and you must quickly find out if the womans fully and you can do forceps right then and there or if it's no where near fully then you go straight down to theatre I mean you must, you must deliver that baby and you've got to move as fast as possible so I think I'd say eek! to that (JS leaves to answer bleep)

W So I'd say eek to that, um for a for a brady- um definate bradycardia you know below 80 with no (EI variability) variability yes um I'd also say eek! I'd better do something, if a very tachycardic trace a heart rate of 170 or or more with with late- with very poor variability and late decelerations so it was almost like a straight line with just tiny shallow late decelerations I would say eek I don't like this I must do something .. a straight line, and its just going up and down horrendously like the baby just can't control its cardiovascular system, if this happened at any stage I would say I don't like that I want to get this baby out um .... The other pattern that people keep talking about is what we call a sinusoidal pattern where its just a straight line doing a nice little sine wave, usually its within the normal range, .. that happens very infrequently and so you know its er regarded as being pre terminal ....

K What is, how deep is a drop in baseline before its regarded as a dip

W More than 5 beats, probably more than 10 beats I would say, 5 beats may be very important because when you when you've got these babies who are really struggling they are tachycardic, the ones that I described before, no variability, and sometimes they seem as though they just don't have the capacity to have decelerations so you might just get a very shallow dip it might be 5 beats .

I There could be all sorts of reasons why theres a dip (JW yep) and I guess one might be um the baby is really in trouble obviously (JW yeah) but it could just be the baby has moved or or whatever, what do you think the major causes of dips (JW reasons for dips) yeah, good ones and bad ones if you like, what you consider the-

W Well the early, the early, you know what I mean by, a deceleration which is the mirror image of the contraction 60 now that is supposedly is associated with head going into the pelvis, with forceps, when you put them on you find heart rate goes down, there is a general theory, I don't know if people are absolutely 100% confident about, that .... early decelerations that can be a result of the head coming down and certainly in someone who is having a rapid delivery these decelerations can be quite big and that's what Jeremy was talking about the head ah the person looks as if they're coming up to fully dilated, they can be quite small or they can be quite large .. by themselves, like I said before, I don't get too uptight about them, recurrent lar- by large I mean more than 60 beats dropped and more than 60 seconds, for that period of time the baby is not getting oxygenated so it will have a cumulative effect, if you've got a baby in good nick at the start of, if you have a multip whose having a tumultuous labour and the baby is whizzing down the pelvis they will have these enourmous dips, no if the baby's fine to start with it will tolerate those periods of

reduced oxygenation and it will cope with that and it will be alright, other babies who are perhaps not happy to start with when they have these, these prolonged- . even if they are early they will have a cumulative effect, a build up in carbon dioxide, leading to respiratory acidosis and eventually a metabolic acidosis, you ask me what are the other reasons for dips (JS returns)

What are, what are the causes of dips?
S The whole premise is that we don't know, have we established that?

W Well I said early deceleration head compression but that's the theory but is that right?

S There is evi- there is concrete evidence that it isn't, at this meeting it emerged that there are two types of type one dips which is interesting, one type of type one dips almost always never do anything but there's another type that's just . an early type two so- . which was interesting, if it to be true doesn't it (JW I'm sure it is) so we lump them all together by looking at them in terms of time which is terribly spurious really if you don't know what the cause is ....

W So I think its a fair summary to say that little, little early decelerations on an otherwise normal trace (JS its a good sign because it means shes contracting) yeah, you know we wouldn't write home about them at all

I There was just a slight -, there was a relative whose wife went into labour and to cut it short, it had something wrapped around its neck (JW & JS the cord!), presumably if 60 you monitored the heart rate there would be signs of, on the heart rate

S We think there are classical signs and thats an 'm' shape dip (EI that would show that) yes an 'm' shape dip.

I Would there be any deceleration or what (JS yes) the baby is obviously being staved of-

S its not really being staved its just that with a contraction you are occluding the vein first and that produces a reflex acceleration of the heart, you then occlude all the vessels to, to a varying degree so you get a dip of varying degree but it is a very short lived dip, as soon as the contraction starts to ease off, everything else is as normal so the flow rapidly returns and compensates and you can keep that going for ages without the baby de-compensating, because during a contraction theres never any blood flow, if the cord is around its neck you just get a slightly increased lack of blood flow over a short duration and because everything else is normal that's the dip you get, we explain that in pseudo science as reflex tachycardia etc etc but it's a neat explanation for students, the problem with cord around the neck is if it happens to tighten during passage through the pelvis (EI yes that's what I was wondering actually) if it's a multip she can push in 20 minutes and you've got a healthy baby, 20 minutes of hypoxia doesn't do any harm, but if that 20 minutes becomes an hour then you get a very dominant decompensation but you can see that in the trend

W We call these a variable deceleration so what you'll have is variables which are sort of short and well, moderately deep, 40 beats or something and then as that gets worse the baseline will go up to a tachycardia and you will loose your variability at the top in between contractions, flatter, it will become deeper and longer and soon you'll have, if you leave it

you'll have this pattern I told you before and if you leave that, all of a sudden it will go clunk (visual, indicating sudden drop in baseline heart rate) and you get a terminal bradycardia, so that's the pattern of those and it's just a cumulative thing ....

K On an ominous dip does the response rather slowly come back up?

S That's exactly right ... If you don't get the pre-dip acceleration, and you get a wild overswing that's supposed to be autonomic imbalance which is a sign of decompensation ....

W The cord doesn't just have to be around the neck, the cord can be round the body or arm or, or just a loop of cords beside the head can give you problems 60

I To the lay man you see the cord around the neck, you get the impression that the baby is about to be strangled

S Yes, its not the neck that counts its the cord, people do think it's the neck that's important

I And its actually the cord

W The cords the important thing .... Other things that cause dips are just simple things like going on the bedpan (JS yes) or vomiting (JS I've never established why) well I mean I can show you a trace out there (inference, in the randomised clinical trial records) right now, that has got large decelerations with someone on the bed-pan (EI is that so) whether it's just an increase in pressure as they strain and push down-

S It's weird isn't it because you don't get it when you are squatting and pushing as far as I can see, this is a classic phenomenon where a student midwife will call you for a caeser .. but it's a bed pan dip

W And vomiting can do this type of thing

S A healthy baby will shrug it off but if you've got a dodgey baby that can be the last straw, so that's why we were saying trends what have you (JS leaves)

W The other things that can cause dips is if the mother is lying flat (EI on her back) on her back so that her blood pressure drops and drops perfusion to the placenta and drops the babies heart rate, this frequently happens in the first stage with a vaginal examination . um . you can get a deceleration during that and sometimes during a vaginal examination with someone just pushing on a babies head, you know, this head compression bit, sometimes that will caused a deceleration as well so those are, and again whether that's significant depends on what the baby was like before .... normally you might see a dip almost like that (quick sketch) with a rapid recovery that's fine, that's alright but if you have this (quick sketch) and it's a slow recovery and it takes a while afterwards you think well the baby took a while to recover from that .... The other thing that causes dips of course is this epidural business which is very important in this day and age (EI that seems to be quite regular) in our experience, theres one paper which gives it an 11% incidence, I don't know what, (JS returns) we were talking about epidural dips and 11% incidence (JS yes) it will be interesting to see what ours is in a way wouldn't it (JS yes) .... and there's two reasons for an epidural dip, one is that the mothers blood pressure has dropped and the other is the

mother absorbs some of the local anaesthetic that they use, although its not put into blood vessels, and its in her circulation and gets into the fetus and those drugs, like Marcaine, are very potent central depressants and produce a very long deceleration for 3 to 4 minutes with a very slow recovery for upto 40 or 50 minutes after you, and she's had a top up so I think we will just wait and see what happens ..

S Often you get characteristics where the womans blood pressure hasn't dipped and we have a suspicion that it's the maternal response to what would be a falling blood pressure, so may be its the maternal response that causes the dip, so I think often the mother must compensate and so you don't get a change in blood pressure but the fact that she's compensating or shunting is enough to cause some change in uterine flow but its a bit difficult to prove

W It's those ones that I'd say were the Marcaine absorbtion dips

S But sometimes its a bit quicker isn't it?. its like in 10 minutes

W Yeah - (untranslatable but offers some possible reasons for it - emphasis on not sure why) ....

I I think we shall come back to this abnormal case, it's perhaps the most important in a way ... what would you then consider to be absolutely normal, that which would give you no concern whatsoever

S Presence of acceleration (EI the pesence of would cheer you up ?) yeah - its just unknown to have complications when you have acceleration by which I mean 15 beats per minute for 15 seconds or more as long as you've got a reasonable baseline which we defined before as being 110 to 160 ...

W And no dips

S Well I don't think you even have

W Well, I think that, I think heart rate tells a little, the basal heart rate tells you a little bit but I'm not, I don't get overly up tight about basal heart rate unless its at the extremes . the variability I think, I think's important

I It ought to vary, you know is that-

W The um, the actual, how much the beat- what we call the beat to beat, short term variability, the little jitter on the paper .... that's important but there are a lot of things that affect, that drugs, pethidine will knock that, sometime an epidural will make that go flat, sometimes the babies asleep so it will go flat . and I think decelerations, I don't get upset with early decelerations .. variable decelerations, that depends what they're like and late decelerations, I think you have to take some notice of them if they've been persistent, I don't think you could ignore um 40 minutes of late decelerations ....

I What would you say was the er bit that-, we've talked about the various things you look at, but I want toexplore, saying the heart rate is going up and up and up isn't it is that correct?

S No thats what I would regard as a trend, an acceleration is a short lived change (EI so we're talking about short lived) yes, it's 15 seconds to 10 minutes so you can put that as absolute

I Ok so that happens without time interval (JS yes)

W Those are the type of things (visual, presence of acceleration on an actual CTG trace) we're talking about, that's a bit

I It goes up and stays there a little

W It may just go up, up and down like that, it may go up and fiddle around a bit and then come down . um the pattern is variable, the basic thing is it usually lasts .. a acceleration can, an acceleration is often associated with fetal movement you see (EI yes)

S This is going to go a long way to shorten this discussion by hours (visual, CTG paper) A change in baseline requires the rate to change by 10 beats per minute for 10 minutes at least .. and that's the difference with acceleration because these are all the questions you get asked but most people, I don't think, will come up with an answer, we haven't dreamed these up (visual reference to CTG paper) we have got these from at least 3 or 4 different books

I I notice in that diagram (visual reference to heart rate pattern on front page of CTG paper) you haven't actually got the contraction waveform, how would that relate to contraction if you imagined a contraction waveform underneath it

S Nothing described here is a contraction related phenomenon, the only established contraction related phenomenon is a dip (JW sometimes-) an acceleration during a contraction is probably the absolute optimum sign in a trace because its an attack response .. um again by the same token an acceleration matched to a movement is a standard thing .... so for a dip, you cannot show a dip without a contraction pattern

K How does the 60 rule fit in with this

W If you have a deceleration that lasts less than 60 seconds you know that oxygen and blood flow is not compromised, after 60 seconds you're talking about a more significant phenomenon for the fetus ...

S The effect will be hypoxia, that hypoxia in a normal fetus then you're fine, but if thats a continued insult it gets more hypoxic each time, ... with this, the thing is I know Mr. Greene disagrees with our definition of a variable dip he says that a variable dip is anything that isn't a type 1 or a type 2, which is too great for me, I couldn't accept that .. well . its just the way I think, you've got a particular dip that can be identified as a variable dip and if they're not variable they are type 2 by my definition, again that wouldn't be a constant thing I think if you were to work out ultraisms that problem wouldn't surface, I don't think it would matter, that distinction (JW no I-), because a variable dip is perhaps one bit of cord or that's the way we like to think about it . so I just mention that he hasn't actually formally accede or agreed with that (visual reference to CTG paper) because I haven't shown him, but we were just talking and he said that ....

W Dips can only be early or late can't they (JS yes) so I recognise the pattern and if it's a late one I'm not as excited, if it has these deceleration then I'm not going to get up tight about a late deceleration (JS precisely precisely) ....

break while we view what JS and JW have produced in the way of tree diagram etc,

W My tree has begun to get very complicated and so I haven't quite finished but you will get a few ideas, the other things I've been trying to do is to get some weightings, some risk assessments, so you would assess the risk at the beginning of the labour, antenatal factors with various weightings which people would obviously disagree with and so you've got a risk factor at the beginning which places a woman in a high, medium or low risk and then you would have events happening during labour which like meconium liqual, slow progess, heart rate abnormalities ... the woman would then have an intrapartum risk assessment which will need to be up dated every now and again and so if you have a woman who's high risk actually enters labour who has high risk changes as opposed to someone who's normal, normal everything's been normal and she has 1 dip, I don't know how you build that into a system but that's how we look at it

I It will evolve as we go along, have you got as far as you need to go on that (visual reference to JW risk assessment)

W I haven't gone as far as I'd like but I will keep working on it

Irrelevant conversation talking about hopes for next meeting, phone rings and JW leaves to answer it

Resumption now looking at some CTG traces

W The first baby, shes had an uneventful pregnancy but she is 15 days post term, so in other words she is over 2 weeks overdue, term is anywhere between 38 weeks and 42 weeks as you start to get beyond 42 weeks you know you start to think well ok that puts her into a high risk, she's been induced with a prostin pessary thing which places her into a risk category as well, she then goes into labour this is the first dip on her trace here (visual reference made to trace) the immediate thing that comes to mind, I say, I say, first of all hang on, there appears to be some degree of baseline tachycardia (EI why do you say that) because up here, I suspect thats the baseline I can immediately see there are some decelerations and I can immediately see that the variability is good, it jiggles up and down a lot, so now I say ok, and look at the contractions and notice that she is contracting quite frequently, now I notice these decelerations, here are late decelerations because they start-, they occur after the contraction ok and I can't see .. a definate pattern like that so these are late decelerations . rapidly contracting, now she gets the waters broken or her membranes ruptured and there is thick thick meconium liqual so that's, so we've got a post mature baby who has been induced, with heart rate irregularities which are significant, and thick meconium liqual so she is a very high risk group, so immediately alarm bells start ringing, now what happens here is she, this is during a vaginal examination so that's probably why that's a bigger dip . um they've given some pethidine here and then you've got the same thing you've got a baseline tachycardia of 170 with late decelerations which are probably only 10 beats to 12 beats of deceleration but those are significant

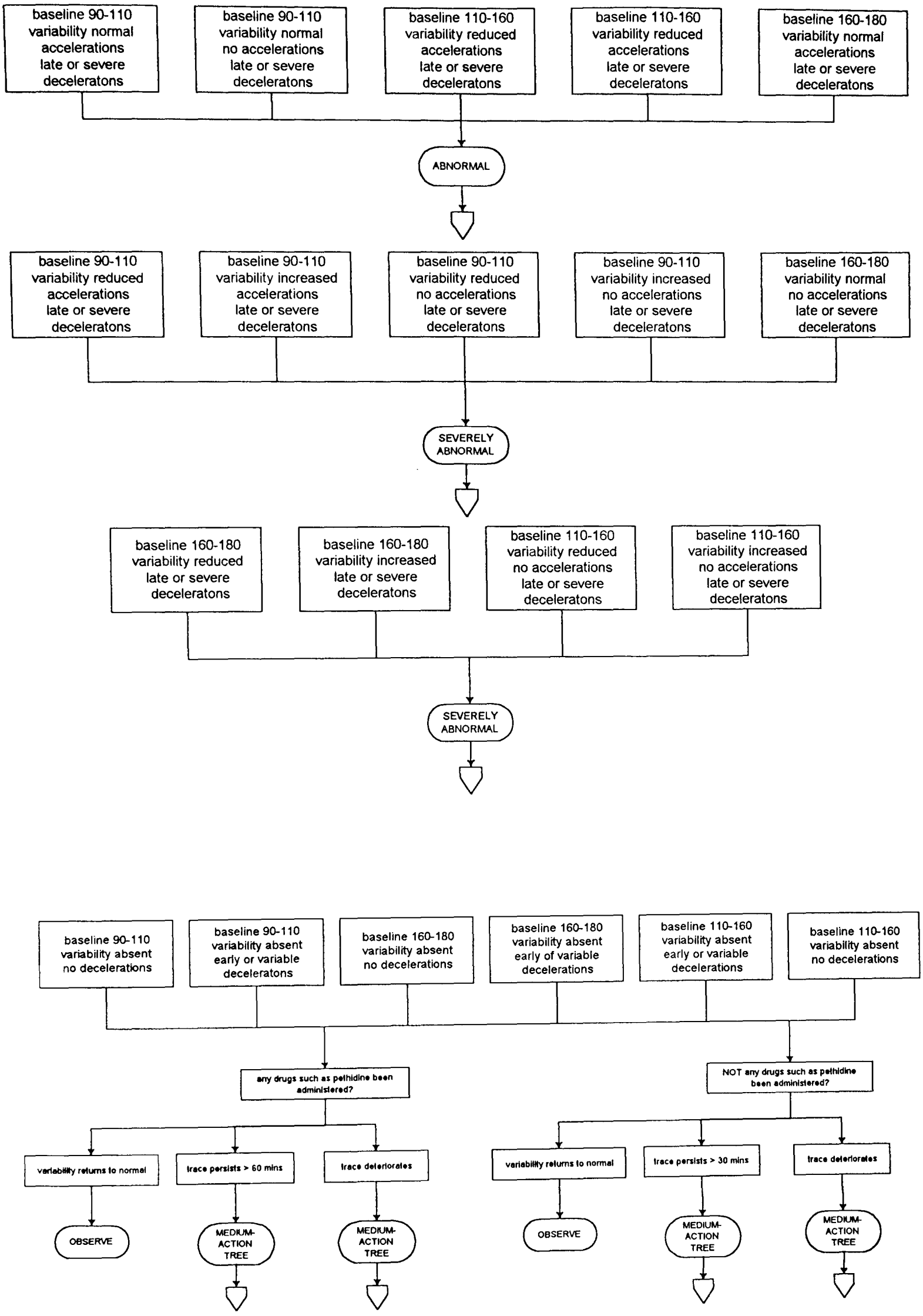
I I want to clear my mind when you say they are significant, we are not overly above 160 which is your magic figure

W Well the baseline up here say is about 170 but it is what I was saying to you, although the variability is reasonable you are getting a late, a dip, a deceleration, you see what I am saying, sometimes these decelerations are not very deep, they are shallow, but that to me, a shallow deceleration on a tachycardic trace are one of the more worrying types, that's significant ok and they're late contraction here, dip there, contraction here dip here, now here we have a bed pan, so there she is sitting up on the bed pan and you get this prolonged . er deceleration which it tries to recover a little and it goes down a bit, and again the dip (EI its gone down quite a lot now) yes it has (EI down to about 100 now) .. now that's something-, the babies had a dramatic change and it's prolonged, so immediately after that I think that's not good news either, this woman already has been on labour ward nearly an hour and I would . have . possibly thought that given all these findings, probably about here (visual reference to CTG trace) the midwife should have called someone and this is a significantly abnormal trace, thick meconium and a post mature baby so she's missed the boat here so it continues and you see that because this doesn't look so bad as that people get fooled and finally she thinks perhaps I'd better talk to someone about this so she gets the SHO ok, so the SHO takes 15 minutes to get there and then the SHO sees the woman and you see these decelerations are now becoming more prolonged um and now the SHO thinks ooo! I better get the registrar, and he comes and thinks oh my goodness! I don't like this at all, if you notice here she's having a long contraction and so she's having quite pronounced decelerations because it's 1, 2, 3 minutes so that's why the heart rate plummets at that point where as the other contractions have been a minute, a so you're only gonna get a shallow deceleration, he then does a fetal blood sample and the ph is 7.15 which is quite abnormal shes only 4 cm so she has an immediate caesarian section (JW leaves to answer phone) so this illustrates nicely a trace which we think is abnormal which was missed, the response time of the midwife is about an hour and a half, now fortunately because this baby has got a good variability here we would expect that although it would come out a bit acidotic I think you could say its not a happy baby but it isn't a damaged baby in fact it was a bit slow to go as we say and it was acidotic but not metabiotically so on its cord gases, it took about 6 hours to recover but it was fine and was back in the ward with its mother, but if you left that longer you probably would have been in trouble.

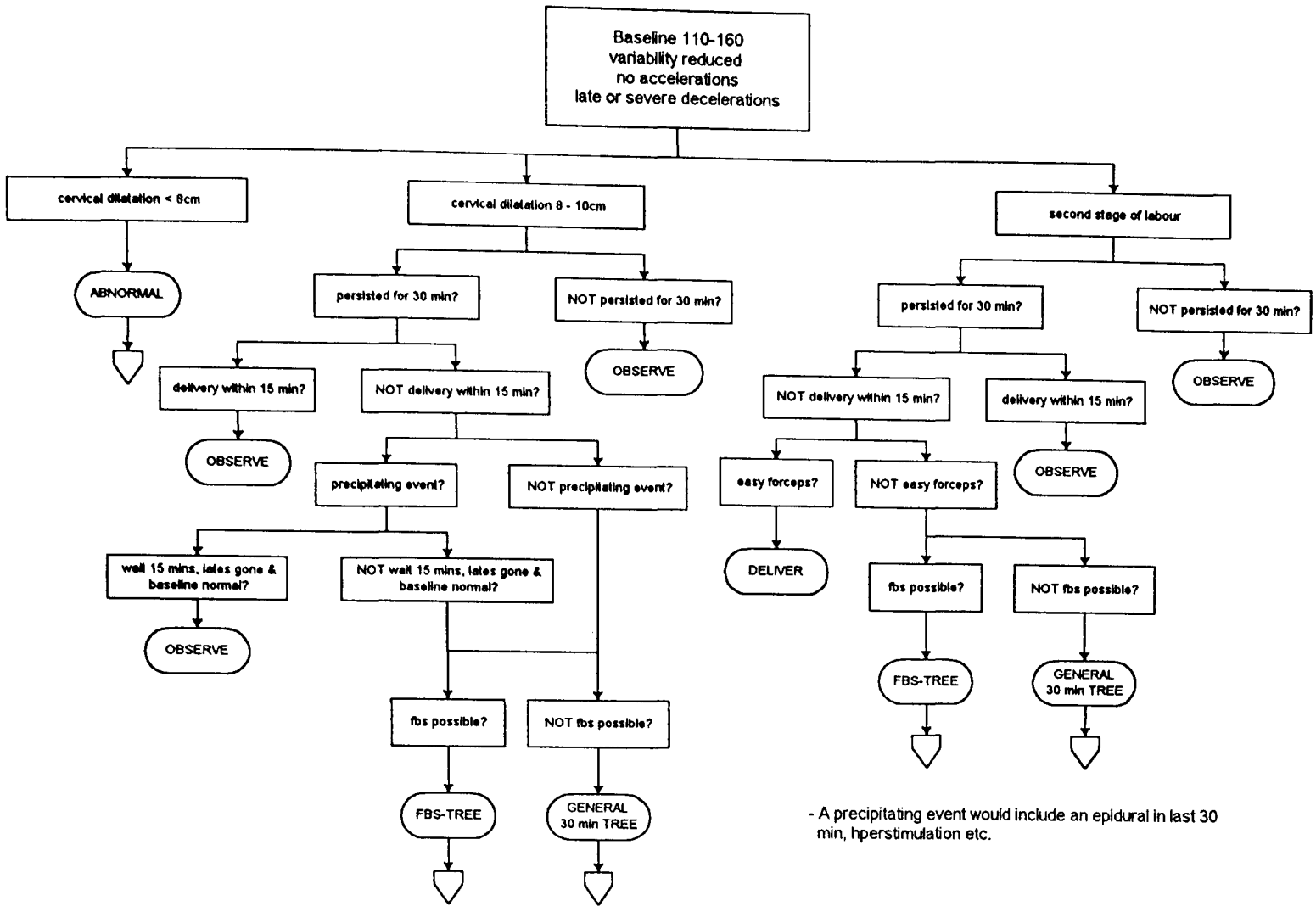
Session closed.

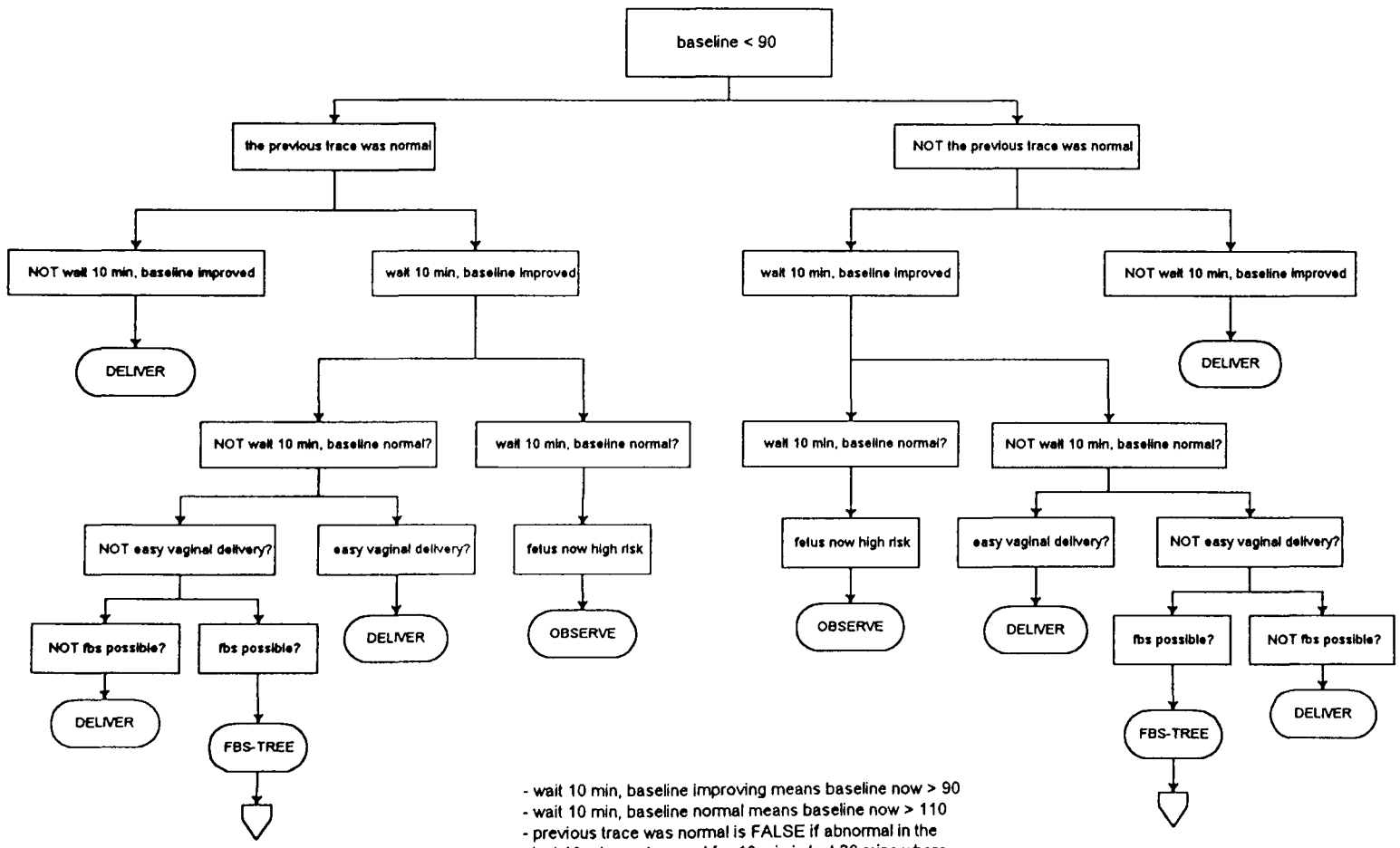
Appendix D

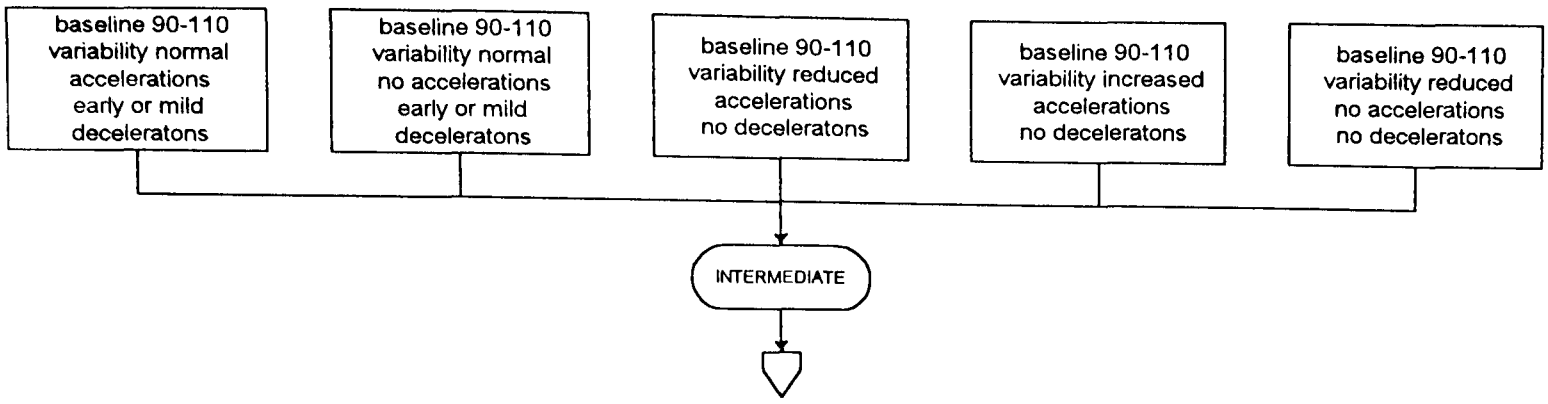
The knowledge tree.

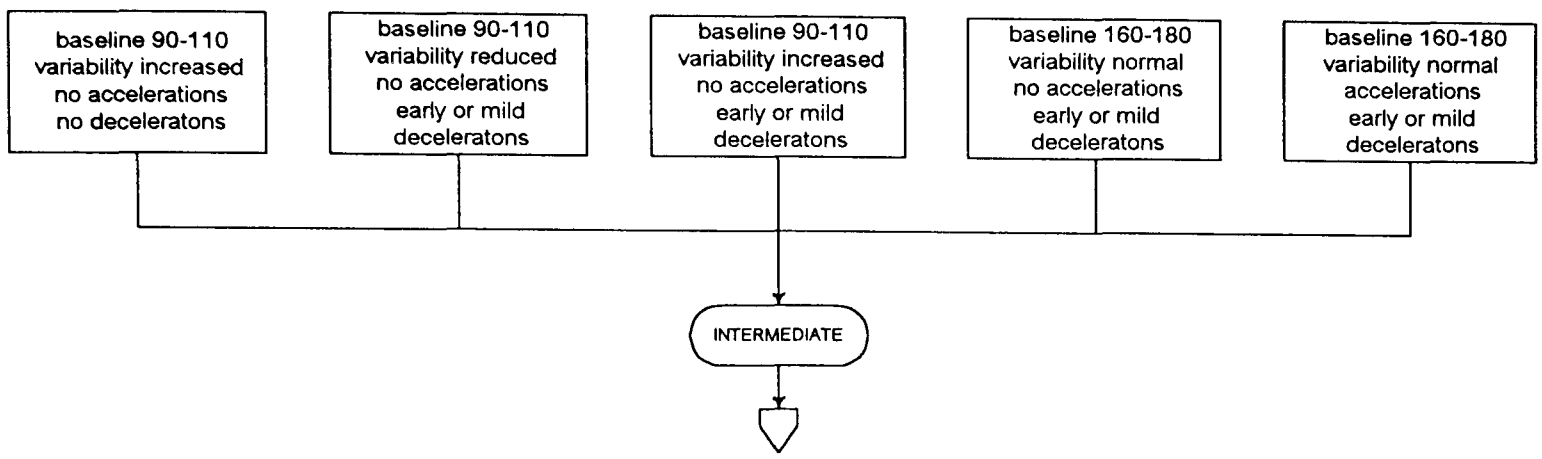


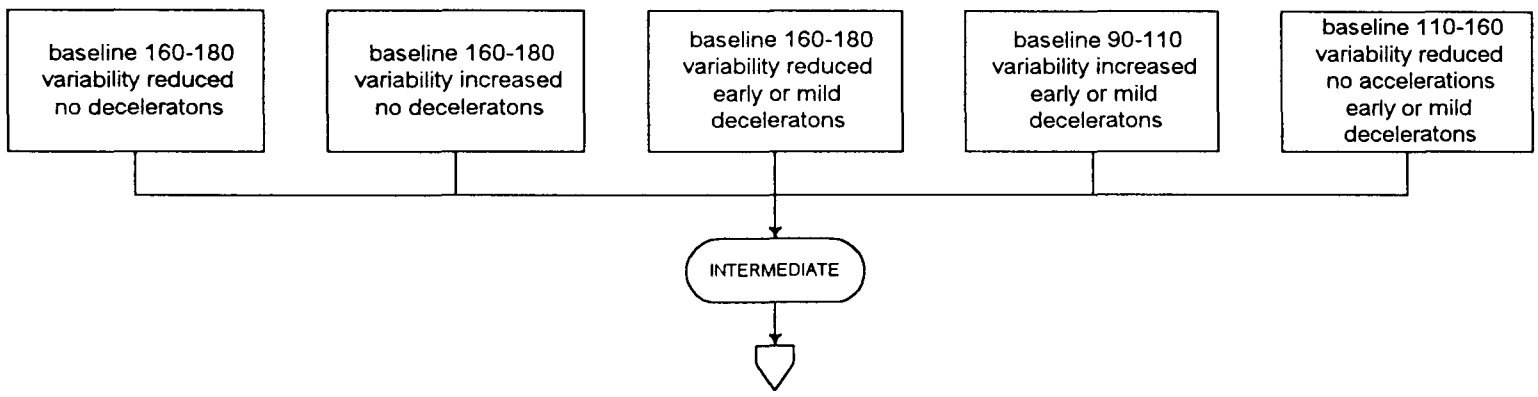
- for normal, the trace must be entirely normal for 10 mins
- the trace deteriorates IF
  decelerations become late or severe
  OR IF baseline not normal & goes < 90 or > 180
  OR IF baseline was normal and goes 90-110 or 160-180

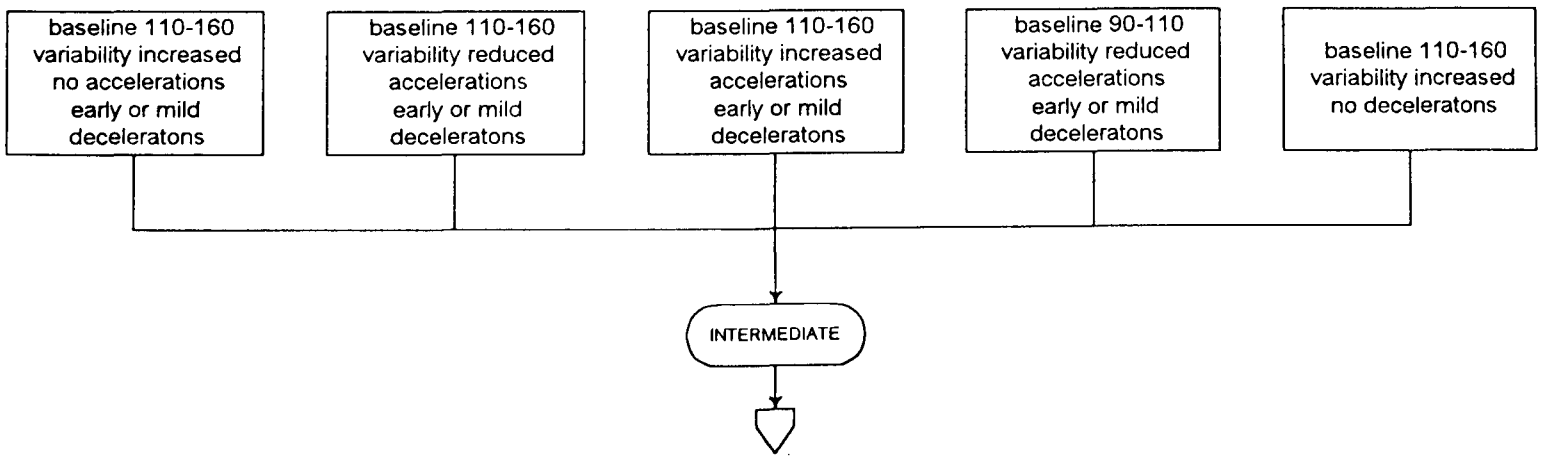

Baseline 110-160
variability reduced
no accelerations
late or severe decelerations
cervical dilatation < 8cm
ABNORMAL
cervical dilatation 8 - 10cm
persisted for 30 min?
NOT persisted for 30 min?
OBSERVE
delivery within 15 min?
NOT delivery within 15 min?
OBSERVE
precipitating event?
NOT precipitating event?
wait 15 mins, lates gone & baseline normal?
NOT wait 15 mins, lates gone & baseline normal?
OBSERVE
fbs possible?
NOT fbs possible?
FBS-TREE
GENERAL 30 min TREE
second stage of labour
persisted for 30 min?
NOT persisted for 30 min?
OBSERVE
NOT delivery within 15 min?
delivery within 15 min?
OBSERVE
easy forceps?
NOT easy forceps?
DELIVER
fbs possible?
NOT fbs possible?
FBS-TREE
GENERAL 30 min TREE
- A precipitating event would include an epidural in last 30 min, hperstimulation etc.

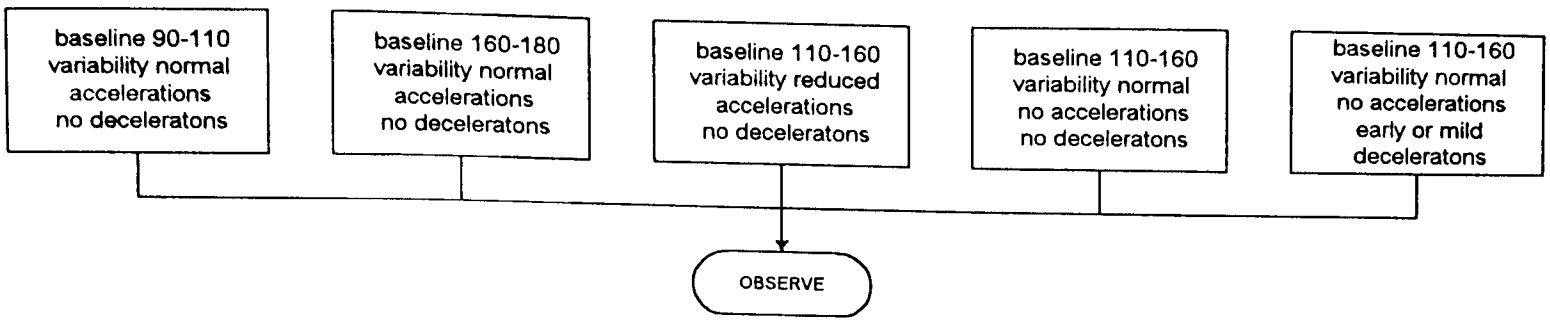

baseline < 90
the previous trace was normal
NOT the previous trace was normal
NOT wait 10 min, baseline improved
DELIVER
wait 10 min, baseline improved
NOT wait 10 min, baseline normal?
wait 10 min, baseline normal?
NOT easy vaginal delivery?
easy vaginal delivery?
fetus now high risk
NOT fbs possible?
fbs possible?
DELIVER
OBSERVE
DELIVER
FBS-TREE
wait 10 min, baseline improved
NOT wait 10 min, baseline improved
DELIVER
wait 10 min, baseline normal?
NOT wait 10 min, baseline normal?
fetus now high risk
easy vaginal delivery?
NOT easy vaginal delivery?
OBSERVE
DELIVER
fbs possible?
NOT fbs possible?
FBS-TREE
DELIVER
- wait 10 min, baseline improving means baseline now > 90
- wait 10 min, baseline normal means baseline now > 110
- previous trace was normal is FALSE if abnormal in the last 10 min or abnormal for 10 min in last 30 mins where
- abnormal means not normal

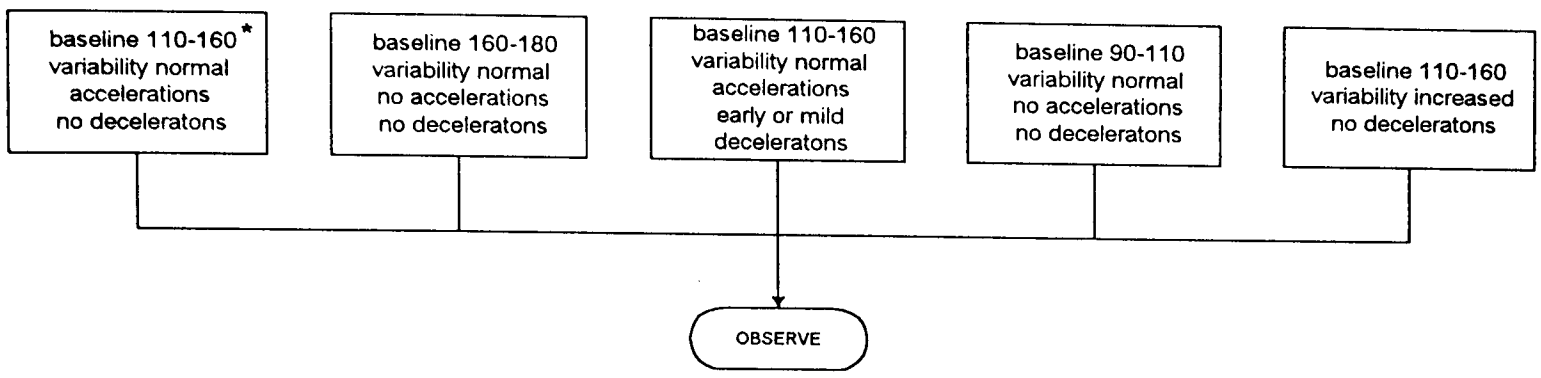

baseline 90-110
variability normal
accelerations
early or mild
deceleratons
baseline 90-110
variability normal
no accelerations
early or mild
deceleratons
baseline 90-110
variability reduced
accelerations
no deceleratons
baseline 90-110
variability increased
accelerations
no deceleratons
baseline 90-110
variability reduced
no accelerations
no deceleratons
INTERMEDIATE


baseline 90-110
variability increased
no accelerations
no deceleratons
baseline 90-110
variability reduced
no accelerations
early or mild
deceleratons
baseline 90-110
variability increased
no accelerations
early or mild
deceleratons
baseline 160-180
variability normal
no accelerations
early or mild
deceleratons
baseline 160-180
variability normal
accelerations
early or mild
deceleratons
INTERMEDIATE

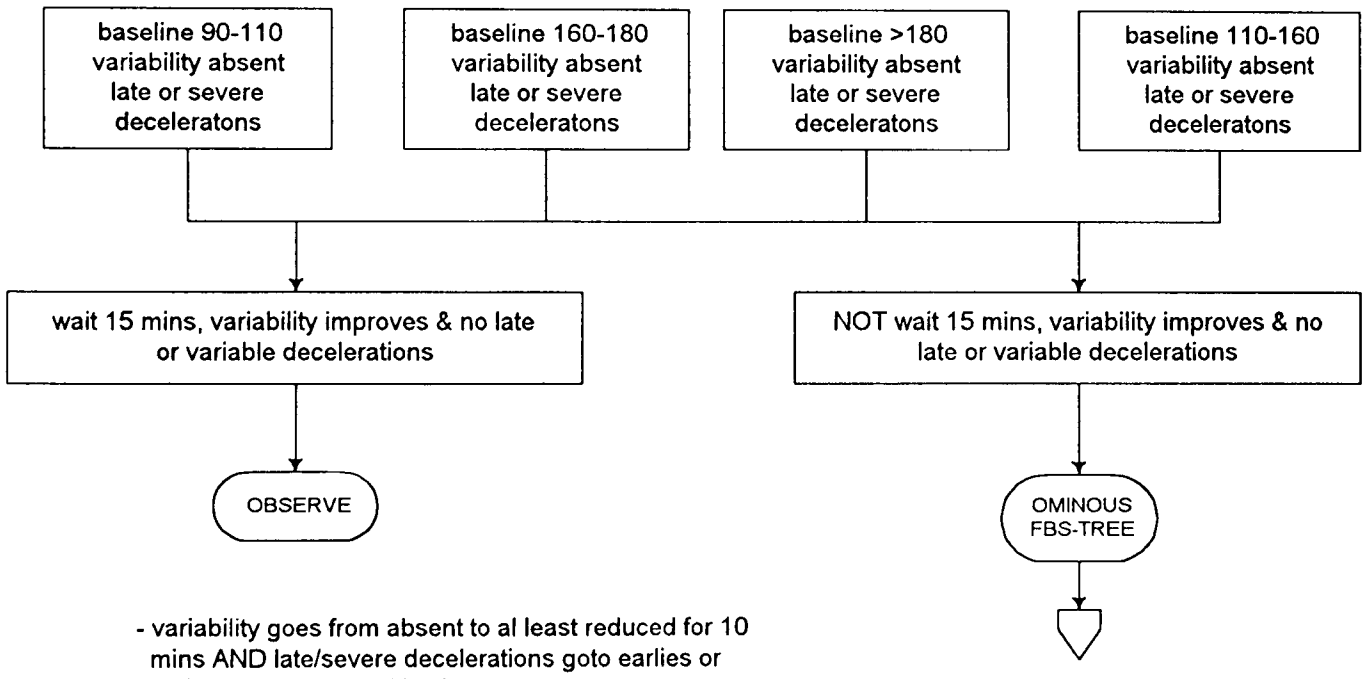

baseline 160-180
variability reduced
no deceleratons
baseline 160-180
variability increased
no deceleratons
baseline 160-180
variability reduced
early or mild
deceleratons
baseline 90-110
variability increased
early or mild
deceleratons
baseline 110-160
variability reduced
no accelerations
early or mild
deceleratons
INTERMEDIATE


baseline 110-160
variability increased
no accelerations
early or mild
deceleratons
baseline 110-160
variability reduced
accelerations
early or mild
deceleratons
baseline 110-160
variability increased
accelerations
early or mild
deceleratons
baseline 90-110
variability reduced
accelerations
early or mild
deceleratons
baseline 110-160
variability increased
no deceleratons
INTERMEDIATE

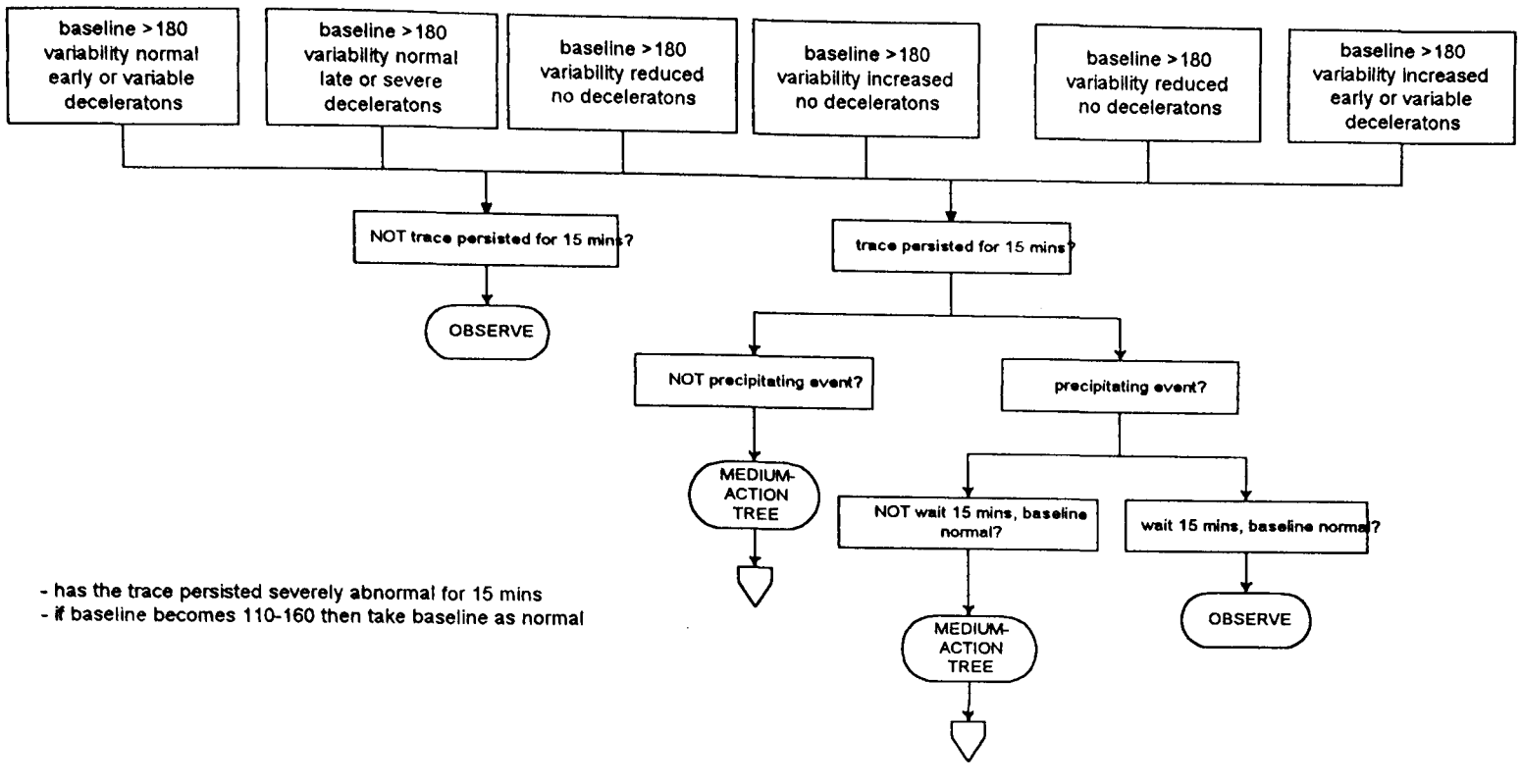




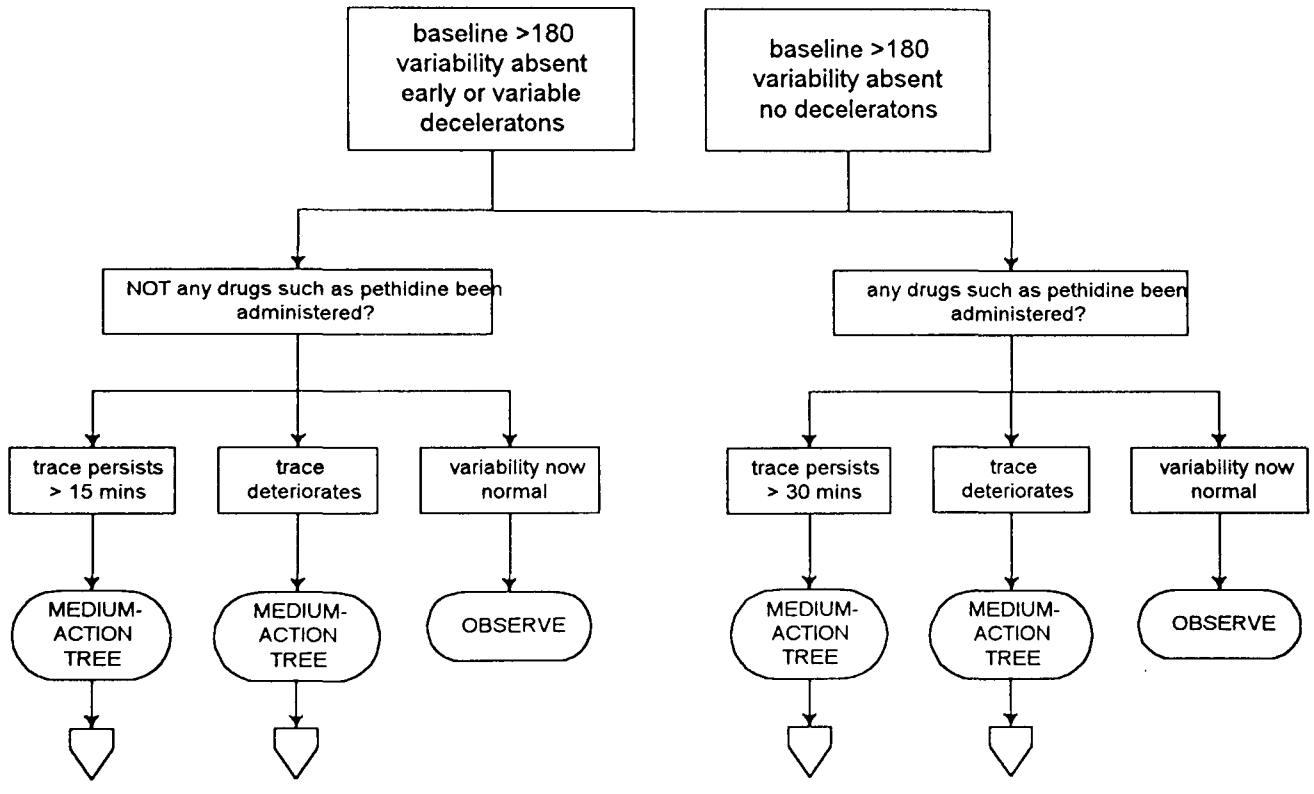
* normal reactive CTG



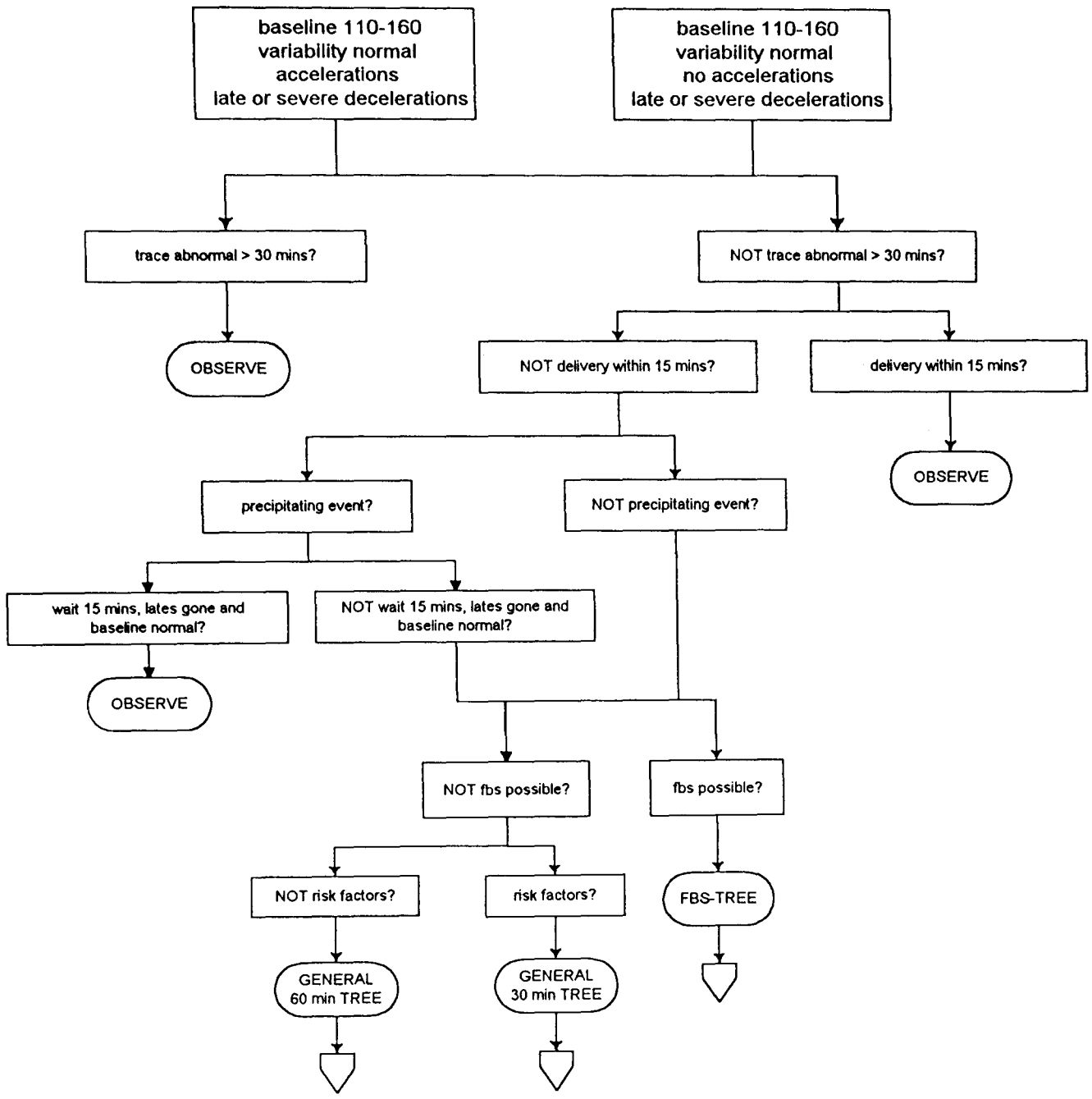
- variability goes from absent to al least reduced for 10 mins AND late/severe decelerations goto earlies or variables for at least 10 mins



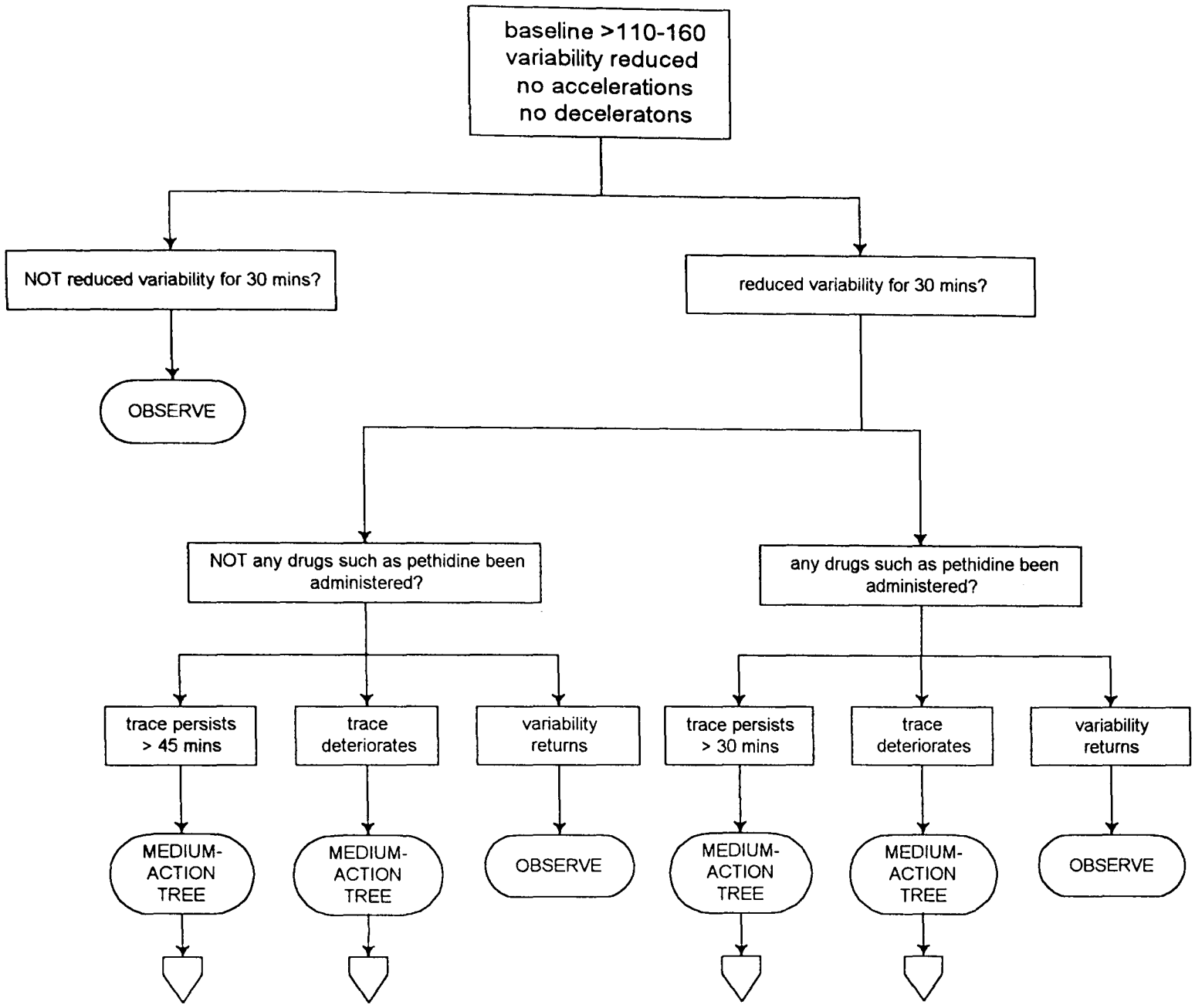
- has the trace persisted severely abnormal for 15 mins
- if baseline becomes 110-160 then take baseline as normal



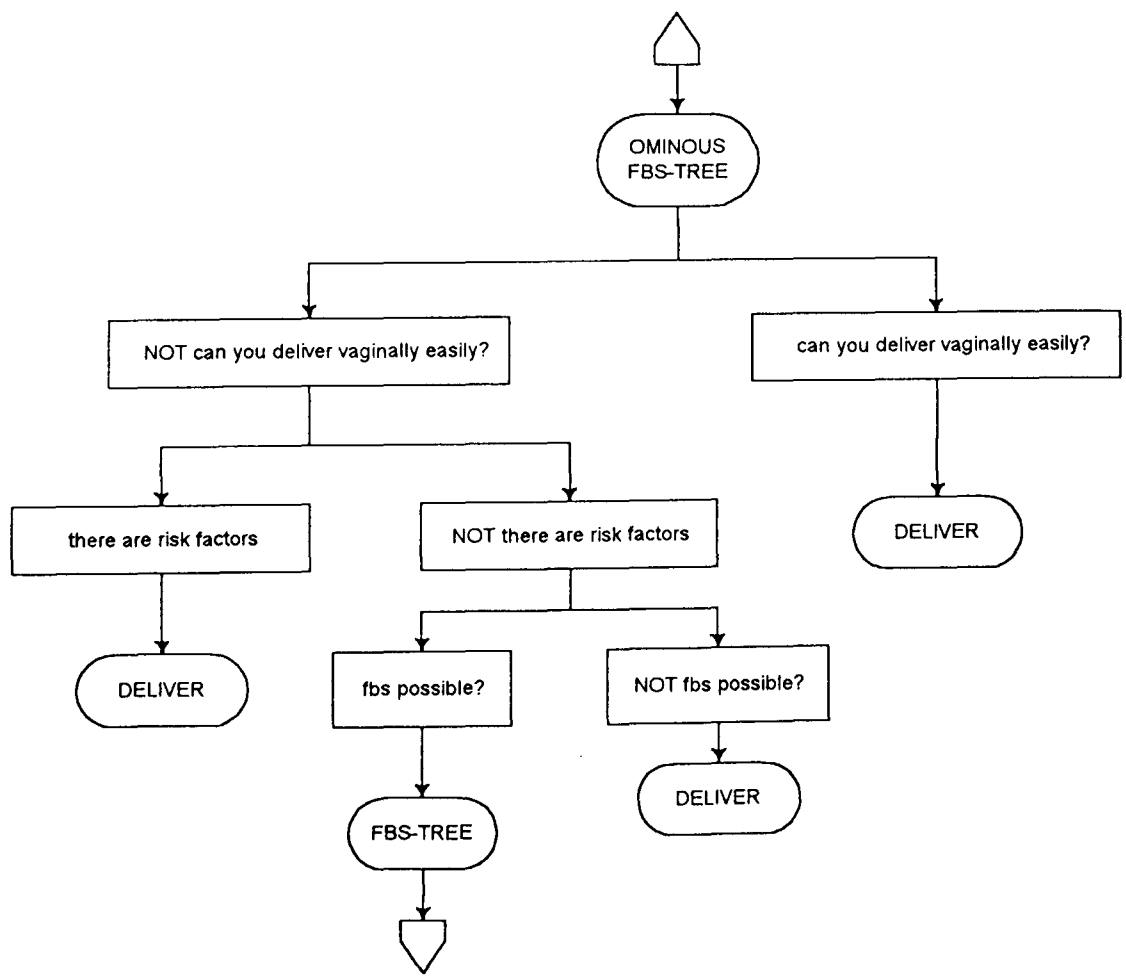
- trace becomes acceptible if baseline normal and variability at least reduced
- trace deteriorates if late or severe decelerations appear

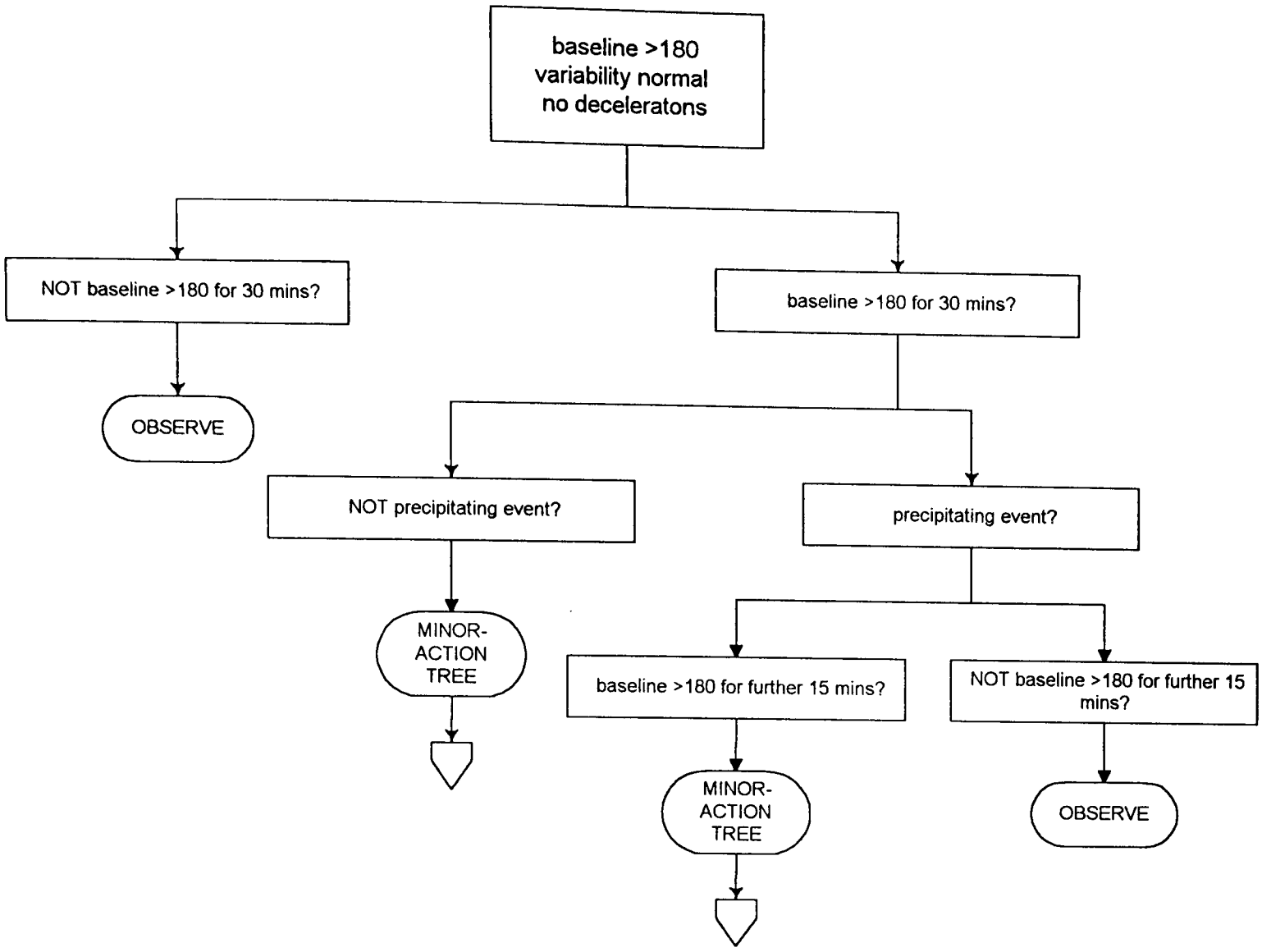


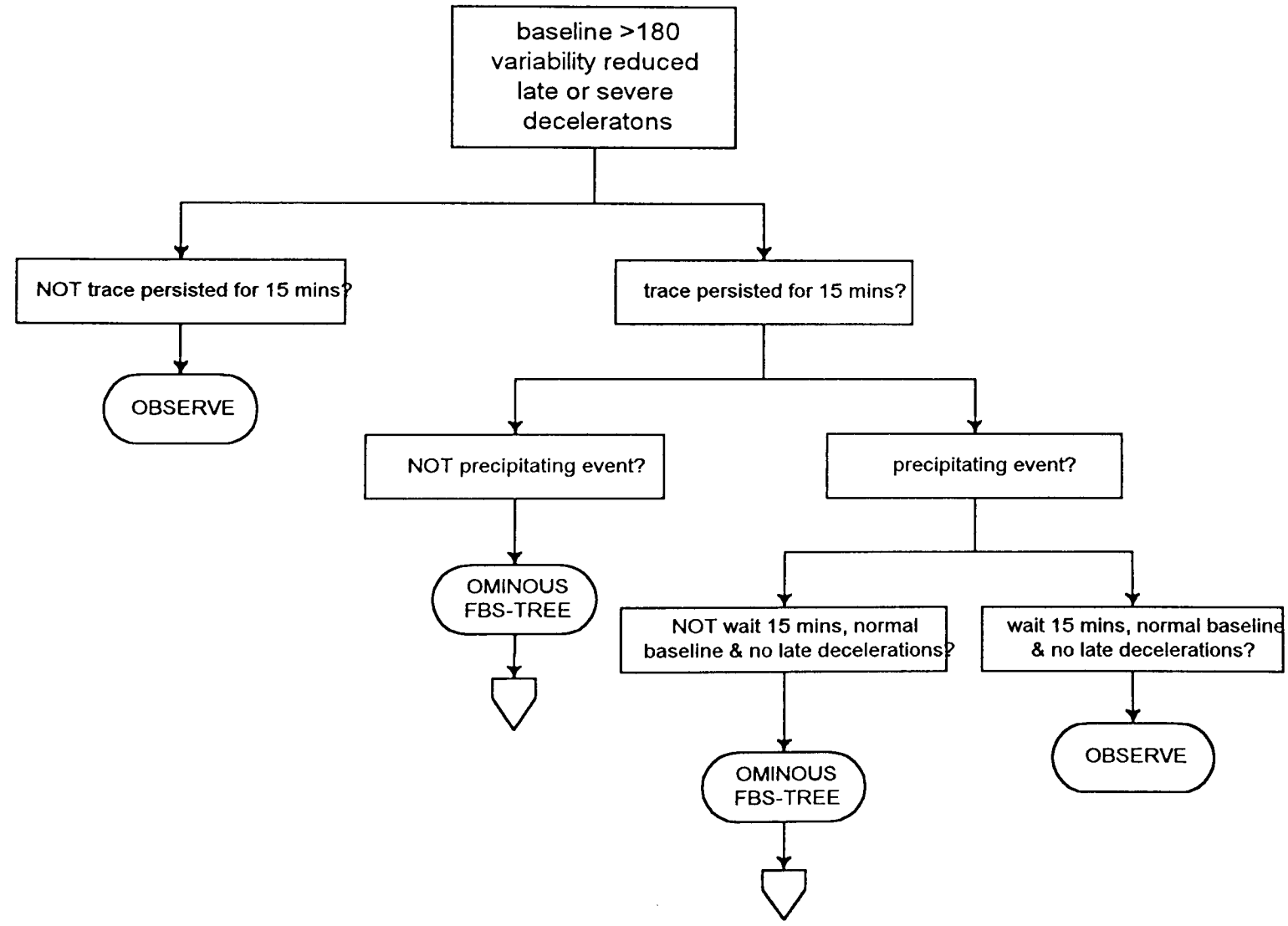
- trace becomes acceptible if no late decelerations for 10 mins
- trace deteriorates if baseline changes of variability becomes other than normal



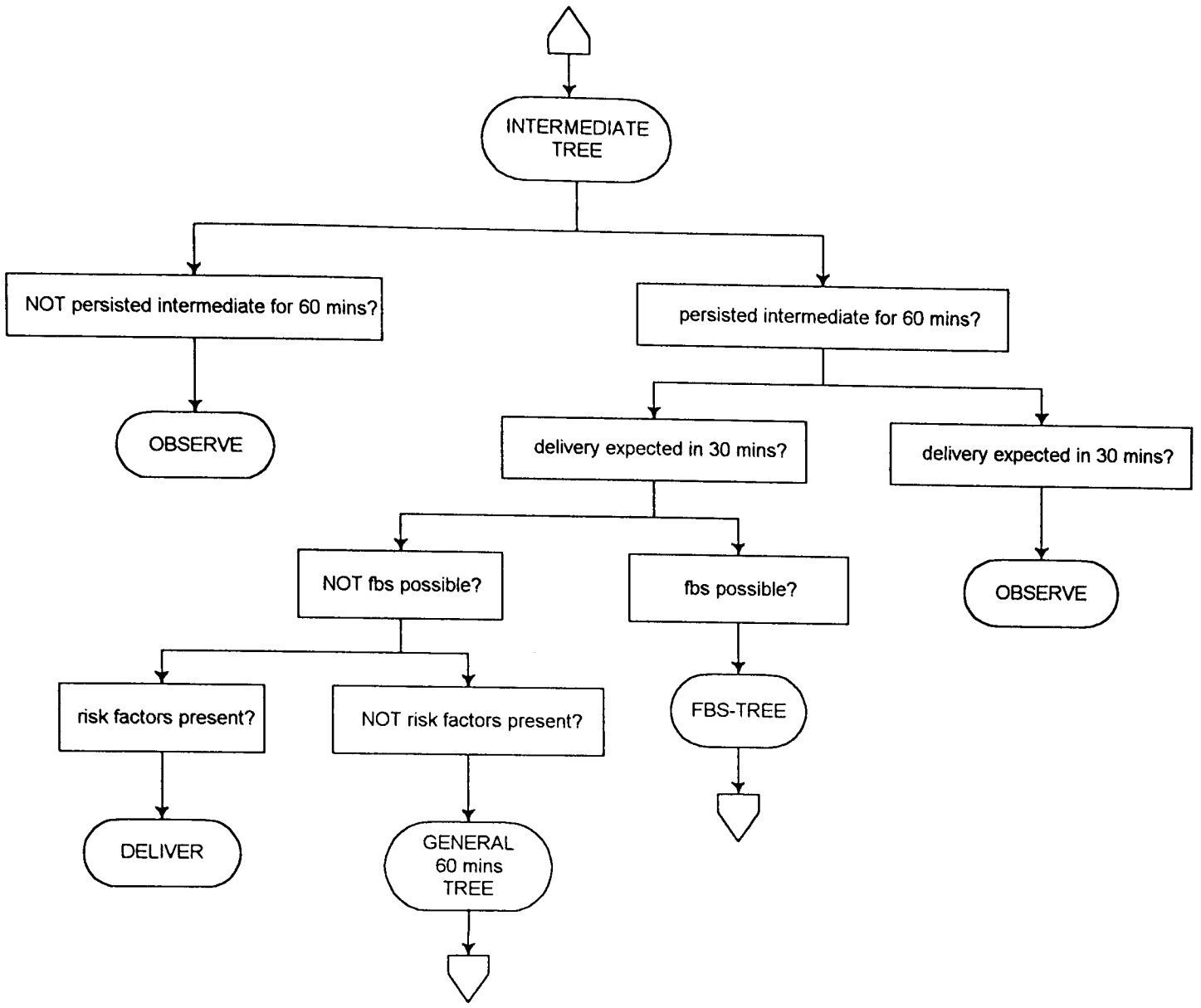
- trace persists if NOT variability returns AND NOT trace deteriorates
- trace deteriorates if late or severe decelerations appear or baseline changes

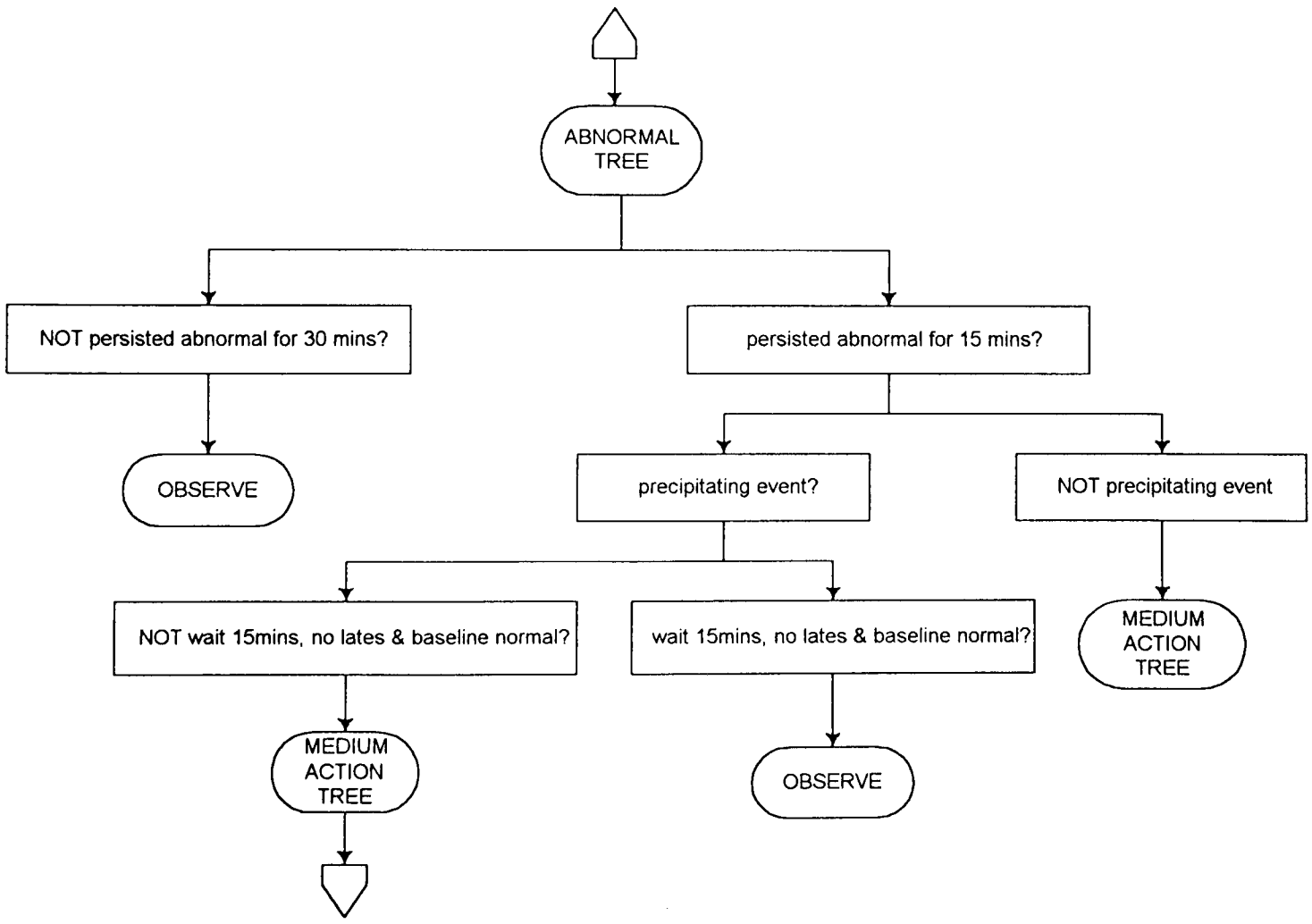


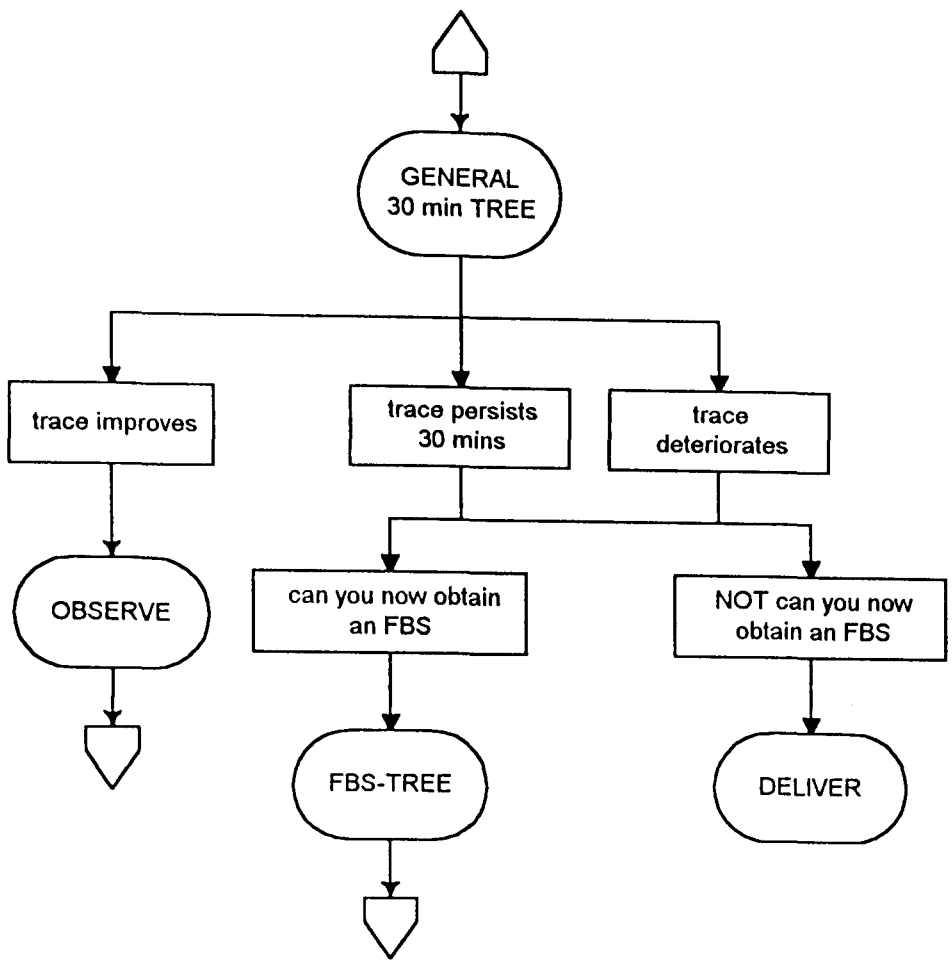


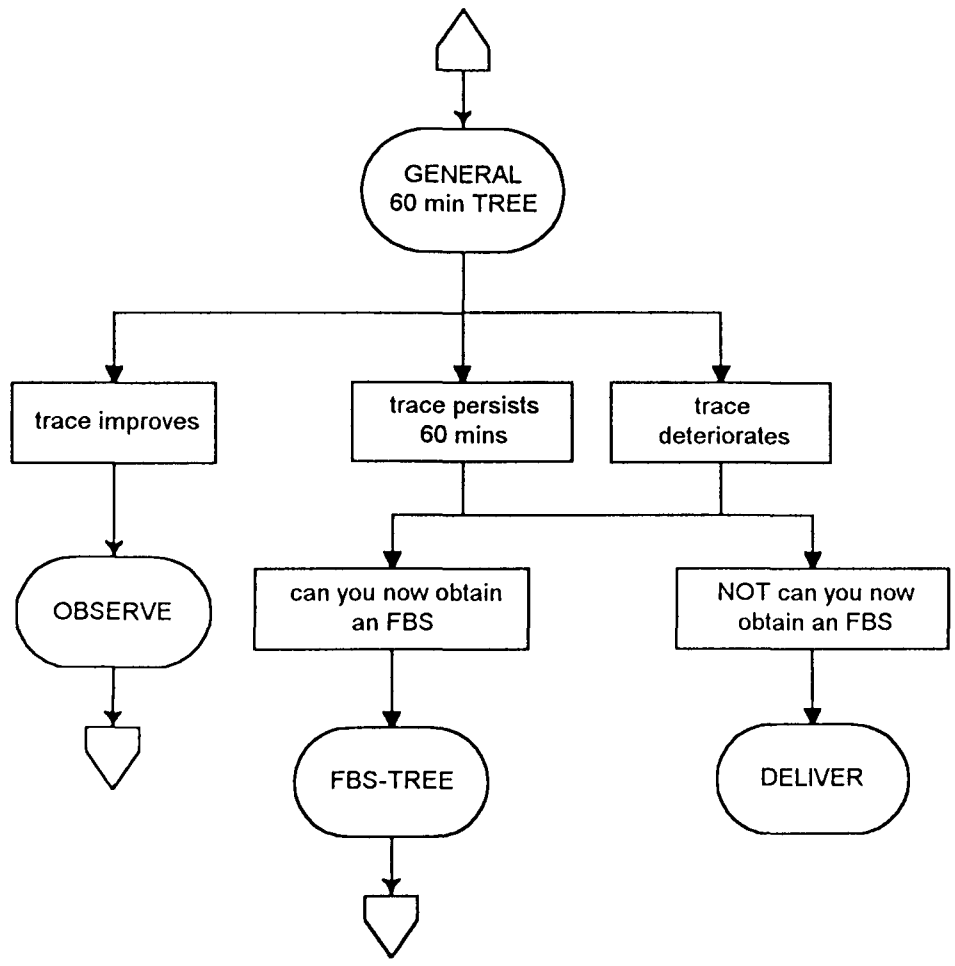


- has the trace persisted severely abnormal for 15 mins

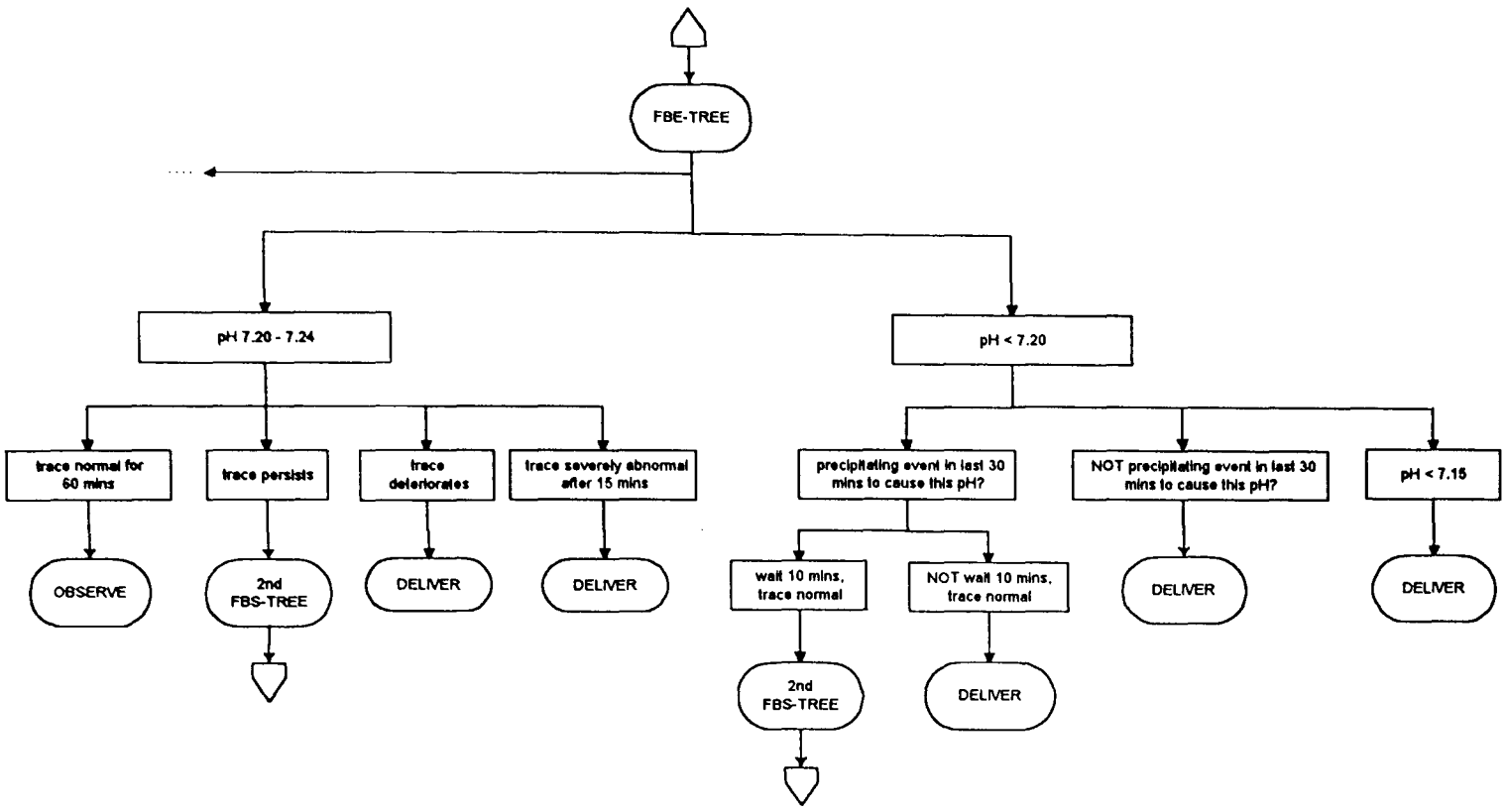

INTERMEDIATE TREE
NOT persisted intermediate for 60 mins?
OBSERVE
persisted intermediate for 60 mins?
delivery expected in 30 mins?
NOT fbs possible?
risk factors present?
DELIVER
NOT risk factors present?
GENERAL 60 mins TREE
fbs possible?
FBS-TREE
delivery expected in 30 mins?
OBSERVE


ABNORMAL TREE
NOT persisted abnormal for 30 mins?
OBSERVE
persisted abnormal for 15 mins?
precipitating event?
NOT wait 15mins, no lates & baseline normal?
MEDIUM ACTION TREE
wait 15mins, no lates & baseline normal?
OBSERVE
NOT precipitating event
MEDIUM ACTION TREE



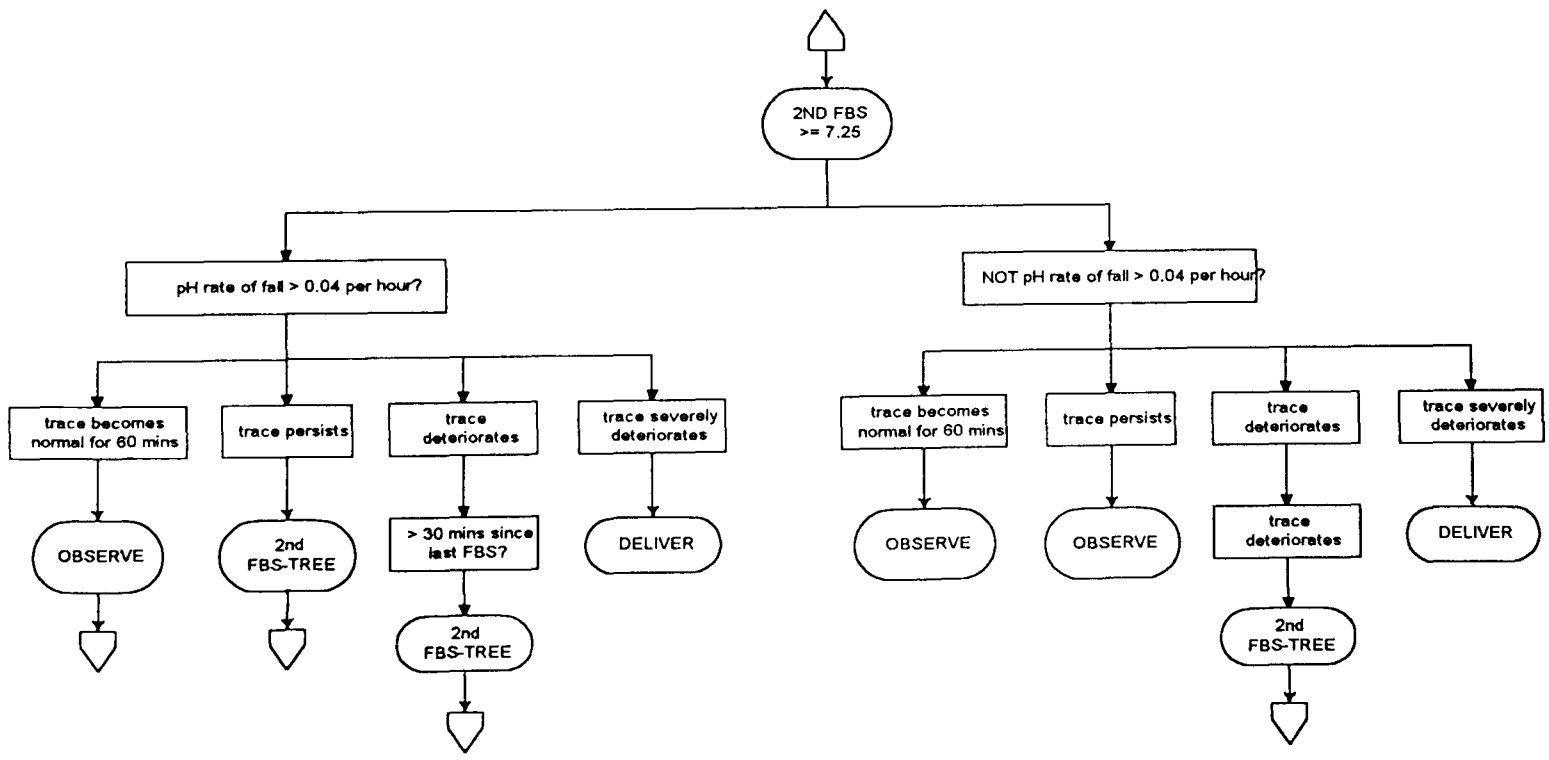


- trace deteriorates if it becomes severely abnormal
- trace improves if it becomes normal or intermediate
- trace persists if trace has not improved or trace has not deteriorated

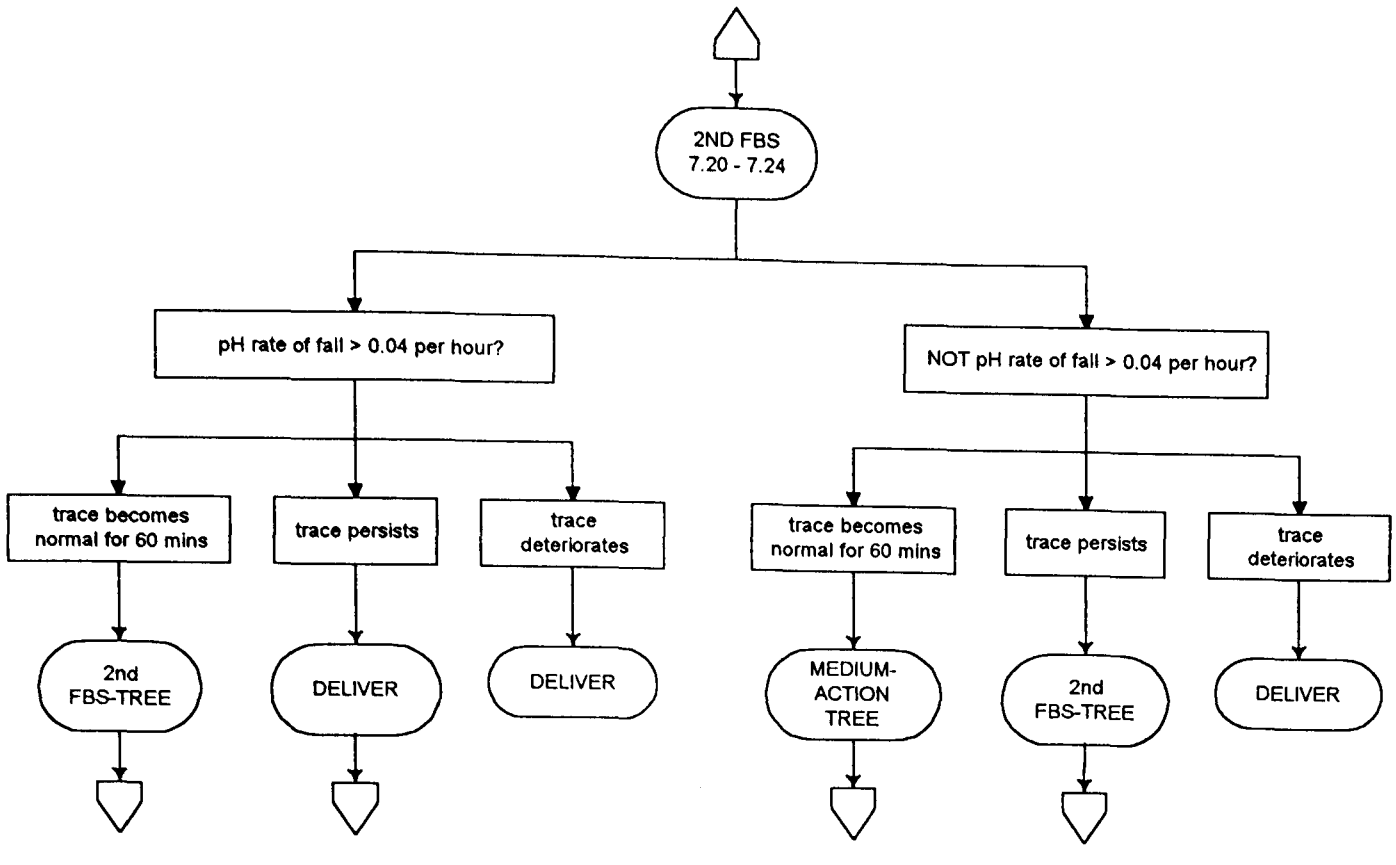


- trace deteriorates if it drops one classification
- trace normal for 60 mins if trace does not deteriorate in first 30 mins and is completely normal for second 30 mins
- trace persists if not normal for 60 mins and trace not deteriorated and trace not severely abnormal after 15 mins

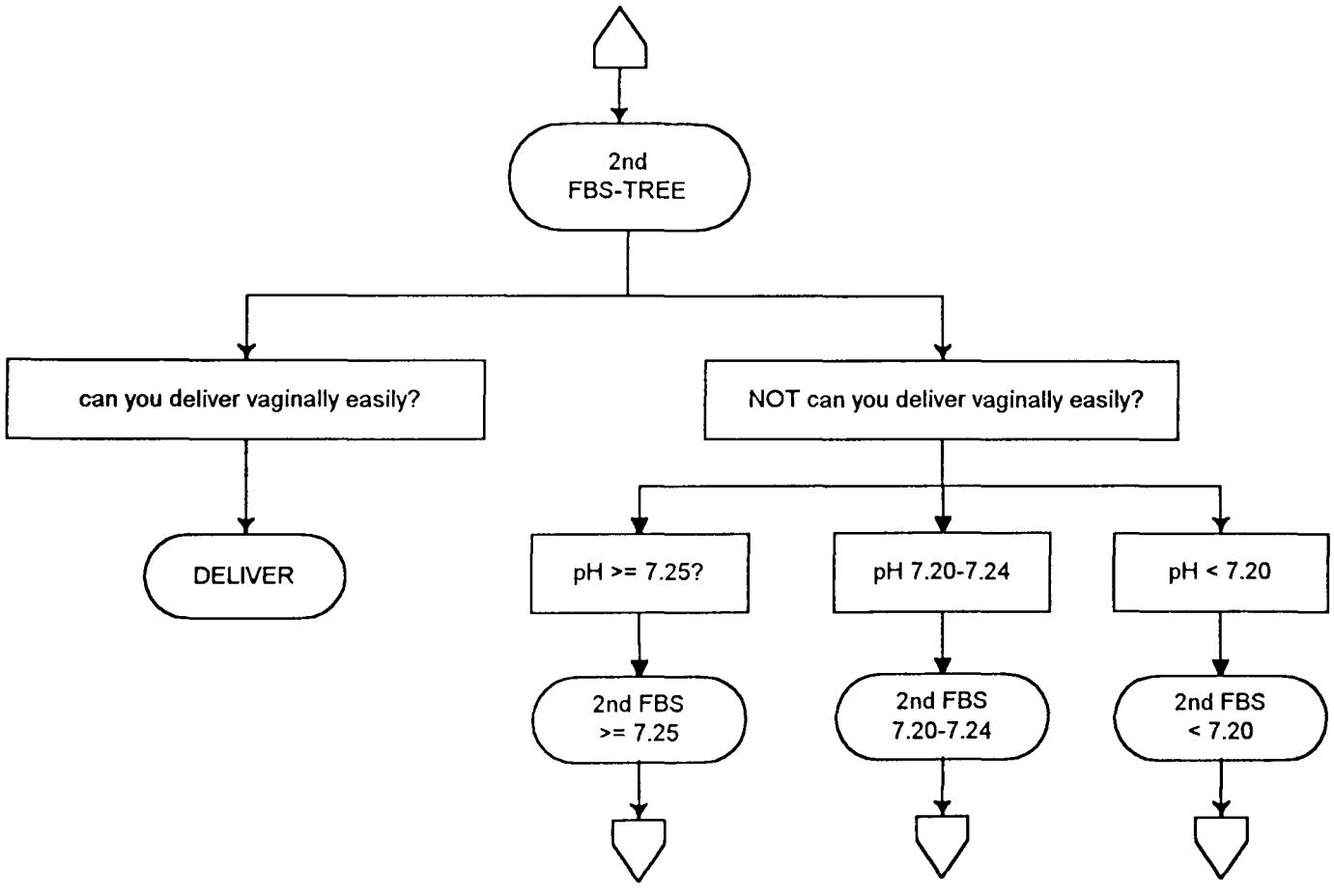
- a precipitating event in the last 30 mins which could have caused the low pH would be a severe bradycardia or severe decelerations in the last 15 mins without any previously

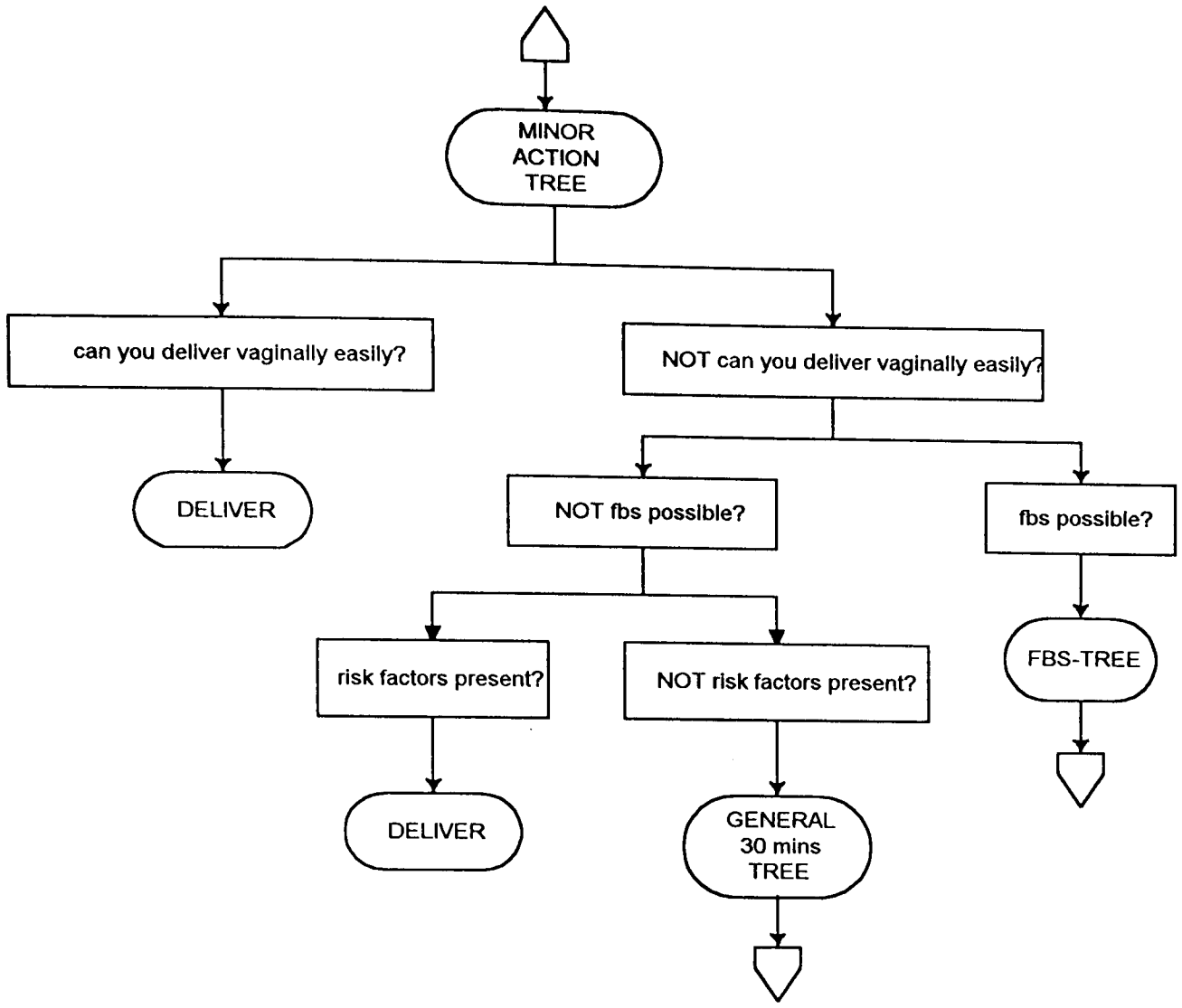


- trace deteriorates if it drops one classification
- trace becomes normal if trace returns to a classification which never requires and FBS for 30 mins in last 60 mins
- trace severely deteriorates if baseline < 90 or baseline now 90-110 and was > 180
- trace persists if trace does not deteriorate and trace does not become normal



- trace deteriorates if it drops one classification
- trace becomes normal for 60 mins if trace does not deteriorate and last 30 mins are all normal
- trace persists if trace does not deteriorate and trace does not become normal




MINOR ACTION TREE
can you deliver vaginally easily?
DELIVER
NOT can you deliver vaginally easily?
NOT fbs possible?
fbs possible?
FBS-TREE
risk factors present?
DELIVER
NOT risk factors present?
GENERAL 30 mins TREE
MEDIUM ACTION TREE
can you deliver vaginally easily?
DELIVER
NOT can you deliver vaginally easily?
NOT fbs possible?
fbs possible?
FBS-TREE
NOT previous trace abnormal?
previous trace abnormal?
risk factors present?
NOT risk factors present?
DELIVER
DELIVER
GENERAL 30 mins TREE

Appendix E

The knowledge base.

Rule format:

rule(*rule number,current node,next node,conditions*)

rule(1,labour,<90,1)
rule(2,<90,prev_n,41)
rule(3,<90,prev_not_n,42)
rule(4,prev_n,base_imp,43)
rule(5,prev_n,goal_5,44)
rule(6,base_imp,goal_6,45)
rule(7,base_imp,goal_7,46,49)
rule(8,base_imp,fbs-tree,46,50,300)
rule(9,base_imp,goal_9,46,50,301)
rule(10,prev_not_n,pnn_base_imp,43)
rule(11,prev_not_n,goal_10,44)
rule(12,pnn_base_imp,goal_11,45)
rule(13,pnn_base_imp,goal_12,46,49)
rule(14,pnn_base_imp,fbs-tree,46,50,300)
rule(15,pnn_base_imp,goal_14,46,50,301)
rule(30,labour,goal_30,2,13,31,21)
rule(31,labour,goal_31,4,13,31,21)
rule(32,labour,goal_32,3,12,31,21)
rule(33,labour,goal_33,3,13,31,22)
rule(34,labour,goal_34,3,13,32,22)
rule(35,labour,goal_35,3,13,31,21)
rule(36,labour,goal_36,3,13,32,21)
rule(37,labour,goal_37,4,13,31,22)
rule(38,labour,goal_38,2,13,31,22)
rule(45,labour,intermediate,2,13,21,32)
rule(46,labour,intermediate,2,13,22,32)
rule(47,labour,intermediate,2,12,21,31)
rule(48,labour,intermediate,2,14,21,31)
rule(49,labour,intermediate,2,12,22,31)
rule(50,labour,intermediate,2,14,22,31)
rule(51,labour,intermediate,2,12,22,32)
rule(52,labour,intermediate,2,14,22,32)
rule(53,labour,intermediate,4,13,21,32)
rule(54,labour,intermediate,4,13,22,32)
rule(55,labour,intermediate,4,12,31)
rule(56,labour,intermediate,4,14,31)
rule(57,labour,intermediate,4,12,32)
rule(58,labour,intermediate,4,14,32)
rule(59,labour,intermediate,3,12,22,32)
rule(60,labour,intermediate,3,14,22,32)
rule(61,labour,intermediate,3,12,21,32)
rule(62,labour,intermediate,3,14,21,32)
rule(63,labour,intermediate,2,12,21,32)
rule(64,labour,intermediate,3,13,31)
rule(70,labour,abnormal,2,13,21,33)
rule(71,labour,abnormal,2,13,22,33)
rule(72,labour,abnormal,3,12,21,33)
rule(73,labour,abnormal,3,14,21,33)
rule(74,labour,abnormal,4,13,21,33)

rule(80,labour,severe-ab,2,12,21,33)
rule(81,labour,severe-ab,2,14,21,33)
rule(82,labour,severe-ab,2,12,22,33)
rule(83,labour,severe-ab,2,14,22,33)
rule(84,labour,severe-ab,4,13,22,33)
rule(85,labour,severe-ab,4,12,33)
rule(86,labour,severe-ab,4,14,33)
rule(87,labour,severe-ab,3,12,22,33)
rule(88,labour,severe-ab,3,14,22,33)
rule(100,labour,var abs-no lates,2,11,31)
rule(101,labour,var abs-no lates,2,11,32)
rule(102,labour,var abs-no lates,4,11,31)
rule(103,labour,var abs-no lates,4,11,32)
rule(104,labour,var abs-no lates,3,11,32)
rule(105,labour,var abs-no lates,3,11,31)
rule(110,var abs-no lates,va-nl peth,51)
rule(111,var abs-no lates,va-nl nopeth,52)
rule(112,va-nl peth,va-nl peth menu,1000)
rule(113,va-nl peth menu,goal_113,1002)
rule(114,va-nl peth menu,medium-action,1004)
rule(115,va-nl peth menu,medium-action,1003)
rule(120,va-nl nopeth,va-nl nopeth menu,1001)
rule(121,va-nl nopeth menu,goal_121,1002)
rule(122,va-nl nopeth menu,medium-action,1005)
rule(123,va-nl nopeth menu,medium-action,1003)
rule(130,labour,var red-no decs,3,12,22,31)
rule(135,var red-no decs,vr-nd ->30,65)
rule(136,var red-no decs,goal_136,66)
rule(137,vr-nd ->30,vr-nd ->30 peth,51)
rule(138,vr-nd ->30,vr-nd ->30 nopeth,52)
rule(139,vr-nd ->30 peth,vr-nd p menu,1010)
rule(140,vr-nd ->30 nopeth,vr-nd no-p menu,1011)
rule(141,vr-nd no-p menu,goal_141,1002)
rule(142,vr-nd no-p menu,medium-action,1014)
rule(143,vr-nd no-p menu,medium-action,1012)
rule(144,vr-nd p menu,goal_144,1002)
rule(145,vr-nd p menu,medium-action,1013)
rule(146,vr-nd p menu,medium-action,1012)
rule(150,labour,>180 all-n,5,13,31)
rule(155,>180 all-n,>180 all-n ->30,61)
rule(156,>180 all-n,goal_156,62)
rule(157,>180 all-n ->30,>180 all-n precip,53)
rule(158,>180 all-n ->30,minor-action,54)
rule(159,>180 all-n precip,minor-action,63)
rule(160,>180 all-n precip,goal_160,64)
rule(170,labour,>180+,5,13,32)
rule(171,labour,>180+,5,13,33)
rule(172,labour,>180+,5,12,31)
rule(173,labour,>180+,5,14,31)
rule(174,labour,>180+,5,12,32)
rule(175,labour,>180+,5,14,32)
rule(180,>180+,>180+ ->15,515)

rule(181,>180+,goal_181,516)
rule(182,>180+ ->15,>180+ precip,53)
rule(183,>180+ ->15,medium-action,54)
rule(184,>180+ precip,goal_184,55)
rule(185,>180+ precip,medium-action,56)
rule(190,labour,>180 vr-dl,5,12,33)
rule(192,>180 vr-dl,>180 vr-dl ->15,515)
rule(193,>180 vr-dl,goal_193,516)
rule(194,>180 vr-dl ->15,>180 vr-dl precip,53)
rule(195,>180 vr-dl ->15,ominous-fbs,54)
rule(196,>180 vr-dl precip,goal_196,57)
rule(197,>180 vr-dl precip,ominous-fbs,58)
rule(200,labour,va-dl,2,11,33)
rule(201,labour,va-dl,4,11,33)
rule(202,labour,va-dl,5,11,33)
rule(203,labour,va-dl,3,11,33)
rule(205,va-dl,goal_205,59)
rule(206,va-dl,ominous-fbs,60)
rule(210,labour,>180 va-nl,5,11,31)
rule(211,labour,>180 va-nl,5,11,32)
rule(213,>180 va-nl,va-nl peth,51)
rule(214,>180 va-nl,>180 va-nl menu,1020)
rule(215,>180 va-nl menu,goal_215,1021)
rule(216,>180 va-nl menu,medium-action,1022)
rule(217,>180 va-nl menu,medium-action,1023)
rule(220,labour,all n-ld,3,13,21,33)
rule(221,labour,all n-ld,3,13,22,33)
rule(222,all n-ld,all n-ld ->30,530)
rule(223,all n-ld,goal_221,531)
rule(224,all n-ld ->30,goal_222,47)
rule(225,all n-ld ->30,all n-ld pre,48,53)
rule(226,all n-ld ->30,all n-ld nopre,48,54)
rule(227,all n-ld pre,goal_225,57)
rule(228,all n-ld pre,all n-ld nopre,58)
rule(229,all n-ld nopre,fbs-tree,300)
rule(230,all n-ld nopre,all n-ld risk,301,200)
rule(231,all n-ld nopre,all n-ld nrisk,301,201)
rule(232,all n-ld nrisk,general 60 menu,1600)
rule(234,all n-ld risk,general 30 menu,1500)
rule(240,labour,vr-ld,3,12,22,33)
rule(245,vr-ld,vr-ld assess dilat,400)
rule(246,vr-ld assess dilat,abnormal,401)
rule(247,vr-ld assess dilat,vr-ld 8-10cm,402)
rule(248,vr-ld assess dilat,vr-ld 2nd stage,403)
rule(249,vr-ld 8-10cm,vr-ld 8-10cm ->30,530)
rule(250,vr-ld 8-10cm,goal_250,531)
rule(251,vr-ld 8-10cm ->30,goal_251,47)
rule(252,vr-ld 8-10cm ->30,8-10cm precip,48,53)
rule(253,vr-ld 8-10cm ->30,8-10cm nopre,48,54)
rule(254,8-10cm precip,goal_254,57)
rule(255,8-10cm precip,8-10cm nopre,58)
rule(256,8-10cm nopre,fbs-tree,300)

rule(257,8-10cm nopre,general 30 menu,301,1500)
rule(260,vr-ld 2nd stage,vr-ld 2nd ->30,530)
rule(261,vr-ld 2nd stage,goal_261,531)
rule(262,vr-ld 2nd ->30,goal_262,47)
rule(263,vr-ld 2nd ->30,goal_263,48,80)
rule(264,vr-ld 2nd ->30,vr-ld no-forc,48,81)
rule(265,vr-ld no-for,fbs-tree,300)
rule(266,vr-ld no-for,general 30 menu,301,1500)
rule(300,minor-action,goal_300,49)
rule(301,minor-action,fbs-tree,50,300)
rule(302,minor-action,goal_302,50,301,200)
rule(303,minor-action,min-act no-risk,50,301,201)
rule(304,min-act no-risk,general 30 menu,1500)
rule(320,medium-action,goal_320,49)
rule(321,medium-action,fbs-tree,50,300)
rule(322,medium-action,goal_322,50,301,67)
rule(323,medium-action,goal_323,50,301,68,200)
rule(324,medium-action,med-a no-r,50,301,68,201)
rule(325,med-a no-r,general 30 menu,1500)
rule(340,ominous-fbs,goal_340,49)
rule(341,ominous-fbs,goal_341,50,200)
rule(342,ominous-fbs,fbs-tree,50,201,300)
rule(343,ominous-fbs,goal_343,50,201,301)
rule(360,intermediate,goal_360,560,82)
rule(361,intermediate,goal_361,561)
rule(362,intermediate,fbs-tree,560,83,300)
rule(363,intermediate,goal_363,560,83,301,200)
rule(364,intermediate,int no-r,560,83,301,201)
rule(365,int no-r,general 60 menu,1600)
rule(380,abnormal,abnormal ->30,530)
rule(381,abnormal,goal_381,531)
rule(382,abnormal ->30,abnormal precip,53)
rule(383,abnormal ->30,medium-action,54)
rule(384,abnormal precip,goal_384,57)
rule(385,abnormal precip,medium-action,58)
rule(390,severe-ab,severe-ab ->15,515)
rule(391,severe-ab,goal_391,516)
rule(392,severe-ab ->15,severe-ab precip,53)
rule(393,severe-ab ->15,ominous-fbs,54)
rule(394,severe-ab precip,goal_394,57)
rule(395,severe-ab precip,ominous-fbs,58)
rule(400,fbs-tree,>=7.25,325)
rule(401,>=7.25,sev-ab fbs-menu,69)
rule(402,>=7.25,fbs-menu,70)
rule(405,sev-ab fbs-menu,goal_405,1100,73)
rule(406,sev-ab fbs-menu,2nd-fbs,1100,351)
rule(407,sev-ab fbs-menu,goal_407,1100,77,87)
rule(408,sev-ab fbs-menu,2nd-fbs,1100,77,88,352)
rule(410,fbs-menu,goal_410,1101,73)
rule(411,fbs-menu,2nd-fbs,1101,350)
rule(412,fbs-menu,fbs-menu,1101,75,71,370)
rule(413,fbs-menu,2nd-fbs,1101,75,72)

rule(414,fbs-menu,goal_414,1101,77,87)
rule(415,fbs-menu,2nd-fbs,1101,88,352)
rule(420,fbs-tree,7.20-7.24_1,326)
rule(421,7.20-7.24_1,goal_421,1110,84)
rule(422,7.20-7.24_1,2nd-fbs,1110,85)
rule(423,7.20-7.24_1,goal_423,1110,75)
rule(424,7.20-7.24_1,goal_424,1110,86)
rule(430,fbs-tree,< 7.20,327)
rule(431,< 7.20,goal_431,327,328)
rule(432,< 7.20,2nd-fbs,91,93)
rule(433,< 7.20,goal_433,91,94)
rule(434,< 7.20,goal_434,92)
rule(450,2nd-fbs,goal_450,89)
rule(451,2nd-fbs,>=7.25_2,90,330)
rule(452,2nd-fbs,7.20-7.24_2,90,331)
rule(453,2nd-fbs,goal_453,90,332)
rule(460,>=7.25_2,goal_460,1130,100,102)
rule(461,>=7.25_2,2nd-fbs,1130,100,103,106)
rule(462,>=7.25_2,2nd-fbs,1130,100,104,110,106)
rule(463,>=7.25_2,goal_463,1130,100,105)
rule(465,>=7.25_2,goal_465,1130,101,102)
rule(466,>=7.25_2,goal_466,1130,101,103)
rule(467,>=7.25_2,2nd-fbs,1130,101,104,110,106)
rule(468,>=7.25_2,goal_468,1130,101,105)
rule(470,7.20-7.24_2,2nd-fbs,1120,100,102,106)
rule(471,7.20-7.24_2,goal_471,1120,100,103)
rule(472,7.20-7.24_2,goal_472,1120,100,104)
rule(475,7.20-7.24_2,goal_475,1120,101,102)
rule(476,7.20-7.24_2,2nd-fbs,1120,101,103,106)
rule(477,7.20-7.24_2,goal_477,1120,101,104)
rule(500,general 30 menu,goal_500,1032)
rule(501,general 30 menu,try fbs again,1035)
rule(502,general 30 menu,try fbs again,1034)
rule(510,general 60 menu,goal_510,1032)
rule(511,general 60 menu,try fbs again,1033)
rule(512,general 60 menu,try fbs again,1034)
rule(520,try fbs again,fbs-tree,302)
rule(521,try fbs again,goal_521,303)
rule(900,quality,labour,900)
rule(901,quality,goal_901,901)
cond(1,baseline < 90,0)
cond(2,baseline 90 - 110,0)
cond(3,baseline 110 - 160,0)
cond(4,baseline 160 - 180,0)
cond(5,baseline > 180,0)
cond(11,variability absent,0)
cond(12,variability reduced,0)
cond(13,variability normal,0)
cond(14,variability increased,0)
cond(21,acceleration present,0)
cond(22,not accerations present,0)
cond(31,no decs,0)

cond(32,early or mild variable decs,0)
cond(33,late or severe variable decs,0)
cond(41,prev trace normal,0)
cond(42,not prev trace normal,0)
cond(43,action wait 10 baseline improv ?,43)
cond(44,not action wait 10 baseline improv ?,0)
cond(45,wait 10 baseline normal ?,6)
cond(46,not wait 10 baseline normal ?,0)
cond(47,do you expect delivery in next 15,47)
cond(48,not do you expect delivery in next 15,0)
cond(49,can deliver vaginally,49)
cond(50,not can deliver vaginally,0)
cond(51,pethidine question,51)
cond(52,not pethidine question,0)
cond(53,precipitating event question,53)
cond(54,not precipitating event question,0)
cond(55,wait 15 baseline normal ?,55)
cond(56,not wait 15 baseline normal ?,0)
cond(57,wait 15 norm base & no ld,57)
cond(58,not wait 15 norm base & no ld,0)
cond(59,wait 15 va to vr or better & no ld,59)
cond(60,not wait 15 va to vr or better & no ld,0)
cond(61,baseline >180 for 30 mins,61)
cond(62,not baseline >180 for 30 mins,62)
cond(63,baseline >180 for further 15 mins,63)
cond(64,not baseline >180 for further 15 mins,0)
cond(65,variability red >=30 mins,65)
cond(66,not variability red >=30 mins,0)
cond(67,the previous trace was abnormal,67)
cond(68,not the previous trace was abnormal,0)
cond(69,previous trace was sev-abnormal,69)
cond(70,not previous trace was sev-abnormal,0)
cond(71,wait 30, trace improves one category,71)
cond(72,not wait 30,trace improves one cat,0)
cond(73,trace is now normal,90)
cond(75,trace drops one category,75)
cond(77,trace severely deteriorated,77)
cond(80,can do easy forceps,80)
cond(81,not can do easy forceps,81)
cond(82,delivery expected in 30 mins,82)
cond(83,not delivery expected in 30 mins,0)
cond(84,trace normal for 60 mins,84)
cond(85,trace persists for 60 mins,85)
cond(86,trace sev-ab after 15 mins,86)
cond(87,can you now deliver vaginally_2,87)
cond(88,not can you now deliver vaginally_2,0)
cond(89,can you now deliver vaginally_3,89)
cond(90,not can you now deliver vaginally_3,0)
cond(91,there was a precip causing low pH,91)
cond(92,not there was a precip causing low pH,0)
cond(93,wait 10 min trace is normal,93)
cond(94,not wait 10 min trace is normal,0)

cond(100,rate of fall in pH >0.04/hr,100)
cond(101,not rate of fall in pH >0.04/hr,101)
cond(102,fbs2: trace normal 60 min,102)
cond(103,fbs2: trace persists 60',103)
cond(104,fbs2: trace deteriorates,104)
cond(105,fbs2: trace sev deteriorates,105)
cond(106,fbs2: clear conditions since 2nd-fbs,0)
cond(110,fbs2: 30 mins since last fbs,110)
cond(200,there are risk factors,200)
cond(201,not there are risk factors,0)
cond(300,can you do an fbs,300)
cond(301,not can you do an fbs,0)
cond(302,can you now do an fbs,302)
cond(303,not can you now do an fbs,303)
cond(325,fbs_1 result >= 7.25,0)
cond(326,fbs_1 result 7.20 - 7.24,0)
cond(327,fbs_1 result < 7.20,0)
cond(328,fbs_1 result < 7.15,0)
cond(330,fbs_2 result >= 7.25,0)
cond(331,fbs_2 result 7.20 - 7.24,0)
cond(332,fbs_2 result < 7.20,0)
cond(333,fbs_2 result < 7.15,0)
cond(350,60 mins since last fbs,350)
cond(351,30 mins since last fbs,351)
cond(352,15 mins since last fbs,352)
cond(370,reset fbs menu,0)
cond(400,cervical dilatation menu,400)
cond(401,cervical dilataion < 8 cm,0)
cond(402,cervical dilatation 8 - 10 cm,0)
cond(403,second stage,0)
cond(515,trace persists sev-ab >= 15 mins,515)
cond(516,not trace persists sev-ab >= 15 mins,0)
cond(530,trace persists ab >= 30 mins,530)
cond(531,not trace persists ab >= 30 mins,0)
cond(560,trace persists int >= 60 mins,560)
cond(561,not trace persists int >= 60 mins,0)
cond(900,the scalp quality is good,900)
cond(901,not the scalp quality is good,900)
cond(1000,abs var no lates peth trigger,1000)
cond(1001,abs var no lates nopeth trigger,1001)
cond(1002,variability now normal,0)
cond(1003,this trace has deteriorated,0)
cond(1004,this trace persisted >= 60 mins,0)
cond(1005,this trace persisted >= 30 mins,0)
cond(1010,var red no decs trigger peth,1010)
cond(1011,var red no decs trigger no peth,1011)
cond(1012,this trace has deteriorated,0)
cond(1013,this tace persisted >=45 mins,0)
cond(1014,this trace persisted >=30 mins,0)
cond(1020,>180 va-nl trigger,1020)
cond(1021,trace becomes acceptible,0)
cond(1022,trace persists >=15,0)

```
cond(1023,trace deteriorates,0)
cond(1032,trace now acceptible,0)
cond(1033,trace persists >= 60 mins,0)
cond(1034,trace deteriorates,0)
cond(1035,trace persists >= 30 mins,0)
cond(1100,sev-ab fbs menu trigger,1100)
cond(1101,fbs menu trigger,1101)
cond(1110,fbs 7.2 - 7.24 trigger,1110)
cond(1120, 2nd fbs 7.2 - 7.24 trigger,1120)
cond(1130, 2nd fbs 7.2 - 7.24 trigger,1130)
cond(1500,general 30 trigger,1500)
cond(1600,general 60 trigger,1600)
```

Appendix F

An expert system written in Prolog software.

/* An Expert system written in Prolog for the management of labour */

/*- R.D.F Keith Feb 1991 */

```
code = 2000

global predicates
inf() - language c
mainy - language c

global domains
file = myfile
 CONDITIONS = BNO*
  HISTORY = RNO*
  RNO, BNO, FNO = INTEGER
  CATEGORY = STRING
  RISK  = string
  data_file = string
  slist = string*

GLOBAL DATABASE
  rule(RNO,CATEGORY,CATEGORY,CONDITIONS)
  cond(BNO,STRING)
  data_file(data_file)
  yes(BNO)
  no(BNO)
  fact(FNO,CATEGORY,CATEGORY)
  topic(string)
  risk_factor(string)

include "tdoms.pro"
include "tpreds.pro"
include "menu2.pro"

PREDICATES
/*Commands*/
  title_go
  load_know
  erase
  clear
  proces(integer)
  endd(integer)
  goes(CATEGORY)
  run
  reverse(CONDITIONS,CONDITIONS)
  reverse1(CONDITIONS,CONDITIONS,CONDITIONS)
  write_data(integer)

  /*patient_info*/

/*Inferences mechanisms*/
  go(HISTORY,CATEGORY)

  check(RNO,HISTORY,CONDITIONS)
  notest(BNO)
  inpq(HISTORY,RNO,BNO,STRING)
  do_answer(HISTORY,RNO,STRING,BNO,INTEGER)
  norm_ctg
```

```
assert_risk_cond(string)
add_risk

labour_risk_info
antenatal_risk_info
choice(integer)
stop(integer)
choi(integer)
sto(integer)
trace_assess
baseline_assess
proces1(integer)
stop1(integer)
variability_assess
proces2(integer)
stop2(integer)
accelerations_assess
proces3(integer)
stop3(integer)
decelerations_assess
proces4(integer)
stop4(integer)
fbs_menu
proces5(integer)
stop5(integer)
trace_condition_menu
proces6(integer)
stop6(integer)
fbs_menu_2
proces7(integer)
stop7(integer)
trace_condition_menu_2
proces8(integer)
stop8(integer)
trace_condition_menu_3
proces9(integer)
stop9(integer)
v_absent_d_nolates_nopeth_menu
proces10(integer)
stop10(integer)
v_absent_d_nolates_peth_menu
proces11(integer)
stop11(integer)
v_absent_d_lates_menu
proces12(integer)
stop12(integer)
cervical_dilatation_menu
proces13(integer)
stop13(integer)

GOAL
  makewindow(1,14,25,"",4,0,20,80), /* inner working window */
  makewindow(2,0,31,"",14,0,10,80),
  makewindow(5,14,0,"",0,0,3,80),
  makewindow(7,15,0,"",3,17,1,45),
  makewindow(8,79,0,"",24,0,1,80),  /* boarder with action text in */
  makewindow(9,12,0,"",0,0,25,80),
    openwrite(myfile,"labour.dat"),

    /*patient_info,*/
    TIME = 0,
```

```
    run.
clauses
 run :-
  shiftwindow(7),
  clearwindow,
  write("    INtelligent Fetal AssessmeNT (INFANT)"),
  shiftwindow(8),
  clearwindow,
  write("  select option with arrow key  "),
  antenatal_risk_info,
  load_know,
    repeat,
      shiftwindow(1),
      menu(6,55,15,9,
            ["Normal CTG",
             "Consultation",
             "Update info"],
             "menu",2,CHOICE),
         proces(CHOICE),
  endd(CHOICE),!.

  proces(0):-shiftwindow(9), clearwindow, closefile(myfile), exit.
  proces(1):-norm_ctg.
  proces(2):-writedevice(myfile), write("0\n"), write("2\n"),

           writedevice(screen),
           title_go.
  proces(3):-labour_risk_info.

  endd(0):-shiftwindow(9), clearwindow, closefile(myfile).

/*patient_info:-write("Are there antenatal risk factors"),*/
      /*       readln(_).*/

/*Inference mechanism*/
  trace_assess:-
      baseline_assess,
      variability_assess,
      accelerations_assess,
      decelerations_assess.

  title_go:-
    goes(Mygoal),
    nl,nl,go([],Mygoal),!.

  goes(Mygoal):-
    clearwindow,
    clear,
    trace_assess,
    risk_factor(X),
    assert_risk_cond(X),

    Mygoal = "heart_rate".

   assert_risk_cond(none):-
      assert(no(26)).

  assert_risk_cond(present):-
      assert(yes(26)).

  go( _, Mygoal ):-                    /* My best guess  */
```

```
    not(rule(_,Mygoal,_,_)),!,nl,
    write("Recommended Action:\n\n",Mygoal),nl,nl,
    writedevice(myfile), write("0\n"), write("Recommended action:- ",
Mygoal),
    write("\n0\n"),
    writedevice(screen),
    write("\n\nPress any key to continue "),
    readchar(_),
    clearwindow.

  go( HISTORY, Mygoal ):-
    rule(RNO,Mygoal,NY,COND),
    check(RNO,HISTORY, COND),
    go([RNO|HISTORY],NY).

  /** VARIABILITY ABSENT DECELERATIONS-NO LATES NO PETHIDINE **/
  check( _, _, [74|_] ):-
      assert(yes(74)),
      clearwindow,
      write("\nContinue to observe the trace until one of the following
become true"),
      v_absent_d_nolates_nopeth_menu,
      !.
 /*********************************************************/

  /** VARIABILITY ABSENT DECELERATIONS-NO LATES PETHIDINE **/
  check( _, _, [79|_] ):-
      assert(yes(79)),
      clearwindow,
      write("\nContinue to observe the trace until one of the following
become true"),
      v_absent_d_nolates_peth_menu,
      !.
 /*********************************************************/

  /********** VARIABILITY ABSENT DECELERATIONS LATES ********/
  check( _, _, [80|_] ):-
      assert(yes(80)),
      clearwindow,
      write("\nContinue to observe the trace until one of the following
become true"),
      v_absent_d_lates_menu,
      !.
 /*********************************************************/

  /**************** ASSESS CERVICAL DILATATION ***************/
  check( _, _, [81|_] ):-
      assert(yes(81)),
      clearwindow,
      write("\n\tWhat is the Cervical Dilatation"),
      cervical_dilatation_menu,
      !.
 /*********************************************************/

  /************************ FBS RESULT *********************/
  check( _, _, [100|_] ):-
      assert(yes(100)),
      clearwindow,
      write("\n\tPerform an FBS and enter result"),
      fbs_menu,
      !.
```

```
/*************************************************************/

/********************** Wait for 30 mins ********************/
/*** used in fbs tree to wait for 30 minutes before *******/
/* requesting another fbs when the trace is deteriorating */
check( _, _, [109|_] ):-

     retract(yes(106)),
     retract(no(105)),
     retract(no(107)),
     retract(yes(109)),
     fail.

/*************************************************************/

/************************ ASSESS TRACE ******************/
check( _, _, [104|_] ):-
     assert(yes(104)),
     clearwindow,
     write("\nObserve the trace:"),
     trace_condition_menu,
     !.
/*************************************************************/

 /****************** FBS SECOND RESULT ******************/
 check( _, _, [111|_] ):-
     assert(yes(111)),
     clearwindow,
     write("\n\tPerform another FBS and enter result"),
     fbs_menu_2,
     !.
/*************************************************************/

/********************** TRACE ASSESS 2 ******************/
/* when > 0.04 u/hr is true */

check( _, _, [133|_] ):-
     assert(yes(133)),
     clearwindow,
     write("\nObserve trace for 30 minutes:"),
     trace_condition_menu_2,
     !.
/*************************************************************/

/********************** TRACE ASSESS 2 ******************/
/* when < 0.04 u/hr is true */

check( _, _, [134|_] ):-
     assert(yes(134)),
     clearwindow,
     write("\nObserve trace for 30 minutes:"),
     trace_condition_menu_2,
     !.
/*************************************************************/

/********************** TRACE ASSESS 3 ******************/
/* when first FBS is 7.20 - 7.24 */

check( _, _, [132|_] ):-
     assert(yes(132)),
     clearwindow,
```

```
      write("\nObserve trace until one of the following conditions
becomes true:"),
      trace_condition_menu_3,
      !.
 /*********************************************************/

  /****************** FBS SECOND RESULT ******************/
  /* when first result was 7.20 - 7.24 */
  check( _, _, [129|_] ):-
      assert(yes(129)),
      clearwindow,
      write("\n\tPerform another FBS and enter result"),
      fbs_menu_2,
      !.
 /*********************************************************/

 /********************** TRACE ASSESS 4 ******************/
 /* when first FBS 7.20-7.24 & second FBS was 7.20-7.24 */

 check( _, _, [130|_] ):-
      assert(yes(130)),
      clearwindow,
      write("\nObserve trace for 30 minutes:"),
      trace_condition_menu_2,
      !.
 /*********************************************************/

  check( RNO, HISTORY, [BNO|REST] ):- yes(BNO), !,
    check(RNO, HISTORY, REST).

  check( _, _, [BNO|_] ):- no(BNO), !,fail.

  check( RNO, HISTORY, [BNO|REST] ):- cond(BNO,NCOND),
    fronttoken(NCOND,"not",_COND),
    frontchar(_COND,_,COND),
    cond(BNO1,COND),
    notest(BNO1), !,
    check(RNO, HISTORY, REST),
    write_data(BNO).


  check(_,_, [BNO|_] ):- cond(BNO,NCOND),
    fronttoken(NCOND,"not",_COND),
    frontchar(_COND,_,COND),
    cond(BNO1,COND),
    yes(BNO1),
     !,fail.

  check( RNO, HISTORY, [BNO|REST] ):-
    cond(BNO,TEXT),
    inpq(HISTORY,RNO,BNO,TEXT),
    check(RNO, HISTORY, REST).

    check( _, _, [] ).

 notest(BNO):-no(BNO),!.
 notest(BNO):-not(yes(BNO)),!.
 inpq(HISTORY,RNO,BNO,TEXT):-
    clearwindow,
    write("\n\n"),
    write(TEXT,": "),
```

```
    ROW = 6,
    COL = 70,
    menu(ROW,COL,15,9,[yes,no],"",1,CHOICE),
    do_answer(HISTORY,RNO,TEXT,BNO,CHOICE).

  do_answer(_,_,_,BNO,1):-assert(yes(BNO)),
  write_data(BNO).

  do_answer(_,_,_,BNO,2):-assert(no(BNO)),
      shiftwindow(1),write(no),nl,fail.

/*Norm CTG*/
norm_ctg:-clearwindow,
write("\n\n\tNormal CTG"),
writedevice(myfile),
write("0\n"),
write("1\n"),
writedevice(screen).

/*Input info*/

/* Enter antenatal risk factors */
antenatal_risk_info:-
      assert(risk_factor("present")),
      risk_factor(X),
      assert_risk_cond(X),
      write_data(0),
      write_data(7),
      repeat,
            shiftwindow(1),
            menu(6,20,71,12,
            ["confirmed IUGR",
            "abnormal antenatal trace",
            "abruption antenatally",
            "none",
            "Exit"],
            "ENTER ANTENATAL RISK FACTORS",
            2,
            OPTION),
          choice(OPTION),
          stop(OPTION),
          !.

choice(0):-write_data(0).
choice(1):-write_data(1).
choice(2):-write_data(2).
choice(3):-write_data(3).
choice(4):-write_data(4).
choice(5):-write_data(0).

stop(0):-clearwindow.
stop(4):-clearwindow,
       retract(yes(26)),
       retractall(risk_factor(_)),
       assert(risk_factor("none")),
       risk_factor(X),
       assert_risk_cond(X).

stop(5):-clearwindow.
/************************** LABOUR RISK FACTORS ********************/
```

```
labour_risk_info:-
      clearwindow,
      write_data(0),
      write_data(3),
      repeat,
            shiftwindow(1),
            menu(6,20,71,12,
                  ["Thick meconium liquor",
                  "Prolonged deceleration > 8 mins",
                  "Exit"],
                  "UPDATE LABOUR RISK FACTORS",
                  2,
                  OPTION),
            choi(OPTION),
            sto(OPTION),
            !.

choi(0):-write_data(0).
choi(1):-write_data(1),
      add_risk.

choi(2):-write_data(2),
      add_risk.

choi(3):-write_data(0).
sto(0):-clearwindow.
sto(3):-clearwindow.

add_risk:-
      retractall(risk_factor(_)),
      retractall(no(_)),
      retractall(yes(_)),
      assert(risk_factor("present")),
      risk_factor(X),
      assert_risk_cond(X).

/********************** MENUS FOR TRACE INTERPRETATION
**********************/

baseline_assess:-
  repeat,
      shiftwindow(1),
      menu(8,25,14,15,
            ["Less than 90 for > 3 minutes",
             "Between 90 - 110",
             "Between 110 - 160",
             "Between 160 - 180",
             "Greater than 180"],

             "BASELINE",2,CHOICE),
        proces1(CHOICE),
  stop1(CHOICE),!.

  proces1(1):-assert(yes(1)), assert(no(13)), assert(no(28)),
assert(no(29)), assert(no(30)).
  proces1(2):-assert(no(1)), assert(yes(13)), assert(no(28)),
assert(no(29)), assert(no(30)).
  proces1(3):-assert(no(1)), assert(no(13)), assert(no(28)),
assert(no(29)), assert(yes(30)).
  proces1(4):-assert(no(1)), assert(no(13)), assert(yes(28)),
assert(no(29)), assert(no(30)).
```

```
  proces1(5):-assert(no(1)), assert(no(13)), assert(no(28)),
assert(yes(29)), assert(no(30)).
  stop1(_):-clearwindow.

variability_assess:-
  repeat,
      shiftwindow(1),
      menu(8,30,14,15,
            ["Absent",
             "Reduced (< 5 bpm)",
             "Normal",
             "Increased (> 25 bpm)"],

             "VARIABILITY",2,CHOICE),
         proces2(CHOICE),
  stop2(CHOICE),!.

  proces2(1):-assert(no(14)), assert(no(15)), assert(no(16)),
assert(yes(78)).
  proces2(2):-assert(yes(14)), assert(no(15)), assert(no(16)),
assert(no(78)).
  proces2(3):-assert(no(14)), assert(yes(15)), assert(no(16)),
assert(no(78)).
  proces2(4):-assert(no(14)), assert(no(15)), assert(yes(16)),
assert(no(78)).
  stop2(_):-clearwindow.

accelerations_assess:-
  repeat,
      shiftwindow(1),
      menu(8,30,14,15,
            ["Absent",
             "Present"],
             "ACCELERATIONS",2,CHOICE),
         proces3(CHOICE),
  stop3(CHOICE),!.

  proces3(1):-assert(no(20)).
  proces3(2):-assert(yes(20)).
  stop3(_):-clearwindow.

decelerations_assess:-
  repeat,
      shiftwindow(1),
      menu(8,30,14,15,
            ["None",
             "Early or Mild Variable",
             "Late or Severe Variable"],

             "DECELERATIONS",2,CHOICE),
         proces4(CHOICE),
  stop4(CHOICE),!.

  proces4(1):-assert(yes(17)), assert(no(18)), assert(no(19)).
  proces4(2):-assert(no(17)), assert(yes(18)), assert(no(19)).
  proces4(3):-assert(no(17)), assert(no(18)), assert(yes(19)).
  stop4(_):-clearwindow.

fbs_menu:-
  repeat,
      shiftwindow(1),
```

```
      menu(8,30,14,15,
            ["Greater or equal to 7.25",
             "Between 7.20 and 7.24",
             "Less than 7.20"],
             "FBS pH",2,CHOICE),
         proces5(CHOICE),
  stop5(CHOICE),!.

  proces5(1):-assert(yes(101)), assert(no(102)), assert(no(103)).
  proces5(2):-assert(no(101)), assert(yes(102)), assert(no(103)).
  proces5(3):-assert(no(101)), assert(no(102)), assert(yes(103)).
  stop5(_):-clearwindow.

fbs_menu_2:-
  repeat,
      shiftwindow(1),
      menu(8,30,14,15,
            ["Greater or equal to 7.25",
             "Between 7.20 and 7.24",
             "Less than 7.20"],
             "FBS pH",2,CHOICE),
         proces6(CHOICE),
  stop6(CHOICE),!.

  proces6(1):-assert(yes(112)), assert(no(113)), assert(no(114)).
  proces6(2):-assert(no(112)), assert(yes(113)), assert(no(114)).
  proces6(3):-assert(no(112)), assert(no(113)), assert(yes(114)).
  stop6(_):-clearwindow.


trace_condition_menu:-
  repeat,
      shiftwindow(1),
      menu(8,30,14,15,
            ["Returns to Acceptible Trace",
             "Trace Deteriorates",
             "60 minutes elapse since last FBS"],
             "TRACE ASSESSMENT",2,CHOICE),
         proces7(CHOICE),
  stop7(CHOICE),!.

  proces7(1):-assert(yes(105)), assert(no(106)), assert(no(107)).
  proces7(2):-assert(no(105)), assert(yes(106)), assert(no(107)).
  proces7(3):-assert(no(105)), assert(no(106)), assert(yes(107)).
  stop7(_):-clearwindow.

trace_condition_menu_2:-
  repeat,
      shiftwindow(1),
      menu(8,30,14,15,
            ["Returns to an Acceptible Trace",
             "Trace remains the same",
             "Trace Deteriorates"],
             "TRACE ASSESSMENT",2,CHOICE),
         proces8(CHOICE),
  stop8(CHOICE),!.

  proces8(1):-assert(yes(117)), assert(no(118)), assert(no(119)).
  proces8(2):-assert(no(117)), assert(yes(118)), assert(no(119)).
  proces8(3):-assert(no(117)), assert(no(118)), assert(yes(119)).
  stop8(_):-clearwindow.
```

```
trace_condition_menu_3:-
  repeat,
      shiftwindow(1),
      menu(10,6,14,15,
            ["Returns to an Acceptible Trace and is maintained for 60
minutes",
             "Trace Persisting for a total of 30 minutes",
             "Trace Deteriorates",
             "Trace previously severely abnormal and this re-occurs"],
             "TRACE ASSESSMENT",2,CHOICE),
         proces9(CHOICE),
  stop9(CHOICE),!.

  proces9(1):-assert(yes(126)), assert(no(127)), assert(no(128)),
assert(no(131)).
  proces9(2):-assert(no(126)), assert(yes(127)), assert(no(128)),
assert(no(131)).
  proces9(3):-assert(no(126)), assert(no(127)), assert(yes(128)),
assert(no(131)).
  proces9(4):-assert(no(126)), assert(no(127)), assert(yes(128)),
assert(yes(131)).
  stop9(_):-clearwindow.

v_absent_d_nolates_nopeth_menu:-
   repeat,
      shiftwindow(1),
      menu(10,25,14,15,
            ["Returns to an Acceptible Trace",
             "Trace Persisting for 30 minutes",
             "Trace Deteriorates"],
             "TRACE ASSESSMENT",2,CHOICE),
         proces10(CHOICE),
  stop10(CHOICE),!.

  proces10(1):-assert(yes(75)), assert(no(76)), assert(no(77)).
  proces10(2):-assert(no(75)), assert(yes(76)), assert(no(77)).
  proces10(3):-assert(no(75)), assert(no(76)), assert(yes(77)).
  stop10(_):-clearwindow.


v_absent_d_nolates_peth_menu:-
  repeat,
      shiftwindow(1),
      menu(10,25,14,15,
            ["Returns to an Acceptible Trace",
             "Trace Persisting for 60 minutes",
             "Trace Deteriorates"],
             "TRACE ASSESSMENT",2,CHOICE),
         proces11(CHOICE),
  stop11(CHOICE),!.

  proces11(1):-assert(yes(75)), assert(no(76)), assert(no(77)).
  proces11(2):-assert(no(75)), assert(yes(76)), assert(no(77)).
  proces11(3):-assert(no(75)), assert(no(76)), assert(yes(77)).
  stop11(_):-clearwindow.


v_absent_d_lates_menu:-
  repeat,
      shiftwindow(1),
```

```
      menu(10,25,14,15,
            ["Returns to an Acceptible Trace",
             "Trace Persisting for 15 minutes",
             "Trace Deteriorates"],
             "TRACE ASSESSMENT",2,CHOICE),
         proces12(CHOICE),
  stop12(CHOICE),!.

  proces12(1):-assert(yes(75)), assert(no(76)), assert(no(77)).
  proces12(2):-assert(no(75)), assert(yes(76)), assert(no(77)).
  proces12(3):-assert(no(75)), assert(no(76)), assert(yes(77)).
  stop12(_):-clearwindow.

cervical_dilatation_menu:-
  repeat,
      shiftwindow(1),
      menu(10,25,14,15,
            ["Less than 8 cm",
             "Between 8 and 10 cm",
             "In ACTIVE second stage of labour"],
             "CERVICAL DILATATION",2,CHOICE),
         proces13(CHOICE),
  stop13(CHOICE),!.

  proces13(1):-assert(yes(43)), assert(no(44)), assert(no(45)).
  proces13(2):-assert(no(43)), assert(yes(44)), assert(no(45)).
  proces13(3):-assert(no(43)), assert(no(44)), assert(yes(45)).
  stop13(_):-clearwindow.


/*****************************************************************
*/

/*User commands*/

  write_data(X):-writedevice(myfile),
  write(X, "\n"),
  writedevice(screen).


  load_know:-consult("infant.gni").

  erase:-retract(_),fail.
  erase.

  clear:-retractall(yes(_)),retractall(no(_)).

 /*system commands*/

  reverse(X,Y):-
     reverse1([],X,Y).
  reverse1(Y,[],Y).
  reverse1(X1,[U|X2],Y):-reverse1([U|X1],X2,Y).
```

Appendix G

An inference engine written in 'C' software.

```
/*    An expert system written in C for the */
/*          management of labour.           */

/*      Robert D. F. Keith - 1992      */

#include <stdio.h>
#include <stdlib.h>                          /*** libraries to include ****/
#include <graphics.h>
#include <math.h>
#include <string.h>
#include <alloc.h>
#include <conio.h>

#define CLS printf("%c[2J",27)
#define TRUE      1
#define FALSE     0

typedef struct
      {
      int bl;
      char hrvar;
      int noaccs;
      int dipear;
      int diplat;
      int dipearsev;
      int diplatsev;
      int nocons;
      int tnoise;
      int snoise;
      char clas;
      } feats;

typedef struct {
      char rule[55];
      } kb_rule_struct;

typedef struct {
      char condition[55];
      } kb_cond_struct;

typedef struct
      {
      int   fbs_time;
      float   fbs_ph;
      } fbs_res;

int numb_of_fbs;
int get_rule();
extern class_ctg();
extern display_conditions();
extern special_condition1();
extern special_condition2();

char current_head[100];
char statement_type[20], rule_number[10], head[30], tail[300];

int cond[20], number_conds, cond_ptr, status;
int yes[100], no[100];
int number_in_no, number_in_yes;
int yes_found_flag = FALSE, no_found_flag = FALSE;
```

```
int yes_found_flag = FALSE, no_found_flag = FALSE;
kb_rule_struct kb_r[300];
kb_cond_struct kb_c[150];
fbs_res fbs_res_array[10];

int rule_position;
int max_rule;
int inhibit_flag;

int validation_score;   // used for validation to measure concern

call_expert(feats segt[], int time)
{

if(time == 15)              /* time == 16 */
      {
      load_kb();         /* only done once - stays in memory */
      set_yes_no();      /* reset when a goal is reached */
      setfillstyle(1,9);
      bar(0,310,640,480);
      }

display_extracted_features(segt, time);
class_ctg(segt, time, yes, no, inhibit_flag);
if(inhibit_flag != TRUE)
      {
      number_in_no = 10;
      number_in_yes = 4;
      }
rule_position = 0;
validation_score = 0;
inference_engine(segt, time);

prn_validation_score();
//getch();
if(validation_score == 5)
      exit(0);
}

/*****************************************************************************/
/************************** INFERENCE ENGINE *********************************/
inference_engine(feats segt[], int time)
{
int flag, goal_flag = TRUE;
int j, k;

strcpy(current_head, "quality");

while(TRUE)
{
no_found_flag = FALSE;

/* DOES CURRENT HEAD EXIST IN KB. IF IT DOES BREAK - *****/
/* IF IT DOESN'T, IT MUST BE THE GOAL SOLUTION ELSE NO SOLUTION EXISTS */

do
      {
      flag = get_rule();  /* GET_RULE() WILL ALSO SPLIT THE RULE */
      if(flag != 0)
            {
```

```
            if(goal_flag == TRUE)
                  {
                  goal_message(current_head);
                  set_yes_no();
                  return;
                  }
            if(goal_flag == FALSE)
                  {
                  printf("\n\nI could not find a solution\n");
                  getch();
                  set_yes_no();
                  return;
                  }
            }
      rule_position++;
      }
while(strcmp(current_head, head) != 0);
                  /******************/

goal_flag = FALSE; /* a rule with the current head has been found */
                  /* therefore if a complete solution does not exist */
                  /* it must be an error. Goal_flag is only set TRUE */
                  /* when a rule is satisfied */

/**** CHECK WHETHER ANY CONDITIONS ASSOCIATED WITH THE CURRENT RULE ****/
/**** EXIST IN THE NO[] ARRAY - IF THEY DO THEN THE CURRENT RULE     ***/
/***** CANNOT BE TRUE *****/

for(j = 0; j < number_conds; j++)
      {
      for(k = 0; k < number_in_no; k++)
            {
            if(cond[j] == no[k])
                  no_found_flag = TRUE;
            }
      }
                  /*****************/

cond_ptr = 0;  /* begin with first condition */

while(no_found_flag == FALSE)
      {
      yes_found_flag = FALSE;

/*if all the conditions associated with the current rule are true then */
/* the rule must be true in which case the tail belonging to the rule */
/* becomes the current head are possibly a goal state */

      if(cond_ptr >= number_conds)
            {
            look_up();   // look up table for validation concern
            display_conditions(cond, number_conds, rule_number);
            strcpy(current_head, tail);
            goal_flag = TRUE;
            rule_position = 0;
            break;
            }
                  /******************/
 /* test to see whether the current condition is already known to be true
*/
            for(k = 0; k < number_in_yes; k++)
```

```
                    {
                    if(cond[cond_ptr] == yes[k])
                          {
                          yes_found_flag = TRUE;
                          cond_ptr++;
                          }
                    }

      /* if it is then continue with the next condition */

      if(yes_found_flag == TRUE)
            continue;

      /************* CHECK COND ************/
/* if the answer to the current condition is unknown then we must try and
   proove the condition */
      rule_position = 0;

      /* check for "not" & special condition */

            if(check_condition(cond[cond_ptr], segt, time) == TRUE)
                  return;
      cond_ptr++;                    /* next condition */
                  /***************/
      }
}

}

/*****************************************************************/
/****************************** LOAD KB ***************************************/
load_kb()
{
FILE *know_file;
char entry[50], entry_test[50];
int rule_array_pos, cond_array_pos, j;
char *ptr;

if((know_file = fopen("inf.kb", "r")) == NULL)
      {
      printf("cannot open file");
      getch();
      exit(0);
      }

rule_array_pos = 0;
cond_array_pos = 0;

while(feof(know_file) == 0)
      {
      fgets(entry,50, know_file);
      strcpy(entry_test, entry);
      ptr = strtok(entry_test, "(");
      if(strcmp(ptr, "rule") == 0)
            {
            strcpy(kb_r[rule_array_pos].rule, entry);
            rule_array_pos++;
            }
      if(strcmp(ptr, "cond") == 0)
            {
            strcpy(kb_c[cond_array_pos].condition, entry);
```

```
            cond_array_pos++;
            }
      }
max_rule = rule_array_pos;
}
/*****************************************************************************/

/********************************** GET RULE ***************************/
int get_rule()
{
int test, dummy,j;
char *ptr, current_rule[100];

number_conds = 0;
for(j = 0; j < 20; j++)
      cond[j] = 0;
if(rule_position > max_rule)
      return(1);
strcpy(current_rule, kb_r[rule_position].rule);

ptr = strtok (current_rule, "(),");

ptr = strtok (NULL, "(),");
strcpy(rule_number, ptr);        /* get rule number */

ptr = strtok (NULL, "(),");      /* get rule head */
strcpy(head, ptr);
                           /* get rule tail */
ptr = strtok (NULL, "(),");
strcpy(tail, ptr);

while(TRUE)
      {
      ptr = strtok (NULL, "(),");     /* get the conditions associated
with the rule */
      if(ptr == NULL)
            break;
      dummy = atoi(ptr);
      if(dummy > 0)                   /* valid conditions > 0 */
            {
            cond[number_conds] = dummy;
            number_conds++;
            }
      }

return(0);
}
/*****************************************************************************/

/************************** SET YES NO ARRAYS TO 0 ********************/
set_yes_no()
{
int j;

for(j = 0; j < 100; j++)
      {
      yes[j] = 0;
      no[j] = 0;
      }
number_in_yes = 0;
number_in_no = 0;
```

```
number_conds = 0;
inhibit_flag = FALSE;
}

/*****************************************************************************/

/****************************** CHECK CONDITION ******************************/
check_condition(int condition_number, feats segt[], int time)
{
char cond_str[10], cond_search[50];
char statement[500], question[500];
char *ptr;
int j, c_ptr;

      /* find the condition given by the token cond(x, */
      /* where x is the condition number */

c_ptr=0;
do
      {
      itoa(condition_number, cond_str, 10);
      strcpy(cond_search, "cond(");
      strcat(cond_search, cond_str);
      strcpy(statement, kb_c[c_ptr].condition);
      c_ptr++;
      }
while(strstr(statement, cond_search) == NULL);

ptr = strtok (statement, ",");
ptr = strtok (NULL, ")");
strcpy(question, ptr);

                  /* NOT CONDITIONS */
/*a "not" condition must always follow numerically after the condition */
/* for which the "not" condition is the opposite response */
/* therefore if the condition number is 22 then the "not" condition */
/* if it exists, must be condition number 23 */

if(strncmp(question, "not", 3) == 0)
                              /*checks first three chars of question */
      {
      /* check if the condition has been asked before and the response */
      /* was no, in which case the "not" condition will be yes. This   */
      /* will virtually always be the case as long as the KB has been  */
      /* constructed with care */

        for(j = 0; j < number_in_no; j++)
            if(no[j] == condition_number - 1)
                  {
                  yes[number_in_yes] = condition_number;
                  number_in_yes++;
                  return(FALSE);
                  }

      /* check if the condition has been asked before and the response */
      /* was yes, in which case the "not" condition will no. This will */
      /* seldom be the case */

      for(j = 0; j < number_in_yes; j++)
            if(yes[j] == condition_number - 1)
```

```
                    {
                    no[number_in_no] = condition_number;
                    number_in_no++;
                    no_found_flag = TRUE;
                     /*   fsetpos(fp, &filepos);   */
                    return(FALSE);
                    }
        }
                    /*************/

if(condition_number < 500)
      status = special_condition1(condition_number, segt, time,
&number_in_yes, &number_in_no, yes, no, fbs_res_array);
if(condition_number >= 500)
      status = special_condition2(condition_number, segt, time,
&number_in_yes, &number_in_no, yes, no, fbs_res_array);

      if(status != 0)
            {
            if(status == 1)
                  {
                  no[number_in_no] = condition_number;
                  number_in_no++;
                  no_found_flag = TRUE;
                  }
            if(status == 2)
                  {
                  yes[number_in_yes] = condition_number;
                  number_in_yes++;
                  yes_found_flag = TRUE;
                  }
            if(status == 3)
                  {
                  yes[number_in_yes] = condition_number;
                  number_in_yes++;
                  yes_found_flag = TRUE;
                  no[number_in_no] = condition_number+1;
                  number_in_no++;
                  }
            if(status == 4)
                  {
                  no[number_in_no] = condition_number;
                  number_in_no++;
                  no_found_flag = TRUE;
                  yes[number_in_yes] = condition_number+1;
                  number_in_yes++;
                  }
            if(status == 5)
                  {
                  inhibit_flag = TRUE;
                  ask(condition_number, 0);
/* display possible message, file must exist in "question" directory.
            response_flag = 0 (FALSE) */

            return(TRUE); /* keep positon in knowledge tree */
                  }
            ask(condition_number, 0);
/* display possible message, file must exist in "question" directory.
response_flag = 0 (FALSE) */

            return(FALSE);
```

```
            }
if(status == 0)
      ask(condition_number, 1);  /* response_flag = 1 TRUE. A question is
to be asked, a yes/no
                                 response is required */
      }
/*****************************************************************************/

/********************************** ASK ***************************************/
ask(int condition_number, int response_flag)
{
/*    response_flag = TRUE :- a question is being aked requiring a yes/no
response response_flag = FALSE :- a message is displayed requiring only
an acknowledgemnt */

#define           TLX   40
#define           TLY   199
#define           BLX   600
#define           BLY   290

FILE *gm;
int dot, j, k, loop;
char *ptr;
void far *buf;
unsigned size;
char out_msg[200];
char ans, cond_num_str[10], quest_file[30];

itoa(condition_number, cond_num_str,10);
strcpy(quest_file,"question\\");
strcat(quest_file,cond_num_str);

if((gm = fopen(quest_file, "rt")) == NULL)
      {
      if(response_flag == TRUE)
            {
            printf("I could not think of the correct question to ask\n");
            printf("The condition I was looking for was %d",
condition_number);
            getch();
            exit(0);
            }
      else
            return;
      }
fgets(out_msg, 500, gm);
fclose(gm);

size = imagesize(TLX,TLY,BLX,BLY);    /* max 108k */
if((buf = farmalloc(size)) == NULL)
      {
      printf("not enough memory");
      getch();
      exit(0);
      }
getimage(TLX,TLY,BLX,BLY, buf);

if(response_flag == TRUE)
      {
        set_up_screen(TLX,TLY,BLX,BLY,8);
      outtextxy(((BLX-TLX)/2)-32, TLY+10,"QUESTION");
```

```
        }
if(response_flag == FALSE)
        {
        set_up_screen(TLX,TLY,BLX,BLY,4);
        outtextxy(((BLX-TLX)/2)-32, TLY+10,"MESSAGE");
        }

ptr = strtok(out_msg, "|!");
loop = 0;
while(TRUE)
        {
        outtextxy(TLX+15,(TLY+30)+15*loop,ptr);
        if((strrchr(ptr, '.')) != NULL)
              break;

        ptr = strtok(NULL, "|!");
        loop++;
        }

while(response_flag == TRUE)
        {

        ans = getch();           /** A CHANGE **/
        if(ans == 'y')
              {
              outtextxy(TLX+15, TLY+65, "YES");
              yes[number_in_yes] = condition_number;
              number_in_yes++;
              break;
              }
              if(ans == 'n')
              {
              no[number_in_no] = condition_number;
              number_in_no++;
              no_found_flag = TRUE;
              break;
              }
        }
if(response_flag == FALSE)
   // sleep(3);
        getch();

putimage(TLX,TLY, buf, COPY_PUT);
farfree(buf);

}
/*************************************************************************/

/************************** DISPLAY EXTRACTED FEATURES *****************/
display_extracted_features(feats segt[], int time)
{
char bline_str[10], hrvar_str[20], noaccs_str[10];
char ear_str[10], lat_str[10], earsev_str[10], latsev_str[10];
char cons_str[10], time_str[25], hours_str[10], minutes_str[10];
int minutes, hours;

itoa(segt[time/5 - 3].bl, bline_str, 10);

if(segt[time/5 - 3].hrvar == 'a')
      strcpy(hrvar_str, "Absent");
if(segt[time/5 - 3].hrvar == 'r')
```

```
      strcpy(hrvar_str, "Reduced");
if(segt[time/5 - 3].hrvar == 'n')
      strcpy(hrvar_str, "Normal");
if(segt[time/5 - 3].hrvar == 'i')
      strcpy(hrvar_str, "Increased");

itoa(segt[time/5 - 3].noaccs, noaccs_str, 10);
itoa(segt[time/5 - 3].dipear, ear_str,10);
itoa(segt[time/5 - 3].diplat, lat_str,10);
itoa(segt[time/5 - 3].dipearsev, earsev_str,10);
itoa(segt[time/5 - 3].diplatsev, latsev_str,10);
itoa(segt[time/5 - 3].nocons, cons_str, 10);

minutes = 0;
hours = 0;

while(TRUE)
      {
      if(time - 60 >=0)
            {
            hours++;
            time -= 60;
            }

      if(time - 60 < 0)
            {
            minutes = time;
            break;
            }
       }
itoa(hours, hours_str, 10);
itoa(minutes, minutes_str, 10);

strcpy(time_str, hours_str);
strcat(time_str, " h:");
strcat(time_str, minutes_str);
strcat(time_str, " m");

setfillstyle(1,9);
bar(0,200, 210, 300);
setcolor(WHITE);
rectangle(1,201,209,299);
rectangle(3,203,207,297);
setcolor(WHITE);
outtextxy(7, 207, "Baseline:");
outtextxy(132, 207, bline_str);
outtextxy(7, 217, "Variability:");
outtextxy(132, 217, hrvar_str);
outtextxy(7, 227, "No. Accelns:");
outtextxy(132, 227, noaccs_str);
outtextxy(7,237, "Earlies:");
outtextxy(132, 237, ear_str);
outtextxy(7,247, "Lates:");
outtextxy(132, 247, lat_str);
outtextxy(7, 257, "Severe Earlies:");
outtextxy(132, 257, earsev_str);
outtextxy(7, 267, "Severe Lates:");
outtextxy(132, 267, latsev_str);
outtextxy(7, 277, "Contractions:");
outtextxy(132, 277, cons_str);
outtextxy(7, 287, "Time elapsed:");
```

```
outtextxy(132, 287, time_str);
}
/*****************************************************************************/

/***************************** GOAL MESSAGE ********************************/
goal_message(char goal_file[])
{

#define           TLX   40
#define           TLY   199
#define           BLX   600
#define           BLY   290

FILE *gm;
int dot, j, k, loop;
char *ptr;
void far *buf;
unsigned size;
char out_msg[500];

gm = fopen(goal_file, "rt");
fgets(out_msg, 500, gm);
fclose(gm);

size = imagesize(TLX,TLY,BLX,BLY);    /* max 108k */
if((buf = farmalloc(size)) == NULL)
      {
      printf("not enough memory");
      getch();
      exit(0);
      }
getimage(TLX,TLY,BLX,BLY, buf);
set_up_screen(TLX,TLY,BLX,BLY,4);

ptr = strtok(out_msg, "|!");
loop = 0;
while(TRUE)
      {
      outtextxy(TLX+10,(TLY+10)+15*loop,ptr);
      if((strrchr(ptr, '.')) != NULL)
            break;

      ptr = strtok(NULL, "|!");
      loop++;
      }

//sleep(3);
getch();
putimage(TLX,TLY, buf, COPY_PUT);
farfree(buf);

}
/*****************************************************************************/

/************************ SET UP SCREEN ********************************/
set_up_screen(int x1, int y1, int x2, int y2, int bkg_col)
{
setfillstyle(1,bkg_col);
bar(x1,y1,x2,y2);
setcolor(WHITE);
rectangle(x1+2,y1+2,x2-2,y2-2);
```

```
rectangle(x1+4,y1+4,x2-4,y2-4);
}
/*****************************************************************************/

/*************************** PRINT VALIDATION SCORE ********************/

prn_validation_score()
{
char validation_score_str[5];

setfillstyle(1,15);
bar(100,70, 200, 115);
itoa(validation_score, validation_score_str, 10);
setcolor(0);
outtextxy(109, 75, "Validation");
outtextxy(130, 85, "Score");
outtextxy(145, 100,validation_score_str);
}
/*****************************************************************************/
```

Appendix H

Case information and results obtained in the validation of the system.

For each of the 50 cases considered in the validation study (chapter 5), the following are given;

1. Previous obstetric history.
2. Relevant labour events.
3. Perinatal outcome.
4. Graph of cervical dilatation and estimated fetal scalp blood pH.
5. The recorded scores from the two reviews (1 and 2) recorded by the experts (A - Q) and system (S).
6. The calculated agreement between each pair of review sequences.

Case 1 1289

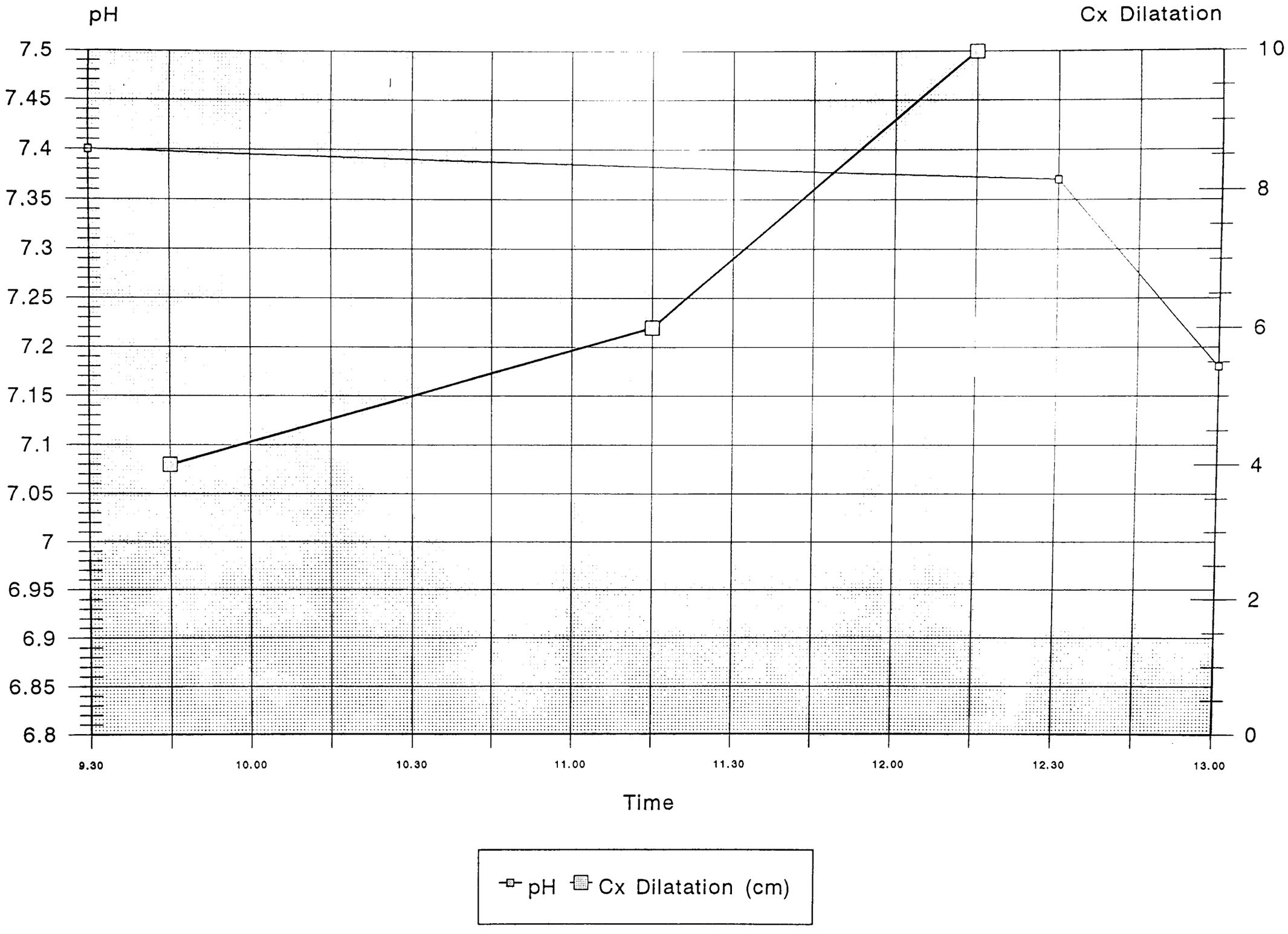
Mrs M.C. is a primigravida. She is a fit lady and does not smoke. Her pregnancy progressed normally and she laboured spontaneously at 39 weeks gestation, being admitted on 5.4.91 at 01.00hrs. At this time the fetal head was 3/5 palpable and the cervix part effaced but closed. Pethidine 100mg was given at 05.00hrs.

Labour events

09.50 VE Cx 4cm dilated, effaced. Station -1. Direct OP position. ARM; clear liquor. FSE applied.
10.15 Epidural begun.
10.30 Epidural working.
11.10 VE Cx 6cm dilated, thin. Station 0.
11.50 Top up.
12.15 VE Cx fully dilated. Station +1. LOT position. Caput + moulding +.
12.25 FBS; pH 7.37 BE -3
12.59 Female infant delivered by Kjellands forceps. Indication; prolonged FH decerations.

Outcome

Birth weight 3.38kg
Apgar 9 & 9
Cord gases pH 7.18 / 7.29 BD(ecf) 6 / 4


pH
Cx Dilatation
7.5
7.45
7.4
7.35
7.3
7.25
7.2
7.15
7.1
7.05
7
6.95
6.9
6.85
6.8
10
8
6
4
2
0
9.30
10.00
10.30
11.00
11.30
12.00
12.30
13.00
Time
pH
Cx Dilatation (cm)

Case 1

		SEGMENT																																																										
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
REVIEWER	A1	2	2	2	2	3	2	2	2	2	4	6																																																	
	A2	1	1	1	2	2	2	2	3	1	2	2	4																																																
	B1	1	2	2	2	3	2	2	1	1	4	4	6																																																
	B2	1	2	2	2	3	2	1	1	2	2	6																																																	
	C1	1	1	1	2	2	2	2	2	2	2	6																																																	
	C2	1	2	1	2	2	2	2	2	2	2	6																																																	
	D1	1	1	1	2	2	2	1	1	1	1	2	2																																																
	D2	1	2	1	2	2	2	2	2	2	2	2	2																																																
	E1	2	2	2	2	3	2	2	2	2	2	6																																																	
	E2	2	2	2	2	3	2	2	2	2	2	2	2																																																
	F1	1	1	1	1	1	1	1	1	1	1	1	1																																																
	F2	1	1	1	1	1	1	1	1	1	1	2	2																																																
	G1	2	2	2	2	2	2	2	2	2	3	2	2																																																
	G2	2	2	2	2	2	2	2	2	2	3	2	2																																																
	H1	2	2	2	2	3	2	2	2	2	2	2	6																																																
	H2	2	2	2	2	2	2	2	2	2	2	2	6																																																
	I1	2	2	2	3	2	2	2	1	2	2	2	4																																																
	I2	2	2	2	3	2	2	2	2	2	2	2	6																																																
	J1	2	2	2	3	2	2	2	2	2	2	2	2																																																
	J2	2	3	2	2	2	3	2	2	2	2	6																																																	
	K1	1	2	2	2	3	2	2	2	2	2	6																																																	
	K2	1	2	2	2	3	2	2	3	2	2	4	4																																																
	L1	1	2	2	3	2	2	2	2	2	6																																																		
	L2	2	2	2	3	2	2	2	1	3	2	6																																																	
	M1	1	1	1	1	1	1	1	1	1	1	1	1																																																
	M2	1	1	1	1	2	1	1	1	1	1	2	2																																																
	N1	1	2	1	2	2	2	2	2	2	2	2	6																																																
	N2	2	2	2	2	2	3	2	2	2	4	4	6																																																
	O1	2	2	3	1	1	1	1	1	2	2	2	6																																																
	O2	2	3	1	1	2	2	2	1	2	2	6																																																	
	P1	1	1	1	2	2	2	2	1	2	6																																																		
	P2	1	1	2	2	2	1	1	2	1	2	2	2																																																
	Q1	2	2	2	2	2	2	2	2	2	2	2	6																																																
	Q2	2	2	2	2	2	2	2	2	2	2	2	2																																																
	S1	1	2	2	2	2	3	2	2	2	6																																																		
	S2	1	2	2	2	2	3	2	2	2	6																																																		
	R1	2	3	4	3	2	2	2	1	1	1	1	1																																																
	R2	1	1	1	2	1	1	1	1	1	1	1	1																																																
	Clinical	0	0	0	0	0	0	0	0	0	3	0	6																																																

Agreement results matrix for case 1

REVIEWER	A1	A2	B1	B2	C1	C2	D1	D2	E1	E2	F1	F2	G1	G2	H1	H2	I1	I2	J1	J2	K1	K2	L1	L2	M1	M2	N1	N2	O1	O2	P1	P2	Q1	Q2	S1	S2	R1	R2
A1	100	69	96	84	69	71	37	42	86	62	31	32	70	70	82	68	82	80	60	79	86	86	82	82	31	35	66	96	71	69	67	39	68	43	82	82	48	33
A2	69	100	78	61	68	67	52	52	60	52	46	48	69	69	63	63	75	55	42	61	62	92	59	67	46	50	65	82	52	58	70	52	63	50	68	68	27	47
B1	96	78	100	75	61	62	32	31	74	48	28	29	57	57	74	61	87	72	46	69	75	91	69	73	28	31	61	97	66	61	57	32	61	31	69	69	42	30
B2	84	61	75	100	80	81	58	59	98	81	50	53	78	78	95	79	77	93	78	87	99	68	93	93	50	56	79	73	86	78	78	60	79	59	93	93	59	53
C1	69	68	61	80	100	99	71	75	80	58	62	65	92	92	78	93	60	78	58	69	82	55	79	77	62	68	96	62	73	81	96	72	93	72	79	79	31	63
C2	71	67	62	81	99	100	69	76	82	60	61	64	94	94	80	95	62	80	60	70	83	55	79	79	61	67	97	63	75	82	95	72	95	74	79	79	32	62
D1	37	52	32	58	71	69	100	92	53	68	92	95	68	68	55	68	49	55	68	44	55	31	52	46	92	99	71	29	56	57	71	97	68	88	52	52	41	94
D2	42	52	31	59	75	76	92	100	60	76	81	86	76	76	62	76	51	62	76	50	61	34	58	49	81	89	78	33	56	59	71	95	76	97	58	58	39	83
E1	86	60	74	98	80	82	53	60	100	83	44	47	80	80	98	81	77	95	80	89	99	68	94	93	44	50	80	75	84	78	76	56	81	62	94	94	59	47
E2	62	52	48	81	58	60	68	76	83	100	57	61	63	63	84	63	70	81	97	73	82	54	77	68	57	65	62	48	69	59	54	72	63	78	77	77	68	61
F1	31	46	28	50	62	61	92	81	44	57	100	97	57	57	46	57	42	46	57	36	46	26	44	38	100	95	62	24	54	50	63	88	57	75	44	44	38	99
F2	32	48	29	53	65	64	95	86	47	61	97	100	62	62	49	62	44	49	61	38	49	27	46	41	97	99	66	26	57	54	65	93	62	80	46	46	36	95
G1	70	69	57	78	92	94	68	76	80	63	57	62	100	100	74	88	59	74	63	69	79	56	80	81	57	65	86	59	69	77	92	72	88	78	80	80	35	60
G2	70	69	57	78	92	94	68	76	80	63	57	62	100	100	74	88	59	74	63	69	79	56	80	81	57	65	86	59	69	77	92	72	88	78	80	80	35	60
H1	82	63	74	95	78	80	55	62	98	84	46	49	74	74	100	84	79	97	81	87	97	69	87	87	46	52	83	74	87	76	68	58	84	63	87	87	60	49
H2	68	63	61	79	93	95	68	76	81	63	57	62	88	88	84	100	65	84	63	70	80	52	72	74	57	65	98	63	79	78	82	72	100	78	72	72	34	60
I1	82	75	87	77	60	62	49	51	77	70	42	44	59	59	79	65	100	82	73	71	77	88	74	74	42	46	64	84	77	71	55	50	65	53	66	66	62	44
I2	80	55	72	93	78	80	55	62	95	81	46	49	74	74	97	84	82	100	84	86	94	64	90	89	46	53	83	70	93	86	68	58	84	63	80	80	67	49
J1	60	42	46	78	58	60	68	76	80	97	57	61	63	63	81	63	73	84	100	72	79	48	80	71	57	65	62	44	77	70	54	72	63	78	70	70	76	61
J2	79	61	69	87	69	70	44	50	89	73	36	38	69	69	87	70	71	86	72	100	89	67	85	85	36	42	68	70	83	85	65	47	70	51	84	84	67	39
K1	86	62	75	99	82	83	55	61	99	82	46	49	79	79	97	80	77	94	79	89	100	69	95	92	46	52	80	74	83	78	78	58	80	61	95	95	58	49
K2	86	92	91	68	55	55	31	34	68	54	26	27	56	56	69	52	88	64	48	67	69	100	68	73	26	29	52	92	57	54	55	33	52	34	68	68	41	28
L1	82	59	69	93	79	79	52	58	94	77	44	46	80	80	87	72	74	90	80	85	95	68	100	95	44	49	72	65	82	85	80	55	72	58	90	90	66	47
L2	82	67	73	93	77	79	46	49	93	68	38	41	81	81	87	74	74	89	71	85	92	73	95	100	38	44	72	69	84	86	79	48	74	50	87	87	61	40
M1	31	46	28	50	62	61	92	81	44	57	100	97	57	57	46	57	42	46	57	36	46	26	44	38	100	95	62	24	54	50	63	88	57	75	44	44	38	99
M2	35	50	31	56	68	67	99	89	50	65	95	99	65	65	52	65	46	53	65	42	52	29	49	44	95	100	69	28	58	56	68	95	65	83	49	49	39	95
N1	66	65	61	79	96	97	71	78	80	62	62	66	86	86	83	98	64	83	62	68	80	52	72	72	62	69	100	62	78	79	85	74	98	76	72	72	33	63
N2	96	82	97	73	62	63	29	33	75	48	24	26	59	59	74	63	84	70	44	70	74	92	65	69	24	28	62	100	60	56	56	31	63	34	71	71	32	26
O1	71	52	66	86	73	75	56	56	84	69	54	57	69	69	87	79	77	93	77	83	83	57	82	84	54	58	78	60	100	93	66	58	79	57	66	66	67	54
O2	69	58	61	78	81	82	57	59	78	59	50	54	77	77	76	78	71	86	70	85	78	54	85	86	50	56	79	56	93	100	78	56	78	58	65	65	67	52
P1	67	70	57	78	96	95	71	71	76	54	63	65	92	92	68	82	55	68	54	65	78	55	80	79	63	68	85	56	66	78	100	70	82	67	80	80	31	64
P2	39	52	32	60	72	72	97	95	56	72	88	93	72	72	58	72	50	58	72	47	58	33	55	48	88	95	74	31	58	56	70	100	72	92	55	55	40	92
Q1	68	63	61	79	93	95	68	76	81	63	57	62	88	88	84	100	65	84	63	70	80	52	72	74	57	65	98	63	79	78	82	72	100	78	72	72	34	60
Q2	43	50	31	59	72	74	88	97	62	78	75	80	78	78	63	78	53	63	78	51	61	34	58	50	75	83	76	34	57	58	67	92	78	100	58	58	40	79
S1	82	68	69	93	79	79	52	58	94	77	44	46	80	80	87	72	66	80	70	84	95	68	90	87	44	49	72	71	66	65	80	55	72	58	100	100	46	47
S2	82	68	69	93	79	79	52	58	94	77	44	46	80	80	87	72	66	80	70	84	95	68	90	87	44	49	72	71	66	65	80	55	72	58	100	100	46	47
R1	48	27	42	59	31	32	41	39	59	68	38	36	35	35	60	34	62	67	76	67	58	41	66	61	38	39	33	32	67	67	31	40	34	40	46	46	100	41
R2	33	47	30	53	63	62	94	83	47	61	99	95	60	60	49	60	44	49	61	39	49	28	47	40	99	95	63	26	54	52	64	92	60	79	47	47	41	100

Case 2 1343

Mrs J.R. is a 31 year old lady expecting her first baby. She is fit and well, and does not smoke. Her pregnancy was straightforward until 38 weeks, when she developed mild hypertension (BP 130/90) without proteinuria. BP remained stable and fetal size was judged to be appropriate for dates. Labour was induced at 40 weeks because of persistent mild hypertension and maternal insistence. On admission at 11.20hrs on 11.4.91, presentation was cephalic 3/5, and cervix closed, uneffaced and firm. Prostin gel 2mg was given PV, and a further 2mg dose at 19.15hrs (Bishop's score had not improved).

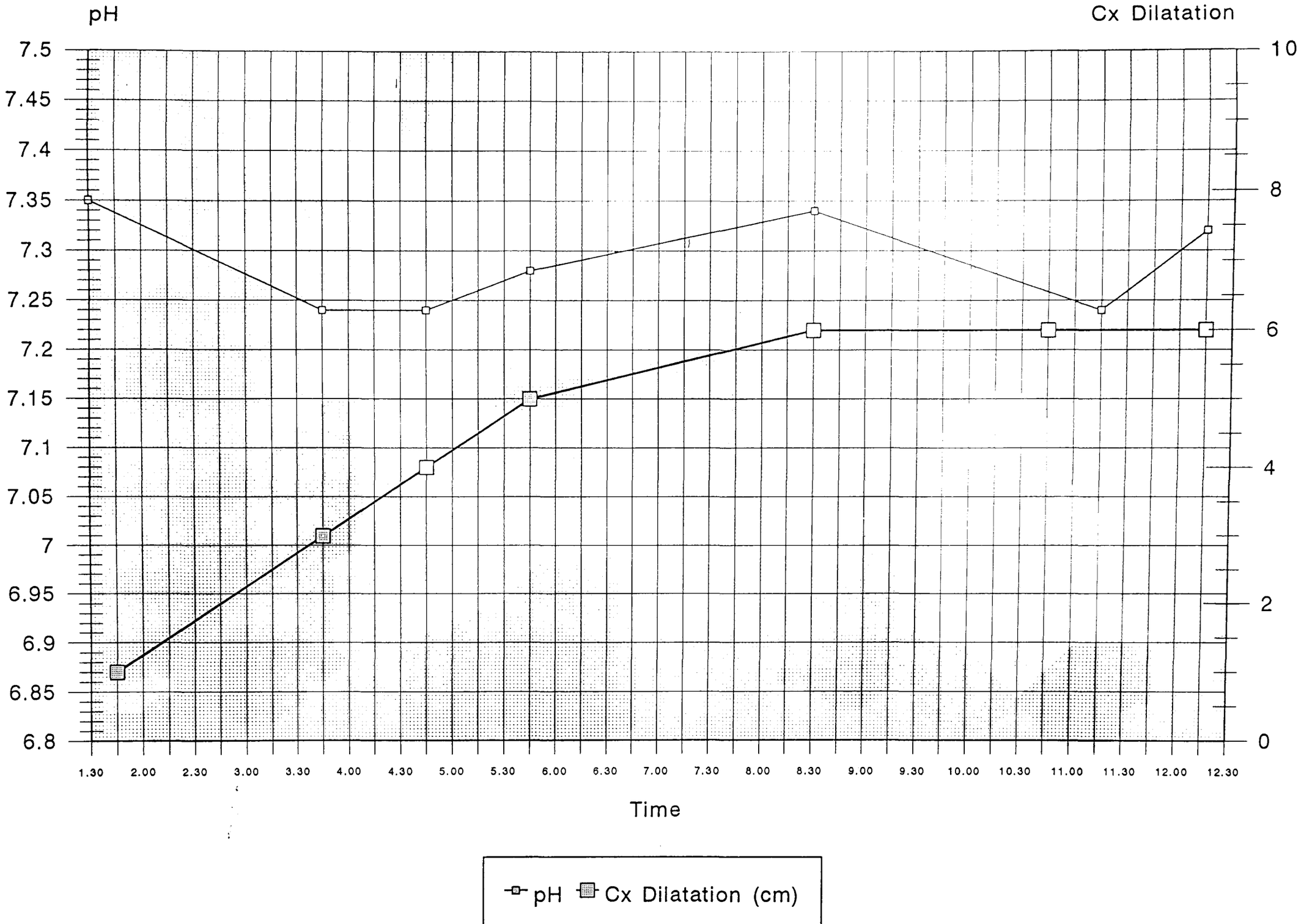
Labour events

Note; maternal BP very stable at 130/70 to 140/80 throughout labour.

23.00	Contractions becoming more regular.
00.50	Pethidine 100mg, Phenergan 25mg im.
01.50	Short but very frequent contractions. VE Cx 1cm dilated, effaced and thin. ARM; clear liquor. FSE applied.
02.00	Ranitidine 50mg, metoclopramide 10mg iv.
02.30	Epidural inserted.
03.50	VE Cx 3cm dilated, thin. Station -2. FBS; pH 7.24 BE -8
04.40	VE Cx 4cm dilated. Station -2. FBS; pH 7.24 BE -9 Maternal sample; pH 7.44
05.12	Top up.
05.45	VE Cx 5cm dilated. Station -1. FBS; pH 7.28 BE -5
07.40	Top up.
08.30	VE Cx 6cm dilated. Station -1. Caput + No moulding. FBS; pH 7.34 BE -4
08.40	Syntocinon started.
09.15	Top up.
10.45	VE Cx 6cm dilated, now thick & oedematous. Station -1. Moulding +.
11.00	Top up.
11.20	FBS; pH 7.24 BE -6 Decision for emergency Caesarean section.
12.20	Male infant delivered by C/S under epidural. Indication; falling fetal scalp pH and poor progress in labour.

Outcome

Birth weight 3.96kg
Apgar 9 & 9
Cord gases pH 7.32 / 7.36 BD(ecf) 1 / 2


pH
Cx Dilatation
7.5
7.45
7.4
7.35
7.3
7.25
7.2
7.15
7.1
7.05
7
6.95
6.9
6.85
6.8
10
8
6
4
2
0
1.30
2.00
2.30
3.00
3.30
4.00
4.30
5.00
5.30
6.00
6.30
7.00
7.30
8.00
8.30
9.00
9.30
10.00
10.30
11.00
11.30
12.00
12.30
Time
pH
Cx Dilatation (cm)

Case 2

SEGMENT (segments 1–30)

REVIEWER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
A1	2	4	2	2	2	2	2	2	2	3	2	2	3	2	3	2	2	3	2	2	3	2	2	2	2	2	2	2	2	2
A2	1	1	2	1	1	2	1	1	1	2	2	2	3	2	2	2	2	2	3	2	2	2	2	3	1	1	2	2	2	2
B1	2	2	3	4	4	4	3	2	2	4	3	5																		
B2	1	2	4	2	2	2	2	2	3	2	2	2	3	5																
C1	2	4	4	4	2	4	5																							
C2	2	4	4	2	2	4	4	4	3	2	2	2	3	2	2	3	2	2	2	3	2	2	2	3	2	2	2	2	2	2
D1	2	2	3	2	2	2	1	2	2	2	2	3	2	2	3	2	2	3	2	2	2	3	4	4	4	3	2	2	2	2
D2	2	2	3	2	2	2	2	2	3	2	2	2	3	2	4	4	3	4	4	4	2	2	3	2	2	2	2	2	2	2
E1	2	2	3	2	2	2	2	3	2	2	2	3	2	2	3	5														
E2	2	2	3	2	2	2	2	2	3	2	2	3	2	2	3	2	2	2	3	2	2	2	3	2	2	2	3	2	2	2
F1	1	1	2	1	2	4	4	3	2	2	2	2	3	1	2	2	2	3	4	4	4	3	4	4	5					
F2	2	2	2	2	2	2	2	2	3	1	1	2	2	1	2	2	3	2	2	2	3	1	1	2	3	2	2	2	3	2
G1	2	2	3	2	2	2	2	2	2	2	2	3	2	2	2	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2
G2	2	2	3	2	2	2	2	2	4	4	3	4	4	4	3	4	4	2	2	2	2	2	2	2	2	2	2	2	2	2
H1	4	5																												
H2	4	5																												
I1	2	2	2	3	1	2	2	2	2	2	2	3	2	2	2	2	2	2	2	2	3	2	2	2	2	2	2	2	2	1
I2	2	2	2	2	2	2	2	2	3	2	2	2	3	2	2	2	2	3	2	2	2	2	2	3	1	1	1	1	2	2
J1	1	1	2	2	2	2	2	2	2	3	2	2	2	2	2	2	2	2	2	2	2	2	2	3	1	1	1	1	1	1
J2	2	2	3	2	2	1	2	2	2	2	2	2	4	2	4	5														
K1	1	2	2	1	2	2	1	2	2	3	2	2	2	1	2	2	2	3	2	2	2	3	2	2	2	3	2	2	2	2
K2	1	2	2	1	1	2	2	3	2	2	3	4	3	4	4	3	4	4	3	4	4	4	3	4	4	4	3	4	4	4
L1	2	4	2	2	2	2	2	2	2	3	2	2	2	2	3	2	2	3	2	2	2	3	2	2	2	2	2	2	2	2
L2	2	2	2	2	2	2	2	2	3	2	2	2	2	3	4	4	4	3	2	2	2	3	2	2	2	2	2	2	2	3
M1	2	2	2	2	2	2	2	2	2	2	2	2	3	2	2	2	2	2	3	2	2	2	2	3	2	2	2	2	2	2
M2	1	1	1	1	2	2	2	2	2	2	3	2	2	2	3	2	2	2	3	2	2	2	3	2	2	2	2	2	2	2
N1	2	2	3	2	2	2	4	4	3	4	4	2	2	2	2	2	2	2	4	3	2	2	4	3	2	2	2	2	2	2
N2	2	2	2	2	2	2	2	3	2	2	2	2	3	2	4	4	2	2	2	2	2	2	3	4	4	4	4	4	4	2
O1	2	2	3	1	2	1	2	2	2	3	2	2	3	5																
O2	2	2	3	1	2	1	2	2	3	2	2	3	2	2	3	2	2	2	3	2	2	2	3	2	2	2	2	2	2	2
P1	2	2	2	2	2	2	2	4	2	2	2	3	2	2	3	2	2	3	2	2	2	2	3	4	3	2	2	2	2	2
P2	2	2	2	2	2	2	2	2	3	2	2	2	3	2	2	3	2	2	2	2	2	2	2	3	2	2	2	2	2	2
Q1	2	2	2	4	4	4	4	4	4	4	4	5																		
Q2	2	2	2	2	4	4	4	4	4	4	4	4	4	2	2	4	4	5												
S1	1	2	2	3	2	2	2	2	2	1	2	1	2	1	1	1	2	2	2	2	1	2	2	2	2	3	2	2	2	2
S2	1	2	2	3	2	2	2	2	2	1	2	1	2	1	1	1	2	2	2	2	1	2	2	2	2	3	2	2	2	2
R1	4	4	4	2	1	1	2	2	2	2	2	1	2	2	3	2	3	1	2	1	1	1	1	2	1	1	2	1	1	2
R2	2	1	1	2	1	2	2	2	1	1	5																			
Clinical	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	3	0	0	0	3	0	0	0	0	0	0	0	0	0

SEGMENT (segments 31–60)

REVIEWER	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
A1	2	1	2	3	2	2	3	2	2	2	2	2	2	3																
A2	2	1	2	2	2	2	2	1	2	2	2	2	3	2																
B1																														
B2																														
C1																														
C2	2	1	2	2	2	3	2	2	2	2	2	2	2																	
D1	2	2	2	3	2	2	2	2	2	2	2	2	3	5																
D2	2	3	2	2	2	2	2	2	2	2	2	2	2																	
E1																														
E2	2	1	2	2	2	3	2	2	2	2	2	2	2	2																
F1																														
F2	2	2	2	3	1	1	2	3	4	4	4	5																		
G1	2	2	2	2	2	3	2	2	2	2	2	2	2	2																
G2	2	1	2	2	2	2	2	2	2	3	2	2	4	2																
H1																														
H2																														
I1	1	1	2	2	2	2	2	2	2	3	2	2	2	2																
I2	1	1	2	2	2	2	3	1	2	2	2	2	2	2																
J1	1	1	2	2	2	2	2	2	2	2	2	3	4	2																
J2																														
K1	2	1	1	2	2	2	3	2	2	2	2	2	3	4																
K2	4	4	3	4	4	4	3	4	4	4	4	4	3	5																
L1	2	2	2	2	3	2	2	2	2	2	2	2	2	2																
L2	2	2	2	2	2	2	2	2	2	2	3	2	2	2																
M1	2	2	2	2	2	2	2	2	3	2	2	2	2	2																
M2	2	2	2	2	2	2	2	2	2	2	2	2	2	2																
N1	2	2	2	2	2	2	4	3	2	2	4	4	4	5																
N2	2	2	2	2	2	4	3	4	4	4	4	4	3	5																
O1																														
O2	2	1	2	2	2	3	1	1	1	2	2	2	3	2																
P1	2	2	2	2	4	5																								
P2	1	1	1	2	2	2	3	5																						
Q1																														
Q2																														
S1	3	2	2	2	2	2	2	3	2	2	3	2	2	2																
S2	3	2	2	2	2	2	2	3	2	2	3	2	2	2																
R1	1	1	1	1	5																									
R2																														
Clinical	0	3	0	0	0	0	0	0	0	0	0	0	0	3	5	n	n	C												

Agreement results matrix for case 2

REVIEWER	A1	A2	B1	B2	C1	C2	D1	D2	E1	E2	F1	F2	G1	G2	H1	H2	I1	I2	J1	J2	K1	K2	L1	L2	M1	M2	N1	N2	O1	O2	P1	P2	Q1	Q2	S1	S2	R1	R2
A1	100	74	33	46	30	78	66	68	43	82	40	57	80	60	23	23	72	79	61	33	78	42	93	68	74	75	52	43	39	87	56	65	26	31	59	59	65	17
A2	74	100	16	28	5	55	65	61	32	76	41	47	70	52	0	0	79	83	80	28	79	32	71	68	87	87	45	39	31	83	56	59	9	19	67	67	42	21
B1	33	16	100	70	58	55	22	28	40	34	37	14	33	48	18	18	35	23	20	38	18	17	33	21	17	20	40	14	62	34	28	21	94	64	23	23	32	55
B2	46	28	70	100	43	49	24	42	76	41	27	18	38	45	25	25	36	37	27	69	24	19	46	43	29	33	23	22	91	40	26	33	58	42	23	23	44	41
C1	30	5	58	43	100	57	12	15	24	19	29	6	19	21	40	40	20	9	6	18	6	3	33	7	6	5	25	5	21	19	17	8	60	43	19	19	43	6
C2	78	55	55	49	57	100	53	62	43	76	57	48	64	59	24	24	59	70	49	28	57	36	78	57	59	61	62	39	35	74	65	60	59	57	51	51	59	14
D1	66	65	22	24	12	53	100	59	32	70	54	62	57	51	5	5	56	60	60	27	70	62	63	55	59	62	67	68	28	71	63	50	14	21	53	53	38	12
D2	68	61	28	42	15	62	59	100	54	71	60	47	63	71	5	5	59	68	45	53	57	52	69	86	63	67	52	43	44	70	53	54	22	51	48	48	45	13
E1	43	32	40	76	24	43	32	54	100	51	32	24	50	51	8	8	40	42	29	84	29	24	43	52	34	41	27	26	80	50	34	40	29	54	27	27	35	21
E2	82	76	34	41	19	76	70	71	51	100	47	55	85	59	7	7	77	88	65	36	78	42	86	71	80	84	53	46	44	92	66	71	25	32	68	68	50	18
F1	40	41	37	27	29	57	54	60	32	47	100	33	26	36	0	0	38	46	30	21	40	48	41	47	41	43	55	42	23	46	60	38	40	52	23	23	23	10
F2	57	47	14	18	6	48	62	47	24	55	33	100	46	47	0	0	51	56	59	16	66	61	53	58	56	47	70	70	18	56	47	60	13	20	57	57	31	12
G1	80	70	33	38	19	64	57	63	50	85	26	46	100	60	8	8	79	81	62	42	68	26	83	62	77	79	39	33	45	84	52	67	19	27	71	71	55	22
G2	60	52	48	45	21	59	51	71	51	59	36	47	60	100	5	5	58	55	55	57	56	48	57	75	54	57	70	51	49	63	48	49	51	70	43	43	38	32
H1	23	0	18	25	40	24	5	5	8	7	0	0	8	5	100	100	5	0	0	8	0	0	26	0	0	0	4	0	9	7	0	0	13	4	5	5	36	0
H2	23	0	18	25	40	24	5	5	8	7	0	0	8	5	100	100	5	0	0	8	0	0	26	0	0	0	4	0	9	7	0	0	13	4	5	5	36	0
I1	72	79	35	36	20	59	56	59	40	77	38	51	79	58	5	5	100	74	73	35	68	27	73	63	86	79	48	35	42	79	46	58	22	24	77	77	43	22
I2	79	83	23	37	9	70	60	68	42	88	46	56	81	55	0	0	74	100	73	30	79	36	82	71	90	84	50	44	38	86	64	77	20	30	66	66	44	21
J1	61	80	20	27	6	49	60	45	29	65	30	59	62	55	0	0	73	73	100	20	84	31	62	58	71	72	58	46	29	72	47	56	16	19	68	68	32	21
J2	33	28	38	69	18	28	27	53	84	36	21	16	42	57	8	8	35	30	20	100	21	25	33	51	30	31	22	25	76	36	24	28	28	59	25	25	32	29
K1	78	79	18	24	6	57	70	57	29	78	40	66	68	56	0	0	68	79	84	21	100	44	72	64	74	75	62	54	26	82	56	64	15	23	69	69	37	18
K2	42	32	17	19	3	36	62	52	24	42	48	61	26	48	0	0	27	36	31	25	44	100	34	50	34	30	69	88	20	41	51	39	17	35	30	30	24	10
L1	93	71	33	46	33	78	63	69	43	86	41	53	83	57	26	26	73	82	62	33	72	34	100	71	74	84	46	35	39	85	60	65	26	30	56	56	68	18
L2	68	68	21	43	7	57	55	86	52	71	47	58	62	75	0	0	63	71	58	51	64	50	71	100	71	74	48	55	44	72	53	59	19	47	55	55	40	15
M1	74	87	17	29	6	59	59	63	34	80	41	56	77	54	0	0	86	90	71	30	74	34	74	71	100	88	46	42	33	78	59	68	10	20	74	74	42	21
M2	75	87	20	33	5	61	62	67	41	84	43	47	79	57	0	0	79	84	72	31	75	30	84	74	88	100	42	33	36	84	62	65	15	26	59	59	43	23
N1	52	45	40	23	25	62	67	52	27	53	55	70	39	70	4	4	48	50	58	22	62	69	46	48	46	42	100	70	24	58	57	47	46	54	43	43	27	19
N2	43	39	14	22	5	39	68	43	26	46	42	70	33	51	0	0	35	44	46	25	54	88	35	55	42	33	70	100	22	47	53	51	13	28	43	43	25	8
O1	39	31	62	91	21	35	28	44	80	44	23	18	45	49	9	9	42	38	29	76	26	20	39	44	33	36	24	22	100	44	26	34	47	37	26	26	30	45
O2	87	83	34	40	19	74	71	70	50	92	46	56	84	63	7	7	79	86	72	36	82	41	85	72	78	84	58	47	44	100	63	70	25	32	66	66	51	18
P1	56	56	28	26	17	65	63	53	34	66	60	47	52	48	0	0	46	64	47	24	56	51	60	53	59	62	57	53	26	63	100	76	35	42	41	41	60	17
P2	65	59	21	33	8	60	50	54	40	71	38	60	67	49	0	0	58	77	56	28	64	39	65	59	68	65	47	51	34	70	76	100	18	28	53	53	50	17
Q1	26	9	94	58	60	59	14	22	29	25	40	13	19	51	13	13	22	20	16	28	15	17	26	19	10	15	46	13	47	25	35	18	100	73	13	13	23	54
Q2	31	19	64	42	43	57	21	51	54	32	52	20	27	70	4	4	24	30	19	59	23	35	30	47	20	26	54	28	37	32	42	28	73	100	12	12	23	31
S1	59	67	23	23	19	51	53	48	27	68	23	57	71	43	5	5	77	66	68	25	69	30	56	55	74	59	43	43	26	66	41	53	13	12	100	100	39	18
S2	59	67	23	23	19	51	53	48	27	68	23	57	71	43	5	5	77	66	68	25	69	30	56	55	74	59	43	43	26	66	41	53	13	12	100	100	39	18
R1	65	42	32	44	43	59	38	45	35	50	23	31	55	38	36	36	43	44	32	32	37	24	68	40	42	43	27	25	30	51	60	50	23	23	39	39	100	11
R2	17	21	55	41	6	14	12	13	21	18	10	12	22	32	0	0	22	21	21	29	18	10	18	15	21	23	19	8	45	18	17	17	54	31	18	18	11	100

Case 3 29

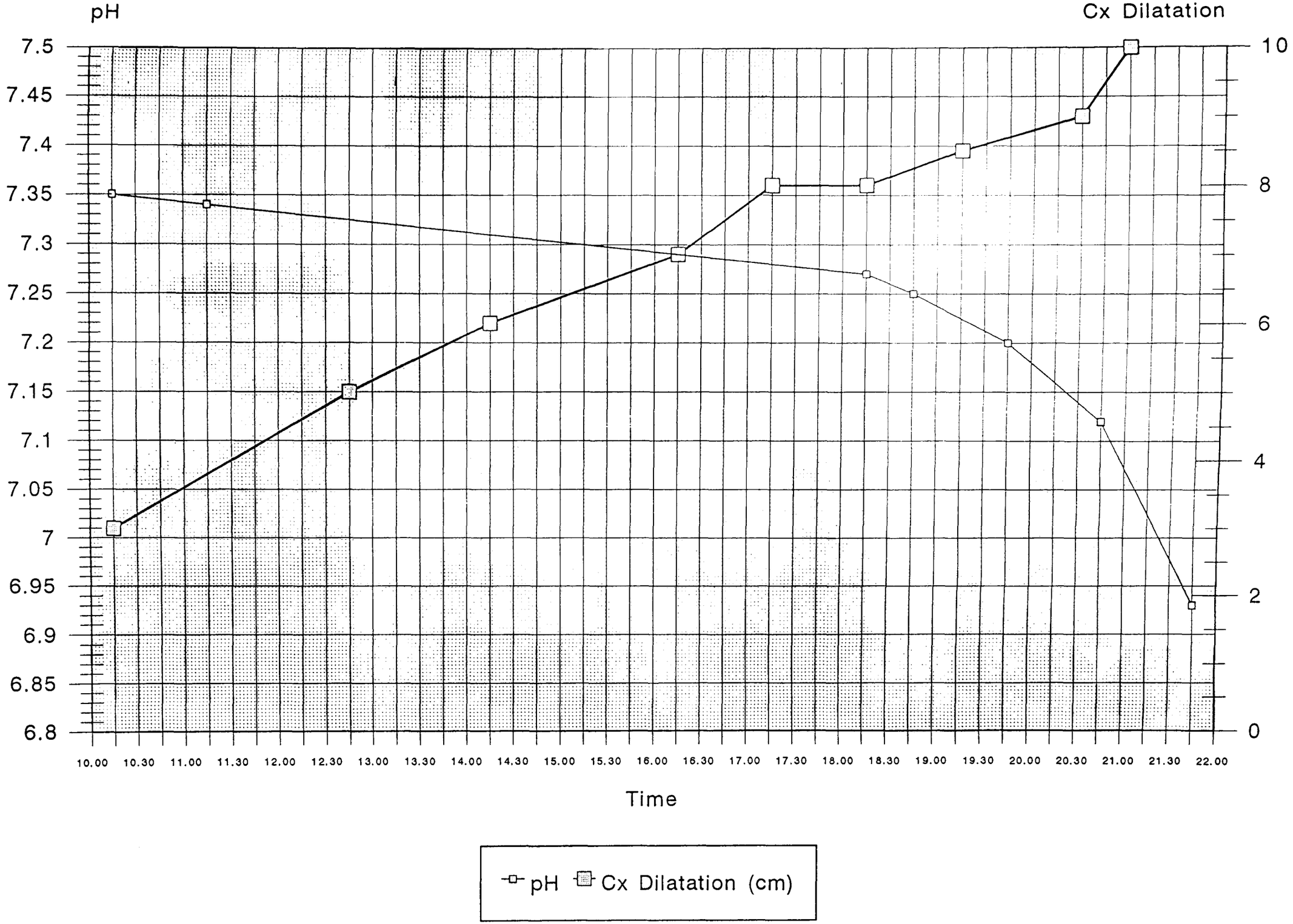
Mrs G.G. is a 29 year old lady expecting her second baby. She has a five year old boy who was delivered normally at term, weighing 9lb 2oz. The current pregnancy was straightforward, although labour was induced at 42 weeks on the grounds of postmaturity. It was suspected at this stage that the baby was fairly large for dates. Mrs G.G. has no significant medical history and she does not smoke. On admission on 11.2.92 the presentation was cephalic; cervix soft but closed and uneffaced. 3 doses of Prostin (3mg tablets) were given over the next 48 hours. At 09.00hrs on 13.2.92 a long deceleration of the fetal heart was heard, and ARM was performed straight away.

Labour events

10.10	Cx 3cm dilated, thick. Station -2. ARM; very small amount of clear liquor seen.
10.35	Maternal oxygen given. Unsuccessful attempt at FBS.
11.00	Ranitidine 100mg maxolon 10mg iv given.
11.15	FBS; pH 7.34 BE -1.
11.40	Epidural begun.
12.45	VE Cx 5cm dilated, thick. Station -2,
13.15	Top up.
14.10	VE Cx 6cm dilated, thick. Station -2.
15.40	Top up.
16.15	VE Cx 7cm dilated, thick. Station -1.
16.30	Syntocinon started.
17.10	VE Cx 8cm dilated, oedematous. Station -1. Syntocinon stopped.
17.40	Top up.
18.10	VE Cx 8cm dilated. OP position. FBS; pH 7.27 BE -2
18.20	Syntocinon started.
18.50	Vomiting. Syntocinon stopped.
19.05	Vomiting.
19.10	VE Cx 8-9cm dilated. Station -1. Appearance of meconium.
19.25	Top up.
20.30	VE Cx 9cm dilated. Station 0. ROL position.
20.45	FBS; pH 7.12 BE -2
20.55	VE Cx fully dilated. Station; just below ischial spines. Decision for delivery; trial of forceps. Top up. Maternal oxygen given.
21.10	Taken to theatre.
21.40	Male infant delivered by Kjelland forceps. Indication; fetal distress (poor CTG & low scalp pH).

Outcome

Birth weight 3.985 kg
Apgar 4 & 9
Cord gases pH 6.93 / 7.12 BD(ecf) 17 / 10


pH
Cx Dilatation
7.5
7.45
7.4
7.35
7.3
7.25
7.2
7.15
7.1
7.05
7
6.95
6.9
6.85
6.8
10
8
6
4
2
0
10.00
10.30
11.00
11.30
12.00
12.30
13.00
13.30
14.00
14.30
15.00
15.30
16.00
16.30
17.00
17.30
18.00
18.30
19.00
19.30
20.00
20.30
21.00
21.30
22.00
Time
pH
Cx Dilatation (cm)

Case 3

REVIEWER / SEGMENT (segments 1–30)

REVIEWER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
A1	1	1	2	2	2	2	2	1	1	1	1	1	3	1	1	1	1	1	1	1	2	1	1	1	1	2	2	1	2	2
A2	1	1	2	3	2	2	2	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	2	2	2	1	3	2
B1	1	1	4	4	3	4	4	4	3	1	2	2	2	3	1	1	2	2	2	2	2	1	1	1	1	3	2	2	4	3
B2	1	1	4	4	3	2	4	4	3	2	2	1	1	1	1	1	2	2	1	1	1	1	1	2	1	1	3	1	2	4
C1	1	1	2	3	2	2	3	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	2	2	2	2	2	3
C2	1	1	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	2	2
D1	1	1	2	3	2	2	2	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	2	2	2
D2	1	1	4	4	3	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2
E1	1	1	3	2	2	2	3	1	1	1	2	1	1	1	1	1	2	1	1	1	1	1	2	1	1	2	2	1	2	2
E2	1	1	4	4	4	2	3	1	1	1	2	1	1	1	1	1	2	1	1	1	1	1	2	1	1	2	2	1	2	3
F1	1	1	2	2	2	2	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	3	4
F2	1	1	4	4	5																									
G1	1	1	2	2	2	2	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2
G2	1	1	4	4	4	2	4	2	2	1	2	1	1	1	1	1	2	1	1	1	1	1	2	1	2	1	2	2	4	4
H1	2	1	4	4	3	2	2	1	1	1	2	1	1	1	1	1	2	1	2	1	1	1	2	2	3	2	3	2	4	3
H2	1	1	3	2	2	2	2	2	2	2	2	1	1	1	1	1	2	1	1	1	1	1	1	1	1	2	1	2	2	2
I1	1	1	4	2	3	2	2	1	2	1	2	1	2	1	1	1	2	1	1	1	1	1	2	2	2	2	2	1	2	2
I2	1	1	3	2	2	2	2	1	2	1	2	1	2	1	1	1	2	1	1	1	1	1	2	2	2	2	2	1	3	2
J1	2	2	4	3	4	4	4	2	4	2	5																			
J2	1	1	4	3	2	2	2	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	2	2
K1	1	1	5																											
K2	2	1	3	4	4	3	4	2	2	1	2	2	1	1	1	1	2	1	1	1	1	1	2	1	1	1	2	1	3	2
L1	1	1	2	3	2	2	2	1	1	1	2	1	2	2	1	1	1	1	1	1	1	1	1	3	1	1	2	1	3	2
L2	1	1	2	3	2	2	2	1	1	1	2	1	1	1	1	1	2	1	1	1	1	1	2	1	1	1	2	1	3	2
M1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
M2	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
N1	2	1	3	4	2	2	3	2	2	1	2	2	2	1	1	1	2	2	1	1	1	1	2	2	2	2	3	2	2	2
N2	2	2	3	4	4	4	4	2	2	2	2	2	2	2	1	1	2	1	1	1	1	1	2	2	2	2	2	2	3	2
O1	1	1	3	2	2	3	2	1	1	1	2	1	1	1	1	1	2	1	1	1	1	1	2	1	2	2	3	1	2	2
O2	1	1	2	3	1	1	2	1	1	1	2	1	1	1	1	1	2	1	1	1	1	1	2	1	1	2	2	1	2	3
P1	1	1	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	2	1
P2	1	1	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2
Q1	4	2	4	4	5																									
Q2	2	2	2	4	4	4	4	4	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	4	2	4	4
S1	1	1	2	1	1	2	2	3	1	1	2	2	1	1	1	1	2	1	1	1	1	1	1	1	1	2	2	3	2	2
S2	1	1	2	2	1	2	2	3	2	1	1	2	1	1	1	1	2	2	1	1	1	1	1	1	1	2	2	3	2	2
R1	2	2	1	2	3	1	1	1	1	1	1	1	1	1	3	2	1	2	1	1	2	2	1	2	2	5				
R2	2	1	1	2	1	2	2	2	1	2	2	1	2	3	3	4	1	1	1	1	1	1	1	1	1	1	1	2	1	1
Clinical	0	0	3	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

REVIEWER / SEGMENT (segments 31–60)

REVIEWER	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
A1	1	2	2	1	2	2	3	2	5																					
A2	1	1	2	2	1	2	2	2	3	5																				
B1	4	4	5																											
B2	3	2	2	4	4	5																								
C1	1	1	2	2	2	2	4	4	5																					
C2	2	2	2	1	1	2	3	4	4	3	5																			
D1	2	2	3	2	2	3	5																							
D2	2	2	2	2	2	2	3	2	3	5																				
E1	1	1	3	3	2	3	5																							
E2	2	2	2	1	2	2	3	2	3	5																				
F1	4	4	2	2	3	5																								
F2																														
G1	2	2	2	2	2	2	2	3	2	2	2	3	6																	
G2	2	2	2	2	2	4	2	2	3	4	4	5																		
H1	2	4	5																											
H2	2	3	2	2	2	2	3	5																						
I1	1	2	3	2	2	2	2	3	5																					
I2	2	2	2	2	1	2	2	3	5																					
J1																														
J2	1	2	2	1	1	2	3	4	5																					
K1																														
K2	2	3	4	2	2	3	4	4	3	5																				
L1	2	2	2	2	2	2	3	4	4	5																				
L2	1	2	2	1	1	2	2	3	4	4	4	3	6																	
M1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	6														
M2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	6														
N1	2	2	3	2	2	2	3	2	2	2	2	2	2	2	6															
N2	2	2	2	2	2	3	4	2	4	4	2	2	2	2	2	6														
O1	1	2	3	2	2	2	3	5																						
O2	1	1	2	1	1	2	3	2	3	5																				
P1	1	1	2	1	1	2	3	4	4	3	5																			
P2	1	1	1	1	1	2	3	2	2	2	2	2	6																	
Q1																														
Q2	4	4	4	4	4	4	4	4	4	4	4	4	4	4	6															
S1	1	2	2	2	2	2	1	1	2	3	5																			
S2	1	1	2	2	2	2	1	1	2	3	5																			
R1																														
R2	2	1	1	2	1	1	1	2	1	1	3	2	1	2	1	1	2													
Clinical	0	0	3	0	0	0	0	0	0	0	0	0	3	5	0	0	6													

Agreement results matrix for case 3

REVIEWER	A1	A2	B1	B2	C1	C2	D1	D2	E1	E2	F1	F2	G1	G2	H1	H2	I1	I2	J1	J2	K1	K2	L1	L2	M1	M2	N1	N2	O1	O2	P1	P2	Q1	Q2	S1	S2	R1	R2
A1	100	82	22	35	79	81	75	75	70	68	48	4	60	45	25	83	79	85	9	83	5	59	80	64	52	52	48	47	78	83	81	66	3	29	71	70	38	58
A2	82	100	35	39	86	84	64	86	60	84	45	15	62	66	46	80	84	95	21	84	8	73	89	78	50	49	60	60	80	97	84	60	14	39	87	87	40	49
B1	22	35	100	81	40	15	34	41	39	55	61	37	30	63	86	33	43	33	53	35	18	63	34	33	19	19	54	57	42	35	15	18	38	65	34	34	36	25
B2	35	39	81	100	60	31	64	49	68	59	76	35	37	70	72	57	58	47	50	54	17	71	45	40	24	24	60	68	64	42	31	30	36	70	38	38	30	22
C1	79	86	40	60	100	78	79	77	79	79	64	14	58	62	43	86	84	88	24	88	7	81	89	73	40	40	58	69	86	86	78	52	14	53	72	72	36	37
C2	81	84	15	31	78	100	57	78	53	71	41	3	64	65	23	67	72	78	6	80	4	68	87	77	42	42	46	57	62	85	99	64	3	44	81	81	27	49
D1	75	64	34	64	79	57	100	65	96	61	74	16	57	44	42	94	81	77	22	80	8	63	66	57	47	47	63	56	91	69	56	60	15	38	41	40	38	40
D2	75	86	41	49	77	78	65	100	62	94	37	41	61	75	48	75	91	81	40	92	25	80	81	69	40	40	67	70	74	87	77	56	42	45	73	72	36	42
E1	70	60	39	68	79	53	96	62	100	62	76	15	56	45	42	90	80	72	25	76	8	65	63	54	42	42	68	58	92	66	54	56	15	41	44	44	37	36
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G1	60	62	30	37	58	64	57	61	56	58	46	9	100	47	33	56	58	57	21	56	6	49	55	75	67	67	71	54	58	62	63	91	7	34	68	68	41	65
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H2	83	80	33	57	86	67	94	75	90	72	66	15	56	47	42	100	88	90	19	87	8	71	79	66	49	49	63	58	92	83	66	60	15	39	56	56	35	42
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K1	5	8	18	17	7	4	8	25	8	25	4	74	6	19	21	8	20	8	27	20	100	16	6	7	7	7	20	19	8	8	4	6	71	10	5	5	8	5
K2	59	73	63	71	81	68	63	80	65	87	58	33	49	81	59	71	81	73	44	79	16	100	79	66	27	27	68	82	76	77	68	39	33	75	62	62	30	29
L1	80	89	34	45	89	87	66	81	63	79	50	13	55	67	45	79	80	89	19	87	6	79	100	79	39	39	56	68	79	89	87	54	12	50	75	75	33	40
L2	64	78	33	40	73	77	57	69	54	69	46	13	75	68	42	66	66	75	19	71	7	66	79	100	47	47	63	74	66	78	77	71	13	56	70	69	34	56
M1	52	50	19	24	40	42	47	40	42	37	33	5	67	28	29	49	47	51	9	41	7	27	39	47	100	100	65	45	44	47	42	73	4	20	51	52	37	61
M2	52	49	19	24	40	42	47	40	42	37	33	5	67	28	29	49	47	51	9	41	7	27	39	47	100	100	65	44	44	47	42	73	3	19	51	52	37	61
N1	48	60	54	60	58	46	63	67	68	72	51	38	71	57	62	63	70	62	42	62	20	68	56	63	65	65	100	78	72	60	45	65	38	50	55	56	42	45
N2	47	60	57	68	69	57	56	70	58	77	48	40	54	80	52	58	65	61	51	69	19	82	68	74	45	44	78	100	62	62	57	46	40	76	52	51	32	37
O1	78	80	42	64	86	62	91	74	92	73	69	16	58	48	50	92	88	88	25	84	8	76	79	66	44	44	72	62	100	80	62	55	16	44	64	63	41	38
O2	83	97	35	42	86	85	69	87	66	86	49	15	62	67	45	83	86	93	21	85	8	77	89	78	47	47	60	62	80	100	85	63	14	43	84	83	37	48
P1	81	84	15	31	78	99	56	77	54	71	41	3	63	65	23	66	72	77	6	80	4	68	87	77	42	42	45	57	62	85	100	64	3	44	81	81	27	49
P2	66	60	18	30	52	64	60	56	56	49	43	5	91	38	28	60	54	59	8	57	6	39	54	71	73	73	65	46	55	63	64	100	4	27	58	58	38	65
Q1	3	14	38	36	14	3	15	42	15	43	5	96	7	36	38	15	36	15	53	35	71	33	12	13	4	3	38	40	16	14	3	4	100	23	4	4	14	3
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S1	71	87	34	38	72	81	41	73	44	75	45	5	68	66	37	56	68	77	17	63	5	62	75	70	51	51	55	52	64	84	81	58	4	38	100	99	34	52
S2	70	87	34	38	72	81	40	72	44	74	44	5	68	65	37	56	68	77	17	63	5	62	75	69	52	52	56	51	63	83	81	58	4	38	99	100	35	52
R1	38	40	36	30	36	27	38	36	37	34	31	16	41	29	39	35	38	37	24	35	8	30	33	34	37	37	42	32	41	37	27	38	14	23	34	35	100	47
R2	58	49	25	22	37	49	40	42	36	38	30	4	65	33	24	42	42	45	9	40	5	29	40	56	61	61	45	37	38	48	49	65	3	19	52	52	47	100

Case 4 2025

Mrs S.P. is a 22 year old primigravida. She is a fit lady but smokes 5 cigarettes per day. Her pregnancy progressed well until 38 weeks, when mild hypertension without proteinuria was noted. At 40 weeks she developed 2+ proteinuria; BP 140/90-100. She was asymptomatic, reflexes were normal and both biochemistry and haematology were within normal limits. The fetus was judged to be of average size. Labour was induced on 17.9.91 on the grounds of proteinuric hypertension at term. Presentation cephalic 2/5. VE Cx 1cm dilated, part effaced. Prostin tablet 3mg was given at 21.10hrs. 6 hours later (03.00hrs) contractions were occurring regularly and Cx was now 1cm dilated, effaced and thin. Pethidine 100mg, phenergan 25mg was given im.

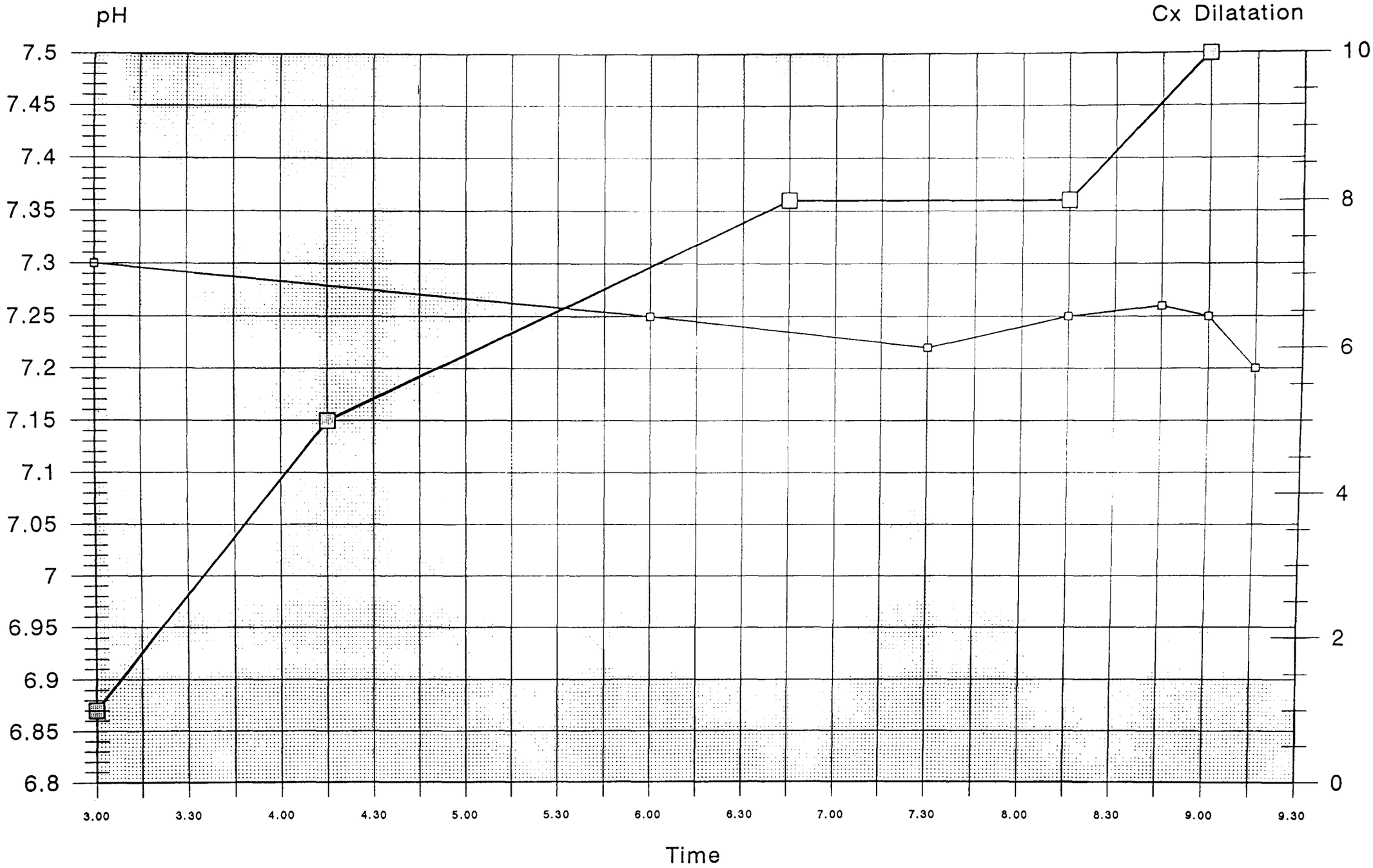
Labour events

Note; BP remained at 140-170/80-100 throughout labour.

04.15	VE Cx 5cm dilated, thin. Station -2. ARM; clear liquor. FSE applied.
04.45	Change of maternal position.
04.50	Epidural begun.
05.05	Epidural complete.
06.40	VE Cx 8cm dilated. Station -1. Direct OP position.
07.30	FBS; pH 7.22 BE -3
07.35	Bedpan.
07.45	Bedpan.
08.05	Bedpan.
08.20	VE Cx 8cm dilated.
08.40	FBS; pH 7.26 (no BE)
08.43	Top up.
08.55 forceps	Cephalic 0/5. VE Cx fully dilated. Station +1. OA position. Decision for delivery.
09.17	Female infant delivered by Neville Barnes forceps. Indication; FH decelerations; borderline scalp pH.

Outcome

Birth weight 2.80kg
Apgar 5 & 9
Cord gases pH 7.20 / 7.29 BD(ecf) 5 / 4


pH
Cx Dilatation
7.5
7.45
7.4
7.35
7.3
7.25
7.2
7.15
7.1
7.05
7
6.95
6.9
6.85
6.8
10
8
6
4
2
0
3.00
3.30
4.00
4.30
5.00
5.30
6.00
6.30
7.00
7.30
8.00
8.30
9.00
9.30
Time
pH
Cx Dilatation (cm)

Case 4

REVIEWER	SEGMENT																																																											
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
A1	1	1	2	1	1	2	2	2	3	2	2	2	3	5																																														
A2	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2																																								
B1	1	2	2	2	1	1	2	2	2	2	2	2	2	2	4	4	3	4	6																																									
B2	1	2	2	1	1	2	1	3	4	4	5																																																	
C1	1	2	2	1	1	2	2	3	2	2	3	1	1	1	2	3	2	2	6																																									
C2	1	1	2	1	1	2	2	2	3	2	2	3	2	2	2	3	1	1	6																																									
D1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	3	6																																									
D2	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	6																																									
E1	1	2	2	2	2	2	2	2	2	3	2	2	2	3	2	2	2	3	6																																									
E2	1	1	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	6																																									
F1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	2	2																																								
F2	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	2	2																																								
G1	1	2	2	2	2	2	2	2	2	2	2	2	2	3	2	2	2	2	6																																									
G2	1	2	2	2	2	2	4	2	2	3	4	2	3	4	4	2	2	2	6																																									
H1	1	1	1	1	1	2	2	2	2	3	5																																																
H2	1	1	1	1	1	2	2	2	2	3	5																																																
I1	1	2	2	2	1	2	3	2	2	2	2	2	2	3	2	2	2	3	2	2																																								
I2	1	2	2	2	1	2	2	2	2	3	2	2	2	2	3	2	2	2	6																																									
J1	1	1	2	1	1	2	2	2	2	2	1	2	2	2	2	2	2	2	2	2																																								
J2	1	2	1	1	1	2	2	2	2	3	1	1	1	2	3	2	2	2	6																																									
K1	1	2	2	1	1	2	2	1	1	2	1	1	1	1	2	3	2	2	6																																									
K2	1	2	2	2	1	2	3	4	4	4	3	2	2	3	4	4	4	3	4	6																																								
L1	1	2	1	1	1	2	2	2	1	2	2	2	1	1	2	3	2	2	6																																									
L2	1	2	2	1	1	2	2	2	2	2	2	2	2	1	1	1	1	2	6																																									
M1	1	1	1	1	1	1	1	1	1	2	1	1	1	2	1	1	1	2	2	2																																								
M2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	6																																									
N1	1	2	2	2	2	2	2	2	3	2	2	2	2	2	3	4	4	4	6																																									
N2	1	2	2	2	2	2	2	3	4	4	2	2	2	3	4	4	4	3	6																																									
O1	1	2	2	1	1	2	2	2	3	2	2	2	3	2	2	2	3	2	6																																									
O2	1	1	1	1	1	2	2	2	2	3	2	2	2	3	2	2	3	2	6																																									
P1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	4	4																																								
P2	1	2	1	1	1	2	1	1	1	1	2	2	1	2	2	2	2	2	2	2																																								
Q1	1	2	2	2	2	2	2	2	2	2	4	4	4	4	4	4	4	4	6																																									
Q2	2	2	2	2	2	2	4	2	2	2	2	2	2	2	4	4	4	4	4	6																																								
S1	1	1	1	2	2	1	2	1	1	2	2	2	1	1	2	2	2	2	1	2																																								
S2	1	2	2	1	2	2	2	1	1	2	2	2	1	1	2	2	2	2	1	2																																								
R1	1	1	2	1	2	1	1	2	2	2	1	3	2	2	5																																														
R2	2	2	1	3	4	2	1	1	1	1	1	1	2	2	1	1	2	4	4	4																																								
Clinical	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	3	0	6																																								

Agreement results matrix for case 4

REVIEWER	A1	A2	B1	B2	C1	C2	D1	D2	E1	E2	F1	F2	G1	G2	H1	H2	I1	I2	J1	J2	K1	K2	L1	L2	M1	M2	N1	N2	O1	O2	P1	P2	Q1	Q2	S1	S2	R1	R2
A1	100	34	45	50	50	55	29	32	52	32	30	30	46	60	57	57	52	53	34	51	36	48	37	32	30	26	51	55	56	53	26	32	51	41	33	33	89	16
A2	34	100	37	17	54	55	72	81	54	83	88	88	69	29	31	31	64	63	98	62	68	16	71	79	91	73	32	22	57	58	59	94	16	24	94	93	40	32
B1	45	37	100	12	63	65	69	61	67	62	32	32	68	67	17	17	64	65	37	64	71	70	72	61	33	56	90	77	67	68	69	35	83	88	35	35	54	68
B2	50	17	12	100	40	39	15	16	33	17	17	17	17	52	87	87	32	35	18	35	16	51	16	17	17	16	27	52	37	33	14	18	42	25	17	18	23	12
C1	50	54	63	40	100	95	75	71	88	72	49	49	77	67	43	43	84	92	56	94	81	63	81	72	53	67	73	65	91	90	56	54	51	55	54	56	46	47
C2	55	55	65	39	95	100	76	72	89	72	50	50	80	68	43	43	83	93	55	91	78	61	79	72	51	65	73	65	96	91	57	52	52	55	53	54	50	43
D1	29	72	69	15	75	76	100	95	79	97	64	64	84	43	26	26	76	80	70	80	90	40	92	94	67	91	62	47	79	80	72	69	37	51	69	67	37	51
D2	32	81	61	16	71	72	95	100	80	99	70	70	88	41	28	28	76	78	83	75	87	34	88	95	73	86	56	42	76	76	73	78	33	47	80	80	38	50
E1	52	54	67	33	88	89	79	80	100	79	46	46	90	72	39	39	87	97	55	95	81	62	82	76	48	68	75	68	95	97	60	52	54	55	53	54	47	45
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F1	30	88	32	17	49	50	64	70	46	71	100	100	60	26	27	27	55	54	87	56	67	14	66	77	97	84	27	18	49	50	51	93	14	21	92	90	38	34
F2	30	88	32	17	49	50	64	70	46	71	100	100	60	26	27	27	55	54	87	56	67	14	66	77	97	84	27	18	49	50	51	93	14	21	92	90	38	34
G1	46	69	68	17	77	80	84	88	90	87	60	60	100	59	27	27	88	88	71	85	89	46	90	84	62	74	66	54	86	86	65	67	50	53	69	70	48	46
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H1	57	31	17	87	43	43	26	28	39	28	27	27	27	45	100	100	30	41	31	42	25	34	26	28	28	25	27	35	40	41	23	28	38	15	29	29	32	13
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J2	51	62	64	35	94	91	80	75	95	76	56	56	85	66	42	42	82	97	63	100	87	59	87	75	60	72	72	64	89	94	60	61	51	52	60	61	47	46
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M1	30	91	33	17	53	51	67	73	48	74	97	97	62	26	28	28	57	56	91	60	69	15	68	77	100	83	29	19	51	52	53	94	14	22	92	90	39	35
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N2	55	22	77	52	65	65	47	42	68	41	18	18	54	88	35	35	64	65	23	64	51	96	52	40	19	36	88	100	68	67	43	21	89	85	22	22	49	49
O1	56	57	67	37	91	96	79	76	95	77	49	49	86	69	40	40	90	90	57	89	81	61	82	75	51	68	73	68	100	96	60	55	52	56	54	55	48	44
O2	53	58	68	33	90	91	80	76	97	77	50	50	86	69	41	41	85	94	57	94	83	62	85	74	52	69	74	67	96	100	60	54	53	54	54	54	47	44
P1	26	59	69	14	56	57	72	73	60	73	51	51	65	34	23	23	58	60	59	60	66	48	68	71	53	66	69	43	60	60	100	56	45	68	56	56	30	79
P2	32	94	35	18	54	52	69	78	52	79	93	93	67	29	28	28	62	60	94	61	72	16	72	77	94	78	32	21	55	54	56	100	16	24	96	97	39	35
Q1	51	16	83	42	51	52	37	33	54	33	14	14	50	83	38	38	47	52	17	51	43	85	44	32	14	29	79	89	52	53	45	16	100	80	16	17	54	49
Q2	41	24	88	25	55	55	51	47	55	47	21	21	53	75	15	15	56	54	25	52	53	87	54	46	22	42	89	85	56	54	68	24	80	100	24	25	45	81
S1	33	94	35	17	54	53	69	80	53	80	92	92	69	29	29	29	62	60	94	60	70	16	71	78	92	77	32	22	54	54	56	96	16	24	100	98	39	34
S2	33	93	35	18	56	54	67	80	54	80	90	90	70	30	29	29	63	62	94	61	72	16	72	79	90	75	33	22	55	54	56	97	17	25	98	100	39	35
R1	89	40	54	23	46	50	37	38	47	38	38	38	48	55	32	32	45	47	41	47	39	44	38	37	39	34	51	49	48	47	30	39	54	45	39	39	100	27
R2	16	32	68	12	47	43	51	50	45	49	34	34	46	43	13	13	50	44	34	46	51	58	50	50	35	51	67	49	44	44	79	35	49	81	34	35	27	100

Case 5 1886

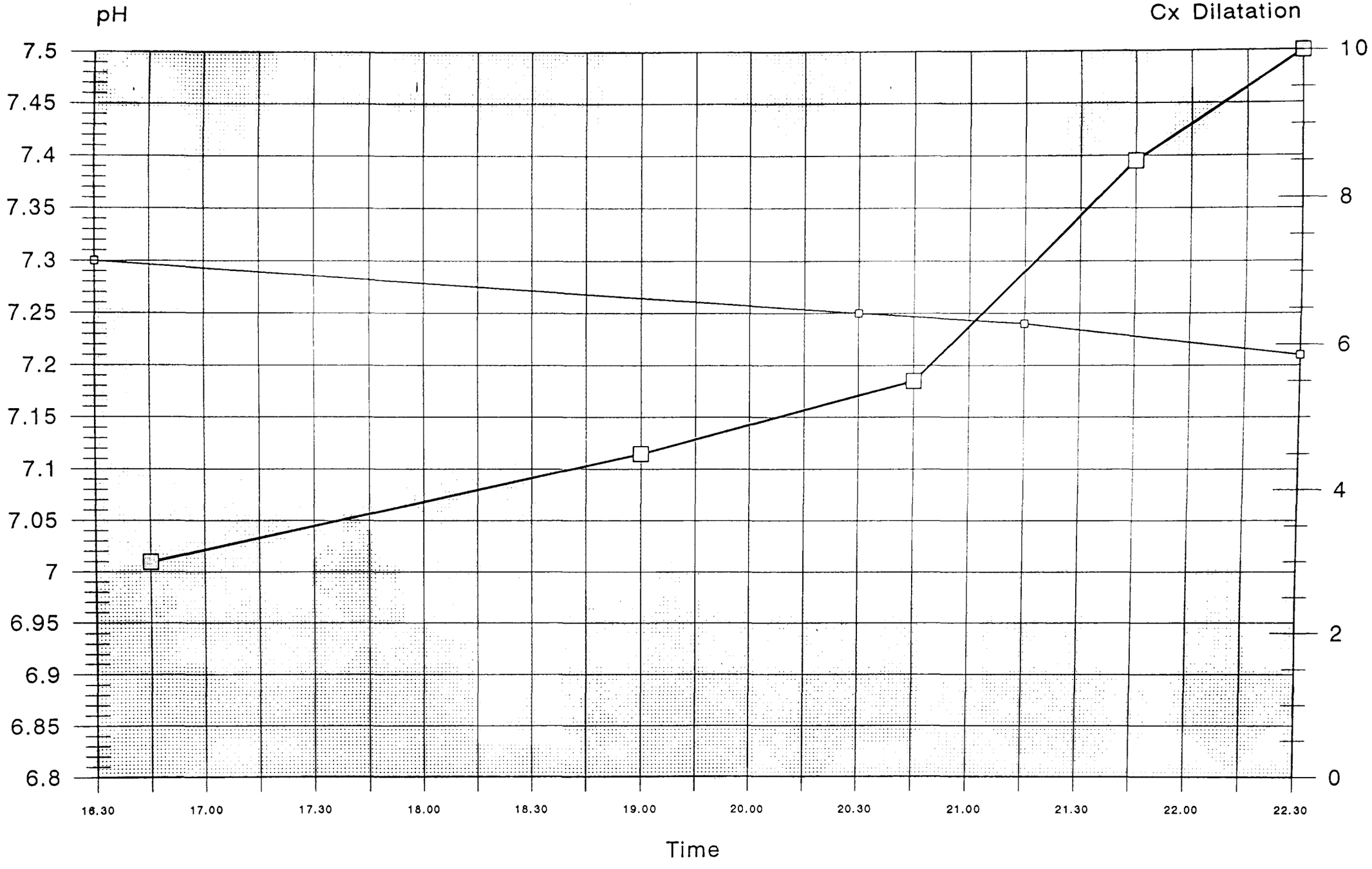
Mrs A.S. is a 30 year old lady expecting her second baby. She is fit and well, and does not smoke. Her first child was delivered by Caesarean section because of a footling breech presentation. (It was an emergency procedure, but prior to established labour.) The baby was full term, and weighed 8lb 4oz. Her current pregnancy progressed well, and a trial of vaginal delivery was planned. Labour was induced at 42 weeks on the grounds of postmaturity. On admission on 19.8.91, the baby was judged to be of an average size; presentation cephalic 2/5. On VE, Cx 3cm dilated, effaced. Station -1. ARM was performed; a small amount of clear liquor drained, and FSE applied. (16.50hrs)

Labour events

17.35	Pethidine 100mg, stemetil 12.5mg im.
18.35	Change of maternal position.
19.00	VE Cx 4-5cm dilated, thin. Station -1.
19.45	Epidural begun.
20.00	Epidural complete.
20.05	Syntocinon begun.
20.20	From now, for at least 1 hour, contractions very frequent (6-7:10)
20.50	VE Cx 5-6cm dilated, thin. Station -1.
21.20	FBS; pH 7.24 BE -2.
21.50	VE Cx 8-9cm dilated. Station 0.
21.55	Top up.
22.10	Mother catheterised.
22.30	VE Cx fully dilated.
22.35	Female infant delivered by Neville Barnes forceps. Indication; prolonged FH decerations. Thick fresh meconium noted at delivery.

Outcome

Birth weight 3.32kg
Apgar 5 & 9
Cord gases pH 7.21 / 7.30 BD(ecf) 4 / 3


pH
Cx Dilatation
7.5
7.45
7.4
7.35
7.3
7.25
7.2
7.15
7.1
7.05
7
6.95
6.9
6.85
6.8
10
8
6
4
2
0
16.30
17.00
17.30
18.00
18.30
19.00
20.00
20.30
21.00
21.30
22.00
22.30
Time
pH
Cx Dilatation (cm)

Case 5

SEGMENT

REVIEWER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
A1	1	1	1	1	1	2	1	2	1	1	1	1	1	1	2	1	1	4	3	2	3	1	2	3	5																																			
A2	1	1	1	1	1	2	1	1	1	1	1	1	1	1	2	1	1	2	2	1	2	1	2	3	2	6																																		
B1	1	1	1	2	1	2	1	2	1	1	2	1	1	1	1	1	1	4	4	3	5																																								
B2	1	1	1	1	2	2	1	1	1	1	2	3	1	1	2	3	2	2	4	5																																									
C1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	1	2	2	3	6																																		
C2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	1	2	2	6																																		
D1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	2	1	2	2	2	3	2	6																																		
D2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	1	1	2	2	2																																		
E1	1	1	2	1	1	2	1	2	1	1	2	1	1	1	2	1	1	1	3	2	3	5																																						
E2	1	1	1	1	4	2	1	1	1	1	2	1	1	1	2	1	1	1	2	2	2	2	2	2	2	2																																		
F1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	2	1	1	2	2	2																																		
F2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	2	1	1	2	1	6																																		
G1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	2	1	2	2	2	2	2	2																																		
G2	1	1	1	1	1	2	1	2	1	1	1	1	1	1	1	1	1	1	4	2	4	2	2	4	2	2																																		
H1	1	1	2	1	1	2	1	2	1	1	1	2	1	1	2	1	1	3	5																																										
H2	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	1	2	3	5																																			
I1	1	1	1	1	1	2	1	2	1	1	2	2	1	1	2	1	1	2	3	2	3	2	2	3	2	6																																		
I2	1	1	1	1	2	2	1	2	2	1	2	2	1	1	2	1	1	2	2	3	2	2	3	2	2	6																																		
J1	1	1	1	1	1	2	1	2	1	1	2	1	1	1	2	1	1	1	3	2	4	2	3	4	4	6																																		
J2	1	1	1	1	1	2	1	1	1	1	1	1	2	1	2	2	2	1	2	2	2	1	2	2	2	6																																		
K1	1	1	1	1	2	2	1	3	1	1	2	1	1	1	2	1	1	2	3	4	3	4	4	5																																				
K2	1	1	1	1	1	3	1	2	1	1	2	2	1	1	1	1	1	2	3	4	3	4	4	3	4	6																																		
L1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	2	3	2	2	2	3	2	2	6																																		
L2	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	1	2	3	4	6																																		
M1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	2	2	2																																		
M2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	2	1	1	2	2	1																																		
N1	1	1	1	1	1	2	2	2	1	1	1	1	1	1	2	1	1	1	2	2	3	4	4	3	4	6																																		
N2	1	1	1	1	2	2	2	2	2	1	2	2	1	1	2	1	1	2	3	2	4	2	2	3	4	6																																		
O1	1	1	1	1	2	2	1	2	1	1	1	2	1	1	2	1	1	2	3	2	4	2	3	5																																				
O2	1	1	1	1	1	2	1	2	1	1	1	2	1	1	2	1	1	2	3	2	3	2	2	3	2	6																																		
P1	1	1	1	1	1	2	1	1	2	2	2	2	1	1	1	1	1	1	2	2	2	1	2	2	2	2																																		
P2	1	1	1	1	1	2	1	2	1	1	2	1	1	1	1	1	1	1	2	2	2	1	1	2	2	1																																		
Q1	4	2	2	2	2	4	5																																																					
Q2	2	2	2	2	2	4	2	2	2	2	2	2	2	2	2	2	2	2	5																																										
S1	1	1	1	1	1	2	1	1	1	1	2	1	1	1	1	1	1	4	4	1	2	2	2	3	2	6																																		
S2	1	1	1	1	1	2	1	1	1	1	2	1	1	1	1	1	1	4	4	1	2	2	2	3	2	6																																		
R1	2	1	1	1	1	3	2	1	2	1	3	1	2	2	1	3	2	1	1	3	3	2	1	2	2	2																																		
R2	1	1	1	1	1	1	3	1	3	1	1	2	1	1	1	1	1	1	2	2	1	2	2	2	1	2																																		
Clinical	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	6																																	

Agreement results matrix for case 5

REVIEWER	A1	A2	B1	B2	C1	C2	D1	D2	E1	E2	F1	F2	G1	G2	H1	H2	I1	I2	J1	J2	K1	K2	L1	L2	M1	M2	N1	N2	O1	O2	P1	P2	Q1	Q2	S1	S2	R1	R2
A1	100	55	58	48	53	49	55	41	65	37	41	48	41	71	49	83	71	66	71	49	80	70	67	63	41	41	68	71	85	71	40	41	6	36	74	74	53	36
A2	55	100	32	32	97	95	99	77	46	64	78	95	78	62	38	69	86	88	69	95	40	58	89	90	77	78	73	73	54	86	76	77	9	31	73	73	53	62
B1	58	32	100	87	31	32	33	34	84	30	34	32	35	72	79	27	52	51	56	31	67	61	50	30	33	34	51	56	62	52	34	35	7	67	70	70	49	29
B2	48	32	87	100	31	32	31	34	68	32	34	32	35	58	84	26	43	41	46	34	50	50	43	28	34	34	40	49	47	43	35	35	7	72	61	61	56	34
C1	53	97	31	31	100	99	97	79	42	64	78	98	78	59	38	68	81	85	66	97	35	54	88	90	78	78	68	70	50	82	76	77	8	29	72	72	46	63
C2	49	95	32	32	99	100	96	88	43	71	88	99	87	58	41	64	79	82	61	97	31	48	85	87	87	87	61	67	46	79	85	86	9	31	69	69	51	69
D1	55	99	33	31	97	96	100	77	46	65	78	95	79	63	38	69	86	88	69	94	40	58	90	90	77	78	73	73	54	86	76	76	9	30	74	74	52	63
D2	41	77	34	34	79	88	77	100	45	78	99	87	97	55	44	56	62	67	42	85	28	31	70	64	99	99	41	47	42	63	96	97	10	33	54	54	55	76
E1	65	46	84	68	42	43	46	45	100	40	45	42	46	64	63	56	63	61	65	42	78	64	60	47	44	45	65	63	81	63	46	46	8	47	50	50	56	39
E2	37	64	30	32	64	71	65	78	40	100	77	69	79	48	38	48	55	59	38	70	29	35	59	54	76	77	37	43	38	55	78	78	39	55	47	47	58	72
F1	41	78	34	34	78	88	78	99	45	77	100	88	98	54	44	55	62	67	42	85	28	31	70	64	99	99	41	46	41	62	95	97	10	33	54	54	55	76
F2	48	95	32	32	98	99	95	87	42	69	88	100	86	57	41	64	78	81	61	96	31	47	83	86	87	88	60	66	45	78	83	86	9	31	69	69	50	68
G1	41	78	35	35	78	87	79	97	46	79	98	86	100	56	44	56	63	69	43	85	29	32	71	64	97	97	42	48	42	63	96	96	10	34	55	55	56	77
G2	71	62	72	58	59	58	63	55	64	48	54	57	56	100	58	58	70	68	90	57	75	84	68	71	54	54	84	88	76	70	54	55	7	46	85	85	56	47
H1	49	38	79	84	38	41	38	44	63	38	44	41	44	58	100	31	51	48	47	41	45	46	50	34	43	44	36	50	47	51	43	44	8	81	59	59	47	37
H2	83	69	27	26	68	64	69	56	56	48	55	64	56	58	31	100	61	61	66	63	67	55	63	78	55	55	67	65	82	61	54	55	7	24	53	53	40	47
I1	71	86	52	43	81	79	86	62	63	55	62	78	63	70	51	61	100	96	79	79	56	73	95	79	61	61	78	84	66	100	64	63	8	35	80	80	69	53
I2	66	88	51	41	85	82	88	67	61	59	67	81	69	68	48	61	96	100	78	82	54	70	97	81	66	67	77	83	65	96	70	69	9	36	78	78	68	57
J1	71	69	56	46	66	61	69	42	65	38	42	61	43	90	47	66	79	78	100	61	75	91	78	84	41	41	94	98	80	79	43	43	6	34	75	75	53	37
J2	49	95	31	34	97	97	94	85	42	70	85	96	85	57	41	63	79	82	61	100	31	47	83	86	84	84	61	67	46	79	84	84	9	34	68	68	53	68
K1	80	40	67	50	35	31	40	28	78	29	28	31	29	75	45	67	56	54	75	31	100	82	53	51	28	28	75	72	90	56	29	29	11	38	57	57	54	38
K2	70	58	61	50	54	48	58	31	64	35	31	47	32	84	46	55	73	70	91	47	82	100	70	70	30	30	92	89	74	73	32	31	12	40	73	73	59	38
L1	67	89	50	43	88	85	90	70	60	59	70	83	71	68	50	63	95	97	78	83	53	70	100	82	69	69	75	81	64	95	69	69	8	32	81	81	67	58
L2	63	90	30	28	90	87	90	64	47	54	64	86	64	71	34	78	79	81	84	86	51	70	82	100	64	64	86	83	62	79	63	64	8	27	69	69	45	53
M1	41	77	33	34	78	87	77	99	44	76	99	87	97	54	43	55	61	66	41	84	28	30	69	64	100	99	41	46	41	61	95	96	10	33	54	54	55	76
M2	41	78	34	34	78	87	78	99	45	77	99	88	97	54	44	55	61	67	41	84	28	30	69	64	99	100	41	46	41	62	95	97	10	33	54	54	55	76
N1	68	73	51	40	68	61	73	41	65	37	41	60	42	84	36	67	78	77	94	61	75	92	75	86	41	41	100	92	74	78	41	41	6	29	65	65	51	36
N2	71	73	56	49	70	67	73	47	63	43	46	66	48	88	50	65	84	83	98	67	72	89	81	83	46	46	92	100	79	84	49	49	7	39	78	78	55	41
O1	85	54	62	47	50	46	54	42	81	38	41	45	42	76	47	82	66	65	80	46	90	74	64	62	41	41	74	79	100	66	42	42	7	35	62	62	52	37
O2	71	86	52	43	82	79	86	63	63	55	62	78	63	70	51	61	100	96	79	79	56	73	95	79	61	62	78	84	66	100	63	63	8	34	80	80	70	53
P1	40	76	34	35	76	85	76	96	46	78	95	83	96	54	43	54	64	70	43	84	29	32	69	63	95	95	41	49	42	63	100	98	10	37	54	54	56	76
P2	41	77	35	35	77	86	76	97	46	78	97	86	96	55	44	55	63	69	43	84	29	31	69	64	96	97	41	49	42	63	98	100	10	36	54	54	56	76
Q1	6	9	7	7	8	9	9	10	8	39	10	9	10	7	8	7	8	9	6	9	11	12	8	8	10	10	6	7	7	8	10	10	100	37	7	7	18	22
Q2	36	31	67	72	29	31	30	33	47	55	33	31	34	46	81	24	35	36	34	34	38	40	32	27	33	33	29	39	35	34	37	36	37	100	47	47	40	40
S1	74	73	70	61	72	69	74	54	50	47	54	69	55	85	59	53	80	78	75	68	57	73	81	69	54	54	65	78	62	80	54	54	7	47	100	100	55	46
S2	74	73	70	61	72	69	74	54	50	47	54	69	55	85	59	53	80	78	75	68	57	73	81	69	54	54	65	78	62	80	54	54	7	47	100	100	55	46
R1	53	53	49	56	46	51	52	55	56	58	55	50	56	56	47	40	69	68	53	53	54	59	67	45	55	55	51	55	52	70	56	56	18	40	55	55	100	69
R2	36	62	29	34	63	69	63	76	39	72	76	68	77	47	37	47	53	57	37	68	38	38	58	53	76	76	36	41	37	53	76	76	22	40	46	46	69	100

Case 6 1297

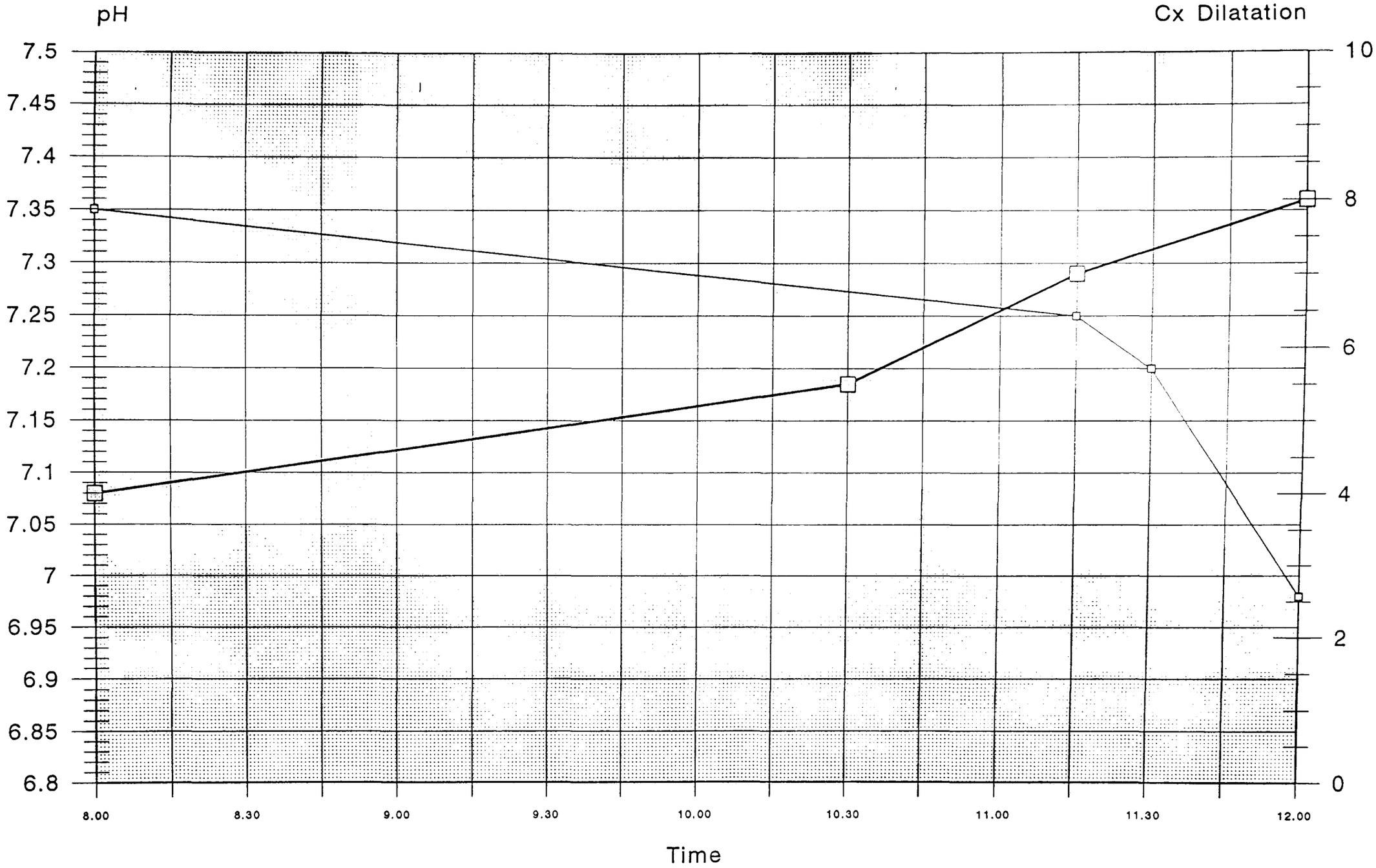
Miss J.H. is an 18 year old primigravida. She has no significant medical history but smokes 15 cigarettes per day. There were no antenatal problems and she was admitted in spontaneous labour at 40 weeks gestation, on 1.4.91. Presentation cephalic 3/5. On VE at 08.05hrs the cervix was 4cm dilated,effacing; station -1.

Labour events

10.30	VE Cx 5-6cm dilated, thin. Station -1. LOT position. ARM; clear liquor. FSE applied.
11.10	Maternal position changed (left lateral) and facial oxygen given. VE Cx 7cm dilated.
11.20	Decision for emergency Caesarean section.
11.52	Female infant delivered by C/S under GA. Indication; prolonged fetal bradycardia. No cause for fetal distress identified.

Outcome

Birth weight 3.23kg
Apgar 4 & 9
Cord gases pH 6.96 / 7.00 BD(ecf) 14 / 10


pH
Cx Dilatation
7.5
7.45
7.4
7.35
7.3
7.25
7.2
7.15
7.1
7.05
7
6.95
6.9
6.85
6.8
10
8
6
4
2
0
8.00
8.30
9.00
9.30
10.00
10.30
11.00
11.30
12.00
Time
pH
Cx Dilatation (cm)

Case 6

SEGMENT

REVIEWER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
A1	1	1	1	1	2	1	4	5																																																				
A2	1	1	1	1	1	1	2	5																																																				
B1	1	1	1	1	1	1	2	5																																																				
B2	1	1	1	1	1	1	2	5																																																				
C1	1	1	1	1	1	1	2	5																																																				
C2	1	1	1	1	1	1	2	5																																																				
D1	2	2	2	2	2	2	5																																																					
D2	1	1	1	2	1	1	2	5																																																				
E1	1	1	1	2	1	1	2	5																																																				
E2	1	1	1	1	1	1	2	5																																																				
F1	1	1	1	1	1	1	1	5																																																				
F2	1	1	1	1	1	1	2	5																																																				
G1	1	1	1	1	1	1	2	5																																																				
G2	1	1	1	1	1	1	2	5																																																				
H1	1	1	1	1	1	1	2	5																																																				
H2	1	1	1	1	1	1	2	3	5																																																			
I1	1	1	1	1	1	1	2	5																																																				
I2	1	1	1	1	1	1	2	5																																																				
J1	1	1	1	1	1	1	2	2	5																																																			
J2	1	1	1	2	1	2	2	3	5																																																			
K1	1	1	1	1	1	1	2	5																																																				
K2	1	1	1	2	1	1	2	5																																																				
L1	1	1	1	1	1	1	2	5																																																				
L2	1	1	1	1	1	1	2	5																																																				
M1	1	1	1	1	1	1	2	3	5																																																			
M2	1	1	1	1	2	1	2	2																																																				
N1	1	1	1	1	1	1	2	5																																																				
N2	1	1	1	1	1	1	2	5																																																				
O1	1	1	1	1	1	1	2	5																																																				
O2	1	1	1	1	1	1	2	3	5																																																			
P1	1	1	1	1	1	1	2	5																																																				
P2	1	1	1	2	1	1	2	5																																																				
Q1	2	2	2	2	2	2	2	5																																																				
Q2	2	2	2	2	2	2	2	5																																																				
S1	1	1	1	2	1	1	4	5																																																				
S2	1	1	1	2	1	1	4	5																																																				
R1	1	1	2	1	2	1	1	2	2	1																																																		
R2	1	2	1	1	1	3	2	1	1	1																																																		
Clinical	0	0	0	0	0	0	0	0	0	5																																																		

Agreement results matrix for case 6

REVIEWER	A1	A2	B1	B2	C1	C2	D1	D2	E1	E2	F1	F2	G1	G2	H1	H2	I1	I2	J1	J2	K1	K2	L1	L2	M1	M2	N1	N2	O1	O2	P1	P2	Q1	Q2	S1	S2	R1	R2
A1	100	95	95	95	95	95	89	95	95	95	96	95	95	95	95	86	95	95	87	86	95	95	95	95	86	23	95	95	95	86	95	95	93	93	100	100	23	36
A2	95	100	100	100	100	100	90	100	100	100	100	100	100	100	100	89	100	100	94	88	100	100	100	100	89	32	100	100	100	89	100	100	96	96	95	95	32	33
B1	95	100	100	100	100	100	90	100	100	100	100	100	100	100	100	89	100	100	94	88	100	100	100	100	89	32	100	100	100	89	100	100	96	96	95	95	32	33
B2	95	100	100	100	100	100	90	100	100	100	100	100	100	100	100	89	100	100	94	88	100	100	100	100	89	32	100	100	100	89	100	100	96	96	95	95	32	33
C1	95	100	100	100	100	100	90	100	100	100	100	100	100	100	100	89	100	100	94	88	100	100	100	100	89	32	100	100	100	89	100	100	96	96	95	95	32	33
C2	95	100	100	100	100	100	90	100	100	100	100	100	100	100	100	89	100	100	94	88	100	100	100	100	89	32	100	100	100	89	100	100	96	96	95	95	32	33
D1	89	90	90	90	90	90	100	91	91	90	89	90	90	90	90	69	90	90	72	70	90	91	90	90	69	26	90	90	90	69	90	91	94	94	89	89	27	30
D2	95	100	100	100	100	100	91	100	100	100	99	100	100	100	100	88	100	100	93	89	100	100	100	100	88	32	100	100	100	88	100	100	97	97	96	96	33	33
E1	95	100	100	100	100	100	91	100	100	100	99	100	100	100	100	88	100	100	93	89	100	100	100	100	88	32	100	100	100	88	100	100	97	97	96	96	33	33
E2	95	100	100	100	100	100	90	100	100	100	100	100	100	100	100	89	100	100	94	88	100	100	100	100	89	32	100	100	100	89	100	100	96	96	95	95	32	33
F1	96	100	100	100	100	100	89	99	99	100	100	100	100	100	100	88	100	100	93	87	100	99	100	100	88	31	100	100	100	88	100	99	95	95	96	96	32	34
F2	95	100	100	100	100	100	90	100	100	100	100	100	100	100	100	89	100	100	94	88	100	100	100	100	89	32	100	100	100	89	100	100	96	96	95	95	32	33
G1	95	100	100	100	100	100	90	100	100	100	100	100	100	100	100	89	100	100	94	88	100	100	100	100	89	32	100	100	100	89	100	100	96	96	95	95	32	33
G2	95	100	100	100	100	100	90	100	100	100	100	100	100	100	100	89	100	100	94	88	100	100	100	100	89	32	100	100	100	89	100	100	96	96	95	95	32	33
H1	95	100	100	100	100	100	90	100	100	100	100	100	100	100	100	89	100	100	94	88	100	100	100	100	89	32	100	100	100	89	100	100	96	96	95	95	32	33
H2	86	89	89	89	89	89	69	88	88	89	88	89	89	89	89	100	89	89	94	99	89	88	89	89	100	29	89	89	89	100	89	88	85	85	86	86	29	42
I1	95	100	100	100	100	100	90	100	100	100	100	100	100	100	100	89	100	100	94	88	100	100	100	100	89	32	100	100	100	89	100	100	96	96	95	95	32	33
I2	95	100	100	100	100	100	90	100	100	100	100	100	100	100	100	89	100	100	94	88	100	100	100	100	89	32	100	100	100	89	100	100	96	96	95	95	32	33
J1	87	94	94	94	94	94	72	93	93	94	93	94	94	94	94	94	94	94	100	94	94	93	94	94	94	34	94	94	94	94	94	93	90	90	87	87	35	32
J2	86	88	88	88	88	88	70	89	89	88	87	88	88	88	88	99	88	88	94	100	88	89	88	88	99	29	88	88	88	99	88	89	87	87	86	86	29	41
K1	95	100	100	100	100	100	90	100	100	100	100	100	100	100	100	89	100	100	94	88	100	100	100	100	89	32	100	100	100	89	100	100	96	96	95	95	32	33
K2	95	100	100	100	100	100	91	100	100	100	99	100	100	100	100	88	100	100	93	89	100	100	100	100	88	32	100	100	100	88	100	100	97	97	96	96	33	33
L1	95	100	100	100	100	100	90	100	100	100	100	100	100	100	100	89	100	100	94	88	100	100	100	100	89	32	100	100	100	89	100	100	96	96	95	95	32	33
L2	95	100	100	100	100	100	90	100	100	100	100	100	100	100	100	89	100	100	94	88	100	100	100	100	89	32	100	100	100	89	100	100	96	96	95	95	32	33
M1	86	89	89	89	89	89	69	88	88	89	88	89	89	89	89	100	89	89	94	99	89	88	89	89	100	29	89	89	89	100	89	88	85	85	86	86	29	42
M2	23	32	32	32	32	32	26	32	32	32	31	32	32	32	32	29	32	32	34	29	32	32	32	32	29	100	32	32	32	29	32	32	28	28	23	23	94	65
N1	95	100	100	100	100	100	90	100	100	100	100	100	100	100	100	89	100	100	94	88	100	100	100	100	89	32	100	100	100	89	100	100	96	96	95	95	32	33
N2	95	100	100	100	100	100	90	100	100	100	100	100	100	100	100	89	100	100	94	88	100	100	100	100	89	32	100	100	100	89	100	100	96	96	95	95	32	33
O1	95	100	100	100	100	100	90	100	100	100	100	100	100	100	100	89	100	100	94	88	100	100	100	100	89	32	100	100	100	89	100	100	96	96	95	95	32	33
O2	86	89	89	89	89	89	69	88	88	89	88	89	89	89	89	100	89	89	94	99	89	88	89	89	100	29	89	89	89	100	89	88	85	85	86	86	29	42
P1	95	100	100	100	100	100	90	100	100	100	100	100	100	100	100	89	100	100	94	88	100	100	100	100	89	32	100	100	100	89	100	100	96	96	95	95	32	33
P2	95	100	100	100	100	100	91	100	100	100	99	100	100	100	100	88	100	100	93	89	100	100	100	100	88	32	100	100	100	88	100	100	97	97	96	96	33	33
Q1	93	96	96	96	96	96	94	97	97	96	95	96	96	96	96	85	96	96	90	87	96	97	96	96	85	28	96	96	96	85	96	97	100	100	93	93	30	31
Q2	93	96	96	96	96	96	94	97	97	96	95	96	96	96	96	85	96	96	90	87	96	97	96	96	85	28	96	96	96	85	96	97	100	100	93	93	30	31
S1	100	95	95	95	95	95	89	96	96	95	96	95	95	95	95	86	95	95	87	86	95	96	95	95	86	23	95	95	95	86	95	96	93	93	100	100	23	36
S2	100	95	95	95	95	95	89	96	96	95	96	95	95	95	95	86	95	95	87	86	95	96	95	95	86	23	95	95	95	86	95	96	93	93	100	100	23	36
R1	23	32	32	32	32	32	27	33	33	32	32	32	32	32	32	29	32	32	35	29	32	33	32	32	29	94	32	32	32	29	32	33	30	30	23	23	100	70
R2	36	33	33	33	33	33	30	33	33	33	34	33	33	33	33	42	33	33	32	41	33	33	33	33	42	65	33	33	33	42	33	33	31	31	36	36	70	100

Case 7 393

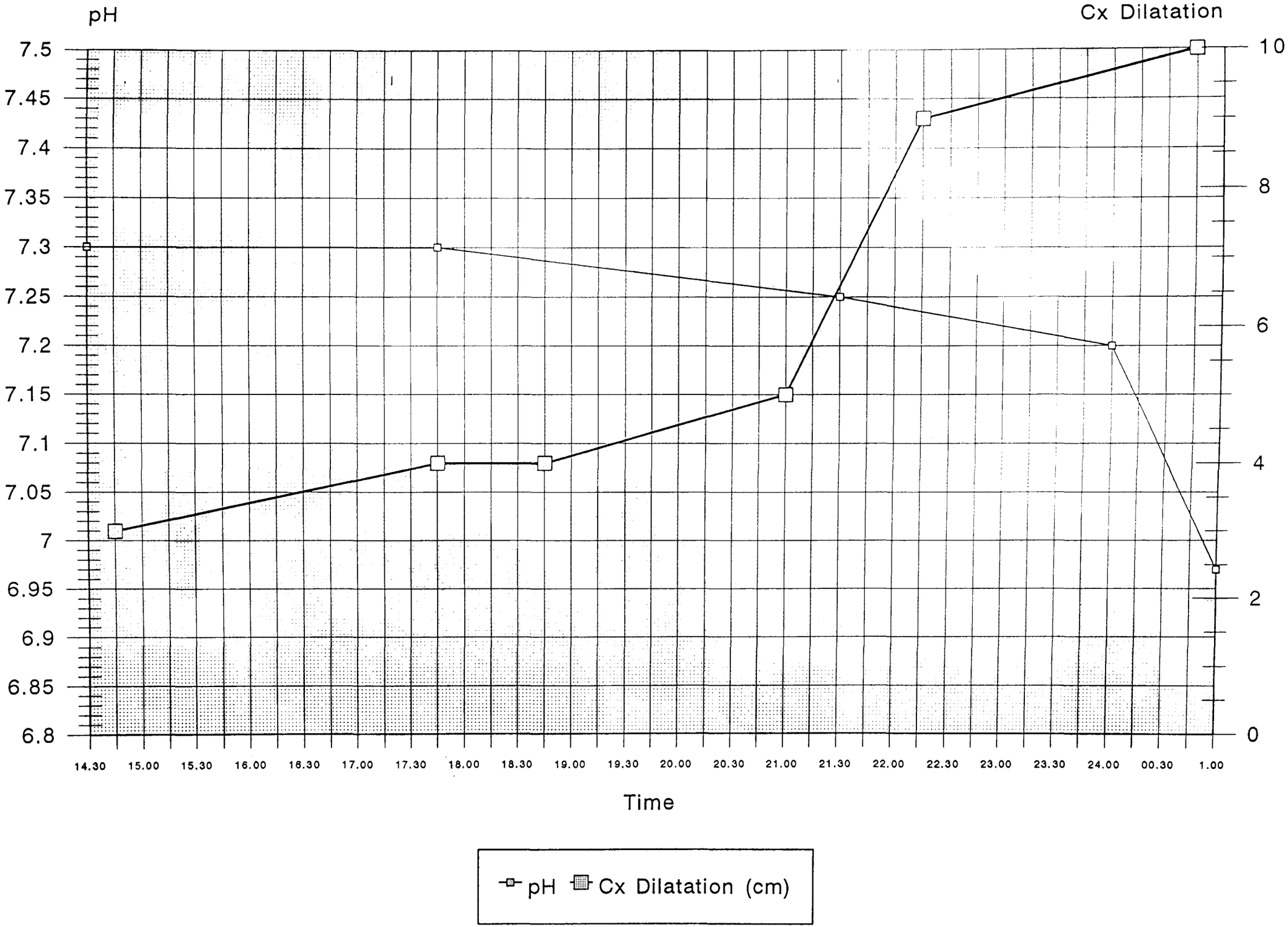
Mrs J.B. is a 26 year old lady expecting her second baby. In 1987 she had a normal delivery of a baby boy, weighing 9lb 2oz. During the current pregnancy, there was clinical suspicion that the baby was large for dates. Investigation showed no evidence of diabetes. Labour was induced at 41 weeks for "postmaturity". When she was admitted for this purpose on 18.9.90 she had already started contracting at home, and the cervix was 3cm dilated. ARM was performed at 14.40hrs and clear liquor drained. She was monitored intermittently until 17.40hrs, when an FSE was applied. By this time the cervix was 4cm dilated; station -2.

Labour events

17.50	Pethidine 100mg, Stemetil 12.5mg im.
18.50	VE No change.
19.00	Epidural begun.
19.45	Epidural working.
20.40	Syntocinon started.
21.05	VE Cx 5cm dilated, thin. Station -2. OP position. FSE reapplied. (Lying flat for VE)
21.25	Hypotensive (BP 80/60) and nauseous. IV fluids increased.
22.00	Bedpan.
22.10	VE Cx 9cm dilated. Station -2. Direct OP position.
22.25	Top up.
00.45	VE Cx fully dilated. Station -1. OP position. Pushing begun.
01.05	Normal delivery of male infant.

Outcome

Birth weight 3.85kg
Apgar 2 & 8
Cord gases pH 6.97 / 7.14 BD(ecf) 8 / 8


pH
Cx Dilatation
7.5
7.45
7.4
7.35
7.3
7.25
7.2
7.15
7.1
7.05
7
6.95
6.9
6.85
6.8
10
8
6
4
2
0
14.30
15.00
15.30
16.00
16.30
17.00
17.30
18.00
18.30
19.00
19.30
20.00
20.30
21.00
21.30
22.00
22.30
23.00
23.30
24.00
00.30
1.00
Time
pH
Cx Dilatation (cm)

Case 7

SEGMENT

REVIEWER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
A1	1	1	1	1	1	1	1	1	1	1	2	1	1	2	2	2	1	2	2	2	2	2	2	1	1	2	2	2																																
A2	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																
B1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	2	2	1	1	2	2																																
B2	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	1	1	1	1	1	1	1	1	1	2	1	1	1																																
C1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1																																
C2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	2	2	2	2	2	3	6																																
D1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	3	2	2	2	3	4	4	3	5																																
D2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1																																
E1	1	2	1	1	2	1	1	1	1	1	1	1	1	2	2	1	2	2	3	2	3	2	3	4	2	3	5																																
E2	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	1	1	2	2	2	2	2	2	2	1	2	2	2																																
F1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																
F2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																
G1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	3	2	2	2	2	2	3	5																																
G2	1	1	1	1	1	1	1	1	1	1	1	1	1	4	2	2	2	4	3	4	4	3	4	4	4	4	3	6																																
H1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	1	1	3	5																																		
H2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2																																
I1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	2	2	1	1	1	1	1	1	1	1	1																																
I2	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	2	2	1	1	1	1	1	1	1	1	1																																
J1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	3	2	2	5																																				
J2	1	1	1	1	1	1	1	1	1	1	1	2	1	1	2	2	1	2	2	2	2	2	2	2	2	2	2	2																																
K1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																
K2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																
L1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	1	1	1	2	3	2	2	3	2	3	4	5																																	
L2	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	1	1	2	3	4	4	4	3	4	5																																	
M1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2																																
M2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	3	2	2	2	2	2	2	3	6																																
N1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2																																
N2	2	2	1	1	1	1	2	1	1	1	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1																																
O1	1	1	1	1	1	1	1	1	1	1	2	2	1	2	2	2	2	3	2	3	2	2	3	5																																		
O2	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	2	2	3	2	3	2	2	3	2	3	5																																
P1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	2	2	1	2	1	2	1	2	2	2	2																																
P2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	2	2	2	2	2	2	2	2	2	2																																
Q1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	1	2	1	1	1	2	1	1	1	1	1																																
Q2	2	2	2	2	2	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2																																
S1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1																																
S2	2	1	1	1	1	1	1	1	1	1	1	1	2	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1																																
R1	3	2	1	2	1	2	4	2	1	2	2	1	2	1	1	3	5																																												
R2	2	1	2	1	2	1	2	1	2	1	1	2	1	2	2	2	1	2	2	2	2	1	1	1	2	4	3	2																																
Clinical	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	D																															

Agreement results matrix for case 7

REVIEWER	A1	A2	B1	B2	C1	C2	D1	D2	E1	E2	F1	F2	G1	G2	H1	H2	I1	I2	J1	J2	K1	K2	L1	L2	M1	M2	N1	N2	O1	O2	P1	P2	Q1	Q2	S1	S2	R1	R2
A1	100	91	94	92	92	76	37	92	40	99	90	90	52	23	51	96	93	93	50	98	91	90	41	28	95	70	98	94	45	46	97	97	94	94	92	91	28	70
A2	91	100	97	99	99	74	34	99	36	92	99	99	48	19	51	90	99	99	46	89	100	99	38	26	92	64	88	88	40	41	94	91	97	84	99	99	28	66
B1	94	97	100	97	96	78	36	96	38	96	97	97	51	21	51	94	96	96	47	94	97	96	39	28	96	68	93	90	42	44	97	96	97	89	96	96	28	67
B2	92	99	97	100	98	75	35	98	37	92	98	98	49	20	51	91	98	98	47	91	99	98	39	27	93	65	90	90	41	43	95	93	97	86	99	98	28	67
C1	92	99	96	98	100	75	35	100	37	92	99	99	50	20	53	92	99	99	47	90	99	99	39	27	92	66	88	89	41	42	95	92	97	84	98	97	28	66
C2	76	74	78	75	75	100	52	75	52	78	74	74	65	40	48	79	74	74	42	78	74	74	48	31	79	91	76	72	40	58	79	79	74	73	76	75	25	84
D1	37	34	36	35	35	52	100	35	97	38	34	34	87	73	65	38	35	35	48	37	34	34	95	79	38	59	37	35	70	90	37	38	35	35	35	35	21	69
D2	92	99	96	98	100	75	35	100	37	92	99	99	50	20	53	92	99	99	47	90	99	99	39	27	92	66	88	89	41	42	95	92	97	84	98	97	28	66
E1	40	36	38	37	37	52	97	37	100	41	36	36	90	71	63	40	38	38	50	40	36	36	93	78	40	64	41	40	70	94	40	40	38	41	37	37	22	63
E2	99	92	96	92	92	78	38	92	41	100	91	91	53	23	52	98	94	94	50	98	92	90	42	29	97	72	98	94	45	46	98	99	94	94	92	92	28	70
F1	90	99	97	98	99	74	34	99	36	91	100	100	49	19	52	90	98	98	46	89	99	99	38	26	92	64	87	87	39	41	94	91	97	83	98	98	28	65
F2	90	99	97	98	99	74	34	99	36	91	100	100	49	19	52	90	98	98	46	89	99	99	38	26	92	64	87	87	39	41	94	91	97	83	98	98	28	65
G1	52	48	51	49	50	65	87	50	90	53	49	49	100	55	59	54	50	50	44	53	48	48	88	65	53	73	52	50	63	97	53	54	50	50	49	49	22	68
G2	23	19	21	20	20	40	73	20	71	23	19	19	55	100	49	23	20	20	51	23	19	19	67	78	22	56	24	22	59	60	22	23	21	22	20	20	27	56
H1	51	51	51	51	53	48	65	53	63	52	52	52	59	49	100	52	52	52	73	51	51	51	79	76	51	49	50	48	89	62	53	52	52	48	51	51	22	57
H2	96	90	94	91	92	79	38	92	40	98	90	90	54	23	52	100	92	92	49	98	90	90	42	29	99	73	97	92	44	47	98	99	92	93	91	90	28	68
I1	93	99	96	98	99	74	35	99	38	94	98	98	50	20	52	92	100	100	48	91	99	98	39	27	91	66	90	91	42	43	96	91	97	86	98	97	28	67
I2	93	99	96	98	99	74	35	99	38	94	98	98	50	20	52	92	100	100	48	91	99	98	39	27	91	66	90	91	42	43	96	91	97	86	98	97	28	67
J1	50	46	47	47	47	42	48	47	50	50	46	46	44	51	73	49	48	48	100	50	46	45	46	65	48	54	51	49	81	46	49	50	49	48	46	46	26	40
J2	98	89	94	91	90	78	37	90	40	98	89	89	53	23	51	98	91	91	50	100	89	88	41	29	97	72	99	95	45	46	97	99	93	94	90	90	28	70
K1	91	100	97	99	99	74	34	99	36	92	99	99	48	19	51	90	99	99	46	89	100	99	38	26	92	64	88	88	40	41	94	91	97	84	99	99	28	66
K2	90	99	96	98	99	74	34	99	36	90	99	99	48	19	51	90	98	98	45	88	99	100	37	26	92	64	86	88	39	41	93	90	96	84	98	98	29	65
L1	41	38	39	39	39	48	95	39	93	42	38	38	88	67	79	42	39	39	46	41	38	37	100	83	41	58	41	40	83	92	41	42	39	39	39	38	22	64
L2	28	26	28	27	27	31	79	27	78	29	26	26	65	78	76	29	27	27	65	29	26	26	83	100	28	47	29	28	82	70	28	29	27	27	27	26	22	43
M1	95	92	96	93	92	79	38	92	40	97	92	92	53	22	51	99	91	91	48	97	92	92	41	28	100	71	95	90	43	46	97	99	92	91	93	92	28	67
M2	70	64	68	65	66	91	59	66	64	72	64	64	73	56	49	73	66	66	54	72	64	64	58	47	71	100	71	68	55	70	71	72	67	68	65	65	26	79
N1	98	88	93	90	88	76	37	88	41	98	87	87	52	24	50	97	90	90	51	99	88	86	41	29	95	71	100	95	45	46	96	98	93	96	89	88	28	69
N2	94	88	90	90	89	72	35	89	40	94	87	87	50	22	48	92	91	91	49	95	88	88	40	28	90	68	95	100	45	45	91	93	93	94	88	89	29	69
O1	45	40	42	41	41	40	70	41	70	45	39	39	63	59	89	44	42	42	81	45	40	39	83	82	43	55	45	45	100	69	43	44	43	43	40	40	28	51
O2	46	41	44	43	42	58	90	42	94	46	41	41	97	60	62	47	43	43	46	46	41	41	92	70	46	70	46	45	69	100	46	46	44	44	42	42	23	63
P1	97	94	97	95	95	79	37	95	40	98	94	94	53	22	53	98	96	96	49	97	94	93	41	28	97	71	96	91	43	46	100	97	94	92	96	95	28	70
P2	97	91	96	93	92	79	38	92	40	99	91	91	54	23	52	99	91	91	50	99	91	90	42	29	99	72	98	93	44	46	97	100	93	94	92	91	28	69
Q1	94	97	97	97	97	74	35	97	38	94	97	97	50	21	52	92	97	97	49	93	97	96	39	27	92	67	93	93	43	44	94	93	100	89	96	95	28	67
Q2	94	84	89	86	84	73	35	84	41	94	83	83	50	22	48	93	86	86	48	94	84	84	39	27	91	68	96	94	43	44	92	94	89	100	85	86	29	70
S1	92	99	96	99	98	76	35	98	37	92	98	98	49	20	51	91	98	98	46	90	99	98	39	27	93	65	89	88	40	42	96	92	96	85	100	99	28	67
S2	91	99	96	98	97	75	35	97	37	92	98	98	49	20	51	90	97	97	46	90	99	98	38	26	92	65	88	89	40	42	95	91	95	86	99	100	29	67
R1	28	28	28	28	28	25	21	28	22	28	28	28	22	27	22	28	28	28	26	28	28	29	22	22	28	26	28	29	28	23	28	28	28	29	28	29	100	25
R2	70	66	67	67	66	84	69	66	63	70	65	65	68	56	57	68	67	67	40	70	66	65	64	43	67	79	69	69	51	63	70	69	67	70	67	67	25	100

Case 8 713

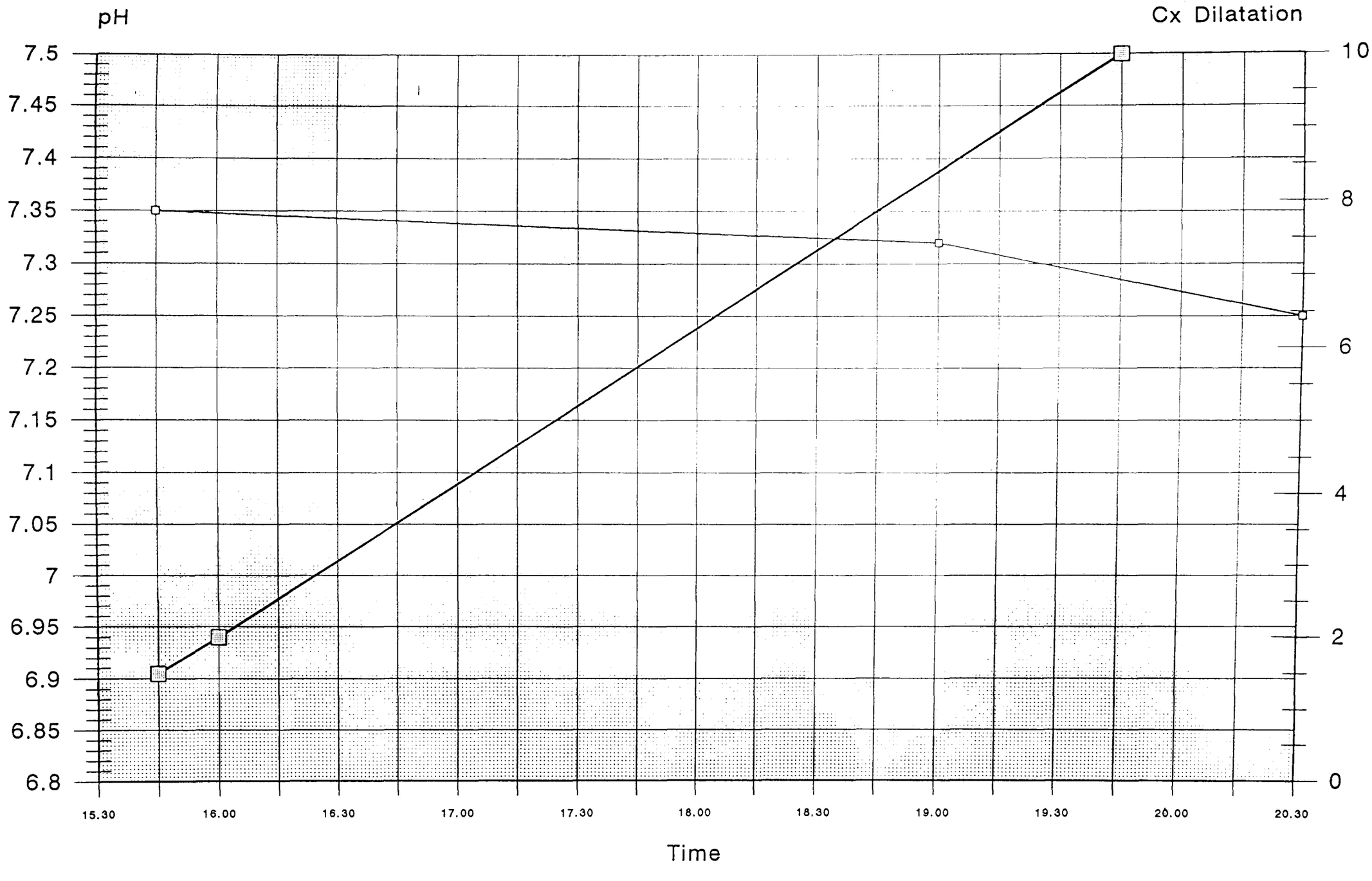
Mrs L.B. is a 27 year old primigravida; a fit nonsmoker. No antenatal problems were encountered, and she laboured spontaneously at 40 weeks. When she came to the labour ward, the membranes had ruptured 4 hours ago and regular contractions had begun. The uterus was term size, presentation cephalic 3/5. VE (12.30hrs on 26.11.91) Cx 1cm dilated, 2cm long. Station -3. Clear liquor noted. 3 hours later, at 15.40hrs, contractions were still mild and the cervix 1-2cm dilated, part effaced. FSE now applied, and syntocinon commenced.

Labour events

16.05 VE Cx 2cm dilated, effaced. Station -2.
16.23 Pethidine 100mg im.
16.50 Syntocinon begun.
17.00 Maternal position changed, oxygen given. Syntocinon stopped.
17.30 Syntocinon restarted.
18.40 Epidural begun.
19.00 Maternal hypotension. IV fluids increased.
19.20 Epidural complete.
19.40 PV bleeding; small clots. VE Cx fully dilated. OA position. Station +1
Decision for forceps.
20.00 Top up.
20.32 Male infant delivered by Neville Barnes forceps. Indication; PV bleeding at full dilatation.

Outcome

Birth weight 3.56kg
Apgar 8 & 9
Cord gases pH 7.25 / 7.31 BD(ecf) 4 / 6


pH
Cx Dilatation
7.5
7.45
7.4
7.35
7.3
7.25
7.2
7.15
7.1
7.05
7
6.95
6.9
6.85
6.8
10
8
6
4
2
0
15.30
16.00
16.30
17.00
17.30
18.00
18.30
19.00
19.30
20.00
20.30
Time
pH
Cx Dilatation (cm)

Case 8

		SEGMENT																																																										
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
REVIEWER	A1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2																																												
	A2	1	1	1	1	1	1	1	2	2	2	1	1	1	2	1	2																																												
	B1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																												
	B2	1	1	1	1	1	1	3	1	2	2	2	3	1	2	1	1																																												
	C1	1	1	1	1	1	2	2	2	3	1	1	1	1	1	1	1																																												
	C2	1	1	1	1	2	2	2	3	1	1	1	1	1	2	1	6																																												
	D1	2	1	1	1	1	2	2	3	2	2	1	1	1	1	1	2																																												
	D2	1	1	1	1	1	1	1	2	2	2	1	1	1	2	1	1																																												
	E1	2	1	1	1	1	1	1	3	2	2	1	1	1	1	2	2																																												
	E2	1	1	1	1	1	1	2	2	2	1	1	1	1	1	1	2																																												
	F1	1	1	1	1	1	1	1	1	1	1	1	1	1	4	1	1																																												
	F2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																												
	G1	1	1	1	1	1	1	2	2	2	2	2	2	1	1	1	1																																												
	G2	1	1	1	1	1	2	2	4	4	2	2	2	1	2	1	1																																												
	H1	1	1	1	2	2	1	1	2	2	2	2	2	1	1	1	1																																												
	H2	1	1	1	1	1	2	2	2	2	1	2	2	1	1	1	1																																												
	I1	1	1	1	1	1	1	2	2	2	1	1	1	1	2	1	2																																												
	I2	1	1	1	2	2	2	2	3	2	2	1	1	1	2	1	2																																												
	J1	2	1	1	1	1	1	2	2	2	2	3	2	2	2	2	2																																												
	J2	1	1	1	1	1	1	2	2	3	1	1	1	1	1	2	2																																												
	K1	1	1	1	1	1	2	2	3	2	1	1	1	1	1	2	2																																												
	K2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																												
	L1	1	1	1	1	1	1	2	2	2	2	1	2	2	6																																														
	L2	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	2																																												
	M1	1	1	1	1	1	1	1	2	2	2	1	1	1	1	1	1																																												
	M2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2																																												
	N1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2																																												
	N2	1	1	1	2	2	2	2	2	3	2	2	2	2	4	2	6																																												
	O1	1	1	1	1	1	1	2	2	3	1	1	1	1	1	2	1																																												
	O2	1	1	1	1	1	2	2	3	1	1	1	1	1	2	1	2																																												
	P1	1	1	1	1	1	1	1	2	2	1	1	1	1	1	1	1																																												
	P2	1	1	1	1	1	1	1	2	2	1	1	2	1	1	1	1																																												
	Q1	1	1	1	1	2	2	2	2	2	2	2	2	2	4	4	4																																												
	Q2	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2																																												
	S1	1	2	1	1	2	2	2	2	2	2	1	2	2	2	1	4																																												
	S2	1	2	1	1	2	2	2	2	2	2	1	2	2	2	1	4																																												
	R1	2	2	1	2	5																																																								
	R2	1	1	3	2	1	3	2	2	1	2	1	1	3	2	1	2																																												
	Clinical	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6																																												

Agreement results matrix for case 8

REVIEWER	A1	A2	B1	B2	C1	C2	D1	D2	E1	E2	F1	F2	G1	G2	H1	H2	I1	I2	J1	J2	K1	K2	L1	L2	M1	M2	N1	N2	O1	O2	P1	P2	Q1	Q2	S1	S2	R1	R2
A1	100	95	85	66	73	62	76	93	77	92	61	85	94	52	92	93	94	76	82	77	77	85	78	89	91	87	100	52	76	75	89	92	41	100	67	67	17	56
A2	95	100	94	68	78	65	79	99	81	98	67	94	95	51	94	94	99	78	78	81	80	94	76	96	98	95	93	48	80	79	97	96	38	93	66	66	17	57
B1	85	94	100	64	78	64	75	95	76	95	71	100	92	49	91	93	94	72	69	77	76	100	70	98	96	99	83	42	78	77	98	97	35	83	62	62	17	53
B2	66	68	64	100	78	70	80	69	81	65	62	64	68	62	67	67	66	79	80	78	79	64	72	65	68	63	66	61	79	80	66	67	43	66	49	49	19	82
C1	73	78	78	78	100	82	95	79	92	81	58	78	79	69	77	81	81	94	82	98	95	78	61	76	80	77	73	62	99	96	81	80	34	73	57	57	15	57
C2	62	65	64	70	82	100	83	65	81	67	62	64	63	61	62	66	67	84	62	82	85	64	72	65	64	65	63	81	82	86	65	64	54	63	68	68	18	67
D1	76	79	75	80	95	83	100	78	98	81	55	75	79	69	77	79	80	97	75	95	99	75	62	75	79	76	76	62	95	97	79	78	35	76	58	58	20	66
D2	93	99	95	69	79	65	78	100	80	97	68	95	96	52	95	95	98	77	76	79	78	95	76	95	99	94	92	47	81	78	99	97	38	92	66	66	17	57
E1	77	81	76	81	92	81	98	80	100	80	56	76	77	67	76	76	80	94	76	95	97	76	62	78	80	78	75	61	94	95	79	78	33	75	55	55	20	65
E2	92	98	95	65	81	67	81	97	80	100	68	95	95	51	93	96	99	78	75	82	82	95	75	95	98	96	91	47	82	81	99	97	38	91	65	65	17	57
F1	61	67	71	62	58	62	55	68	56	68	100	71	65	39	65	66	67	53	59	57	56	71	72	70	68	70	59	76	58	58	70	69	87	59	79	79	14	57
F2	85	94	100	64	78	64	75	95	76	95	71	100	92	49	91	93	94	72	69	77	76	100	70	98	96	99	83	42	78	77	98	97	35	83	62	62	17	53
G1	94	95	92	68	79	63	79	96	77	95	65	92	100	53	97	99	94	76	77	77	77	92	76	90	97	91	94	48	78	76	96	97	40	94	67	67	17	55
G2	52	51	49	62	69	61	69	52	67	51	39	49	53	100	52	53	51	69	59	68	68	49	43	49	51	48	52	51	68	68	50	51	28	52	42	42	22	48
H1	92	94	91	67	77	62	77	95	76	93	65	91	97	52	100	96	92	78	75	75	75	91	73	89	96	90	91	49	76	74	94	96	40	91	66	66	18	56
H2	93	94	93	67	81	66	79	95	76	96	66	93	99	53	96	100	95	78	76	78	79	93	75	91	96	92	93	49	80	78	96	97	40	93	68	68	17	56
I1	94	99	94	66	81	67	80	98	80	99	67	94	94	51	92	95	100	79	77	82	81	94	76	96	97	95	93	48	81	81	97	96	38	93	66	66	17	58
I2	76	78	72	79	94	84	97	77	94	78	53	72	76	69	78	78	79	100	74	93	97	72	62	74	77	73	77	64	93	97	76	75	36	77	59	59	20	68
J1	82	78	69	80	82	62	75	76	76	75	59	69	77	59	75	76	77	74	100	85	75	69	76	73	74	70	81	63	84	74	73	75	41	81	58	58	16	65
J2	77	81	77	78	98	82	95	79	95	82	57	77	77	68	75	78	82	93	85	100	97	77	63	78	79	79	76	63	99	96	80	79	34	76	56	56	15	58
K1	77	80	76	79	95	85	99	78	97	82	56	76	77	68	75	79	81	97	75	97	100	76	63	77	78	77	77	62	96	99	79	78	35	77	57	57	19	66
K2	85	94	100	64	78	64	75	95	76	95	71	100	92	49	91	93	94	72	69	77	76	100	70	98	96	99	83	42	78	77	98	97	35	83	62	62	17	53
L1	78	76	70	72	61	72	62	76	62	75	72	70	76	43	73	75	76	62	76	63	63	70	100	72	74	71	78	67	63	62	73	76	61	78	71	71	16	69
L2	89	96	98	65	76	65	75	95	78	95	70	98	90	49	89	91	96	74	73	78	77	98	72	100	94	99	88	44	78	79	96	95	36	88	62	62	17	56
M1	91	98	96	68	80	64	79	99	80	98	68	96	97	51	96	96	97	77	74	79	78	96	74	94	100	95	89	46	81	77	100	99	38	89	65	65	17	55
M2	87	95	99	63	77	65	76	94	78	96	70	99	91	48	90	92	95	73	70	79	77	99	71	99	95	100	85	44	78	78	97	96	35	85	61	61	17	54
N1	100	93	83	66	73	63	76	92	75	91	59	83	94	52	91	93	93	77	81	76	77	83	78	88	89	85	100	52	75	76	88	90	42	100	68	68	17	56
N2	52	48	42	61	62	81	62	47	61	47	76	42	48	51	49	49	48	64	63	63	62	42	67	44	46	44	52	100	63	62	45	46	85	52	74	74	13	57
O1	76	80	78	79	99	82	95	81	94	82	58	78	78	68	76	80	81	93	84	99	96	78	63	78	81	78	75	63	100	96	81	81	34	75	56	56	15	58
O2	75	79	77	80	96	86	97	78	95	81	58	77	76	68	74	78	81	97	74	96	99	77	62	79	77	78	76	62	96	100	78	78	34	76	57	57	19	67
P1	89	97	98	66	81	65	79	99	79	99	70	98	96	50	94	96	97	76	73	80	79	98	73	96	100	97	88	45	81	78	100	99	37	88	65	65	17	55
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S1	67	66	62	49	57	68	58	66	55	65	79	62	67	42	66	68	66	59	58	56	57	62	71	62	65	61	68	74	56	57	65	66	93	68	100	100	16	50
S2	67	66	62	49	57	68	58	66	55	65	79	62	67	42	66	68	66	59	58	56	57	62	71	62	65	61	68	74	56	57	65	66	93	68	100	100	16	50
R1	17	17	17	19	15	18	20	17	20	17	14	17	17	22	18	17	17	20	16	15	19	17	16	17	17	17	17	13	15	19	17	17	11	17	16	16	100	20
R2	56	57	53	82	57	67	66	57	65	57	57	53	55	48	56	56	58	68	65	58	66	53	69	56	55	54	56	57	58	67	55	55	46	56	50	50	20	100

Case 9 1129

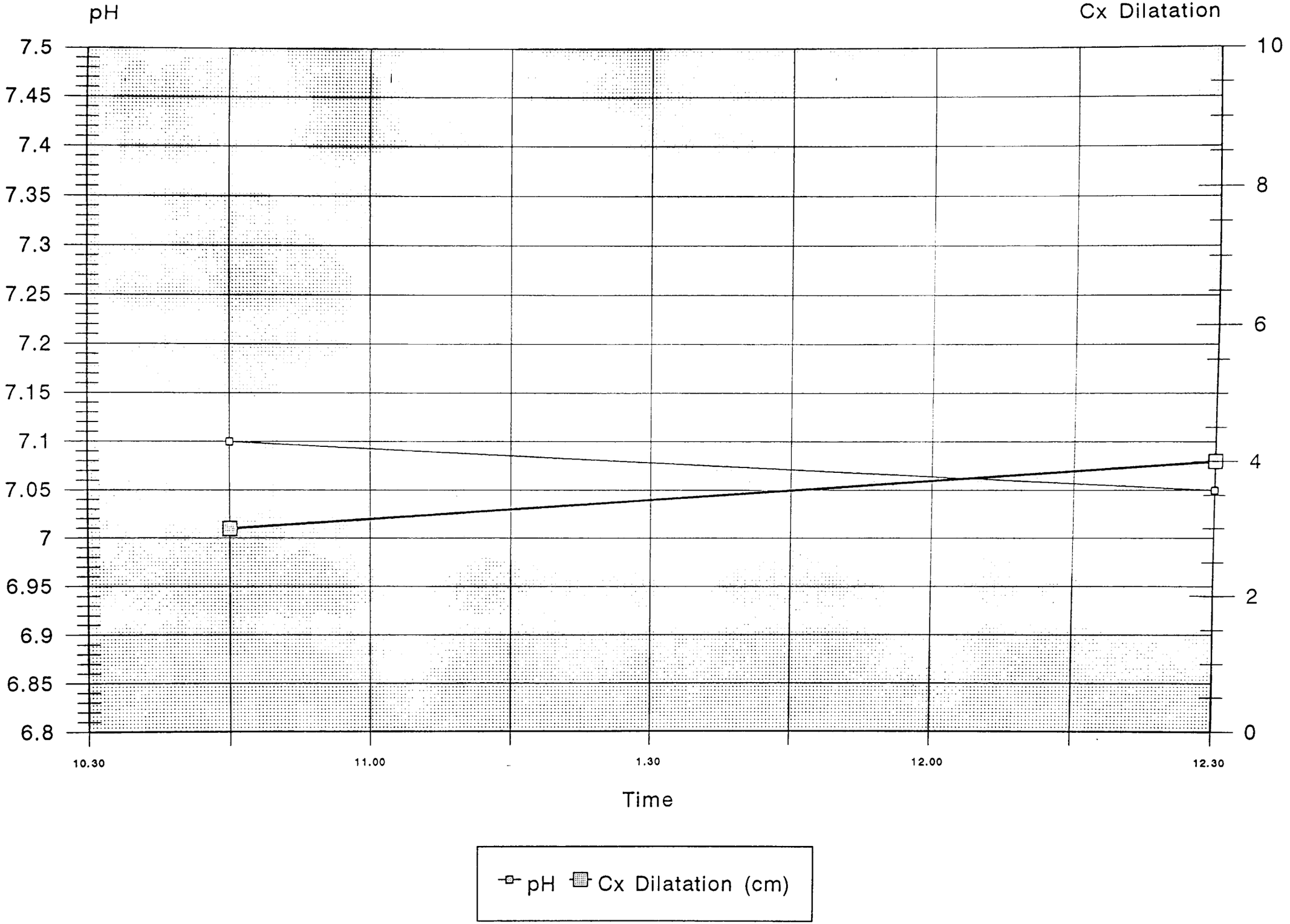
Miss S.W. is a 28 year old primigravida. She is a fit lady but smokes 10 cigarettes per day. There were no antenatal problems, and she laboured spontaneously at 39 weeks gestation. She was admitted on 27/2/91 at 10.50hrs in early labour Uterus term size. Cephalic 3/5. VE Cx 3cm dilated, 0.5cm thick. Station -3.

Labour events

11.35	VE as described. ARM; thick meconium. Unsuccessful attempt at FBS. Maternal oxygen given. Decision for C/S.
12.24	Female infant delivered by emergency C/S under GA. Indication; poor CTG very early in labour. Scalp pH not possible.

Outcome

Birth weight 2.38kg
Apgar 5 & 7
Cord gases pH 7.03 / 7.10 BD(ecf) 13 / 13


pH
Cx Dilatation
7.5
7.45
7.4
7.35
7.3
7.25
7.2
7.15
7.1
7.05
7
6.95
6.9
6.85
6.8
10
8
6
4
2
0
10.30
11.00
1.30
12.00
12.30
Time
pH
Cx Dilatation (cm)

Case 9

SEGMENT

REVIEWER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
A1	2	2	2	3	5																																																							
A2	2	2	2	2	2	3	5																																																					
B1	2	4	4	5																																																									
B2	2	2	4	3	5																																																							
C1	2	2	2	3	5																																																							
C2	2	3	5																																																									
D1	2	3	5																																																									
D2	2	3	5																																																									
E1	2	3	5																																																									
E2	2	3	5																																																									
F1	2	2	3	5																																																								
F2	2	2	3	5																																																								
G1	2	2	3	5																																																								
G2	2	3	5																																																									
H1	2	3	5																																																									
H2	2	3	5																																																									
I1	1	2	2	3	5																																																							
I2	2	2	2	3	5																																																							
J1	1	2	2	2	3	5																																																					
J2	2	2	2	2	3	5																																																					
K1	1	2	2	2	3	5																																																					
K2	2	2	2	3	5																																																							
L1	1	2	2	3	5																																																							
L2	1	2	2	3	5																																																							
M1	1	2	2	2	3	5																																																					
M2	1	2	2	3	5																																																							
N1	2	2	2	4	4	5																																																					
N2	2	2	2	3	5																																																							
O1	2	2	2	3	5																																																							
O2	2	2	2	3	5																																																							
P1	1	1	1	3	5																																																							
P2	2	2	2	3	5																																																							
Q1	2	4	4	5																																																								
Q2	4	4	4	4	5																																																							
S1	1	2	2	2	3	5																																																					
S2	1	2	2	2	3	5																																																					
R1	2	4	2	2	1	2	1																																																				
R2	1	2	1	2	1	2	2																																																				
Clinical	0	0	0	3	0	0	5																																																				

Agreement results matrix for case 9

REVIEWER	A1	A2	B1	B2	C1	C2	D1	D2	E1	E2	F1	F2	G1	G2	H1	H2	I1	I2	J1	J2	K1	K2	L1	L2	M1	M2	N1	N2	O1	O2	P1	P2	Q1	Q2	S1	S2	R1	R2
A1	100	73	78	94	100	72	72	72	72	72	93	93	93	72	72	72	100	100	93	93	93	100	100	100	93	100	87	100	100	100	98	100	78	73	93	93	31	17
A2	73	100	31	65	73	8	8	8	8	8	42	42	42	8	8	8	73	73	93	93	93	73	73	73	93	73	79	73	73	73	71	73	31	42	93	93	17	23
B1	78	31	100	93	78	87	87	87	87	87	89	89	89	87	87	87	77	78	57	57	57	78	77	77	57	77	77	78	78	78	77	78	100	95	57	57	63	6
B2	94	65	93	100	94	73	73	73	73	73	90	90	90	73	73	73	94	94	84	84	84	94	94	94	84	94	90	94	94	94	93	94	93	93	84	84	51	11
C1	100	73	78	94	100	72	72	72	72	72	93	93	93	72	72	72	100	100	93	93	93	100	100	100	93	100	87	100	100	100	98	100	78	73	93	93	31	17
C2	72	8	87	73	72	100	100	100	100	100	93	93	93	100	100	100	71	72	41	41	41	72	71	71	41	71	48	72	72	72	71	72	87	70	41	41	47	9
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E2	72	8	87	73	72	100	100	100	100	100	93	93	93	100	100	100	71	72	41	41	41	72	71	71	41	71	48	72	72	72	71	72	87	70	41	41	47	9
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H1	72	8	87	73	72	100	100	100	100	100	93	93	93	100	100	100	71	72	41	41	41	72	71	71	41	71	48	72	72	72	71	72	87	70	41	41	47	9
H2	72	8	87	73	72	100	100	100	100	100	93	93	93	100	100	100	71	72	41	41	41	72	71	71	41	71	48	72	72	72	71	72	87	70	41	41	47	9
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J1	93	93	57	84	93	41	41	41	41	41	72	72	72	41	41	41	93	93	100	100	100	93	93	93	100	93	89	93	93	93	92	93	57	60	100	100	20	21
J2	93	93	57	84	93	41	41	41	41	41	72	72	72	41	41	41	93	93	100	100	100	93	93	93	100	93	89	93	93	93	91	93	57	60	100	100	21	20
K1	93	93	57	84	93	41	41	41	41	41	72	72	72	41	41	41	93	93	100	100	100	93	93	93	100	93	89	93	93	93	92	93	57	60	100	100	20	21
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L1	100	73	77	94	100	71	71	71	71	71	92	92	92	71	71	71	100	100	93	93	93	100	100	100	93	100	87	100	100	100	99	100	77	73	93	93	30	17
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M2	100	73	77	94	100	71	71	71	71	71	92	92	92	71	71	71	100	100	93	93	93	100	100	100	93	100	87	100	100	100	99	100	77	73	93	93	30	17
N1	87	79	77	90	87	48	48	48	48	48	73	73	73	48	48	48	87	87	89	89	89	87	87	87	89	87	100	87	87	87	86	87	77	85	89	89	38	11
N2	100	73	78	94	100	72	72	72	72	72	93	93	93	72	72	72	100	100	93	93	93	100	100	100	93	100	87	100	100	100	98	100	78	73	93	93	31	17
O1	100	73	78	94	100	72	72	72	72	72	93	93	93	72	72	72	100	100	93	93	93	100	100	100	93	100	87	100	100	100	98	100	78	73	93	93	31	17
O2	100	73	78	94	100	72	72	72	72	72	93	93	93	72	72	72	100	100	93	93	93	100	100	100	93	100	87	100	100	100	98	100	78	73	93	93	31	17
P1	98	71	77	93	98	71	71	71	71	71	91	91	91	71	71	71	99	98	92	91	92	98	99	99	92	99	86	98	98	98	100	98	77	73	92	92	28	17
P2	100	73	78	94	100	72	72	72	72	72	93	93	93	72	72	72	100	100	93	93	93	100	100	100	93	100	87	100	100	100	98	100	78	73	93	93	31	17
Q1	78	31	100	93	78	87	87	87	87	87	89	89	89	87	87	87	77	78	57	57	57	78	77	77	57	77	77	78	78	78	77	78	100	95	57	57	63	6
Q2	73	42	95	93	73	70	70	70	70	70	76	76	76	70	70	70	73	73	60	60	60	73	73	73	60	73	85	73	73	73	73	73	95	100	60	60	62	0
S1	93	93	57	84	93	41	41	41	41	41	72	72	72	41	41	41	93	93	100	100	100	93	93	93	100	93	89	93	93	93	92	93	57	60	100	100	20	21
S2	93	93	57	84	93	41	41	41	41	41	72	72	72	41	41	41	93	93	100	100	100	93	93	93	100	93	89	93	93	93	92	93	57	60	100	100	20	21
R1	31	17	63	51	31	47	47	47	47	47	41	41	41	47	47	47	30	31	20	21	20	31	30	30	20	30	38	31	31	31	28	31	63	62	20	20	100	47
R2	17	23	6	11	17	9	9	9	9	9	13	13	13	9	9	9	17	17	21	20	21	17	17	17	21	17	11	17	17	17	17	17	6	0	21	21	47	100

Case 10 518

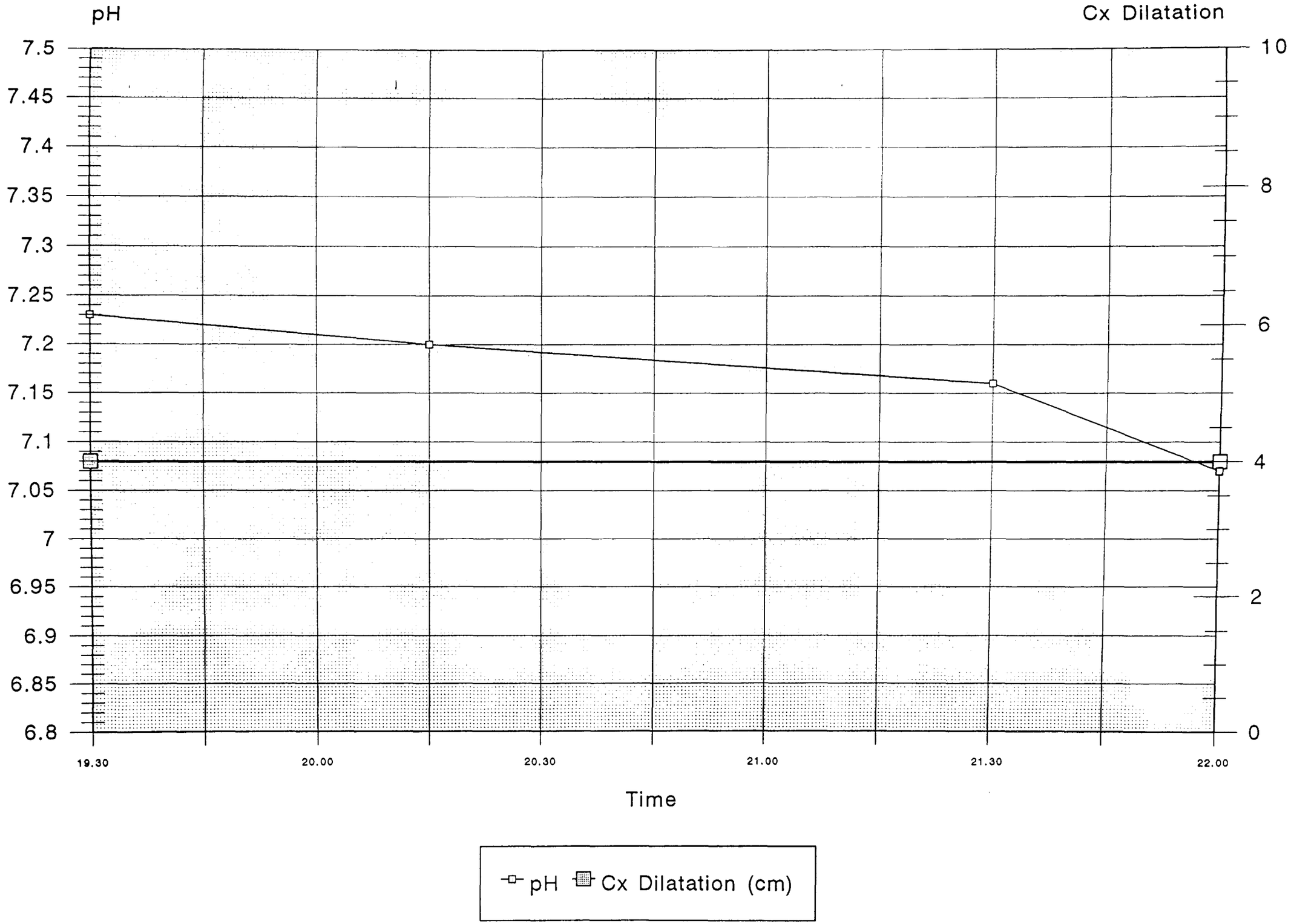
Mrs V.C. is a 33 year old primigravida; a fit lady and a nonsmoker. Her pregnancy was straightforward, and she was admitted with spontaneous rupture of the membranes at 42 weeks, on 23.10.90. On admission the fetus was felt to be well grown, cephalic presentation 2/5. VE (at 10.30hrs) Cx 1cm dilated, uneffaced. Station -2. Clear liquor seen. Labour did not establish over the next few hours, and prostin gel 2mg was given at 14.50hrs. Intermittent monitoring was performed. By 19.35hrs contractions were becoming regular; the cervix now 4cm dilated, fully effaced. Station -2. Forewater rupture performed; liquor stained with fresh meconium.

Labour events

20.00	Pethidine 100mg, phenergan 25mg im.
20.20	Bedpan.
21.00	Maternal position changed, oxygen given.
21.24	VE Cx 4cm dilated. FBS; pH 7.16 BE -10 Decision for C/S
22.00	Female infant delivered by emergency C/S under GA. Indication; low scalp pH at 4cm dilatation.

Outcome

Birth weight	3.83kg
Apgar	3 & 7 (8 at 15 minutes)
Cords	pH 7.05 / 7.12 BD(ecf) 5 / 6


pH
Cx Dilatation
7.5
7.45
7.4
7.35
7.3
7.25
7.2
7.15
7.1
7.05
7
6.95
6.9
6.85
6.8
10
8
6
4
2
0
19.30
20.00
20.30
21.00
21.30
22.00
Time
pH
Cx Dilatation (cm)

Case 10

	SEGMENT																																																										
REVIEWER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
A1	2	2	2	2	3	5																																																						
A2	2	2	3	5																																																								
B1	2	3	5																																																									
B2	4	3	5																																																									
C1	2	3	5																																																									
C2	3	4	5																																																									
D1	3	5																																																										
D2	2	2	2	3	5																																																							
E1	3	5																																																										
E2	2	2	3	5																																																							
F1	1	1	2	2	1	2	1	1																																																				
F2	1	2	2	3	5																																																							
G1	2	2	2	3	5																																																							
G2	3	4	5																																																									
H1	3	5																																																										
H2	2	3	5																																																									
I1	2	3	5																																																									
I2	2	3	4	3	5																																																							
J1	2	2	3	5																																																							
J2	2	2	2	2	3	5																																																						
K1	2	2	3	5																																																							
K2	2	2	3	4	3	5																																																						
L1	2	3	5																																																									
L2	2	2	3	5																																																							
M1	2	2	2	2	2	2	2	2																																																				
M2	2	2	3	2	2	2	3	5																																																				
N1	2	3	4	4	2	3	5																																																					
N2	3	4	4	4	3	5																																																						
O1	2	3	5																																																									
O2	3	5																																																										
P1	2	3	2	5																																																							
P2	3	2	2	2	3	5																																																						
Q1	4	4	5																																																									
Q2	4	4	4	4	4	5																																																						
S1	2	2	5																																																									
S2	2	2	5																																																									
R1	1	1	1	2	1	2	1	2	1	2																																																		
R2	1	1	1	1	1	3	1	1	2	2																																																		
Clinical	0	0	0	0	0	0	0	3	5	C																																																		

Agreement results matrix for case 10

REVIEWER	A1	A2	B1	B2	C1	C2	D1	D2	E1	E2	F1	F2	G1	G2	H1	H2	I1	I2	J1	J2	K1	K2	L1	L2	M1	M2	N1	N2	O1	O2	P1	P2	Q1	Q2	S1	S2	R1	R2
A1	100	72	41	33	41	32	5	93	5	72	19	93	93	32	5	41	41	80	72	100	72	92	41	72	22	73	78	73	41	5	67	93	28	65	42	42	18	39
A2	72	100	93	83	93	83	70	93	70	100	12	92	93	83	70	93	93	90	100	72	100	77	93	100	14	26	56	70	93	70	98	72	75	66	87	87	11	21
B1	41	93	100	93	100	94	92	72	92	93	8	71	72	94	92	100	100	77	93	41	93	53	100	93	10	22	43	57	100	92	94	49	87	54	93	93	7	9
B2	33	83	93	100	93	97	90	62	90	83	2	62	62	97	90	93	93	75	83	33	83	50	93	83	4	21	45	62	93	90	85	47	97	64	86	86	1	3
C1	41	93	100	93	100	94	92	72	92	93	8	71	72	94	92	100	100	77	93	41	93	53	100	93	10	22	43	57	100	92	94	49	87	54	93	93	7	9
C2	32	83	94	97	94	100	92	60	92	83	2	60	60	100	92	94	94	77	83	32	83	50	94	83	3	18	47	65	94	92	86	46	97	65	88	88	1	3
D1	5	70	92	90	92	92	100	38	100	70	2	38	38	92	100	92	92	51	70	5	70	27	92	70	4	16	36	43	92	100	74	22	87	42	84	84	1	0
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F1	19	12	8	2	8	2	2	16	2	12	100	17	16	2	2	8	8	7	12	19	12	10	8	12	88	21	10	2	8	2	14	16	0	0	13	13	94	66
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G1	93	93	72	62	72	60	38	100	38	93	16	100	100	60	38	72	72	92	93	93	93	90	72	93	18	51	70	76	72	38	89	88	54	70	69	69	14	32
G2	32	83	94	97	94	100	92	60	92	83	2	60	60	100	92	94	94	77	83	32	83	50	94	83	3	18	47	65	94	92	86	46	97	65	88	88	1	3
H1	5	70	92	90	92	92	100	38	100	70	2	38	38	92	100	92	92	51	70	5	70	27	92	70	4	16	36	43	92	100	74	22	87	42	84	84	1	0
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I2	80	90	77	75	77	77	51	92	51	90	7	92	92	77	51	77	77	100	90	80	90	93	77	90	9	51	82	93	77	51	89	84	74	88	67	67	7	23
J1	72	100	93	83	93	83	70	93	70	100	12	92	93	83	70	93	93	90	100	72	100	77	93	100	14	26	56	70	93	70	98	72	75	66	87	87	11	21
J2	100	72	41	33	41	32	5	93	5	72	19	93	93	32	5	41	41	80	72	100	72	92	41	72	22	73	78	73	41	5	67	93	28	65	42	42	18	39
K1	72	100	93	83	93	83	70	93	70	100	12	92	93	83	70	93	93	90	100	72	100	77	93	100	14	26	56	70	93	70	98	72	75	66	87	87	11	21
K2	92	77	53	50	53	50	27	90	27	77	10	90	90	50	27	53	53	93	77	92	77	100	53	77	12	71	94	93	53	27	74	91	46	87	45	45	9	35
L1	41	93	100	93	100	94	92	72	92	93	8	71	72	94	92	100	100	77	93	41	93	53	100	93	10	22	43	57	100	92	94	49	87	54	93	93	7	9
L2	72	100	93	83	93	83	70	93	70	100	12	92	93	83	70	93	93	90	100	72	100	77	93	100	14	26	56	70	93	70	98	72	75	66	87	87	11	21
M1	22	14	10	4	10	3	4	18	4	14	88	17	18	3	4	10	10	9	14	22	14	12	10	14	100	24	12	5	10	4	16	18	0	0	15	15	86	56
M2	73	26	22	21	22	18	16	51	16	26	21	51	51	18	16	22	22	51	26	73	26	71	22	26	24	100	81	60	22	16	25	73	15	51	12	12	21	41
N1	78	56	43	45	43	47	36	70	36	56	10	70	70	47	36	43	43	82	56	78	56	94	43	56	12	81	100	94	43	36	56	82	45	90	35	35	10	32
N2	73	70	57	62	57	65	43	76	43	70	2	76	76	65	43	57	57	93	70	73	70	93	57	70	5	60	94	100	57	43	71	82	64	97	49	49	2	21
O1	41	93	100	93	100	94	92	72	92	93	8	71	72	94	92	100	100	77	93	41	93	53	100	93	10	22	43	57	100	92	94	49	87	54	93	93	7	9
O2	5	70	92	90	92	92	100	38	100	70	2	38	38	92	100	92	92	51	70	5	70	27	92	70	4	16	36	43	92	100	74	22	87	42	84	84	1	0
P1	67	98	94	85	94	86	74	89	74	98	14	89	89	86	74	94	94	89	98	67	98	74	94	98	16	25	56	71	94	74	100	73	77	67	87	87	12	15
P2	93	72	49	47	49	46	22	88	22	72	16	88	88	46	22	49	49	84	72	93	72	91	49	72	18	73	82	82	49	22	73	100	39	72	39	39	15	34
Q1	28	75	87	97	87	97	87	54	87	75	0	54	54	97	87	87	87	74	75	28	75	46	87	75	0	15	45	64	87	87	77	39	100	68	88	88	0	3
Q2	65	66	54	64	54	65	42	70	42	66	0	70	70	65	42	54	54	88	66	65	66	87	54	66	0	51	90	97	54	42	67	72	68	100	53	53	0	16
S1	42	87	93	86	93	88	84	69	84	87	13	69	69	88	84	93	93	67	87	42	87	45	93	87	15	12	35	49	93	84	87	39	88	53	100	100	11	13
S2	42	87	93	86	93	88	84	69	84	87	13	69	69	88	84	93	93	67	87	42	87	45	93	87	15	12	35	49	93	84	87	39	88	53	100	100	11	13
R1	18	11	7	1	7	1	1	14	1	11	94	15	14	1	1	7	7	7	11	18	11	9	7	11	86	21	10	2	7	1	12	15	0	0	11	11	100	71
R2	39	21	9	3	9	3	0	32	0	21	66	33	32	3	0	9	9	23	21	39	21	35	9	21	56	41	32	21	9	0	15	34	3	16	13	13	71	100

Case 11 1526

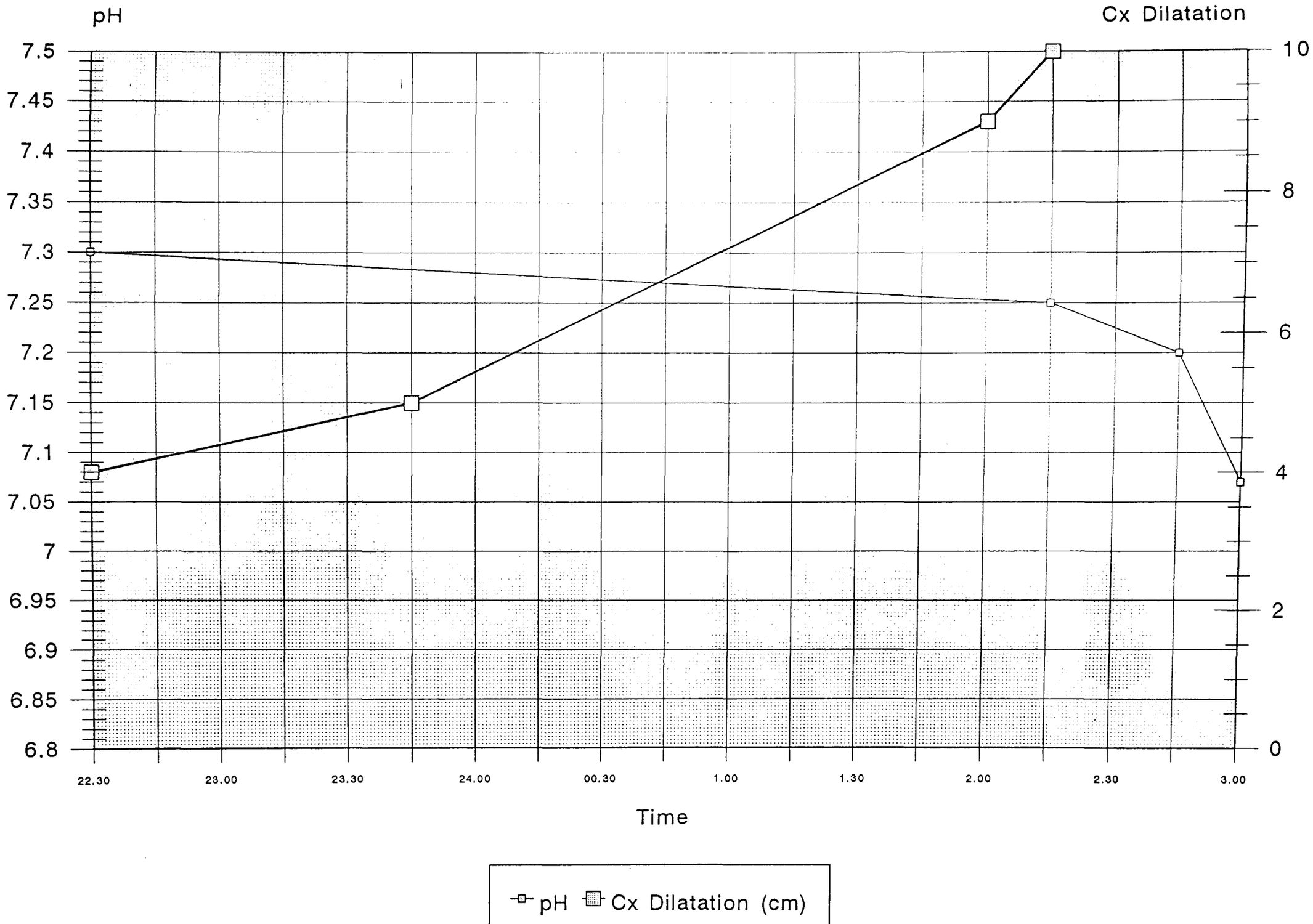
Mrs C.L. is a 20 year old primigravida. She is a fit lady but smokes 10 cigarettes per day. There were no antenatal problems, and she laboured spontaneously at 37 weeks. On admission (22.5.91) the uterus was appropriate for dates, presentation cephalic 2/5. VE (at 22.30hrs) Cx 4cm dilated, effaced and thin. Station 0. Clear liquor already draining.

Labour events

23.50	VE Cx 5cm dilated. Station 0. FSE applied.
00.15	Epidural begun.
00.35	Epidural complete.
02.00	VE Cx 9cm dilated. Station 0.
02.15	VE Cx fully dilated. Pushing begun.
03.05	Normal delivery of male infant.

Outcome

Birth weight 3.11kg
Apgar 9 & 9
Cord gases pH 7.15 BD(ecf) - / 6


pH
Cx Dilatation
7.5
7.45
7.4
7.35
7.3
7.25
7.2
7.15
7.1
7.05
7
6.95
6.9
6.85
6.8
10
8
6
4
2
0
22.30
23.00
23.30
24.00
00.30
1.00
1.30
2.00
2.30
3.00
Time
pH
Cx Dilatation (cm)

Case 11

SEGMENT

REVIEWER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
A1	2	2	1	1	1	1	1	2	2	1	1	2	2	2	4	4																																												
A2	2	2	1	1	1	1	1	2	2	2	1	2	2	2	2	6																																												
B1	1	1	1	1	1	1	1	2	2	2	1	1	1	1	4	4																																												
B2	1	1	1	2	1	1	2	2	2	1	1	2	1	1	2	6																																												
C1	1	1	1	1	1	1	1	1	2	1	1	2	1	2	6																																													
C2	1	1	1	1	1	1	1	1	1	1	1	2	1	2	6																																													
D1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	6																																												
D2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2																																												
E1	1	1	1	1	1	1	1	1	2	1	1	2	2	2	6																																													
E2	1	1	1	1	1	1	1	1	1	1	1	2	1	1	2	2																																												
F1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2																																												
F2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	6																																												
G1	1	1	1	1	1	1	1	1	2	1	1	2	2	2	2	2																																												
G2	1	1	1	1	1	1	1	1	2	1	1	2	2	2	4	2																																												
H1	2	1	1	1	1	1	1	1	2	1	1	2	2	2	6																																													
H2	2	2	1	1	1	1	1	1	2	1	1	2	2	1	6																																													
I1	1	1	1	1	1	1	1	1	2	1	1	2	2	1	2	6																																												
I2	1	1	1	1	1	1	2	2	2	1	1	2	2	2	2	6																																												
J1	1	1	1	1	1	1	1	1	2	2	1	2	2	2	2	2																																												
J2	2	1	1	1	1	1	2	1	2	2	1	2	2	1	1	1																																												
K1	1	1	1	1	1	1	1	1	1	1	1	2	2	1	1	6																																												
K2	1	1	1	1	1	1	1	1	2	1	1	2	2	1	4	6																																												
L1	1	1	1	1	1	1	1	1	2	1	1	2	1	1	1	2																																												
L2	1	1	1	1	1	1	1	2	2	2	1	2	2	2	2	2																																												
M1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																												
M2	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	6																																												
N1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																												
N2	2	2	1	1	1	1	2	1	1	1	1	2	1	1	2	6																																												
O1	1	1	1	1	1	1	1	2	2	1	1	2	2	1	4	6																																												
O2	2	2	1	2	1	1	1	2	2	1	1	2	2	1	6																																													
P1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1																																												
P2	1	1	1	2	1	1	1	1	2	1	1	2	1	1	2	2																																												
Q1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	4	4																																												
Q2	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2																																												
S1	2	3	2	1	1	1	1	1	1	1	1	1	1	1	2	4																																												
S2	2	3	2	1	1	1	1	1	1	1	1	1	1	1	2	4																																												
R1	1	1	2	2	2	2	2	2	1	1	2	5																																																
R2	2	2	1	1	2	1	1	2	2	2	2	2	1	2	1	1																																												
Clinical	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	D																																											

Agreement results matrix for case 11

REVIEWER	A1	A2	B1	B2	C1	C2	D1	D2	E1	E2	F1	F2	G1	G2	H1	H2	I1	I2	J1	J2	K1	K2	L1	L2	M1	M2	N1	N2	O1	O2	P1	P2	Q1	Q2	S1	S2	R1	R2
A1	100	71	97	68	69	68	67	49	69	50	49	67	52	97	71	70	69	70	52	51	68	94	50	52	48	69	48	69	94	70	49	50	98	51	87	87	36	51
A2	71	100	67	95	94	92	93	74	95	76	74	93	80	77	96	95	97	97	80	78	94	83	77	81	71	95	71	96	83	95	72	77	69	79	67	67	33	78
B1	97	67	100	69	69	68	69	51	68	50	51	69	50	95	68	68	69	68	50	52	68	95	52	51	52	68	52	67	95	68	51	51	97	50	85	85	35	50
B2	68	95	69	100	95	94	96	78	94	79	78	96	78	76	93	92	97	98	78	77	96	83	80	79	75	95	75	96	84	94	76	81	69	78	66	66	36	76
C1	69	94	69	95	100	99	95	79	99	80	79	95	81	79	98	97	97	95	80	77	95	84	80	80	76	96	76	94	83	96	78	80	68	77	65	65	37	75
C2	68	92	68	94	99	100	96	80	98	81	80	96	80	78	98	97	96	94	79	76	96	83	79	77	77	97	77	94	83	95	79	79	67	75	65	65	37	73
D1	67	93	69	96	95	96	100	83	94	82	83	100	79	76	93	93	98	95	78	75	98	84	81	77	80	99	80	97	83	91	79	80	65	73	68	68	33	72
D2	49	74	51	78	79	80	83	100	77	99	100	83	95	68	77	75	80	77	94	91	80	58	97	93	97	81	97	79	57	74	96	97	47	89	58	58	36	87
E1	69	95	68	94	99	98	94	77	100	79	77	94	81	80	99	97	97	96	81	77	95	84	78	81	75	96	75	92	83	96	76	79	69	78	63	63	37	74
E2	50	76	50	79	80	81	82	99	79	100	99	82	97	69	78	77	81	78	96	93	81	59	99	94	96	81	96	80	58	75	97	98	49	91	58	58	37	89
F1	49	74	51	78	79	80	83	100	77	99	100	83	95	68	77	75	80	77	94	91	80	58	97	93	97	81	97	79	57	74	96	97	47	89	58	58	36	87
F2	67	93	69	96	95	96	100	83	94	82	83	100	79	76	93	93	98	95	78	75	98	84	81	77	80	99	80	97	83	91	79	80	65	73	68	68	33	72
G1	52	80	50	78	81	80	79	95	81	97	95	79	100	71	81	77	82	81	100	93	79	59	96	99	92	81	92	77	59	76	93	97	52	96	55	55	37	90
G2	97	77	95	76	79	78	76	68	80	69	68	76	71	100	79	77	78	78	71	67	77	95	69	70	66	78	66	75	95	76	67	69	96	68	81	81	42	64
H1	71	96	68	93	98	98	93	77	99	78	77	93	81	79	100	99	96	95	80	78	95	83	78	80	74	95	74	94	83	98	76	78	68	77	65	65	37	76
H2	70	95	68	92	97	97	93	75	97	77	75	93	77	77	99	100	95	93	77	79	95	83	78	76	75	93	75	95	82	99	77	77	67	74	66	66	36	77
I1	69	97	69	97	97	96	98	80	97	81	80	98	82	78	96	95	100	98	81	78	99	85	82	81	77	98	77	96	85	94	79	81	69	78	66	66	34	75
I2	70	97	68	98	95	94	95	77	96	78	77	95	81	78	95	93	98	100	81	77	96	84	78	82	73	97	73	95	84	93	74	78	70	81	64	64	35	75
J1	52	80	50	78	80	79	78	94	81	96	94	78	100	71	80	77	81	81	100	94	78	59	96	100	91	81	91	76	59	76	92	96	52	97	55	55	37	91
J2	51	78	52	77	77	76	75	91	77	93	91	75	93	67	78	79	78	77	94	100	78	59	96	94	94	75	94	78	59	79	95	93	51	93	56	56	37	96
K1	68	94	68	96	95	96	98	80	95	81	80	98	79	77	95	95	99	96	78	78	100	85	81	77	80	98	80	96	84	93	81	79	67	74	66	66	34	74
K2	94	83	95	83	84	83	84	58	84	59	58	84	59	95	83	83	85	84	59	59	85	100	60	59	58	84	58	82	100	82	59	59	94	57	80	80	39	56
L1	50	77	52	80	80	79	81	97	78	99	97	81	96	69	78	78	82	78	96	96	81	60	100	95	97	79	97	78	60	77	98	99	50	92	57	57	37	92
L2	52	81	51	79	80	77	77	93	81	94	93	77	99	70	80	76	81	82	100	94	77	59	95	100	89	79	89	76	59	76	91	96	53	99	54	54	37	92
M1	48	71	52	75	76	77	80	97	75	96	97	80	92	66	74	75	77	73	91	94	80	58	97	89	100	77	100	76	57	73	99	94	46	85	57	57	36	89
M2	69	95	68	95	96	97	99	81	96	81	81	99	81	78	95	93	98	97	81	75	98	84	79	79	77	100	77	96	83	92	77	79	67	76	67	67	33	72
N1	48	71	52	75	76	77	80	97	75	96	97	80	92	66	74	75	77	73	91	94	80	58	97	89	100	77	100	76	57	73	99	94	46	85	57	57	36	89
N2	69	96	67	96	94	94	97	79	92	80	79	97	77	75	94	95	96	95	76	78	96	82	78	76	76	96	76	100	82	94	77	78	66	74	70	70	34	76
O1	94	83	95	84	83	83	83	57	83	58	57	83	59	95	83	82	85	84	59	59	84	100	60	59	57	83	57	82	100	82	58	59	94	58	80	80	39	56
O2	70	95	68	94	96	95	91	74	96	75	74	91	76	76	98	99	94	93	76	79	93	82	77	76	73	92	73	94	82	100	75	77	67	74	66	66	38	78
P1	49	72	51	76	78	79	79	96	76	97	96	79	93	67	76	77	79	74	92	95	81	59	98	91	99	77	99	77	58	75	100	95	48	88	56	56	37	90
P2	50	77	51	81	80	79	80	97	79	98	97	80	97	69	78	77	81	78	96	93	79	59	99	96	94	79	94	78	59	77	95	100	50	93	58	58	38	91
Q1	98	69	97	69	68	67	65	47	69	49	47	65	52	96	68	67	69	70	52	51	67	94	50	53	46	67	46	66	94	67	48	50	100	54	82	82	37	50
Q2	51	79	50	78	77	75	73	89	78	91	89	73	96	68	77	74	78	81	97	93	74	57	92	99	85	76	85	74	58	74	88	93	54	100	51	51	38	92
S1	87	67	85	66	65	65	68	58	63	58	58	68	55	81	65	66	66	64	55	56	66	80	57	54	57	67	57	70	80	66	56	58	82	51	100	100	26	55
S2	87	67	85	66	65	65	68	58	63	58	58	68	55	81	65	66	66	64	55	56	66	80	57	54	57	67	57	70	80	66	56	58	82	51	100	100	26	55
R1	36	33	35	36	37	37	33	36	37	37	36	33	37	42	37	36	34	35	37	37	34	39	37	37	36	33	36	34	39	38	37	38	37	38	26	26	100	38
R2	51	78	50	76	75	73	72	87	74	89	87	72	90	64	76	77	75	75	91	96	74	56	92	92	89	72	89	76	56	78	90	91	50	92	55	55	38	100

Case 12 1316

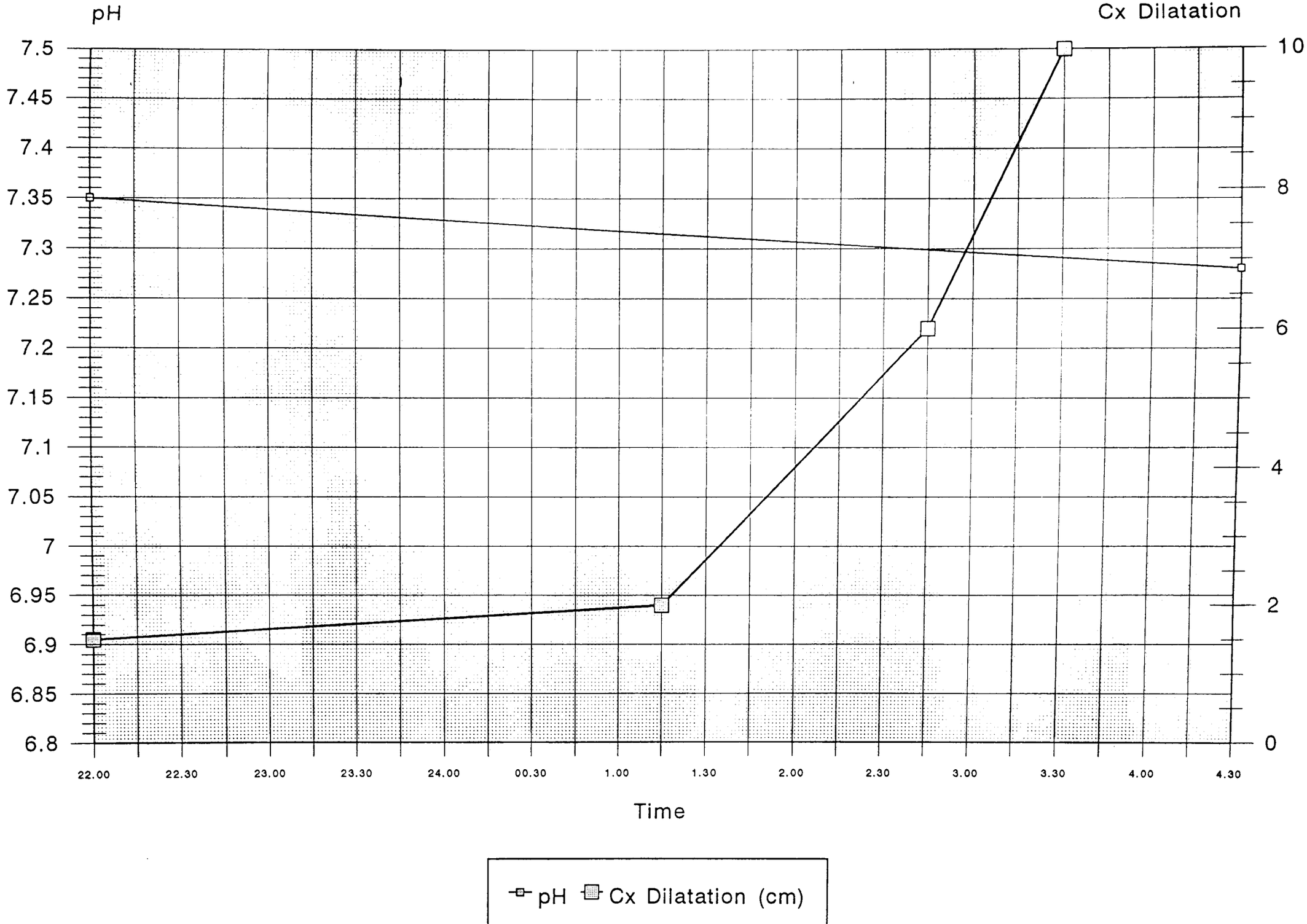
Miss S.W. is a 18 year old primigravida. She suffers from Crohn's disease which is well controlled on mesalazine. She does not smoke. There were no antenatal problems. Labour was induced at 40 weeks on the grounds of a severe pregnancy-related rash. The baby was felt to be adequately grown, presentation cephalic 2/5. The cervix was closed and uneffaced. Prostin gel 1mg was given on 6.4.91 at 11.30hrs, and a further 1mg at 18.15hrs. By 22.00hrs contractions were occurring regularly and the cervix was by now 1-2cm dilated, partly effaced.

Labour events

01.10	VE Cx 2cm dilated, effacing. ARM; clear liquor. FSE applied.
01.20	Pethidine 100mg, phenergan 25mg im.
02.50	VE Cx 6cm dilated, thin. Station +1. FSE reapplied.
03.30	VE Cx fully dilated. Pushing begun.
04.30	Normal delivery of female infant.

Outcome

Birth weight 3.66kg
Apgar 9 & 9
Cord gases pH 7.28 / 7.39 BD(ecf) 3 / 3


pH
Cx Dilatation
7.5
7.45
7.4
7.35
7.3
7.25
7.2
7.15
7.1
7.05
7
6.95
6.9
6.85
6.8
10
8
6
4
2
0
22.00
22.30
23.00
23.30
24.00
00.30
1.00
1.30
2.00
2.30
3.00
3.30
4.00
4.30
Time
pH
Cx Dilatation (cm)

Case 12

REVIEWER	SEGMENT																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A1	1	1	2	2	3	1	2	2	2	3	2	2	2	1	3	2	2	2	2	
A2	2	2	2	2	3	2	2	2	2	2	2	2	2	1	2	2	2	2	2	
B1	2	2	2	3	4	2	4	5												
B2	4	3	2	5																
C1	1	1	2	2	2	1	2	2	2	1	1	1	1	1	1	1	2	2	1	
C2	2	2	2	2	2	1	2	2	2	1	1	1	1	1	1	1	2	6		
D1	2	3	2	2	2	2	3	2	2	2	2	2	2	2	3	2	2	2	6	
D2	2	3	4	4	4	3	4	4	4	4	2	2	3	2	2	2	6			
E1	2	3	2	3	2	1	2	2	2	3	1	2	2	2	2	2	2	2	2	
E2	2	3	2	4	5															
F1	2	2	2	3	5															
F2	2	2	4	3	4	2	2	4	3	2	2	2	2	2	2	2	6			
G1	2	2	2	2	3	1	2	2	2	2	1	1	1	1	1	1	2	2	2	
G2	2	2	2	3	2	1	2	2	2	1	1	1	1	1	1	1	2	6		
H1	1	1	1	2	3	1	2	2	2	1	1	1	1	1	1	1	2	2	2	
H2	2	2	2	3	1	1	2	2	2	1	1	1	1	1	1	1	2	2	6	
I1	1	1	1	2	2	1	1	2	2	2	1	2	1	1	1	2	2	2	2	
I2	2	2	2	2	3	1	2	2	2	2	1	2	2	2	2	2	2	2	6	
J1	2	2	2	2	2	2	2	3	2	2	2	2	3	2	2	2	6			
J2	2	2	3	2	2	2	2	3	2	2	2	2	2	2	2	4	6			
K1	2	2	2	2	3	2	2	2	2	2	1	2	2	1	2	1	1	1	1	
K2	2	2	2	2	3	2	2	2	2	3	1	2	2	2	2	2	2	2	2	
L1	2	2	2	3	2	1	2	2	2	2	1	2	2	1	1	2	2	2	2	
L2	2	2	2	3	2	1	2	2	2	2	1	1	1	1	1	2	2	2	2	
M1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
M2	2	3	2	2	2	2	2	2	2	2	2	3	2	2	2	2	2	2	2	
N1	2	2	2	3	4	2	2	2	4	2	2	2	3	2	2	2	2	2	2	
N2	2	2	2	3	4	2	4	3	2	2	2	2	3	2	2	2	6			
O1	1	2	2	3	1	1	1	2	2	2	1	1	1	1	1	2	3	2	2	
O2	1	2	2	3	1	1	1	1	2	1	1	1	1	2	2	2	3	2	2	
P1	2	2	2	2	3	1	2	2	3	2	2	2	2	2	2	2	4	4	4	
P2	2	2	2	2	3	1	2	2	2	1	1	2	2	2	1	2	2	2	2	
Q1	2	2	4	4	4	4	4	4	5											
Q2	2	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	6	
S1	2	2	2	2	3	2	2	2	3	2	2	2	3	2	2	3	2	2	2	
S2	2	2	2	2	3	2	2	2	3	2	2	2	3	2	2	3	2	2	2	
R1	1	1	1	1	2	1	2	1	1	2	2	2	1	1	2	1	2	1	1	
R2	2	1	2	2	2	2	1	1	1	1	2	1	1	3	3	2	2	2	1	
Clinical	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	D

Agreement results matrix for case 12

REVIEWER	A1	A2	B1	B2	C1	C2	D1	D2	E1	E2	F1	F2	G1	G2	H1	H2	I1	I2	J1	J2	K1	K2	L1	L2	M1	M2	N1	N2	O1	O2	P1	P2	Q1	Q2	S1	S2	R1	R2
A1	100	77	34	14	60	59	74	52	82	22	29	67	75	71	75	65	63	69	76	72	73	88	75	74	63	72	73	70	80	79	62	76	28	36	92	92	60	76
A2	77	100	37	17	76	67	67	37	79	27	35	55	96	81	92	81	79	87	61	59	96	87	96	94	84	72	64	59	81	80	49	97	26	16	71	71	76	59
B1	34	37	100	33	13	13	33	68	38	58	57	68	36	32	35	32	12	34	25	34	37	37	34	34	14	23	63	66	31	31	29	36	92	50	35	35	12	12
B2	14	17	33	100	8	8	28	40	34	85	78	41	17	24	16	23	7	15	7	24	17	15	25	25	9	31	33	33	23	23	11	17	42	31	13	13	7	7
C1	60	76	13	8	100	82	50	13	59	9	13	29	82	71	84	71	97	67	53	42	78	66	80	82	90	64	41	31	71	68	34	79	4	2	50	50	93	68
C2	59	67	13	8	82	100	67	21	53	10	13	40	72	88	70	85	79	82	69	62	67	59	71	72	75	57	37	43	83	81	53	70	5	12	58	58	75	66
D1	74	67	33	28	50	67	100	55	69	29	26	64	64	76	61	74	52	79	79	81	64	64	66	64	57	70	62	71	75	75	62	66	28	37	78	78	50	68
D2	52	37	68	40	13	21	55	100	50	52	41	88	35	39	34	37	13	42	48	54	37	47	35	34	16	41	85	86	40	40	46	37	79	82	58	58	14	26
E1	82	79	38	34	59	53	69	50	100	35	36	66	77	73	75	74	60	72	58	67	76	91	85	83	63	90	72	63	74	75	55	80	30	28	77	77	57	47
E2	22	27	58	85	9	10	29	52	35	100	92	52	27	28	25	28	9	25	11	27	27	25	30	30	10	30	46	49	27	27	18	27	55	37	22	22	8	9
F1	29	35	57	78	13	13	26	41	36	92	100	46	35	34	33	33	12	32	14	26	35	32	36	36	14	25	43	47	32	32	22	35	45	28	28	28	12	12
F2	67	55	68	41	29	40	64	88	66	52	46	100	52	60	50	57	30	60	57	70	53	64	54	52	33	48	82	90	61	61	61	54	75	68	69	69	30	37
G1	75	96	36	17	82	72	64	35	77	27	35	52	100	85	97	86	81	84	57	55	95	84	96	97	78	67	61	56	85	82	47	97	26	15	67	67	75	59
G2	71	81	32	24	71	88	76	39	73	28	34	60	85	100	83	98	68	92	62	72	81	72	86	87	65	65	55	61	96	93	62	83	22	24	69	69	64	59
H1	75	92	35	16	84	70	61	34	75	25	33	50	97	83	100	84	83	82	54	53	92	81	93	94	76	64	58	54	84	82	45	95	25	15	64	64	79	59
H2	65	81	32	23	71	85	74	37	74	28	33	57	86	98	84	100	69	94	57	65	80	72	86	87	65	65	56	58	92	90	61	84	22	21	64	64	65	52
I1	63	79	12	7	97	79	52	13	60	9	12	30	81	68	83	69	100	68	55	43	76	67	81	81	93	67	43	33	71	69	35	80	4	2	52	52	94	68
I2	69	87	34	15	67	82	79	42	72	25	32	60	84	92	82	94	68	100	69	68	83	78	85	83	72	64	59	64	88	88	65	87	25	23	69	69	65	53
J1	76	61	25	7	53	69	79	48	58	11	14	57	57	62	54	57	55	69	100	76	59	68	52	50	61	67	61	75	63	63	61	60	20	34	90	90	54	76
J2	72	59	34	24	42	62	81	54	67	27	26	70	55	72	53	65	43	68	76	100	57	62	59	57	48	55	56	72	73	73	81	57	28	51	77	77	42	57
K1	73	96	37	17	78	67	64	37	76	27	35	53	95	81	92	80	76	83	59	57	100	84	93	92	79	68	62	58	79	78	48	95	26	15	67	67	77	58
K2	88	87	37	15	66	59	64	47	91	25	32	64	84	72	81	72	67	78	68	62	84	100	84	83	72	78	72	64	72	73	58	87	30	26	83	83	64	53
L1	75	96	34	25	80	71	66	35	85	30	36	54	96	86	93	86	81	85	52	59	93	84	100	99	81	78	64	54	86	84	48	97	23	15	67	67	76	59
L2	74	94	34	25	82	72	64	34	83	30	36	52	97	87	94	87	81	83	50	57	92	83	99	100	79	76	62	53	87	84	46	95	23	15	65	65	76	60
M1	63	84	14	9	90	75	57	16	63	10	14	33	78	65	76	65	93	72	61	48	79	72	81	79	100	73	47	37	67	67	38	81	5	3	57	57	90	67
M2	72	72	23	31	64	57	70	41	90	30	25	48	67	65	64	65	67	64	67	55	68	78	78	76	73	100	68	55	66	66	42	70	16	23	72	72	64	70
N1	73	64	63	33	41	37	62	85	72	46	43	82	61	55	58	56	43	59	61	56	62	72	64	62	47	68	100	85	56	56	47	63	68	62	77	77	42	55
N2	70	59	66	33	31	43	71	86	63	49	47	90	56	61	54	58	33	64	75	72	58	64	54	53	37	55	85	100	62	62	60	58	68	64	80	80	32	50
O1	80	81	31	23	71	83	75	40	74	27	32	61	85	96	84	92	71	88	63	73	79	72	86	87	67	66	56	62	100	98	61	83	21	25	74	74	66	71
O2	79	80	31	23	68	81	75	40	75	27	32	61	82	93	82	90	69	88	63	73	78	73	84	84	67	66	56	62	98	100	61	83	21	26	74	74	66	72
P1	62	49	29	11	34	53	62	46	55	18	22	61	47	62	45	61	35	65	61	81	48	58	48	46	38	42	47	60	61	61	100	49	25	49	65	65	35	40
P2	76	97	36	17	79	70	66	37	80	27	35	54	97	83	95	84	80	87	60	57	95	87	97	95	81	70	63	58	83	83	49	100	26	16	69	69	75	59
Q1	28	26	92	42	4	5	28	79	30	55	45	75	26	22	25	22	4	25	20	28	26	30	23	23	5	16	68	68	21	21	25	26	100	65	29	29	4	4
Q2	36	16	50	31	2	12	37	82	28	37	28	68	15	24	15	21	2	23	34	51	15	26	15	15	3	23	62	64	25	26	49	16	65	100	40	40	2	19
S1	92	71	35	13	50	58	78	58	77	22	28	69	67	69	64	64	52	69	90	77	67	83	67	65	57	72	77	80	74	74	65	69	29	40	100	100	50	75
S2	92	71	35	13	50	58	78	58	77	22	28	69	67	69	64	64	52	69	90	77	67	83	67	65	57	72	77	80	74	74	65	69	29	40	100	100	50	75
R1	60	76	12	7	93	75	50	14	57	8	12	30	75	64	79	65	94	65	54	42	77	64	76	76	90	64	42	32	66	66	35	75	4	2	50	50	100	69
R2	76	59	12	7	68	66	68	26	47	9	12	37	59	59	59	52	68	53	76	57	58	53	59	60	67	70	55	50	71	72	40	59	4	19	75	75	69	100

Case 13 2315

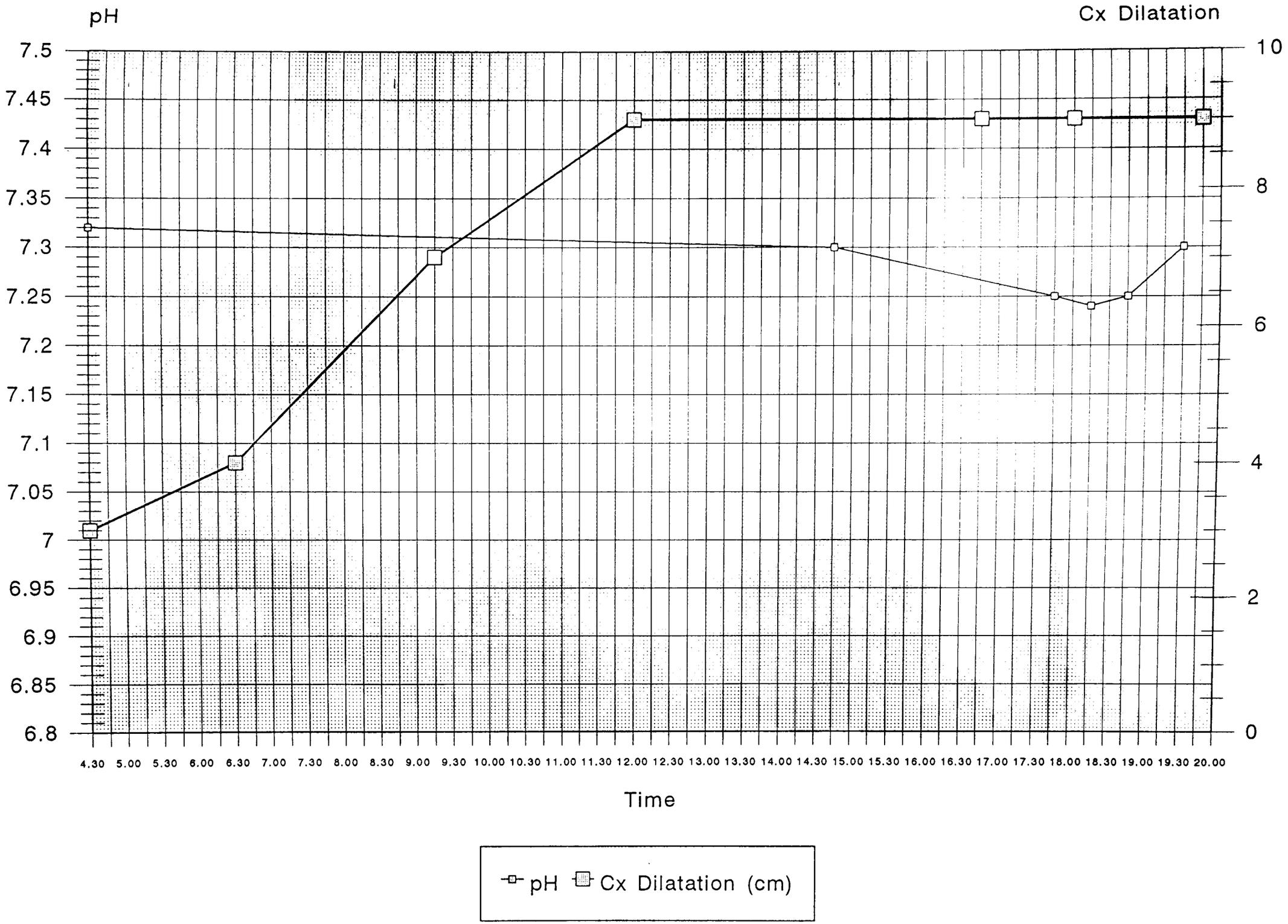
Mrs C.H. is a 37 year old primigravida; a fit lady, and a nonsmoker. Biochemical testing suggested a low risk of Down's syndrome; amniocentesis was declined. No problems were encountered during the pregnancy, and she laboured spontaneously at 39 weeks. She was admitted on 18.11.91 at 16.45hrs. The membranes had ruptured 8 hours ago, and mild contractions were just starting. The uterus was term size, presentation cephalic 3/5. VE Cx 1cm dilated, with plenty of clear liquor noted. She was monitored intermittently until labour established, returning to the labour ward at 02.15hrs on 19.11.91.

Labour events

04.30	VE Cx 3cm dilated, effaced and thin. Station -1. Pethidine 100mg, phenergan 25mg given im.
06.30	VE Cx 4cm dilated. Station -1. FSE applied.
07.15	Epidural inserted.
07.50	Syntocinon begun.
09.10	VE Cx 7cm dilated. Station 0.
09.50	Contractions too frequent; syntocinon reduced.
12.00	VE Cx 9cm dilated. Station 0.
14.50	VE Cx thought to be fully dilated. Station 0. LOA position. Pushing begun.
16.15	No progress. Top up.
16.50	VE Cx 9cm dilated. Station 0. Caput + moulding ++. LOA position.
18.00	VE no change.
18.19	FBS; pH 7.24 BE -8. Decision for C/S.
18.45	Top up.
19.00	Syntocinon discontinued.
19.45	Female infant delivered by emergency C/S under epidural. Indication; failure to progress in labour despite augmentation. Overdistended lower segment noted at operation, and liquor stained with meconium.

Outcome

Birth weight 3.62kg
Apgar 5 & 9
Cord gases pH 7.28 / 7.32 BD(ecf) 3 / 4


pH
Cx Dilatation
7.5
7.45
7.4
7.35
7.3
7.25
7.2
7.15
7.1
7.05
7
6.95
6.9
6.85
6.8
10
8
6
4
2
0
4.30 5.00 5.30 6.00 6.30 7.00 7.30 8.00 8.30 9.00 9.30 10.00 10.30 11.00 11.30 12.00 12.30 13.00 13.30 14.00 14.30 15.00 15.30 16.00 16.30 17.00 17.30 18.00 18.30 19.00 19.30 20.00
Time
pH
Cx Dilatation (cm)

Case 13

SEGMENT

REVIEWER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
A1	2	2	2	2	1	1	1	1	1	2	2	1	2	2	1	2	2	2	2	3	2	2	2	2	2	2	2	3	2	2	2	2	2	2	2	3	2	2	2	1	1	1	1	1	2	2	2	2	2	2	3	2	2	4	4	4				
A2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	1	2	2	2	2	1	2	3	2	2	2	2	3	2	2	2	3				
B1	2	3	2	4	2	2	2	1	1	2	1	1	1	1	1	2	2	2	2	3	2	2	2	2	2	2	2	3	2	2	2	2	3	2	2	2	3	2	2	2	2	3	2	2	2	2	3	4	4	4	5									
B2	1	2	2	3	1	1	2	1	1	1	2	1	1	1	1	2	2	3	2	2	2	3	2	2	2	3	1	2	2	2	2	2	3	2	2	4	4	3	2	2	4	5																		
C1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	2	2	2	1	1	1	1	1	2	2	1	1	2	2	2	3	1	1	1	1	1	1	1	2	2	1	1	2	3	1	2	3	4	3	4	5						
C2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	2	3	2	2	2	3	1	1	1	2	2	1	1	2	2	3	1	1	1	1	1	1	2	2	3	1	1	2	2	2	2	2	2	2	2	3	2	2				
D1	2	2	3	2	2	1	1	1	1	2	1	1	1	1	1	1	2	1	1	1	2	2	2	2	2	2	2	1	2	1	1	1	1	1	1	2	1	1	1	1	2	3	2	2	2	2	2	2	3	5										
D2	1	2	2	2	2	3	1	1	1	1	1	1	1	1	1	1	2	1	2	2	2	3	1	1	1	1	1	2	2	1	1	2	1	1	1	2	1	2	1	1	1	2	3	2	2	2	2	3	2	2	4	4	4	5						
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E2	1	2	2	2	2	1	2	1	1	2	2	2	2	2	2	2	2	2	2	3	2	2	2	2	2	2	2	2	2	2	2	3	2	2	2	2	2	2	2	2	2	2	3	2	2	2	2	3	2	2	3	2	2	3	4	5				
F1	1	2	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	2	2	3	1	1	1	1	1	2	2	2	2	3	1	1	1	2	1	1	1	1	1	2	3	1	1	2	2	2	2	1	2	2	2	3	5					
F2	1	2	2	2	1	1	1	1	2	2	3	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	2	1	2	2	2	2	2	1	1	2	1	1	1	2	3	2	2	2	2	2	1	1	2	2	2	3	4	5				
G1	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	2	2	2	2	2				
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H1	2	2	2	2	1	1	1	1	1	2	1	1	1	1	2	2	2	1	2	3	2	2	2	2	2	2	2	2	1	3	2	2	2	2	2	1	2	1	2	1	2	3	2	1	1	2	2	3	2	2	2	3	5							
H2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	3	2	1	2	2	2	2	3	2	2	2	2	2	3	2	2	2	2	1	1	1	2	3	2	2	2	2	3	2	2	2	3	5								
I1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	1	2	2	3	1	1	2	1	1	2	2	2	2	3	2	2	2	2	2	2	1	2	1	2	2	2	1	2	2	3	2	2	2	2	3	2	2	2	3				
I2	1	2	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	2	2	2	2	2	1	2	3	2	2	2	3	2	2	2	3	2				
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J2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	3	1	1	2	2	2	2	2	2	3	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	2	2	2	1	1	2	3	1	2	2	2	2	2	2	2	2				
K1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	1	1	3	1	2	1	1	1	1	1	1	1	1	2	1	1	1	2	1	3	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	2	2	3	2	2				
K2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	2	3	2	2	2	2				
L1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	3	2	2	2	2	1	2	2	3	2	2	1	1	1	1	2	2	1	1	2	3	2	2	2	2	2	2	3	2	3				
L2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	2	2	1	1	2	2	1	2	3	1	1	1	1	1	2	1	2	1	1	1	1	2	3	2	1	1	2	2	1	2	2	3	5								
M1	2	2	2	2	2	2	1	1	1	1	1	1	1	1	2	2	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	2	2				
M2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	2	2	2	2	2	2	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	2	2	2	2	3	2	2	2	2	2	3				
N1	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	3	2	2	2	2	2	2	2	2	3	2	2	4	4	2	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4				
N2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	2	2	2	2	2	2	2	2	2	2	2	2	3	2	2	2	2	2	2	2	2	2	2	3	2	2	2	4	3	4	4	4	3	4	5							
O1	1	2	2	2	1	1	1	1	1	1	1	1	1	1	2	2	1	1	2	2	3	1	1	1	2	1	2	2	3	1	1	1	1	1	1	2	1	2	2	1	2	2	2	1	1	2	3	1	2	2	2	3	2	2	2	3				
O2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	1	2	2	1	1	2	2	1	2	2	2	3	1	1	1	1	1	1	1	2	2	2	1	1	2	2	1	2	2	3	2	2	3	1	2				
P1	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	2	2	2	1	2	2	2	2	2	2	2	2	3	2					
P2	2	1	1	1	1	1	1	1	1	2	1	1	1	1	1	2	1	1	2	2	2	3	2	2	1	1	2	2	2	2	2	2	2	2	1	2	2	2	2	2	2	2	3	2	1	2	2	2	2	2	2	2	2	2	2					
Q1	2	2	2	2	2	2	2	1	1	2	2	2	1	2	2	2	2	2	2	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	5														
Q2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	4	2	2	2	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	2	4	4	4	5																	
S1	1	1	1	1	1	2	1	1	1	1	1	1	1	2	2	1	1	1	1	1	2	1	2	2	1	2	2	2	2	2	1	1	2	1	1	2	2	2	1	1	1	1	1	2	2	2	1	1	1	1	2	3	2	2	2	3				
S2	1	1	1	1	1	2	1	1	1	1	1	1	1	2	2	1	1	1	1	1	2	1	2	2	1	2	2	2	2	2	1	1	2	1	1	2	2	1	1	1	1	1	1	2	2	2	1	1	1	1	2	3	2	2	2	3				
R1	2	1	4	4	3	2	1	1	2	1	2	2	2	1	2	2	1	1	1	2	2	1	2	1	2	2	1	.2	2	1	2	2	2	3	2	2	1	2	1	1	1	5																		
R2	2	3	2	3	2	1	1	3	2	1	1	1	1	1	2	1	3	1	1	2	2	2	2	1	2	1	1	2	2	2	1	1	3	1	1	2	1	2	2	2	2	2	1	2	2	2	2	2	1	1	1	3	2	1	1	2				
Clinical	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	C			

Agreement results matrix for case 13

REVIEWER	A1	A2	B1	B2	C1	C2	D1	D2	E1	E2	F1	F2	G1	G2	H1	H2	I1	I2	J1	J2	K1	K2	L1	L2	M1	M2	N1	N2	O1	O2	P1	P2	Q1	Q2	S1	S2	R1	R2
A1	100	69	52	45	70	68	47	66	58	76	66	69	66	79	71	66	71	74	85	55	72	62	73	62	68	74	52	55	74	69	73	59	24	27	69	69	37	58
A2	69	100	48	34	67	71	61	59	62	68	63	63	88	68	69	65	89	93	75	78	74	81	87	62	89	83	34	59	88	83	85	74	11	10	89	89	41	67
B1	52	48	100	49	61	47	77	64	80	52	41	33	46	47	69	78	53	53	52	46	43	37	52	66	39	54	60	78	53	46	43	45	34	31	39	39	49	51
B2	45	34	49	100	32	52	38	35	46	39	41	30	36	48	40	47	41	39	42	43	47	32	44	37	36	40	52	30	38	39	42	45	55	65	33	33	71	48
C1	70	67	61	32	100	59	57	86	60	74	75	68	63	65	80	79	66	66	68	51	58	63	65	76	57	56	52	82	64	71	57	48	15	15	63	63	37	58
C2	68	71	47	52	59	100	55	60	63	68	78	65	72	73	66	69	78	77	72	68	83	74	79	62	76	72	38	46	75	83	83	84	29	30	74	74	47	68
D1	47	61	77	38	57	55	100	62	84	51	49	48	64	53	67	73	55	59	59	57	49	60	54	79	58	57	38	64	56	59	56	61	14	14	58	58	47	61
D2	66	59	64	35	86	60	62	100	61	74	77	70	55	69	83	76	61	60	74	49	51	53	53	75	54	58	54	80	62	56	59	57	19	17	55	55	39	54
E1	58	62	80	46	60	63	84	61	100	59	50	46	61	54	71	80	63	68	61	58	59	51	60	72	55	67	49	67	61	56	59	65	26	24	53	53	40	50
E2	76	68	52	39	74	68	51	74	59	100	85	83	61	72	77	66	73	74	80	54	59	54	63	54	63	72	51	65	69	67	66	60	24	24	61	61	36	57
F1	66	63	41	41	75	78	49	77	50	85	100	85	60	68	79	67	72	65	72	54	65	63	64	65	66	66	41	60	68	72	72	72	25	25	66	66	40	59
F2	69	63	33	30	68	65	48	70	46	83	85	100	57	68	64	49	59	60	72	51	61	61	61	55	66	59	38	50	59	64	65	62	13	13	65	65	36	54
G1	66	88	46	36	63	72	64	55	61	61	60	57	100	68	66	63	79	85	74	75	75	88	73	68	91	77	25	54	76	87	87	83	8	10	87	87	44	73
G2	79	68	47	48	65	73	53	69	54	72	68	68	68	100	67	66	68	72	84	56	63	63	67	64	69	67	59	58	66	69	72	65	39	37	68	68	41	54
H1	71	69	69	40	80	66	67	83	71	77	79	64	66	67	100	89	75	72	73	58	61	61	63	87	63	68	48	81	74	65	68	66	25	25	61	61	36	57
H2	66	65	78	47	79	69	73	76	80	66	67	49	63	66	89	100	71	71	67	58	57	56	67	88	56	65	48	79	68	65	61	63	31	30	58	58	40	57
I1	71	89	53	41	66	78	55	61	63	73	72	59	79	68	75	71	100	92	74	69	76	74	80	62	78	86	40	61	95	83	84	76	22	21	83	83	41	66
I2	74	93	53	39	66	77	59	60	68	74	65	60	85	72	72	71	92	100	79	73	80	78	82	61	84	86	37	59	90	82	89	77	15	14	83	83	39	67
J1	85	75	52	42	68	72	59	74	61	80	72	72	74	84	73	67	74	79	100	64	64	65	67	65	75	77	51	61	73	71	78	75	20	21	72	72	38	58
J2	55	78	46	43	51	68	57	49	58	54	54	51	75	56	58	58	69	73	64	100	65	69	76	54	77	75	23	47	69	66	73	74	18	21	70	69	42	66
K1	72	74	43	47	58	83	49	51	59	59	65	61	75	63	61	57	76	80	64	65	100	83	79	58	81	64	31	40	77	81	84	74	17	19	82	82	45	72
K2	62	81	37	32	63	74	60	53	51	54	63	61	88	63	61	56	74	78	65	69	83	100	74	69	85	65	23	47	77	88	82	76	7	9	91	91	43	70
L1	73	87	52	44	65	79	54	53	60	63	64	61	73	67	63	67	80	82	67	76	79	74	100	62	81	77	38	52	84	82	79	67	23	24	81	81	45	64
L2	62	62	66	37	76	62	79	75	72	54	65	55	68	64	87	88	62	61	65	54	58	69	62	100	61	62	40	74	67	67	60	64	20	21	66	66	38	54
M1	68	89	39	36	57	76	58	54	55	63	66	66	91	69	63	56	78	84	75	77	81	85	81	61	100	76	25	45	77	85	93	81	9	11	89	88	45	72
M2	74	83	54	40	56	72	57	58	67	72	66	59	77	67	68	65	86	86	77	75	64	65	77	62	76	100	39	56	88	71	79	79	26	26	76	76	39	59
N1	52	34	60	52	52	38	38	54	49	51	41	38	25	59	48	48	40	37	51	23	31	23	38	40	25	39	100	67	38	32	28	27	64	54	27	27	33	26
N2	55	59	78	30	82	46	64	80	67	65	60	50	54	58	81	79	61	59	61	47	40	47	52	74	45	56	67	100	58	55	44	46	27	19	49	49	30	45
O1	74	88	53	38	64	75	56	62	61	69	68	59	76	66	74	68	95	90	73	69	77	77	84	67	77	88	38	58	100	77	83	74	22	22	83	83	38	63
O2	69	83	46	39	71	83	59	56	56	67	72	64	87	69	65	65	83	82	71	66	81	88	82	67	85	71	32	55	77	100	83	73	14	17	87	87	47	77
P1	73	85	43	42	57	83	56	59	59	66	72	65	87	72	68	61	84	89	78	73	84	82	79	60	93	79	28	44	83	83	100	87	14	15	84	84	43	68
P2	59	74	45	45	48	84	61	57	65	60	72	62	83	65	66	63	76	77	75	74	74	76	67	64	81	79	27	46	74	73	87	100	21	21	75	75	45	62
Q1	24	11	34	55	15	29	14	19	26	24	25	13	8	39	25	31	22	15	20	18	17	7	23	20	9	26	64	27	22	14	14	21	100	92	8	8	26	15
Q2	27	10	31	65	15	30	14	17	24	24	25	13	10	37	25	30	21	14	21	21	19	9	24	21	11	26	54	19	22	17	15	21	92	100	10	10	35	19
S1	69	89	39	33	63	74	58	55	53	61	66	65	87	68	61	58	83	83	72	70	82	91	81	66	89	76	27	49	83	87	84	75	8	10	100	100	44	70
S2	69	89	39	33	63	74	58	55	53	61	66	65	87	68	61	58	83	83	72	69	82	91	81	66	88	76	27	49	83	87	84	75	8	10	100	100	44	70
R1	37	41	49	71	37	47	47	39	40	36	40	36	44	41	36	40	41	39	38	42	45	43	45	38	45	39	33	30	38	47	43	45	26	35	44	44	100	57
R2	58	67	51	48	58	68	61	54	50	57	59	54	73	54	57	57	66	67	58	66	72	70	64	54	72	59	26	45	63	77	68	62	15	19	70	70	57	100

Case 14 1037

Mrs S.B. is a 29 year old lady expecting her second baby. She is fit and well, and a nonsmoker. Her first child was born normally at term, and weighed 7lb 10oz. There were no antenatal problems but she was admitted for induction of labour at 43 weeks. The baby was felt to be well grown, presentation cephalic 2/5. VE Cx 3cm dilated. Admission CTG started at 15.50hrs.

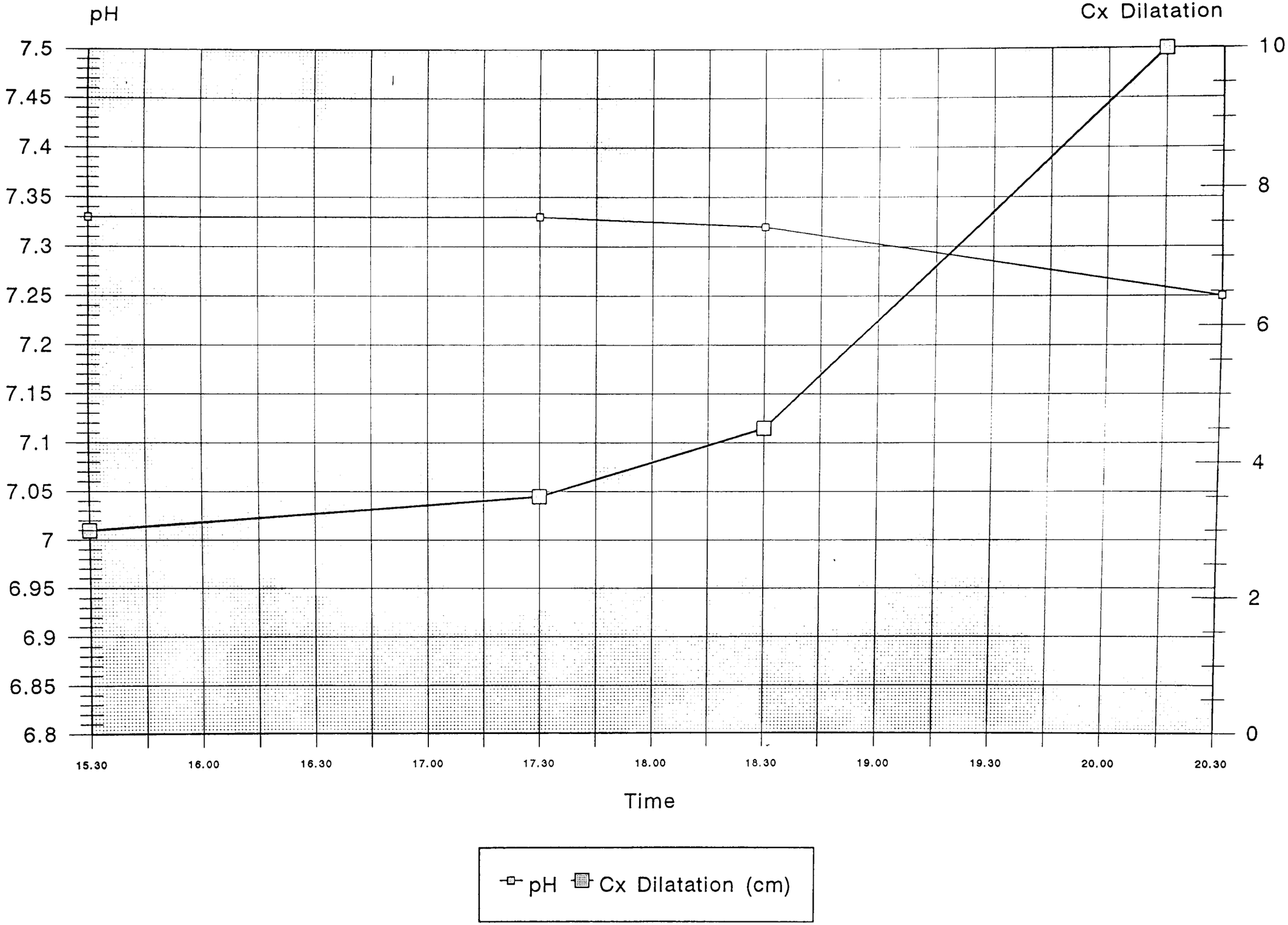
Labour events

5.2.91

17.30	VE Cx 3-4cm dilated, 0.5cm thick. Station -1. ARM; minimal clear liquor.
18.30	VE Cx 4-5cm dilated. FBS; pH 7.32 BE 0
19.05	Syntocinon begun.
19.20	Stemetil 12.5mg im.
19.30	Vomiting.
19.35	Bedpan.
20.05	Syntocinon stopped.
20.08	VE Cx fully dilated; vertex visible.
20.34	Normal delivery of female infant.

Outcome

Birth weight	2.94kg
Apgar	5 & 9
Cord gases	pH 7.25 / 7.32 BD(ecf) 0 / 1


pH
Cx Dilatation
7.5
7.45
7.4
7.35
7.3
7.25
7.2
7.15
7.1
7.05
7
6.95
6.9
6.85
6.8
10
8
6
4
2
0
15.30
16.00
16.30
17.00
17.30
18.00
18.30
19.00
19.30
20.00
20.30
Time
pH
Cx Dilatation (cm)

Case 14

	SEGMENT																																																										
REVIEWER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
A1	1	1	1	1	2	2	2	2	2	2	2	2	1	2	2	2																																												
A2	1	1	1	1	1	1	2	2	1	2	1	1	1	1	2	4																																												
B1	2	2	3	2	2	2	3	2	2	4	3	4	4	4	3	6																																												
B2	2	2	3	2	2	4	3	2	2	4	4	3	2	2	2	6																																												
C1	1	1	1	1	2	1	2	1	1	2	1	1	1	1	1	2																																												
C2	1	1	1	2	2	1	2	2	2	3	1	1	1	1	1	4																																												
D1	1	1	1	1	1	1	2	2	2	3	2	2	1	1	1	2																																												
D2	1	1	1	1	1	1	2	2	1	2	2	2	1	1	1	2																																												
E1	1	1	2	2	2	2	2	2	2	3	2	2	1	2	2	2																																												
E2	1	1	2	2	2	2	2	2	2	2	3	2	2	1	2	2																																												
F1	1	1	1	2	2	2	2	2	1	2	2	2	2	3	1	1																																												
F2	1	1	1	2	2	2	3	1	1	1	1	2	2	3	1	1																																												
G1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2																																												
G2	2	2	2	2	2	2	3	2	2	2	1	1	1	1	2	2																																												
H1	2	2	3	2	2	2	3	2	2	2	2	1	1	2	2	6																																												
H2	2	2	2	2	3	2	2	2	2	2	1	1	1	1	1	6																																												
I1	1	1	1	1	2	1	2	1	1	2	1	1	1	2	1	1																																												
I2	2	2	2	2	3	2	2	2	2	2	2	1	1	2	2	2																																												
J1	1	1	2	2	2	2	2	2	2	3	2	1	1	1	1	2																																												
J2	1	1	2	2	2	2	2	2	2	3	1	1	1	1	1	1																																												
K1	1	1	1	2	2	2	2	2	2	3	1	1	1	1	1	6																																												
K2	1	1	2	2	3	2	2	1	1	2	2	2	1	1	1	6																																												
L1	1	1	1	1	1	1	2	1	1	2	1	1	1	1	2	2																																												
L2	1	1	1	1	2	1	2	1	1	2	1	1	1	1	2	6																																												
M1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2																																												
M2	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2																																												
N1	1	1	2	2	2	2	2	2	2	3	2	2	2	2	2	4																																												
N2	1	2	2	2	3	2	2	2	2	3	2	1	1	1	1	2																																												
O1	1	1	1	2	2	2	3	1	1	1	1	1	1	1	2	6																																												
O2	1	1	1	1	2	1	1	1	1	2	1	1	1	1	1	6																																												
P1	1	1	1	1	1	1	2	1	2	2	1	1	1	1	1	2																																												
P2	1	1	2	2	2	2	3	2	2	2	2	1	1	1	1	1																																												
Q1	2	2	2	2	2	4	5																																																						
Q2	2	2	2	2	2	2	2	2	2	4	2	2	2	2	2	2																																												
S1	1	1	2	1	1	1	1	2	2	2	1	1	1	1	1	4																																												
S2	1	1	2	1	1	1	1	2	2	2	1	1	1	1	1	4																																												
R1	2	1	2	1	2	1	1	1	1	3	1	2	2	1	2	2																																												
R2	1	4	1	1	1	1	2	2	2	1	2	2	1	2	2	1																																												
Clinical	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	D																																											

Agreement results matrix for case 14

REVIEWER	A1	A2	B1	B2	C1	C2	D1	D2	E1	E2	F1	F2	G1	G2	H1	H2	I1	I2	J1	J2	K1	K2	L1	L2	M1	M2	N1	N2	O1	O2	P1	P2	Q1	Q2	S1	S2	R1	R2
A1	100	67	19	27	93	57	79	95	81	80	78	63	99	76	57	62	92	77	79	75	65	65	93	78	99	99	59	66	64	74	93	77	16	66	64	64	74	68
A2	67	100	40	30	70	87	59	69	56	55	68	60	64	55	57	65	69	55	57	56	68	66	71	80	66	66	83	49	68	78	70	56	12	46	98	98	56	52
B1	19	40	100	85	17	57	37	16	40	42	45	54	19	31	58	48	16	30	39	37	55	47	16	38	18	18	59	46	47	37	16	29	21	55	41	41	38	22
B2	27	30	85	100	24	48	44	24	47	48	40	55	28	46	64	53	24	45	46	45	55	52	23	36	26	26	50	58	53	35	23	44	44	65	30	30	46	30
C1	93	70	17	24	100	59	78	96	75	75	76	65	90	75	54	63	98	73	78	78	67	66	99	82	90	90	54	65	68	81	99	77	16	60	68	68	77	66
C2	57	87	57	48	59	100	74	57	73	71	62	62	55	58	59	60	59	48	75	76	84	60	58	69	55	55	96	66	68	69	59	60	15	57	88	88	72	45
D1	79	59	37	44	78	74	100	82	95	93	65	62	77	72	54	53	77	62	96	94	82	56	79	66	79	79	72	82	63	65	80	75	16	73	59	59	93	59
D2	95	69	16	24	96	57	82	100	76	77	78	63	92	72	52	61	94	73	77	74	64	66	97	79	95	95	55	64	64	78	97	76	15	61	67	67	76	69
E1	81	56	40	47	75	73	95	76	100	97	66	63	81	76	59	55	75	68	98	95	83	57	75	65	79	79	77	85	65	61	74	77	19	78	55	55	93	57
E2	80	55	42	48	75	71	93	77	97	100	77	64	81	66	50	56	74	67	95	93	81	58	74	64	79	79	75	82	54	61	74	67	16	77	55	55	91	56
F1	78	68	45	40	76	62	65	78	66	77	100	85	79	61	64	72	78	63	66	64	75	77	73	85	77	77	63	56	73	84	74	66	15	56	68	68	63	57
F2	63	60	54	55	65	62	62	63	63	64	85	100	64	78	76	79	67	69	64	64	73	83	63	74	62	62	61	67	90	75	63	81	29	53	59	59	66	49
G1	99	64	19	28	90	55	77	92	81	81	79	64	100	75	57	61	90	77	78	74	64	65	89	75	98	98	61	65	63	71	89	76	17	68	61	61	74	66
G2	76	55	31	46	75	58	72	72	76	66	61	78	75	100	76	77	73	90	77	76	65	73	74	64	72	72	57	81	82	61	74	96	33	65	55	55	73	54
H1	57	57	58	64	54	59	54	52	59	50	64	76	57	76	100	88	53	77	58	56	71	86	53	71	55	55	61	70	84	69	52	72	29	52	58	58	55	57
H2	62	65	48	53	63	60	53	61	55	56	72	79	61	77	88	100	63	84	58	58	74	96	61	81	59	59	58	75	87	80	63	75	29	49	67	67	53	53
I1	92	69	16	24	98	59	77	94	75	74	78	67	90	73	53	63	100	73	76	78	66	65	96	81	91	91	55	63	67	81	96	77	16	60	67	67	76	67
I2	77	55	30	45	73	48	62	73	68	67	63	69	77	90	77	84	73	100	67	64	55	81	73	63	75	75	51	85	72	59	73	85	32	60	54	54	63	62
J1	79	57	39	46	78	75	96	77	98	95	66	64	78	77	58	58	76	67	100	99	85	58	76	66	75	75	74	87	66	64	77	79	19	76	57	57	93	56
J2	75	56	37	45	78	76	94	74	95	93	64	64	74	76	56	58	78	64	99	100	86	57	74	64	72	72	72	85	65	64	77	79	19	73	58	58	91	55
K1	65	68	55	55	67	84	82	64	83	81	75	73	64	65	71	74	66	55	85	86	100	74	65	84	62	62	80	74	82	83	66	67	17	64	68	68	80	49
K2	65	66	47	52	66	60	56	66	57	58	77	83	65	73	86	96	65	81	58	57	74	100	64	83	63	63	60	74	89	83	64	76	28	48	67	67	55	55
L1	93	71	16	23	99	58	79	97	75	74	73	63	89	74	53	61	96	73	76	74	65	64	100	82	92	92	53	63	67	80	99	74	14	59	68	68	77	67
L2	78	80	38	36	82	69	66	79	65	64	85	74	75	64	71	81	81	63	66	64	84	83	82	100	76	76	65	56	85	99	81	64	14	52	78	78	66	58
M1	99	66	18	26	90	55	79	95	79	79	77	62	98	72	55	59	91	75	75	72	62	63	92	76	100	100	59	63	61	72	92	74	15	66	63	63	74	68
M2	99	66	18	26	90	55	79	95	79	79	77	62	98	72	55	59	91	75	75	72	62	63	92	76	100	100	59	63	61	72	92	74	15	66	63	63	74	68
N1	59	83	59	50	54	96	72	55	77	75	63	61	61	57	61	58	55	51	74	72	80	60	53	65	59	59	100	66	65	63	53	58	16	62	83	83	72	44
N2	66	49	46	58	65	66	82	64	85	82	56	67	65	81	70	75	63	85	87	85	74	74	63	56	63	63	66	100	69	54	64	82	30	67	50	50	80	55
O1	64	68	47	53	68	68	63	64	65	54	73	90	63	82	84	87	67	72	66	65	82	89	67	85	61	61	65	69	100	84	66	81	29	52	66	66	66	48
O2	74	78	37	35	81	69	65	78	61	61	84	75	71	61	69	80	81	59	64	64	83	83	80	99	72	72	63	54	84	100	80	64	14	49	78	78	65	56
P1	93	70	16	23	99	59	80	97	74	74	74	63	89	74	52	63	96	73	77	77	66	64	99	81	92	92	53	64	66	80	100	76	14	59	69	69	76	67
P2	77	56	29	44	77	60	75	76	77	67	66	81	76	96	72	75	77	85	79	79	67	76	74	64	74	74	58	82	81	64	76	100	32	62	58	58	71	56
Q1	16	12	21	44	16	15	16	15	19	16	15	29	17	33	29	29	16	32	19	19	17	28	14	14	15	15	16	30	29	14	14	32	100	26	13	13	18	11
Q2	66	46	55	65	60	57	73	61	78	77	56	53	68	65	52	49	60	60	76	73	64	48	59	52	66	66	62	67	52	49	59	62	26	100	45	45	74	48
S1	64	98	41	30	68	88	59	67	55	55	68	59	61	55	58	67	67	54	57	58	68	67	68	78	63	63	83	50	66	78	69	58	13	45	100	100	55	51
S2	64	98	41	30	68	88	59	67	55	55	68	59	61	55	58	67	67	54	57	58	68	67	68	78	63	63	83	50	66	78	69	58	13	45	100	100	55	51
R1	74	56	38	46	77	72	93	76	93	91	63	66	74	73	55	53	76	63	93	91	80	55	77	66	74	74	72	80	66	65	76	71	18	74	55	55	100	55
R2	68	52	22	30	66	45	59	69	57	56	57	49	66	54	57	53	67	62	56	55	49	55	67	58	68	68	44	55	48	56	67	56	11	48	51	51	55	100

Case 15 251

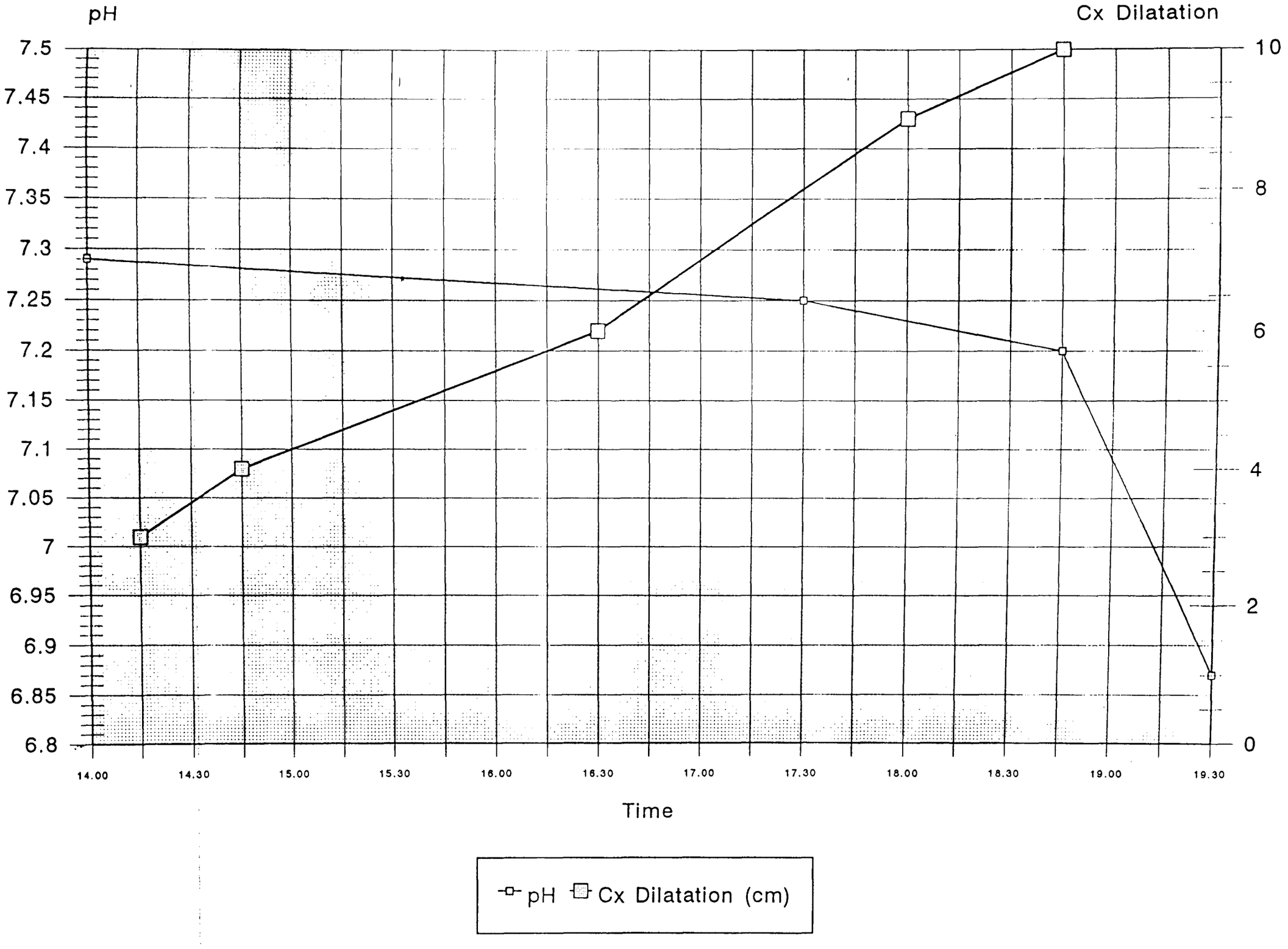
Mrs C.W. is a 27 year old primigravida; fit, and a nonsmoker. Her antenatal progress was good and she was admitted in spontaneous labour at 41 weeks gestation. At this stage (08.00hrs on 21.8.90) contractions were mild and the cervix closed. She was monitored intermittently until 14.00hrs, when labour was established.

Labour events

14.10	Now contracting more regularly. Cephalic 2/5. VE Cx 3cm dilated, 1cm thick. Station -1. ARM performed; thick meconium drained. FSE applied.
14.40	FSE fell off; reapplied 5 minutes later. Cx now 4cm dilated. Station -1.
16.30	VE Cx 6cm dilated & thin. Station -1. LOA position.
18.00	VE Cx 9cm dilated. Station 0. LOA position.
18.45	VE Cx fully dilated. Pushing begun.
19.30	Normal delivery of female infant.

Outcome

Birth weight 3.28kg
Apgar 5 & 7 (8at 10 minutes)
Cord gases pH 6.87 / 7.08 BD(ecf) 16 / 3


pH
Cx Dilatation
7.5
7.45
7.4
7.35
7.3
7.25
7.2
7.15
7.1
7.05
7
6.95
6.9
6.85
6.8
10
8
6
4
2
0
14.00
14.30
15.00
15.30
16.00
16.30
17.00
17.30
18.00
18.30
19.00
19.30
Time
pH
Cx Dilatation (cm)

Case 15

REVIEWER	SEGMENT																				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
A1	1	1	1	2	2	2	2	1	2	2	1	2	2	1	2	2	2	2	2	1	
A2	1	1	1	2	2	2	2	1	1	2	2	1	2	1	2	1	1	1	1	1	
B1	2	2	3	4	4	4	3	2	4	4	3	2	4	4	5						
B2	2	2	2	3	4	4	4	3	2	2	2	2	3	2	4	4	2	3	6		
C1	2	2	2	3	1	2	2	1	1	2	2	2	2	1	1	1	1	1	1	1	
C2	2	2	2	3	1	1	1	3	1	1	1	1	2	1	1	1	1	1	1	1	
D1	1	1	1	1	1	2	1	1	1	1	1	1	2	1	1	1	1	1	1	1	
D2	1	1	1	2	2	2	2	1	1	1	2	2	2	2	2	2	1	1	1	1	
E1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	2	2	1	
E2	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	
F1	2	2	2	2	2	3	2	2	2	2	3	2	2	2	2	2	2	2	2	2	
F2	2	2	3	2	2	2	2	2	3	2	2	2	3	2	2	1	2	2	2	2	
G1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	1	
G2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
H1	3	4	4	3	5																
H2	2	2	3	2	2	2	2	2	2	2	3	2	2	1	3	5					
I1	2	2	2	2	3	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2	
I2	2	2	2	2	3	2	2	1	2	2	2	2	2	1	2	2	2	2	1	1	
J1	2	2	2	2	3	2	2	2	2	3	2	2	2	2	2	2	2	2	2	2	
J2	1	1	1	2	2	3	1	1	1	1	2	2	3	2	2	2	2	2	1	1	
K1	1	1	1	1	2	3	2	2	2	3	2	2	3	1	1	1	2	2	2	2	
K2	1	1	1	1	2	2	2	1	1	1	1	1	2	1	1	1	1	1	1	1	
L1	2	2	2	2	2	2	2	2	2	2	2	2	3	2	2	3	2	2	6		
L2	1	1	1	1	2	2	2	1	1	2	1	1	2	1	2	2	1	1	1	1	
M1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
M2	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
N1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
N2	2	2	2	3	2	2	2	2	3	2	2	2	2	2	2	2	2	2	2	2	
O1	1	1	2	2	2	3	2	1	2	2	2	3	2	1	2	1	1	2	1	1	
O2	1	1	1	2	2	2	2	1	1	1	1	2	2	1	2	1	1	1	1	1	
P1	2	2	2	3	1	1	2	1	2	2	2	2	3	1	2	1	1	2	2	2	
P2	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
Q1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
Q2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
S1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	
S2	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	
R1	2	2	4	2	1	2	2	2	1	1	2	2	2	2	1	1	1	1	2	2	
R2	2	2	3	2	2	2	1	1	1	2	1	1	2	2	1	1	2	2	1	2	
Clinical	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	D

Agreement results matrix for case 15

REVIEWER	A1	A2	B1	B2	C1	C2	D1	D2	E1	E2	F1	F2	G1	G2	H1	H2	I1	I2	J1	J2	K1	K2	L1	L2	M1	M2	N1	N2	O1	O2	P1	P2	Q1	Q2	S1	S2	R1	R2
A1	100	95	10	21	76	64	91	95	96	97	70	61	95	95	2	33	81	82	70	72	63	92	61	96	97	97	93	70	72	94	68	80	93	93	88	88	68	80
A2	95	100	9	19	81	68	96	98	95	92	65	58	96	89	2	32	76	79	65	70	60	97	56	99	91	91	88	65	73	98	67	75	88	88	93	93	69	79
B1	10	9	100	75	26	36	8	10	10	10	41	43	10	11	39	64	27	27	39	38	44	9	24	9	10	10	11	37	40	9	38	17	11	11	8	8	33	23
B2	21	19	75	100	36	45	17	20	22	22	47	54	21	23	39	51	42	42	46	52	53	18	51	19	22	22	23	47	49	19	49	25	23	23	17	17	38	33
C1	76	81	26	36	100	85	79	79	79	76	74	72	78	76	31	44	91	94	79	74	66	80	51	79	73	73	76	81	78	80	85	75	76	76	77	77	80	93
C2	64	68	36	45	85	100	71	66	64	61	73	79	63	61	29	43	80	83	82	73	70	69	42	68	59	59	61	88	73	69	74	62	61	61	70	70	69	82
D1	91	96	8	17	79	71	100	93	87	84	59	53	89	81	1	29	70	73	59	68	58	99	50	97	83	83	79	59	68	97	65	67	79	79	99	99	68	77
D2	95	98	10	20	79	66	93	100	95	94	66	59	97	91	2	32	77	79	67	73	59	95	58	97	93	93	89	67	72	98	66	76	89	89	91	91	69	78
E1	96	95	10	22	79	64	87	95	100	98	71	64	98	97	3	34	81	81	71	69	63	90	62	92	97	97	95	71	73	93	70	82	95	95	85	85	71	79
E2	97	92	10	22	76	61	84	94	98	100	72	63	97	99	3	34	82	82	72	71	62	86	63	91	99	99	97	72	72	91	68	83	97	97	82	82	68	78
F1	70	65	41	47	74	73	59	66	71	72	100	78	69	74	17	48	86	84	96	87	91	61	65	65	72	72	75	87	93	64	84	66	75	75	57	57	61	69
F2	61	58	43	54	72	79	53	59	64	63	78	100	61	65	30	59	72	70	85	76	84	55	67	57	63	63	65	88	76	57	87	72	65	65	51	51	65	76
G1	95	96	10	21	78	63	89	97	98	97	69	61	100	94	2	33	78	80	69	70	61	91	60	96	95	95	92	69	72	95	66	79	92	92	87	87	68	76
G2	95	89	11	23	76	61	81	91	97	99	74	65	94	100	4	34	84	82	74	68	62	83	64	88	98	98	99	74	70	88	70	85	99	99	79	79	70	79
H1	2	2	39	39	31	29	1	2	3	3	17	30	2	4	100	24	25	25	24	15	14	2	4	2	2	2	4	29	16	2	28	29	4	4	0	0	54	33
H2	33	32	64	51	44	43	29	32	34	34	48	59	33	34	24	100	41	42	51	46	52	31	52	31	33	33	35	51	48	32	56	42	35	35	28	28	39	45
I1	81	76	27	42	91	80	70	77	81	82	86	72	78	84	25	41	100	98	88	81	72	71	57	75	82	82	85	86	82	75	84	74	85	85	67	67	74	88
I2	82	79	27	42	94	83	73	79	81	82	84	70	80	82	25	42	98	100	86	82	72	75	56	79	80	80	82	84	84	78	83	72	82	82	71	71	73	88
J1	70	65	39	46	79	82	59	67	71	72	96	85	69	74	24	51	88	86	100	78	87	61	58	65	72	72	75	96	87	64	81	66	75	75	57	57	66	77
J2	72	70	38	52	74	73	68	73	69	71	87	76	70	68	15	46	81	82	78	100	88	68	69	71	70	70	67	70	95	71	86	59	67	67	67	67	58	69
K1	63	60	44	53	66	70	58	59	63	62	91	84	61	62	14	52	72	72	87	88	100	59	66	60	63	63	61	78	92	59	84	54	61	61	56	56	54	59
K2	92	97	9	18	80	69	99	95	90	86	61	55	91	83	2	31	71	75	61	68	59	100	52	98	86	86	82	61	69	98	64	69	82	82	97	97	69	79
L1	61	56	24	51	51	42	50	58	62	63	65	67	60	64	4	52	57	56	58	69	66	52	100	56	63	63	65	52	66	55	71	58	65	65	49	49	49	54
L2	96	99	9	19	79	68	97	97	92	91	65	57	96	88	2	31	75	79	65	71	60	98	56	100	91	91	87	65	71	98	66	74	87	87	95	95	68	79
M1	97	91	10	22	73	59	83	93	97	99	72	63	95	98	2	33	82	80	72	70	63	86	63	91	100	100	97	72	70	89	68	83	97	97	81	81	68	77
M2	97	91	10	22	73	59	83	93	97	99	72	63	95	98	2	33	82	80	72	70	63	86	63	91	100	100	97	72	70	89	68	83	97	97	81	81	68	77
N1	93	88	11	23	76	61	79	89	95	97	75	65	92	99	4	35	85	82	75	67	61	82	65	87	97	97	100	75	69	86	71	86	100	100	77	77	70	80
N2	70	65	37	47	81	88	59	67	71	72	87	88	69	74	29	51	86	84	96	70	78	61	52	65	72	72	75	100	75	64	76	73	75	75	56	56	69	82
O1	72	73	40	49	78	73	68	72	73	72	93	76	72	70	16	48	82	84	87	95	92	69	66	71	70	70	69	75	100	72	88	61	69	69	66	66	60	69
O2	94	98	9	19	80	69	97	98	93	91	64	57	95	88	2	32	75	78	64	71	59	98	55	98	89	89	86	64	72	100	66	73	86	86	95	95	70	79
P1	68	67	38	49	85	74	65	66	70	68	84	87	66	70	28	56	84	83	81	86	84	64	71	66	68	68	71	76	88	66	100	70	71	71	64	64	71	82
P2	80	75	17	25	75	62	67	76	82	83	66	72	79	85	29	42	74	72	66	59	54	69	58	74	83	83	86	73	61	73	70	100	86	86	65	65	74	86
Q1	93	88	11	23	76	61	79	89	95	97	75	65	92	99	4	35	85	82	75	67	61	82	65	87	97	97	100	75	69	86	71	86	100	100	77	77	70	80
Q2	93	88	11	23	76	61	79	89	95	97	75	65	92	99	4	35	85	82	75	67	61	82	65	87	97	97	100	75	69	86	71	86	100	100	77	77	70	80
S1	88	93	8	17	77	70	99	91	85	82	57	51	87	79	0	28	67	71	57	67	56	97	49	95	81	81	77	56	66	95	64	65	77	77	100	100	67	76
S2	88	93	8	17	77	70	99	91	85	82	57	51	87	79	0	28	67	71	57	67	56	97	49	95	81	81	77	56	66	95	64	65	77	77	100	100	67	76
R1	68	69	33	38	80	69	68	69	71	68	61	65	68	70	54	39	74	73	66	58	54	69	49	68	68	68	70	69	60	70	71	74	70	70	67	67	100	80
R2	80	79	23	33	93	82	77	78	79	78	69	76	76	79	33	45	88	88	77	69	59	79	54	79	77	77	80	82	69	79	82	86	80	80	76	76	80	100

Case 16 1459

Miss S.H. is a 28 year old primigravida; a fit lady and a nonsmoker. Her antenatal progress was good. She was noted to be of short stature (4ft 11in); clinically her pelvis was thought to have a small outlet but Xray pelvimetry demonstrated good AP diameters. The fetus was felt to be of an average size; cephalic, 4-5/5 palpable per abdomen. Labour was induced at 42 weeks on the grounds of postmaturity. On admission (4.5.91 at 17.10hrs) the cervix was 1cm dilated and soft;station -3, and Prostin gel 2mg was given PV.

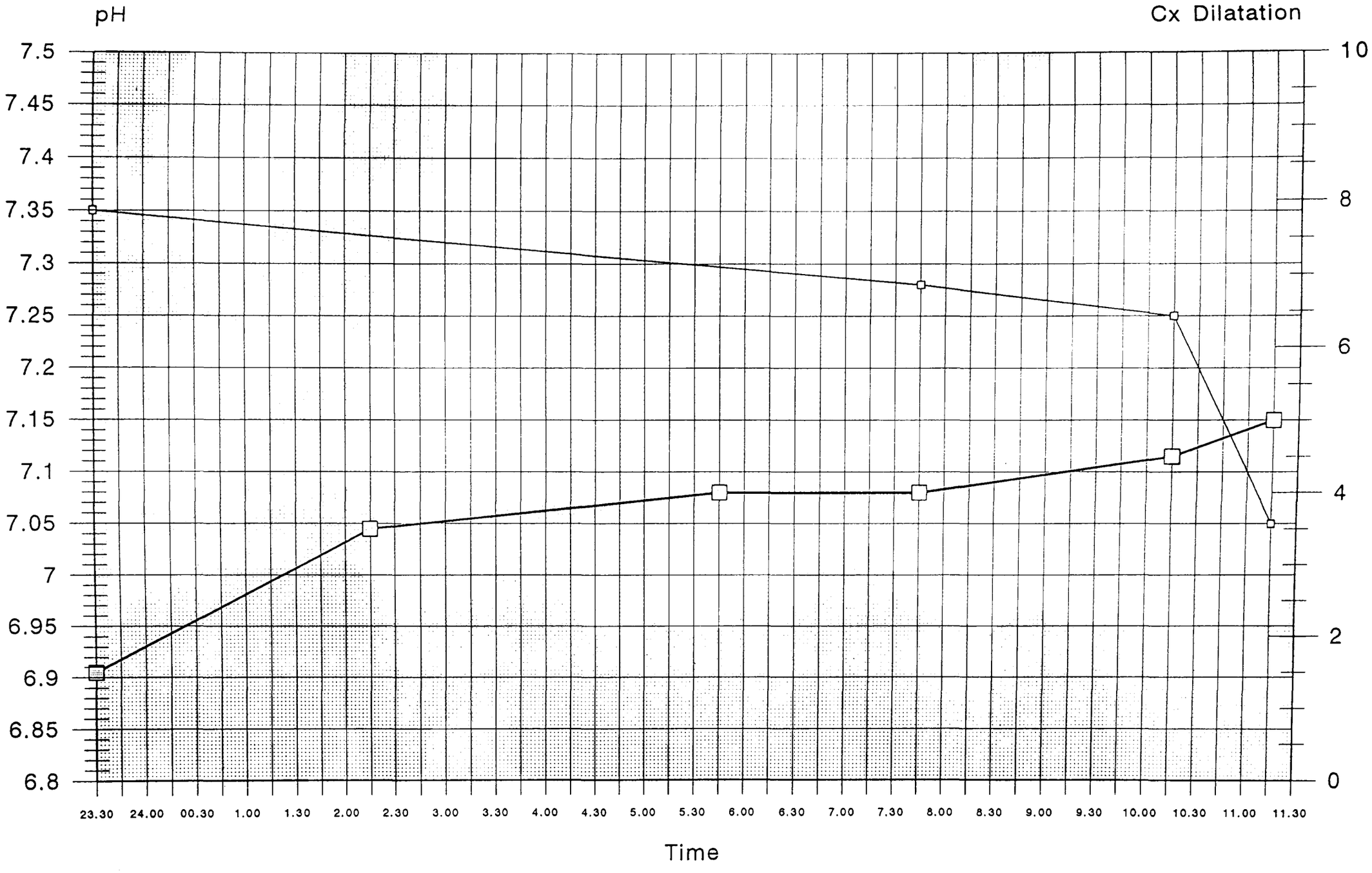
Labour events

Note; mild maternal pyrexia (37.5 to 37.7°C) from 05.30 until delivery.

23.30	Contracting 4:10. VE Cx 1.5cm dilated, effaced, 0.5cm thick. Station -2 / -3.
00.20	Pethidine 100mg, stemetil 12.5mg im.
02.10	VE Cx 3-4cm dilated, thin. Station -2. ARM; clear liquor. FSE applied.
03.15	Epidural begun.
03.45	Epidural working.
05.40	VE Cx 4cm dilated, thin but poorly applied to presenting part. Station -2.
06.10	Top up.
06.30	Syntocinon started.
07.45	VE Cx 4cm dilated. Station -2. IUPD inserted. FBS; pH 7.28 BE -8
08.30	Top up.
09.20	Appearance of thick fresh meconium.
10.15	VE Cx 4-5cm dilated, still quite thick. FBS; pH 7.25 BE -13 Decision for Caesarean section.
10.20	Syntocinon discontinued.
10.30	Top up.
10.40	Taken to theatre.
11.17	Male infant delivered by C/S under epidural. Indication; falling fetal scalp pH and poor progress in labour.

Outcome

Birth weight 3.50kg
Apgar 7 & 9
Cord gases pH 7.05 / 7.13 BD(ecf) - / 7


pH
Cx Dilatation
7.5
7.45
7.4
7.35
7.3
7.25
7.2
7.15
7.1
7.05
7
6.95
6.9
6.85
6.8
10
8
6
4
2
0
23.30
24.00
00.30
1.00
1.30
2.00
2.30
3.00
3.30
4.00
4.30
5.00
5.30
6.00
6.30
7.00
7.30
8.00
8.30
9.00
9.30
10.00
10.30
11.00
11.30
Time
pH
Cx Dilatation (cm)

Case 16

SEGMENT

REVIEWER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
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B1	2	1	1	1	2	3	2	2	2	2	3	2	2	4	4	5																																												
B2	2	1	1	2	3	1	2	2	3	1	1	2	2	3	1	2	2	4	5																																									
C1	1	1	1	1	2	2	3	2	2	2	2	2	3	1	1	1	2	1	2	2	2	3	1	1	1	1	2	2	4	5																														
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D1	2	1	1	2	2	3	2	2	2	2	2	2	3	2	2	2	2	2	2	2	2	3	2	2	2	2	2	3	4	4	4	3	4	4	4	3	4	5																						
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I1	1	1	1	1	2	2	2	3	2	2	1	2	2	2	1	2	2	2	3	2	2	2	2	1	2	2	2	2	3	2	2	2	2	2	2	2	3	2	2	2	2	2	2	2	2	3	5													
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K2	1	1	1	1	2	2	3	2	2	2	2	1	1	2	2	3	2	2	2	3	2	2	2	4	3	4	5																																	
L1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	2	2	3	2	2	2	2	2	2	2	2	3	2	2	2	2	2	2	3	2	2	2	2	3	2	2	2	2	2	3	5													
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Q1	2	1	1	2	2	4	4	4	4	4	4	4	4	4	4	4	5																																											
Q2	4	2	2	2	4	4	4	4	4	4	2	2	4	4	4	4	4	5																																										
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R1	1	3	1	2	1	2	2	2	1	1	1	2	1	2	5																																													
R2	4	1	1	3	2	1	1	2	1	2	3	1	2	2	2	1	1	2	2	1	2	2	1	1	2	1	1	1	1	1	4	2	1	3	3	3	1	1	4	2	3	1	2	2	4	2														
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Agreement results matrix for case 16

REVIEWER	A1	A2	B1	B2	C1	C2	D1	D2	E1	E2	F1	F2	G1	G2	H1	H2	I1	I2	J1	J2	K1	K2	L1	L2	M1	M2	N1	N2	O1	O2	P1	P2	Q1	Q2	S1	S2	R1	R2
A1	100	66	18	20	45	54	58	31	60	41	35	63	77	68	74	79	49	60	38	42	42	42	53	75	50	58	39	50	77	68	50	45	11	13	52	52	16	62
A2	66	100	20	26	41	84	64	24	71	39	40	77	55	45	77	81	54	58	39	49	45	39	52	53	52	56	36	48	56	61	72	73	11	13	60	60	22	51
B1	18	20	100	57	33	27	22	22	22	33	22	24	10	7	23	27	21	19	40	14	22	28	13	12	13	22	15	22	19	15	24	19	73	65	34	34	75	23
B2	20	26	57	100	35	35	23	38	28	53	37	33	15	20	32	32	31	25	45	19	33	34	23	23	24	29	33	28	28	23	28	29	52	60	43	43	32	26
C1	45	41	33	35	100	48	56	52	52	68	36	42	37	38	39	44	41	36	71	56	77	57	33	37	34	42	46	80	43	36	42	35	24	23	59	59	21	42
C2	54	84	27	35	48	100	66	33	71	43	31	77	50	42	77	74	55	47	43	44	41	34	46	47	48	49	27	36	52	49	73	68	20	19	58	58	18	57
D1	58	64	22	23	56	66	100	36	93	44	26	79	67	68	55	55	42	42	39	65	43	35	40	41	32	46	30	44	53	41	64	55	17	17	44	44	13	61
D2	31	24	22	38	52	33	36	100	33	80	61	30	27	43	30	35	30	25	57	25	72	75	21	23	20	35	79	54	31	24	22	19	40	44	40	40	9	20
E1	60	71	22	28	52	71	93	33	100	44	24	84	68	68	72	66	50	47	41	58	46	38	47	45	42	50	28	44	58	47	61	54	20	21	50	50	14	60
E2	41	39	33	53	68	43	44	80	44	100	73	43	34	44	40	48	40	40	73	38	78	78	34	37	33	45	82	72	37	35	35	35	28	32	59	59	17	27
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F2	63	77	24	33	42	77	79	30	84	43	30	100	62	55	72	71	53	51	36	43	41	38	50	51	42	50	27	37	47	45	75	73	22	22	54	54	17	55
G1	77	55	10	15	37	50	67	27	68	34	25	62	100	85	59	56	49	54	29	48	38	30	52	56	51	56	30	38	68	58	46	44	4	7	38	38	10	71
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J1	38	39	40	45	71	43	39	57	41	73	42	36	29	26	45	45	43	37	100	34	76	76	33	33	35	43	56	79	37	34	46	42	29	29	50	50	24	38
J2	42	49	14	19	56	44	65	25	58	38	34	43	48	49	45	45	40	42	34	100	50	35	39	42	39	43	33	50	54	44	57	49	4	5	52	52	19	46
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M1	50	52	13	24	34	48	32	20	42	33	28	42	51	52	56	53	91	92	35	39	40	31	96	69	100	88	27	40	61	89	46	48	6	9	61	61	18	51
M2	58	56	22	29	42	49	46	35	50	45	36	50	56	59	61	66	91	93	43	43	49	41	90	68	88	100	36	42	70	90	46	45	16	20	66	66	17	59
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N2	50	48	22	28	80	36	44	54	44	72	50	37	38	39	42	46	40	46	79	50	85	77	40	43	40	42	67	100	41	43	38	41	11	14	55	55	22	31
O1	77	56	19	28	43	52	53	31	58	37	32	47	68	68	71	69	65	63	37	54	47	38	63	79	61	70	31	41	100	80	44	40	17	19	58	58	16	64
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P2	45	73	19	29	35	68	55	19	54	35	34	73	44	33	49	48	49	48	42	49	39	34	47	49	48	45	30	41	40	45	87	100	7	11	56	55	22	39
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S1	52	60	34	43	59	58	44	40	50	59	49	54	38	33	60	59	67	61	50	52	63	56	58	59	61	66	41	55	58	61	62	56	27	26	100	100	24	45
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R1	16	22	75	32	21	18	13	9	14	17	20	17	10	8	18	19	17	19	24	19	18	20	17	18	18	17	16	22	16	18	21	22	42	38	24	24	100	22
R2	62	51	23	26	42	57	61	20	60	27	16	55	71	58	54	54	54	57	38	46	30	20	59	56	51	59	13	31	64	61	47	39	16	23	45	45	22	100

Case 17 1971

Mrs C.W. is a 31 year old primigravida. She has essential hypertension, treated with a low dose of labetolol. She does not smoke. Her antenatal progress was good; she needed only a small increase in her dose of labetolol to maintain her BP at 120-140/90. Fetal growth was judged to be adequate both clinically and by ultrasound. However, at 39 weeks her BP was 150/100, and this was sustained during 48 hours as an inpatient. She had no proteinuria. Induction of labour was planned, but she laboured sponaneously at 39 weeks on 1/9/91. At 19.45hrs; cephalic 2/5. VE Cx 3cm dilated, effaced but thick. Station -2. ARM; clear liquor. FSE applied.

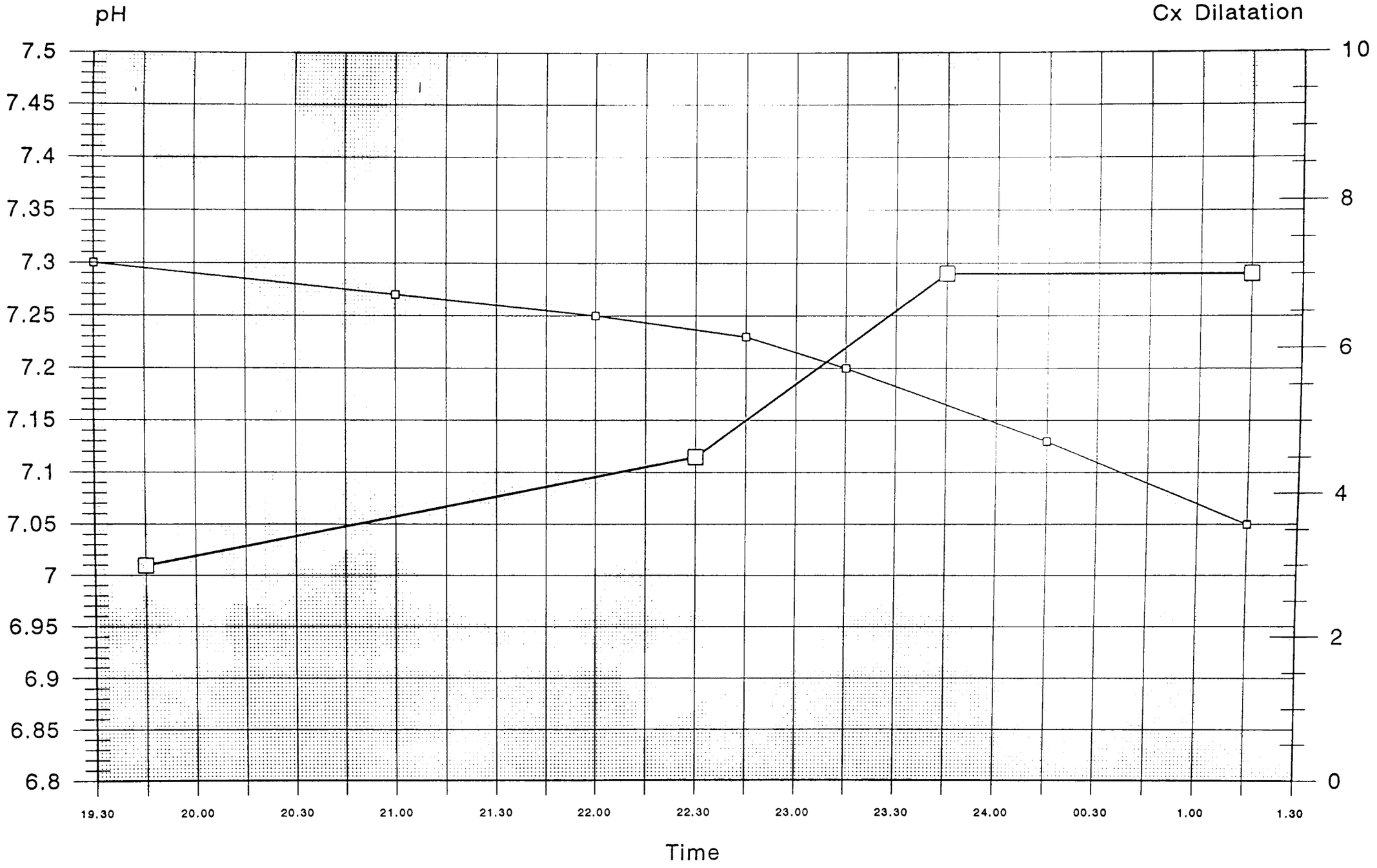
Labour events

Note; BP stable at 140/90 throughout labour.

20.20	Very frequent contractions; uterus scarcely relaxing.
21.00	FBS pH 7.27 BE +3
21.12	Epidural begun.
21.30	Epidural completed.
22.10	Maternal oxygen given. Position changed.
22.25	VE Cx 4-5cm dilated, thick. Station -2. Moulding ++.
22.50	FBS; pH 7.23 BE +3
23.00	Syntocinon begun.
23.50	VE Cx 7cm dilated, thin. Station -2.
00.15	FBS; pH 7.13 BE -2. Decision for C/S.
00.35	Syntocinon stopped. Top up.
01.15	Male infant delivered by emergency C/S under epidural. Indication; low fetal scalp pH at 7cm dilatation.

Outcome

Birth weight 3.26kg
Apgar 6 & 9
Cord gases pH 7.21 BD(ecf) - / 1


pH
Cx Dilatation
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7.45
7.4
7.35
7.3
7.25
7.2
7.15
7.1
7.05
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6.9
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6.8
10
8
6
4
2
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19.30
20.00
20.30
21.00
21.30
22.00
22.30
23.00
23.30
24.00
00.30
1.00
1.30
Time
pH
Cx Dilatation (cm)

Case 17

	SEGMENT																																																										
REVIEWER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
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B1	3	2	4	4	3	4	4	5																																																				
B2	4	3	2	4	2	3	2	4	5																																																			
C1	3	2	2	2	3	2	2	2	3	4	4	3	5																																															
C2	3	2	2	2	2	3	2	2	3	2	2	2	3	5																																													
D1	3	2	2	2	2	2	2	3	4	3	5																																																	
D2	2	2	2	3	2	2	2	3	5																																																			
E1	3	2	2	2	2	2	3	4	3	5																																																	
E2	3	2	2	3	2	2	2	3	5																																																			
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G2	3	2	2	2	2	2	2	4	3	4	2	2	4	5																																													
H1	3	2	2	2	3	5																																																						
H2	3	2	2	2	2	3	2	2	2	3	5																																																
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L2	3	2	2	2	2	2	2	3	4	4	2	3	5																																															
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Q2	4	4	4	4	4	4	4	4	4	5																																																	
S1	2	1	2	1	2	2	1	2	2	2	1	1	2	3	5																																													
S2	2	1	2	1	2	2	1	2	2	2	1	1	5																																															
R1	1	2	3	1	2	3	2	2	1	1	2	2	4	1	3	2	1	2	1																																									
R2	1	1	1	3	2	1	1	1	2	3	2	1	1	1	1	2	3	3	2																																									
Clinical	0	0	0	3	0	0	0	0	0	0	0	3	0	0	0	0	3	5	0	C																																								

Agreement results matrix for case 17

REVIEWER	A1	A2	B1	B2	C1	C2	D1	D2	E1	E2	F1	F2	G1	G2	H1	H2	I1	I2	J1	J2	K1	K2	L1	L2	M1	M2	N1	N2	O1	O2	P1	P2	Q1	Q2	S1	S2	R1	R2
A1	100	74	55	58	88	78	69	46	61	50	69	83	63	91	35	61	77	73	87	48	87	51	77	87	35	65	88	86	55	75	59	71	52	63	50	53	56	35
A2	74	100	17	22	77	92	56	32	37	30	97	83	44	81	15	55	85	93	79	32	80	34	85	79	45	94	75	80	33	97	85	98	11	16	82	77	55	41
B1	55	17	100	90	39	33	48	70	68	74	12	28	43	43	73	48	34	29	40	68	35	73	34	40	11	12	41	29	64	29	5	16	95	86	4	5	34	27
B2	58	22	90	100	48	37	70	78	82	82	18	35	48	46	56	66	38	30	49	80	46	84	38	49	17	18	48	39	79	30	9	20	90	91	9	9	36	31
C1	88	77	39	48	100	84	81	48	65	53	74	79	57	89	28	81	91	79	95	49	96	53	91	95	35	63	96	91	62	81	59	74	31	49	51	68	58	42
C2	78	92	33	37	84	100	60	34	45	41	90	79	49	84	33	65	95	92	84	40	80	45	95	84	41	86	75	74	36	93	79	92	25	28	77	72	64	43
D1	69	56	48	70	81	60	100	74	94	79	52	53	49	70	30	92	75	52	85	81	81	81	75	85	33	34	79	81	87	55	23	52	40	65	15	52	43	38
D2	46	32	70	78	48	34	74	100	85	96	28	40	37	42	51	72	38	39	46	91	52	92	38	46	26	29	53	46	93	40	14	30	57	60	15	16	36	40
E1	61	37	68	82	65	45	94	85	100	89	32	48	45	59	40	87	59	35	68	92	64	92	59	68	30	32	64	64	90	38	13	33	58	72	12	34	40	34
E2	50	30	74	82	53	41	79	96	89	100	26	38	39	47	58	77	45	39	52	96	52	96	45	52	24	27	52	43	89	38	13	27	60	63	14	15	38	40
F1	69	97	12	18	74	90	52	28	32	26	100	83	42	80	11	51	83	92	78	28	77	28	83	78	43	93	73	76	28	92	87	98	7	12	87	83	52	39
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G1	63	44	43	48	57	49	49	37	45	39	42	59	100	63	27	40	49	48	57	35	56	37	49	57	69	43	58	56	45	49	40	41	46	54	32	28	57	50
G2	91	81	43	46	89	84	70	42	59	47	80	90	63	100	29	59	80	79	93	48	89	48	80	93	36	76	87	89	50	78	70	79	37	48	62	67	57	35
H1	35	15	73	56	28	33	30	51	40	58	11	16	27	29	100	35	34	26	27	52	21	58	34	27	11	12	24	17	33	24	9	16	62	42	10	11	34	26
H2	61	55	48	66	81	65	92	72	87	77	51	41	40	59	35	100	82	54	75	78	76	81	82	75	30	31	71	72	83	58	27	51	37	56	19	61	51	42
I1	77	85	34	38	91	95	75	38	59	45	83	68	49	80	34	82	100	90	86	39	86	45	100	86	38	71	82	79	53	89	67	85	25	39	63	76	61	46
I2	73	93	29	30	79	92	52	39	35	39	92	79	48	79	26	54	90	100	78	31	82	35	90	78	41	88	79	74	39	97	83	94	22	25	82	77	64	45
J1	87	79	40	49	95	84	85	46	68	52	78	83	57	93	27	75	86	78	100	53	96	53	86	100	38	67	94	93	63	77	59	79	33	50	53	67	53	36
J2	48	32	68	80	49	40	81	91	92	96	28	40	35	48	52	78	39	31	53	100	49	98	39	53	26	29	47	46	85	32	14	30	55	58	15	16	33	31
K1	87	80	35	46	96	80	81	52	64	52	77	82	56	89	21	76	86	82	96	49	100	50	86	96	39	67	99	94	66	82	59	78	29	48	51	68	59	44
K2	51	34	73	84	53	45	81	92	92	96	28	41	37	48	58	81	45	35	53	98	50	100	45	53	26	29	50	46	87	38	13	31	60	62	14	15	39	36
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L2	87	79	40	49	95	84	85	46	68	52	78	83	57	93	27	75	86	78	100	53	96	53	86	100	38	67	94	93	63	77	59	79	33	50	53	67	53	36
M1	35	45	11	17	35	41	33	26	30	24	43	41	69	36	11	30	38	41	38	26	39	26	38	38	100	45	36	36	26	43	36	43	6	11	35	25	44	59
M2	65	94	12	18	63	86	34	29	32	27	93	85	43	76	12	31	71	88	67	29	67	29	71	67	45	100	63	65	28	89	91	94	7	11	92	68	52	43
N1	88	75	41	48	96	75	79	53	64	52	73	83	58	87	24	71	82	79	94	47	99	50	82	94	36	63	100	95	70	79	57	73	34	53	48	65	55	40
N2	86	80	29	39	91	74	81	46	64	43	76	83	56	89	17	72	79	74	93	46	94	46	79	93	36	65	95	100	64	78	60	77	23	44	49	69	51	34
O1	55	33	64	79	62	36	87	93	90	89	28	48	45	50	33	83	53	39	63	85	66	87	53	63	26	28	70	64	100	40	15	30	53	68	14	37	43	38
O2	75	97	29	30	81	93	55	40	38	38	92	81	49	78	24	58	89	97	77	32	82	38	89	77	43	89	79	78	40	100	81	95	21	25	77	72	62	49
P1	59	85	5	9	59	79	23	14	13	13	87	80	40	70	9	27	67	83	59	14	59	13	67	59	36	91	57	60	15	81	100	88	0	1	95	74	57	32
P2	71	98	16	20	74	92	52	30	33	27	98	83	41	79	16	51	85	94	79	30	78	31	85	79	43	94	73	77	30	95	88	100	10	14	87	82	57	35
Q1	52	11	95	90	31	25	40	57	58	60	7	22	46	37	62	37	25	22	33	55	29	60	25	33	6	7	34	23	53	21	0	10	100	92	0	0	26	21
Q2	63	16	86	91	49	28	65	60	72	63	12	34	54	48	42	56	39	25	50	58	48	62	39	50	11	11	53	44	68	25	1	14	92	100	0	12	29	24
S1	50	82	4	9	51	77	15	15	12	14	87	73	32	62	10	19	63	82	53	15	51	14	63	53	35	92	48	49	14	77	95	87	0	0	100	75	51	36
S2	53	77	5	9	68	72	52	16	34	15	83	58	28	67	11	61	76	77	67	16	68	15	76	67	25	68	65	69	37	72	74	82	0	12	75	100	48	30
R1	56	55	34	36	58	64	43	36	40	38	52	54	57	57	34	51	61	64	53	33	59	39	61	53	44	52	55	51	43	62	57	57	26	29	51	48	100	67
R2	35	41	27	31	42	43	38	40	34	40	39	36	50	35	26	42	46	45	36	31	44	36	46	36	59	43	40	34	38	49	32	35	21	24	36	30	67	100

Case 18 959

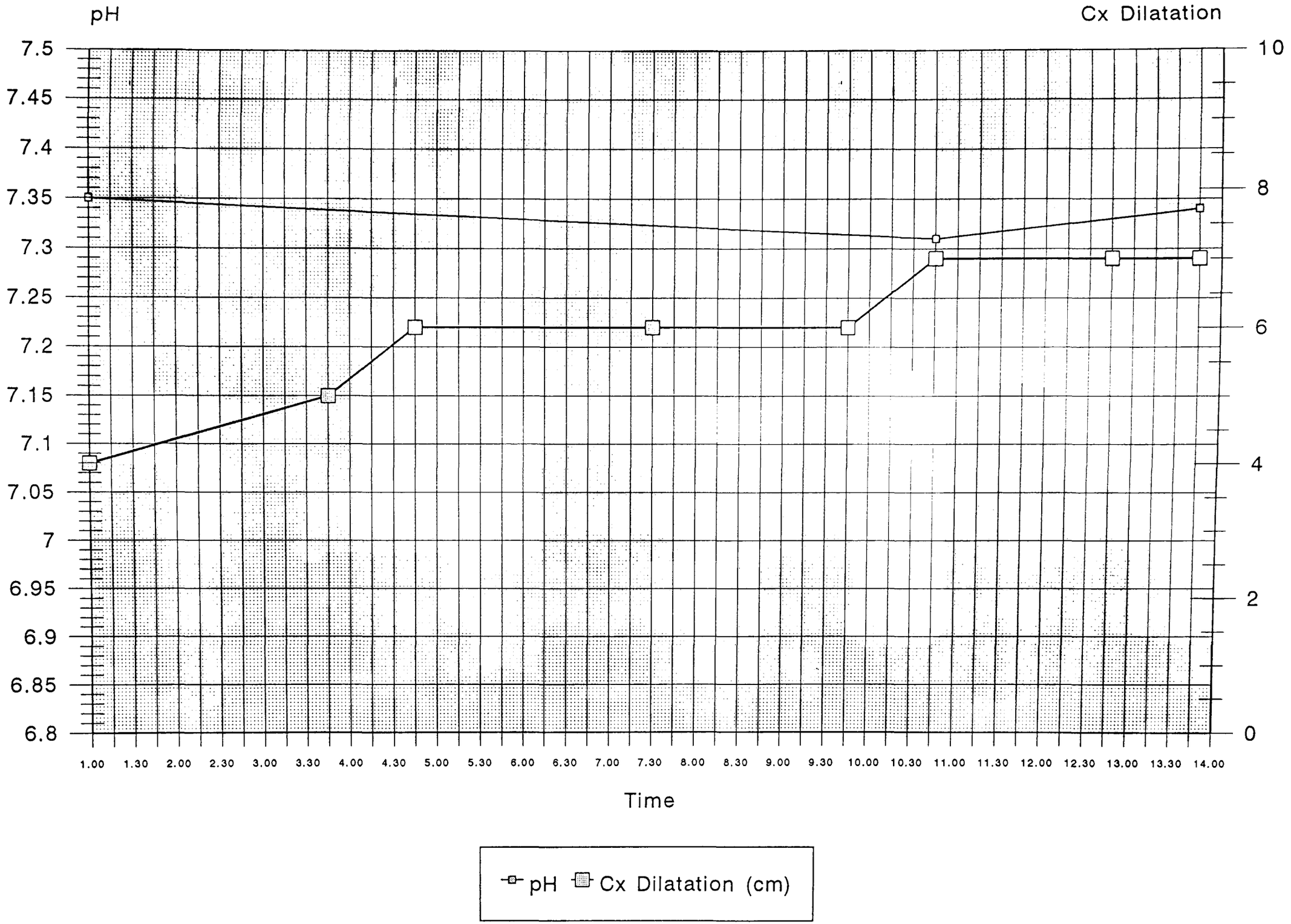
Mrs K.D. is a 31 year old lady expecting her first baby. She has had one early miscarriage. She is a fit lady and a non smoker. Her pregnancy was straightforward, and she laboured spontaneously at 41 weeks gestation. She was admitted on 19.1.91 in early labour; presentation cephalic 3/5, and the cervix at 22.35hrs was 3cm dilated, part effaced. Intermittent monitoring was performed. By 01.00hrs the cervix was 4cm dilated, effaced and thin. ARM was performed, with the drainage of a small amout of clear liquor.

Labour events

03.50	VE Cx 5cm dilated, thin. Station -1. OP position. FSE applied.
04.30	Epidural inserted.
04.50	VE Cx 6cm dilated. Station -1. OP position.
06.30	Syntocinon started.
07.30	VE Cx 6cm dilated. Station -1. OP position.
07.40	Top up.
09.40	VE No change.
10.40	VE Cx 7cm dilated. Station -1. Direct OP position. IUPD inserted. FBS pH 7.31 BE -0.9
12.40	VE No change. Decision for LSCS. Syntocinon stopped.
13.41	Male infant delivered by C/S under epidural. Indication; "failure to progress". Thick meconium noted at operation.

Outcome

Birth weight 3.4kg
Apgar 9 & 9
Cord gases pH 7.34 / 7.35 BD(ecf) - / 3


pH
Cx Dilatation
7.5
7.45
7.4
7.35
7.3
7.25
7.2
7.15
7.1
7.05
7
6.95
6.9
6.85
6.8
10
8
6
4
2
0
1.00
1.30
2.00
2.30
3.00
3.30
4.00
4.30
5.00
5.30
6.00
6.30
7.00
7.30
8.00
8.30
9.00
9.30
10.00
10.30
11.00
11.30
12.00
12.30
13.00
13.30
14.00
Time
pH
Cx Dilatation (cm)

Case 18

	SEGMENT																																																												
REVIEWER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
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G1	1	1	1	2	1	2	2	1	2	2	1	2	2	2	2	2	2	2	2	2	2	3	2	2	2	2	2	2	2	3	2	2	2	2	2	2																								
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P2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2																								
Q1	2	2	2	2	2	2	2	2	2	4	2	2	2	4	2	2	2	2	2	4	4	4	4	4	5																																			
Q2	2	2	2	2	2	2	2	2	2	2	2	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4																								
S1	1	1	2	1	1	2	2	1	1	1	1	3	2	1	1	2	1	1	1	1	2	2	2	2	2	2	2	2	1	2	2	3	2	3	2	2																								
S2	1	1	2	2	2	2	2	1	1	1	1	3	2	1	2	2	1	1	1	1	1	1	2	2	2	2	2	2	1	2	2	3	2	3	2	2																								
R1	1	2	1	4	3	2	1	1	2	1	1	1	4	1	1	2	3	3	2	1	2	1	2	2	2	1	2	1	2	1	2	1	2	4	2	2																								
R2	2	2	1	4	4	2	3	1	2	2	2	2	2	1	1	2	3	2	2	2	1	2	1	1	1	2	2	1	1	2	1	1	1	2	2	1																								
Clinical	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	n	C																						

Agreement results matrix for case 18

REVIEWER	A1	A2	B1	B2	C1	C2	D1	D2	E1	E2	F1	F2	G1	G2	H1	H2	I1	I2	J1	J2	K1	K2	L1	L2	M1	M2	N1	N2	O1	O2	P1	P2	Q1	Q2	S1	S2	R1	R2
A1	100	80	51	55	85	89	86	83	89	81	67	69	79	79	86	81	76	82	84	49	89	77	84	71	60	62	58	60	82	82	72	63	41	43	73	73	57	47
A2	80	100	46	47	87	84	84	81	80	82	85	70	86	86	79	81	82	75	84	47	86	88	82	85	69	72	80	69	78	77	88	80	35	28	67	67	53	56
B1	51	46	100	89	49	45	45	37	44	38	42	36	38	41	46	36	41	39	46	42	45	41	44	37	16	17	32	16	46	41	35	31	68	70	23	22	27	20
B2	55	47	89	100	48	49	44	43	44	43	40	42	37	38	54	41	41	48	52	46	49	40	49	42	20	21	31	21	46	45	37	32	64	75	29	29	42	36
C1	85	87	49	48	100	86	92	84	81	80	77	73	82	82	80	84	79	78	77	44	85	85	84	79	70	72	74	69	80	79	81	74	34	36	71	71	57	52
C2	89	84	45	49	86	100	88	86	80	84	80	75	79	79	85	84	75	82	75	50	97	84	88	78	70	71	70	70	81	84	79	72	37	38	69	68	60	54
D1	86	84	45	44	92	88	100	87	88	87	73	76	88	86	80	86	82	80	80	46	91	89	81	74	76	79	70	75	77	81	88	79	33	33	74	73	59	55
D2	83	81	37	43	84	86	87	100	89	96	69	76	79	77	84	82	77	90	80	47	87	79	87	73	76	79	65	76	78	81	84	77	30	33	84	84	64	54
E1	89	80	44	44	81	80	88	89	100	89	67	74	87	87	85	73	86	89	85	43	81	76	81	63	72	75	66	73	84	81	83	74	36	33	84	84	55	47
E2	81	82	38	43	80	84	87	96	89	100	65	72	76	76	81	81	74	89	80	46	85	76	90	76	73	76	67	73	80	80	81	71	28	33	81	81	65	57
F1	67	85	42	40	77	80	73	69	67	65	100	61	78	76	70	73	72	63	70	44	78	86	79	78	74	74	87	73	81	71	83	88	35	20	63	62	53	55
F2	69	70	36	42	73	75	76	76	74	72	61	100	72	69	66	61	67	71	67	35	73	76	65	47	70	70	52	72	66	66	76	63	24	41	69	69	58	43
G1	79	86	38	37	82	79	88	79	87	76	78	72	100	98	78	80	90	76	82	45	82	89	67	76	77	80	75	76	64	88	93	85	34	22	73	72	45	52
G2	79	86	41	38	82	79	86	77	87	76	76	69	98	100	76	75	91	78	80	45	79	83	72	77	70	73	77	70	68	89	89	82	35	22	67	67	44	52
H1	86	79	46	54	80	85	80	84	85	81	70	66	78	76	100	81	80	89	81	53	87	73	83	72	65	67	68	66	76	79	74	66	40	37	73	73	59	58
H2	81	81	36	41	84	84	86	82	73	81	73	61	80	75	81	100	67	71	76	46	87	82	89	91	81	83	79	81	78	79	69	70	34	30	77	77	62	58
I1	76	82	41	41	79	75	82	77	86	74	72	67	90	91	80	67	100	76	78	52	76	78	70	67	65	68	72	66	75	83	87	80	36	23	68	68	46	56
I2	82	75	39	48	78	82	80	90	89	89	63	71	76	78	89	71	76	100	85	54	81	70	85	66	65	68	61	66	76	80	76	69	33	34	75	75	69	63
J1	84	84	46	52	77	75	80	80	85	80	70	67	82	80	81	76	78	85	100	50	76	82	74	71	64	67	62	64	77	75	78	71	39	32	75	75	68	64
J2	49	47	42	46	44	50	46	47	43	46	44	35	45	45	53	46	52	54	50	100	49	44	51	48	30	33	33	32	42	51	44	46	57	30	30	30	43	49
K1	89	86	45	49	85	97	91	87	81	85	78	73	82	79	87	87	76	81	76	49	100	87	87	78	73	76	73	72	78	83	83	75	36	37	70	69	59	53
K2	77	88	41	40	85	84	89	79	76	76	86	76	89	83	73	82	78	70	82	44	87	100	73	75	79	80	76	78	74	77	91	86	34	27	72	70	57	54
L1	84	82	44	49	84	88	81	87	81	90	79	65	67	72	83	89	70	85	74	51	87	73	100	87	72	75	76	72	85	75	70	74	36	35	75	74	63	57
L2	71	85	37	42	79	78	74	73	63	76	78	47	76	77	72	91	67	66	71	48	78	75	87	100	70	73	87	71	75	80	68	73	33	22	63	63	58	62
M1	60	69	16	20	70	70	76	76	72	73	74	70	77	70	65	81	65	65	64	30	73	79	72	70	100	98	82	96	71	65	81	82	16	13	89	86	54	52
M2	62	72	17	21	72	71	79	79	75	76	74	70	80	73	67	83	68	68	67	33	76	80	75	73	98	100	84	95	73	65	82	84	18	13	88	86	55	54
N1	58	80	32	31	74	70	70	65	66	67	87	52	75	77	68	79	72	61	62	33	73	76	76	87	82	84	100	79	74	69	77	84	24	13	69	67	48	53
N2	60	69	16	21	69	70	75	76	73	73	73	72	76	70	66	81	66	66	64	32	72	78	72	71	96	95	79	100	74	66	79	80	18	14	88	88	55	54
O1	82	78	46	46	80	81	77	78	84	80	81	66	64	68	76	78	75	76	77	42	78	74	85	75	71	73	74	74	100	60	69	74	36	32	81	82	63	53
O2	82	77	41	45	79	84	81	81	81	80	71	66	88	89	79	79	83	80	75	51	83	77	75	80	65	65	69	66	60	100	82	74	37	30	67	67	52	57
P1	72	88	35	37	81	79	88	84	83	81	83	76	93	89	74	69	87	76	78	44	83	91	70	68	81	82	77	79	69	82	100	92	28	21	74	72	53	54
P2	63	80	31	32	74	72	79	77	74	71	88	63	85	82	66	70	80	69	71	46	75	86	74	73	82	84	84	80	74	74	92	100	29	13	69	67	57	57
Q1	41	35	68	64	34	37	33	30	36	28	35	24	34	35	40	34	36	33	39	57	36	34	36	33	16	18	24	18	36	37	28	29	100	63	22	23	30	20
Q2	43	28	70	75	36	38	33	33	33	33	20	41	22	22	37	30	23	34	32	30	37	27	35	22	13	13	13	14	32	30	21	13	63	100	22	22	44	13
S1	73	67	23	29	71	69	74	84	84	81	63	69	73	67	73	77	68	75	75	30	70	72	75	63	89	88	69	88	81	67	74	69	22	22	100	99	58	48
S2	73	67	22	29	71	68	73	84	84	81	62	69	72	67	73	77	68	75	75	30	69	70	74	63	86	86	67	88	82	67	72	67	23	22	99	100	58	48
R1	57	53	27	42	57	60	59	64	55	65	53	58	45	44	59	62	46	69	68	43	59	57	63	58	54	55	48	55	63	52	53	57	30	44	58	58	100	78
R2	47	56	20	36	52	54	55	54	47	57	55	43	52	52	58	58	56	63	64	49	53	54	57	62	52	54	53	54	53	57	54	57	20	13	48	48	78	100

Case 19 1887

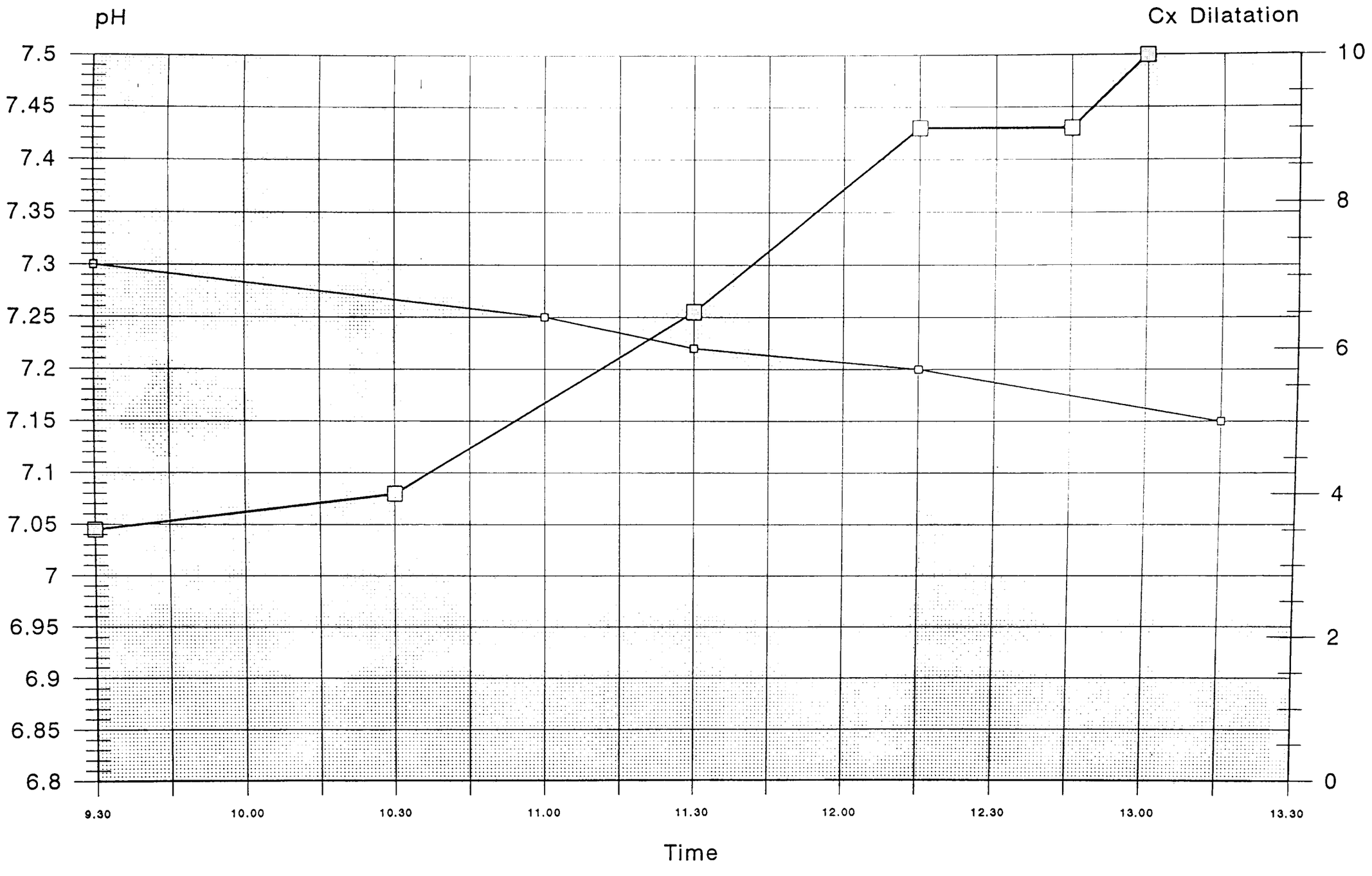
Miss L.B. is an 18 year old girl expecting her second baby. She is fit and well, but smokes 10 cigarettes per day. Her first child was delivered by emergency Caesarean section because of fetal distress which occurred at 4cm dilatation in a term spontaneous labour. The baby (girl) weighed 2.44kg. During the current pregnancy fetal growth was judged clinically to be satisfactory, and ultrasound measurements at 30 weeks were well within the normal range. There was no hypertension or proteinuria. Xray pelvimetry demonstrated good pelvic capacity and a trial of vaginal delivery was planned. Spontaneous labour occurred at 37 weeks; when she was admitted on 20.8.91 the fetal head was 3/5 palpable and the cervix 2cm dilated (03.00hrs).

Labour events

09.50	Contractions more painful. Continuous monitoring begun.
10.30	VE Cx 4cm dilated, fully effaced. Station -1. ARM; clear liquor. FSE applied.
10.50	Epidural inserted.
11.00	Oxygen given.
11.35	VE Cx 6-7cm dilated. Station +1. LOT position. FBS; pH 7.22 BE -3
12.20	VE Cx 9cm dilated. Station +1. LOT position. FBS; pH 7.20 BE -4
12.45	VE Cx 9cm dilated.
13.00	VE Cx fully dilated. Station +1. LOT position. Caput + moulding +.
13.22	Male infant delivered by Ventouse extraction. Indication; continuing fetal heart decelerations and borderline scalp pH.

Outcome

Birth weight 2.30kg
Apgar 9 & 9
Cord gases pH 7.15 / 7.23 BD(ecf) 5 / 3


pH
Cx Dilatation
7.5
7.45
7.4
7.35
7.3
7.25
7.2
7.15
7.1
7.05
7
6.95
6.9
6.85
6.8
10
8
6
4
2
0
9.30
10.00
10.30
11.00
11.30
12.00
12.30
13.00
13.30
Time
pH
Cx Dilatation (cm)

Case 19

SEGMENT

REVIEWER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
A1	1	1	2	2	3	4	3	5																																																				
A2	1	1	1	2	2	2	2	3	2	3	5																																																	
B1	1	2	2	3	4	4	3	5																																																				
B2	1	2	2	2	3	4	5																																																					
C1	1	1	1	1	4	4	5																																																					
C2	1	1	1	1	2	1	2	2	2	3	4	5																																															
D1	1	1	1	1	2	2	3	2	3	2	2	5																																															
D2	1	1	1	2	2	2	3	5																																																				
E1	1	1	2	2	3	2	3	4	3	4	3	5																																															
E2	1	1	2	2	3	4	3	5																																																				
F1	1	2	2	1	2	2	2	2	2	3	2	2	2	6																																													
F2	1	1	1	1	2	2	2	2	2	3	2	3	5																																														
G1	1	1	2	2	4	2	3	4	2	3	4	5																																															
G2	1	1	1	2	4	2	4	3	4	4	4	5																																															
H1	1	2	2	2	3	5																																																						
H2	1	1	1	2	2	2	3	5																																																				
I1	1	1	1	2	2	3	2	3	5																																																		
I2	1	1	1	2	3	2	2	3	5																																																		
J1	2	2	2	2	3	2	4	3	5																																																		
J2	1	1	1	1	3	2	5																																																					
K1	1	1	2	2	3	2	4	4	3	4	3	5																																															
K2	1	1	1	1	2	2	3	4	3	5																																																
L1	1	1	1	1	2	2	3	2	3	2	3	5																																															
L2	1	1	1	1	3	2	4	3	5																																																		
M1	1	1	1	1	2	2	2	2	3	2	2	2	6																																													
M2	1	1	1	1	2	2	3	2	5																																																		
N1	1	1	1	1	2	2	3	4	2	2	3	4	6																																														
N2	1	1	1	1	2	2	3	2	2	3	4	4	6																																														
O1	1	1	2	2	3	2	2	3	2	3	2	3	6																																														
O2	1	1	1	1	2	2	3	2	3	2	3	2	6																																														
P1	1	1	1	1	2	2	4	4	4	5																																																
P2	1	1	1	1	3	2	3	5																																																				
Q1	2	2	2	2	2	2	2	2	4	4	4	4	4	4	6																																													
Q2	2	2	2	2	2	4	4	4	4	4	4	4	4	6																																														
S1	1	1	1	1	2	2	1	1	2	3	5																																																	
S2	1	1	1	1	2	2	1	1	2	3	5																																																	
R1	1	2	2	2	2	2	1	2	1	2	1	1	2	1	6																																													
R2	2	1	1	1	1	3	1	1	1	2	2	1	1	2	1																																													
Clinical	0	0	0	0	0	0	0	3	0	0	3	0	0	0	6																																													

Agreement results matrix for case 19

REVIEWER	A1	A2	B1	B2	C1	C2	D1	D2	E1	E2	F1	F2	G1	G2	H1	H2	I1	I2	J1	J2	K1	K2	L1	L2	M1	M2	N1	N2	O1	O2	P1	P2	Q1	Q2	S1	S2	R1	R2
A1	100	49	98	94	91	20	36	92	53	100	21	16	52	55	78	92	86	87	93	89	54	77	35	93	29	85	51	38	45	42	76	94	32	55	36	36	14	42
A2	49	100	43	21	19	91	93	55	83	49	51	79	81	76	18	55	78	76	70	22	79	87	93	71	54	76	64	70	59	60	76	53	57	53	97	97	25	35
B1	98	43	100	93	92	17	32	83	51	98	17	13	56	58	77	83	79	80	90	84	54	70	31	90	23	76	47	34	42	37	74	87	29	57	31	31	10	39
B2	94	21	93	100	96	10	26	84	43	94	15	11	43	46	93	84	70	71	80	95	48	53	25	79	19	67	43	25	36	30	59	87	23	48	11	11	14	37
C1	91	19	92	96	100	10	24	78	38	91	13	10	47	49	86	78	64	63	74	89	46	51	22	76	18	63	41	23	29	28	61	79	20	50	11	11	10	32
C2	20	91	17	10	10	100	91	26	84	20	48	89	82	80	9	26	50	50	44	15	80	71	92	46	49	50	65	74	50	52	65	24	70	58	93	93	26	23
D1	36	93	32	26	24	91	100	35	86	36	49	86	84	77	23	35	60	59	55	27	80	77	98	56	56	59	63	70	57	62	63	37	57	52	89	89	30	46
D2	92	55	83	84	78	26	35	100	48	92	30	22	43	45	73	100	93	92	88	89	46	79	34	89	38	94	49	38	41	44	75	97	34	46	47	47	21	41
E1	53	83	51	43	38	84	86	48	100	53	43	75	92	91	33	48	63	64	67	40	98	83	88	67	48	59	76	72	63	60	80	51	69	77	77	77	16	34
E2	100	49	98	94	91	20	36	92	53	100	21	16	52	55	78	92	86	87	93	89	54	77	35	93	29	85	51	38	45	42	76	94	32	55	36	36	14	42
F1	21	51	17	15	13	48	49	30	43	21	100	59	39	32	15	30	35	35	31	22	41	40	53	31	94	33	67	70	82	87	31	27	54	43	49	49	80	50
F2	16	79	13	11	10	89	86	22	75	16	59	100	72	64	10	22	27	27	23	16	71	51	90	25	62	25	63	67	61	62	42	20	58	46	79	79	37	28
G1	52	81	56	43	47	82	84	43	92	52	39	72	100	96	34	43	58	57	63	36	93	79	85	63	42	54	75	70	55	53	80	44	68	80	75	75	17	32
G2	55	76	58	46	49	80	77	45	91	55	32	64	96	100	32	45	59	59	67	38	94	79	77	67	37	57	72	69	47	46	84	46	71	84	70	70	12	25
H1	78	18	77	93	86	9	23	73	33	78	15	10	34	32	100	73	52	53	56	93	36	32	22	55	17	49	34	22	33	28	36	76	14	35	11	11	17	37
H2	92	55	83	84	78	26	35	100	48	92	30	22	43	45	73	100	93	92	88	89	46	79	34	89	38	94	49	38	41	44	75	97	34	46	47	47	21	41
I1	86	78	79	70	64	50	60	93	63	86	35	27	58	59	52	93	100	99	93	74	61	91	59	94	43	98	55	54	51	51	83	93	42	50	69	69	21	45
I2	87	76	80	71	63	50	59	92	64	87	35	27	57	59	53	92	99	100	94	76	62	90	58	95	40	96	54	52	53	49	83	94	41	49	69	69	21	44
J1	93	70	90	80	74	44	55	88	67	93	31	23	63	67	56	88	93	94	100	74	69	90	54	98	36	90	58	49	49	45	89	90	44	62	61	61	17	41
J2	89	22	84	95	89	15	27	89	40	89	22	16	36	38	93	89	74	76	74	100	43	52	26	76	25	74	41	26	36	33	55	93	22	40	17	17	19	41
K1	54	79	54	48	46	80	80	46	98	54	41	71	93	94	36	46	61	62	69	43	100	82	83	69	45	55	75	67	59	55	83	49	70	80	73	73	15	31
K2	77	87	70	53	51	71	77	79	83	77	40	51	79	79	32	79	91	90	90	52	82	100	77	92	47	90	66	61	51	54	96	78	55	67	82	82	17	38
L1	35	93	31	25	22	92	98	34	88	35	53	90	85	77	22	34	59	58	54	26	83	77	100	56	59	57	69	74	65	69	63	36	58	54	89	89	26	41
L2	93	71	90	79	76	46	56	89	67	93	31	25	63	67	55	89	94	95	98	76	69	92	56	100	38	92	59	50	49	47	90	92	43	61	63	63	15	42
M1	29	54	23	19	18	49	56	38	48	29	94	62	42	37	17	38	43	40	36	25	45	47	59	38	100	41	72	73	86	93	36	34	50	45	50	50	70	59
M2	85	76	76	67	63	50	59	94	59	85	33	25	54	57	49	94	98	96	90	74	55	90	57	92	41	100	54	51	43	47	85	92	42	48	70	70	24	43
N1	51	64	47	43	41	65	63	49	76	51	67	63	75	72	34	49	55	54	58	41	75	66	69	59	72	54	100	91	79	80	66	50	84	88	57	57	41	46
N2	38	70	34	25	23	74	70	38	72	38	70	67	70	69	22	38	54	52	49	26	67	61	74	50	73	51	91	100	79	81	53	40	86	78	65	65	40	40
O1	45	59	42	36	29	50	57	41	63	45	82	61	55	47	33	41	51	53	49	36	59	51	65	49	86	43	79	79	100	92	38	46	51	52	50	50	52	56
O2	42	60	37	30	28	52	62	44	60	42	87	62	53	46	28	44	51	49	45	33	55	54	69	47	93	47	80	81	92	100	40	45	52	51	53	53	54	62
P1	76	76	74	59	61	65	63	75	80	76	31	42	80	84	36	75	83	83	89	55	83	96	63	90	36	85	66	53	38	40	100	74	60	74	72	72	13	28
P2	94	53	87	87	79	24	37	97	51	94	27	20	44	46	76	97	93	94	90	93	49	78	36	92	34	92	50	40	46	45	74	100	32	46	44	44	18	46
Q1	32	57	29	23	20	70	57	34	69	32	54	58	68	71	14	34	42	41	44	22	70	55	58	43	50	42	84	86	51	52	60	32	100	92	56	56	37	17
Q2	55	53	57	48	50	58	52	46	77	55	43	46	80	84	35	46	50	49	62	40	80	67	54	61	45	48	88	78	52	51	74	46	92	100	47	47	23	23
S1	36	97	31	11	11	93	89	47	77	36	49	79	75	70	11	47	69	69	61	17	73	82	89	63	50	70	57	65	50	53	72	44	56	47	100	100	28	28
S2	36	97	31	11	11	93	89	47	77	36	49	79	75	70	11	47	69	69	61	17	73	82	89	63	50	70	57	65	50	53	72	44	56	47	100	100	28	28
R1	14	25	10	14	10	26	30	21	16	14	80	37	17	12	17	21	21	21	17	19	15	17	26	15	70	24	41	40	52	54	13	18	37	23	28	28	100	62
R2	42	35	39	37	32	23	46	41	34	42	50	28	32	25	37	41	45	44	41	41	31	38	41	42	59	43	46	40	56	62	28	46	17	23	28	28	62	100

Case 20 1558

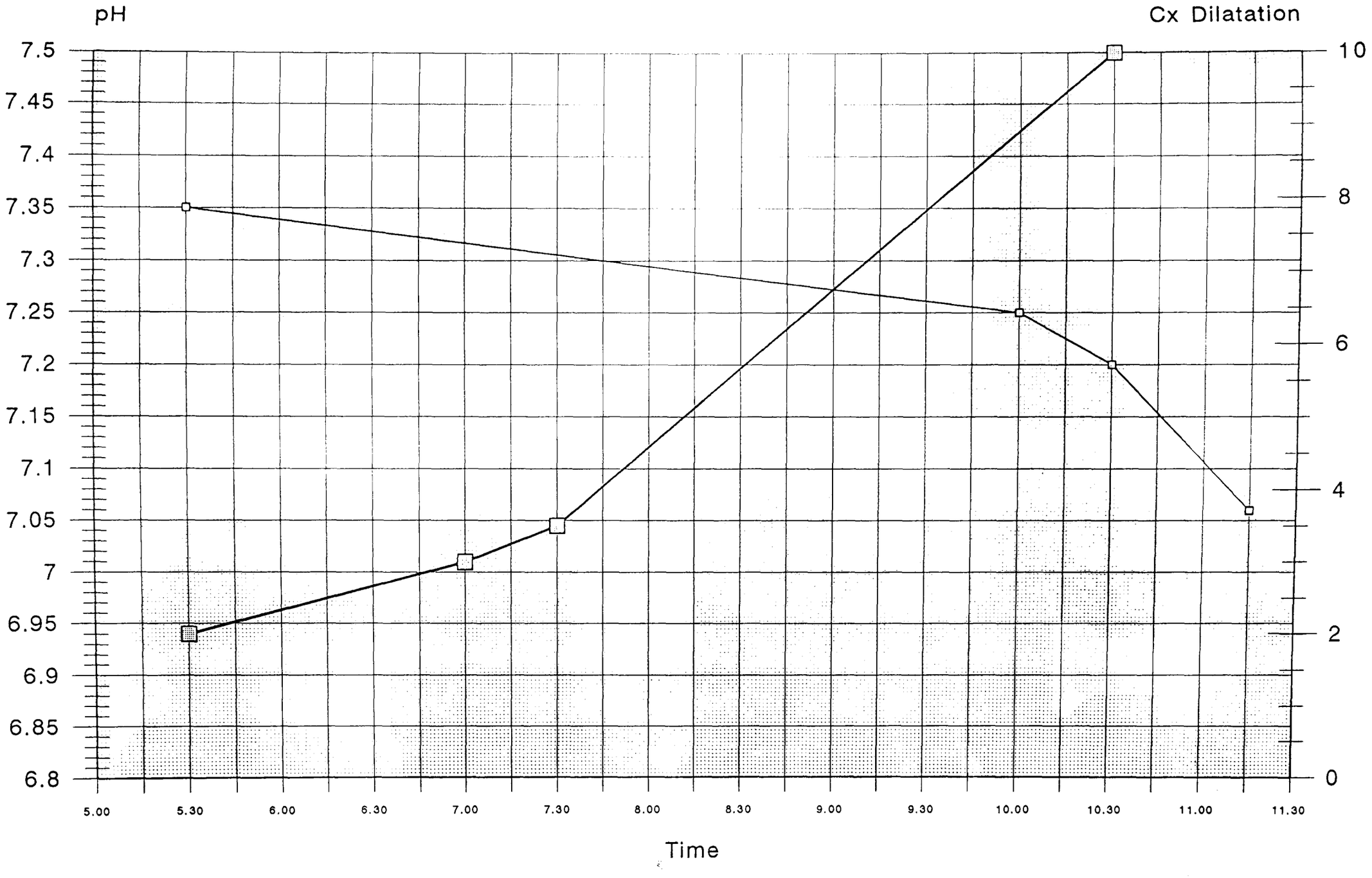
Mrs J.D. is a 32 year old primigravida; a fit lady, and a nonsmoker. Her pregnancy was straightforward until she was admitted at 35 weeks with spontaneous rupture of the membranes. After 36 hours labour had still not established. The uterus was thought to be small for dates (fundal height 31cm); cephalic 2/5. VE Cx closed, thick. Clear liquor was seen. Labour was induced with vaginal prostaglandins, and on 29/5/91 at 09.50hrs prostin gel 2mg PV was given. This was repeated 11 hours later; VE being unchanged. After a further 10 hours (05.00hrs on 30/5/91) she had regular contractions, and the cervix was 2cm dilated, effacing; station -1.

Labour events

05.35	VE Cx 2cm dilated. FSE applied.
07.00	VE Cx 3cm dilated, effaced. Station 0.
07.30	VE Cx 3-4cm dilated. Station -1.
07.40	Epidural begun.
08.15	Epidural completed.
09.00	Syntocinon started.
09.50	Top up.
10.25	VE Cx fully dilated. Station +1.
10.40	Pushing begun.
11.15	Normal delivery of female infant.

Outcome

Birth weight 1.66kg
Apgar 6 & 9
Cord gases pH 7.06 / 7.09 BD(ecf) 3 / 5


pH
Cx Dilatation
7.5
7.45
7.4
7.35
7.3
7.25
7.2
7.15
7.1
7.05
7
6.95
6.9
6.85
6.8
10
8
6
4
2
0
5.00
5.30
6.00
6.30
7.00
7.30
8.00
8.30
9.00
9.30
10.00
10.30
11.00
11.30
Time
pH
Cx Dilatation (cm)

Case 20

REVIEWER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
A1	1	1	1	1	2	2	1	1	1	1	2	2	2	2	1	1	2	2	2	4	4	2	4																																					
A2	1	1	1	2	2	2	1	1	1	1	2	1	2	1	1	1	2	2	2	2	2	2	4																																					
B1	1	1	1	1	2	2	1	1	1	1	2	2	1	1	1	2	2	2	2	4	4	2	6																																					
B2	1	1	1	1	2	2	1	1	1	1	2	1	1	2	2	2	1	2	3	6																																								
C1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	2	2	2	3	6																																								
C2	1	1	1	1	1	2	1	1	1	1	2	1	1	2	1	2	2	2	2	6																																								
D1	1	1	1	1	2	2	1	1	1	1	2	1	1	1	1	1	1	2	2	2	2	2	6																																					
D2	1	1	1	1	2	2	1	1	1	1	2	2	1	1	2	2	1	1	2	2	6																																							
E1	1	1	1	1	2	2	1	1	1	1	2	2	1	2	1	2	2	2	2	2	2	2	6																																					
E2	1	1	1	1	2	2	1	1	1	1	2	2	1	2	2	2	2	2	2	6																																								
F1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																					
F2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																					
G1	1	1	1	1	2	2	1	1	1	1	2	1	1	2	2	2	2	2	2	2	2	2	2																																					
G2	1	1	1	1	2	2	1	1	1	1	2	1	1	2	1	2	2	2	2	2	2	2	4																																					
H1	1	1	1	1	2	2	1	1	1	1	2	2	1	2	2	2	2	2	2	2	2	2	6																																					
H2	1	1	1	1	2	2	1	1	1	1	2	2	1	1	1	1	2	2	2	6																																								
I1	1	1	1	2	2	3	1	1	1	1	2	2	2	2	2	3	2	2	3	6																																								
I2	1	1	1	2	2	3	1	1	1	1	2	2	2	2	3	2	2	2	3	6																																								
J1	1	1	1	1	2	2	1	1	1	1	3	2	1	2	2	2	2	2	3	2	2	6																																						
J2	1	1	1	2	3	2	1	1	1	1	2	2	2	2	2	3	2	2	2	6																																								
K1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	6																																								
K2	1	1	1	1	1	1	1	1	1	1	2	2	1	1	1	1	1	1	1	2	2	1	6																																					
L1	1	1	1	1	2	2	1	1	1	1	2	2	1	2	2	2	3	2	2	6																																								
L2	1	1	1	1	2	2	1	1	1	1	3	2	1	1	2	2	2	2	3	4	6																																							
M1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2																																					
M2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2																																					
N1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	6																																					
N2	1	1	1	1	1	1	1	1	1	1	2	1	1	2	2	2	2	3	2	2	2	2	6																																					
O1	1	1	1	1	2	2	1	1	1	1	2	2	1	2	2	2	3	2	2	6																																								
O2	1	1	1	1	2	2	1	1	1	1	2	2	1	2	1	2	2	3	2	2	6																																							
P1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	4																																					
P2	1	1	1	1	2	2	1	1	1	1	2	1	1	1	1	1	1	1	2	2	6																																							
Q1	2	2	2	2	2	2	2	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	4																																					
Q2	2	2	2	2	2	2	2	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2																																					
S1	1	1	1	1	1	1	1	1	1	1	2	2	2	1	1	1	1	1	2	6																																								
S2	1	1	1	1	1	1	1	1	1	1	2	2	2	1	1	1	1	1	2	6																																								
R1	2	1	1	2	4	1	1	2	2	1	2	1	1	2	3	4	1	2	1	1	1	1	1																																					
R2	1	2	1	2	2	2	2	1	1	1	1	3	2	1	1	1	1	2	2	2	2	1	2																																					
Clinical	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	D																																				

(Column header spanning segments 1–60: SEGMENT)

Agreement results matrix for case 20

REVIEWER	A1	A2	B1	B2	C1	C2	D1	D2	E1	E2	F1	F2	G1	G2	H1	H2	I1	I2	J1	J2	K1	K2	L1	L2	M1	M2	N1	N2	O1	O2	P1	P2	Q1	Q2	S1	S2	R1	R2
A1	100	87	94	64	63	65	65	67	66	65	47	47	52	87	65	65	56	56	63	56	62	63	61	80	49	48	63	64	61	66	82	66	85	50	64	64	33	47
A2	87	100	79	62	62	71	84	77	84	70	70	70	76	99	83	72	51	51	67	57	68	80	63	59	74	72	82	74	63	70	93	77	96	73	69	69	44	68
B1	94	79	100	69	70	71	75	74	75	71	51	51	57	80	75	71	59	59	71	59	68	72	67	86	54	53	73	73	67	72	75	73	77	54	69	69	34	50
B2	64	62	69	100	98	98	71	93	71	98	64	64	71	63	72	97	84	81	85	82	95	68	95	81	68	67	69	85	95	95	58	92	60	67	95	95	44	60
C1	63	62	70	98	100	98	71	91	71	96	65	65	70	63	70	97	82	79	84	80	96	68	93	80	69	68	71	85	93	94	60	91	57	64	94	94	43	59
C2	65	71	71	98	98	100	80	95	82	99	75	75	82	72	81	98	78	78	84	77	96	78	91	79	79	77	80	83	91	94	67	95	67	76	96	96	44	68
D1	65	84	75	71	71	80	100	90	98	79	80	80	84	83	97	82	55	55	77	62	80	97	71	62	85	83	98	86	71	80	80	92	78	78	80	80	47	74
D2	67	77	74	93	91	95	90	100	90	96	77	77	83	77	91	96	75	75	84	76	94	89	86	77	81	80	88	83	86	91	74	99	74	78	95	95	46	71
E1	66	84	75	71	71	82	98	90	100	82	76	76	86	85	99	82	58	58	79	65	77	95	73	63	82	80	96	88	73	82	77	89	81	82	79	79	47	73
E2	65	70	71	98	96	99	79	96	82	100	72	72	83	72	82	98	80	80	85	79	93	76	92	79	76	74	77	83	92	94	65	93	69	78	95	95	44	68
F1	47	70	51	64	65	75	80	77	76	72	100	100	87	70	75	75	46	46	58	53	80	84	63	46	95	97	81	68	63	66	78	79	62	79	78	78	54	78
F2	47	70	51	64	65	75	80	77	76	72	100	100	87	70	75	75	46	46	58	53	80	84	63	46	95	97	81	68	63	66	78	79	62	79	78	78	54	78
G1	52	76	57	71	70	82	84	83	86	83	87	87	100	78	87	80	56	56	68	64	77	80	73	53	93	91	82	76	73	74	69	81	74	94	77	77	52	82
G2	87	99	80	63	63	72	83	77	85	72	70	70	78	100	84	71	52	52	68	57	68	80	64	60	74	72	82	75	64	71	93	77	96	73	68	68	44	66
H1	65	83	75	72	70	81	97	91	99	82	75	75	87	84	100	80	58	58	79	65	76	94	73	63	81	79	95	88	73	82	76	88	81	83	77	77	47	72
H2	65	72	71	97	97	98	82	96	82	98	75	75	80	71	80	100	78	78	83	77	96	79	90	79	79	77	80	81	90	94	67	96	66	76	97	97	44	70
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I2	56	51	59	81	79	78	55	75	58	80	46	46	56	52	58	78	99	100	72	96	73	53	84	69	50	49	53	72	84	81	44	72	51	55	76	76	63	54
J1	63	67	71	85	84	84	77	84	79	85	58	58	68	68	79	83	74	72	100	72	79	74	83	89	62	61	75	87	83	87	61	82	65	65	80	80	43	75
J2	56	57	59	82	80	77	62	76	65	79	53	53	64	57	65	77	98	96	72	100	72	59	88	69	57	55	59	72	88	82	50	73	57	62	74	74	67	55
K1	62	68	68	95	96	96	80	94	77	93	80	80	77	68	76	96	73	73	79	72	100	81	87	75	83	82	82	81	87	90	71	96	61	69	98	98	44	67
K2	63	80	72	68	68	78	97	89	95	76	84	84	80	80	94	79	52	53	74	59	81	100	68	59	85	85	97	85	68	78	83	90	74	74	82	82	48	72
L1	61	63	67	95	93	91	71	86	73	92	63	63	73	64	73	90	88	84	83	88	87	68	100	78	67	65	69	86	100	96	58	83	62	69	88	88	57	61
L2	80	59	86	81	80	79	62	77	63	79	46	46	53	60	63	79	72	69	89	69	75	59	78	100	49	48	60	73	78	81	55	76	58	50	76	76	35	61
M1	49	74	54	68	69	79	85	81	82	76	95	95	93	74	81	79	50	50	62	57	83	85	67	49	100	99	87	73	67	70	75	83	66	85	81	81	51	81
M2	48	72	53	67	68	77	83	80	80	74	97	97	91	72	79	77	49	49	61	55	82	85	65	48	99	100	85	71	65	68	76	82	64	83	80	80	52	79
N1	63	82	73	69	71	80	98	88	96	77	81	81	82	82	95	80	53	53	75	59	82	97	69	60	87	85	100	87	69	79	81	90	75	75	80	80	46	72
N2	64	74	73	85	85	83	86	83	88	83	68	68	76	75	88	81	75	72	87	72	81	85	86	73	73	71	87	100	86	92	70	81	71	70	81	81	53	62
O1	61	63	67	95	93	91	71	86	73	92	63	63	73	64	73	90	88	84	83	88	87	68	100	78	67	65	69	86	100	96	58	83	62	69	88	88	57	61
O2	66	70	72	95	94	94	80	91	82	94	66	66	74	71	82	94	84	81	87	82	90	78	96	81	70	68	79	92	96	100	64	90	67	70	91	91	52	63
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Q1	85	96	77	60	57	67	78	74	81	69	62	62	74	96	81	66	51	51	65	57	61	74	62	58	66	64	75	71	62	67	87	71	100	78	63	63	43	65
Q2	50	73	54	67	64	76	78	78	82	78	79	79	94	73	83	76	55	55	65	62	69	74	69	50	85	83	75	70	69	70	62	75	78	100	72	72	51	82
S1	64	69	69	95	94	96	80	95	79	95	78	78	77	68	77	97	75	76	80	74	98	82	88	76	81	80	80	81	88	91	69	95	63	72	100	100	44	68
S2	64	69	69	95	94	96	80	95	79	95	78	78	77	68	77	97	75	76	80	74	98	82	88	76	81	80	80	81	88	91	69	95	63	72	100	100	44	68
R1	33	44	34	44	43	44	47	46	47	44	54	54	52	44	47	44	62	63	43	67	44	48	57	35	51	52	46	53	57	52	45	45	43	51	44	44	100	53
R2	47	68	50	60	59	68	74	71	73	68	78	78	82	66	72	70	48	54	75	55	67	72	61	61	81	79	72	62	61	63	62	72	65	82	68	68	53	100

Case 21 1932

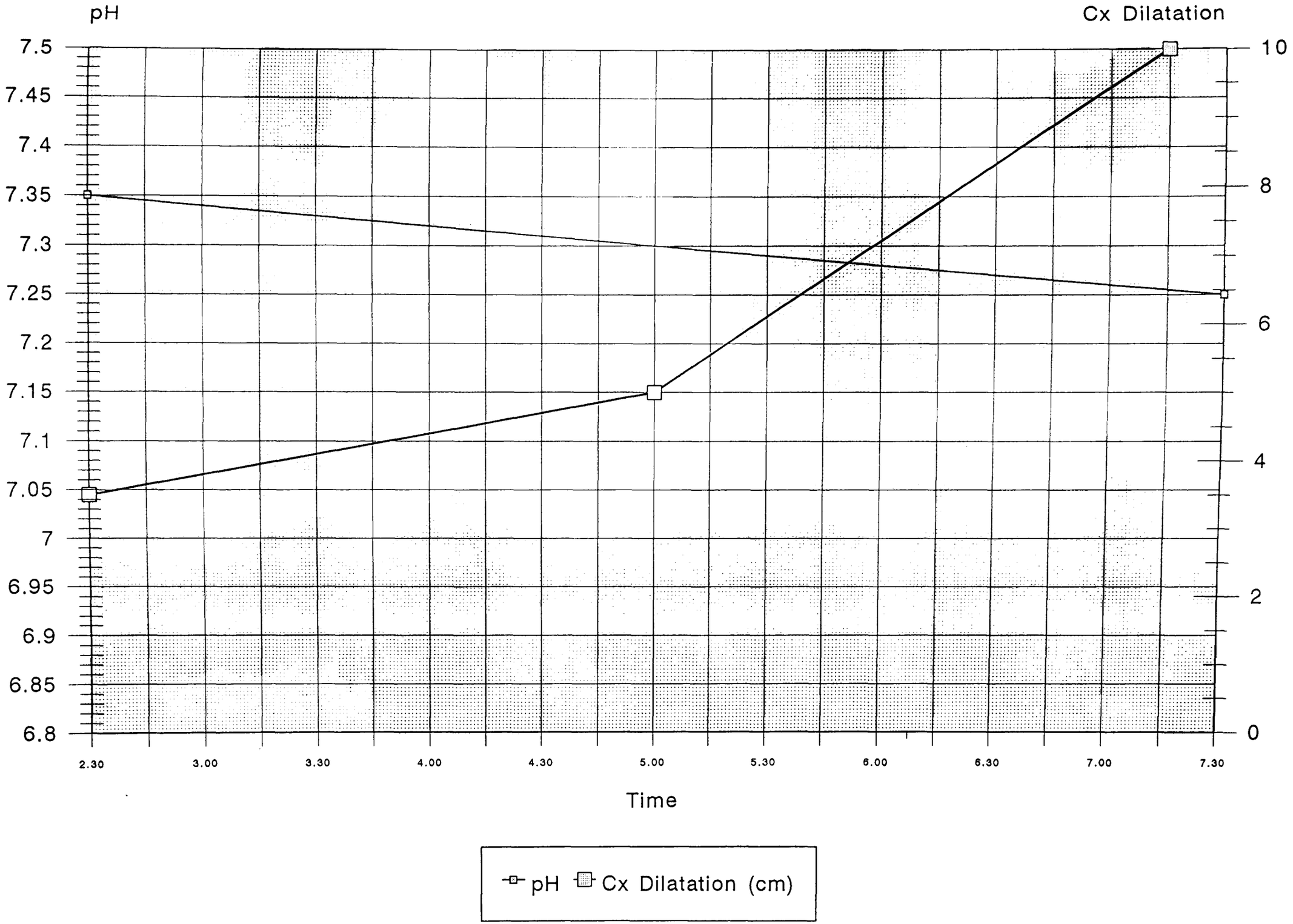
Mrs T.D. is a 26 year old lady expecting her fourth child. She is a fit lady, but smokes 15 cigarettes per day. Her first two children were born normally at term and weighed 6lb 7oz and 7lb 3oz respectively. Her third child was delivered by Caesarean section because of fetal distress during preterm labour at 34 weeks. The baby was appropriately grown. Her current pregnancy progressed normally and a trial of vaginal delivery was planned. She was admitted in spontaneous labour at 40 weeks, on 25.8.91. The uterus was term size, presentation cephalic 2/5. VE (at 02.35hrs) Cx 3-4cm dilated, effaced and thin. Station -1. Clear liquor seen.

Labour events

05.00	VE Cx 5cm dilated. Station -1. FSE applied.
05.30	Epidural begun. (Not effective)
06.30	Top up.
07.10	VE Cx fully dilated. Vertex visible.
07.20	Pushing begun.
07.28	Normal delivery of male infant.

Outcome

Birth weight 3.60kg
Apgar 9 & 9
Cord gases pH 7.25 / 7.42 BD(ecf) 10 / 2


pH
Cx Dilatation
7.5
7.45
7.4
7.35
7.3
7.25
7.2
7.15
7.1
7.05
7
6.95
6.9
6.85
6.8
10
8
6
4
2
0
2.30
3.00
3.30
4.00
4.30
5.00
5.30
6.00
6.30
7.00
7.30
Time
pH
Cx Dilatation (cm)

Case 21

SEGMENT

REVIEWER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
A1	1	1	2	2	1	1	1	2	2	2	2	2	1	2	1	4																																												
A2	1	1	1	1	1	1	1	2	2	2	1	1	1	1	1	2																																												
B1	1	1	2	2	1	1	1	1	2	2	2	2	1	1	1	1																																												
B2	1	1	2	2	2	1	1	2	2	2	1	1	1	1	1	2																																												
C1	1	1	2	2	1	1	1	1	1	1	1	1	1	1	1	1																																												
C2	1	1	1	2	1	1	1	1	2	2	1	1	1	1	1	2																																												
D1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1																																												
D2	1	1	1	1	1	1	1	1	2	2	1	1	1	1	1	2																																												
E1	1	1	1	1	1	1	1	2	2	2	1	1	1	1	1	2																																												
E2	1	1	1	1	1	1	1	2	2	2	1	2	1	1	1	2																																												
F1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																												
F2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																												
G1	1	1	2	2	2	1	1	2	2	2	2	2	1	1	1	1																																												
G2	1	1	1	2	1	1	1	2	2	2	2	2	1	1	2	2																																												
H1	1	1	2	2	2	2	1	2	2	2	2	1	1	1	1	2																																												
H2	1	1	2	1	1	1	1	2	2	2	1	2	1	1	1	2																																												
I1	1	1	2	2	1	2	1	2	2	2	2	1	1	2	2	2																																												
I2	1	1	2	2	1	1	1	2	2	2	2	2	1	2	1	2																																												
J1	1	1	2	2	1	1	1	2	3	2	2	2	1	1	2	4																																												
J2	1	1	2	2	1	1	1	2	2	2	1	2	1	1	1	1																																												
K1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	2																																												
K2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																												
L1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2																																												
L2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2																																												
M1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																												
M2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																												
N1	1	1	1	2	2	2	1	2	2	2	2	1	1	1	1	2																																												
N2	1	1	1	1	1	1	1	2	2	2	2	2	1	1	1	1																																												
O1	1	1	2	1	1	1	1	2	2	2	2	1	1	1	1	2																																												
O2	1	1	1	1	1	1	1	2	2	2	2	1	1	1	1	2																																												
P1	1	1	1	1	1	1	1	1	2	2	1	1	1	1	1	1																																												
P2	1	1	2	2	1	1	1	1	2	1	1	1	1	1	1	1																																												
Q1	2	2	2	2	2	2	1	2	2	2	2	2	1	2	1	1																																												
Q2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2																																												
S1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																												
S2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																												
R1	1	3	2	2	5																																																							
R2	1	2	2	1	1	1	2	3	2	1	2	1	3	2	2	2																																												
Clinical	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	D																																											

Agreement results matrix for case 21

REVIEWER	A1	A2	B1	B2	C1	C2	D1	D2	E1	E2	F1	F2	G1	G2	H1	H2	I1	I2	J1	J2	K1	K2	L1	L2	M1	M2	N1	N2	O1	O2	P1	P2	Q1	Q2	S1	S2	R1	R2
A1	100	67	70	68	65	68	66	66	67	68	64	64	70	70	68	69	69	71	89	70	65	64	63	63	64	64	68	69	69	68	67	67	68	65	64	64	13	57
A2	67	100	94	96	93	99	97	100	100	99	95	95	93	96	94	98	94	95	58	96	99	95	96	96	95	95	96	97	99	100	99	96	87	83	95	95	13	65
B1	70	94	100	96	95	96	95	95	94	95	93	93	99	96	96	97	94	97	60	99	93	93	92	92	93	93	96	97	98	96	96	96	94	87	93	93	16	64
B2	68	96	96	100	95	99	93	96	96	95	92	92	97	97	99	97	97	96	59	97	95	92	93	93	92	92	99	93	97	96	95	98	93	89	92	92	16	65
C1	65	93	95	95	100	96	97	95	93	92	98	98	93	90	92	94	90	91	55	95	96	98	97	97	98	98	91	91	93	92	96	99	88	79	98	98	16	61
C2	68	99	96	99	96	100	97	99	99	97	96	96	96	97	97	98	96	96	59	97	99	96	97	97	96	96	97	95	98	98	98	98	89	84	96	96	15	64
D1	66	97	95	93	97	97	100	99	97	96	99	99	92	92	91	95	90	92	56	95	98	99	98	98	99	99	93	96	95	96	100	97	86	78	99	99	13	62
D2	66	100	95	96	95	99	99	100	100	99	97	97	93	96	94	97	94	94	58	95	100	97	98	98	97	97	95	96	98	99	99	96	87	81	97	97	13	64
E1	67	100	94	96	93	99	97	100	100	99	95	95	93	96	94	98	94	95	58	96	99	95	96	96	95	95	96	97	99	100	99	96	87	83	95	95	13	65
E2	68	99	95	95	92	97	96	99	99	100	94	94	94	97	94	99	94	96	59	97	98	94	95	95	94	94	95	98	98	99	97	95	88	85	94	94	13	65
F1	64	95	93	92	98	96	99	97	95	94	100	100	90	90	89	93	88	89	54	93	98	100	99	99	100	100	90	93	93	94	98	97	83	75	100	100	13	60
F2	64	95	93	92	98	96	99	97	95	94	100	100	90	90	89	93	88	89	54	93	98	100	99	99	100	100	90	93	93	94	98	97	83	75	100	100	13	60
G1	70	93	99	97	93	96	92	93	93	94	90	90	100	96	98	96	94	97	60	99	91	90	89	89	90	90	98	96	96	95	94	95	96	90	90	90	16	63
G2	70	96	96	97	90	97	92	96	96	97	90	90	96	100	97	98	98	99	61	96	94	90	92	92	90	90	97	96	98	98	94	93	91	90	90	90	15	66
H1	68	94	96	99	92	97	91	94	94	94	89	89	98	97	100	95	97	96	59	96	92	89	90	90	89	89	100	93	96	95	93	94	95	91	89	89	17	64
H2	69	98	97	97	94	98	95	97	98	99	93	93	96	98	95	100	96	97	60	99	97	93	94	94	93	93	96	97	99	98	96	97	91	88	93	93	15	66
I1	69	94	94	97	90	96	90	94	94	94	88	88	94	98	97	96	100	97	60	94	92	88	90	90	88	88	96	92	96	95	92	92	93	93	88	88	16	68
I2	71	95	97	96	91	96	92	94	95	96	89	89	97	99	96	97	97	100	61	97	93	89	90	90	89	89	96	96	98	96	93	94	94	92	89	89	16	67
J1	89	58	60	59	55	59	56	58	58	59	54	54	60	61	59	60	60	61	100	60	57	54	55	55	54	54	59	59	60	59	57	58	57	56	54	54	12	70
J2	70	96	99	97	95	97	95	95	96	97	93	93	99	96	96	99	94	97	60	100	95	93	92	92	93	93	96	97	98	96	96	98	93	87	93	93	16	65
K1	65	99	93	95	96	99	98	100	99	98	98	98	91	94	92	97	92	93	57	95	100	98	99	99	98	98	94	95	96	97	99	97	85	80	98	98	13	64
K2	64	95	93	92	98	96	99	97	95	94	100	100	90	90	89	93	88	89	54	93	98	100	99	99	100	100	90	93	93	94	98	97	83	75	100	100	13	60
L1	63	96	92	93	97	97	98	98	96	95	99	99	89	92	90	94	90	90	55	92	99	99	100	100	99	99	91	92	94	95	97	96	82	77	99	99	13	62
L2	63	96	92	93	97	97	98	98	96	95	99	99	89	92	90	94	90	90	55	92	99	99	100	100	99	99	91	92	94	95	97	96	82	77	99	99	13	62
M1	64	95	93	92	98	96	99	97	95	94	100	100	90	90	89	93	88	89	54	93	98	100	99	99	100	100	90	93	93	94	98	97	83	75	100	100	13	60
M2	64	95	93	92	98	96	99	97	95	94	100	100	90	90	89	93	88	89	54	93	98	100	99	99	100	100	90	93	93	94	98	97	83	75	100	100	13	60
N1	68	96	96	99	91	97	93	95	96	95	90	90	98	97	100	96	96	96	59	96	94	90	91	91	90	90	100	95	96	96	94	94	93	90	90	90	16	64
N2	69	97	97	93	91	95	96	96	97	98	93	93	96	96	93	97	92	96	59	97	95	93	92	92	93	93	95	100	97	99	97	94	90	84	93	93	13	64
O1	69	99	98	97	93	98	95	98	99	98	93	93	96	98	96	99	96	98	60	98	96	93	94	94	93	93	96	97	100	99	97	96	91	87	93	93	15	66
O2	68	100	96	96	92	98	96	99	100	99	94	94	95	98	95	98	95	96	59	96	97	94	95	95	94	94	96	99	99	100	98	94	89	84	94	94	13	65
P1	67	99	96	95	96	98	100	99	99	97	98	98	94	94	93	96	92	93	57	96	99	98	97	97	98	98	94	97	97	98	100	97	88	79	98	98	13	63
P2	67	96	96	98	99	98	97	96	96	95	97	97	95	93	94	97	92	94	58	98	97	97	96	96	97	97	94	94	96	94	97	100	90	82	97	97	16	63
Q1	68	87	94	93	88	89	86	87	87	88	83	83	96	91	95	91	93	94	57	93	85	83	82	82	83	83	93	90	91	89	88	90	100	95	83	83	16	64
Q2	65	83	87	89	79	84	78	81	83	85	75	75	90	90	91	88	93	92	56	87	80	75	77	77	75	75	90	84	87	84	79	82	95	100	75	75	16	65
S1	64	95	93	92	98	96	99	97	95	94	100	100	90	90	89	93	88	89	54	93	98	100	99	99	100	100	90	93	93	94	98	97	83	75	100	100	13	60
S2	64	95	93	92	98	96	99	97	95	94	100	100	90	90	89	93	88	89	54	93	98	100	99	99	100	100	90	93	93	94	98	97	83	75	100	100	13	60
R1	13	13	16	16	16	15	13	13	13	13	13	13	16	15	17	15	16	16	12	16	13	13	13	13	13	13	16	13	15	13	13	16	16	16	13	13	100	16
R2	57	65	64	65	61	64	62	64	65	65	60	60	63	66	64	66	68	67	70	65	64	60	62	62	60	60	64	64	66	65	63	63	64	65	60	60	16	100

Case 22 237

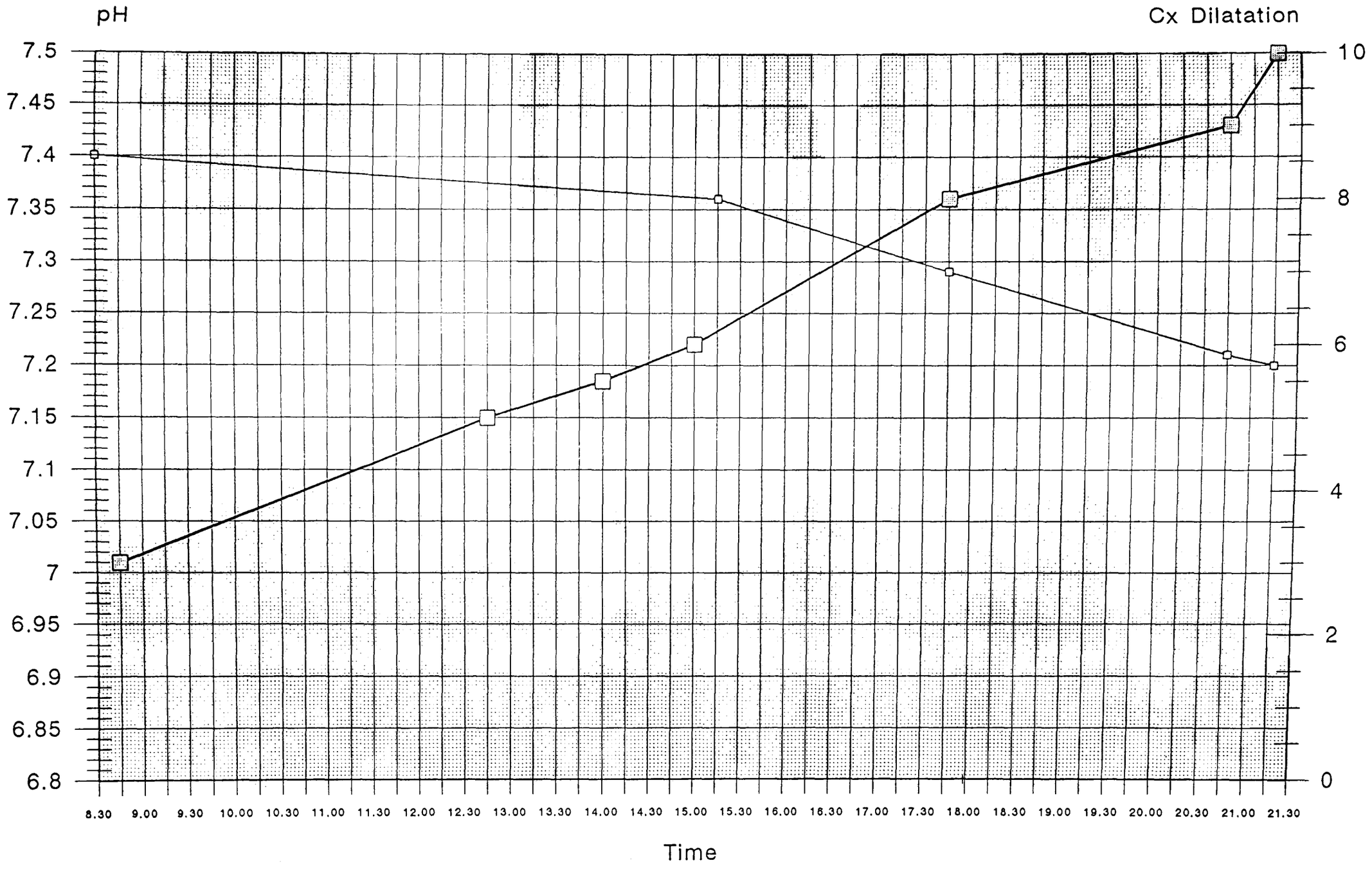
Mrs C.H. is a 26 year old primigravida; a fit lady, and a nonsmoker. Her pregnancy was straightforward and she laboured spontaneously at 41 weeks. She was admitted on 17/8/90 at 08.50hrs in early labour. Cephalic 3/5. VE Cx 3cm dilated, 50% effaced. Station -2.

Labour events

10.00	SROM; clear liquor.
10.15	Pethidine 100mg, phenergan 25mg im.
12.40	VE Cx 5cm dilated, fully effaced & thin. Station -1. FSE applied.
13.30	Epidural.
13.50	Change of maternal position.
13.55	VE Cx 5-6cm dilated. Station -1. LOA position.
14.30	Hypotensive (BP 90/60). IV fluids increased.
14.55	VE Cx 6cm dilated. Station -1.
15.20	FBS; pH 7.36 BE -6
15.45	Top up. Syntocinon started.
17.45	VE Cx 8cm dilated. Station 0.
	FBS; pH 7.29 BE -4
18.05	Top up.
20.00	Top up.
20.45	VE Cx 9cm dilated. Station +1. OA position.
	FBS; pH 7.21 BE -3.5
21.15	VE Cx fully dilated. Head low & descending well with pushing.
21.20	Normal delivery of male infant.

Outcome

Birth weight 3.54kg
Apgar 5 & 9
Cord gases pH 7.20 / 7.24 BD(ecf) 4 / 6


pH
Cx Dilatation
7.5
7.45
7.4
7.35
7.3
7.25
7.2
7.15
7.1
7.05
7
6.95
6.9
6.85
6.8
10
8
6
4
2
0
8.30
9.00
9.30
10.00
10.30
11.00
11.30
12.00
12.30
13.00
13.30
14.00
14.30
15.00
15.30
16.00
16.30
17.00
17.30
18.00
18.30
19.00
19.30
20.00
20.30
21.00
21.30
Time
pH
Cx Dilatation (cm)

Case 22

SEGMENT

REVIEWER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
A1	1	1	1	2	2	2	2	1	2	2	1	2	2	1	2	2	2	2	2	1																																								
A2	1	1	1	2	2	2	2	1	1	2	2	1	2	1	2	1	1	1	1	1																																								
B1	2	2	3	4	4	4	3	2	4	4	3	2	4	4	5																																													
B2	2	2	2	3	4	4	4	3	2	2	2	2	3	2	4	4	2	3	6																																									
C1	2	2	2	3	1	2	2	1	1	2	2	2	2	1	1	1	1	1	1	1																																								
C2	2	2	2	3	1	1	1	3	1	1	1	1	2	1	1	1	1	1	1	1																																								
D1	1	1	1	1	1	2	1	1	1	1	1	1	2	1	1	1	1	1	1	1																																								
D2	1	1	1	2	2	2	2	1	1	1	2	2	2	2	2	2	1	1	1	1																																								
E1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	2	2	1																																								
E2	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1																																								
F1	2	2	2	2	2	3	2	2	2	2	3	2	2	2	2	2	2	2	2	2																																								
F2	2	2	3	2	2	2	2	2	3	2	2	2	3	2	2	1	2	2	2	2																																								
G1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	1																																								
G2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2																																								
H1	3	4	4	3	5																																																							
H2	2	2	3	2	2	2	2	2	2	2	3	2	2	1	3	5																																												
I1	2	2	2	2	3	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2																																								
I2	2	2	2	2	3	2	2	1	2	2	2	2	2	1	2	2	2	2	1	1																																								
J1	2	2	2	2	3	2	2	2	2	3	2	2	2	2	2	2	2	2	2	2																																								
J2	1	1	1	2	2	3	1	1	1	1	2	2	3	2	2	2	2	2	1	1																																								
K1	1	1	1	1	2	3	2	2	2	3	2	2	3	1	1	1	2	2	2	2																																								
K2	1	1	1	1	2	2	2	1	1	1	1	1	2	1	1	1	1	1	1	1																																								
L1	2	2	2	2	2	2	2	2	2	2	2	2	3	2	2	3	2	2	6																																									
L2	1	1	1	1	2	2	2	1	1	2	1	1	2	1	2	2	1	1	1	1																																								
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M2	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2																																								
N1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2																																								
N2	2	2	2	3	2	2	2	2	3	2	2	2	2	2	2	2	2	2	2	2																																								
O1	1	1	2	2	2	3	2	1	2	2	2	3	2	1	2	1	1	2	1	1																																								
O2	1	1	1	2	2	2	2	1	1	1	1	2	2	1	2	1	1	1	1	1																																								
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P2	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2																																								
Q1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2																																								
Q2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2																																								
S1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1																																								
S2	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1																																								
R1	1	2	2	2	1	1	1	1	1	1	1	1	2	1	2	2	1	1	2	1																																								
R2	1	2	1	1	2	4	1	1	1	1	2	2	2	2	3	1	2	1	4	1																																								
Clinical	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	D																																							

Agreement results matrix for case 22

REVIEWER	A1	A2	B1	B2	C1	C2	D1	D2	E1	E2	F1	F2	G1	G2	H1	H2	I1	I2	J1	J2	K1	K2	L1	L2	M1	M2	N1	N2	O1	O2	P1	P2	Q1	Q2	S1	S2	R1	R2
A1	100	95	10	21	76	64	91	95	96	97	70	61	95	95	2	33	81	82	70	72	63	92	61	96	97	97	93	70	72	94	68	80	93	93	88	88	92	50
A2	95	100	9	19	81	68	96	98	95	92	65	58	96	89	2	32	76	79	65	70	60	97	56	99	91	91	88	65	73	98	67	75	88	88	93	93	93	51
B1	10	9	100	75	26	36	8	10	10	10	41	43	10	11	39	64	27	27	39	38	44	9	24	9	10	10	11	37	40	9	38	17	11	11	8	8	9	45
B2	21	19	75	100	36	45	17	20	22	22	47	54	21	23	39	51	42	42	46	52	53	18	51	19	22	22	23	47	49	19	49	25	23	23	17	17	19	72
C1	76	81	26	36	100	85	79	79	79	76	74	72	78	76	31	44	91	94	79	74	66	80	51	79	73	73	76	81	78	80	85	75	76	76	77	77	79	55
C2	64	68	36	45	85	100	71	66	64	61	73	79	63	61	29	43	80	83	82	73	70	69	42	68	59	59	61	88	73	69	74	62	61	61	70	70	71	53
D1	91	96	8	17	79	71	100	93	87	84	59	53	89	81	1	29	70	73	59	68	58	99	50	97	83	83	79	59	68	97	65	67	79	79	99	99	94	51
D2	95	98	10	20	79	66	93	100	95	94	66	59	97	91	2	32	77	79	67	73	59	95	58	97	93	93	89	67	72	98	66	76	89	89	91	91	92	52
E1	96	95	10	22	79	64	87	95	100	98	71	64	98	97	3	34	81	81	71	69	63	90	62	92	97	97	95	71	73	93	70	82	95	95	85	85	89	50
E2	97	92	10	22	76	61	84	94	98	100	72	63	97	99	3	34	82	82	72	71	62	86	63	91	99	99	97	72	72	91	68	83	97	97	82	82	88	49
F1	70	65	41	47	74	73	59	66	71	72	100	78	69	74	17	48	86	84	96	87	91	61	65	65	72	72	75	87	93	64	84	66	75	75	57	57	65	51
F2	61	58	43	54	72	79	53	59	64	63	78	100	61	65	30	59	72	70	85	76	84	55	67	57	63	63	65	88	76	57	87	72	65	65	51	51	57	53
G1	95	96	10	21	78	63	89	97	98	97	69	61	100	94	2	33	78	80	69	70	61	91	60	96	95	95	92	69	72	95	66	79	92	92	87	87	88	50
G2	95	89	11	23	76	61	81	91	97	99	74	65	94	100	4	34	84	82	74	68	62	83	64	88	98	98	99	74	70	88	70	85	99	99	79	79	88	48
H1	2	2	39	39	31	29	1	2	3	3	17	30	2	4	100	24	25	25	24	15	14	2	4	2	2	2	4	29	16	2	28	29	4	4	0	0	3	24
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I2	82	79	27	42	94	83	73	79	81	82	84	70	80	82	25	42	98	100	86	82	72	75	56	79	80	80	82	84	84	78	83	72	82	82	71	71	78	57
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L1	61	56	24	51	51	42	50	58	62	63	65	67	60	64	4	52	57	56	58	69	66	52	100	56	63	63	65	52	66	55	71	58	65	65	49	49	56	66
L2	96	99	9	19	79	68	97	97	92	91	65	57	96	88	2	31	75	79	65	71	60	98	56	100	91	91	87	65	71	98	66	74	87	87	95	95	93	51
M1	97	91	10	22	73	59	83	93	97	99	72	63	95	98	2	33	82	80	72	70	63	86	63	91	100	100	97	72	70	89	68	83	97	97	81	81	86	49
M2	97	91	10	22	73	59	83	93	97	99	72	63	95	98	2	33	82	80	72	70	63	86	63	91	100	100	97	72	70	89	68	83	97	97	81	81	86	49
N1	93	88	11	23	76	61	79	89	95	97	75	65	92	99	4	35	85	82	75	67	61	82	65	87	97	97	100	75	69	86	71	86	100	100	77	77	87	48
N2	70	65	37	47	81	88	59	67	71	72	87	88	69	74	29	51	86	84	96	70	78	61	52	65	72	72	75	100	75	64	76	73	75	75	56	56	64	50
O1	72	73	40	49	78	73	68	72	73	72	93	76	72	70	16	48	82	84	87	95	92	69	66	71	70	70	69	75	100	72	88	61	69	69	66	66	69	59
O2	94	98	9	19	80	69	97	98	93	91	64	57	95	88	2	32	75	78	64	71	59	98	55	98	89	89	86	64	72	100	66	73	86	86	95	95	94	52
P1	68	67	38	49	85	74	65	66	70	68	84	87	66	70	28	56	84	83	81	86	84	64	71	66	68	68	71	76	88	66	100	70	71	71	64	64	69	60
P2	80	75	17	25	75	62	67	76	82	83	66	72	79	85	29	42	74	72	66	59	54	69	58	74	83	83	86	73	61	73	70	100	86	86	65	65	74	43
Q1	93	88	11	23	76	61	79	89	95	97	75	65	92	99	4	35	85	82	75	67	61	82	65	87	97	97	100	75	69	86	71	86	100	100	77	77	87	48
Q2	93	88	11	23	76	61	79	89	95	97	75	65	92	99	4	35	85	82	75	67	61	82	65	87	97	97	100	75	69	86	71	86	100	100	77	77	87	48
S1	88	93	8	17	77	70	99	91	85	82	57	51	87	79	0	28	67	71	57	67	56	97	49	95	81	81	77	56	66	95	64	65	77	77	100	100	95	51
S2	88	93	8	17	77	70	99	91	85	82	57	51	87	79	0	28	67	71	57	67	56	97	49	95	81	81	77	56	66	95	64	65	77	77	100	100	95	51
R1	92	93	9	19	79	71	94	92	89	88	65	57	88	88	3	30	76	78	65	69	56	93	56	93	86	86	87	64	69	94	69	74	87	87	95	95	100	51
R2	50	51	45	72	55	53	51	52	50	49	51	53	50	48	24	44	56	57	50	66	58	51	66	51	49	49	48	50	59	52	60	43	48	48	51	51	51	100

Case 23 1222

Mrs M.D. is a 29 year old primigravida. She is a fit lady and does not smoke. She required several admissions for hyperemesis in the first 16 weeks, and continued to be troubled with vomiting throughout the whole of her pregnancy. However, she gained weight normally and fetal growth was judged to be adequate both on clinical assessment and by ultrasound. She was admitted in spontaneous labour at 42 weeks on 21/3/91 at 23.30hrs. Uterus term size. Cephalic 3/5. VE (at 00.15hrs) Cx 2cm dilated, fully effaced & thin. Station -2.

Labour events

Note; mild maternal pyrexia from 03.30 to 07.00 (37.5 - 37.8°C).

01.50	VE Cx 3cm dilated, thin.
02.05	Epidural begun.
02.40	Epidural complete.
03.00	VE Cx 5cm dilated. Station -2. ARM; no liquor seen. Caput ++.
05.00	VE Cx 5cm dilated. Station -2.
05.20	Hypotensive (BP 75/40). IV fluids increased.
05.30	Top up.
06.00	Vomiting.
06.30	Vomiting.
07.45	VE Cx 5cm dilated. Station -2. ROP position.
08.00	Syntocinon started. Top up. Maternal hypotension during top up (BP 90/55). IV fluids increased.
09.15	Vomiting.
10.10	Top up.
11.10	Vomiting.
11.20	VE Cx 9cm dilated. Station -1. Direct OP position. Caput +. FSE reapplied. Syntocinon stopped.
11.30	Top up.
11.55	FBS; pH 7.35 BE -2
12.00	Syntocinon started.
13.30	Vomiting.
13.35	VE Cx 8-9cm dilated, thick. Direct OP position. Station -1.
14.00	Decision for C/S.
14.15	Top up.
15.17	Male delivered by emergency C/S under epidural. Indication; failure to progress in first stage of labour; OP position. Thick meconium noted at operation.

Outcome

Birth weight 3.56kg
Apgar 8 & 9
Cord gases pH 7.30 / 7.37 BD(ecf) 0 / 0

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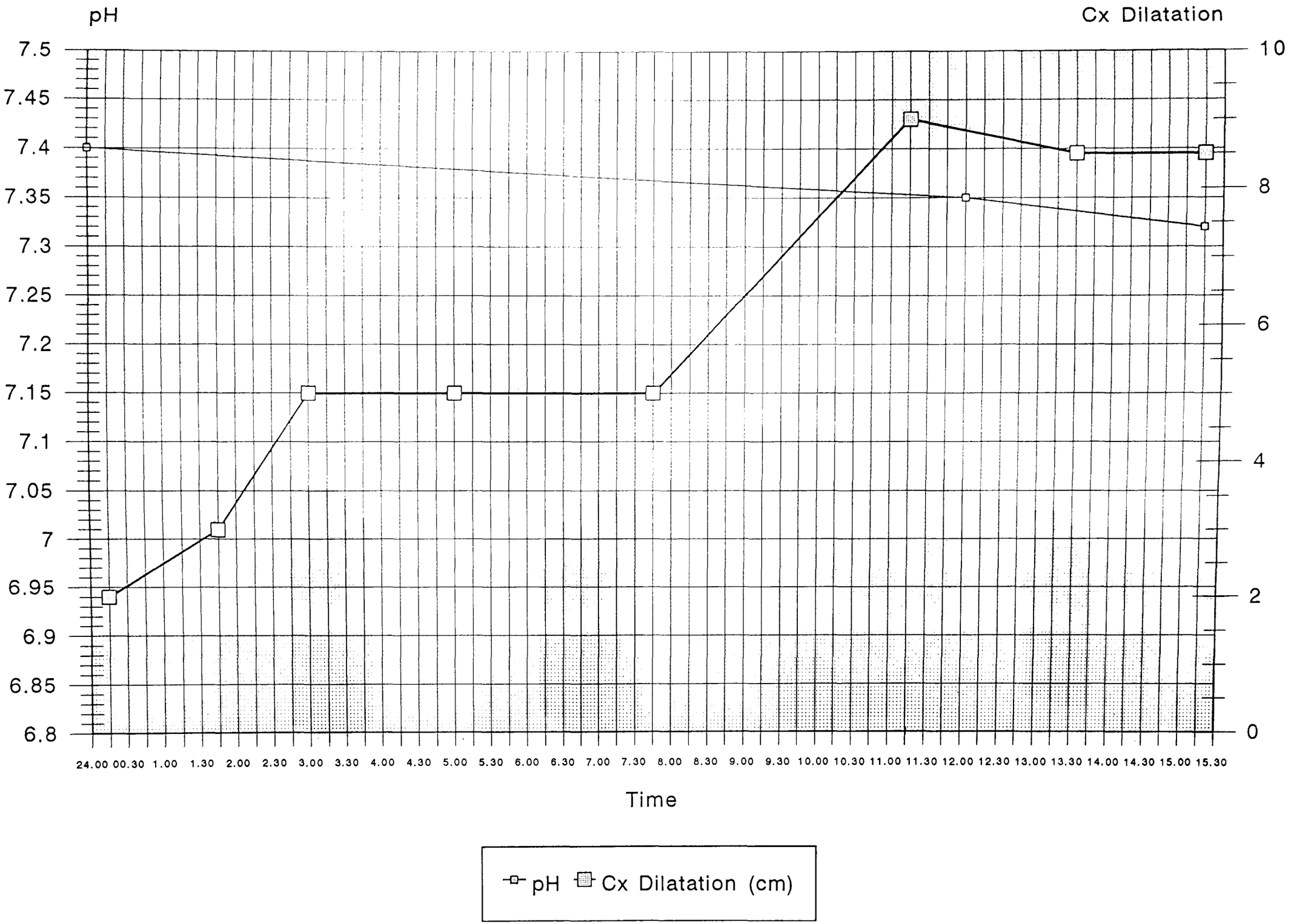
Apgar 8 & 9
Cord gases pH 7.30 / 7.37 BD(ecf) 0 / 0


pH
Cx Dilatation
7.5
7.45
7.4
7.35
7.3
7.25
7.2
7.15
7.1
7.05
7
6.95
6.9
6.85
6.8
10
8
6
4
2
0
24.00 00.30 1.00 1.30 2.00 2.30 3.00 3.30 4.00 4.30 5.00 5.30 6.00 6.30 7.00 7.30 8.00 8.30 9.00 9.30 10.00 10.30 11.00 11.30 12.00 12.30 13.00 13.30 14.00 14.30 15.00 15.30
Time
pH
Cx Dilatation (cm)

Case 23

SEGMENT

REVIEWER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
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B2	1	2	2	2	3	1	2	2	2	1	1	1	2	2	2	2	2	1	3	1	1	2	2	1	1	1	1	1	1	1	2	2	1	2	2	2	2	2	3	1	2	2	1	1	1	1	2	3	2	2	2	2								
C1	1	2	2	2	2	2	2	3	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	3	1	1	2	2	2	2	2	1	1	2	2	2	2	2	1	2								
C2	2	2	2	2	2	2	2	2	1	1	2	1	1	1	1	2	1	2	2	1	1	1	1	2	2	2	2	2	2	1	1	2	2	3	1	2	2	3	2	2	1	2	2	1	2	2	2	3	2	2	2	2								
D1	1	1	2	2	2	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	2	1	1	1								
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S1	1	1	1	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	2	2	1	1	1	1	1	2	2	2	2	1	1	1	2	1	2	2	1	1								
S2	1	1	1	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	2	2	2	2	1	1	1	2	1	2	2	1	1								
R1	3	2	1	1	2	1	2	2	1	1	1	1	2	1	2	1	2	2	1	2	1	1	2	1	2	2	2	1	1	2	2	2	2	2	1	2	1	2	1	1	2	2	1	4	2	2	2	1	1	1	2	4								
R2	2	2	2	1	2	2	2	1	3	2	1	5																																																
Clinical	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	n	n	5					

Agreement results matrix for case 23

REVIEWER	A1	A2	B1	B2	C1	C2	D1	D2	E1	E2	F1	F2	G1	G2	H1	H2	I1	I2	J1	J2	K1	K2	L1	L2	M1	M2	N1	N2	O1	O2	P1	P2	Q1	Q2	S1	S2	R1	R2
A1	100	83	75	79	68	77	60	73	79	79	64	66	79	75	80	79	76	81	77	81	62	69	71	77	74	78	79	75	68	72	69	72	10	3	63	62	62	17
A2	83	100	83	80	83	81	75	89	84	81	79	82	85	86	80	83	89	95	80	80	77	84	78	86	85	91	90	79	73	87	81	85	10	3	78	78	64	20
B1	75	83	100	95	76	82	78	78	83	76	74	77	76	71	78	87	78	80	73	70	72	78	67	75	70	73	74	75	78	75	69	73	17	13	75	74	64	18
B2	79	80	95	100	74	80	79	74	83	80	75	77	79	73	82	91	75	78	75	70	71	77	71	74	72	72	72	75	75	71	72	74	18	14	73	73	59	17
C1	68	83	76	74	100	81	88	88	78	75	76	76	77	77	72	73	85	82	70	68	78	77	73	82	76	84	79	69	68	84	87	82	11	16	85	86	63	30
C2	77	81	82	80	81	100	72	83	74	82	68	68	84	79	81	75	82	81	83	73	69	69	83	81	77	84	80	76	69	81	76	79	2	3	75	75	62	19
D1	60	75	78	79	88	72	100	84	71	76	83	83	74	78	65	79	76	73	67	61	83	82	68	75	78	75	69	65	67	75	85	82	11	16	91	90	66	24
D2	73	89	78	74	88	83	84	100	74	80	81	81	82	83	69	73	88	87	74	70	82	83	77	86	82	90	85	74	71	85	79	85	2	3	86	85	67	21
E1	79	84	83	83	78	74	71	74	100	79	64	66	81	74	82	90	78	81	76	75	62	68	77	74	73	79	79	77	74	74	79	72	22	20	64	64	62	23
E2	79	81	76	80	75	82	76	80	79	100	74	74	98	93	73	88	82	83	87	73	75	77	87	84	92	87	83	87	74	78	86	90	2	3	81	80	67	21
F1	64	79	74	75	76	68	83	81	64	74	100	99	72	76	57	73	72	71	64	62	86	97	67	72	77	73	68	63	64	73	73	81	7	2	90	90	66	19
F2	66	82	77	77	76	68	83	81	66	74	99	100	71	76	60	75	72	75	64	63	86	97	67	72	76	73	68	63	63	73	72	80	9	2	89	89	66	19
G1	79	85	76	79	77	84	74	82	81	98	72	71	100	94	76	86	84	86	89	74	73	74	86	87	93	91	87	89	75	77	87	90	2	3	78	78	67	21
G2	75	86	71	73	77	79	78	83	74	93	76	76	94	100	71	81	85	87	83	69	78	79	81	84	99	93	89	84	70	82	92	95	2	3	83	83	70	22
H1	80	80	78	82	72	81	65	69	82	73	57	60	76	71	100	82	77	80	81	73	62	62	74	72	71	76	79	84	76	75	73	68	19	15	60	60	63	19
H2	79	83	87	91	73	75	79	73	90	88	73	75	86	81	82	100	77	79	82	75	71	78	78	76	80	76	76	81	75	73	80	80	18	15	73	73	62	19
I1	76	89	78	75	85	82	76	88	78	82	72	72	84	85	77	77	100	97	86	80	84	73	79	85	84	91	96	85	79	95	81	83	11	3	80	79	65	20
I2	81	95	80	78	82	81	73	87	81	83	71	75	86	87	80	79	97	100	86	81	82	77	79	86	86	93	98	86	79	94	81	85	11	2	77	77	64	19
J1	77	80	73	75	70	83	67	74	76	87	64	64	89	83	81	82	86	86	100	86	76	66	85	79	83	82	88	90	77	83	78	80	11	3	71	71	61	19
J2	81	80	70	70	68	73	61	70	75	73	62	63	74	69	73	75	80	81	86	100	69	66	72	72	69	74	81	77	69	78	67	70	26	3	63	63	57	16
K1	62	77	72	71	78	69	83	82	62	75	86	86	73	78	62	71	84	82	76	69	100	87	67	72	79	75	80	75	73	86	75	82	11	3	89	90	66	20
K2	69	84	78	77	77	69	82	83	68	77	97	97	74	79	62	78	73	77	66	66	87	100	67	73	78	75	70	66	65	75	75	84	9	2	89	89	66	20
L1	71	78	67	71	73	83	68	77	77	87	67	67	86	81	74	78	79	79	85	72	67	67	100	86	82	85	80	77	74	77	76	79	1	2	73	73	61	18
L2	77	86	75	74	82	81	75	86	74	84	72	72	87	84	72	76	85	86	79	72	72	73	86	100	84	89	85	78	81	80	79	86	2	2	80	79	63	20
M1	74	85	70	72	76	77	78	82	73	92	77	76	93	99	71	80	84	86	83	69	79	78	82	84	100	93	88	82	69	81	91	94	1	2	84	83	70	21
M2	78	91	73	72	84	84	75	90	79	87	73	73	91	93	76	76	91	93	82	74	75	75	85	89	93	100	94	81	72	87	86	88	2	2	80	80	67	20
N1	79	90	74	72	79	80	69	85	79	83	68	68	87	89	79	76	96	98	88	81	80	70	80	85	88	94	100	88	78	93	82	84	11	3	74	74	63	19
N2	75	79	75	75	69	76	65	74	77	87	63	63	89	84	84	81	85	86	90	77	75	66	77	78	82	81	88	100	86	79	77	80	11	3	69	69	67	19
O1	68	73	78	75	68	69	67	71	74	74	64	63	75	70	76	75	79	79	77	69	73	65	74	81	69	72	78	86	100	75	66	71	16	11	66	66	67	17
O2	72	87	75	71	84	81	75	85	74	78	73	73	77	82	75	73	95	94	83	78	86	75	77	80	81	87	93	79	75	100	77	82	11	3	82	82	64	19
P1	69	81	69	72	87	76	85	79	79	86	73	72	87	92	73	80	81	81	78	67	75	75	76	79	91	86	82	77	66	77	100	89	11	17	82	81	67	32
P2	72	85	73	74	82	79	82	85	72	90	81	80	90	95	68	80	83	85	80	70	82	84	79	86	94	88	84	80	71	82	89	100	2	3	88	89	69	22
Q1	10	10	17	18	11	2	11	2	22	2	7	9	2	2	19	18	11	11	11	26	11	9	1	2	1	2	11	11	16	11	11	2	100	71	2	2	4	27
Q2	3	3	13	14	16	3	16	3	20	3	2	2	3	3	15	15	3	2	3	3	3	2	2	2	2	2	3	3	11	3	17	3	71	100	2	2	6	53
S1	63	78	75	73	85	75	91	86	64	81	90	89	78	83	60	73	80	77	71	63	89	89	73	80	84	80	74	69	66	82	82	88	2	2	100	100	70	21
S2	62	78	74	73	86	75	90	85	64	80	90	89	78	83	60	73	79	77	71	63	90	89	73	79	83	80	74	69	66	82	81	89	2	2	100	100	70	21
R1	62	64	64	59	63	62	66	67	62	67	66	66	67	70	63	62	65	64	61	57	66	66	61	63	70	67	63	67	67	64	67	69	4	6	70	70	100	17
R2	17	20	18	17	30	19	24	21	23	21	19	19	21	22	19	19	20	19	19	16	20	20	18	20	21	20	19	19	17	19	32	22	27	53	21	21	17	100

Case 24 1094

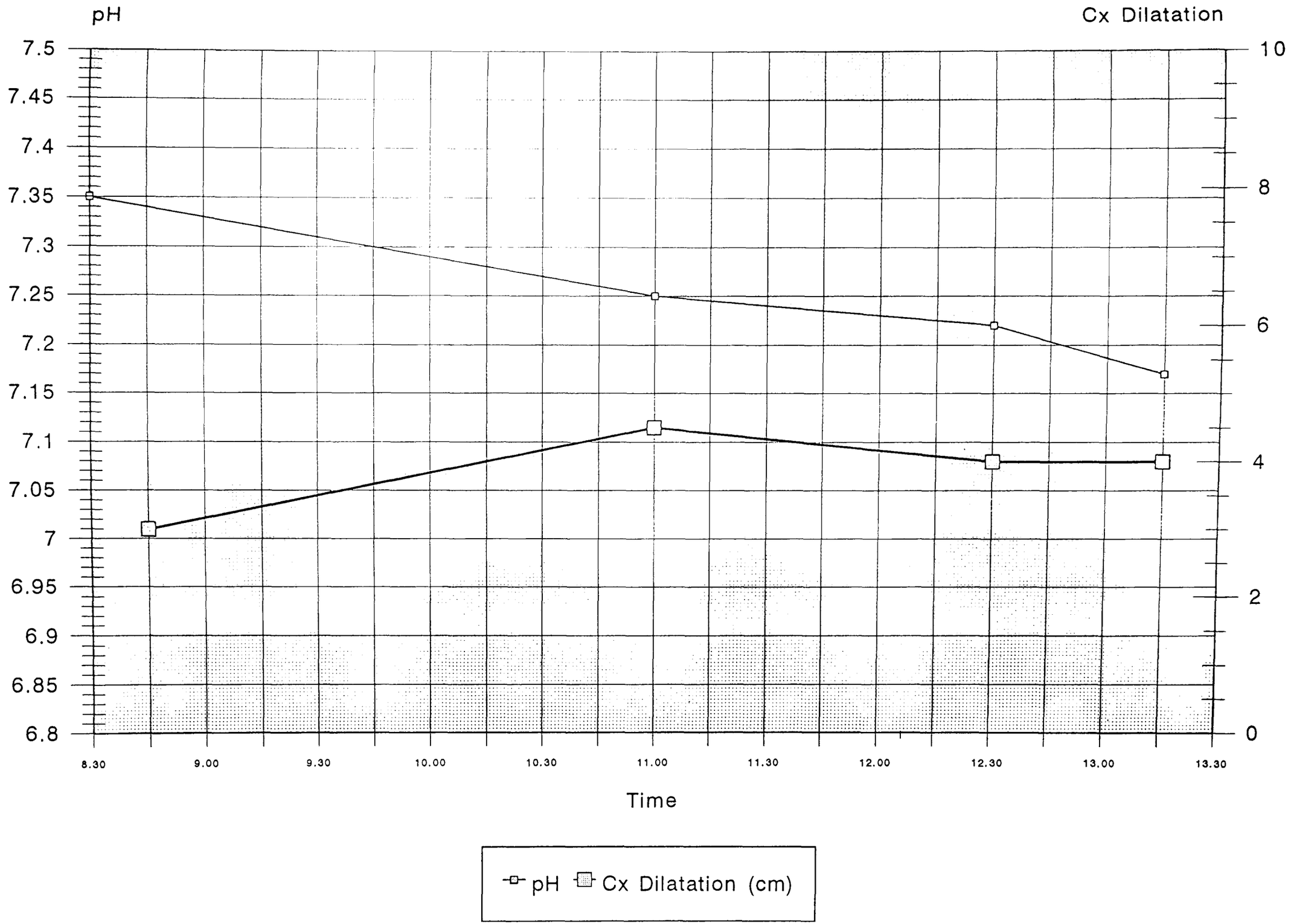
Miss J.D. is a 19 year old primigravida. She is fit and well, and does not smoke. There were no antenatal problems, and spontaneous labour occurred at 41 weeks. She was admitted on 16/2/91 at 08.20hrs in early labour. Her BP was raised at 160/95 and there was 2+ proteinuria. Miss J.D. was asymptomatic and reflexes were normal. The baby was judged to be well grown; cephalic 3/5. VE (at 08.50hrs) Cx 3cm dilated, effaced.Station -3.

Labour events

09.30	In the bath.
10.30	Pethidine 100mg, Phenergan 25mg im.
10.45	Vomiting.
10.50	Maternal oxygen given.
10.55	VE Cx 4-5cm dilated, thin. Station -2. ARM; clear liquor. FSE applied.
11.40	Unsuccessful attempt at FBS. (Head easily pushed out of pelvis)
12.15	Ranitidine 50mg, maxolon 10mg iv.
12.25	VE Cx 4cm dilated. FBS pH 7.22 BE -13
12.35	Decision for C/S.
13.22	Male infant delivered by emergency C/S under GA. Indication; prolonged decelerations at 4cm dilatation.

Outcome

Birth weight 3.47kg
Apgar 6 & 9
Cord gases pH 7.17 / 7.21 BD(ecf) 2 / 4


pH
Cx Dilatation
7.5
7.45
7.4
7.35
7.3
7.25
7.2
7.15
7.1
7.05
7
6.95
6.9
6.85
6.8
10
8
6
4
2
0
8.30
9.00
9.30
10.00
10.30
11.00
11.30
12.00
12.30
13.00
13.30
Time
pH
Cx Dilatation (cm)

Case 24

	SEGMENT																																																										
REVIEWER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
A1	1	1	2	1	2	2	2	3	5																																																				
A2	1	2	2	1	2	2	3	2	3	5																																																		
B1	1	2	4	3	4	5																																																						
B2	1	2	4	3	2	4	3	4	5																																																			
C1	1	2	2	1	1	1	2	2	2	3	5																																																	
C2	1	2	2	1	1	2	4	2	3	5																																																		
D1	1	1	3	2	2	2	3	2	5																																																			
D2	1	2	3	2	2	2	3	5																																																				
E1	1	2	3	2	2	2	3	2	5																																																			
E2	1	2	3	2	2	2	3	5																																																				
F1	1	2	3	2	2	1	2	3	2	2	5																																																	
F2	1	1	2	2	2	1	3	4	4	5																																																		
G1	1	2	2	2	2	2	2	3	2	5																																																		
G2	1	1	4	2	2	2	4	4	3	2	5																																																	
H1	1	2	2	2	2	3	5																																																					
H2	1	2	3	5																																																								
I1	1	2	2	2	2	2	2	3	2	3	5																																																	
I2	1	2	2	2	3	2	2	3	2	3	5																																																	
J1	1	1	3	2	2	2	3	2	5																																																			
J2	1	1	3	1	2	2	2	4	3	5																																																		
K1	1	1	3	2	2	3	4	3	4	5																																																		
K2	1	1	2	1	1	1	2	2	3	5																																																		
L1	1	1	3	2	2	2	3	2	2	3	5																																																	
L2	1	1	2	2	2	1	2	3	4	5																																																		
M1	1	1	2	2	1	1	1	2	3	2																																																		
M2	1	2	2	2	2	2	2	3	2	3	5																																																	
N1	1	2	3	2	2	2	4	4	3	4	5																																																	
N2	1	1	2	2	2	2	2	3	4	5																																																		
O1	1	2	3	5																																																								
O2	1	2	3	2	2	2	3	2	2	3	5																																																	
P1	1	2	2	1	1	2	2	2	2	2																																																		
P2	1	2	2	1	2	2	2	2	3	5																																																		
Q1	1	2	4	2	2	2	2	4	4	4																																																		
Q2	2	2	4	2	2	2	2	4	4	4																																																		
S1	1	4	4	1	1	1	2	1	4	4																																																		
S2	1	4	4	1	1	1	2	1	4	4																																																		
R1	2	1	1	2	2	2	4	2	3	1																																																		
R2	1	2	1	2	1	1	1	3	1	1																																																		
Clinical	0	0	0	0	3	0	0	3	0	0	n	5																																																

Agreement results matrix for case 24

REVIEWER	A1	A2	B1	B2	C1	C2	D1	D2	E1	E2	F1	F2	G1	G2	H1	H2	I1	I2	J1	J2	K1	K2	L1	L2	M1	M2	N1	N2	O1	O2	P1	P2	Q1	Q2	S1	S2	R1	R2
A1	100	93	31	74	75	89	91	86	91	86	73	89	94	67	74	8	79	76	91	85	82	93	73	92	49	79	71	93	8	72	30	93	56	55	46	46	57	49
A2	93	100	17	72	89	91	86	73	87	73	86	90	98	75	53	9	93	91	86	87	84	97	88	95	53	93	79	95	9	88	29	98	55	54	46	46	53	52
B1	31	17	100	67	6	30	47	65	47	65	26	26	12	49	76	76	11	26	47	34	42	7	27	15	10	11	39	15	76	27	9	8	52	52	51	51	39	15
B2	74	72	67	100	48	78	85	84	85	84	66	83	69	84	70	35	57	66	85	85	88	65	67	75	29	57	79	75	35	67	12	65	76	76	70	70	56	33
C1	75	89	6	48	100	84	64	43	64	43	88	76	89	72	15	7	97	91	64	79	68	94	88	85	52	97	76	85	7	88	34	93	47	47	43	43	43	44
C2	89	91	30	78	84	100	80	69	80	69	80	92	90	86	52	15	86	84	80	92	89	91	80	92	48	86	89	92	15	80	26	91	62	61	49	49	67	46
D1	91	86	47	85	64	80	100	95	100	95	81	85	87	69	74	25	70	74	100	89	89	83	80	86	40	70	75	86	25	79	26	83	61	60	54	54	49	43
D2	86	73	65	84	43	69	95	100	95	100	60	74	72	56	89	26	51	56	95	78	80	68	60	72	37	51	61	73	26	60	23	69	59	59	50	50	52	41
E1	91	87	47	85	64	80	100	95	100	95	81	85	87	69	74	25	71	75	100	89	88	83	79	86	40	71	75	86	25	80	26	84	61	61	54	54	48	43
E2	86	73	65	84	43	69	95	100	95	100	60	74	72	56	89	26	51	56	95	78	80	68	60	72	37	51	61	73	26	60	23	69	59	59	50	50	52	41
F1	73	86	26	66	88	80	81	60	81	60	100	77	88	80	27	24	91	94	81	87	83	86	96	84	46	91	85	83	24	97	29	86	54	54	52	52	43	45
F2	89	90	26	83	76	92	85	74	85	74	77	100	90	84	57	8	81	81	85	90	93	87	78	98	42	81	88	98	8	77	17	87	70	70	58	58	60	44
G1	94	98	12	69	89	90	87	72	87	72	88	90	100	74	51	8	93	89	87	87	83	97	86	96	50	93	78	96	8	86	32	98	54	54	45	45	50	50
G2	67	75	49	84	72	86	69	56	69	56	80	84	74	100	39	27	77	78	69	89	87	74	80	82	39	77	92	82	27	79	17	74	79	78	74	74	60	37
H1	74	53	76	70	15	52	74	89	74	89	27	57	51	39	100	42	27	32	74	49	58	45	29	52	31	27	41	52	42	29	23	46	46	46	30	30	55	39
H2	8	9	76	35	7	15	25	26	25	26	24	8	8	27	42	100	7	19	25	21	24	7	23	7	11	7	21	7	100	23	13	8	30	30	36	36	21	11
I1	79	93	11	57	97	86	70	51	71	51	91	81	93	77	27	7	100	96	70	81	77	92	93	88	54	100	80	88	7	93	29	93	50	50	43	43	51	51
I2	76	91	26	66	91	84	74	56	75	56	94	81	89	78	32	19	96	100	74	84	82	86	95	85	49	96	83	85	19	95	26	87	53	52	48	48	50	49
J1	91	86	47	85	64	80	100	95	100	95	81	85	87	69	74	25	70	74	100	89	89	83	80	86	40	70	75	86	25	79	26	83	61	60	54	54	49	43
J2	85	87	34	85	79	92	89	78	89	78	87	90	87	89	49	21	81	84	89	100	94	88	86	91	44	81	94	92	21	86	21	88	70	69	62	62	60	41
K1	82	84	42	88	68	89	89	80	88	80	83	93	83	87	58	24	77	82	89	94	100	79	84	91	39	77	93	91	24	84	14	80	72	71	62	62	61	42
K2	93	97	7	65	94	91	83	68	83	68	86	87	97	74	45	7	92	86	83	88	79	100	85	95	54	92	78	95	7	85	32	99	53	53	47	47	49	49
L1	73	88	27	67	88	80	80	60	79	60	96	78	86	80	29	23	93	95	80	86	84	85	100	82	47	93	84	82	23	100	25	85	54	54	52	52	46	44
L2	92	95	15	75	85	92	86	72	86	72	84	98	96	82	52	7	88	85	86	91	91	95	82	100	49	88	87	100	7	82	24	95	67	67	56	56	57	47
M1	49	53	10	29	52	48	40	37	40	37	46	42	50	39	31	11	54	49	40	44	39	54	47	49	100	54	40	47	11	47	71	52	45	44	39	39	75	92
M2	79	93	11	57	97	86	70	51	71	51	91	81	93	77	27	7	100	96	70	81	77	92	93	88	54	100	80	88	7	93	29	93	50	50	43	43	51	51
N1	71	79	39	79	76	89	75	61	75	61	85	88	78	92	41	21	80	83	75	94	93	78	84	87	40	80	100	87	21	84	14	78	76	76	66	66	60	37
N2	93	95	15	75	85	92	86	73	86	73	83	98	96	82	52	7	88	85	86	92	91	95	82	100	47	88	87	100	7	82	24	95	67	67	55	55	57	46
O1	8	9	76	35	7	15	25	26	25	26	24	8	8	27	42	100	7	19	25	21	24	7	23	7	11	7	21	7	100	23	13	8	30	30	36	36	21	11
O2	72	88	27	67	88	80	79	60	80	60	97	77	86	79	29	23	93	95	79	86	84	85	100	82	47	93	84	82	23	100	26	86	55	54	52	52	46	44
P1	30	29	9	12	34	26	26	23	26	23	29	17	32	17	23	13	29	26	26	21	14	32	25	24	71	29	14	24	13	26	100	33	22	21	21	21	45	66
P2	93	98	8	65	93	91	83	69	84	69	86	87	98	74	46	8	93	87	83	88	80	99	85	95	52	93	78	95	8	86	33	100	54	54	46	46	50	48
Q1	56	55	52	76	47	62	61	59	61	59	54	70	54	79	46	30	50	53	61	70	72	53	54	67	45	50	76	67	30	55	22	54	100	100	97	97	65	42
Q2	55	54	52	76	47	61	60	59	61	59	54	70	54	78	46	30	50	52	60	69	71	53	54	67	44	50	76	67	30	54	21	54	100	100	96	96	65	42
S1	46	46	51	70	43	49	54	50	54	50	52	58	45	74	30	36	43	48	54	62	62	47	52	56	39	43	66	55	36	52	21	46	97	96	100	100	47	37
S2	46	46	51	70	43	49	54	50	54	50	52	58	45	74	30	36	43	48	54	62	62	47	52	56	39	43	66	55	36	52	21	46	97	96	100	100	47	37
R1	57	53	39	56	43	67	49	52	48	52	43	60	50	60	55	21	51	50	49	60	61	49	46	57	75	51	60	57	21	46	45	50	65	65	47	47	100	75
R2	49	52	15	33	44	46	43	41	43	41	45	44	50	37	39	11	51	49	43	41	42	49	44	47	92	51	37	46	11	44	66	48	42	42	37	37	75	100

Case 25 2156

Mrs T.T. is a 24 year old primigravida; a fit lady, and a nonsmoker. Her antenatal progress was uneventful until 36 weeks, when she developed mild hypertension without proteinuria. By 39 weeks her BP was 140/100 and she had 3+ proteinuria. She remained asymptomatic, reflexes were just slightly brisk and both haematology and biochemistry results were within normal limits. Fetal size was judged to be appropriate for dates. Labour was induced at 39 weeks using vaginal prostaglandins. Presentation cephalic 4/5; cervix closed, 50% effaced, soft. Prostin gel 2mg was given at 10.00hrs on 6.10.91, and a further 2mg dose at 16.10hrs (Bishop's score being unchanged).

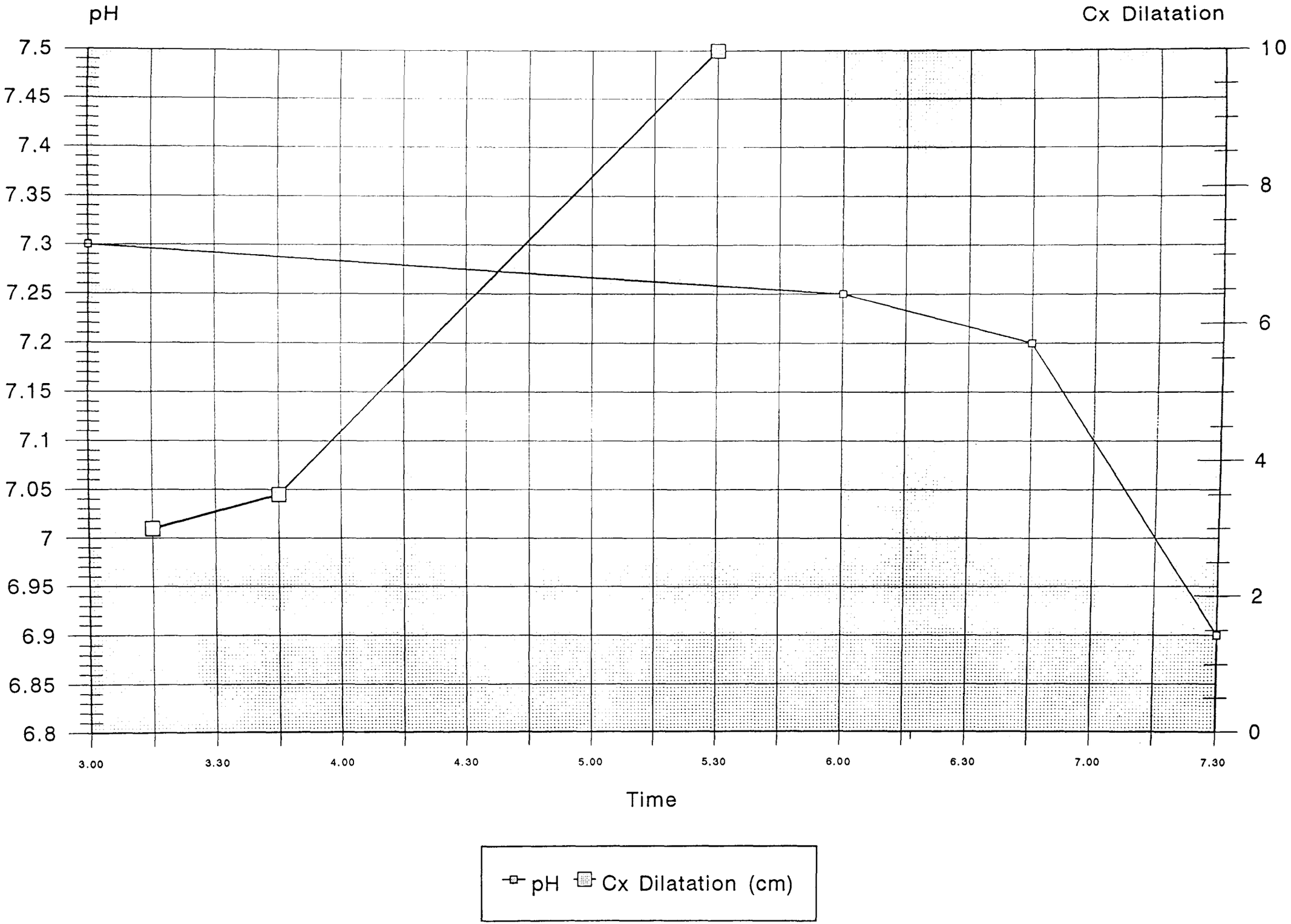
Labour events

Note; BP 120/60 to 140/85 throughout labour.

03.10	SROM; liquor faintly stained with meconium. VE Cx 3cm dilated, thin. Station -1.
03.40	VE Cx 3-4cm dilated. FSE applied.
04.25	Epidural begun.
04.40	Epidural main dose.
05.30	VE Cx fully dilated. Station 0. OA position. "Involuntary pushing".
06.00	Active pushing begun.
06.20	Maternal oxygen. Position changed.
07.29	Episiotomy.
07.30	Normal delivery of male infant.

Outcome

Birth weight 3.00kg
Apgar 6 & 7 (9 at 7 minutes)
Cord gases pH 6.87 / 6.96 BD(ecf) 17 / 18


pH
Cx Dilatation
7.5
7.45
7.4
7.35
7.3
7.25
7.2
7.15
7.1
7.05
7
6.95
6.9
6.85
6.8
10
8
6
4
2
0
3.00
3.30
4.00
4.30
5.00
5.30
6.00
6.30
7.00
7.30
Time
pH
Cx Dilatation (cm)

Case 25

SEGMENT

REVIEWER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
A1	1	1	1	1	2	2	2	2	2	2	4	6																																																	
A2	1	1	1	1	2	2	2	2	2	1	2	4	2	2																																														
B1	1	1	2	2	2	2	2	2	2	2	4	6																																																	
B2	1	1	2	1	2	2	2	2	1	1	2	6																																																	
C1	1	1	1	1	2	2	4	2	2	6																																																		
C2	1	1	1	1	2	2	4	2	2	6																																																		
D1	1	1	2	2	2	2	2	2	2	2	2	6																																																	
D2	1	1	2	2	2	2	2	1	1	1	2	6																																																	
E1	1	1	1	1	2	2	2	2	1	2	2	6																																																	
E2	1	1	1	2	2	2	2	2	2	2	6																																																		
F1	1	1	1	1	1	1	1	1	1	1	1	1	6																																																
F2	1	1	1	1	1	1	1	1	1	1	1	6																																																	
G1	1	1	1	1	2	2	2	2	2	2	2	6																																																	
G2	1	1	1	1	2	2	2	2	2	2	4	6																																																	
H1	3	1	1	1	2	2	2	2	2	2	6																																																		
H2	2	1	1	1	2	2	2	2	2	2	2	6																																																	
I1	1	1	1	2	2	3	2	2	2	2	6																																																		
I2	1	1	1	1	2	2	2	2	2	6																																																		
J1	1	1	1	1	2	2	2	2	2	2	6																																																		
J2	1	1	1	1	2	2	2	1	1	1	6																																																		
K1	1	1	1	1	2	2	1	2	1	1	1	6																																																	
K2	1	1	1	1	1	1	1	1	1	1	1	2	1	1																																														
L1	1	1	1	1	2	2	2	2	1	2	2	6																																																	
L2	1	1	1	1	2	2	2	2	2	2	2	6																																																	
M1	1	1	1	1	1	1	2	1	1	2	2	6																																																	
M2	1	1	1	1	1	1	1	1	1	1	2	6																																																	
N1	1	1	1	1	2	2	2	2	1	2	2	6																																																	
N2	2	1	1	1	2	2	2	2	2	2	6																																																		
O1	1	1	1	1	2	2	3	2	2	6																																																		
O2	1	1	1	1	2	2	2	2	2	6																																																		
P1	1	1	1	1	2	2	2	2	2	2	2	4	2	6																																														
P2	1	2	2	2	2	3	2	2	2	2	6																																																		
Q1	2	2	2	2	2	2	2	2	2	2	2	6																																																	
Q2	2	2	2	2	2	2	2	2	2	2	2	6																																																	
S1	1	1	1	2	2	1	1	1	1	2	4	6																																																	
S2	1	1	1	2	2	1	1	1	1	2	4	6																																																	
R1	3	1	1	2	3	3	1	1	1	1	1	2	1	1																																														
R2	1	1	2	2	1	1	1	1	2	1	1	4	2	2																																														
Clinical	0	0	0	0	0	0	0	0	0	0	0	0	0	0	D																																													

Agreement results matrix for case 25

REVIEWER	A1	A2	B1	B2	C1	C2	D1	D2	E1	E2	F1	F2	G1	G2	H1	H2	I1	I2	J1	J2	K1	K2	L1	L2	M1	M2	N1	N2	O1	O2	P1	P2	Q1	Q2	S1	S2	R1	R2
A1	100	90	99	81	57	57	82	79	83	81	72	77	83	100	70	83	71	74	82	79	80	45	83	83	81	78	83	81	64	74	89	69	79	79	97	97	29	86
A2	90	100	89	75	48	48	74	73	75	71	69	70	75	90	60	75	61	64	72	70	74	60	75	75	73	71	75	71	55	64	93	59	71	71	87	87	38	96
B1	99	89	100	81	56	56	83	81	81	81	70	75	82	99	70	81	71	72	80	77	79	42	81	82	78	76	81	79	63	72	88	71	82	82	97	97	29	87
B2	81	75	81	100	61	61	97	99	99	94	90	94	97	81	78	96	79	84	94	95	97	69	99	97	96	95	99	93	70	84	74	78	95	95	80	80	42	72
C1	57	48	56	61	100	100	61	59	62	69	47	57	63	57	59	62	77	75	69	67	60	41	62	63	60	58	62	68	81	75	44	75	59	59	54	54	45	45
C2	57	48	56	61	100	100	61	59	62	69	47	57	63	57	59	62	77	75	69	67	60	41	62	63	60	58	62	68	81	75	44	75	59	59	54	54	45	45
D1	82	74	83	97	61	61	100	97	97	96	85	88	98	82	79	97	81	85	95	90	94	63	97	98	94	90	97	94	71	85	75	81	98	98	79	79	39	70
D2	79	73	81	99	59	59	97	100	97	93	90	93	95	79	76	94	78	82	92	94	96	69	97	95	95	94	97	91	68	82	72	78	95	95	81	81	43	72
E1	83	75	81	99	62	62	97	97	100	95	90	93	99	83	79	98	80	86	96	95	97	69	100	99	98	95	100	95	72	86	75	78	94	94	81	81	40	70
E2	81	71	81	94	69	69	96	93	95	100	77	87	96	81	82	95	84	96	100	96	92	61	95	96	92	88	95	99	80	96	68	82	93	93	78	78	37	67
F1	72	69	70	90	47	47	85	90	90	77	100	97	87	72	65	86	64	64	79	84	94	78	90	87	93	95	90	78	53	64	74	62	81	81	76	76	43	73
F2	77	70	75	94	57	57	88	93	93	87	97	100	91	77	72	90	72	79	88	93	97	76	93	91	97	99	93	87	65	79	69	69	85	85	81	81	41	73
G1	83	75	82	97	63	63	98	95	99	96	87	91	100	83	80	99	81	87	97	92	95	66	99	100	96	93	99	96	72	87	76	78	95	95	79	79	39	70
G2	100	90	99	81	57	57	82	79	83	81	72	77	83	100	70	83	71	74	82	79	80	45	83	83	81	78	83	81	64	74	89	69	79	79	97	97	29	86
H1	70	60	70	78	59	59	79	76	79	82	65	72	80	70	100	81	70	79	82	79	77	49	79	80	77	73	79	83	67	79	59	69	77	77	67	67	56	57
H2	83	75	81	96	62	62	97	94	98	95	86	90	99	83	81	100	80	86	96	91	95	65	98	99	95	92	98	97	72	86	75	78	97	97	79	79	39	69
I1	71	61	71	79	77	77	81	78	80	84	64	72	81	71	70	80	100	80	83	80	77	49	80	81	77	73	80	82	94	80	60	99	78	78	68	68	67	58
I2	74	64	72	84	75	75	85	82	86	96	64	79	87	74	79	86	80	100	97	93	84	59	86	87	83	79	86	96	88	100	57	77	81	81	70	70	33	59
J1	82	72	80	94	69	69	95	92	96	100	79	88	97	82	82	96	83	97	100	96	93	62	96	97	93	89	96	99	80	97	69	81	92	92	78	78	36	66
J2	79	70	77	95	67	67	90	94	95	96	84	93	92	79	79	91	80	93	96	100	96	68	95	92	93	93	95	95	77	93	65	77	87	87	79	79	40	68
K1	80	74	79	97	60	60	94	96	97	92	94	97	95	80	77	95	77	84	93	96	100	73	97	95	96	96	97	92	70	84	72	75	90	90	81	81	43	73
K2	45	60	42	69	41	41	63	69	69	61	78	76	66	45	49	65	49	59	62	68	73	100	69	66	73	75	69	61	47	59	49	46	59	59	49	49	53	64
L1	83	75	81	99	62	62	97	97	100	95	90	93	99	83	79	98	80	86	96	95	97	69	100	99	98	95	100	95	72	86	75	78	94	94	81	81	40	70
L2	83	75	82	97	63	63	98	95	99	96	87	91	100	83	80	99	81	87	97	92	95	66	99	100	96	93	99	96	72	87	76	78	95	95	79	79	39	70
M1	81	73	78	96	60	60	94	95	98	92	93	97	96	81	77	95	77	83	93	93	96	73	98	96	100	99	98	92	69	83	73	74	90	90	81	81	41	72
M2	78	71	76	95	58	58	90	94	95	88	95	99	93	78	73	92	73	79	89	93	96	75	95	93	99	100	95	88	65	79	71	70	87	87	82	82	41	73
N1	83	75	81	99	62	62	97	97	100	95	90	93	99	83	79	98	80	86	96	95	97	69	100	99	98	95	100	95	72	86	75	78	94	94	81	81	40	70
N2	81	71	79	93	68	68	94	91	95	99	78	87	96	81	83	97	82	96	99	95	92	61	95	96	92	88	95	100	79	96	68	81	93	93	77	77	36	66
O1	64	55	63	70	81	81	71	68	72	80	53	65	72	64	67	72	94	88	80	77	70	47	72	72	69	65	72	79	100	88	49	92	68	68	61	61	59	51
O2	74	64	72	84	75	75	85	82	86	96	64	79	87	74	79	86	80	100	97	93	84	59	86	87	83	79	86	96	88	100	57	77	81	81	70	70	33	59
P1	89	93	88	74	44	44	75	72	75	68	74	69	76	89	59	75	60	57	69	65	72	49	75	76	73	71	75	68	49	57	100	58	72	72	86	86	33	89
P2	69	59	71	78	75	75	81	78	78	82	62	69	78	69	69	78	99	77	81	77	75	46	78	78	74	70	78	81	92	77	58	100	80	80	67	67	66	58
Q1	79	71	82	95	59	59	98	95	94	93	81	85	95	79	77	97	78	81	92	87	90	59	94	95	90	87	94	93	68	81	72	80	100	100	77	77	38	68
Q2	79	71	82	95	59	59	98	95	94	93	81	85	95	79	77	97	78	81	92	87	90	59	94	95	90	87	94	93	68	81	72	80	100	100	77	77	38	68
S1	97	87	97	80	54	54	79	81	81	78	76	81	79	97	67	79	68	70	78	79	81	49	81	79	81	82	81	77	61	70	86	67	77	77	100	100	32	89
S2	97	87	97	80	54	54	79	81	81	78	76	81	79	97	67	79	68	70	78	79	81	49	81	79	81	82	81	77	61	70	86	67	77	77	100	100	32	89
R1	29	38	29	42	45	45	39	43	40	37	43	41	39	29	56	39	67	33	36	40	43	53	40	39	41	41	40	36	59	33	33	66	38	38	32	32	100	41
R2	86	96	87	72	45	45	70	72	70	67	73	73	70	86	57	69	58	59	66	68	73	64	70	70	72	73	70	66	51	59	89	58	68	68	89	89	41	100

Case 26 205

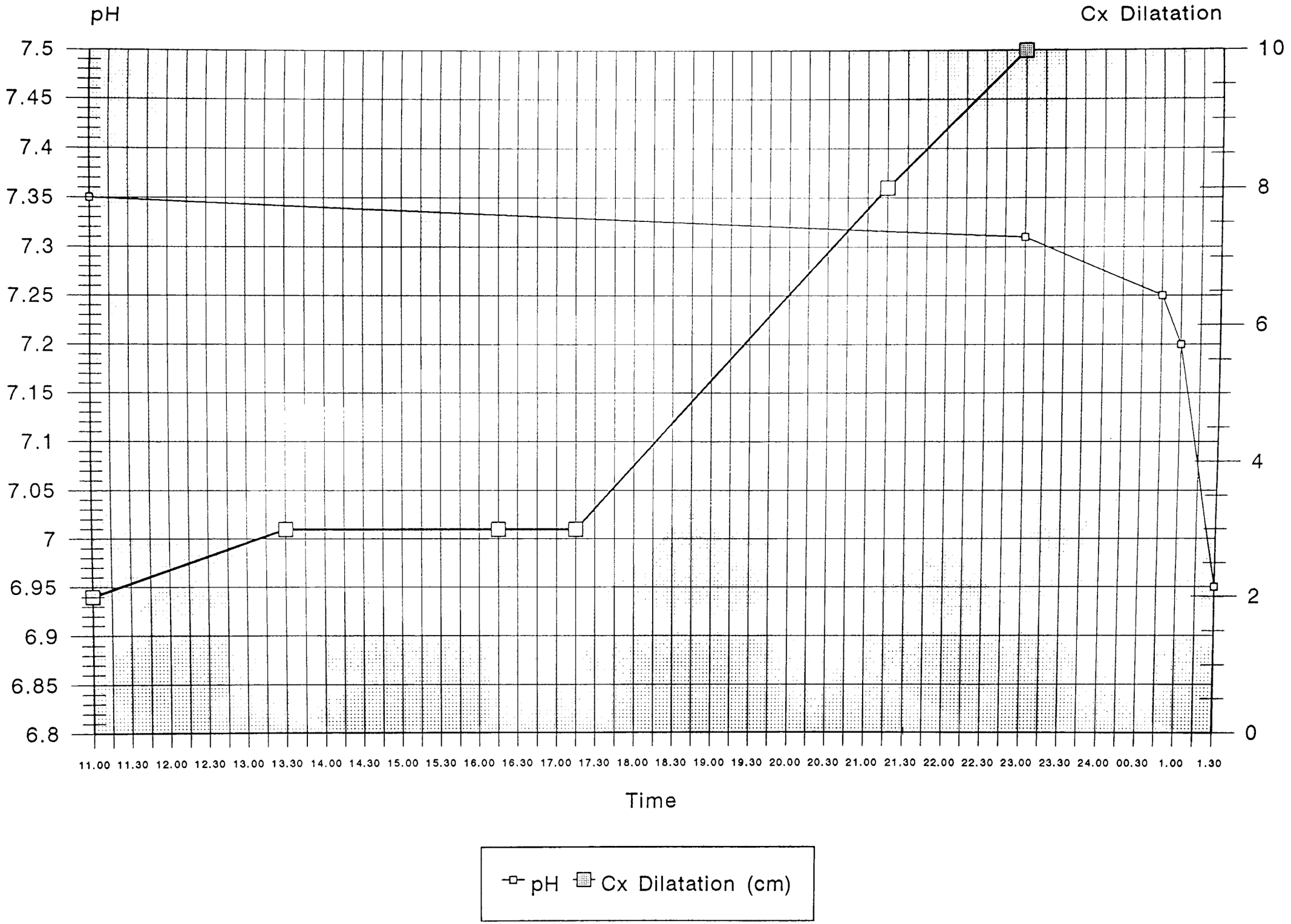
Mrs C.H. is a 28 year old primigravid lady. She is fit and does not smoke. There were no antenatal problems, and she laboured spontaneously at 41 weeks gestation. She was admitted on 7.8.90 with irregular contractions; at this stage the cervix was closed and she rested overnight on the antenatal ward. By 11.00hrs the following day, contractions were more regular and painful, and pethidine 100mg was given im.

Labour events

13.30	VE Cx 3cm dilated, 1cm thick. Station -2.
17.15	VE No change. ARM ; clear liquor. FSE applied.
17.30	Pethidine 100mg Stemetil 12.5mg im.
19.20	Epidural inserted.
19.35	Syntocinon started.
21.20	VE Cx 8cm dilated. Station 0. Position ; unsure.
22.10	Top up.
23.00	VE Cx fully dilated. Station +2. LOT position.
	FBS ; pH 7.31 BE -1.7
00.45	Pushing begun.
01.10	Squatting position for 10 minutes.
01.24	Normal delivery of male infant.

Outcome

Birth weight 3.66kg
Apgar 6 & 9
Cord gases pH 6.95 / 7.13 BD(ecf) 7 / 4


pH
Cx Dilatation
7.5
7.45
7.4
7.35
7.3
7.25
7.2
7.15
7.1
7.05
7
6.95
6.9
6.85
6.8
10
8
6
4
2
0
11.00 11.30 12.00 12.30 13.00 13.30 14.00 14.30 15.00 15.30 16.00 16.30 17.00 17.30 18.00 18.30 19.00 19.30 20.00 20.30 21.00 21.30 22.00 22.30 23.00 23.30 24.00 00.30 1.00 1.30
Time
pH
Cx Dilatation (cm)

Case 26

SEGMENT

REVIEWER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
A1	1	1	1	1	1	1	1	1	2	1	1	2	1	2	2	2	2	2	1	2	3	2	2	2	2	2	2	2	2	2	2																													
A2	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2																													
B1	1	1	1	1	1	1	1	1	1	1	2	2	1	2	3	1	2	1	1	2	2	2	2	1	1	1	1	1	1	2	4																													
B2	1	2	1	1	1	1	1	1	1	1	2	2	2	2	3	1	2	1	1	2	1	2	2	1	1	1	1	1	1	2	4																													
C1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	6																															
C2	1	1	1	1	1	1	1	1	1	1	1	2	1	2	1	1	1	1	1	2	2	2	2	1	2	2	6																															
D1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	2	6																													
D2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	6																													
E1	1	1	1	1	1	1	1	1	1	1	1	2	1	2	2	1	2	2	2	3	1	1	2	1	1	2	1	1	2	6																														
E2	1	2	1	1	1	1	1	1	1	1	1	2	1	2	2	1	2	2	1	2	2	2	2	1	1	2	2	2	2	2	6																													
F1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	1	1	1	1	1	1	2	6																													
F2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	2	1	1	1	1	1	1	1	6																													
G1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	6																													
G2	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	4	4																													
H1	1	2	2	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	2	2	2	2	1	1	2	1	1	1	6																														
H2	1	2	1	1	1	1	1	1	1	1	1	3	1	1	2	1	1	1	1	2	2	2	2	1	1	1	1	1	1	2	6																													
I1	1	1	1	1	1	1	1	1	2	1	2	2	2	2	2	2	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2																													
I2	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	6																													
J1	1	2	2	1	1	1	1	1	1	1	2	2	2	2	2	2	3	2	2	2	2	3	2	2	2	6																																
J2	1	1	1	1	1	1	1	1	1	1	2	3	1	2	2	2	2	1	1	2	2	2	2	1	1	1	1	1	1	1	2																													
K1	1	1	1	1	1	1	1	1	1	1	2	2	1	1	2	1	1	1	1	2	2	2	3	1	1	1	1	1	1	1	2																													
K2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1																													
L1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	3	2	1	1	2	2	2	2	2	2	2	6																															
L2	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	1	2	3	2	2	2	2	2	2	2	2	6																														
M1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2																													
M2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	2	2	2	2	2	2	1	1	2	2	2	2	2																													
N1	2	2	2	1	1	1	1	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	6																														
N2	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	6																													
O1	1	1	1	1	1	1	1	1	2	1	2	2	2	3	1	2	2	1	1	2	2	3	1	1	2	2	2	3	2	4	6																													
O2	1	1	1	1	1	1	1	1	1	1	1	2	1	2	2	2	2	2	1	2	3	1	1	1	1	2	2	2	2	6																														
P1	1	1	1	1	1	1	1	1	1	1	1	2	1	2	1	1	1	1	1	2	1	1	2	1	1	1	1	1	1	1	2																													
P2	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	1	1	1	1	2	2	2	2	1	1	1	1	1	1	2	6																													
Q1	2	2	2	2	1	1	1	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2																													
Q2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	4	4	4	4	4	4	4	4	4	6																															
S1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	2	2	1	1	1	2	2	1	2	1	1	1	2	1	1	2	4																													
S2	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	2	1	1	1	2	2	1	2	1	1	1	2	1	1	2	4																													
R1	1	2	1	1	1	2	1	2	2	1	1	1	4	1	4	2	1	2	1	1	1	2	1	1	2	2	1	1	2	1	2																													
R2	1	2	1	1	1	1	2	2	1	1	1	2	2	1	1	2	1	1	1	2	2	1	1	2	1	1	1	1	2	2	2																													
Clinical	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	D																												

Agreement results matrix for case 26

REVIEWER	A1	A2	B1	B2	C1	C2	D1	D2	E1	E2	F1	F2	G1	G2	H1	H2	I1	I2	J1	J2	K1	K2	L1	L2	M1	M2	N1	N2	O1	O2	P1	P2	Q1	Q2	S1	S2	R1	R2
A1	100	89	66	65	70	74	73	78	86	80	75	73	78	64	74	69	90	81	75	77	87	79	69	90	81	86	79	81	66	89	82	76	86	35	72	71	61	84
A2	89	100	72	71	76	82	79	85	77	88	81	79	85	70	81	75	99	90	67	85	83	86	77	81	88	94	87	90	58	78	90	85	95	22	76	76	64	92
B1	66	72	100	99	59	64	78	76	72	79	79	78	76	89	77	79	71	77	61	74	69	72	72	70	71	73	73	77	83	71	74	80	68	25	90	90	65	73
B2	65	71	99	100	57	63	77	74	72	78	77	77	74	88	77	78	71	76	61	73	68	71	71	70	70	71	74	76	82	70	74	80	69	26	89	89	65	73
C1	70	76	59	57	100	91	70	75	63	71	73	72	75	55	73	65	75	68	77	68	84	78	80	64	77	80	67	68	54	63	78	70	71	36	66	66	53	76
C2	74	82	64	63	91	100	73	77	75	76	75	73	77	63	84	68	81	74	77	73	74	79	89	75	80	83	79	74	66	75	81	75	77	36	69	69	56	80
D1	73	79	78	77	70	73	100	94	87	94	98	99	94	72	95	89	78	89	53	77	79	88	63	81	89	86	85	89	70	85	89	96	74	24	86	86	61	87
D2	78	85	76	74	75	77	94	100	85	96	96	95	100	77	94	87	84	94	58	75	76	83	67	86	85	89	90	94	72	85	84	94	81	25	84	85	60	84
E1	86	77	72	72	63	75	87	85	100	88	86	86	85	72	87	79	77	87	69	71	76	76	68	95	77	78	86	87	77	97	79	87	74	40	77	76	56	77
E2	80	88	79	78	71	76	94	96	88	100	95	93	96	79	94	88	87	97	61	78	78	81	69	88	84	88	95	97	73	88	85	96	85	28	84	84	61	85
F1	75	81	79	77	73	75	98	96	86	95	100	99	96	73	96	90	80	90	55	78	80	88	64	83	88	87	86	90	70	84	88	97	76	24	86	86	62	86
F2	73	79	78	77	72	73	99	95	86	93	99	100	95	73	96	89	78	89	55	78	80	89	63	82	87	85	85	89	70	84	89	96	74	24	86	86	61	85
G1	78	85	76	74	75	77	94	100	85	96	96	95	100	77	94	87	84	94	58	75	76	83	67	86	85	89	90	94	72	85	84	94	81	25	84	85	60	84
G2	64	70	89	88	55	63	72	77	72	79	73	73	77	100	74	69	69	81	52	60	59	60	61	75	61	66	79	81	82	72	63	76	67	35	94	93	48	64
H1	74	81	77	77	73	84	95	94	87	94	96	96	94	74	100	89	81	90	59	77	79	85	73	85	83	85	92	90	73	85	87	95	80	29	83	84	60	85
H2	69	75	79	78	65	68	89	87	79	88	90	89	87	69	89	100	74	84	53	90	74	78	60	77	78	78	82	84	75	78	80	90	72	24	79	79	68	79
I1	90	99	71	71	75	81	78	84	77	87	80	78	84	69	81	74	100	89	67	85	82	86	76	81	88	94	87	89	59	78	90	84	96	23	77	76	65	92
I2	81	90	77	76	68	74	89	94	87	97	90	89	94	81	90	84	89	100	63	77	75	76	70	90	78	85	96	100	73	87	81	94	87	28	81	81	59	83
J1	75	67	61	61	77	77	53	58	69	61	55	55	58	52	59	53	67	63	100	59	75	58	87	72	57	63	64	63	67	70	61	59	67	49	53	53	52	63
J2	77	85	74	73	68	73	77	75	71	78	78	78	75	60	77	90	85	77	59	100	81	85	67	70	83	85	74	77	61	71	87	81	81	20	73	73	72	86
K1	87	83	69	68	84	74	79	76	76	78	80	80	76	59	79	74	82	75	75	81	100	87	65	79	85	85	72	75	64	81	89	81	78	36	73	73	61	86
K2	79	86	72	71	78	79	88	83	76	81	88	89	83	60	85	78	86	76	58	85	87	100	68	71	97	93	73	76	52	73	98	84	81	18	79	80	66	93
L1	69	77	72	71	80	89	63	67	68	69	64	63	67	61	73	60	76	70	87	67	65	68	100	72	68	73	75	70	70	69	71	67	73	36	62	62	62	72
L2	90	81	70	70	64	75	81	86	95	88	83	82	86	75	85	77	81	90	72	70	79	71	72	100	72	77	89	90	81	97	74	85	78	43	75	74	55	75
M1	81	88	71	70	77	80	89	85	77	84	88	87	85	61	83	78	88	78	57	83	85	97	68	72	100	95	75	78	54	76	96	84	83	19	79	80	66	95
M2	86	94	73	71	80	83	86	89	78	88	87	85	89	66	85	78	94	85	63	85	85	93	73	77	95	100	82	85	56	77	94	85	90	20	80	80	65	95
N1	79	87	73	74	67	79	85	90	86	95	86	85	90	79	92	82	87	96	64	74	72	73	75	89	75	82	100	96	74	86	78	90	89	33	79	78	58	82
N2	81	90	77	76	68	74	89	94	87	97	90	89	94	81	90	84	89	100	63	77	75	76	70	90	78	85	96	100	73	87	81	94	87	28	81	81	59	83
O1	66	58	83	82	54	66	70	72	77	73	70	70	72	82	73	75	59	73	67	61	64	52	70	81	54	56	74	73	100	82	55	72	56	52	77	77	55	57
O2	89	78	71	70	63	75	85	85	97	88	84	84	85	72	85	78	78	87	70	71	81	73	69	97	76	77	86	87	82	100	76	85	75	43	77	76	56	76
P1	82	90	74	74	78	81	89	84	79	85	88	89	84	63	87	80	90	81	61	87	89	98	71	74	96	94	78	81	55	76	100	88	86	19	80	80	65	96
P2	76	85	80	80	70	75	96	94	87	96	97	96	94	76	95	90	84	94	59	81	81	84	67	85	84	85	90	94	72	85	88	100	80	26	85	84	60	87
Q1	86	95	68	69	71	77	74	81	74	85	76	74	81	67	80	72	96	87	67	81	78	81	73	78	83	90	89	87	56	75	86	80	100	24	73	73	63	91
Q2	35	22	25	26	36	36	24	25	40	28	24	24	25	35	29	24	23	28	49	20	36	18	36	43	19	20	33	28	52	43	19	26	24	100	26	26	18	22
S1	72	76	90	89	66	69	86	84	77	84	86	86	84	94	83	79	77	81	53	73	73	79	62	75	79	80	79	81	77	77	80	85	73	26	100	100	58	79
S2	71	76	90	89	66	69	86	85	76	84	86	86	85	93	84	79	76	81	53	73	73	80	62	74	80	80	78	81	77	76	80	84	73	26	100	100	58	80
R1	61	64	65	65	53	56	61	60	56	61	62	61	60	48	60	68	65	59	52	72	61	66	62	55	66	65	58	59	55	56	65	60	63	18	58	58	100	67
R2	84	92	73	73	76	80	87	84	77	85	86	85	84	64	85	79	92	83	63	86	86	93	72	75	95	95	82	83	57	76	96	87	91	22	79	80	67	100

Case 27 1288

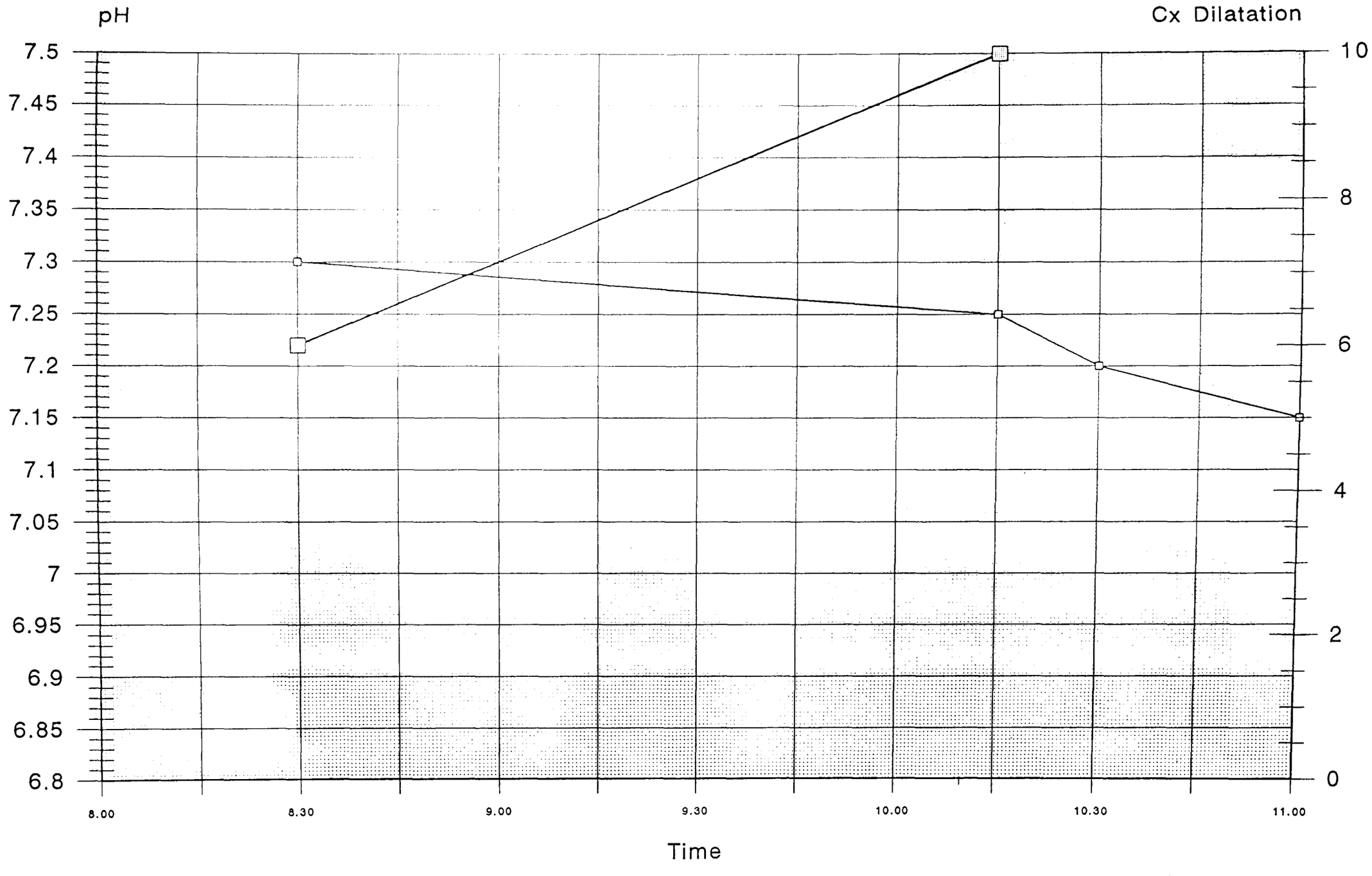
Miss D.F. is a fit 27 year old primigravida. She smokes 5 cigarettes per day. Her pregnancy was quite straightforward and she was admitted in spontaneous labour at 39 weeks on 4/4/91 at 08.30hrs. The uterus was term size. Cephalic 1/5. VE (at 09.30hrs) Cx 6cm dilated, 0.5cm thick. Station -1. (Membranes had already ruptured; liquor clear.)

Labour events

09.45	Pethidine 100mg, stemetil 12.5mg im.
11.15	VE Cx fully dilated. Station +1.
11.30	Pushing begun.
11.50	Episiotomy.
12.00	Normal delivery of female infant.

Outcome

Birth weight 3.14kg
Apgar 9 & 9
Cord gases pH 7.24 BD(ecf) - / 5


pH
Cx Dilatation
7.5
7.45
7.4
7.35
7.3
7.25
7.2
7.15
7.1
7.05
7
6.95
6.9
6.85
6.8
10
8
6
4
2
0
8.00
8.30
9.00
9.30
10.00
10.30
11.00
Time
pH
Cx Dilatation (cm)

Case 27

SEGMENT

REVIEWER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
A1	1	2	2	2	2	6																																																							
A2	1	2	2	2	2	4	4	4																																																				
B1	1	2	3	4	4	6																																																						
B2	1	2	3	2	2	6																																																						
C1	1	1	1	2	2	6																																																						
C2	1	2	2	3	2	6																																																						
D1	1	2	2	2	3	6																																																						
D2	1	2	2	2	2	6																																																						
E1	1	2	3	2	2	6																																																						
E2	1	2	2	2	2	2	6																																																					
F1	1	1	2	2	3	6																																																						
F2	1	1	2	2	2	6																																																						
G1	1	2	2	2	2	6																																																						
G2	1	2	2	2	2	4	6																																																					
H1	1	2	2	2	2	6																																																						
H2	1	2	2	2	2	2	6																																																					
I1	1	2	2	3	2	2	4	6																																																				
I2	1	2	2	3	2	2	6																																																					
J1	2	2	3	2	2	6																																																						
J2	1	2	2	3	1	6																																																						
K1	1	1	2	2	2	6																																																						
K2	1	1	2	2	2	2	6																																																					
L1	1	1	2	2	3	6																																																						
L2	1	1	2	2	2	6																																																						
M1	1	1	1	1	1	1	2	2																																																				
M2	2	2	2	2	2	2	6																																																					
N1	1	1	1	1	1	6																																																						
N2	1	1	1	1	1	2	6																																																					
O1	1	2	2	3	2	6																																																						
O2	1	2	2	2	3	2	6																																																					
P1	1	1	1	1	1	4	4	2																																																				
P2	1	1	2	2	2	2	6																																																					
Q1	2	2	2	2	2	2	6																																																					
Q2	2	2	4	4	4	4	6																																																					
S1	1	1	2	2	2	4	6																																																					
S2	1	2	2	2	2	4	6																																																					
R1	2	2	1	1	3	2	1	2																																																				
R2	3	1	1	2	2	6																																																						
Clinical	0	0	0	0	0	0	0	0	n	n	n	D																																																

Agreement results matrix for case 27

REVIEWER	A1	A2	B1	B2	C1	C2	D1	D2	E1	E2	F1	F2	G1	G2	H1	H2	I1	I2	J1	J2	K1	K2	L1	L2	M1	M2	N1	N2	O1	O2	P1	P2	Q1	Q2	S1	S2	R1	R2
A1	100	52	58	85	97	93	98	100	85	95	97	99	100	77	100	95	67	89	84	91	99	95	97	99	52	94	92	89	93	94	54	95	94	47	76	77	87	76
A2	52	100	70	48	50	51	52	52	48	54	52	51	52	90	52	54	90	53	47	50	51	54	52	51	20	54	48	51	51	55	95	54	54	80	90	90	43	44
B1	58	70	100	72	57	71	69	58	72	47	69	58	58	81	58	47	71	69	71	71	58	47	69	58	13	47	57	45	71	67	74	47	47	95	80	81	60	62
B2	85	48	72	100	84	97	92	85	100	75	92	85	85	68	85	75	73	94	99	95	85	75	92	85	37	74	80	70	97	90	50	75	74	54	67	68	83	87
C1	97	50	57	84	100	91	96	97	84	93	97	99	97	75	97	93	66	87	81	89	99	95	97	99	57	90	97	93	91	92	56	95	90	46	76	75	87	77
C2	93	51	71	97	91	100	97	93	97	82	96	92	93	72	93	82	76	97	96	99	92	82	96	92	38	81	88	78	100	94	53	82	81	55	71	72	88	80
D1	98	52	69	92	96	97	100	98	92	89	100	97	98	75	98	89	73	93	91	96	97	88	100	97	37	88	93	84	97	96	55	88	88	54	74	75	90	78
D2	100	52	58	85	97	93	98	100	85	95	97	99	100	77	100	95	67	89	84	91	99	95	97	99	52	94	92	89	93	94	54	95	94	47	76	77	87	76
E1	85	48	72	100	84	97	92	85	100	75	92	85	85	68	85	75	73	94	99	95	85	75	92	85	37	74	80	70	97	90	50	75	74	54	67	68	83	87
E2	95	54	47	75	93	82	89	95	75	100	88	95	95	79	95	100	71	86	74	80	95	99	88	95	57	99	87	94	82	93	55	99	99	42	78	79	78	73
F1	97	52	69	92	97	96	100	97	92	88	100	98	97	74	97	88	72	93	90	96	98	89	100	98	39	86	94	85	96	96	56	89	86	53	75	74	89	79
F2	99	51	58	85	99	92	97	99	85	95	98	100	99	76	99	95	67	89	83	91	100	95	98	100	55	92	94	91	92	94	55	95	92	47	77	76	86	77
G1	100	52	58	85	97	93	98	100	85	95	97	99	100	77	100	95	67	89	84	91	99	95	97	99	52	94	92	89	93	94	54	95	94	47	76	77	87	76
G2	77	90	81	68	75	72	75	77	68	79	74	76	77	100	77	79	88	74	67	70	76	78	74	76	32	78	72	74	72	77	90	78	78	84	100	100	63	63
H1	100	52	58	85	97	93	98	100	85	95	97	99	100	77	100	95	67	89	84	91	99	95	97	99	52	94	92	89	93	94	54	95	94	47	76	77	87	76
H2	95	54	47	75	93	82	89	95	75	100	88	95	95	79	95	100	71	86	74	80	95	99	88	95	57	99	87	94	82	93	55	99	99	42	78	79	78	73
I1	67	90	71	73	66	76	73	67	73	71	72	67	67	88	67	71	100	83	73	74	67	71	72	67	29	70	63	68	76	81	86	71	70	72	88	88	65	61
I2	89	53	69	94	87	97	93	89	94	86	93	89	89	74	89	86	83	100	93	95	89	86	93	89	42	85	84	82	97	97	54	86	85	56	73	74	86	78
J1	84	47	71	99	81	96	91	84	99	74	90	83	84	67	84	74	73	93	100	94	83	72	90	83	34	75	78	67	96	89	48	72	75	55	66	67	84	86
J2	91	50	71	95	89	99	96	91	95	80	96	91	91	70	91	80	74	95	94	100	91	79	96	91	41	79	90	79	99	92	54	79	79	55	70	70	89	79
K1	99	51	58	85	99	92	97	99	85	95	98	100	99	76	99	95	67	89	83	91	100	95	98	100	55	92	94	91	92	94	55	95	92	47	77	76	86	77
K2	95	54	47	75	95	82	88	95	75	99	89	95	95	78	95	99	71	86	72	79	95	100	89	95	59	97	89	96	82	93	56	100	97	41	79	78	77	74
L1	97	52	69	92	97	96	100	97	92	88	100	98	97	74	97	88	72	93	90	96	98	89	100	98	39	86	94	85	96	96	56	89	86	53	75	74	89	79
L2	99	51	58	85	99	92	97	99	85	95	98	100	99	76	99	95	67	89	83	91	100	95	98	100	55	92	94	91	92	94	55	95	92	47	77	76	86	77
M1	52	20	13	37	57	38	37	52	37	57	39	55	52	32	52	57	29	42	34	41	55	59	39	55	100	54	61	67	38	43	36	59	54	9	34	32	64	40
M2	94	54	47	74	90	81	88	94	74	99	86	92	94	78	94	99	70	85	75	79	92	97	86	92	54	100	85	91	81	92	53	97	100	42	77	78	79	72
N1	92	48	57	80	97	88	93	92	80	87	94	94	92	72	92	87	63	84	78	90	94	89	94	94	61	85	100	95	88	89	58	89	85	46	73	72	88	74
N2	89	51	45	70	93	78	84	89	70	94	85	91	89	74	89	94	68	82	67	79	91	96	85	91	67	91	95	100	78	88	59	96	91	40	76	74	79	71
O1	93	51	71	97	91	100	97	93	97	82	96	92	93	72	93	82	76	97	96	99	92	82	96	92	38	81	88	78	100	94	53	82	81	55	71	72	88	80
O2	94	55	67	90	92	94	96	94	90	93	96	94	94	77	94	93	81	97	89	92	94	93	96	94	43	92	89	88	94	100	56	93	92	55	76	77	88	76
P1	54	95	74	50	56	53	55	54	50	55	56	55	54	90	54	55	86	54	48	54	55	56	56	55	36	53	58	59	53	56	100	56	53	80	91	90	54	47
P2	95	54	47	75	95	82	88	95	75	99	89	95	95	78	95	99	71	86	72	79	95	100	89	95	59	97	89	96	82	93	56	100	97	41	79	78	77	74
Q1	94	54	47	74	90	81	88	94	74	99	86	92	94	78	94	99	70	85	75	79	92	97	86	92	54	100	85	91	81	92	53	97	100	42	77	78	79	72
Q2	47	80	95	54	46	55	54	47	54	42	53	47	47	84	47	42	72	56	55	55	47	41	53	47	9	42	46	40	55	55	80	41	42	100	83	84	46	48
S1	76	90	80	67	76	71	74	76	67	78	75	77	76	100	76	78	88	73	66	70	77	79	75	77	34	77	73	76	71	76	91	79	77	83	100	100	62	64
S2	77	90	81	68	75	72	75	77	68	79	74	76	77	100	77	79	88	74	67	70	76	78	74	76	32	78	72	74	72	77	90	78	78	84	100	100	63	63
R1	87	43	60	83	87	88	90	87	83	78	89	86	87	63	87	78	65	86	84	89	86	77	89	86	64	79	88	79	88	88	54	77	79	46	62	63	100	69
R2	76	44	62	87	77	80	78	76	87	73	79	77	76	63	76	73	61	78	86	79	77	74	79	77	40	72	74	71	80	76	47	74	72	48	64	63	69	100

Case 28 1232

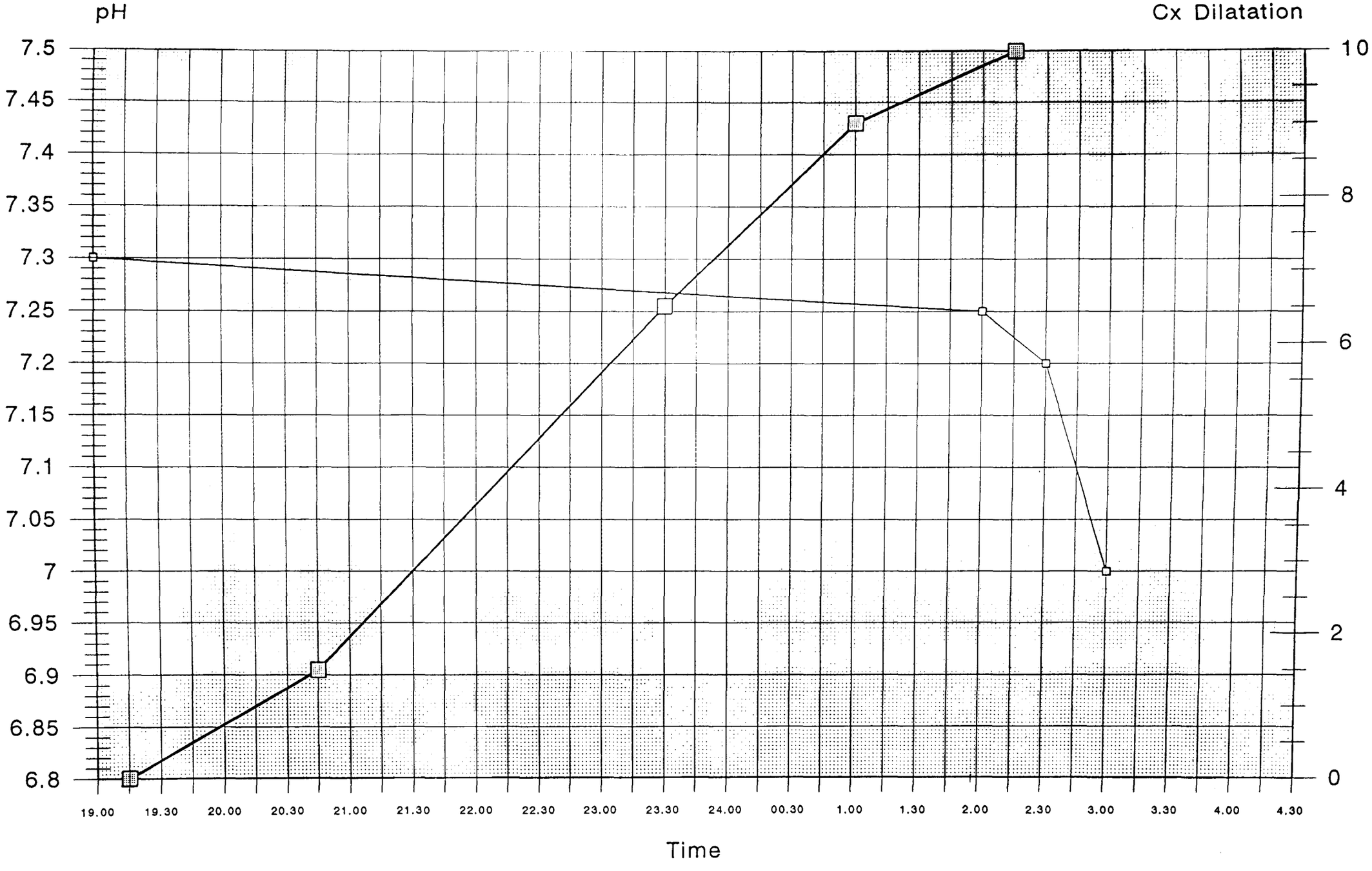
Miss E.M. is a 20 year old primigravida. She is generally fit, but smokes 3 cigarettes per day. There were no antenatal problems and she laboured spontaneously at 40 weeks gestation. When she arrived on labour ward at 19.15hrs on 18.3.91, presentation was cephalic 2/5; cervix closed and uneffaced; station -2.

Labour events

20.05	Pethidine 100mg, Phenergan 25mg given.
20.40	SROM; liquor stained with thick meconium. VE Cx 1-2cm dilated, thick. Station -2. FSE applied.
21.40	Epidural begun.
22.30	Epidural complete.
23.30	VE Cx 6-7cm dilated, thin. Station -1.
01.00	VE Cx 9cm dilated. Station -1.
01.10	Top up.
02.10	VE Cx fully dilated. Pushing begun.
03.06	Male infant delivered by Ventouse extraction (after attempted manual rotation).

Outcome

Birth weight 3.15kg
Apgar 5 & 9
Cord gases pH 6.97 / 7.10 BD(ecf) 7 / 6


pH
Cx Dilatation
7.5
7.45
7.4
7.35
7.3
7.25
7.2
7.15
7.1
7.05
7
6.95
6.9
6.85
6.8
10
8
6
4
2
0
19.00
19.30
20.00
20.30
21.00
21.30
22.00
22.30
23.00
23.30
24.00
00.30
1.00
1.30
2.00
2.30
3.00
3.30
4.00
4.30
Time
pH
Cx Dilatation (cm)

Case 28

SEGMENT

REVIEWER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
A1	1	2	2	2	2	2	1	1	2	2	1	2	1	1	1	1	1	2	2	2	3	2	2	4	4	4																																		
A2	1	2	2	2	2	2	1	1	1	2	1	1	1	1	1	1	2	1	1	2	2	2	2	4	4																																			
B1	1	1	2	3	4	4	2	2	2	2	1	2	1	1	1	1	1	1	1	1	1	2	6																																					
B2	1	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	4	6																																			
C1	4	4	5																																																									
C2	2	3	2	2	1	1	1	2	3	1	1	1	1	1	1	1	1	1	1	1	1	2	4	6																																			
D1	1	1	2	3	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	6																																			
D2	2	2	2	3	2	2	2	3	2	2	2	2	2	2	2	3	2	2	2	2	2	6																																					
E1	2	2	2	3	2	2	1	1	2	1	1	2	1	1	1	1	2	1	1	1	2	2	2	6																																			
E2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	2	2	2	2	6																																				
F1	2	2	2	4	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	6																																			
F2	2	2	2	3	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	6																																			
G1	1	1	1	2	2	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	6																																			
G2	1	2	2	2	2	2	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	6																																			
H1	2	2	3	2	1	1	1	3	2	2	2	2	1	1	1	1	1	2	2	2	3	2	6																																				
H2	2	2	2	2	2	2	2	3	2	2	2	2	1	1	1	1	1	1	1	1	2	2	2	6																																			
I1	1	2	2	2	2	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	2	2	6																																			
I2	1	2	2	2	2	2	2	2	2	2	1	3	1	1	1	1	1	1	1	1	2	2	2	6																																			
J1	2	2	3	2	2	2	2	2	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	6																																			
J2	2	2	2	1	1	1	2	1	2	2	1	1	1	1	1	1	1	2	2	2	2	2	6																																				
K1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	6																																		
K2	1	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	6																																		
L1	2	3	2	2	2	1	1	2	2	2	1	2	2	3	2	2	2	2	2	2	2	6																																					
L2	1	1	2	2	1	1	1	2	2	2	1	2	2	2	2	2	2	1	1	1	1	1	6																																				
M1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2																																		
M2	1	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	6																																		
N1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	4	4	6																																				
N2	2	2	2	2	2	1	1	1	1	1	1	2	1	1	1	1	1	1	1	2	2	2	6																																				
O1	1	1	2	1	1	2	1	1	1	2	1	2	2	1	1	1	1	1	1	1	2	2	2	6																																			
O2	1	1	2	1	1	1	1	1	2	1	1	2	1	1	1	1	1	1	2	2	2	2	2	2	6																																		
P1	2	3	2	2	1	1	1	2	2	2	2	2	1	1	1	1	1	1	1	2	2	2	1	4	6																																		
P2	2	3	2	2	2	1	1	1	2	2	2	2	1	1	1	1	1	1	1	2	2	2	2	6																																			
Q1	2	2	2	2	2	2	2	2	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	6																																		
Q2	2	2	4	4	4	4	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	6																																		
S1	1	1	1	1	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	1	4	6																																		
S2	1	1	1	1	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	1	4	6																																		
R1	2	1	4	2	1	3	2	4	4	2	1	1	1	3	2	1	2	1	1	1	1	1	2	2	2	2																																		
R2	1	2	2	4	1	2	1	1	2	1	2	1	2	2	2	2	1	2	1	2	1	2	6																																				
Clinical	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6																																		

Agreement results matrix for case 28

REVIEWER	A1	A2	B1	B2	C1	C2	D1	D2	E1	E2	F1	F2	G1	G2	H1	H2	I1	I2	J1	J2	K1	K2	L1	L2	M1	M2	N1	N2	O1	O2	P1	P2	Q1	Q2	S1	S2	R1	R2
A1	100	94	47	81	0	71	61	50	62	64	53	60	65	66	61	61	66	62	56	65	60	64	54	62	45	63	67	65	66	66	82	62	64	40	86	86	28	56
A2	94	100	49	91	0	77	69	49	70	69	59	69	72	73	58	69	75	69	61	72	69	75	54	68	59	75	64	73	75	75	87	70	72	42	94	94	34	61
B1	47	49	100	57	25	63	78	67	78	59	89	78	55	56	73	65	60	57	67	59	49	56	58	60	47	57	49	59	60	56	60	66	53	88	54	54	67	88
B2	81	91	57	100	0	84	80	56	80	80	68	80	81	81	67	78	88	78	66	83	74	84	62	80	65	84	80	86	86	82	85	78	77	43	95	95	34	70
C1	0	0	25	0	100	16	12	11	12	0	33	12	0	0	15	0	0	0	16	0	0	0	18	0	0	0	0	0	0	0	16	19	0	47	0	0	34	34
C2	71	77	63	84	16	100	77	69	77	66	68	77	66	66	83	79	73	72	83	71	62	70	67	69	54	70	71	72	71	69	88	81	65	51	80	80	51	67
D1	61	69	78	80	12	77	100	68	97	77	88	99	80	80	78	76	89	78	79	81	80	88	70	81	75	88	54	84	87	83	79	89	77	61	79	79	50	81
D2	50	49	67	56	11	69	68	100	74	71	65	70	64	67	86	74	58	56	85	66	39	51	81	66	44	52	63	64	60	54	58	68	61	56	49	49	60	69
E1	62	70	78	80	12	77	97	74	100	82	87	98	83	84	81	80	88	79	85	84	75	85	76	81	69	85	58	87	87	84	82	92	83	65	77	77	50	82
E2	64	69	59	80	0	66	77	71	82	100	63	78	94	96	76	83	88	83	79	92	68	81	77	93	68	81	74	91	90	85	71	82	91	47	74	74	38	79
F1	53	59	89	68	33	68	88	65	87	63	100	88	65	66	73	70	74	64	69	69	67	73	60	67	61	72	47	71	71	70	70	76	64	86	65	65	64	92
F2	60	69	78	80	12	77	99	70	98	78	88	100	78	79	78	78	88	78	81	82	77	88	71	79	72	88	56	85	85	81	80	89	79	62	78	78	50	81
G1	65	72	55	81	0	66	80	64	83	94	65	78	100	98	70	80	91	80	78	89	80	86	72	92	74	85	64	89	93	92	74	83	93	49	80	80	38	77
G2	66	73	56	81	0	66	80	67	84	96	66	79	98	100	72	83	91	82	80	90	77	86	73	92	71	86	66	90	93	91	75	85	96	51	78	78	38	78
H1	61	58	73	67	15	83	78	86	81	76	73	78	70	72	100	82	71	66	88	78	53	62	79	73	52	61	68	77	71	67	73	83	64	57	60	60	54	74
H2	61	69	65	78	0	79	76	74	80	83	70	78	80	83	82	100	85	81	85	83	72	82	62	80	66	83	59	84	86	82	72	80	83	53	75	75	55	68
I1	66	75	60	88	0	73	89	58	88	88	74	88	91	91	71	85	100	86	72	91	88	96	67	91	83	95	60	96	98	94	77	87	87	45	85	85	40	76
I2	62	69	57	78	0	72	78	56	79	83	64	78	80	82	66	81	86	100	74	83	74	84	74	81	68	84	58	84	86	84	71	79	82	44	77	77	48	69
J1	56	61	67	66	16	83	79	85	85	79	69	81	78	80	88	85	72	74	100	73	59	69	76	73	53	70	58	72	73	72	77	84	80	63	65	65	56	74
J2	65	72	59	83	0	71	81	66	84	92	69	82	89	90	78	83	91	83	73	100	76	85	74	90	77	85	69	96	93	90	73	85	86	44	78	78	38	77
K1	60	69	49	74	0	62	80	39	75	68	67	77	80	77	53	72	88	74	59	76	100	94	47	77	87	93	39	77	87	92	72	74	80	42	84	84	40	63
K2	64	75	56	84	0	70	88	51	85	81	73	88	86	86	62	82	96	84	69	85	94	100	58	85	84	100	51	89	93	93	76	83	88	45	86	86	41	71
L1	54	54	58	62	18	67	70	81	76	77	60	71	72	73	79	62	67	74	76	74	47	58	100	75	53	58	66	73	67	62	69	81	67	49	54	54	51	72
L2	62	68	60	80	0	69	81	66	81	93	67	79	92	92	73	80	91	81	73	90	77	85	75	100	77	84	70	90	92	84	70	80	85	44	75	75	39	79
M1	45	59	47	65	0	54	75	44	69	68	61	72	74	71	52	66	83	68	53	77	87	84	53	77	100	84	38	78	82	83	57	68	70	34	68	68	44	62
M2	63	75	57	84	0	70	88	52	85	81	72	88	85	86	61	83	95	84	70	85	93	100	58	84	84	100	51	88	93	93	76	82	88	46	86	86	42	71
N1	67	64	49	80	0	71	54	63	58	74	47	56	64	66	68	59	60	58	58	69	39	51	66	70	38	51	100	68	61	53	64	58	60	36	65	65	26	62
N2	65	73	59	86	0	72	84	64	87	91	71	85	89	90	77	84	96	84	72	96	77	89	73	90	78	88	68	100	95	89	73	86	84	43	79	79	38	77
O1	66	75	60	86	0	71	87	60	87	90	71	85	93	93	71	86	98	86	73	93	87	93	67	92	82	93	61	95	100	96	77	87	89	46	86	86	40	77
O2	66	75	56	82	0	69	83	54	84	85	70	81	92	91	67	82	94	84	72	90	92	93	62	84	83	93	53	89	96	100	79	85	91	48	85	85	40	72
P1	82	87	60	85	16	88	79	58	82	71	70	80	74	75	73	72	77	71	77	73	72	76	69	70	57	76	64	73	77	79	100	89	75	56	88	88	40	68
P2	62	70	66	78	19	81	89	68	92	82	76	89	83	85	83	80	87	79	84	85	74	83	81	80	68	82	58	86	87	85	89	100	82	57	75	75	45	78
Q1	64	72	53	77	0	65	77	61	83	91	64	79	93	96	64	83	87	82	80	86	80	88	67	85	70	88	60	84	89	91	75	82	100	53	79	79	40	72
Q2	40	42	88	43	47	51	61	56	65	47	86	62	49	51	57	53	45	44	63	44	42	45	49	44	34	46	36	43	46	48	56	57	53	100	44	44	73	89
S1	86	94	54	95	0	80	79	49	77	74	65	78	80	78	60	75	85	77	65	78	84	86	54	75	68	86	65	79	86	85	88	75	79	44	100	100	35	65
S2	86	94	54	95	0	80	79	49	77	74	65	78	80	78	60	75	85	77	65	78	84	86	54	75	68	86	65	79	86	85	88	75	79	44	100	100	35	65
R1	28	34	67	34	34	51	50	60	50	38	64	50	38	38	54	55	40	48	56	38	40	41	51	39	44	42	26	38	40	40	40	45	40	73	35	35	100	57
R2	56	61	88	70	34	67	81	69	82	79	92	81	77	78	74	68	76	69	74	77	63	71	72	79	62	71	62	77	77	72	68	78	72	89	65	65	57	100

Case 29 194

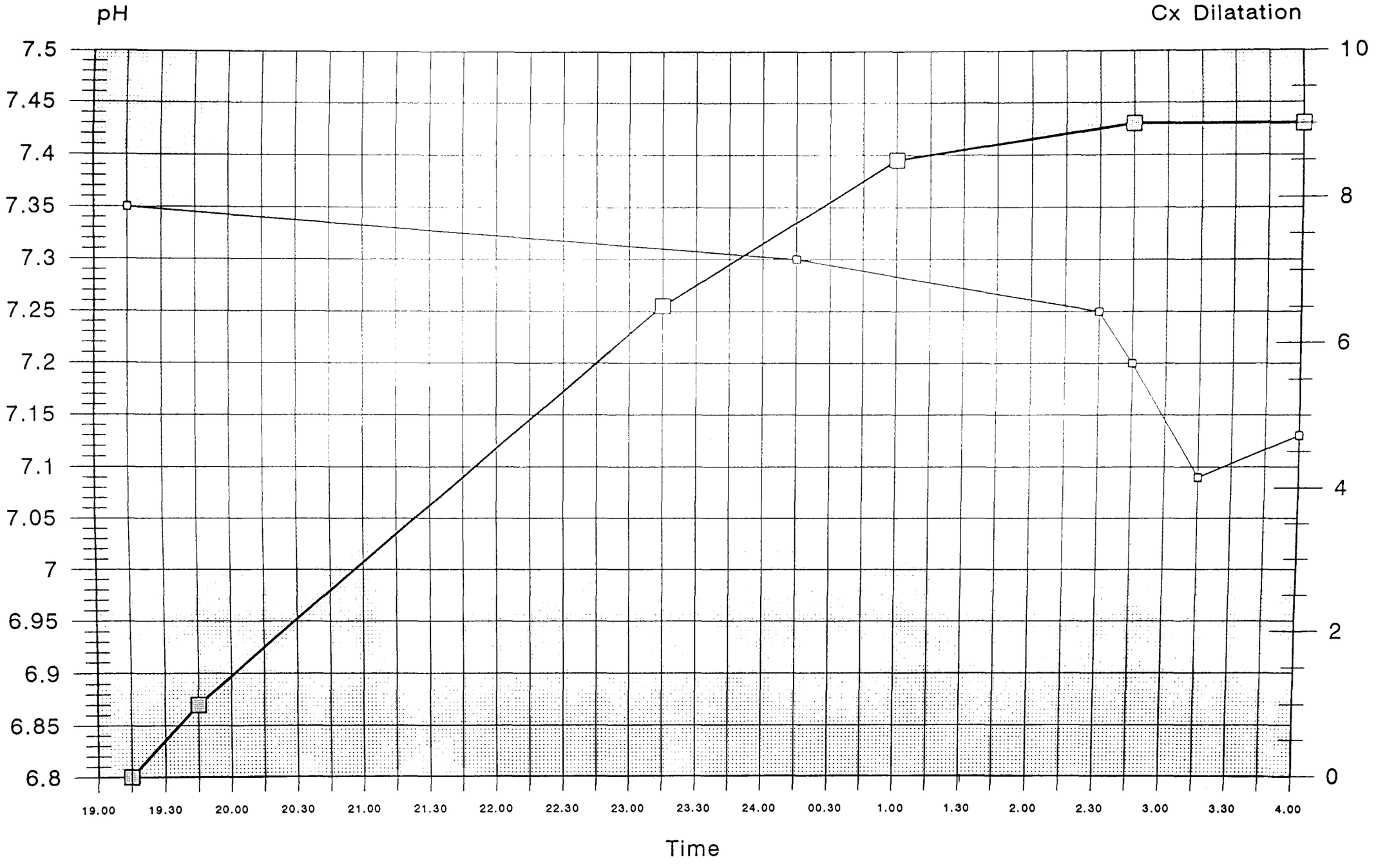
Mrs S.D. is a 28 year old primigravida; fit and well and a nonsmoker. Her pregnancy was straightforward. She was admitted at 41 weeks with spontaneous rupture of the membranes; this had probably occurred 4 days previously. The uterus was felt to be term size; cephalic 4/5. On VE clear liqor was seen and the cervix closed and uneffaced. Since she had no contractions labour was induced with IV syntocinon, which was commenced at 15.20hrs on 11.8.90.

Labour events

19.15	VE Cx closed, uneffaced. Station -3.
19.45	VE Cx 1cm dilated, 0.5cm thick. Forewaters ruptured; clear liquor.
21.20	Epidural inserted.
23.20	VE Cx 6-7cm dilated, thick. Station -1. FSE applied.
23.40	Top up.
00.15	FBS; pH 7.30 BE -7.
01.05	VE Cx 8-9cm dilated, thin. Station -1.
01.40	Top up.
02.45	VE Cx 9cm dilated. Station -1. Maternal oxygen given; position changed.
03.10	FBS; pH 7.09 (no BE) Thick meconium now present. Decision for C/S.
03.35	Top up.
03.50	Top up.
04.00	Male infant delivered by emergency C/S under epidural. Indication; low scalp pH; immediate vaginal delivery not possible. Fresh meconium noted at operation.

Outcome

Birth weight 3.21kg
Apgar 6 & 6 (10 at 10 minutes)
Cord gases pH 7.13 / 7.20 BD(ecf) 4 / 6


pH
Cx Dilatation
7.5
7.45
7.4
7.35
7.3
7.25
7.2
7.15
7.1
7.05
7
6.95
6.9
6.85
6.8
10
8
6
4
2
0
19.00
19.30
20.00
20.30
21.00
21.30
22.00
22.30
23.00
23.30
24.00
00.30
1.00
1.30
2.00
2.30
3.00
3.30
4.00
Time
pH
Cx Dilatation (cm)

Case 29

SEGMENT

REVIEWER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
A1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	5										
A2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	2	2	2	2	2	2	3	2	2	2	2	2	2	3	4	4	3	5								
B1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	2	2	1	1	2	3	2	2	2	3	2	2	2	3	2	4	4	3	5											
B2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	1	1	1	1	2	2	3	2	2	4	3	2	2	4	2	3	2	4	4	3	5										
C1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	2	2	2	2	3	2	2	2	3	1	1	2	3	1	2	2	3	5										
C2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	1	2	2	2	2	3	2	2	2	3	1	2	2	2	2	2	3	2	4	5										
D1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	1	1	1	1	1	1	2	2	3	2	2	5											
D2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	2	3	2	2	2	2	2	2	2	3	2	2	2	3	5										
E1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	2	2	2	2	2	2	3	2	2	2	2	2	2	2	2	2	3	2	2	5										
E2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	2	2	2	2	2	2	3	2	2	2	2	2	2	2	3	2	2	3	2	5										
F1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	2	2	1	1	1	1	1	1	1	1	1	1	1	1	3	5									
F2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	3	1	1	1	1	2	1	1	1	1	1	2	2	5										
G1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	3	2	2	2	2	2	2	2	5										
G2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	4	4	2	2	2	2	2	2	2	2	2	2	2	4	5									
H1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	2	2	3	2	2	2	2	3	2	2	2	3	4	4	4	5										
H2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	2	2	2	3	2	2	2	2	2	2	3	2	2	2	2	2	3	5									
I1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	2	2	3	2	1	2	2	2	2	2	2	3	2	2	2	4	5									
I2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	2	1	1	2	2	2	3	2	2	1	2	2	2	2	2	3	2	2	2	3	5									
J1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	2	2	2	2	2	1	2	2	2	2	3	2	2	2	3	2	2	2	2	2	3	2	2	3	5									
J2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	1	2	1	2	2	2	2	3	2	2	2	2	2	1	2	3	2	2	4	3	5										
K1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	1	2	2	3	2	2	2	3	2	2	2	3	5										
K2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	1	1	1	1	1	1	2	1	1	1	2	3	5								
L1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	3	2	2	2	3	2	2	2	2	3	2	2	2	2	3	5										
L2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	3	2	2	2	2	2	2	2	2	2	2	2	3	5										
M1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	5									
M2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	5										
N1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	3	2	2	2	2	2	2	3	4	4	4	3	4	5										
N2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	2	1	1	1	2	3	2	2	2	2	2	2	3	2	2	2	2	3	4	5										
O1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	2	1	2	1	2	2	2	2	3	2	2	2	3	2	2	2	3	2	2	2	3	5										
O2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	2	1	1	2	2	2	3	1	1	1	1	1	2	2	2	3	1	2	2	3	5									
P1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	2	2	1	2	3	2	2	1	2	2	2	2	2	2	2	2	2	4	5									
P2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	5									
Q1	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	1	2	2	2	2	2	2	4	4	4	2	4	2	2	2	4	4	4	4	4	5										
Q2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	4	4	4	2	4	4	4	4	4	4	4	4	4	4	5									
S1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	4	4	4	1	1	2	1	2	2	2	2	2	1	4	3	5									
S2	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	4	4	4	1	1	2	2	2	2	2	2	2	1	4	3	5									
R1	1	1	4	2	2	2	1	2	1	1	1	1	2	1	2	1	1	2	2	2	1	1	1	1	1	1	2	1	4	2	1	1	2	1	2	2	2	1	1	1	1	1	2	2	3	1	1	4	3	3	2	2	2							
R2	1	1	1	3	1	2	2	1	1	2	2	2	2	3	2	2	1	1	3	1	1	1	2	1	1	1	2	1	2	2	1	2	2	1	2	1	1	1	2	1	1	1	1	1	4	2	2	1	2	2	2	2	1							
Clinical	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	5	0	C						

Agreement results matrix for case 29

REVIEWER	A1	A2	B1	B2	C1	C2	D1	D2	E1	E2	F1	F2	G1	G2	H1	H2	I1	I2	J1	J2	K1	K2	L1	L2	M1	M2	N1	N2	O1	O2	P1	P2	Q1	Q2	S1	S2	R1	R2
A1	100	83	78	74	89	89	90	92	94	91	93	89	92	83	82	89	88	90	88	89	92	84	89	96	96	97	77	90	89	89	91	93	64	53	76	76	63	51
A2	83	100	71	78	83	86	70	80	79	78	86	75	83	83	85	85	89	85	89	81	86	86	81	81	89	79	77	86	83	84	88	84	70	68	79	79	64	43
B1	78	71	100	90	87	89	82	86	85	87	66	76	78	68	92	78	78	78	80	91	85	54	88	82	68	74	94	89	88	77	73	65	83	73	70	70	66	56
B2	74	78	90	100	85	87	74	84	80	83	67	75	76	79	90	79	80	79	81	90	83	59	86	79	69	71	90	87	86	79	77	66	91	89	81	81	63	50
C1	89	83	87	85	100	94	86	95	92	95	84	88	89	82	90	94	91	92	94	93	95	76	95	92	85	85	85	93	99	92	88	83	73	66	79	78	63	51
C2	89	86	89	87	94	100	87	92	95	93	82	89	88	84	94	86	93	90	92	93	90	72	93	93	83	87	86	95	94	89	91	84	78	69	81	81	62	48
D1	90	70	82	74	86	87	100	89	90	89	81	88	88	71	85	80	84	82	77	87	89	70	83	86	81	91	80	87	85	83	80	82	66	54	68	67	64	57
D2	92	80	86	84	95	92	89	100	95	98	86	91	89	83	88	96	94	96	90	96	93	79	95	96	89	89	87	95	96	94	91	86	71	63	81	81	65	53
E1	94	79	85	80	92	95	90	95	100	98	85	93	87	85	88	90	95	94	91	93	88	76	92	97	88	92	84	93	93	93	93	89	72	60	79	79	59	53
E2	91	78	87	83	95	93	89	98	98	100	84	89	87	83	88	94	93	94	91	96	91	75	95	95	87	88	87	95	95	93	90	86	72	64	78	78	63	54
F1	93	86	66	67	84	82	81	86	85	84	100	90	87	82	73	89	87	89	86	82	86	96	83	90	96	91	69	82	82	91	91	92	57	50	78	78	61	53
F2	89	75	76	75	88	89	88	91	93	89	90	100	90	85	83	88	91	89	84	88	84	82	87	94	88	93	76	89	87	90	94	89	66	55	81	81	55	52
G1	92	83	78	76	89	88	88	89	87	87	87	90	100	79	85	88	85	83	86	85	94	81	88	89	90	96	76	91	90	82	88	92	65	58	73	72	57	53
G2	83	83	68	79	82	84	71	83	85	83	82	85	79	100	79	86	88	86	84	82	78	78	82	87	84	83	73	83	82	85	91	85	81	72	96	96	52	43
H1	82	85	92	90	90	94	85	88	88	88	73	83	85	79	100	83	89	83	85	95	87	64	85	86	75	81	95	95	90	83	85	74	85	78	80	80	68	50
H2	89	85	78	79	94	86	80	96	90	94	89	88	88	86	83	100	95	97	92	92	90	87	94	93	93	87	82	92	94	96	94	89	67	63	82	82	62	53
I1	88	89	78	80	91	93	84	94	95	93	87	91	85	88	89	95	100	97	92	92	88	84	90	92	90	88	84	92	91	96	96	90	72	66	84	84	62	51
I2	90	85	78	79	92	90	82	96	94	94	89	89	83	86	83	97	97	100	95	92	89	87	91	94	92	86	82	89	93	99	94	89	68	61	83	83	62	53
J1	88	89	80	81	94	92	77	90	91	91	86	84	86	84	85	92	92	95	100	88	90	83	89	91	89	83	79	90	95	94	90	86	70	64	80	80	59	50
J2	89	81	91	90	93	93	87	96	93	96	82	88	85	82	95	92	92	92	88	100	90	73	93	93	84	86	92	95	94	91	89	82	80	71	81	81	70	52
K1	92	86	85	83	95	90	89	93	88	91	86	84	94	78	87	90	88	89	90	90	100	78	93	89	90	89	82	91	96	88	84	86	70	63	74	74	65	52
K2	84	86	54	59	76	72	70	79	76	75	96	82	81	78	64	87	84	87	83	73	78	100	75	81	94	84	60	73	75	87	87	91	48	45	75	74	57	54
L1	89	81	88	86	95	93	83	95	92	95	83	87	88	82	85	94	90	91	89	93	93	75	100	93	86	86	84	94	95	90	88	83	71	65	79	79	62	50
L2	96	81	82	79	92	93	86	96	97	95	90	94	89	87	86	93	92	94	91	93	89	81	93	100	93	93	81	93	93	93	94	90	69	57	83	83	61	49
M1	96	89	68	69	85	83	81	89	88	87	96	88	90	84	75	93	90	92	89	84	90	94	86	93	100	94	71	85	86	91	93	96	58	51	79	78	60	52
M2	97	79	74	71	85	87	91	89	92	88	91	93	96	83	81	87	88	86	83	86	89	84	86	93	94	100	74	87	86	85	92	96	62	51	75	74	57	54
N1	77	77	94	90	85	86	80	87	84	87	69	76	76	73	95	82	84	82	79	92	82	60	84	81	71	74	100	90	85	81	78	68	86	82	75	74	66	57
N2	90	86	89	87	93	95	87	95	93	95	82	89	91	83	95	92	92	89	90	95	91	73	94	93	85	87	90	100	94	88	91	83	76	70	81	81	65	48
O1	89	83	88	86	99	94	85	96	93	95	82	87	90	82	90	94	91	93	95	94	96	75	95	93	86	86	85	94	100	92	88	83	73	66	78	78	63	51
O2	89	84	77	79	92	89	83	94	93	93	91	90	82	85	83	96	96	99	94	91	88	87	90	93	91	85	81	88	92	100	93	88	67	61	83	83	63	54
P1	91	88	73	77	88	91	80	91	93	90	91	94	88	91	85	94	96	94	90	89	84	87	88	94	93	92	78	91	88	93	100	94	69	61	86	86	58	48
P2	93	84	65	66	83	84	82	86	89	86	92	89	92	85	74	89	90	89	86	82	86	91	83	90	96	96	68	83	83	88	94	100	57	50	74	74	54	55
Q1	64	70	83	91	73	78	66	71	72	72	57	66	65	81	85	67	72	68	70	80	70	48	71	69	58	62	86	76	73	67	69	57	100	96	84	84	55	47
Q2	53	68	73	89	66	69	54	63	60	64	50	55	58	72	78	63	66	61	64	71	63	45	65	57	51	51	82	70	66	61	61	50	96	100	75	75	51	46
S1	76	79	70	81	79	81	68	81	79	78	78	81	73	96	80	82	84	83	80	81	74	75	79	83	79	75	75	81	78	83	86	74	84	75	100	100	55	40
S2	76	79	70	81	78	81	67	81	79	78	78	81	72	96	80	82	84	83	80	81	74	74	79	83	78	74	74	81	78	83	86	74	84	75	100	100	55	40
R1	63	64	66	63	63	62	64	65	59	63	61	55	57	52	68	62	62	62	59	70	65	57	62	61	60	57	66	65	63	63	58	54	55	51	55	55	100	61
R2	51	43	56	50	51	48	57	53	53	54	53	52	53	43	50	53	51	53	50	52	52	54	50	49	52	54	57	48	51	54	48	55	47	46	40	40	61	100

Case 30 359

Miss J.B. is an 18 year old primigravida. She is a fit lady and does not smoke. Her pregnancy was straightforward until term, when a mild degree of hypertension was noted (BP 140/90). By 41 weeks BP was 140/100 and she had a trace of proteinuria. The baby was felt to be appropriately grown; presentation cephalic 4/5, and the cervix 1cm dilated, partly effaced. Labour was now induced using vaginal prostaglandins; prostin 3mg was given at 12.15hrs on 16.9.90. Contractions gradually became establised over the next 18 hours.

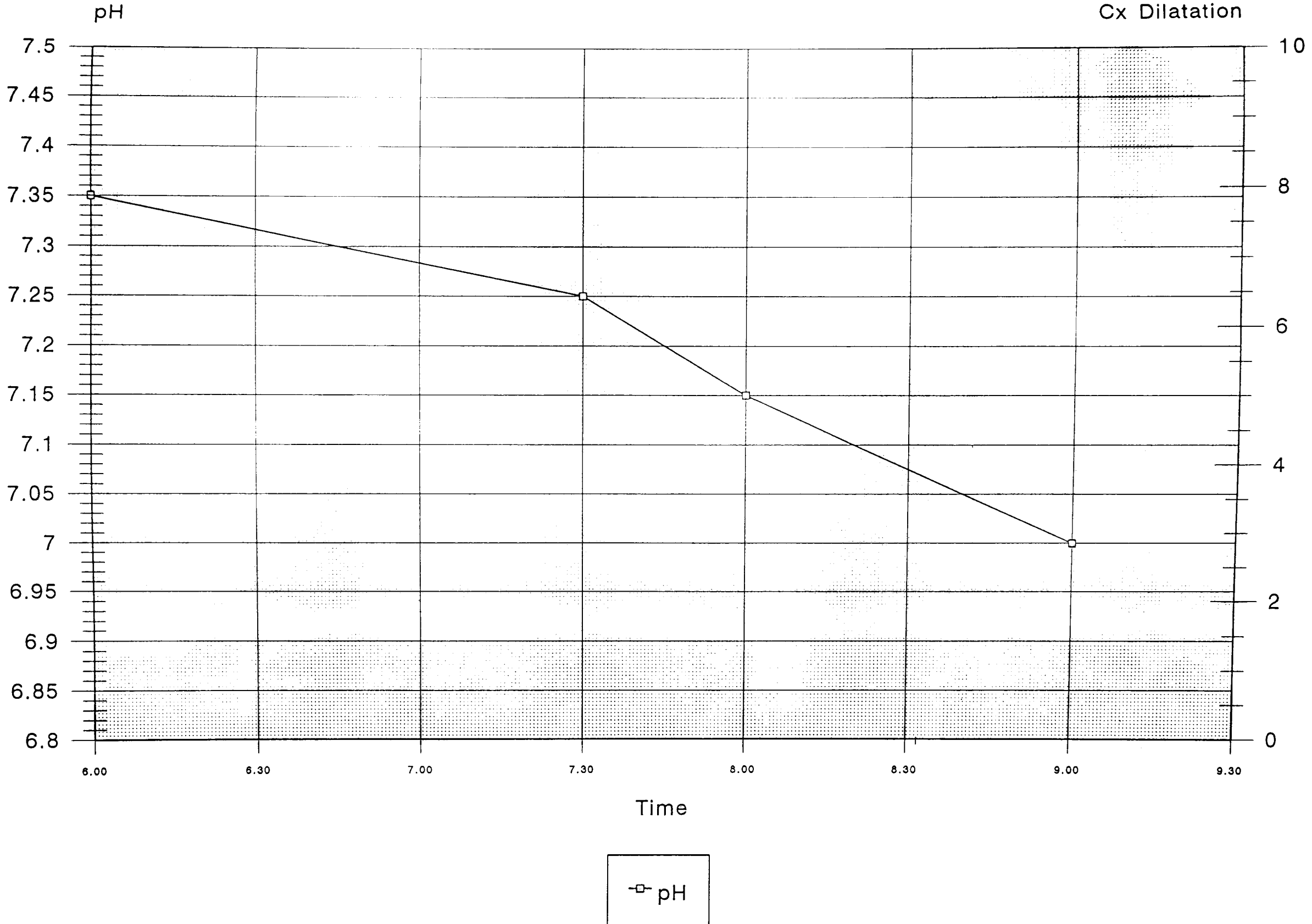
Labour events

Note; BP stable throughout labour at 130/90-100

06.10	Contractions now more painful. Continuous monitoring begun.
06.30	VE Cx fully dilated. Station 0. ARM performed; clear liquor. Position LOA.
07.43	FSE applied.
07.50	Pushing begun.
08.05	In kneeling position.
08.20	Maternal position changed, oxygen given.
09.10	Episiotomy.
09.15	Normal delivery of male infant.

Outcome

Birth weight 3.66kg
Apgar 6 & 9
Cord gases pH 6.88 / 6.97 BD(ecf) 22 / 15


pH
Cx Dilatation
7.5
7.45
7.4
7.35
7.3
7.25
7.2
7.15
7.1
7.05
7
6.95
6.9
6.85
6.8
10
8
6
4
2
0
6.00
6.30
7.00
7.30
8.00
8.30
9.00
9.30
Time
pH

Case 30

	SEGMENT																																																										
REVIEWER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
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B1	1	1	1	1	2	2	1	2	4	4	4																																																	
B2	1	1	1	1	4	2	2	6																																																				
C1	1	1	1	1	2	2	1	2	6																																																			
C2	1	1	1	1	6																																																							
D1	1	1	1	1	2	6																																																						
D2	1	1	1	1	2	6																																																						
E1	1	1	1	1	2	6																																																						
E2	1	1	2	1	6																																																							
F1	1	1	1	1	1	2	1	2	2	2	2																																																	
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G1	1	1	1	1	1	2	2	2	2	6																																																		
G2	1	1	1	1	4	4	2	4	6																																																			
H1	1	1	1	1	6																																																							
H2	1	1	1	1	2	6																																																						
I1	1	1	1	1	4	4	2	4	2	2	2																																																	
I2	1	1	1	1	4	4	2	4	6																																																			
J1	1	1	2	2	6																																																							
J2	1	1	1	1	2	1	1	6																																																				
K1	1	1	1	1	6																																																							
K2	1	1	1	1	2	2	1	2	2	2	1																																																	
L1	1	1	1	1	2	6																																																						
L2	1	1	1	1	2	6																																																						
M1	1	1	1	1	1	1	6																																																					
M2	1	1	1	1	2	6																																																						
N1	1	1	1	1	4	4	4	6																																																				
N2	1	1	1	1	6																																																							
O1	1	1	1	1	2	4	1	4	6																																																			
O2	1	1	1	1	2	2	2	6																																																				
P1	1	1	1	1	2	2	2	6																																																				
P2	1	1	1	1	2	2	2	2	2	2	2																																																	
Q1	1	1	2	2	4	6																																																						
Q2	2	2	2	2	2	6																																																						
S1	2	1	1	1	2	2	1	1	1	1	1																																																	
S2	2	1	1	1	2	2	1	1	1	1	1																																																	
R1	1	2	2	1	2	1	1	1	2	1	2																																																	
R2	1	2	1	2	1	2	6																																																					
Clinical	0	0	0	0	0	0	0	0	0	0	0	D																																																

Agreement results matrix for case 30

REVIEWER	A1	A2	B1	B2	C1	C2	D1	D2	E1	E2	F1	F2	G1	G2	H1	H2	I1	I2	J1	J2	K1	K2	L1	L2	M1	M2	N1	N2	O1	O2	P1	P2	Q1	Q2	S1	S2	R1	R2
A1	100	45	73	75	41	35	42	42	42	36	24	37	37	95	35	42	98	95	37	44	35	24	42	42	43	42	90	35	93	45	45	25	70	42	22	22	23	45
A2	45	100	49	72	94	58	82	82	82	60	64	82	84	55	58	82	47	55	60	96	58	63	82	82	91	82	53	58	65	99	99	66	58	78	60	60	61	94
B1	73	49	100	40	56	18	27	27	27	18	32	59	58	62	18	27	61	62	18	49	18	32	27	27	37	27	47	18	72	49	49	31	19	24	30	30	30	37
B2	75	72	40	100	65	59	67	67	67	58	42	58	59	87	59	67	83	87	57	71	59	41	67	67	72	67	92	59	82	73	73	43	88	62	39	39	38	72
C1	41	94	56	65	100	40	64	64	64	38	71	96	95	51	40	64	42	51	38	95	40	71	64	64	81	64	45	40	64	95	95	70	39	57	66	66	67	81
C2	35	58	18	59	40	100	94	94	94	99	48	39	39	41	100	94	44	41	96	61	100	47	94	94	81	94	48	100	41	60	60	47	73	85	44	44	44	78
D1	42	82	27	67	64	94	100	100	100	93	54	44	45	49	94	100	48	49	92	81	94	54	100	100	93	100	54	94	53	83	83	55	76	92	52	52	50	93
D2	42	82	27	67	64	94	100	100	100	93	54	44	45	49	94	100	48	49	92	81	94	54	100	100	93	100	54	94	53	83	83	55	76	92	52	52	50	93
E1	42	82	27	67	64	94	100	100	100	93	54	44	45	49	94	100	48	49	92	81	94	54	100	100	93	100	54	94	53	83	83	55	76	92	52	52	50	93
E2	36	60	18	58	38	99	93	93	93	100	46	38	38	41	99	93	43	41	99	59	99	45	93	93	80	93	48	99	41	58	58	45	74	89	43	43	46	79
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G1	37	84	58	59	95	39	45	45	45	38	73	99	100	46	39	45	38	46	36	81	39	72	45	45	64	45	35	39	55	85	85	74	26	37	65	65	67	65
G2	95	55	62	87	51	41	49	49	49	41	24	45	46	100	41	49	96	100	40	54	41	23	49	49	53	49	96	41	98	55	55	24	78	46	21	21	21	52
H1	35	58	18	59	40	100	94	94	94	99	48	39	39	41	100	94	44	41	96	61	100	47	94	94	81	94	48	100	41	60	60	47	73	85	44	44	44	78
H2	42	82	27	67	64	94	100	100	100	93	54	44	45	49	94	100	48	49	92	81	94	54	100	100	93	100	54	94	53	83	83	55	76	92	52	52	50	93
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J2	44	96	49	71	95	61	81	81	81	59	64	83	81	54	61	81	46	54	58	100	61	64	81	81	95	81	54	61	66	97	97	62	56	74	64	64	63	92
K1	35	58	18	59	40	100	94	94	94	99	48	39	39	41	100	94	44	41	96	61	100	47	94	94	81	94	48	100	41	60	60	47	73	85	44	44	44	78
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L1	42	82	27	67	64	94	100	100	100	93	54	44	45	49	94	100	48	49	92	81	94	54	100	100	93	100	54	94	53	83	83	55	76	92	52	52	50	93
L2	42	82	27	67	64	94	100	100	100	93	54	44	45	49	94	100	48	49	92	81	94	54	100	100	93	100	54	94	53	83	83	55	76	92	52	52	50	93
M1	43	91	37	72	81	81	93	93	93	80	59	65	64	53	81	93	48	53	76	95	81	58	93	93	100	93	58	81	60	92	92	56	68	85	56	56	56	96
M2	42	82	27	67	64	94	100	100	100	93	54	44	45	49	94	100	48	49	92	81	94	54	100	100	93	100	54	94	53	83	83	55	76	92	52	52	50	93
N1	90	53	47	92	45	48	54	54	54	48	20	35	35	96	48	54	93	96	47	54	48	19	54	54	58	54	100	48	94	54	54	20	87	51	16	16	17	57
N2	35	58	18	59	40	100	94	94	94	99	48	39	39	41	100	94	44	41	96	61	100	47	94	94	81	94	48	100	41	60	60	47	73	85	44	44	44	78
O1	93	65	72	82	64	41	53	53	53	41	31	56	55	98	41	53	93	98	40	66	41	31	53	53	60	53	94	41	100	65	65	31	72	50	30	30	31	59
O2	45	99	49	73	95	60	83	83	83	58	65	84	85	55	60	83	48	55	59	97	60	65	83	83	92	83	54	60	65	100	100	67	57	76	61	61	59	93
P1	45	99	49	73	95	60	83	83	83	58	65	84	85	55	60	83	48	55	59	97	60	65	83	83	92	83	54	60	65	100	100	67	57	76	61	61	59	93
P2	25	66	31	43	70	47	55	55	55	45	98	73	74	24	47	55	33	24	46	62	47	97	55	55	56	55	20	47	31	67	67	100	30	47	88	88	90	59
Q1	70	58	19	88	39	73	76	76	76	74	29	25	26	78	73	76	78	78	75	56	73	30	76	76	68	76	87	73	72	57	57	30	100	75	27	27	29	70
Q2	42	78	24	62	57	85	92	92	92	89	44	36	37	46	85	92	45	46	91	74	85	47	92	92	85	92	51	85	50	76	76	47	75	100	48	48	50	92
S1	22	60	30	39	66	44	52	52	52	43	90	66	65	21	44	52	29	21	43	64	44	93	52	52	56	52	16	44	30	61	61	88	27	48	100	100	93	56
S2	22	60	30	39	66	44	52	52	52	43	90	66	65	21	44	52	29	21	43	64	44	93	52	52	56	52	16	44	30	61	61	88	27	48	100	100	93	56
R1	23	61	30	38	67	44	50	50	50	46	93	69	67	21	44	50	29	21	44	63	44	94	50	50	56	50	17	44	31	59	59	90	29	50	93	93	100	56
R2	45	94	37	72	81	78	93	93	93	79	57	64	65	52	78	93	48	52	79	92	78	58	93	93	96	93	57	78	59	93	93	59	70	92	56	56	56	100

Case 31 2324

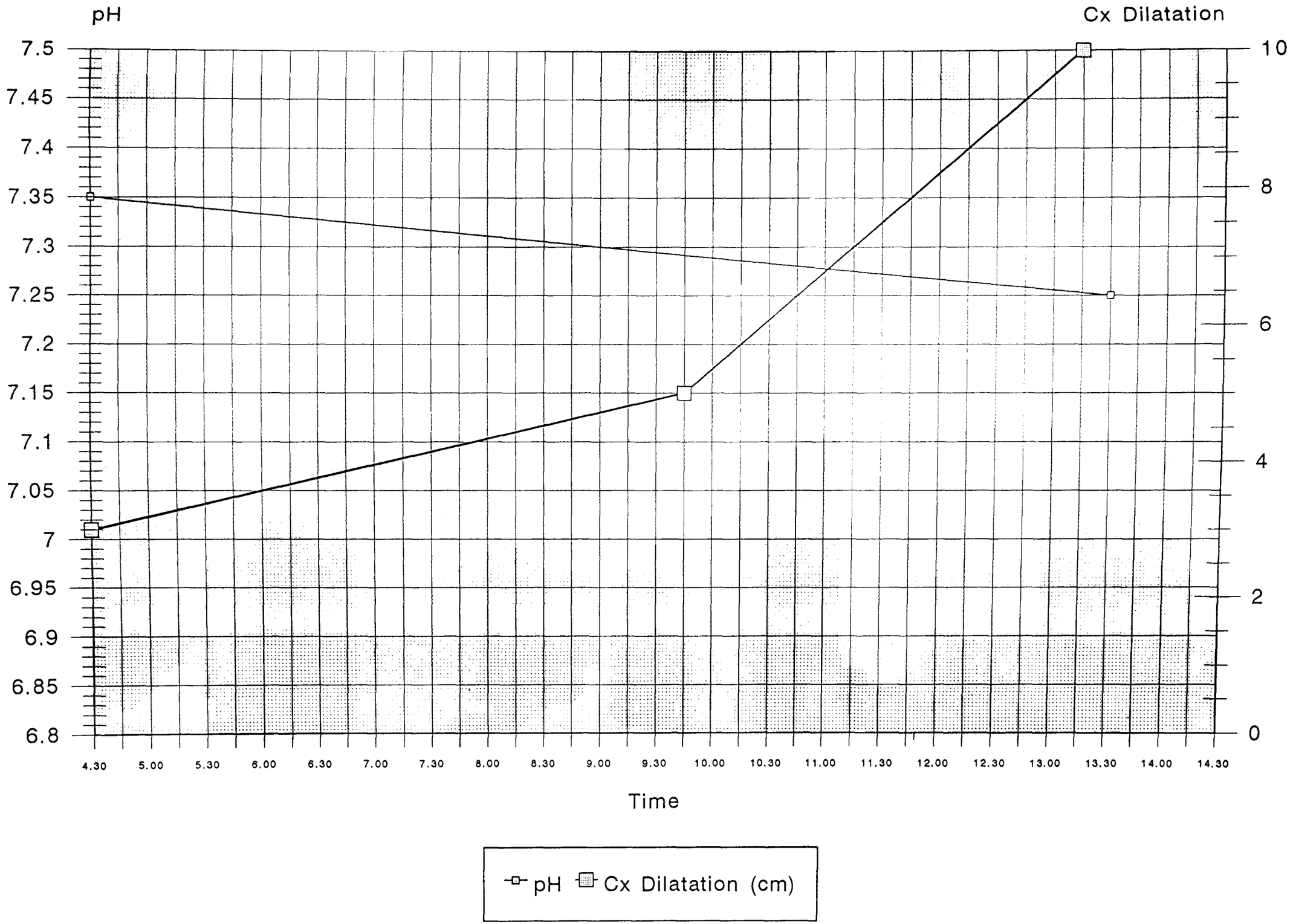
Mrs J.W. is a 24 year old lady expecting her second baby. She is a fit lady and does not smoke. Her first child was delivered vaginally as a breech. He was adopted, and there is no record of his weight. Her current pregnancy progressed well, and she was admitted with spontaneous rupture of the membranes at 39 weeks, on 20.11.91. The uterus was felt to be appropriate for dates, presentation cephalic 3/5. VE (at 04.30hrs) Cx 3cm dilated. Contractions were mild and 5 hours later (at 09.50hrs) the cervix was still just 5cm dilated. Forewater rupture was performed; clear liquor was seen.

Labour events

10.50 Epidural begun.
11.10 Epidural complete.
13.15 VE Cx fully dilated. Station +1. LOA position.
13.45 Pushing begun.
14.26 Normal delivery of female infant.

Outcome

Birth weight 3.4kg
Apgar 9 & 9
Cord gases pH 7.25 / 7.37 BD(ecf) 0 / 0


pH
Cx Dilatation
7.5
7.45
7.4
7.35
7.3
7.25
7.2
7.15
7.1
7.05
7
6.95
6.9
6.85
6.8
10
8
6
4
2
0
4.30
5.00
5.30
6.00
6.30
7.00
7.30
8.00
8.30
9.00
9.30
10.00
10.30
11.00
11.30
12.00
12.30
13.00
13.30
14.00
14.30
Time
pH
Cx Dilatation (cm)

Case 31

	SEGMENT																																																										
REVIEWER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
A1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																												
A2	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1																																												
B1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2																																												
B2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2																																												
C1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																												
C2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2																																												
D1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																												
D2	1	1	1	2	1	1	1	1	1	1	1	2	1	1	1	2																																												
E1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1																																												
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F1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																												
F2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																												
G1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																												
G2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2																																												
H1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1																																												
H2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																												
I1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	2																																												
I2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2																																												
J1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																												
J2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																												
K1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																												
K2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																												
L1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																												
L2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2																																												
M1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																												
M2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																												
N1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1																																												
N2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																												
O1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																												
O2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2																																												
P1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																												
P2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																												
Q1	1	2	2	2	1	2	2	2	1	2	1	2	1	2	2	2																																												
Q2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2																																												
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R1	2	1	2	3	2	2	2	1	1	4	3	1	2	1	1	1																																												
R2	1	1	1	1	1	1	4	3	1	1	1	2	1	1	5																																													
Clinical	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	D																																											

Agreement results matrix for case 31

REVIEWER	A1	A2	B1	B2	C1	C2	D1	D2	E1	E2	F1	F2	G1	G2	H1	H2	I1	I2	J1	J2	K1	K2	L1	L2	M1	M2	N1	N2	O1	O2	P1	P2	Q1	Q2	S1	S2	R1	R2
A1	100	99	99	99	100	99	100	97	99	97	100	100	100	99	99	100	98	99	100	100	100	100	100	99	100	100	99	100	100	99	100	100	87	75	99	98	47	35
A2	99	100	98	98	99	98	99	96	100	96	99	99	99	98	98	99	99	98	99	99	99	99	99	98	99	99	100	99	99	98	99	99	88	78	100	99	48	35
B1	99	98	100	100	99	100	99	98	98	98	99	99	99	100	98	99	99	100	99	99	99	99	99	100	99	99	98	99	99	100	99	99	89	77	98	99	47	35
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C1	100	99	99	99	100	99	100	97	99	97	100	100	100	99	99	100	98	99	100	100	100	100	100	99	100	100	99	100	100	99	100	100	87	75	99	98	47	35
C2	99	98	100	100	99	100	99	98	98	98	99	99	99	100	98	99	99	100	99	99	99	99	99	100	99	99	98	99	99	100	99	99	89	77	98	99	47	35
D1	100	99	99	99	100	99	100	97	99	97	100	100	100	99	99	100	98	99	100	100	100	100	100	99	100	100	99	100	100	99	100	100	87	75	99	98	47	35
D2	97	96	98	98	97	98	97	100	96	99	97	97	97	98	96	97	97	98	97	97	97	97	97	98	97	97	96	97	97	98	97	97	91	82	96	97	49	35
E1	99	100	98	98	99	98	99	96	100	96	99	99	99	98	98	99	99	98	99	99	99	99	99	98	99	99	100	99	99	98	99	99	88	78	100	99	48	35
E2	97	96	98	98	97	98	97	99	96	100	97	97	97	98	96	97	97	98	97	97	97	97	97	98	97	97	96	97	97	98	97	97	92	81	96	97	49	34
F1	100	99	99	99	100	99	100	97	99	97	100	100	100	99	99	100	98	99	100	100	100	100	100	99	100	100	99	100	100	99	100	100	87	75	99	98	47	35
F2	100	99	99	99	100	99	100	97	99	97	100	100	100	99	99	100	98	99	100	100	100	100	100	99	100	100	99	100	100	99	100	100	87	75	99	98	47	35
G1	100	99	99	99	100	99	100	97	99	97	100	100	100	99	99	100	98	99	100	100	100	100	100	99	100	100	99	100	100	99	100	100	87	75	99	98	47	35
G2	99	98	100	100	99	100	99	98	98	98	99	99	99	100	98	99	99	100	99	99	99	99	99	100	99	99	98	99	99	100	99	99	89	77	98	99	47	35
H1	99	98	98	98	99	98	99	96	98	96	99	99	99	98	100	99	97	98	99	99	99	99	99	98	99	99	98	99	99	98	99	99	88	78	98	97	48	35
H2	100	99	99	99	100	99	100	97	99	97	100	100	100	99	99	100	98	99	100	100	100	100	100	99	100	100	99	100	100	99	100	100	87	75	99	98	47	35
I1	98	99	99	99	98	99	98	97	99	97	98	98	98	99	97	98	100	99	98	98	98	98	98	99	98	98	99	98	98	99	98	98	90	79	99	100	47	34
I2	99	98	100	100	99	100	99	98	98	98	99	99	99	100	98	99	99	100	99	99	99	99	99	100	99	99	98	99	99	100	99	99	89	77	98	99	47	35
J1	100	99	99	99	100	99	100	97	99	97	100	100	100	99	99	100	98	99	100	100	100	100	100	99	100	100	99	100	100	99	100	100	87	75	99	98	47	35
J2	100	99	99	99	100	99	100	97	99	97	100	100	100	99	99	100	98	99	100	100	100	100	100	99	100	100	99	100	100	99	100	100	87	75	99	98	47	35
K1	100	99	99	99	100	99	100	97	99	97	100	100	100	99	99	100	98	99	100	100	100	100	100	99	100	100	99	100	100	99	100	100	87	75	99	98	47	35
K2	100	99	99	99	100	99	100	97	99	97	100	100	100	99	99	100	98	99	100	100	100	100	100	99	100	100	99	100	100	99	100	100	87	75	99	98	47	35
L1	100	99	99	99	100	99	100	97	99	97	100	100	100	99	99	100	98	99	100	100	100	100	100	99	100	100	99	100	100	99	100	100	87	75	99	98	47	35
L2	99	98	100	100	99	100	99	98	98	98	99	99	99	100	98	99	99	100	99	99	99	99	99	100	99	99	98	99	99	100	99	99	89	77	98	99	47	35
M1	100	99	99	99	100	99	100	97	99	97	100	100	100	99	99	100	98	99	100	100	100	100	100	99	100	100	99	100	100	99	100	100	87	75	99	98	47	35
M2	100	99	99	99	100	99	100	97	99	97	100	100	100	99	99	100	98	99	100	100	100	100	100	99	100	100	99	100	100	99	100	100	87	75	99	98	47	35
N1	99	100	98	98	99	98	99	96	100	96	99	99	99	98	98	99	99	98	99	99	99	99	99	98	99	99	100	99	99	98	99	99	88	78	100	99	48	35
N2	100	99	99	99	100	99	100	97	99	97	100	100	100	99	99	100	98	99	100	100	100	100	100	99	100	100	99	100	100	99	100	100	87	75	99	98	47	35
O1	100	99	99	99	100	99	100	97	99	97	100	100	100	99	99	100	98	99	100	100	100	100	100	99	100	100	99	100	100	99	100	100	87	75	99	98	47	35
O2	99	98	100	100	99	100	99	98	98	98	99	99	99	100	98	99	99	100	99	99	99	99	99	100	99	99	98	99	99	100	99	99	89	77	98	99	47	35
P1	100	99	99	99	100	99	100	97	99	97	100	100	100	99	99	100	98	99	100	100	100	100	100	99	100	100	99	100	100	99	100	100	87	75	99	98	47	35
P2	100	99	99	99	100	99	100	97	99	97	100	100	100	99	99	100	98	99	100	100	100	100	100	99	100	100	99	100	100	99	100	100	87	75	99	98	47	35
Q1	87	88	89	89	87	89	87	91	88	92	87	87	87	89	88	87	90	89	87	87	87	87	87	89	87	87	88	87	87	89	87	87	100	95	88	90	49	32
Q2	75	78	77	77	75	77	75	82	78	81	75	75	75	77	78	75	79	77	75	75	75	75	75	77	75	75	78	75	75	77	75	75	95	100	78	79	48	28
S1	99	100	98	98	99	98	99	96	100	96	99	99	99	98	98	99	99	98	99	99	99	99	99	98	99	99	100	99	99	98	99	99	88	78	100	99	48	35
S2	98	99	99	99	98	99	98	97	99	97	98	98	98	99	97	98	100	99	98	98	98	98	98	99	98	98	99	98	98	99	98	98	90	79	99	100	47	34
R1	47	48	47	47	47	47	47	49	48	49	47	47	47	47	48	47	47	47	47	47	47	47	47	47	47	47	48	47	47	47	47	47	49	48	48	47	100	39
R2	35	35	35	35	35	35	35	35	35	34	35	35	35	35	35	35	34	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	32	28	35	34	39	100

Case 32 1224

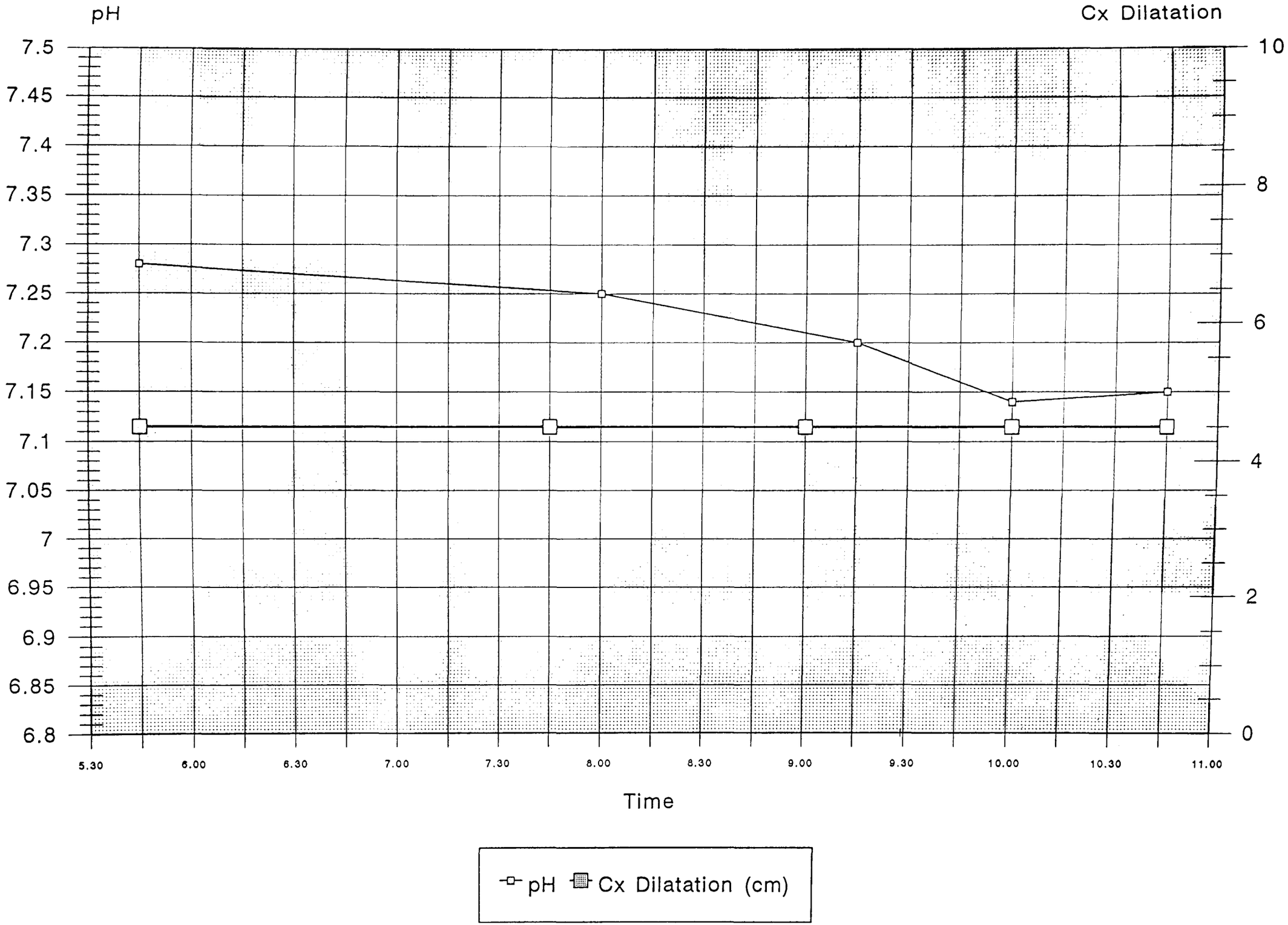
Miss M.F. is a 23 year old primigravida. She is a fit lady but smokes 10-15 cigarettes per day. Her pregnancy was uneventful and she was admitted in spontaneous labour at 39 weeks on 23/3/91 at 05.40hrs. The presentation was cephalic 2/5. VE Cx 4-5cm dilated, thin. Station -2. Thin meconium-stained liquor already draining.

Labour events

05.50	Pethidine 100mg, stemetil 12.5mg im.
06.30	Vomiting.
07.40	VE Cx 4-5cm dilated, thin. Station -2. FSE applied.
08.20	Syntocinon started.
09.00	VE No change.
10.00	VE No change. FBS; pH 7.14 BE -14 Decision for C/S.
10.40	Male infant delivered by C/S under GA. Indication; fetal distress (low scalp pH at 4cm dilatation)

Outcome

Birth weight 3.33kg
Apgar 6 & 9
Cord gases pH 7.15 / 7.21 BD(ecf) 10 / 10


pH
Cx Dilatation
7.5
7.45
7.4
7.35
7.3
7.25
7.2
7.15
7.1
7.05
7
6.95
6.9
6.85
6.8
10
8
6
4
2
0
5.30
6.00
6.30
7.00
7.30
8.00
8.30
9.00
9.30
10.00
10.30
11.00
Time
pH
Cx Dilatation (cm)

Case 32

REVIEWER	SEGMENT																																																											
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
A1	1	2	2	2	3	2	2	3	2	3	5																																																	
A2	1	2	2	2	2	2	2	2	1	1	2	2	2	3	5																																													
B1	2	2	2	3	4	4	4	3	4	4	4	3	5																																															
B2	2	2	3	2	4	2	3	4	4	2	4	3	5																																															
C1	2	3	2	2	2	3	1	1	1	2	2	2	2	2	3	5																																												
C2	2	3	2	2	2	2	2	3	2	1	2	2	2	3	5																																													
D1	2	3	2	2	2	3	2	2	2	3	5																																																	
D2	1	2	2	2	3	2	2	2	3	5																																																		
E1	2	3	2	2	2	3	2	2	3	2	2	2	3	5																																														
E2	2	3	2	2	2	3	2	2	3	2	3	2	3	5																																														
F1	2	2	1	1	1	1	1	1	1	2	2	2	1	2	2	1	1																																											
F2	2	2	2	2	3	2	1	1	1	1	2	2	1	2	2	1	1																																											
G1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2																																											
G2	2	4	3	2	2	2	2	2	2	2	2	2	2	2	2	3	5																																											
H1	3	2	2	3	2	2	2	2	3	5																																																		
H2	3	2	2	2	3	2	2	2	2	2	2	2	3	5																																														
I1	2	2	2	2	2	1	1	2	1	1	2	2	2	2	2	1	2																																											
I2	2	2	2	2	2	2	2	2	2	2	2	3	5																																															
J1	2	2	2	2	3	2	2	2	2	2	2	2	3	5																																														
J2	1	2	2	2	3	1	2	2	2	2	2	2	2	3	5																																													
K1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	3	5																																											
K2	2	2	2	1	2	2	2	2	2	1	2	2	3	4	5																																													
L1	2	3	2	2	2	2	2	3	2	2	3	5																																																
L2	1	2	2	2	3	2	2	2	2	2	2	2	3	5																																														
M1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																											
M2	2	2	2	3	2	2	2	2	2	2	2	2	2	2	2	2	2																																											
N1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	5																																										
N2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	5																																												
O1	1	1	1	2	2	2	3	2	2	3	5																																																	
O2	1	2	2	2	2	1	1	1	1	2	2	2	2	3	5																																													
P1	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	5																																											
P2	3	2	2	2	2	2	2	2	2	2	2	2	2	2	3	5																																												
Q1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	4																																											
Q2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	4	2																																											
S1	1	2	2	1	1	1	2	1	1	1	1	1	1	1	1	2	2																																											
S2	1	2	2	1	1	1	2	1	1	1	1	1	1	1	1	2	2																																											
R1	1	1	2	2	1	2	2	2	1	1	2	2	2	2	1	2	1																																											
R2	1	2	5																																																									
Clinical	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	n	n	5																																								

Agreement results matrix for case 32

REVIEWER	A1	A2	B1	B2	C1	C2	D1	D2	E1	E2	F1	F2	G1	G2	H1	H2	I1	I2	J1	J2	K1	K2	L1	L2	M1	M2	N1	N2	O1	O2	P1	P2	Q1	Q2	S1	S2	R1	R2
A1	100	19	68	69	29	35	93	94	60	62	21	40	26	22	87	51	24	66	55	31	13	26	87	55	19	38	17	18	96	18	16	16	22	22	22	22	25	10
A2	19	100	36	45	82	88	19	18	77	75	37	36	41	65	16	82	41	77	87	93	74	95	44	88	34	37	54	93	20	99	73	88	55	62	38	38	42	7
B1	68	36	100	97	38	55	65	56	68	69	7	25	9	19	55	60	8	55	61	50	5	43	70	61	4	24	7	23	64	36	10	24	8	13	6	6	8	15
B2	69	45	97	100	46	63	70	55	75	77	13	29	15	24	57	68	14	64	68	56	10	51	77	68	10	28	12	29	65	45	18	33	14	19	12	12	14	15
C1	29	82	38	46	100	91	36	28	79	75	34	49	35	85	32	79	36	45	75	89	79	77	35	75	29	47	69	87	25	83	88	92	54	56	32	32	34	11
C2	35	88	55	63	91	100	39	31	93	90	30	38	34	71	39	87	34	68	84	88	64	86	61	83	26	42	48	83	31	87	75	88	47	53	30	30	33	10
D1	93	19	65	70	36	39	100	89	65	67	21	39	26	29	90	59	24	67	54	30	12	26	91	53	18	40	18	18	92	18	27	27	23	23	22	22	24	11
D2	94	18	56	55	28	31	89	100	39	41	22	39	26	22	93	28	25	46	30	28	13	17	72	31	20	39	17	17	90	16	16	16	22	22	23	23	25	11
E1	60	77	68	75	79	93	65	39	100	98	25	41	30	51	43	93	28	80	90	85	38	79	80	90	20	42	22	65	56	77	51	71	34	42	24	24	28	10
E2	62	75	69	77	75	90	67	41	98	100	23	37	27	49	44	92	26	80	89	82	36	78	82	89	18	39	21	61	58	74	48	67	32	39	22	22	25	10
F1	21	37	7	13	34	30	21	22	25	23	100	79	87	31	20	28	93	33	31	34	43	31	24	31	92	73	42	39	24	40	37	35	63	63	91	91	91	11
F2	40	36	25	29	49	38	39	39	41	37	79	100	77	41	34	43	81	31	47	48	37	29	32	46	73	91	40	37	34	37	35	34	58	58	76	76	78	16
G1	26	41	9	15	35	34	26	26	30	27	87	77	100	35	24	33	95	38	36	38	37	33	28	36	75	84	48	45	27	40	42	40	72	72	85	85	93	12
G2	22	65	19	24	85	71	29	22	51	49	31	41	35	100	29	53	33	21	51	70	79	58	29	50	26	49	80	79	14	64	90	86	55	54	29	29	33	24
H1	87	16	55	57	32	39	90	93	43	44	20	34	24	29	100	37	22	43	28	25	11	16	79	27	16	40	16	16	81	15	28	28	21	21	20	20	22	12
H2	51	82	60	68	79	87	59	28	93	92	28	43	33	53	37	100	31	83	94	89	41	83	73	94	23	47	24	69	48	81	55	76	37	46	27	27	31	10
I1	24	41	8	14	36	34	24	25	28	26	93	81	95	33	22	31	100	36	34	37	41	32	27	34	85	79	45	43	26	41	40	38	69	69	90	90	94	12
I2	66	77	55	64	45	68	67	46	80	80	33	31	38	21	43	83	36	100	88	72	21	79	82	88	28	34	24	53	70	75	25	49	32	42	31	31	35	7
J1	55	87	61	68	75	84	54	30	90	89	31	47	36	51	28	94	34	88	100	94	44	88	69	100	26	48	26	73	51	86	47	69	40	50	30	30	34	10
J2	31	93	50	56	89	88	30	28	85	82	34	48	38	70	25	89	37	72	94	100	69	90	47	95	30	49	51	88	27	93	69	83	51	58	33	33	37	10
K1	13	74	5	10	79	64	12	13	38	36	43	37	37	79	11	41	41	21	44	69	100	65	14	45	44	33	89	88	15	75	88	83	61	59	44	44	42	6
K2	26	95	43	51	77	86	26	17	79	78	31	29	33	58	16	83	32	79	88	90	65	100	50	87	27	30	46	87	27	94	65	82	50	61	30	30	32	6
L1	87	44	70	77	35	61	91	72	80	82	24	32	28	29	79	73	27	82	69	47	14	50	100	69	20	36	19	21	87	43	28	30	25	25	23	23	26	10
L2	55	88	61	68	75	83	53	31	90	89	31	46	36	50	27	94	34	88	100	95	45	87	69	100	27	48	26	73	52	87	47	68	40	49	31	31	35	11
M1	19	34	4	10	29	26	18	20	20	18	92	73	75	26	16	23	85	28	26	30	44	27	20	27	100	62	35	33	23	36	31	29	54	54	95	95	89	11
M2	38	37	24	28	47	42	40	39	42	39	73	91	84	49	40	47	79	34	48	49	33	30	36	48	62	100	43	40	30	36	44	42	63	63	71	71	77	17
N1	17	54	7	12	69	48	18	17	22	21	42	40	48	80	16	24	45	24	26	51	89	46	19	26	35	43	100	79	18	53	89	74	68	62	40	40	44	7
N2	18	93	23	29	87	83	18	17	65	61	39	37	45	79	16	69	43	53	73	88	88	87	21	73	33	40	79	100	18	92	89	94	65	68	37	37	42	7
O1	96	20	64	65	25	31	92	90	56	58	24	34	27	14	81	48	26	70	51	27	15	27	87	52	23	30	18	18	100	19	17	17	23	23	24	24	28	7
O2	18	99	36	45	83	87	18	16	77	74	40	37	40	64	15	81	41	75	86	93	75	94	43	87	36	36	53	92	19	100	72	87	54	61	38	38	40	7
P1	16	73	10	18	88	75	27	16	51	48	37	35	42	90	28	55	40	25	47	69	88	65	28	47	31	44	89	89	17	72	100	95	64	62	35	35	39	9
P2	16	88	24	33	92	88	27	16	71	67	35	34	40	86	28	76	38	49	69	83	83	82	30	68	29	42	74	94	17	87	95	100	60	62	34	34	38	9
Q1	22	55	8	14	54	47	23	22	34	32	63	58	72	55	21	37	69	32	40	51	61	50	25	40	54	63	68	65	23	54	64	60	100	96	61	61	67	9
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S1	22	38	6	12	32	30	22	23	24	22	91	76	85	29	20	27	90	31	30	33	44	30	23	31	95	71	40	37	24	38	35	34	61	61	100	100	92	12
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R1	25	42	8	14	34	33	24	25	28	25	91	78	93	33	22	31	94	35	34	37	42	32	26	35	89	77	44	42	28	40	39	38	67	67	92	92	100	12
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Case 33 970

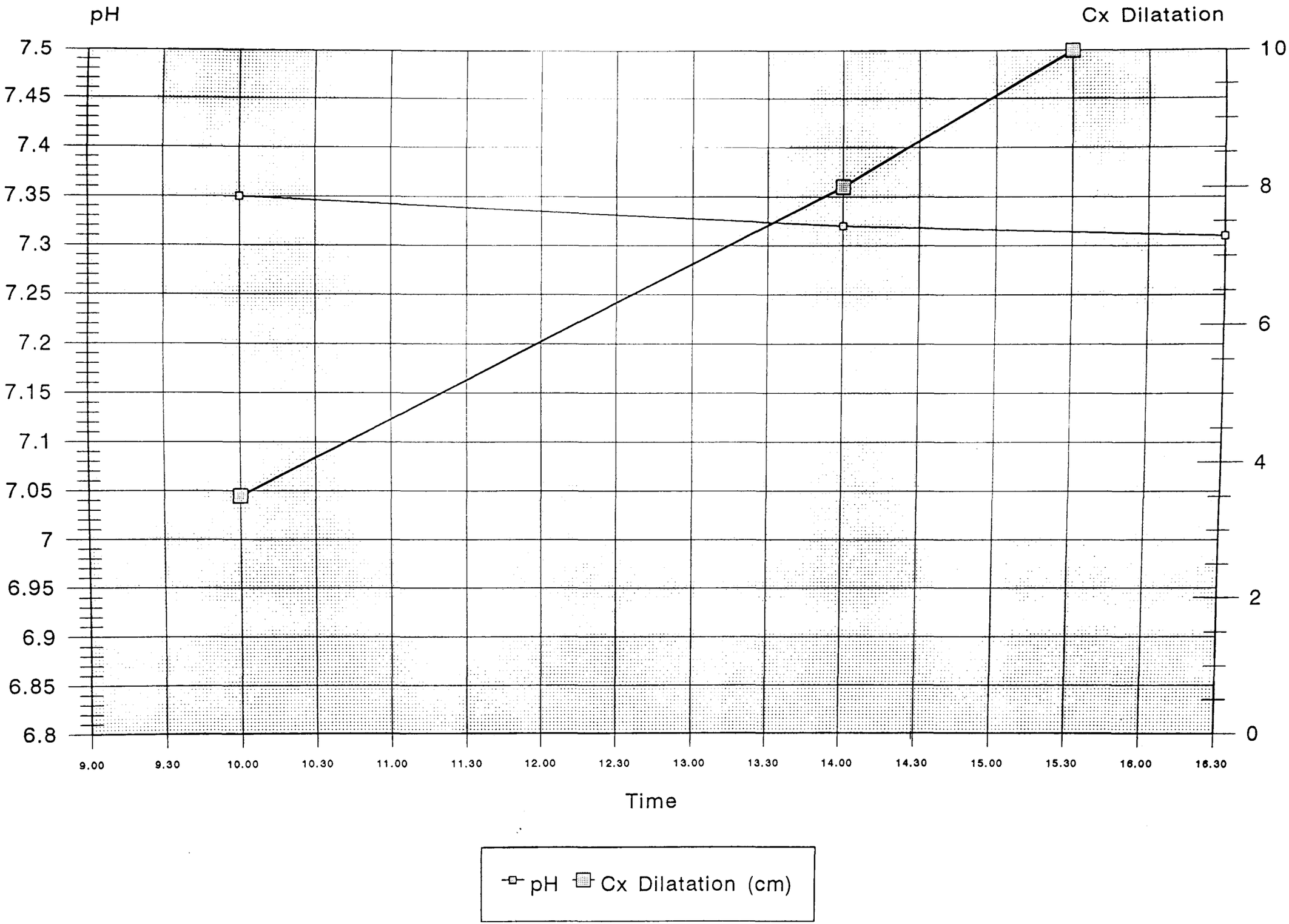
Miss S.B. is a 16 year old primigravida. She is a fit nonsmoker. There were no antenatal problems and she was admitted in spontaneous labour at 40 weeks gestation on 29.1.91. Presentation cephalic 1/5. At 09.50hrs the cervix was 3-4cm dilated; effaced and thin. Station -1. ARM was performed, and clear liquor drained.

Labour events

12.50	Pethidine 100mg, Stemetil 25mg. FSE applied.
13.45	VE Cx 7-8cm dilated. Station 0.
15.15	VE Cx fully dilated. Station +2.
15.20	Pushing began.
16.00	Episiotomy.
16.08	Normal delivery of female infant.

Outcome

Birth weight	3.63kg
Apgar	8 & 9
Cord gases	pH 7.31 / 7.38 BD(ecf) 0 / 2


pH
Cx Dilatation
7.5
7.45
7.4
7.35
7.3
7.25
7.2
7.15
7.1
7.05
7
6.95
6.9
6.85
6.8
10
8
6
4
2
0
9.00
9.30
10.00
10.30
11.00
11.30
12.00
12.30
13.00
13.30
14.00
14.30
15.00
15.30
16.00
16.30
Time
pH
Cx Dilatation (cm)

Case 33

	SEGMENT																																																											
REVIEWER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
A1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2																																																			
A2	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2																																																				
B1	1	1	1	1	1	1	2	2	2	3	1	1	2	2	4																																																				
B2	1	1	1	2	1	1	2	3	2	2	1	1	2	4	4																																																				
C1	1	1	1	1	1	1	1	2	1	1	1	1	2	2	1																																																				
C2	1	1	1	1	1	1	2	2	2	2	2	2	4	4	2																																																				
D1	1	1	1	1	1	1	1	1	2	2	1	1	2	2	2																																																				
D2	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2																																																				
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E2	1	1	1	2	1	2	2	2	3	2	2	2	2	2	2																																																				
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F2	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1																																																				
G1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2																																																				
G2	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2																																																				
H1	1	1	1	1	1	2	2	2	2	2	2	2	2	6																																																					
H2	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2																																																				
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I2	1	1	1	2	2	2	3	2	2	2	2	2	2	2	2																																																				
J1	1	1	1	2	2	2	3	2	2	2	2	2	6																																																						
J2	1	1	1	2	2	2	2	2	2	2	2	2	1	1	1																																																				
K1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																																				
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L1	1	1	1	1	1	1	2	2	2	2	1	1	2	1	1																																																				
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M1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																																				
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N1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																																				
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P1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																																				
P2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																																				
Q1	1	1	2	2	2	2	2	2	2	2	2	2	4	4	4																																																				
Q2	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2																																																				
S1	1	1	1	1	1	2	2	3	2	2	1	2	2	2	1																																																				
S2	1	1	1	1	1	2	2	3	2	2	1	2	2	2	1																																																				
R1	2	3	2	1	1	3	2	1	2	1	1	1	2	2	1																																																				
R2	4	2	1	4	2	1	1	2	2	1	1	1	2	1	2																																																				
Clinical	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	D																																																		

Agreement results matrix for case 33

REVIEWER	A1	A2	B1	B2	C1	C2	D1	D2	E1	E2	F1	F2	G1	G2	H1	H2	I1	I2	J1	J2	K1	K2	L1	L2	M1	M2	N1	N2	O1	O2	P1	P2	Q1	Q2	S1	S2	R1	R2
A1	100	96	58	44	93	53	96	96	99	80	86	88	89	99	80	100	79	79	62	92	86	86	95	99	86	100	86	86	74	77	86	86	38	99	79	79	61	48
A2	96	100	56	44	88	50	91	100	98	81	81	83	84	98	79	96	80	82	65	96	81	81	91	98	81	96	81	81	73	73	81	81	40	98	78	78	60	47
B1	58	56	100	93	58	83	58	56	58	72	54	56	56	58	66	58	66	56	59	54	54	54	59	58	54	58	54	54	74	75	54	54	85	58	68	68	42	35
B2	44	44	93	100	44	88	44	44	44	58	41	43	42	44	61	44	59	57	68	43	41	41	45	44	41	44	41	41	53	53	41	41	90	44	60	60	47	29
C1	93	88	58	44	100	49	97	88	91	74	97	97	97	91	73	93	74	72	56	88	97	97	97	91	97	93	97	97	77	78	97	97	34	91	78	78	64	50
C2	53	50	83	88	49	100	50	50	52	45	45	47	47	52	69	53	45	44	59	49	45	45	50	52	45	53	45	45	48	49	45	45	96	52	45	45	36	31
D1	96	91	58	44	97	50	100	91	94	76	93	95	97	94	75	96	75	74	58	87	93	93	95	94	93	96	93	93	75	78	93	93	35	94	77	77	62	50
D2	96	100	56	44	88	50	91	100	98	81	81	83	84	98	79	96	80	82	65	96	81	81	91	98	81	96	81	81	73	73	81	81	40	98	78	78	60	47
E1	99	98	58	44	91	52	94	98	100	81	84	87	88	100	80	99	80	80	63	93	84	84	95	100	84	99	84	84	75	76	84	84	39	100	80	80	61	48
E2	80	81	72	58	74	45	76	81	81	100	67	70	70	81	66	80	96	89	74	77	67	67	76	81	67	80	67	67	90	92	67	67	35	81	95	95	62	42
F1	86	81	54	41	97	45	93	81	84	67	100	99	97	84	67	86	69	65	51	86	100	100	93	84	100	86	100	100	75	76	100	100	32	84	72	72	61	48
F2	88	83	56	43	97	47	95	83	87	70	99	100	96	87	69	88	72	68	54	89	99	99	96	87	99	88	99	99	78	79	99	99	33	87	75	75	62	49
G1	89	84	56	42	97	47	97	84	88	70	97	96	100	88	70	89	69	68	53	83	97	97	92	88	97	89	97	97	73	76	97	97	32	88	72	72	61	49
G2	99	98	58	44	91	52	94	98	100	81	84	87	88	100	80	99	80	80	63	93	84	84	95	100	84	99	84	84	75	76	84	84	39	100	80	80	61	48
H1	80	79	66	61	73	69	75	79	80	66	67	69	70	80	100	80	66	66	81	76	67	67	77	80	67	80	67	67	61	63	67	67	62	80	66	66	51	40
H2	100	96	58	44	93	53	96	96	99	80	86	88	89	99	80	100	79	79	62	92	86	86	95	99	86	100	86	86	74	77	86	86	38	99	79	79	61	48
I1	79	80	66	59	74	45	75	80	80	96	69	72	69	80	66	79	100	96	80	79	69	69	78	80	69	79	69	69	85	84	69	69	35	80	98	98	72	42
I2	79	82	56	57	72	44	74	82	80	89	65	68	68	80	66	79	96	100	84	78	65	65	74	80	65	79	65	65	72	72	65	65	36	80	94	94	77	47
J1	62	65	59	68	56	59	58	65	63	74	51	54	53	63	81	62	80	84	100	63	51	51	60	63	51	62	51	51	65	64	51	51	56	63	79	79	64	39
J2	92	96	54	43	88	49	87	96	93	77	86	89	83	93	76	92	79	78	63	100	86	86	94	93	86	92	86	86	78	75	86	86	39	93	77	77	60	48
K1	86	81	54	41	97	45	93	81	84	67	100	99	97	84	67	86	69	65	51	86	100	100	93	84	100	86	100	100	75	76	100	100	32	84	72	72	61	48
K2	86	81	54	41	97	45	93	81	84	67	100	99	97	84	67	86	69	65	51	86	100	100	93	84	100	86	100	100	75	76	100	100	32	84	72	72	61	48
L1	95	91	59	45	97	50	95	91	95	76	93	96	92	95	77	95	78	74	60	94	93	93	100	95	93	95	93	93	80	80	93	93	36	95	80	80	63	50
L2	99	98	58	44	91	52	94	98	100	81	84	87	88	100	80	99	80	80	63	93	84	84	95	100	84	99	84	84	75	76	84	84	39	100	80	80	61	48
M1	86	81	54	41	97	45	93	81	84	67	100	99	97	84	67	86	69	65	51	86	100	100	93	84	100	86	100	100	75	76	100	100	32	84	72	72	61	48
M2	100	96	58	44	93	53	96	96	99	80	86	88	89	99	80	100	79	79	62	92	86	86	95	99	86	100	86	86	74	77	86	86	38	99	79	79	61	48
N1	86	81	54	41	97	45	93	81	84	67	100	99	97	84	67	86	69	65	51	86	100	100	93	84	100	86	100	100	75	76	100	100	32	84	72	72	61	48
N2	86	81	54	41	97	45	93	81	84	67	100	99	97	84	67	86	69	65	51	86	100	100	93	84	100	86	100	100	75	76	100	100	32	84	72	72	61	48
O1	74	73	74	53	77	48	75	73	75	90	75	78	73	75	61	74	85	72	65	78	75	75	80	75	75	74	75	75	100	99	75	75	37	75	87	87	54	43
O2	77	73	75	53	78	49	78	73	76	92	76	79	76	76	63	77	84	72	64	75	76	76	80	76	76	77	76	76	99	100	76	76	36	76	87	87	54	44
P1	86	81	54	41	97	45	93	81	84	67	100	99	97	84	67	86	69	65	51	86	100	100	93	84	100	86	100	100	75	76	100	100	32	84	72	72	61	48
P2	86	81	54	41	97	45	93	81	84	67	100	99	97	84	67	86	69	65	51	86	100	100	93	84	100	86	100	100	75	76	100	100	32	84	72	72	61	48
Q1	38	40	85	90	34	96	35	40	39	35	32	33	32	39	62	38	35	36	56	39	32	32	36	39	32	38	32	32	37	36	32	32	100	39	34	34	28	24
Q2	99	98	58	44	91	52	94	98	100	81	84	87	88	100	80	99	80	80	63	93	84	84	95	100	84	99	84	84	75	76	84	84	39	100	80	80	61	48
S1	79	78	68	60	78	45	77	78	80	95	72	75	72	80	66	79	98	94	79	77	72	72	80	80	72	79	72	72	87	87	72	72	34	80	100	100	73	43
S2	79	78	68	60	78	45	77	78	80	95	72	75	72	80	66	79	98	94	79	77	72	72	80	80	72	79	72	72	87	87	72	72	34	80	100	100	73	43
R1	61	60	42	47	64	36	62	60	61	62	61	62	61	61	51	61	72	77	64	60	61	61	63	61	61	61	61	61	54	54	61	61	28	61	73	73	100	63
R2	48	47	35	29	50	31	50	47	48	42	48	49	49	48	40	48	42	47	39	48	48	48	50	48	48	48	48	48	43	44	48	48	24	48	43	43	63	100

Case 34 594

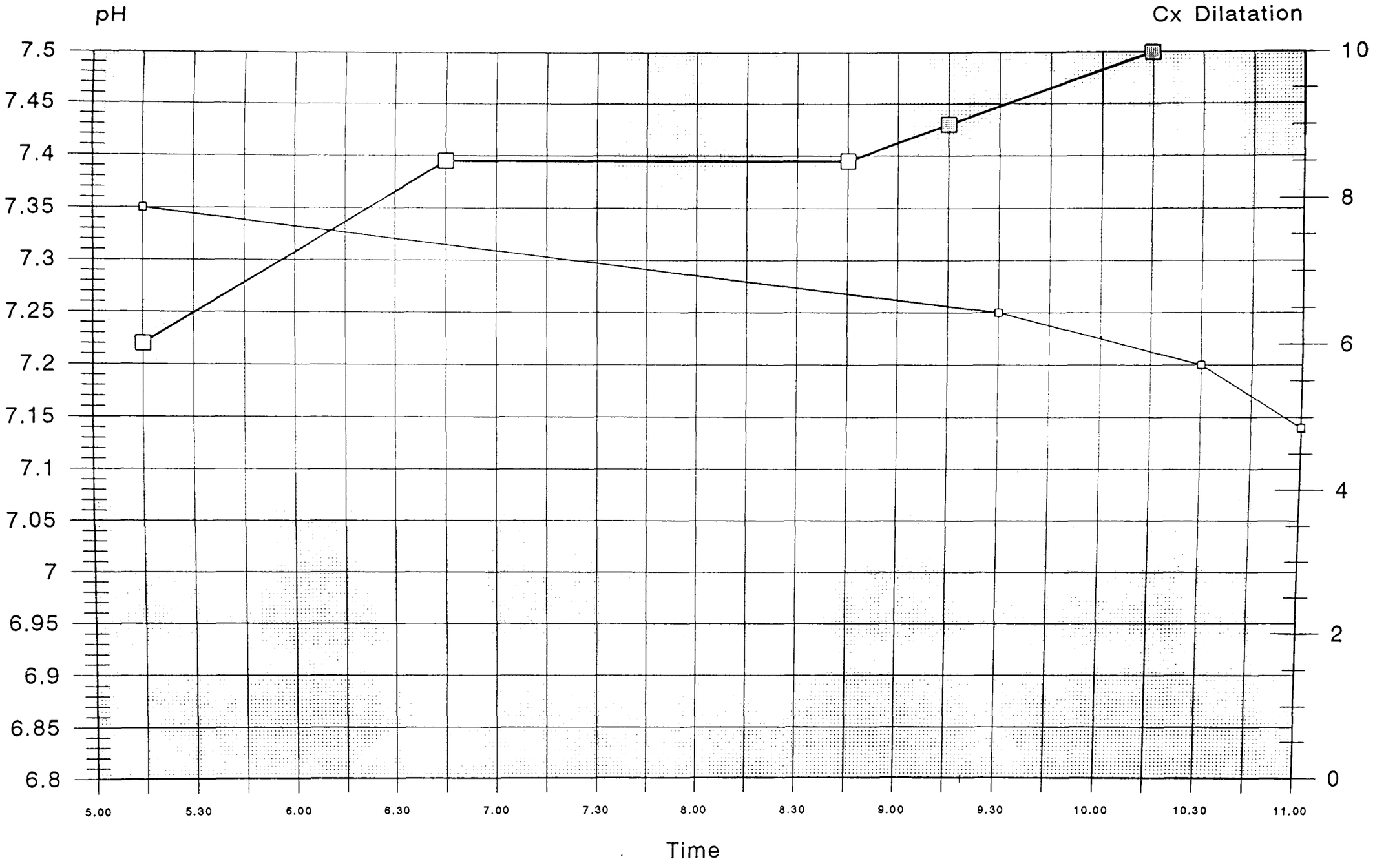
Mrs M.B. is a primigravida, 20 years of age, fit and a nonsmoker. During her pregnancy she lost 1kg in weight from booking to full term. Fetal size was felt clinically to be adequate. She was admitted in established labour at 38 weeks, at 05.15hrs on 5.11.90. Presentation cephalic 2/5; cervix already 6cm dilated, station -1. The membranes had ruptured spontaneously and clear liquor was draining; an FSE was applied.

Labour events

06.50	VE Cx 8-9cm dilated. Station -1.
08.50	VE Cx No change.
09.00	Pethidine 100mg im.
09.10	Oxygen to mother for 20 minutes.
09.20	VE Cx 9cm dilated. Station 0. OP position.
09.50	Syntocinon started.
10.20	VE Cx fully dilated. Station +1. OP position. FBS; pH 7.21 BE -5.
10.30	Pushing begun.
10.55	Little progress. Meconium now present.
11.07	Neville Barnes forceps delivery of female infant. (Indication; slow progress, borderline scalp pH; baby delivered OP)

Outcome

Birth weight 2.19kg
Apgar 4 & 7
Cord gases pH 7.14 / 7.20 BD(ecf) 7 / 5


pH
Cx Dilatation
7.5
7.45
7.4
7.35
7.3
7.25
7.2
7.15
7.1
7.05
7
6.95
6.9
6.85
6.8
10
8
6
4
2
0
5.00
5.30
6.00
6.30
7.00
7.30
8.00
8.30
9.00
9.30
10.00
10.30
11.00
Time
pH
Cx Dilatation (cm)

Case 34

REVIEWER	SEGMENT																																																											
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
A1	2	1	1	2	2	2	2	3	2	2	1	2	2	2	3	4	4	3	5																																									
A2	2	1	1	1	1	1	2	2	1	1	1	1	1	2	2	3	2	3	2	2	6																																							
B1	1	1	1	1	1	1	1	1	1	2	1	1	1	2	2	3	4	4	5																																									
B2	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	3	4	4	5																																									
C1	1	1	1	1	1	1	1	1	1	2	1	1	1	2	2	2	2	4	4	6																																								
C2	2	1	1	2	1	1	1	1	1	2	1	1	1	2	2	2	3	2	2	6																																								
D1	2	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	3	4	3	6																																								
D2	2	1	1	1	1	1	1	1	1	1	1	1	1	2	2	3	2	2	2	6																																								
E1	2	1	1	1	1	1	2	2	1	2	2	2	1	2	3	2	3	4	3	6																																								
E2	2	1	1	1	1	1	2	2	2	2	1	1	1	2	2	3	2	3	2	6																																								
F1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	3	4	4	6																																						
F2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	3	4	4	6																																						
G1	2	1	1	1	1	1	1	2	1	1	1	1	1	1	2	2	3	3	3	6																																								
G2	2	1	1	1	1	1	1	2	2	2	2	2	1	1	2	2	3	4	5																																									
H1	2	1	1	1	1	1	1	1	1	2	1	1	1	2	2	3	4	4	3	6																																								
H2	2	1	1	1	1	1	2	2	1	2	1	1	1	2	2	3	2	2	3	6																																								
I1	2	1	1	1	1	1	2	1	1	1	1	1	1	1	2	2	3	2	3	2	6																																							
I2	2	2	1	2	1	1	2	2	1	1	1	1	1	2	2	2	3	2	2	3	6																																							
J1	3	2	1	2	2	1	2	2	1	3	2	2	2	3	2	2	5																																											
J2	2	1	1	2	1	1	2	2	2	3	1	2	1	2	4	3	4	4	3	4	6																																							
K1	1	1	1	1	1	1	1	1	1	1	1	1	1	3	2	3	2	3	2	6																																								
K2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	3	2	4	3	6																																							
L1	1	1	1	1	1	1	2	2	1	2	1	1	1	2	2	3	2	3	2	6																																								
L2	2	1	1	2	1	1	2	2	2	2	2	1	1	2	2	3	2	3	4	4	6																																							
M1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	3	2	2	6																																							
M2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	3	2	2	6																																							
N1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	6																																								
N2	2	1	1	1	1	1	1	1	1	1	1	1	1	2	1	2	2	3	2	2	2	2	6																																					
O1	2	1	1	1	1	1	2	2	1	2	3	2	1	2	2	3	2	3	5																																									
O2	2	1	1	1	1	1	2	1	1	1	1	2	1	2	2	3	2	2	3	2	6																																							
P1	2	1	1	1	1	2	2	2	1	2	1	1	1	2	2	2	2	2	2	6																																								
P2	2	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	3	4	4	6																																								
Q1	2	1	1	1	1	1	2	2	1	1	1	1	1	2	2	2	2	2	2	2	4	6																																						
Q2	2	2	2	2	2	2	2	2	2	2	1	1	2	2	2	2	2	4	4	4	4	6																																						
S1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	2	1	2	3	2	6																																								
S2	1	1	1	1	1	1	1	1	1	1	1	1	2	1	2	1	1	2	3	6																																								
R1	2	2	2	1	1	1	2	2	2	2	2	2	1	1	1	3	2	2	1	1	1	2	1																																					
R2	1	2	5																																																									
Clinical	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	6																																					

Agreement results matrix for case 34

REVIEWER	A1	A2	B1	B2	C1	C2	D1	D2	E1	E2	F1	F2	G1	G2	H1	H2	I1	I2	J1	J2	K1	K2	L1	L2	M1	M2	N1	N2	O1	O2	P1	P2	Q1	Q2	S1	S2	R1	R2
A1	100	54	91	90	65	51	69	50	73	56	49	49	56	88	76	55	51	51	73	79	56	60	56	66	45	45	35	43	84	53	38	69	36	64	48	43	47	5
A2	54	100	54	54	73	94	86	94	86	98	75	75	95	57	80	96	96	96	41	68	95	87	98	82	95	95	83	90	61	98	84	79	74	64	93	88	80	7
B1	91	54	100	100	77	54	77	54	77	56	58	58	57	97	80	56	53	51	69	74	57	71	56	73	50	50	42	47	87	53	41	79	44	70	52	48	47	5
B2	90	54	100	100	77	54	77	54	76	55	58	58	57	97	80	55	54	52	68	73	57	72	56	72	50	50	43	47	86	54	41	80	44	70	52	48	47	5
C1	65	73	77	77	100	76	95	74	90	74	87	87	77	75	94	76	76	76	48	82	70	95	75	91	76	76	77	68	64	75	75	97	76	89	77	79	52	6
C2	51	94	54	54	76	100	88	97	85	95	74	74	96	57	80	96	96	98	39	64	91	88	96	79	95	95	91	86	59	94	90	80	72	61	96	93	77	8
D1	69	86	77	77	95	88	100	86	96	86	80	80	91	75	98	88	88	88	47	83	84	96	87	90	86	86	80	79	68	87	79	99	65	80	87	86	62	6
D2	50	94	54	54	74	97	86	100	84	95	73	73	93	54	80	98	95	96	42	64	94	88	95	77	91	91	88	82	59	97	86	78	73	58	92	90	78	8
E1	73	86	77	76	90	85	96	84	100	87	74	74	88	76	97	89	86	86	54	85	86	93	87	91	80	80	71	73	71	87	73	95	59	78	81	77	67	6
E2	56	98	56	55	74	95	86	95	87	100	72	72	96	59	81	98	94	95	42	68	95	86	99	83	92	92	83	84	64	95	86	79	68	62	93	88	80	7
F1	49	75	58	58	87	74	80	73	74	72	100	100	78	62	73	74	79	77	29	72	69	90	73	90	79	79	76	76	59	76	74	86	93	90	78	79	45	6
F2	49	75	58	58	87	74	80	73	74	72	100	100	78	62	73	74	79	77	29	72	69	90	73	90	79	79	76	76	59	76	74	86	93	90	78	79	45	6
G1	56	95	57	57	77	96	91	93	88	96	78	78	100	61	83	97	97	96	37	69	92	89	96	82	95	95	88	87	64	95	87	83	66	62	96	94	70	7
G2	88	57	97	97	75	57	75	54	76	59	62	62	61	100	76	58	56	55	66	69	56	71	59	74	54	54	47	51	91	55	48	78	50	70	56	52	52	5
H1	76	80	80	80	94	80	98	80	97	81	73	73	83	76	100	83	81	80	54	89	81	92	82	89	77	77	67	71	68	81	67	97	55	80	78	75	59	6
H2	55	96	56	55	76	96	88	98	89	98	74	74	97	58	83	100	96	96	42	68	94	87	98	82	91	91	87	83	64	97	89	80	71	62	93	91	75	7
I1	51	96	53	54	76	96	88	95	86	94	79	79	97	56	81	96	100	97	36	67	90	89	94	80	97	97	89	91	59	98	89	81	76	64	94	93	75	7
I2	51	96	51	52	76	98	88	96	86	95	77	77	96	55	80	96	97	100	37	67	90	89	95	81	95	95	90	87	58	96	91	81	77	66	94	92	71	8
J1	73	41	69	68	48	39	47	42	54	42	29	29	37	66	54	42	36	37	100	58	46	40	42	46	33	33	33	33	73	41	36	49	29	43	34	33	44	8
J2	79	68	74	73	82	64	83	64	85	68	72	72	69	69	89	68	67	67	58	100	66	80	68	86	61	61	50	57	69	68	51	84	57	84	61	57	48	4
K1	56	95	57	57	70	91	84	94	86	95	69	69	92	56	81	94	90	90	46	66	100	84	96	80	87	87	78	79	65	93	76	77	62	56	88	83	75	7
K2	60	87	71	72	95	88	96	88	93	86	90	90	89	71	92	87	89	89	40	80	84	100	87	94	88	88	83	80	66	87	81	98	79	87	87	86	59	6
L1	56	98	56	56	75	96	87	95	87	99	73	73	96	59	82	98	94	95	42	68	96	87	100	82	94	94	85	85	64	95	86	80	68	61	95	89	78	7
L2	66	82	73	72	91	79	90	77	91	83	90	90	82	74	89	82	80	81	46	86	80	94	82	100	77	77	68	71	71	81	70	94	80	93	76	73	59	6
M1	45	95	50	50	76	95	86	91	80	92	79	79	95	54	77	91	97	95	33	61	87	88	94	77	100	100	94	92	55	94	91	78	80	62	97	95	72	8
M2	45	95	50	50	76	95	86	91	80	92	79	79	95	54	77	91	97	95	33	61	87	88	94	77	100	100	94	92	55	94	91	78	80	62	97	95	72	8
N1	35	83	42	43	77	91	80	88	71	83	76	76	88	47	67	87	89	90	33	50	78	83	85	68	94	94	100	83	48	86	97	72	80	58	95	97	62	9
N2	43	90	47	47	68	86	79	82	73	84	76	76	87	51	71	83	91	87	33	57	79	80	85	71	92	92	83	100	52	88	81	72	78	61	88	85	75	8
O1	84	61	87	86	64	59	68	59	71	64	59	59	64	91	68	64	59	58	73	69	65	66	64	71	55	55	48	52	100	61	50	69	48	60	58	55	54	5
O2	53	98	53	54	75	94	87	97	87	95	76	76	95	55	81	97	98	96	41	68	93	87	95	81	94	94	86	88	61	100	86	79	76	63	92	90	76	7
P1	38	84	41	41	75	90	79	86	73	86	74	74	87	48	67	89	89	91	36	51	76	81	86	70	91	91	97	81	50	86	100	71	81	61	92	94	66	9
P2	69	79	79	80	97	80	99	78	95	79	86	86	83	78	97	80	81	81	49	84	77	98	80	94	78	78	72	72	69	79	71	100	71	88	79	78	57	6
Q1	36	74	44	44	76	72	65	73	59	68	93	93	66	50	55	71	76	77	29	57	62	79	68	80	80	80	80	78	48	76	81	71	100	86	74	75	55	7
Q2	64	64	70	70	89	61	80	58	78	62	90	90	62	70	80	62	64	66	43	84	56	87	61	93	62	62	58	61	60	63	61	88	86	100	60	60	41	5
S1	48	93	52	52	77	96	87	92	81	93	78	78	96	56	78	93	94	94	34	61	88	87	95	76	97	97	95	88	58	92	92	79	74	60	100	98	71	8
S2	43	88	48	48	79	93	86	90	77	88	79	79	94	52	75	91	93	92	33	57	83	86	89	73	95	95	97	85	55	90	94	78	75	60	98	100	62	8
R1	47	80	47	47	52	77	62	78	67	80	45	45	70	52	59	75	75	71	44	48	75	59	78	59	72	72	62	75	54	76	66	57	55	41	71	62	100	9
R2	5	7	5	5	6	8	6	8	6	7	6	6	7	5	6	7	7	8	8	4	7	6	7	6	8	8	9	8	5	7	9	6	7	5	8	8	9	100

Case 35 1591

Mrs J.M. is a 27 year old primigravida; fit and a nonsmoker. Her pregnancy was straightforward apart from very mild hypertension at 39 weeks (BP 130/85) without proteinuria. Fetal size was judged to be adequate. Labour was induced at 41 weeks on the grounds of postmaturity and mild hypertension. She was admitted on 6.6.91 at which time the presentation was cephalic 3/5; cervix 1cm dilated, 2cm long. Prostin gel 2mg was given at 14.00hrs, and a repeat dose of 2mg was given at 18.30hrs the following day, because although the cervix was now 3cm dilated the head was still "high" and ARM felt to be inadvisable. ARM was performed at 16.35hrs on 8.6.91; cervix still 3cm dilated; station -3. Clear liquor drained, and FSE applied.

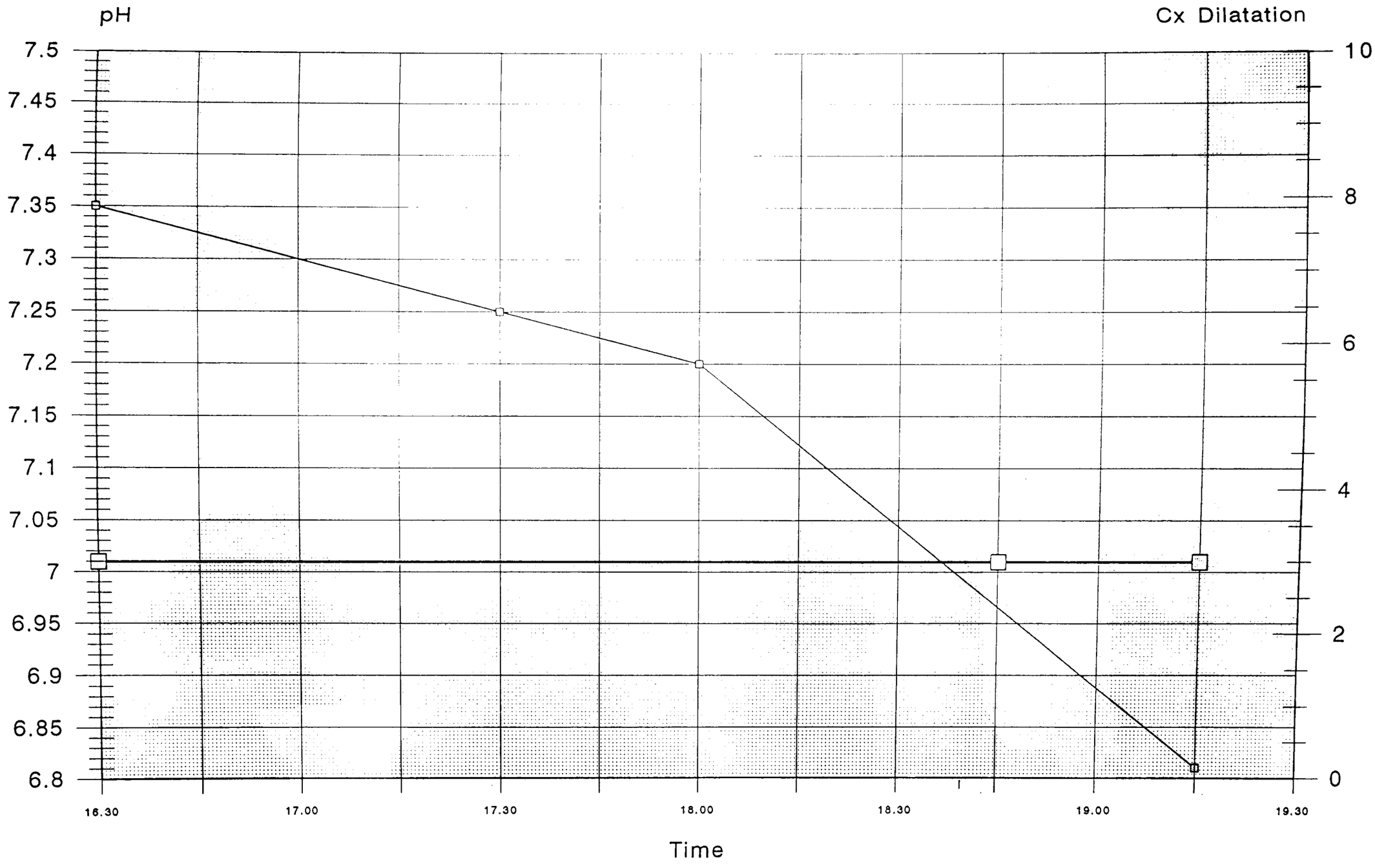
Labour events

Note; BP stable at 130/80-85 throughout labour, with no significant proteinuria.

16.45 Maternal position changed; oxygen given for 30 minutes.
18.15 Epidural started.
18.40 VE Cx 3cm dilated. Loop of cord felt. Decision for emergency Caesarean section.
19.12 Male infant delivered by C/S. Indication; cord prolapse at 3cm dilatation. There was difficulty with intubation of the mother; GA was therefore abandoned and C/S was carried out under epidural.

Outcome

Birth weight 3.85kg
Apgar 3 & 8
Cord gases pH 6.81 / 7.20 BD(ecf) 11 / -


pH
Cx Dilatation
7.5
7.45
7.4
7.35
7.3
7.25
7.2
7.15
7.1
7.05
7
6.95
6.9
6.85
6.8
10
8
6
4
2
0
16.30
17.00
17.30
18.00
18.30
19.00
19.30
Time
pH
Cx Dilatation (cm)

Case 35

SEGMENT

REVIEWER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
A1	2	2	2	3	5																																																							
A2	2	2	2	3	2	3	5																																																					
B1	2	3	4	4	3	5																																																						
B2	2	2	3	4	5																																																							
C1	2	2	2	3	4	5																																																						
C2	4	3	1	2	2	3	5																																																					
D1	2	2	2	3	2	3	5																																																					
D2	2	3	2	2	2	3	5																																																					
E1	3	2	2	2	2	3	5																																																					
E2	3	2	2	2	2	3	5																																																					
F1	2	2	2	2	2	2	2	5																																																			
F2	2	2	2	1	1	2	3	5																																																			
G1	2	2	2	2	2	3	5																																																					
G2	2	2	2	3	2	5																																																						
H1	2	3	2	2	2	3	5																																																					
H2	3	2	2	2	2	2	3	5																																																			
I1	4	3	2	2	2	3	5																																																					
I2	2	2	3	2	2	3	5																																																					
J1	3	2	2	2	2	3	5																																																					
J2	2	2	3	2	2	3	5																																																					
K1	3	2	2	2	3	5																																																						
K2	2	3	2	2	2	3	5																																																					
L1	2	3	2	2	2	3	5																																																					
L2	2	2	2	3	4	4	3	5																																																			
M1	2	2	2	2	2	2	2	3	5																																																		
M2	2	2	2	2	2	2	3	5																																																			
N1	2	2	2	2	2	3	4	5																																																			
N2	2	3	2	2	2	3	5																																																					
O1	2	3	2	2	3	5																																																						
O2	2	2	3	2	2	3	5																																																					
P1	2	2	1	2	2	2	2	5																																																			
P2	2	2	2	2	2	2	3	5																																																			
Q1	4	4	4	4	4	4	4	5																																																			
Q2	2	4	2	2	2	2	2	5																																																			
S1	2	2	1	2	1	2	2	3	5																																																		
S2	2	2	2	2	1	2	3	5																																																			
R1	2	2	3	4	2	1	1	3																																																			
R2	2	3	2	4	2	2	1	1																																																			
Clinical	0	0	0	0	0	0	0	5	n	C																																																		

Agreement results matrix for case 35

REVIEWER	A1	A2	B1	B2	C1	C2	D1	D2	E1	E2	F1	F2	G1	G2	H1	H2	I1	I2	J1	J2	K1	K2	L1	L2	M1	M2	N1	N2	O1	O2	P1	P2	Q1	Q2	S1	S2	R1	R2
A1	100	77	85	95	92	64	77	73	70	70	41	43	73	94	73	43	65	76	70	76	88	73	73	58	13	44	50	73	91	76	41	44	48	42	12	44	54	53
A2	77	100	79	70	88	85	100	96	93	93	80	88	98	93	96	85	86	99	93	99	89	96	96	88	69	89	91	96	91	99	80	89	65	76	68	89	50	42
B1	85	79	100	93	93	83	79	80	78	78	46	52	71	84	80	63	83	80	78	80	86	80	80	78	30	53	61	80	88	80	46	53	82	72	29	52	67	69
B2	95	70	93	100	93	64	70	68	65	65	34	35	63	87	68	42	65	70	65	70	83	68	68	61	9	35	44	68	86	70	33	35	63	50	9	35	65	67
C1	92	88	93	93	100	75	88	83	81	81	61	63	85	96	83	61	75	87	81	87	91	83	83	82	37	63	73	83	93	87	61	63	71	62	36	63	61	59
C2	64	85	83	64	75	100	85	92	91	91	69	75	80	78	92	86	100	90	91	90	86	92	92	77	59	75	76	92	86	90	69	75	80	86	59	75	46	44
D1	77	100	79	70	88	85	100	96	93	93	80	88	98	93	96	85	86	99	93	99	89	96	96	88	69	89	91	96	91	99	80	89	65	76	68	89	50	42
D2	73	96	80	68	83	92	96	100	99	99	80	86	93	88	100	93	92	99	99	99	93	100	100	84	69	86	87	100	94	99	80	86	66	80	68	86	48	46
E1	70	93	78	65	81	91	93	99	100	100	80	86	93	85	99	94	92	96	100	96	94	99	99	82	69	86	87	99	93	96	80	86	66	79	68	86	45	44
E2	70	93	78	65	81	91	93	99	100	100	80	86	93	85	99	94	92	96	100	96	94	99	99	82	69	86	87	99	93	96	80	86	66	79	68	86	45	44
F1	41	80	46	34	61	69	80	80	80	80	100	93	87	69	80	87	69	80	80	80	63	80	80	76	89	94	90	80	63	80	100	94	52	85	88	94	24	20
F2	43	88	52	35	63	75	88	86	86	86	93	100	93	68	86	92	75	86	86	86	68	86	86	83	93	99	95	86	68	86	93	99	54	80	93	100	37	22
G1	73	98	71	63	85	80	98	93	93	93	87	93	100	89	93	86	81	95	93	95	86	93	93	85	74	93	93	93	86	95	87	93	58	75	74	93	40	32
G2	94	93	84	87	96	78	93	88	85	85	69	68	89	100	88	66	78	91	85	91	94	88	88	75	42	69	74	88	96	91	68	69	59	66	41	68	51	49
H1	73	96	80	68	83	92	96	100	99	99	80	86	93	88	100	93	92	99	99	99	93	100	100	84	69	86	87	100	94	99	80	86	66	80	68	86	48	46
H2	43	85	63	42	61	86	85	93	94	94	87	92	86	66	93	100	87	90	94	90	77	93	93	80	87	93	89	93	76	90	86	93	63	84	86	92	45	36
I1	65	86	83	65	75	100	86	92	92	92	69	75	81	78	92	87	100	90	92	90	87	92	92	77	60	76	77	92	87	90	69	76	80	87	59	75	47	45
I2	76	99	80	70	87	90	99	99	96	96	80	86	95	91	99	90	90	100	96	100	90	99	99	87	69	86	89	99	93	100	80	86	66	79	68	86	51	45
J1	70	93	78	65	81	91	93	99	100	100	80	86	93	85	99	94	92	96	100	96	94	99	99	82	69	86	87	99	93	96	80	86	66	79	68	86	45	44
J2	76	99	80	70	87	90	99	99	96	96	80	86	95	91	99	90	90	100	96	100	90	99	99	87	69	86	89	99	93	100	80	86	66	79	68	86	51	45
K1	88	89	86	83	91	86	89	93	94	94	63	68	86	94	93	77	87	90	94	90	100	93	93	74	41	68	72	93	99	90	62	68	62	64	41	68	49	53
K2	73	96	80	68	83	92	96	100	99	99	80	86	93	88	100	93	92	99	99	99	93	100	100	84	69	86	87	100	94	99	80	86	66	80	68	86	48	46
L1	73	96	80	68	83	92	96	100	99	99	80	86	93	88	100	93	92	99	99	99	93	100	100	84	69	86	87	100	94	99	80	86	66	80	68	86	48	46
L2	58	88	78	61	82	77	88	84	82	82	76	83	85	75	84	80	77	87	82	87	74	84	84	100	72	83	93	84	76	87	75	83	84	75	71	83	64	51
M1	13	69	30	9	37	59	69	69	69	69	89	93	74	42	69	87	60	69	69	69	41	69	69	72	100	93	85	69	41	69	88	93	45	77	99	93	37	19
M2	44	89	53	35	63	75	89	86	86	86	94	99	93	69	86	93	76	86	86	86	68	86	86	83	93	100	95	86	68	86	94	100	54	81	93	100	38	22
N1	50	91	61	44	73	76	91	87	87	87	90	95	93	74	87	89	77	89	87	89	72	87	87	93	85	95	100	87	72	89	90	95	68	79	85	95	39	29
N2	73	96	80	68	83	92	96	100	99	99	80	86	93	88	100	93	92	99	99	99	93	100	100	84	69	86	87	100	94	99	80	86	66	80	68	86	48	46
O1	91	91	88	86	93	86	91	94	93	93	63	68	86	96	94	76	87	93	93	93	99	94	94	76	41	68	72	94	100	93	62	68	62	65	41	68	53	55
O2	76	99	80	70	87	90	99	99	96	96	80	86	95	91	99	90	90	100	96	100	90	99	99	87	69	86	89	99	93	100	80	86	66	79	68	86	51	45
P1	41	80	46	33	61	69	80	80	80	80	100	93	87	68	80	86	69	80	80	80	62	80	80	75	88	94	90	80	62	80	100	94	52	85	88	93	24	20
P2	44	89	53	35	63	75	89	86	86	86	94	99	93	69	86	93	76	86	86	86	68	86	86	83	93	100	95	86	68	86	94	100	54	81	93	100	38	22
Q1	48	65	82	63	71	80	65	66	66	66	52	54	58	59	66	63	80	66	66	66	62	66	66	84	45	54	68	66	62	66	52	54	100	83	45	54	59	56
Q2	42	76	72	50	62	86	76	80	79	79	85	80	75	66	80	84	87	79	79	79	64	80	80	75	77	81	79	80	65	79	85	81	83	100	76	81	47	46
S1	12	68	29	9	36	59	68	68	68	68	88	93	74	41	68	86	59	68	68	68	41	68	68	71	99	93	85	68	41	68	88	93	45	76	100	93	37	18
S2	44	89	52	35	63	75	89	86	86	86	94	100	93	68	86	92	75	86	86	86	68	86	86	83	93	100	95	86	68	86	93	100	54	81	93	100	38	22
R1	54	50	67	65	61	46	50	48	45	45	24	37	40	51	48	45	47	51	45	51	49	48	48	64	37	38	39	48	53	51	24	38	59	47	37	38	100	86
R2	53	42	69	67	59	44	42	46	44	44	20	22	32	49	46	36	45	45	44	45	53	46	46	51	19	22	29	46	55	45	20	22	56	46	18	22	86	100

Case 36 46

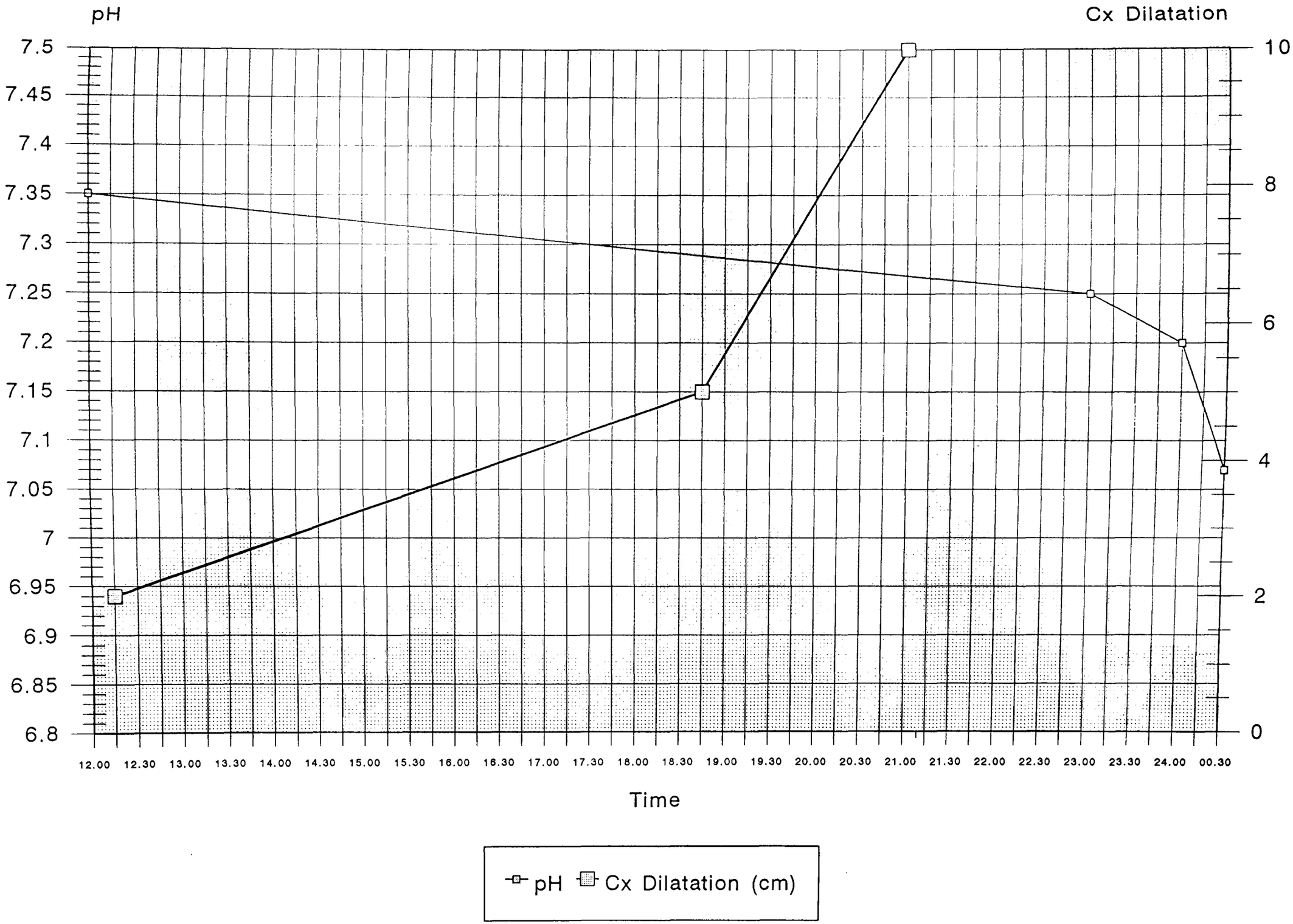
Mrs M.T. is a 32 year old primigravida; fit, and a nonsmoker. There were no antenatal problems. Labour was induced at 42 weeks on 10.6.90, on the grounds of postmaturity.

Labour events

12.15	Induction of labour. Uterus term size. Cephalic 3/5.
	VE Cx 2cm dilated, partly effaced. Station -2. ARM; clear liquor. FSE applied.
14.15	VE difficult because of patient discomfort. Cx not reached.
14.55	Syntocinon started.
16.50	Epidural started.
18.40	VE Cx 5cm dilated, 75% effaced. Station -1.
19.05	Top up.
21.00	VE Cx fully dilated. Station 0. OP position. Attempt at pushing for 20 minutes.
21.20	No progress. Top up given to allow descent of head.
22.30	Maternal pyrexia 38°C (from now until delivery).
	Pushing started.
00.00	Top up.
00.15	In lithotomy position.
00.30	Female infant delivered by Kjelland forceps. Indication; delay in 2nd stage, maternal exhaustion.

Outcome

Birth weight 3.92kg
Apgar 4 & 9
Cord gases pH 7.07 / 7.30 BD(ecf) 4 / 1


pH
Cx Dilatation
7.5
7.45
7.4
7.35
7.3
7.25
7.2
7.15
7.1
7.05
7
6.95
6.9
6.85
6.8
10
8
6
4
2
0
12.00
12.30
13.00
13.30
14.00
14.30
15.00
15.30
16.00
16.30
17.00
17.30
18.00
18.30
19.00
19.30
20.00
20.30
21.00
21.30
22.00
22.30
23.00
23.30
24.00
00.30
Time
pH
Cx Dilatation (cm)

Case 36

	SEGMENT																																																											
REVIEWER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
A1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	3	2	3	2	2	6																																					
A2	1	1	1	2	1	1	1	1	2	2	1	2	1	1	1	2	1	2	1	1	1	1	2	1	2	2	2	2	2	2	2	1	1	1	2	2	2	4																						
B1	1	1	1	2	1	1	2	2	2	3	2	2	1	1	1	2	2	3	2	2	2	2	3	2	4	4	6																																	
B2	1	1	1	2	2	1	1	1	1	2	2	1	1	1	1	2	2	2	3	1	1	1	1	2	4	4	4	2	2	2	4	4	2	2	4	4	4	6																						
C1	1	1	1	1	1	1	1	1	2	2	2	2	1	1	1	2	3	2	2	1	1	3	1	2	6																																			
C2	1	1	1	1	1	1	1	1	2	2	2	2	1	1	1	2	2	3	1	1	1	1	1	2	2	2	2	2	2	2	1	1	1	1	2	2	2	6																						
D1	1	1	1	1	1	1	1	2	2	2	3	1	1	1	1	2	2	2	2	1	1	3	2	2	6																																			
D2	1	1	1	2	2	1	1	2	2	3	2	1	1	1	1	2	2	2	2	2	3	2	2	2	6																																			
E1	1	1	1	2	1	1	1	1	2	2	2	1	1	1	1	2	2	3	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	6																										
E2	1	1	1	2	2	1	1	2	2	3	2	2	1	1	2	2	2	2	3	2	2	2	2	2	2	3	2	2	2	2	2	2	6																											
F1	1	1	1	1	1	1	1	1	1	2	2	1	1	1	1	1	1	2	3	1	1	1	3	2	2	2	6																																	
F2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	1	2	2	2	6																																				
G1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	6																						
G2	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	3	2	2	6																																
H1	1	1	1	2	2	2	1	1	1	1	2	1	1	1	1	2	2	3	1	1	1	1	2	2	6																																			
H2	1	1	1	2	2	1	1	1	2	2	2	1	1	1	1	2	2	2	2	1	1	2	3	2	2	2	2	2	2	2	1	1	1	1	1	2	2	6																						
I1	1	1	2	2	2	1	1	2	2	2	2	2	1	1	1	2	2	3	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	6																						
I2	1	1	2	2	1	1	1	1	2	2	2	2	1	1	1	2	2	2	2	1	1	1	2	1	2	2	2	2	2	2	2	2	2	2	2	6																								
J1	1	1	1	2	2	1	1	1	1	2	2	3	1	1	1	2	1	2	1	1	1	1	1	2	2	2	2	2	2	2	6																													
J2	1	1	2	2	2	1	1	1	1	1	2	2	2	1	1	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	6																						
K1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	2	6																																			
K2	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	1	1	1	1	2	4	6																																		
L1	1	1	1	2	1	1	1	1	1	1	2	1	1	1	1	2	2	3	1	1	1	1	2	2	6																																			
L2	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	6																									
M1	1	1	1	1	1	1	1	1	1	2	2	1	1	1	1	1	1	1	1	1	1	2	2	1	1	1	1	1	1	2	2	2	2	2	2	2	2	6																						
M2	2	2	2	2	2	2	2	2	3	2	2	2	2	2	2	2	2	2	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	6																							
N1	1	1	1	2	1	1	1	1	1	1	2	1	1	1	1	2	2	2	1	1	2	2	2	2	2	2	2	2	2	2	6																													
N2	1	1	1	2	2	1	2	1	1	1	1	1	1	1	1	2	2	2	2	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	6																									
O1	1	1	1	2	2	2	1	2	1	2	2	2	1	1	2	2	2	3	2	2	1	1	2	2	2	2	2	2	6																															
O2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	3	1	1	2	2	2	3	2	2	2	6																																
P1	1	1	1	1	1	1	1	1	1	2	2	1	1	1	1	2	2	2	1	1	1	1	1	1	6																																			
P2	1	1	1	2	1	1	1	1	2	2	2	2	1	1	1	2	2	2	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	4	4	6																							
Q1	2	2	2	2	2	1	1	2	2	2	2	2	1	1	1	2	2	2	2	2	2	2	2	4	4	4	4	6																																
Q2	2	2	2	2	2	2	2	2	2	4	4	4	2	2	2	4	4	4	4	2	2	4	4	2	4	4	4	4	4	4	6																													
S1	1	1	1	1	2	1	1	1	2	2	3	2	1	1	1	2	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	6																									
S2	1	1	1	1	2	1	1	1	2	2	3	2	1	1	1	2	1	1	1	1	2	2	2	2	2	2	1	2	2	2	2	2	2	2	6																									
R1	1	2	1	2	1	1	2	1	2	1	1	5																																																
R2	1	1	2	2	2	2	2	2	2	3	1	1	1	1	2	2	1	2	2	2	2	1	1	6																																				
Clinical	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6																						

Agreement results matrix for case 36

REVIEWER	A1	A2	B1	B2	C1	C2	D1	D2	E1	E2	F1	F2	G1	G2	H1	H2	I1	I2	J1	J2	K1	K2	L1	L2	M1	M2	N1	N2	O1	O2	P1	P2	Q1	Q2	S1	S2	R1	R2
A1	100	46	66	37	88	65	74	77	69	65	84	79	51	66	87	64	64	50	48	47	71	61	89	51	48	58	57	52	72	85	71	39	44	30	47	47	28	67
A2	46	100	38	54	52	82	52	51	69	57	55	58	86	59	56	82	81	84	66	83	61	53	56	79	85	70	70	78	61	55	61	82	36	14	73	72	25	52
B1	66	38	100	58	74	48	74	76	50	74	76	62	38	66	71	53	49	41	47	36	62	80	71	39	37	54	43	40	62	74	63	34	87	61	49	48	22	71
B2	37	54	58	100	40	51	36	39	49	53	44	34	46	40	43	49	51	47	38	44	37	52	43	45	45	48	39	46	43	44	37	68	62	56	43	43	12	32
C1	88	52	74	40	100	65	84	81	67	69	88	83	54	76	90	69	63	57	55	52	82	74	91	56	53	54	59	56	70	86	84	45	57	35	52	52	26	73
C2	65	82	48	51	65	100	51	54	81	67	67	56	88	56	70	85	96	85	64	86	59	51	71	77	86	83	68	77	75	68	61	74	35	22	73	72	24	49
D1	74	52	74	36	84	51	100	96	54	74	80	83	54	76	75	69	51	57	68	50	81	73	76	55	53	57	59	56	56	73	83	45	58	34	66	66	31	89
D2	77	51	76	39	81	54	96	100	58	82	77	79	52	75	77	66	56	56	64	50	76	70	77	53	51	67	60	55	62	72	77	44	58	35	65	65	30	90
E1	69	69	50	49	67	81	54	58	100	83	70	61	73	61	74	68	83	86	73	66	62	53	75	88	71	77	80	88	79	72	62	73	37	25	83	83	26	52
E2	65	57	74	53	69	67	74	82	83	100	74	60	59	69	74	62	70	68	75	55	63	62	74	69	57	77	72	71	73	73	64	58	55	43	80	80	25	71
F1	84	55	76	44	88	67	80	77	70	74	100	80	59	83	88	68	65	59	59	54	81	76	89	61	57	57	63	60	82	93	81	47	61	36	55	55	26	69
F2	79	58	62	34	83	56	83	79	61	60	80	100	65	85	85	72	55	63	61	59	95	81	86	66	62	46	71	65	62	79	94	48	56	22	58	58	32	82
G1	51	86	38	46	54	88	54	52	73	59	59	65	100	65	59	88	89	91	68	88	66	57	60	88	96	76	76	86	63	60	64	78	36	14	79	79	27	52
G2	66	59	66	40	76	56	76	75	61	69	83	85	65	100	81	69	56	63	68	57	89	84	81	66	61	50	76	66	78	88	86	49	67	31	60	60	28	73
H1	87	56	71	43	90	70	75	77	74	74	88	85	59	81	100	66	70	61	61	58	88	79	99	62	57	60	66	63	78	89	87	47	57	32	56	56	29	75
H2	64	82	53	49	69	85	69	66	68	62	68	72	88	69	66	100	84	85	64	86	70	61	66	77	85	74	69	78	62	67	70	74	47	21	73	72	25	65
I1	64	81	49	51	63	96	51	56	83	70	65	55	89	56	70	84	100	87	64	83	57	50	70	78	87	88	69	79	76	67	57	75	37	24	75	75	24	50
I2	50	84	41	47	57	85	57	56	86	68	59	63	91	63	61	85	87	100	72	86	65	57	61	95	89	80	77	96	68	59	67	84	39	15	88	88	27	56
J1	48	66	47	38	55	64	68	64	73	75	59	61	68	68	61	64	64	72	100	65	65	56	61	72	66	60	90	71	77	63	65	56	41	30	80	79	32	66
J2	47	83	36	44	52	86	50	50	66	55	54	59	88	57	58	86	83	86	65	100	63	54	58	79	91	73	69	80	62	54	64	74	35	13	72	73	26	53
K1	71	61	62	37	82	59	81	76	62	63	81	95	66	89	88	70	57	65	65	63	100	88	89	70	64	46	71	69	64	80	97	50	59	23	59	59	32	81
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L1	89	56	71	43	91	71	76	77	75	74	89	86	60	81	99	66	70	61	61	58	89	79	100	63	58	59	67	63	77	90	88	48	57	32	56	56	29	73
L2	51	79	39	45	56	77	55	53	88	69	61	66	88	66	62	77	78	95	72	79	70	60	63	100	84	71	78	98	66	61	67	80	36	14	88	88	28	56
M1	48	85	37	45	53	86	53	51	71	57	57	62	96	61	57	85	87	89	66	91	64	54	58	84	100	74	72	81	60	56	65	76	34	13	78	79	26	52
M2	58	70	54	48	54	83	57	67	77	77	57	46	76	50	60	74	88	80	60	73	46	41	59	71	74	100	60	75	68	58	47	70	35	29	79	79	23	60
N1	57	70	43	39	59	68	59	60	80	72	63	71	76	76	66	69	69	77	90	69	71	61	67	78	72	60	100	78	83	72	71	59	44	24	72	71	29	59
N2	52	78	40	46	56	77	56	55	88	71	60	65	86	66	63	78	79	96	71	80	69	59	63	98	81	75	78	100	68	61	67	80	37	15	87	87	28	58
O1	72	61	62	43	70	75	56	62	79	73	82	62	63	78	78	62	76	68	77	62	64	61	77	66	60	68	83	68	100	87	64	53	53	35	62	62	27	58
O2	85	55	74	44	86	68	73	72	72	73	93	79	60	88	89	67	67	59	63	54	80	73	90	61	56	58	72	61	87	100	79	47	62	39	56	56	26	66
P1	71	61	63	37	84	61	83	77	62	64	81	94	64	86	87	70	57	67	65	64	97	86	88	67	65	47	71	67	64	79	100	50	60	23	60	60	31	81
P2	39	82	34	68	45	74	45	44	73	58	47	48	78	49	47	74	75	84	56	74	50	44	48	80	76	70	59	80	53	47	50	100	32	13	76	75	21	42
Q1	44	36	87	62	57	35	58	58	37	55	61	56	36	67	57	47	37	39	41	35	59	87	57	36	34	35	44	37	53	62	60	32	100	60	36	36	18	53
Q2	30	14	61	56	35	22	34	35	25	43	36	22	14	31	32	21	24	15	30	13	23	40	32	14	13	29	24	15	35	39	23	13	60	100	22	22	22	30
S1	47	73	49	43	52	73	66	65	83	80	55	58	79	60	56	73	75	88	80	72	59	51	56	88	78	79	72	87	62	56	60	76	36	22	100	100	29	66
S2	47	72	48	43	52	72	66	65	83	80	55	58	79	60	56	72	75	88	79	73	59	51	56	88	79	79	71	87	62	56	60	75	36	22	100	100	29	66
R1	28	25	22	12	26	24	31	30	26	25	26	32	27	28	29	25	24	27	32	26	32	27	29	28	26	23	29	28	27	26	31	21	18	22	29	29	100	33
R2	67	52	71	32	73	49	89	90	52	71	69	82	52	73	75	65	50	56	66	53	81	71	73	56	52	60	59	58	58	66	81	42	53	30	66	66	33	100

Case 37 894

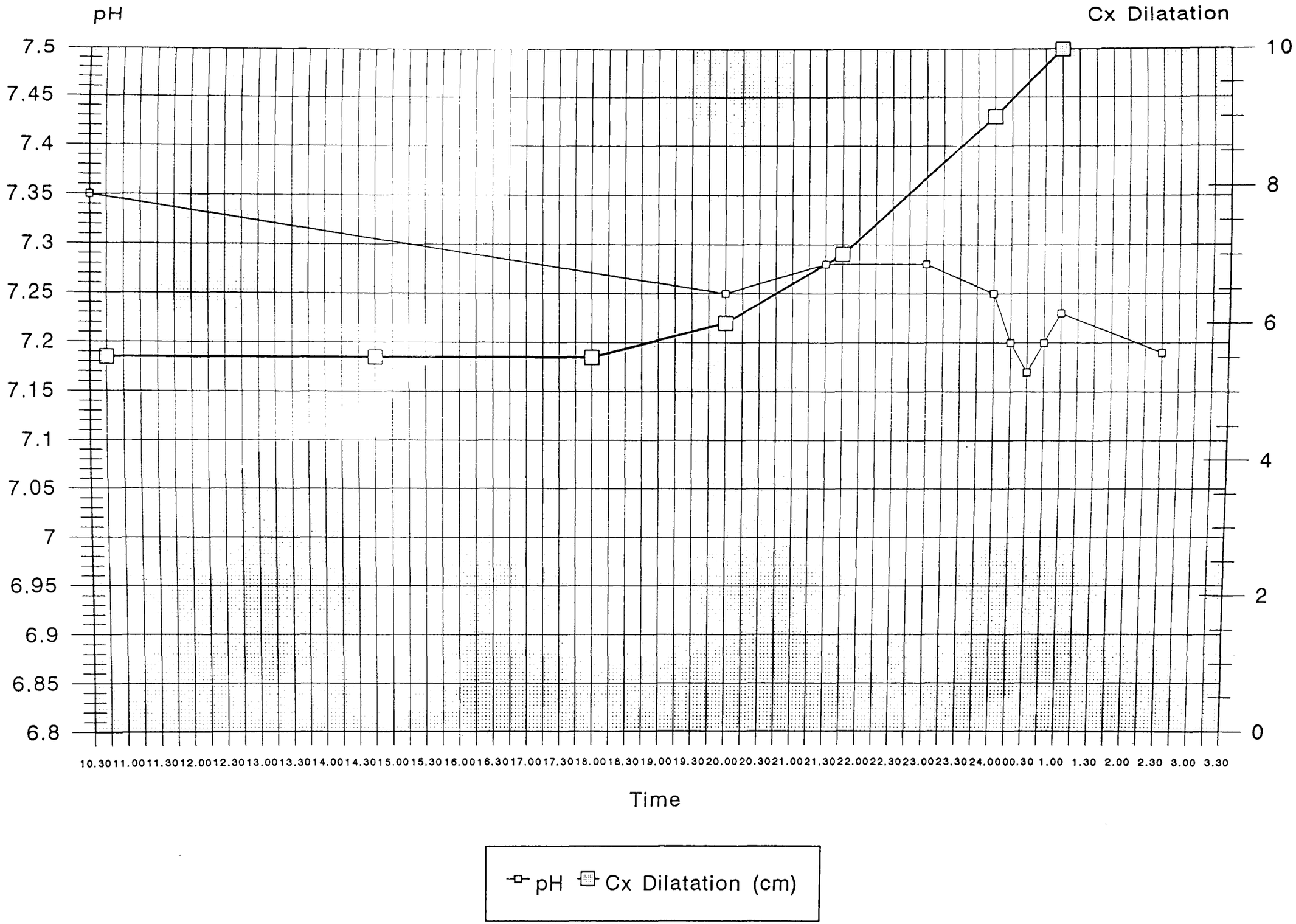
Miss M.L. is a 17 year old primigravida. She smokes 5 cigarettes per day and has mild asthma, for which she uses no regular medication. Her pregnancy was straightforward and she laboured spontaneously at 40 weeks. When she was admitted on 30.12.90 at 10.50hrs the fetal head was 2/5 palpable, and the cervix 5-6cm dilated. ARM was performed and clear liquor drained; an FSE was applied.

Labour events

11.04 Bedpan.
14.50 VE No change.
15.30 Syntocinon begun.
15.40 Epidural begun.
16.00 Epidural complete.
17.50 Bedpan.
18.00 VE Cx No change.
18.15 Top up.
20.05 VE Cx 6cm dilated. OP position. IUPD inserted.
FBS; pH 7.25 BE -1
20.30 Top up.
21.50 VE Cx 7cm dilated. Station -1. OP position. Caput ++ moulding ++.
22.00 Top up.
00.05 VE Cx 9cm dilated. Station 0. OP position. Caput ++ moulding ++.
Top up.
00.07 Syntocinon stopped. Maternal oxygen.
00.25 Syntocinon restarted.
01.00 VE Cx fully dilated. Station +2. Uncertain position.
01.25 Pushing begun.
02.05 Top up.
02.30 Delivery of male infant by Neville Barnes forceps. Indication; maternal exhaustion.

Outcome

Birth weight 2.95kg
Apgar 8 & 9
Cord gases pH 7.19 / 7.22 BD(ecf) 7 / 6


pH
Cx Dilatation
7.5
7.45
7.4
7.35
7.3
7.25
7.2
7.15
7.1
7.05
7
6.95
6.9
6.85
6.8
10
8
6
4
2
0
10.30 11.00 11.30 12.00 12.30 13.00 13.30 14.00 14.30 15.00 15.30 16.00 16.30 17.00 17.30 18.00 18.30 19.00 19.30 20.00 20.30 21.00 21.30 22.00 22.30 23.00 23.30 24.00 00.30 1.00 1.30 2.00 2.30 3.00 3.30
Time
pH
Cx Dilatation (cm)

Case 37

SEGMENT

REVIEWER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
A1	1	1	1	1	1	2	2	1	2	2	2	1	1	2	2	2	1	1	1	2	2	2	2	2	3	2	2	3	2	2	2	2	3	4	5																									
A2	1	2	1	1	1	2	2	1	2	2	2	1	1	2	1	2	1	1	1	2	1	2	2	2	2	2	2	2	2	2	1	1	2	2	2	3	2	1	1	2	2	2	2	1	2	2	2	2	3	4	2	1	1	1	2	2	1	1	2	
B1	2	2	1	1	1	1	2	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	2	3	2	2	2	3	4	2	2	2	3	5																									
B2	2	2	1	1	1	1	2	1	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	3	2	2	4	3	2	2	2	3	2	2	2	2	1	2	3	2	1	1	2	2	2	3	5										
C1	1	1	1	1	1	1	2	1	1	1	1	1	1	2	2	2	1	1	1	2	1	1	2	2	2	3	1	2	2	3	1	1	2	3	1	2	2	2	2	2	2	3	2	1	2	2	2	2	3	4	4	2	1	1	2	6				
C2	1	2	1	1	1	1	2	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1	2	2	2	3	1	2	2	3	1	2	2	2	3	2	2	1	1	2	2	3	1	1	1	1	1	2	2	5										
D1	2	2	1	1	1	1	2	1	1	1	1	1	1	2	2	1	1	1	1	2	1	1	2	2	2	1	2	3	2	2	2	2	2	3	5																									
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E1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	1	1	1	1	2	1	2	2	3	2	2	2	3	2	3	2	2	3	5																										
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F1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	2	2	2	3	1	1	1	1	1	1	1	2	3	1	1	1	1	1	2	2	1	1	1	1	2	2	5										
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G1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	3	2	2	2	1	1	1	2	2	2	2	2	2	2	2	5										
G2	2	2	1	1	1	1	2	2	2	2	2	2	2	2	2	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	4	2	4	2	2	2	2	2	2	2	2	2	2	2	2	2	2	4	4	2	2	2	2	2	2	2	2	
H1	1	2	2	2	1	1	2	1	1	2	2	1	1	2	1	1	1	1	1	2	1	2	2	3	2	2	2	2	2	3	5																													
H2	2	1	1	1	1	1	2	1	1	1	2	1	1	1	2	1	1	1	1	2	1	2	2	2	2	2	3	2	2	2	2	2	3	2	2	2	3	1	2	2	2	2	2	1	2	2	2	2	2	3	5									
I1	2	2	1	1	1	2	2	2	2	2	2	1	1	2	1	1	1	1	1	2	1	1	2	2	2	2	2	3	2	2	2	1	2	2	2	2	3	1	2	2	2	2	2	2	2	2	2	2	2	4	3	5								
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J1	1	2	1	1	1	1	2	1	2	2	2	1	2	2	1	2	1	2	1	2	2	2	2	3	2	2	2	3	2	2	2	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	5										
J2	1	1	1	1	1	2	2	2	2	2	2	2	1	2	2	1	1	1	2	2	1	1	2	2	1	2	2	3	1	1	2	2	4	2	2	2	2	1	2	2	2	3	1	2	2	2	2	2	2	3	5									
K1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	3	2	2	2	1	2	2	2	2	3	1	1	1	2	3	2	2	2	2	2	2	3	5										
K2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	1	1	1	1	2	2	2	3	2	1	1	1	2	2	3	1	1	1	1	1	2	5										
L1	1	1	1	1	1	1	2	1	1	1	2	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	3	2	2	2	2	2	3	2	2	2	2	2	2	2	3	2	2	2	2	2	2	2	2	5										
L2	1	1	1	1	1	1	1	1	1	2	1	1	1	2	1	1	1	1	1	2	1	1	2	2	2	2	3	2	2	2	2	2	3	2	2	2	3	1	1	1	2	2	2	2	2	2	2	2	3	5										
M1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	3	2	2	2	2	2	2	2	2	2	2	2	2	2	3	2	2	2	2	2	2	2	2	2	
M2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	3	2	2	2	2	2	2	2	2	3	2	2	2	2	2	2	3	2	2	2	2	2	2	2	6		
N1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	3	2	2	2	2	2	2	2	2	2	2	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	5									
N2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	3	2	2	4	3	2	2	2	2	4	3	2	2	2	2	2	2	5										
O1	2	2	1	1	1	1	2	1	1	1	1	1	2	2	1	1	1	1	1	2	2	2	2	2	3	2	2	2	2	3	2	1	2	2	3	2	2	1	2	2	2	3	2	2	2	2	2	2	3	5										
O2	1	1	1	1	1	1	2	1	1	1	1	1	1	2	1	1	1	1	1	2	1	2	2	2	2	3	2	2	2	2	2	2	3	1	2	2	2	1	1	1	2	2	2	1	2	2	2	2	3	2	2	2	1	1	2	2	6			
P1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	3	2	2	2	2	2	2	2	1	3	2	2	2	1	1	2	1	2	2	2	1	2	2	1	1	2	5										
P2	1	1	1	1	1	1	2	2	2	2	2	1	1	1	1	1	1	1	1	2	1	1	2	2	2	2	2	2	2	2	2	2	2	2	3	2	2	2	2	1	2	2	2	1	2	2	2	2	2	5										
Q1	2	2	2	2	1	2	2	2	2	2	2	1	1	2	2	2	1	1	1	2	1	2	2	2	2	2	2	2	2	2	2	2	4	4	4	4	4	2	2	2	2	2	2	2	2	2	2	2	2	4	4	2	2	2	2	6				
Q2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	4	4	4	4	4	2	2	4	4	4	5																								
S1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	2	1	1	2	2	1	2	1	1	1	2	4	4	2	1	1	1	1	1	1	1	1	1	1	1	1	4	4	1	1	1	2	2	6			
S2	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	2	1	1	2	2	1	2	1	1	1	2	2	4	2	1	1	1	1	1	1	1	2	1	1	1	1	4	4	1	1	1	2	2	6			
R1	2	1	2	2	1	1	2	2	2	2	1	3	1	1	2	2	1	1	1	2	2	1	2	1	1	2	1	1	2	2	2	2	1	2	1	1	1	2	1	2	1	1	2	2	1	3	2	1	1	2	2	1	1	2	3	2	1	2	1	
R2	2	1	1	1	2	3	1	3	3	1	1	1	2	2	2	3	1	1	1	2	2	2	1	2	1	1	1	2	1	2	1	1	1	1	2	3	2	2	2	2	2	1	2	1	1	1	2	2	1	1	1	2	2	1	1	2	6			
Clinical	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	

Agreement results matrix for case 37

REVIEWER	A1	A2	B1	B2	C1	C2	D1	D2	E1	E2	F1	F2	G1	G2	H1	H2	I1	I2	J1	J2	K1	K2	L1	L2	M1	M2	N1	N2	O1	O2	P1	P2	Q1	Q2	S1	S2	R1	R2
A1	100	43	90	47	48	50	93	53	93	96	47	34	43	56	53	51	41	47	55	55	41	38	51	51	44	46	47	48	49	56	50	44	59	77	51	46	36	37
A2	43	100	42	66	81	68	48	68	40	44	72	69	75	84	38	74	77	83	64	66	73	71	66	75	90	80	75	64	71	79	68	76	72	30	80	84	70	65
B1	90	42	100	56	51	55	91	53	89	94	48	36	44	48	60	48	43	51	51	48	45	40	48	48	46	45	47	47	53	53	49	44	51	79	47	44	36	37
B2	47	66	56	100	78	92	48	87	49	48	82	75	80	63	47	85	77	68	84	85	90	81	88	87	61	65	80	79	92	65	80	81	58	49	57	58	46	45
C1	48	81	51	78	100	79	49	76	51	51	69	62	67	75	43	73	72	81	69	73	74	68	75	73	71	80	72	66	81	83	70	67	72	38	77	80	60	57
C2	50	68	55	92	79	100	52	90	52	54	91	83	87	62	46	85	78	70	86	84	90	90	92	86	62	65	84	83	95	66	88	87	57	39	62	64	50	51
D1	93	48	91	48	49	52	100	50	90	94	51	41	50	52	46	52	45	46	50	50	47	45	52	52	52	51	46	50	49	56	47	49	54	71	52	49	41	43
D2	53	68	53	87	76	90	50	100	53	56	82	76	82	64	46	85	77	74	90	83	86	78	91	88	59	60	84	76	94	67	85	85	57	40	56	58	54	47
E1	93	40	89	49	51	52	90	53	100	93	47	37	43	48	71	50	40	50	57	51	43	37	51	50	44	46	48	45	52	56	52	43	49	65	46	42	36	35
E2	96	44	94	48	51	54	94	56	93	100	47	38	45	51	55	51	44	53	57	51	44	40	52	51	46	47	48	48	53	57	52	46	53	71	49	46	41	38
F1	47	72	48	82	69	91	51	82	47	47	100	91	92	62	38	89	82	66	84	79	90	91	87	92	67	60	86	78	85	65	88	91	56	36	67	69	53	54
F2	34	69	36	75	62	83	41	76	37	38	91	100	93	61	37	80	75	58	82	76	83	90	84	83	65	60	83	74	79	60	90	91	49	20	65	70	58	51
G1	43	75	44	80	67	87	50	82	43	45	92	93	100	68	36	86	79	64	85	78	88	92	89	90	73	68	90	83	85	65	93	98	61	28	68	71	55	55
G2	56	84	48	63	75	62	52	64	48	51	62	61	68	100	41	68	70	75	66	74	60	62	65	66	74	70	67	67	64	68	65	70	93	50	87	84	57	55
H1	53	38	60	47	43	46	46	46	71	55	38	37	36	41	100	39	37	49	51	43	38	33	40	39	40	38	41	33	47	48	47	37	36	45	31	33	38	32
H2	51	74	48	85	73	85	52	85	50	51	89	80	86	68	39	100	91	69	87	87	89	82	88	96	71	67	91	80	86	72	86	87	62	38	63	65	50	52
I1	41	77	43	77	72	78	45	77	40	44	82	75	79	70	37	91	100	74	77	83	83	76	76	83	69	61	85	70	79	61	72	80	63	34	67	70	50	49
I2	47	83	51	68	81	70	46	74	50	53	66	58	64	75	49	69	74	100	70	61	68	63	63	70	74	73	68	61	72	77	65	65	68	38	72	76	67	62
J1	55	64	51	84	69	86	50	90	57	57	84	82	85	66	51	87	77	70	100	82	81	76	92	89	58	59	86	74	87	68	92	86	55	39	56	58	52	46
J2	55	66	48	85	73	84	50	83	51	51	79	76	78	74	43	87	83	61	82	100	85	79	88	84	61	66	81	76	85	65	77	80	68	49	64	63	49	45
K1	41	73	45	90	74	90	47	86	43	44	90	83	88	60	38	89	83	68	81	85	100	90	88	92	69	67	84	84	92	63	80	86	55	33	63	66	51	49
K2	38	71	40	81	68	90	45	78	37	40	91	90	92	62	33	82	76	63	76	79	90	100	85	84	67	68	84	87	85	58	86	91	56	25	68	70	55	54
L1	51	66	48	88	75	92	52	91	51	52	87	84	89	65	40	88	76	63	92	88	88	85	100	90	62	67	85	82	89	69	90	89	56	37	59	61	51	48
L2	51	75	48	87	73	86	52	88	50	51	92	83	90	66	39	96	83	70	89	84	92	84	90	100	70	66	88	81	88	73	88	89	61	38	64	66	52	51
M1	44	90	46	61	71	62	52	59	44	46	67	65	73	74	40	71	69	74	58	61	69	67	62	70	100	88	74	62	65	81	64	72	63	29	71	74	71	68
M2	46	80	45	65	80	65	51	60	46	47	60	60	68	70	38	67	61	73	59	66	67	68	67	66	88	100	69	66	68	87	64	66	64	29	71	74	70	68
N1	47	75	47	80	72	84	46	84	48	48	86	83	90	67	41	91	85	68	86	81	84	84	85	88	74	69	100	77	89	71	92	90	61	30	65	67	51	51
N2	48	64	47	79	66	83	50	76	45	48	78	74	83	67	33	80	70	61	74	76	84	87	82	81	62	66	77	100	82	54	78	82	70	38	68	67	46	48
O1	49	71	53	92	81	95	49	94	52	53	85	79	85	64	47	86	79	72	87	85	92	85	89	88	65	68	89	82	100	69	87	85	58	38	60	62	49	49
O2	56	79	53	65	83	66	56	67	56	57	65	60	65	68	48	72	61	77	68	65	63	58	69	73	81	87	71	54	69	100	70	65	62	38	70	73	74	68
P1	50	68	49	80	70	88	47	85	52	52	88	90	93	65	47	86	72	65	92	77	80	86	90	88	64	64	92	78	87	70	100	92	56	31	64	66	53	49
P2	44	76	44	81	67	87	49	85	43	46	91	91	98	70	37	87	80	65	86	80	86	91	89	89	72	66	90	82	85	65	92	100	63	30	67	69	57	55
Q1	59	72	51	58	72	57	54	57	49	53	56	49	61	93	36	62	63	68	55	68	55	56	56	61	63	64	61	70	58	62	56	63	100	55	91	88	49	54
Q2	77	30	79	49	38	39	71	40	65	71	36	20	28	50	45	38	34	38	39	49	33	25	37	38	29	29	30	38	38	38	31	30	55	100	43	37	23	27
S1	51	80	47	57	77	62	52	56	46	49	67	65	68	87	31	63	67	72	56	64	63	68	59	64	71	71	65	68	60	70	64	67	91	43	100	99	58	62
S2	46	84	44	58	80	64	49	58	42	46	69	70	71	84	33	65	70	76	58	63	66	70	61	66	74	74	67	67	62	73	66	69	88	37	99	100	63	64
R1	36	70	36	46	60	50	41	54	36	41	53	58	55	57	38	50	50	67	52	49	51	55	51	52	71	70	51	46	49	74	53	57	49	23	58	63	100	68
R2	37	65	37	45	57	51	43	47	35	38	54	51	55	55	32	52	49	62	46	45	49	54	48	51	68	68	51	48	49	68	49	55	54	27	62	64	68	100

Case 38 2009

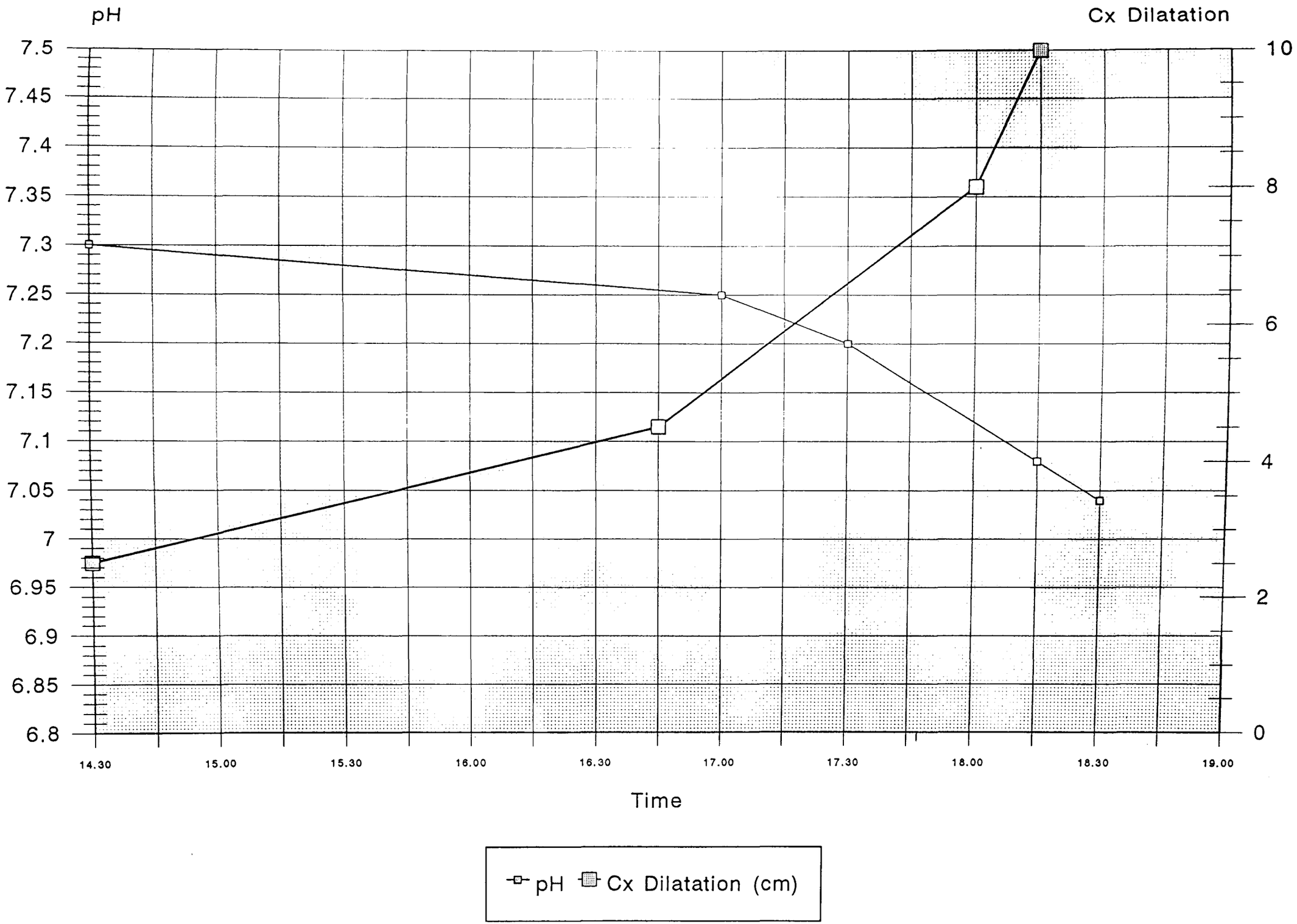
Mrs D.P. is a 24 year old primigravida. She is a fit lady but smokes 6 cigarettes per day. There were no antenatal problems, and spontaneous labour occurred at 37 weeks. She was admitted at 14.35hrs on 9.9.91, and at this time the presentation was cephalic 2/5, cervix 2-3cm dilated, effacing.

Labour events

15.00	Enema given.
15.30	Bath.
16.40	VE Cx 4-5cm dilated, thinning. Station -1. ARM; liquor stained with fresh meconium. FSE applied.
16.50	Pethidine 100mg, phenergan 25mg im.
17.55	VE Cx 8cm dilated. Station +1. OA position.
18.05	Maternal oxygen given.
18.15	FBS; pH 7.08 BE -11
18.20	VE Cx fully dilated. Pushing begun.
18.30	Episiotomy.
18.33	Normal delivery of male infant.

Outcome

Birth weight 2.61kg
Apgar 3 & 6 (9 at 10 minutes)
Cord gases pH 7.04 / 7.08 BD(ecf) 11 / 11


pH
Cx Dilatation
7.5
7.45
7.4
7.35
7.3
7.25
7.2
7.15
7.1
7.05
7
6.95
6.9
6.85
6.8
10
8
6
4
2
0
14.30
15.00
15.30
16.00
16.30
17.00
17.30
18.00
18.30
19.00
Time
pH
Cx Dilatation (cm)

Case 38

SEGMENT

REVIEWER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
A1	2	1	1	1	1	1	2	2	2	3	2	4	4	3																																														
A2	1	1	1	1	1	1	2	2	2	3	2	2	3	5																																														
B1	2	2	1	1	1	1	1	1	2	3	5																																																	
B2	2	2	1	1	1	1	1	1	2	3	4	5																																																
C1	1	1	1	1	1	1	1	1	2	3	4	3	5																																															
C2	1	1	1	1	1	1	1	2	2	3	2	3	5																																															
D1	2	2	1	1	1	1	1	1	1	3	4	3	5																																															
D2	2	2	1	1	1	1	1	1	2	3	2	3	5																																															
E1	2	2	1	1	1	1	1	1	2	3	4	3	5																																															
E2	2	2	1	1	2	1	1	1	2	3	4	3	5																																															
F1	2	2	1	1	1	1	1	1	2	3	2	2	3	5																																														
F2	1	1	1	1	1	1	1	1	1	2	2	3	5																																															
G1	1	1	1	1	1	1	1	1	2	2	3	4	3	5																																														
G2	1	1	1	1	1	1	1	1	2	4	3	4	4	5																																														
H1	2	1	1	1	1	1	1	1	2	3	5																																																	
H2	2	1	1	1	1	1	2	2	3	4	5																																																	
I1	2	1	1	1	1	1	1	1	2	3	2	3	5																																															
I2	2	1	1	2	1	1	1	1	2	3	2	3	5																																															
J1	1	1	1	2	1	1	1	1	2	3	4	4	3	5																																														
J2	1	1	1	1	1	1	1	1	2	2	3	2	3	5																																														
K1	1	1	1	1	1	1	1	1	3	4	4	3	5																																															
K2	1	1	1	1	1	1	1	1	2	2	3	4	4	3																																														
L1	1	1	1	1	1	1	1	1	1	3	2	2	3	5																																														
L2	1	1	1	1	1	1	1	1	1	3	4	4	3	5																																														
M1	1	1	1	1	1	1	1	1	1	2	2	2	3	5																																														
M2	1	1	1	1	1	1	1	1	1	2	3	2	3	5																																														
N1	2	2	1	2	1	1	2	2	3	4	5																																																	
N2	2	1	1	2	1	1	2	2	2	3	4	3	5																																															
O1	1	1	1	1	1	1	1	1	1	2	2	3	5																																															
O2	1	1	1	1	1	1	1	1	2	2	3	2	3	5																																														
P1	1	1	1	1	1	1	1	1	2	2	3	2	3	5																																														
P2	1	1	1	1	1	1	2	2	2	3	2	2	3	5																																														
Q1	2	2	1	2	1	1	1	1	2	4	4	4	4	4																																														
Q2	2	4	2	2	2	2	2	2	4	4	5																																																	
S1	1	1	1	1	1	1	1	1	1	1	1	1	2	1																																														
S2	1	1	1	1	1	1	1	1	1	1	1	1	2	1																																														
R1	4	2	2	2	4	2	3	2	2	3	2	1	2	1																																														
R2	2	2	2	2	2	3	1	2	2	3	1	2	4	1																																														
Clinical	0	0	0	0	0	0	0	0	0	0	0	0	0	3	D																																													

Agreement results matrix for case 38

REVIEWER	A1	A2	B1	B2	C1	C2	D1	D2	E1	E2	F1	F2	G1	G2	H1	H2	I1	I2	J1	J2	K1	K2	L1	L2	M1	M2	N1	N2	O1	O2	P1	P2	Q1	Q2	S1	S2	R1	R2
A1	100	70	61	71	74	71	73	70	74	74	70	66	78	78	62	62	70	70	80	68	72	98	69	80	63	68	61	75	66	68	68	70	91	48	33	33	40	85
A2	70	100	57	72	88	95	86	93	87	87	99	91	94	85	57	53	94	94	89	98	82	69	99	88	95	98	53	88	91	98	98	100	58	41	33	33	36	61
B1	61	57	100	93	79	79	80	80	80	80	58	76	59	61	100	95	80	80	61	56	78	61	57	61	50	56	95	79	76	56	56	57	61	78	31	31	35	54
B2	71	72	93	100	94	88	94	89	95	94	74	85	80	82	93	93	89	89	83	73	93	70	73	83	67	72	93	94	85	73	73	72	75	79	26	26	34	60
C1	74	88	79	94	100	95	99	95	99	99	87	93	93	92	80	80	95	95	95	88	98	75	88	95	83	88	79	99	93	88	88	88	76	68	26	26	35	61
C2	71	95	79	88	95	100	94	99	94	94	94	97	91	86	80	72	100	99	89	94	88	71	94	88	90	93	72	95	97	94	94	95	62	57	32	32	37	62
D1	73	86	80	94	99	94	100	95	100	100	88	92	92	91	80	79	95	94	94	87	98	74	87	95	82	87	79	99	92	87	87	86	76	68	26	26	35	62
D2	70	93	80	89	95	99	95	100	95	95	95	97	91	85	80	72	100	100	88	93	88	70	94	88	89	93	72	94	97	93	93	93	63	58	31	31	38	63
E1	74	87	80	95	99	94	100	95	100	100	88	92	93	92	80	80	95	95	95	87	98	75	87	95	82	87	80	99	92	87	87	87	77	69	25	25	36	63
E2	74	87	80	94	99	94	100	95	100	100	88	92	93	91	80	80	95	95	95	87	98	74	87	94	82	87	80	99	92	87	87	87	77	69	24	24	37	63
F1	70	99	58	74	87	94	88	95	88	88	100	91	94	85	58	53	95	94	89	98	82	68	99	88	95	98	53	87	91	98	98	99	59	41	33	33	36	62
F2	66	91	76	85	93	97	92	97	92	92	91	100	92	84	76	65	97	97	86	94	84	70	92	86	94	94	65	91	100	94	94	91	61	53	38	38	28	56
G1	78	94	59	80	93	91	92	91	93	93	94	92	100	96	59	56	91	91	98	95	90	80	94	98	93	95	55	92	92	95	95	94	76	46	27	27	30	64
G2	78	85	61	82	92	86	91	85	92	91	85	84	96	100	61	64	85	85	96	86	92	80	85	96	82	86	63	91	84	86	86	85	84	59	20	20	29	65
H1	62	57	100	93	80	80	80	80	80	80	58	76	59	61	100	95	80	80	61	57	78	61	58	61	50	57	95	79	76	57	57	57	61	78	32	32	34	53
H2	62	53	95	93	80	72	79	72	80	80	53	65	56	64	95	100	72	72	63	50	83	58	52	63	41	50	100	80	65	50	50	53	68	87	23	23	35	52
I1	70	94	80	89	95	100	95	100	95	95	95	97	91	85	80	72	100	100	88	93	88	71	94	88	90	93	72	94	97	93	93	94	63	57	32	32	37	62
I2	70	94	80	89	95	99	94	100	95	95	94	97	91	85	80	72	100	100	89	93	88	71	94	88	89	93	72	95	97	93	93	94	63	58	32	32	38	63
J1	80	89	61	83	95	89	94	88	95	95	89	86	98	96	61	63	88	89	100	89	94	80	89	100	84	89	63	95	86	89	89	89	80	55	22	22	33	66
J2	68	98	56	73	88	94	87	93	87	87	98	94	95	86	57	50	93	93	89	100	81	70	99	89	98	100	49	87	94	100	100	98	59	39	35	35	31	59
K1	72	82	78	93	98	88	98	88	98	98	82	84	90	92	78	83	88	88	94	81	100	73	82	94	74	81	82	97	84	81	81	82	78	73	21	21	35	59
K2	98	69	61	70	75	71	74	70	75	74	68	70	80	80	61	58	71	71	80	70	73	100	69	80	66	70	57	74	70	70	70	69	91	47	34	34	34	82
L1	69	99	57	73	88	94	87	94	87	87	99	92	94	85	58	52	94	94	89	99	82	69	100	89	96	99	52	86	92	99	99	99	58	40	35	35	34	60
L2	80	88	61	83	95	88	95	88	95	94	88	86	98	96	61	63	88	88	100	89	94	80	89	100	84	89	63	94	86	89	89	88	80	54	23	23	31	65
M1	63	95	50	67	83	90	82	89	82	82	95	94	93	82	50	41	90	89	84	98	74	66	96	84	100	98	41	81	94	98	98	95	55	32	39	39	23	52
M2	68	98	56	72	88	93	87	93	87	87	98	94	95	86	57	50	93	93	89	100	81	70	99	89	98	100	49	86	94	100	100	98	58	39	35	35	31	59
N1	61	53	95	93	79	72	79	72	80	80	53	65	55	63	95	100	72	72	63	49	82	57	52	63	41	49	100	80	65	49	49	53	68	87	22	22	36	53
N2	75	88	79	94	99	95	99	94	99	99	87	91	92	91	79	80	94	95	95	87	97	74	86	94	81	86	80	100	91	87	87	88	76	70	23	23	37	63
O1	66	91	76	85	93	97	92	97	92	92	91	100	92	84	76	65	97	97	86	94	84	70	92	86	94	94	65	91	100	94	94	91	61	53	38	38	28	56
O2	68	98	56	73	88	94	87	93	87	87	98	94	95	86	57	50	93	93	89	100	81	70	99	89	98	100	49	87	94	100	100	98	59	39	35	35	31	59
P1	68	98	56	73	88	94	87	93	87	87	98	94	95	86	57	50	93	93	89	100	81	70	99	89	98	100	49	87	94	100	100	98	59	39	35	35	31	59
P2	70	100	57	72	88	95	86	93	87	87	99	91	94	85	57	53	94	94	89	98	82	69	99	88	95	98	53	88	91	98	98	100	58	41	33	33	36	61
Q1	91	58	61	75	76	62	76	63	77	77	59	61	76	84	61	68	63	63	80	59	78	91	58	80	55	58	68	76	61	59	59	58	100	63	21	21	30	77
Q2	48	41	78	79	68	57	68	58	69	69	41	53	46	59	78	87	57	58	55	39	73	47	40	54	32	39	87	70	53	39	39	41	63	100	14	14	50	41
S1	33	33	31	26	26	32	26	31	25	24	33	38	27	20	32	23	32	32	22	35	21	34	35	23	39	35	22	23	38	35	35	33	21	14	100	100	31	42
S2	33	33	31	26	26	32	26	31	25	24	33	38	27	20	32	23	32	32	22	35	21	34	35	23	39	35	22	23	38	35	35	33	21	14	100	100	31	42
R1	40	36	35	34	35	37	35	38	36	37	36	28	30	29	34	35	37	38	33	31	35	34	34	31	23	31	36	37	28	31	31	36	30	50	31	31	100	62
R2	85	61	54	60	61	62	62	63	63	63	62	56	64	65	53	52	62	63	66	59	59	82	60	65	52	59	53	63	56	59	59	61	77	41	42	42	62	100

Case 39 1305

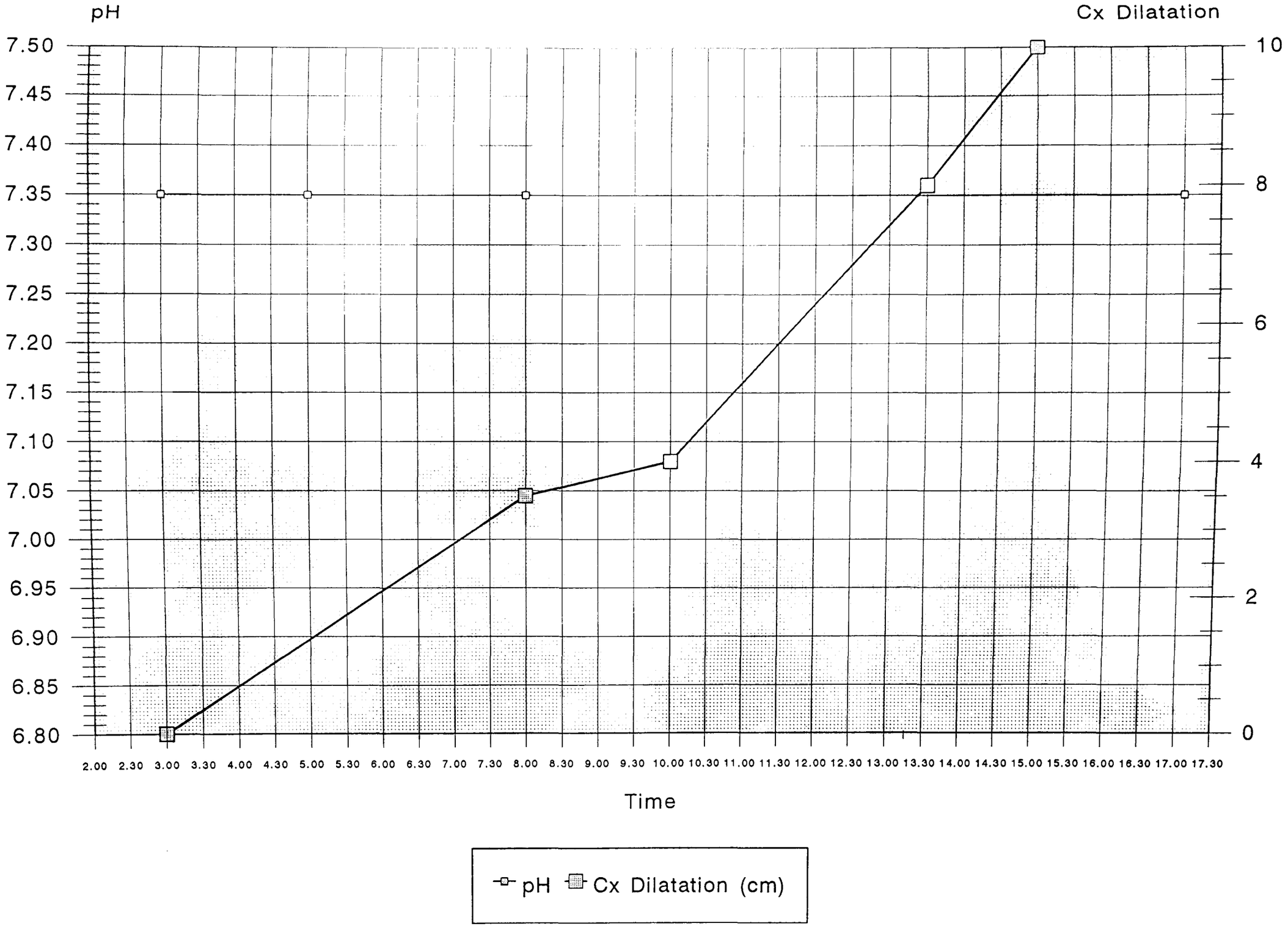
Mrs K.G. is a 22 year old primigravida; fit and a nonsmoker. Her pregnancy was entirely straightforward and she was admitted in spontaneous labour at 40 weeks gestation on 3.4.91. The uterus was term size, presentation cephalic 2/5, and on VE at 02.50hrs the cervix was found to be closed. Contractions continued and the membranes ruptured spontaneously at 04.15 with the drainage of clear liquor. By 07.45hrs the cervix was 3-4cm dilated, 1cm thick. Station -1. OP position.

Labour events

10.00	VE Cx 4cm dilated, 1cm thick.
11.40	Epidural inserted.
11.55	Syntocinon started.
13.30	VE Cx 8cm dilated. Station -1. OP position.
13.45	Top up.
15.15	VE Cx fully dilated. Station 0. LOP position.
15.55	Pushing began.
17.00	Episiotomy.
17.05	Normal delivery of female infant.

Outcome

Birth weight	3.59kg
Apgar	9 & 9
Cord gases	pH 7.38 / 7.40 BD(ecf) 8 / -6


pH
Cx Dilatation
7.50
7.45
7.40
7.35
7.30
7.25
7.20
7.15
7.10
7.05
7.00
6.95
6.90
6.85
6.80
10
8
6
4
2
0
2.00 2.30 3.00 3.30 4.00 4.30 5.00 5.30 6.00 6.30 7.00 7.30 8.00 8.30 9.00 9.30 10.00 10.30 11.00 11.30 12.00 12.30 13.00 13.30 14.00 14.30 15.00 15.30 16.00 16.30 17.00 17.30
Time
pH
Cx Dilatation (cm)

Case 39

REVIEWER	SEGMENT																																																										
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
A1	1	1	1	1	1	1	2	1	1	1	2	2	2	2	2	2	2	2	3	1	1	1	1	2	2	2	2																																	
A2	1	1	1	1	1	1	1	1	1	1	2	2	1	1	1	2	1	2	3	2	1	1	1	1	1	2	2																																	
B1	1	1	1	1	1	1	2	1	1	1	1	2	1	1	1	2	2	2	2	1	1	1	1	1	1	2	2																																	
B2	1	1	1	1	1	1	1	1	1	1	1	2	2	1	1	1	2	2	1	1	1	1	1	1	1	2	2																																	
C1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2																																	
C2	1	1	1	1	1	1	1	1	1	1	2	2	1	1	1	2	2	2	2	2	2	1	1	2	2	6																																		
D1	1	1	1	1	1	1	2	1	1	1	1	2	1	1	1	2	2	1	1	1	1	1	1	1	1	1	1																																	
D2	1	1	1	1	1	1	2	1	1	1	1	2	1	1	1	2	1	2	1	1	1	1	1	1	1	1	1																																	
E1	1	1	1	1	1	1	2	1	1	1	2	2	2	2	1	2	2	2	2	2	2	2	1	2	2	2	2																																	
E2	1	1	1	1	1	1	2	1	1	2	2	2	1	1	1	2	2	2	2	2	2	2	1	1	1	2	2																																	
F1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1																																	
F2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																	
G1	1	1	1	1	1	1	2	1	1	1	2	2	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2																																	
G2	1	1	1	1	1	1	2	1	1	1	2	2	2	2	2	2	2	2	2	1	1	2	2	2	2	2	2																																	
H1	1	1	1	1	1	1	2	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2																																	
H2	1	1	1	1	1	1	2	1	1	1	2	2	1	1	1	2	2	2	2	2	2	1	1	2	2	2	2																																	
I1	1	1	1	1	1	1	2	1	1	1	2	2	1	1	2	2	2	2	1	1	1	1	1	1	1	2	2																																	
I2	1	1	1	1	1	1	2	1	1	1	2	2	2	1	2	2	2	2	2	2	1	1	2	2	1	2	2																																	
J1	1	1	1	1	1	1	2	1	1	2	2	2	2	2	2	2	2	3	2	2	2	2	1	1	1	2	2																																	
J2	1	1	1	1	1	1	2	1	1	2	2	2	2	1	2	2	2	2	2	2	1	1	1	1	1	1	1																																	
K1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	1	1	1	1	1	1	2	2																																	
K2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																	
L1	1	1	1	1	1	1	2	1	1	1	2	2	1	1	1	2	2	2	2	2	2	1	1	1	1	2	1																																	
L2	1	1	1	1	1	1	1	1	1	2	2	2	2	1	1	1	2	2	1	1	1	1	1	1	1	1	2																																	
M1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																	
M2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																	
N1	1	1	1	1	1	1	1	1	1	1	2	2	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2																																	
N2	1	1	1	1	1	1	1	1	1	1	2	2	2	1	1	1	1	1	1	1	1	1	1	2	2	2	2																																	
O1	1	1	1	1	1	1	1	1	1	1	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	2	2																																	
O2	1	1	1	1	1	1	1	1	1	1	2	2	1	1	1	2	2	2	2	2	3	1	1	1	1	2	2																																	
P1	1	1	1	1	1	1	1	1	1	2	2	2	2	1	1	2	2	2	1	1	1	1	1	1	1	1	2																																	
P2	1	1	1	1	1	1	1	1	1	1	2	2	1	1	1	2	2	2	2	2	2	1	1	1	1	1	1																																	
Q1	2	1	1	1	1	1	2	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2																																	
Q2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2																																	
S1	1	1	1	1	1	1	1	1	1	1	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																	
S2	1	1	1	1	1	1	1	1	1	1	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																	
R1	2	2	1	2	1	3	2	1	2	5																																																		
R2	2	1	2	2	2	2	2	2	2	1	4	2	1	1	1	1	3	2	1	2	2	1	1	1	1	1	2																																	
Clinical	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	D																															

Agreement results matrix for case 39

REVIEWER	A1	A2	B1	B2	C1	C2	D1	D2	E1	E2	F1	F2	G1	G2	H1	H2	I1	I2	J1	J2	K1	K2	L1	L2	M1	M2	N1	N2	O1	O2	P1	P2	Q1	Q2	S1	S2	R1	R2
A1	100	96	86	85	80	76	83	83	86	84	80	78	85	88	86	86	87	87	95	85	84	78	84	84	78	78	81	84	83	90	85	82	85	79	80	80	23	70
A2	96	100	87	87	85	78	85	86	85	87	85	84	83	83	82	87	87	86	94	86	87	84	87	87	84	84	85	85	86	93	87	87	82	75	85	85	22	73
B1	86	87	100	99	96	85	97	98	95	97	96	94	94	95	93	97	99	98	84	96	99	94	98	97	94	94	92	95	96	87	97	96	91	85	95	95	24	68
B2	85	87	99	100	98	85	97	97	94	95	97	96	93	94	91	95	98	95	83	94	98	96	96	99	96	96	93	97	99	86	98	95	90	82	97	97	23	67
C1	80	85	96	98	100	82	96	96	89	91	98	98	88	89	86	92	95	91	78	90	97	98	93	95	98	98	93	97	98	83	95	92	85	77	97	97	23	66
C2	76	78	85	85	82	100	82	82	86	86	81	80	86	84	85	88	84	86	76	84	85	80	86	84	80	80	85	84	82	78	84	85	84	77	81	81	22	59
D1	83	85	97	97	96	82	100	99	91	93	98	98	90	91	89	93	98	94	81	96	96	98	96	97	98	98	90	94	96	84	97	96	87	81	98	98	24	67
D2	83	86	98	97	96	82	99	100	91	94	98	98	90	91	89	94	97	95	81	96	96	98	96	97	98	98	91	94	96	84	97	96	87	81	98	98	24	68
E1	86	85	95	94	89	86	91	91	100	97	89	87	99	98	99	99	95	98	87	95	93	87	97	93	87	87	95	93	92	86	94	95	98	91	89	89	25	66
E2	84	87	97	95	91	86	93	94	97	100	91	90	96	94	95	98	96	97	87	97	95	90	99	95	90	90	95	92	93	88	96	97	95	89	92	92	25	68
F1	80	85	96	97	98	81	98	98	89	91	100	99	87	88	86	91	95	91	78	93	97	99	94	96	99	99	91	94	96	84	95	95	84	77	98	98	23	66
F2	78	84	94	96	98	80	98	98	87	90	99	100	86	86	84	90	94	90	76	91	95	100	93	95	100	100	91	94	96	82	94	94	82	75	99	99	23	65
G1	85	83	94	93	88	86	90	90	99	96	87	86	100	98	99	98	93	98	86	93	91	86	95	92	86	86	96	92	90	84	92	93	99	92	87	87	25	65
G2	88	83	95	94	89	84	91	91	98	94	88	86	98	100	99	96	95	98	86	94	92	86	94	93	86	86	93	93	91	83	94	91	98	91	88	88	25	64
H1	86	82	93	91	86	85	89	89	99	95	86	84	99	99	100	97	93	98	87	93	90	84	94	90	84	84	94	91	89	84	91	92	99	93	86	86	25	64
H2	86	87	97	95	92	88	93	94	99	98	91	90	98	96	97	100	96	98	86	95	96	90	98	94	90	90	96	94	93	87	95	96	96	89	91	91	25	67
I1	87	87	99	98	95	84	98	97	95	96	95	94	93	95	93	96	100	97	85	97	98	94	97	97	94	94	91	95	96	86	98	95	92	86	95	95	25	67
I2	87	86	98	95	91	86	94	95	98	97	91	90	98	98	98	98	97	100	87	97	95	90	97	95	90	90	94	94	93	87	96	96	97	90	91	91	25	66
J1	95	94	84	83	78	76	81	81	87	87	78	76	86	86	87	86	85	87	100	86	82	76	86	84	76	76	82	80	81	84	84	85	87	81	79	79	23	76
J2	85	86	96	94	90	84	96	96	95	97	93	91	93	94	93	95	97	97	86	100	94	91	98	96	91	91	90	91	93	86	97	98	93	87	94	94	25	67
K1	84	87	99	98	97	85	96	96	93	95	97	95	91	92	90	96	98	95	82	94	100	95	96	96	95	95	92	94	95	87	96	96	89	82	94	94	23	66
K2	78	84	94	96	98	80	98	98	87	90	99	100	86	86	84	90	94	90	76	91	95	100	93	95	100	100	91	94	96	82	94	94	82	75	99	99	23	65
L1	84	87	98	96	93	86	96	96	97	99	94	93	95	94	94	98	97	97	86	98	96	93	100	96	93	93	94	92	94	88	96	99	93	87	94	94	25	68
L2	84	87	97	99	95	84	97	97	93	95	96	95	92	93	90	94	97	95	84	96	96	95	96	100	95	95	92	96	98	86	100	96	90	83	98	98	24	67
M1	78	84	94	96	98	80	98	98	87	90	99	100	86	86	84	90	94	90	76	91	95	100	93	95	100	100	91	94	96	82	94	94	82	75	99	99	23	65
M2	78	84	94	96	98	80	98	98	87	90	99	100	86	86	84	90	94	90	76	91	95	100	93	95	100	100	91	94	96	82	94	94	82	75	99	99	23	65
N1	81	85	92	93	93	85	90	91	95	95	91	91	96	93	94	96	91	94	82	90	92	91	94	92	91	91	100	96	94	84	91	93	94	86	92	92	23	65
N2	84	85	95	97	97	84	94	94	93	92	94	94	92	93	91	94	95	94	80	91	94	94	92	96	94	94	96	100	99	83	95	91	90	82	96	96	23	64
O1	83	86	96	99	98	82	96	96	92	93	96	96	90	91	89	93	96	93	81	93	95	96	94	98	96	96	94	99	100	84	97	93	88	81	98	98	23	66
O2	90	93	87	86	83	78	84	84	86	88	84	82	84	83	84	87	86	87	84	86	87	82	88	86	82	82	84	83	84	100	86	88	83	76	83	83	22	61
P1	85	87	97	98	95	84	97	97	94	96	95	94	92	94	91	95	98	96	84	97	96	94	96	100	94	94	91	95	97	86	100	97	91	84	97	97	24	67
P2	82	87	96	95	92	85	96	96	95	97	95	94	93	91	92	96	95	96	85	98	96	94	99	96	94	94	93	91	93	88	97	100	91	84	95	95	23	67
Q1	85	82	91	90	85	84	87	87	98	95	84	82	99	98	99	96	92	97	87	93	89	82	93	90	82	82	94	90	88	83	91	91	100	95	85	85	26	64
Q2	79	75	85	82	77	77	81	81	91	89	77	75	92	91	93	89	86	90	81	87	82	75	87	83	75	75	86	82	81	76	84	84	95	100	77	77	26	66
S1	80	85	95	97	97	81	98	98	89	92	98	99	87	88	86	91	95	91	79	94	94	99	94	98	99	99	92	96	98	83	97	95	85	77	100	100	23	66
S2	80	85	95	97	97	81	98	98	89	92	98	99	87	88	86	91	95	91	79	94	94	99	94	98	99	99	92	96	98	83	97	95	85	77	100	100	23	66
R1	23	22	24	23	23	22	24	24	25	25	23	23	25	25	25	25	25	25	23	25	23	23	25	24	23	23	23	23	23	22	24	23	26	26	23	23	100	40
R2	70	73	68	67	66	59	67	68	66	68	66	65	65	64	64	67	67	66	76	67	66	65	68	67	65	65	65	64	66	61	67	67	64	66	66	66	40	100

Case 40 1688

Miss K.W. is a 17 year old primigravida. She is generally well, but smokes 5 cigarettes per day. No problems were detected antenatally, and intrauterine growth retardation was not suspected until she was admitted at 37 weeks with reduced fetal movements. At that time it was noted that the fundal height measured only 31cm. Moreover, the CTG was abnormal and labour was induced straight away. (BP was normal and there was no proteinuria.)

Labour events

3.7.91

00.40 Induction of labour. Cephalic 3/5. VE Cx 4cm dilated, 1cm thick. Station -1. ARM; clear liquor. FSE applied

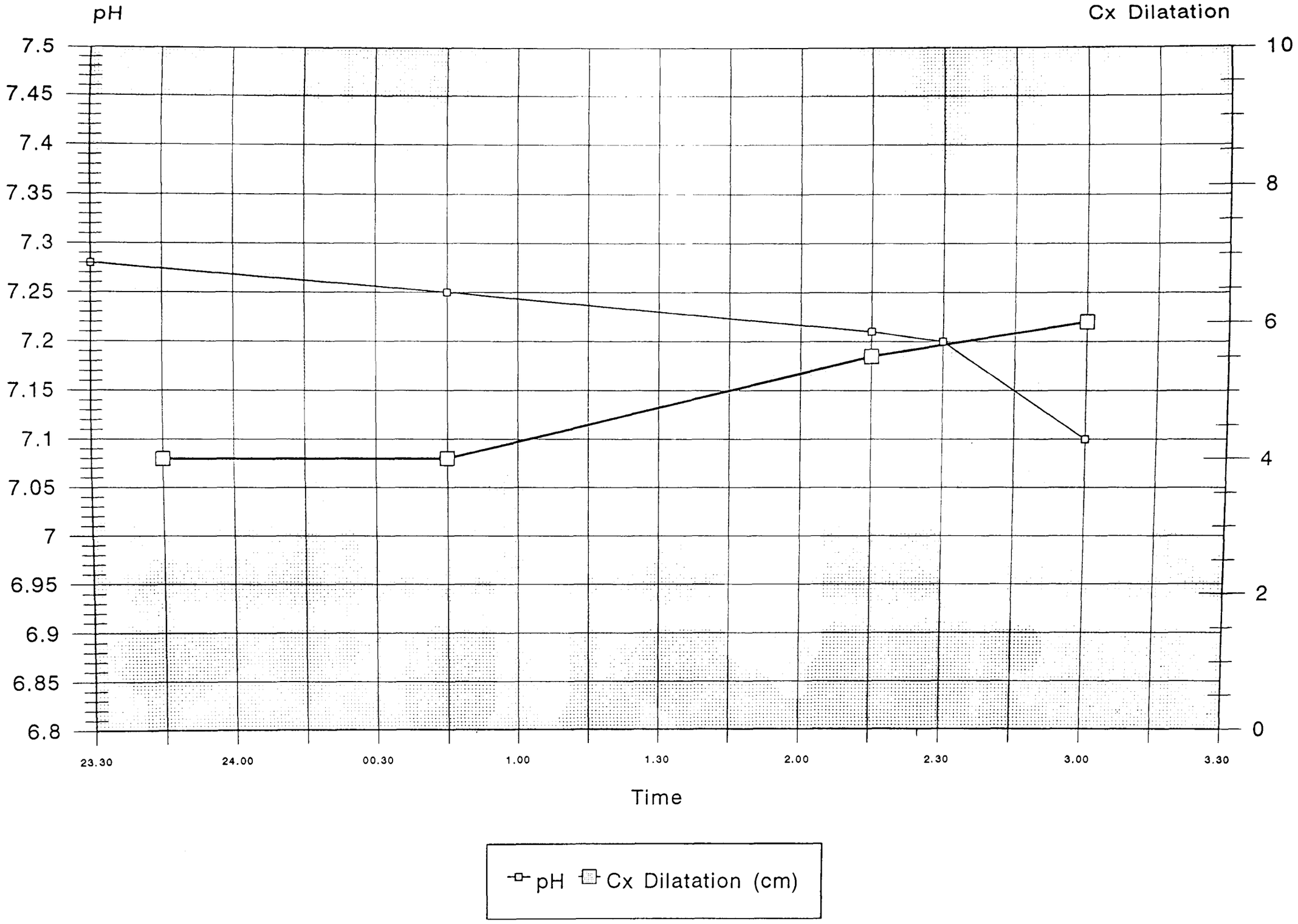
02.00 Bed pan..

02.20 VE Cx 5-6cm dilated. FBS; pH 7.21 BE -3
Decision for Caesarean section.

03.06 Male infant delivered by C/S under GA. Indication; low fetal scalp pH early in labour; baby thought to be growth retarded.

Outcome

Birth weight 1.96kg
Apgar 7 & 9
Cord gases pH 7.25 BD(ecf) 3 / 6


pH
Cx Dilatation
7.5
7.45
7.4
7.35
7.3
7.25
7.2
7.15
7.1
7.05
7
6.95
6.9
6.85
6.8
10
8
6
4
2
0
23.30
24.00
00.30
1.00
1.30
2.00
2.30
3.00
3.30
Time
pH
Cx Dilatation (cm)

Case 40

	SEGMENT																																																											
REVIEWER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
A1	1	1	1	2	2	2	3	2	2	3	5																																																	
A2	1	1	2	2	2	2	3	4	3	5																																																		
B1	2	2	3	5																																																								
B2	2	2	2	3	4	4	5																																																					
C1	2	2	2	2	2	3	4	3	4	4																																																		
C2	1	1	2	2	2	3	4	2	3	5																																																		
D1	1	1	2	3	2	2	2	3	5																																																			
D2	2	2	3	2	2	2	3	5																																																				
E1	1	2	2	2	2	2	3	2	3	5																																																		
E2	2	2	3	2	3	5																																																						
F1	2	2	2	2	3	2	2	2	3	5																																																		
F2	1	1	2	2	2	3	2	2	2	3	5																																																	
G1	2	2	2	2	3	2	2	2	2	3	5																																																	
G2	2	4	4	3	5																																																							
H1	1	1	2	3	5																																																							
H2	3	2	2	2	3	5																																																						
I1	2	2	2	3	2	3	5																																																					
I2	2	2	2	2	3	2	3	5																																																				
J1	1	2	2	2	3	4	5																																																					
J2	1	1	2	2	2	3	4	2	2	3	5																																																	
K1	1	1	2	2	3	4	4	3	5																																																			
K2	1	1	2	2	2	2	3	2	2	3	5																																																	
L1	2	2	2	2	3	2	3	2	3	5																																																		
L2	1	1	2	2	2	3	4	3	5																																																			
M1	2	2	2	3	2	2	3	2	2	3	5																																																	
M2	2	2	2	3	2	2	2	2	3	2	5																																																	
N1	2	2	2	2	2	2	3	4	4	3	5																																																	
N2	1	2	2	2	2	2	2	2	2	2																																																		
O1	2	2	3	5																																																								
O2	1	1	2	2	3	2	2	3	5																																																			
P1	2	2	2	1	2	2	2	2	3	5																																																		
P2	2	2	2	2	2	2	3	2	2	3	5																																																	
Q1	2	2	2	2	2	4	4	4	4	4																																																		
Q2	4	2	2	4	4	5																																																						
S1	1	1	2	2	5																																																							
S2	1	2	2	2	5																																																							
R1	1	1	2	2	3	1	2	2	1	2	3																																																	
R2	1	2	1	2	2	1	1	2	2	1	2																																																	
Clinical	0	0	0	0	0	0	0	0	3	5	0	C																																																

Agreement results matrix for case 40

REVIEWER	A1	A2	B1	B2	C1	C2	D1	D2	E1	E2	F1	F2	G1	G2	H1	H2	I1	I2	J1	J2	K1	K2	L1	L2	M1	M2	N1	N2	O1	O2	P1	P2	Q1	Q2	S1	S2	R1	R2
A1	100	87	8	22	60	87	75	50	94	20	89	99	95	10	16	20	28	55	26	92	68	100	92	74	95	91	88	29	8	77	91	99	50	14	15	15	55	29
A2	87	100	8	49	76	97	88	74	95	30	90	86	82	14	21	30	54	78	54	92	90	88	93	93	84	82	95	21	8	90	92	87	75	24	20	20	43	20
B1	8	8	100	55	20	18	23	26	9	77	20	14	20	86	92	72	50	22	49	18	29	9	20	18	23	23	8	13	100	19	8	9	24	68	85	86	27	12
B2	22	49	55	100	61	58	65	80	41	89	47	25	28	73	77	86	90	81	98	46	82	22	49	75	31	28	40	11	55	65	32	23	67	86	71	71	35	10
C1	60	76	20	61	100	76	66	63	66	47	65	60	59	26	33	45	61	67	63	72	78	61	68	77	62	58	79	20	20	69	60	62	95	39	28	29	53	19
C2	87	97	18	58	76	100	86	74	92	39	90	88	85	24	31	37	57	77	60	95	94	87	92	95	86	83	91	23	18	89	87	87	75	33	26	26	50	22
D1	75	88	23	65	66	86	100	92	89	54	92	74	76	26	27	50	77	92	69	72	87	75	92	91	80	80	75	26	23	99	86	74	58	39	17	17	46	25
D2	50	74	26	80	63	74	92	100	73	77	74	52	52	47	50	73	93	96	83	54	84	51	77	87	59	57	57	23	26	89	69	52	60	58	41	42	38	21
E1	94	95	9	41	66	92	89	73	100	23	96	93	90	10	16	23	52	78	47	87	80	94	98	87	90	89	88	29	9	91	97	94	56	16	15	15	50	27
E2	20	30	77	89	47	39	54	77	23	100	31	26	30	80	92	95	93	77	91	37	58	21	34	53	33	30	30	17	77	53	13	22	48	81	81	82	41	16
F1	89	90	20	47	65	90	92	74	96	31	100	92	94	22	24	27	55	78	50	86	80	90	98	85	92	94	85	28	20	94	93	90	55	20	16	16	55	27
F2	99	86	14	25	60	88	74	52	93	26	92	100	98	16	22	24	32	56	29	93	68	99	92	73	96	94	87	30	14	77	88	98	50	18	16	16	59	29
G1	95	82	20	28	59	85	76	52	90	30	94	98	100	22	24	25	32	56	29	90	67	95	93	70	97	98	85	30	20	78	87	96	49	19	15	16	60	29
G2	10	14	86	73	26	24	26	47	10	80	22	16	22	100	85	77	66	43	64	24	36	10	23	25	26	25	13	7	86	23	5	10	32	90	79	79	28	6
H1	16	21	92	77	33	31	27	50	16	92	24	22	24	85	100	88	76	51	76	31	41	16	25	32	26	25	18	17	92	27	9	16	37	78	94	93	36	16
H2	20	30	72	86	45	37	50	73	23	95	27	24	25	77	88	100	89	72	86	36	55	21	29	51	29	27	30	17	72	49	13	22	46	83	80	80	34	16
I1	28	54	50	90	61	57	77	93	52	93	55	32	32	66	76	89	100	93	95	44	77	29	58	77	38	33	42	20	50	77	42	29	58	72	66	67	42	19
I2	55	78	22	81	67	77	92	96	78	77	78	56	56	43	51	72	93	100	88	57	87	55	81	90	59	57	60	23	22	93	69	56	62	56	42	43	44	21
J1	26	54	49	98	63	60	69	83	47	91	50	29	29	64	76	86	95	88	100	48	82	26	52	79	31	27	42	17	49	71	37	26	66	80	71	71	38	16
J2	92	92	18	46	72	95	72	54	87	37	86	93	90	24	31	36	44	57	48	100	82	93	87	82	90	87	94	24	18	75	82	92	72	32	26	26	54	23
K1	68	90	29	82	78	94	87	84	80	58	80	68	67	36	41	55	77	87	82	82	100	68	82	98	70	68	78	15	29	89	71	68	77	54	35	34	41	14
K2	100	88	9	22	61	87	75	51	94	21	90	99	95	10	16	21	29	55	26	93	68	100	92	74	95	92	88	30	9	77	91	99	50	15	15	15	55	29
L1	92	93	20	49	68	92	92	77	98	34	98	92	93	23	25	29	58	81	52	87	82	92	100	86	94	92	87	25	20	93	91	93	57	22	16	17	55	23
L2	74	93	18	75	77	95	91	87	87	53	85	73	70	25	32	51	77	90	79	82	98	74	86	100	73	70	81	19	18	94	81	73	75	45	28	27	41	18
M1	95	84	23	31	62	86	80	59	90	33	92	96	97	26	26	29	38	59	31	90	70	95	94	73	100	97	86	26	23	79	86	96	51	22	15	16	59	25
M2	91	82	23	28	58	83	80	57	89	30	94	94	98	25	25	27	33	57	27	87	68	92	92	70	97	100	83	30	23	79	88	93	47	21	15	15	54	29
N1	88	95	8	40	79	91	75	57	88	30	85	87	85	13	18	30	42	60	42	94	78	88	87	81	86	83	100	18	8	76	86	89	79	24	17	17	44	17
N2	29	21	13	11	20	23	26	23	29	17	28	30	30	7	17	17	20	23	17	24	15	30	25	19	26	30	18	100	13	26	32	30	15	8	22	23	58	93
O1	8	8	100	55	20	18	23	26	9	77	20	14	20	86	92	72	50	22	49	18	29	9	20	18	23	23	8	13	100	19	8	9	24	68	85	86	27	12
O2	77	90	19	65	69	89	99	89	91	53	94	77	78	23	27	49	77	93	71	75	89	77	93	94	79	79	76	26	19	100	86	76	59	38	18	18	47	25
P1	91	92	8	32	60	87	86	69	97	13	93	88	87	5	9	13	42	69	37	82	71	91	91	81	86	88	86	32	8	86	100	92	52	8	11	12	41	30
P2	99	87	9	23	62	87	74	52	94	22	90	98	96	10	16	22	29	56	26	92	68	99	93	73	96	93	89	30	9	76	92	100	51	15	14	15	54	29
Q1	50	75	24	67	95	75	58	60	56	48	55	50	49	32	37	46	58	62	66	72	77	50	57	75	51	47	79	15	24	59	52	51	100	50	37	37	41	14
Q2	14	24	68	86	39	33	39	58	16	81	20	18	19	90	78	83	72	56	80	32	54	15	22	45	22	21	24	8	68	38	8	15	50	100	77	78	24	8
S1	15	20	85	71	28	26	17	41	15	81	16	16	15	79	94	80	66	42	71	26	35	15	16	28	15	15	17	22	85	18	11	14	37	77	100	100	24	21
S2	15	20	86	71	29	26	17	42	15	82	16	16	16	79	93	80	67	43	71	26	34	15	17	27	16	15	17	23	86	18	12	15	37	78	100	100	24	21
R1	55	43	27	35	53	50	46	38	50	41	55	59	60	28	36	34	42	44	38	54	41	55	55	41	59	54	44	58	27	47	41	54	41	24	24	24	100	59
R2	29	20	12	10	19	22	25	21	27	16	27	29	29	6	16	16	19	21	16	23	14	29	23	18	25	29	17	93	12	25	30	29	14	8	21	21	59	100

Case 41 2232

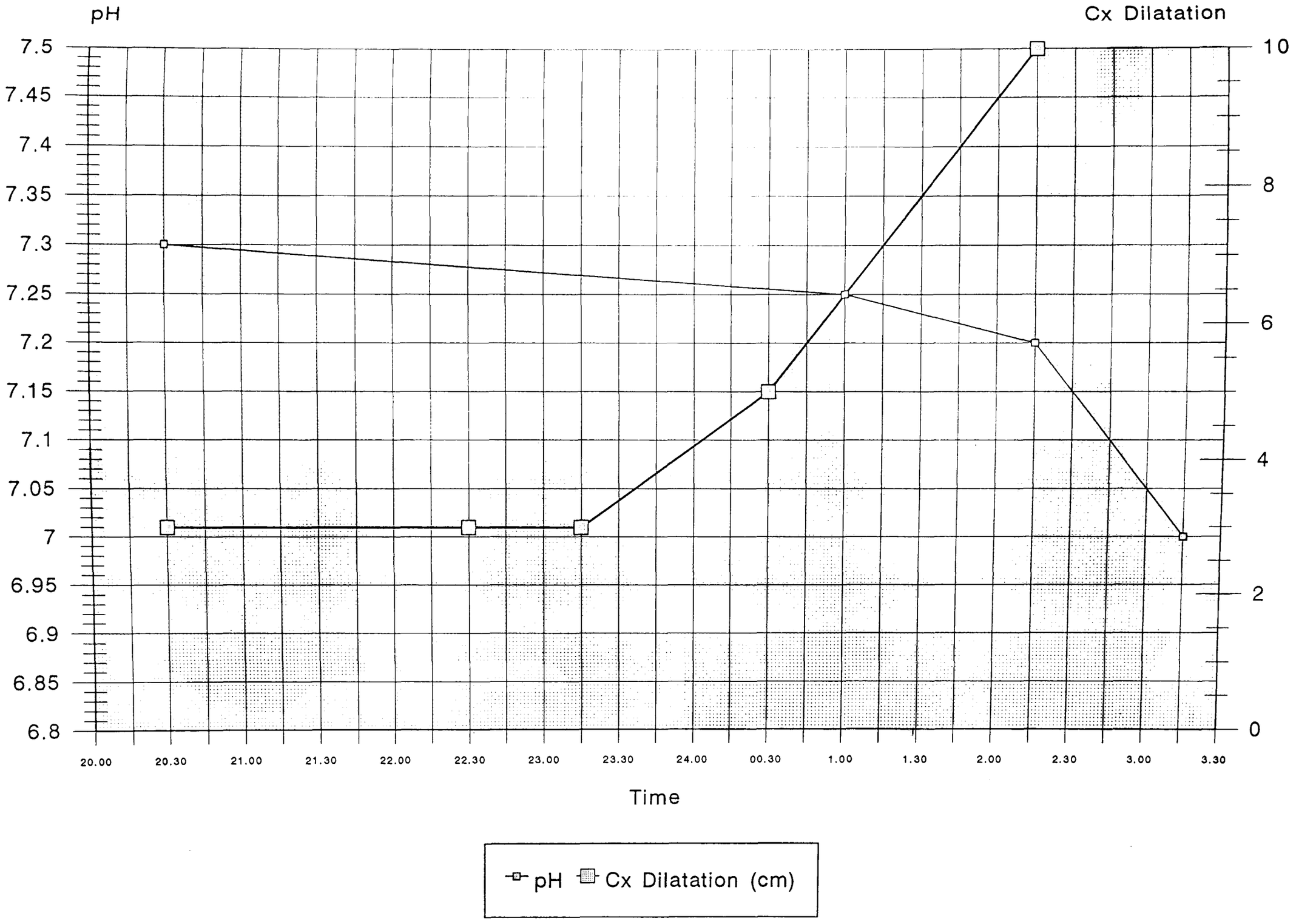
Miss J.S. is a 19 year old primigravida. She has asthma for which she uses a ventolin inhaler on a regular basis. She is a nonsmoker. Her pregnancy was entirely uneventful and spontaneous labour occurred at 41 weeks. She was admitted on 24.10.91 at 07.30hrs in very early labour, and the cervix was then just 1cm dilated, partly effaced (head 2/5 palpable). She returned to the labour ward at 20.00hrs, when labour was becoming established.

Labour events

20.30	VE Cx 3cm dilated, thin. Station -1.
20.45	Pethidine 100mg, phenergan 25mg im.
22.30	VE Cx 3cm dilated, thin. Station -1. ARM; clear liquor.
23.10	VE Cx No change. FSE applied.
23.50	Epidural begun
00.30	VE Cx 5cm dilated. Station -1. OP position.
01.00	Contractions felt to be mild and only 2:10. Syntocinon started.
01.50	Top up.
02.10	VE Cx fully dilated. Station +1. OA position.
02.30	Pushing begun.
03.11	Normal delivery of female infant.

Outcome

Birth weight 2.84kg
Apgar 9 & 9
Cord gases pH 6.97 / 7.06 BD(ecf) 12 / 7


pH
Cx Dilatation
7.5
7.45
7.4
7.35
7.3
7.25
7.2
7.15
7.1
7.05
7
6.95
6.9
6.85
6.8
10
8
6
4
2
0
20.00
20.30
21.00
21.30
22.00
22.30
23.00
23.30
24.00
00.30
1.00
1.30
2.00
2.30
3.00
3.30
Time
pH
Cx Dilatation (cm)

Case 41

SEGMENT

REVIEWER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
A1	1	1	1	1	2	2	2	2	3	5																																																		
A2	2	1	2	2	2	3	2	3	2	3	2	6																																															
B1	1	1	2	2	2	2	3	2	4	5																																																	
B2	1	1	1	2	2	2	2	2	3	4	4	6																																															
C1	1	1	1	1	2	2	2	3	2	3	2	6																																															
C2	1	1	2	2	3	2	2	2	3	4	4	6																																															
D1	1	1	2	2	2	2	2	2	3	2	2	6																																															
D2	1	1	2	2	2	2	2	2	3	2	3	6																																															
E1	1	1	2	2	2	2	2	2	3	2	3	6																																															
E2	1	1	2	2	2	2	2	2	3	2	3	6																																															
F1	1	1	1	1	2	2	1	1	1	2	2	2	1	1	1																																														
F2	1	1	1	1	2	2	1	1	2	3	2	4	4	2	6																																														
G1	1	1	2	2	2	2	2	2	2	2	2	6																																															
G2	2	1	2	2	2	2	2	2	4	4	2	6																																															
H1	1	1	2	2	2	2	3	5																																																				
H2	1	1	2	2	3	2	2	2	2	3	5																																																
I1	2	1	2	2	2	3	2	2	3	2	3	6																																															
I2	2	1	2	2	2	2	2	2	3	2	3	6																																															
J1	2	2	2	2	2	2	2	2	3	4	2	2	2	2	2																																															
J2	1	1	1	2	2	2	2	2	3	2	2	6																																															
K1	1	1	1	1	2	2	2	2	3	4	4	6																																															
K2	1	1	2	2	2	2	1	1	3	4	4	6																																															
L1	1	1	1	1	1	2	2	2	3	2	2	6																																															
L2	2	1	1	1	2	2	2	2	2	2	2	2	2	6																																															
M1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2																																														
M2	1	1	1	1	1	1	1	1	1	2	2	2	2	2	6																																														
N1	1	1	2	2	2	2	2	2	3	4	2	4	6																																															
N2	1	1	1	1	2	2	2	2	2	3	2	4	4	2	2																																														
O1	1	1	1	2	2	2	3	2	2	3	2	6																																															
O2	1	1	1	2	2	2	2	3	2	2	3	6																																															
P1	1	1	1	1	1	2	1	1	2	2	2	2	2	2	2																																														
P2	1	1	2	2	2	2	2	2	2	2	2	2	2	1	4																																														
Q1	2	1	2	2	2	2	2	2	2	2	4	4	4	4	4																																															
Q2	2	2	2	2	2	2	2	2	2	2	2	4	2	2	2																																														
S1	1	1	1	1	1	1	1	2	1	2	1	4	4	2	2																																														
S2	1	1	1	1	1	1	2	2	1	2	1	4	4	2	2																																														
R1	2	1	2	2	1	2	2	2	1	1	2	1	2	1	6																																														
R2	2	1	2	1	2	1	1	4	2	1	2	1	1	2	2																																														
Clinical	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	D																																													

Agreement results matrix for case 41

REVIEWER	A1	A2	B1	B2	C1	C2	D1	D2	E1	E2	F1	F2	G1	G2	H1	H2	I1	I2	J1	J2	K1	K2	L1	L2	M1	M2	N1	N2	O1	O2	P1	P2	Q1	Q2	S1	S2	R1	R2
A1	100	51	92	67	54	62	51	53	53	53	29	50	39	61	74	87	51	53	63	52	67	66	52	28	28	25	62	54	52	52	30	25	42	45	44	44	26	48
A2	51	100	51	73	95	78	89	89	89	89	40	62	71	67	46	62	97	90	72	89	72	72	87	56	39	42	73	64	97	94	41	41	46	55	48	49	46	57
B1	92	51	100	67	48	67	44	44	44	44	22	42	31	69	79	85	49	44	65	44	66	66	42	22	21	19	64	45	49	47	22	21	43	43	40	40	21	59
B2	67	73	67	100	77	93	76	79	79	79	30	81	66	94	46	64	75	78	89	77	100	99	76	46	30	33	96	84	75	77	31	32	75	77	76	76	34	59
C1	54	95	48	77	100	73	95	95	95	95	49	69	81	71	42	55	92	94	74	96	77	75	96	64	49	51	76	72	98	98	51	46	48	59	55	56	52	58
C2	62	78	67	93	73	100	70	73	73	73	25	75	60	88	47	72	80	72	83	70	93	93	68	41	25	29	90	78	74	74	27	29	71	71	69	70	31	56
D1	51	89	44	76	95	70	100	99	99	99	56	66	90	73	39	50	91	98	75	100	76	75	98	73	55	57	77	70	94	96	57	54	49	66	57	58	60	58
D2	53	89	44	79	95	73	99	100	100	100	46	68	90	74	37	54	93	99	73	99	78	78	97	66	45	48	76	71	93	98	47	46	51	65	57	58	51	53
E1	53	89	44	79	95	73	99	100	100	100	46	68	90	74	37	54	93	99	73	99	78	78	97	66	45	48	76	71	93	98	47	46	51	65	57	58	51	53
E2	53	89	44	79	95	73	99	100	100	100	46	68	90	74	37	54	93	99	73	99	78	78	97	66	45	48	76	71	93	98	47	46	51	65	57	58	51	53
F1	29	40	22	30	49	25	56	46	46	46	100	39	68	36	23	27	39	45	51	57	30	30	57	74	93	76	33	42	49	47	95	65	23	59	47	47	75	65
F2	50	62	42	81	69	75	66	68	68	68	39	100	62	63	22	55	62	68	69	67	81	81	67	63	40	62	88	96	66	67	41	67	90	84	90	91	60	40
G1	39	71	31	66	81	60	90	90	90	90	68	62	100	66	24	45	78	89	61	89	65	64	87	86	67	67	67	65	82	85	69	62	50	73	61	62	71	48
G2	61	67	69	94	71	88	73	74	74	74	36	63	66	100	50	56	70	75	88	72	94	94	71	50	35	38	91	66	70	73	36	37	66	72	63	63	42	76
H1	74	46	79	46	42	47	39	37	37	37	23	22	24	50	100	51	42	37	49	39	45	46	37	22	21	19	41	24	44	41	23	21	19	20	15	16	22	53
H2	87	62	85	64	55	72	50	54	54	54	27	55	45	56	51	100	63	53	57	50	63	63	49	29	26	23	60	59	58	54	27	26	50	52	50	51	26	37
I1	51	97	49	75	92	80	91	93	93	93	39	62	78	70	42	63	100	93	70	91	74	74	89	59	38	41	72	65	95	94	40	40	48	58	52	52	45	53
I2	53	90	44	78	94	72	98	99	99	99	45	68	89	75	37	53	93	100	74	98	78	77	96	67	45	48	76	71	93	97	47	45	51	66	57	58	52	54
J1	63	72	65	89	74	83	75	73	73	73	51	69	61	88	49	57	70	74	100	74	88	89	72	48	52	44	86	76	72	71	53	44	57	79	65	66	48	79
J2	52	89	44	77	96	70	100	99	99	99	57	67	89	72	39	50	91	98	74	100	76	75	99	74	56	58	77	70	94	97	59	53	49	65	58	59	60	59
K1	67	72	66	100	77	93	76	78	78	78	30	81	65	94	45	63	74	78	88	76	100	98	76	46	31	34	96	84	75	77	32	31	74	76	76	77	34	59
K2	66	72	66	99	75	93	75	78	78	78	30	81	64	94	46	63	74	77	89	75	98	100	74	44	30	34	95	82	74	76	31	30	74	76	75	75	34	60
L1	52	87	42	76	96	68	98	97	97	97	57	67	87	71	37	49	89	96	72	99	76	74	100	74	59	60	75	70	93	95	60	52	48	63	59	60	60	59
L2	28	56	22	46	64	41	73	66	66	66	74	63	86	50	22	29	59	67	48	74	46	44	74	100	75	91	55	58	64	67	77	75	50	70	62	63	93	54
M1	28	39	21	30	49	25	55	45	45	45	93	40	67	35	21	26	38	45	52	56	31	30	59	75	100	81	33	43	48	47	99	62	22	60	51	50	73	65
M2	25	42	19	33	51	29	57	48	48	48	76	62	67	38	19	23	41	48	44	58	34	34	60	91	81	100	45	51	50	49	80	73	41	58	59	59	93	56
N1	62	73	64	96	76	90	77	76	76	76	33	88	67	91	41	60	72	76	86	77	96	95	75	55	33	45	100	90	75	74	34	47	83	82	82	82	47	56
N2	54	64	45	84	72	78	70	71	71	71	42	96	65	66	24	59	65	71	76	70	84	82	70	58	43	51	90	100	68	70	45	67	90	91	93	94	51	43
O1	52	97	49	75	98	74	94	93	93	93	49	66	82	70	44	58	95	93	72	94	75	74	93	64	48	50	75	68	100	96	50	47	47	60	54	55	52	57
O2	52	94	47	77	98	74	96	98	98	98	47	67	85	73	41	54	94	97	71	97	77	76	95	67	47	49	74	70	96	100	48	45	49	61	56	57	50	55
P1	30	41	22	31	51	27	57	47	47	47	95	41	69	36	23	27	40	47	53	59	32	31	60	77	99	80	34	45	50	48	100	64	23	63	50	50	74	65
P2	25	41	21	32	46	29	54	46	46	46	65	67	62	37	21	26	40	45	44	53	31	30	52	75	62	73	47	67	47	45	64	100	73	68	71	72	77	48
Q1	42	46	43	75	48	71	49	51	51	51	23	90	50	66	19	50	48	51	57	49	74	74	48	50	22	41	83	90	47	49	23	73	100	84	90	91	44	29
Q2	45	55	43	77	59	71	66	65	65	65	59	84	73	72	20	52	58	66	79	65	76	76	63	70	60	58	82	91	60	61	63	68	84	100	92	93	62	48
S1	44	48	40	76	55	69	57	57	57	57	47	90	61	63	15	50	52	57	65	58	76	75	59	62	51	59	82	93	54	56	50	71	90	92	100	100	56	39
S2	44	49	40	76	56	70	58	58	58	58	47	91	62	63	16	51	52	58	66	59	77	75	60	63	50	59	82	94	55	57	50	72	91	93	100	100	57	38
R1	26	46	21	34	52	31	60	51	51	51	75	60	71	42	22	26	45	52	48	60	34	34	60	93	73	93	47	51	52	50	74	77	44	62	56	57	100	56
R2	48	57	59	59	58	56	58	53	53	53	65	40	48	76	53	37	53	54	79	59	59	60	59	54	65	56	56	43	57	55	65	48	29	48	39	38	56	100

Case 42 1303

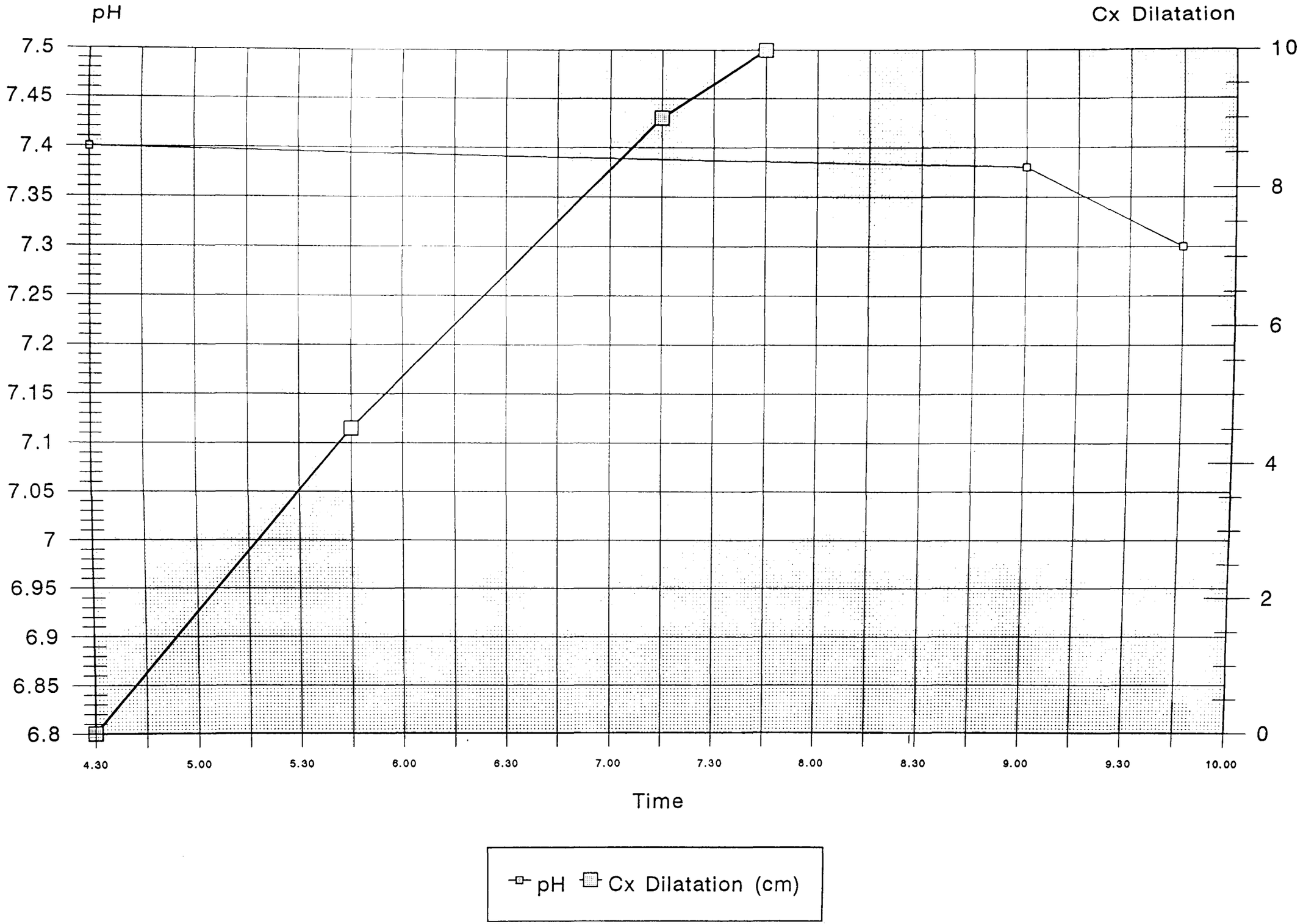
Mrs S.E. is a 32 year old primigravida. She is a fit lady and does not smoke. There were no antenatal problems and she was admitted in spontaneous labour at 41 weeks on 3.4.91 at 00.20hrs. The membranes had recently ruptured, but she had had no contractions. The uterus was term size, cephalic 1/5. VE (01.15hrs) Cx closed, uneffaced. Station -2. Liquor stained with meconium.

Labour events

04.30	VE No change. Stemetil 12.5mg im.
05.17	Epidural inserted.
05.40	VE Cx 4-5cm dilated, effaced. Station -2. FSE applied.
07.10	VE Cx 9cm dilated. Station -2. ROP position.
07.30	Top up.
07.52	VE Cx fully dilated. Station 0. ROP position.
08.10	Pushing begun.
08.40	Syntocinon started.
09.00	VE Cx fully dilated. Station +1. OP position. Caput + moulding +. FBS pH 7.38
09.10	Top up.
09.20	Decision for forceps delivery
09.30	In dorsal position for catheterisation.
09.46	Female infant delivered by Neville Barnes forceps. Indication; prolonged fetal bradycardia in 2nd stage. (Delivered in OA position)

Outcome

Birth weight 3.05kg
Apgar 9 & 9
Cord gases pH 7.29 / 7.34 BD(ecf) -2 / -1


pH
Cx Dilatation
7.5
7.45
7.4
7.35
7.3
7.25
7.2
7.15
7.1
7.05
7
6.95
6.9
6.85
6.8
10
8
6
4
2
0
4.30
5.00
5.30
6.00
6.30
7.00
7.30
8.00
8.30
9.00
9.30
10.00
Time
pH
Cx Dilatation (cm)

Case 42

	SEGMENT																																																										
REVIEWER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
A1	4	2	2	3	1	1	1	1	1	4	1	1	2	2	1	4	4																																												
A2	4	2	2	3	2	1	1	1	1	4	1	1	2	2	1	1	4																																												
B1	2	2	2	3	2	1	1	1	1	4	2	2	4	2	2	4	6																																												
B2	2	2	2	2	1	1	1	1	1	4	4	2	2	2	1	2	6																																												
C1	4	3	1	1	1	1	1	1	1	4	1	1	2	2	1	2	6																																												
C2	4	2	2	2	2	1	1	1	1	4	2	2	2	2	1	2	6																																												
D1	3	2	2	2	1	1	1	1	1	6																																																			
D2	3	2	2	2	1	1	1	1	1	4	2	2	2	2	1	1	6																																												
E1	3	2	2	2	1	1	1	1	1	6																																																			
E2	4	3	2	2	2	2	2	2	1	6																																																			
F1	2	1	2	2	1	1	1	1	1	2	1	2	1	1	1	1	1																																												
F2	2	2	2	2	1	1	1	1	1	2	2	2	1	1	1	1	2																																												
G1	2	3	2	2	2	1	1	1	1	2	2	2	2	2	2	2	6																																												
G2	4	4	3	2	2	1	1	1	1	4	2	2	2	2	2	4	6																																												
H1	3	2	2	2	2	1	1	1	1	4	2	6																																																	
H2	3	2	2	2	1	1	1	1	1	6																																																			
I1	4	3	2	2	1	1	1	1	1	4	2	2	2	1	1	2	2																																												
I2	4	2	2	3	1	1	1	2	1	4	2	2	2	2	2	2	6																																												
J1	2	2	2	2	2	2	2	2	2	6																																																			
J2	4	2	2	2	2	1	1	1	1	4	2	2	2	2	2	2	6																																												
K1	3	2	2	2	2	1	1	1	1	6																																																			
K2	3	2	1	1	1	1	1	1	1	6																																																			
L1	3	2	2	2	2	1	1	1	1	6																																																			
L2	2	2	1	1	1	1	1	1	1	6																																																			
M1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2																																												
M2	2	2	2	2	2	2	2	1	1	2	2	2	2	2	2	2	6																																												
N1	2	2	2	3	2	1	1	1	1	6																																																			
N2	3	2	2	2	2	1	1	1	1	4	2	2	2	2	2	2	6																																												
O1	3	1	1	1	1	1	1	1	1	4	2	2	1	2	1	4	6																																												
O2	3	1	1	1	1	1	1	1	1	6																																																			
P1	4	3	2	2	2	2	2	2	2	4	2	2	2	2	2	2	6																																												
P2	3	2	2	2	2	1	1	1	1	4	2	2	2	2	1	2	4																																												
Q1	4	4	4	4	2	2	1	1	1	4	4	2	2	2	2	2	6																																												
Q2	4	4	4	2	2	2	1	2	2	4	4	4	4	4	2	2	4																																												
S1	4	4	1	2	2	1	1	1	1	2	1	1	1	1	1	1	4																																												
S2	4	4	1	2	2	2	1	1	1	2	2	1	1	1	1	1	4																																												
R1	2	1	1	1	2	1	1	4	2	1	1	6																																																	
R2	2	1	1	1	2	1	2	1	1	2	2	2	2	1	2	2	2																																												
Clinical	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	6																																												

Agreement results matrix for case 42

REVIEWER	A1	A2	B1	B2	C1	C2	D1	D2	E1	E2	F1	F2	G1	G2	H1	H2	I1	I2	J1	J2	K1	K2	L1	L2	M1	M2	N1	N2	O1	O2	P1	P2	Q1	Q2	S1	S2	R1	R2
A1	100	99	83	67	81	79	43	71	43	57	32	32	55	95	57	43	73	84	29	79	42	42	42	32	29	43	46	70	85	42	79	86	78	85	83	83	40	30
A2	99	100	80	70	86	85	49	75	49	65	39	38	58	94	64	49	82	89	35	84	49	48	49	36	35	46	53	74	82	47	84	85	82	83	83	83	46	36
B1	83	80	100	82	71	71	40	76	40	39	33	35	60	79	60	40	61	77	36	71	40	39	40	37	34	53	50	76	84	38	72	81	67	78	52	52	49	34
B2	67	70	82	100	77	85	48	91	48	37	46	48	57	65	75	48	71	79	50	85	48	47	48	52	45	61	48	91	82	46	76	81	62	62	35	35	61	46
C1	81	86	71	77	100	95	58	88	58	72	40	40	71	90	72	58	91	94	34	95	58	59	58	40	37	52	49	88	83	60	96	79	88	75	74	73	49	41
C2	79	85	71	85	95	100	54	88	54	69	46	48	69	89	72	54	90	94	43	100	55	53	55	43	46	62	45	89	80	52	95	79	89	76	74	74	52	47
D1	43	49	40	48	58	54	100	66	100	81	50	50	61	45	79	100	65	52	77	54	100	99	100	81	45	41	80	65	53	97	56	60	41	35	42	41	58	47
D2	71	75	76	91	88	88	66	100	66	57	52	54	79	75	82	66	82	84	47	88	65	65	65	49	49	67	51	99	90	64	87	88	69	61	54	54	57	51
E1	43	49	40	48	58	54	100	66	100	81	50	50	61	45	79	100	65	52	77	54	100	99	100	81	45	41	80	65	53	97	56	60	41	35	42	41	58	47
E2	57	65	39	37	72	69	81	57	81	100	33	33	55	67	68	81	79	68	60	69	82	80	82	56	36	32	71	58	48	79	75	54	65	54	66	67	45	33
F1	32	39	33	46	40	46	50	52	50	33	100	97	64	27	41	50	47	39	54	44	49	49	49	59	85	73	49	49	41	48	36	46	20	14	43	43	48	92
F2	32	38	35	48	40	48	50	54	50	33	97	100	67	28	43	50	49	42	56	47	50	48	50	59	89	77	50	52	41	46	39	48	21	15	42	42	46	93
G1	55	58	60	57	71	69	61	79	61	55	64	67	100	64	53	61	62	69	41	69	61	59	61	41	68	86	55	80	70	57	72	69	49	34	62	63	35	68
G2	95	94	79	65	90	89	45	75	45	67	27	28	64	100	60	45	82	91	26	89	46	45	46	27	28	45	44	76	83	44	91	80	91	87	83	83	36	28
H1	57	64	60	75	72	72	79	82	79	68	41	43	53	60	100	79	80	68	61	72	79	77	79	62	40	38	64	83	69	76	73	77	60	58	38	39	75	41
H2	43	49	40	48	58	54	100	66	100	81	50	50	61	45	79	100	65	52	77	54	100	99	100	81	45	41	80	65	53	97	56	60	41	35	42	41	58	47
I1	73	82	61	71	91	90	65	82	65	79	47	49	62	82	80	65	100	88	40	89	64	64	64	43	45	42	55	81	70	63	90	77	83	72	69	69	52	47
I2	84	89	77	79	94	94	52	84	52	68	39	42	69	91	68	52	88	100	38	94	51	51	51	39	42	56	56	84	77	50	94	75	88	75	70	70	48	42
J1	29	35	36	50	34	43	77	47	77	60	54	56	41	26	61	77	40	38	100	43	78	74	78	90	63	51	78	48	36	72	40	43	24	25	23	24	65	56
J2	79	84	71	85	95	100	54	88	54	69	44	47	69	89	72	54	89	94	43	100	55	53	55	43	47	63	45	89	79	52	96	79	89	76	73	73	53	47
K1	42	49	40	48	58	55	100	65	100	82	49	50	61	46	79	100	64	51	78	55	100	97	100	80	46	42	80	66	53	96	57	60	41	36	43	42	58	47
K2	42	48	39	47	59	53	99	65	99	80	49	48	59	45	77	99	64	51	74	53	97	100	97	83	42	39	78	64	55	99	55	59	40	35	42	41	59	48
L1	42	49	40	48	58	55	100	65	100	82	49	50	61	46	79	100	64	51	78	55	100	97	100	80	46	42	80	66	53	96	57	60	41	36	43	42	58	47
L2	32	36	37	52	40	43	81	49	81	56	59	59	41	27	62	81	43	39	90	43	80	83	80	100	51	46	80	48	41	81	35	44	24	23	25	24	69	59
M1	29	35	34	45	37	46	45	49	45	36	85	89	68	28	40	45	45	42	63	47	46	42	46	51	100	82	46	52	37	40	44	46	22	16	37	38	44	93
M2	43	46	53	61	52	62	41	67	41	32	73	77	86	45	38	41	42	56	51	63	42	39	42	46	82	100	42	69	59	37	57	57	33	23	48	49	39	79
N1	46	53	50	48	49	45	80	51	80	71	49	50	55	44	64	80	55	56	78	45	80	78	80	80	46	42	100	52	41	76	48	47	41	33	34	34	58	47
N2	70	74	76	91	88	89	65	99	65	58	49	52	80	76	83	65	81	84	48	89	66	64	66	48	52	69	52	100	88	63	89	89	70	62	53	54	58	52
O1	85	82	84	82	83	80	53	90	53	48	41	41	70	83	69	53	70	77	36	79	53	55	53	41	37	59	41	88	100	55	80	94	66	70	66	66	50	42
O2	42	47	38	46	60	52	97	64	97	79	48	46	57	44	76	97	63	50	72	52	96	99	96	81	40	37	76	63	55	100	54	58	40	35	42	41	59	48
P1	79	84	72	76	96	95	56	87	56	75	36	39	72	91	73	56	90	94	40	96	57	55	57	35	44	57	48	89	80	54	100	79	88	76	71	72	47	41
P2	86	85	81	81	79	79	60	88	60	54	46	48	69	80	77	60	77	75	43	79	60	59	60	44	46	57	47	89	94	58	79	100	65	70	67	67	53	47
Q1	78	82	67	62	88	89	41	69	41	65	20	21	49	91	60	41	83	88	24	89	41	40	41	24	22	33	41	70	66	40	88	65	100	88	70	70	33	22
Q2	85	83	78	62	75	76	35	61	35	54	14	15	34	87	58	35	72	75	25	76	36	35	36	23	16	23	33	62	70	35	76	70	88	100	63	64	36	15
S1	83	83	52	35	74	74	42	54	42	66	43	42	62	83	38	42	69	70	23	73	43	42	43	25	37	48	34	53	66	42	71	67	70	63	100	100	25	40
S2	83	83	52	35	73	74	41	54	41	67	43	42	63	83	39	41	69	70	24	73	42	41	42	24	38	49	34	54	66	41	72	67	70	64	100	100	25	41
R1	40	46	49	61	49	52	58	57	58	45	48	46	35	36	75	58	52	48	65	53	58	59	58	69	44	39	58	58	50	59	47	53	33	36	25	25	100	48
R2	30	36	34	46	41	47	47	51	47	33	92	93	68	28	41	47	47	42	56	47	47	48	47	59	93	79	47	52	42	48	41	47	22	15	40	41	48	100

Case 43 631

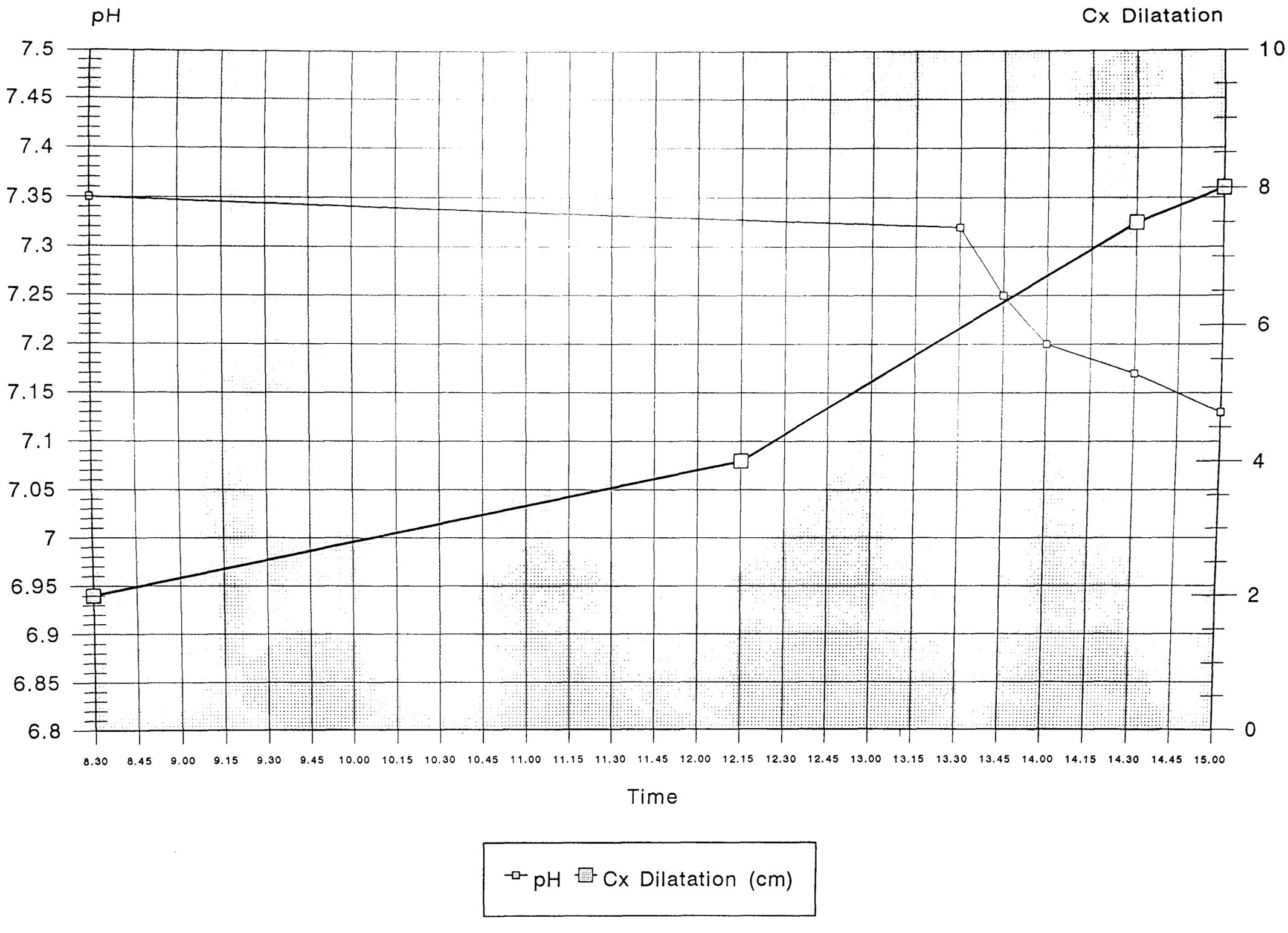
Miss T.W. is a 22 year old lady expecting her second baby. Her first child was delivered in 1987 by emergency Caesarean section because of fetal distress prior to established labour. The child was born at term and weighed 7lb 6oz. During this pregnancy no problems were detected antenatally, and it was planned that she should have a trial of vaginal delivery. She laboured spontaneously at 40 weeks gestation, being admitted at 08.30hrs on 13.11.90. Presentation cephalic 3/5. Cervix 2cm dilated, thick; station -1. Continuous monitoring was begun at 10.20hrs.

Labour events

11.00	Pethidine 50mg, Stemetil 12.5mg im.
11.10	Vomited.
12.15	VE Cx 4cm dilated, thin. Station -2. ARM; clear liquor. FSE applied.
13.10	Epidural begun.
13.45	Epidural main dose.
14.25	VE Cx 7-8cm dilated. Station -1.
	FBS; pH 7.17 BE-7
	Decision for Caesarean section.
15.00	Male infant delivered by emergency C/S under GA. Indication; fetal distress.
	Cord found alongside fetal head at operation.

Outcome

Birth weight	3.66kg
Apgar	7 & 9
Cords	pH 7.13 / 7.17 BD(ecf) 5 / 5


pH
Cx Dilatation
7.5
7.45
7.4
7.35
7.3
7.25
7.2
7.15
7.1
7.05
7
6.95
6.9
6.85
6.8
10
8
6
4
2
0
8.30
8.45
9.00
9.15
9.30
9.45
10.00
10.15
10.30
10.45
11.00
11.15
11.30
11.45
12.00
12.15
12.30
12.45
13.00
13.15
13.30
13.45
14.00
14.15
14.30
14.45
15.00
Time
pH
Cx Dilatation (cm)

Case 43

SEGMENT

REVIEWER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
A1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	3	5																																												
A2	1	1	1	1	1	1	1	1	1	1	1	2	2	3	5																																													
B1	1	1	1	1	1	1	1	1	1	1	2	2	3	5																																														
B2	1	1	1	1	1	1	1	1	1	1	2	2	2	2	4	3	5																																											
C1	1	1	1	1	1	1	1	1	1	1	1	1	2	4	4	3	5																																											
C2	1	1	1	1	1	1	1	1	1	1	1	2	3	4	5																																													
D1	1	1	1	1	1	1	1	1	1	1	1	2	2	3	5																																													
D2	1	1	1	1	1	1	1	1	1	1	2	2	2	3	5																																													
E1	1	1	1	1	1	1	1	1	1	1	2	2	2	3	5																																													
E2	2	2	2	2	1	1	2	1	1	2	2	2	2	4	3	5																																											
F1	1	1	1	1	1	1	1	1	1	1	1	2	2	3	2	2	2	3	5																																								
F2	1	1	1	1	1	1	1	1	1	1	1	1	1	2	3	5																																											
G1	1	1	1	1	1	1	1	1	1	1	1	1	1	5																																													
G2	1	1	1	1	1	1	1	1	1	1	1	1	2	4	5																																													
H1	1	1	1	1	1	1	1	1	1	2	2	1	2	3	5																																													
H2	1	1	1	1	1	1	1	1	1	1	2	2	2	3	5																																													
I1	1	1	1	1	1	1	1	1	1	1	2	2	2	4	3	5																																											
I2	1	1	1	1	1	1	1	1	1	2	2	2	2	3	5																																													
J1	1	1	1	1	1	1	2	1	2	2	2	2	3	3	5																																													
J2	1	1	1	1	1	1	1	1	1	1	1	2	2	3	5																																													
K1	1	1	1	1	1	1	1	1	1	1	1	1	2	3	5																																													
K2	1	1	1	1	1	1	1	1	1	1	1	2	2	2	3	5																																												
L1	1	1	1	1	1	1	1	1	1	1	2	2	3	4	3	5																																												
L2	1	1	1	1	1	1	1	1	1	1	1	1	2	3	5																																													
M1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	3	5																																									
M2	1	1	1	1	1	1	1	1	1	1	1	2	2	3	5																																													
N1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	3	5																																											
N2	1	1	1	1	1	1	1	1	1	1	1	2	2	3	4	4	3	5																																									
O1	1	1	1	1	1	1	1	1	1	1	1	2	2	3	5																																													
O2	1	1	1	1	1	1	1	1	1	1	1	2	2	3	5																																													
P1	1	1	1	1	1	1	1	1	1	1	2	2	2	4	4	4	5																																											
P2	1	1	1	1	1	1	1	1	1	1	1	1	2	4	3	5																																												
Q1	2	1	1	2	1	1	1	1	1	2	2	2	2	4	4	4	4																																											
Q2	2	2	2	2	2	2	2	2	2	2	2	2	4	4	4	4	4																																											
S1	1	1	1	1	1	1	1	1	1	1	1	1	1	5																																													
S2	1	1	1	1	1	1	1	1	1	1	1	1	1	5																																													
R1	1	3	2	2	1	4	3	1	1	1	2	2	5																																															
R2	2	1	2	4	2	1	1	1	1	2	2	1	2	2	1	2	1	1																																									
Clinical	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	5	C																																									

Agreement results matrix for case 43

REVIEWER	A1	A2	B1	B2	C1	C2	D1	D2	E1	E2	F1	F2	G1	G2	H1	H2	I1	I2	J1	J2	K1	K2	L1	L2	M1	M2	N1	N2	O1	O2	P1	P2	Q1	Q2	S1	S2	R1	R2
A1	100	94	78	92	88	87	94	94	94	93	60	98	74	87	94	94	95	94	92	94	93	99	93	93	77	94	94	80	94	94	86	94	67	60	74	74	40	34
A2	94	100	94	79	78	96	100	100	100	90	40	94	89	95	99	100	92	99	98	100	100	94	92	100	54	100	78	64	100	100	78	92	67	62	89	89	57	32
B1	78	94	100	57	59	93	94	94	94	76	37	77	94	90	94	94	78	94	94	94	94	78	81	94	27	94	54	49	94	94	61	78	61	60	94	94	68	30
B2	92	79	57	100	99	78	79	79	79	92	73	91	56	80	78	79	94	79	76	79	78	92	91	78	86	79	95	94	79	79	97	93	78	74	56	56	28	30
C1	88	78	59	99	100	82	78	78	78	93	70	88	59	83	78	78	95	77	76	78	78	88	93	78	80	78	88	94	78	78	98	95	80	78	59	59	33	24
C2	87	96	93	78	82	100	96	96	96	91	38	87	88	98	95	96	93	95	96	96	96	87	95	96	46	96	69	66	96	96	83	93	73	72	88	88	58	26
D1	94	100	94	79	78	96	100	100	100	90	40	94	89	95	99	100	92	99	98	100	100	94	92	100	54	100	78	64	100	100	78	92	67	62	89	89	57	32
D2	94	100	94	79	78	96	100	100	100	90	40	93	89	94	100	100	92	100	99	100	99	94	92	99	54	100	78	64	100	100	78	92	67	62	89	89	57	32
E1	94	100	94	79	78	96	100	100	100	90	40	93	89	94	100	100	92	100	99	100	99	94	92	99	54	100	78	64	100	100	78	92	67	62	89	89	57	32
E2	93	90	76	92	93	91	90	90	90	100	56	92	73	91	90	90	98	90	89	90	89	93	97	89	68	90	85	81	90	90	91	97	76	77	73	73	44	28
F1	60	40	37	73	70	38	40	40	40	56	100	60	30	35	40	40	58	40	42	40	40	61	59	40	90	40	78	83	40	40	65	58	51	46	30	30	20	35
F2	98	94	77	91	88	87	94	93	93	92	60	100	76	88	94	93	94	93	90	94	94	99	93	94	79	94	94	80	94	94	86	95	66	59	76	76	39	34
G1	74	89	94	56	59	88	89	89	89	73	30	76	100	92	89	89	75	88	84	89	90	75	73	90	31	89	54	43	89	89	60	76	60	58	100	100	69	34
G2	87	95	90	80	83	98	95	94	94	91	35	88	92	100	94	94	94	94	91	95	95	88	92	95	50	95	72	64	95	95	84	94	73	72	92	92	59	29
H1	94	99	94	78	78	95	99	100	100	90	40	94	89	94	100	100	92	100	99	99	99	94	92	99	54	99	78	64	99	99	78	92	67	63	89	89	57	33
H2	94	100	94	79	78	96	100	100	100	90	40	93	89	94	100	100	92	100	99	100	99	94	92	99	54	100	78	64	100	100	78	92	67	62	89	89	57	32
I1	95	92	78	94	95	93	92	92	92	98	58	94	75	94	92	92	100	92	90	92	92	95	98	92	70	92	87	83	92	92	93	99	76	75	75	75	43	28
I2	94	99	94	79	77	95	99	100	100	90	40	93	88	94	100	100	92	100	99	99	99	94	92	99	53	99	78	64	99	99	78	91	67	63	88	88	57	32
J1	92	98	94	76	76	96	98	99	99	89	42	90	84	91	99	99	90	99	100	98	98	91	92	98	48	98	74	64	98	98	77	89	66	64	84	84	55	28
J2	94	100	94	79	78	96	100	100	100	90	40	94	89	95	99	100	92	99	98	100	100	94	92	100	54	100	78	64	100	100	78	92	67	62	89	89	57	32
K1	93	100	94	78	78	96	100	99	99	89	40	94	90	95	99	99	92	99	98	100	100	94	91	100	55	100	78	64	100	100	78	92	66	62	90	90	56	32
K2	99	94	78	92	88	87	94	94	94	93	61	99	75	88	94	94	95	94	91	94	94	100	93	94	78	94	94	80	94	94	86	95	67	60	75	75	40	34
L1	93	92	81	91	93	95	92	92	92	97	59	93	73	92	92	92	98	92	92	92	91	93	100	91	66	92	84	83	92	92	92	98	76	74	73	73	42	25
L2	93	100	94	78	78	96	100	99	99	89	40	94	90	95	99	99	92	99	98	100	100	94	91	100	55	100	78	64	100	100	78	92	66	62	90	90	56	32
M1	77	54	27	86	80	46	54	54	54	68	90	79	31	50	54	54	70	53	48	54	55	78	66	55	100	54	94	85	54	54	75	71	53	44	31	31	18	37
M2	94	100	94	79	78	96	100	100	100	90	40	94	89	95	99	100	92	99	98	100	100	94	92	100	54	100	78	64	100	100	78	92	67	62	89	89	57	32
N1	94	78	54	95	88	69	78	78	78	85	78	94	54	72	78	78	87	78	74	78	78	94	84	78	94	78	100	88	78	78	85	87	62	54	54	54	20	36
N2	80	64	49	94	94	66	64	64	64	81	83	80	43	64	64	64	83	64	64	64	64	80	83	64	85	64	88	100	64	64	94	83	81	77	43	43	28	23
O1	94	100	94	79	78	96	100	100	100	90	40	94	89	95	99	100	92	99	98	100	100	94	92	100	54	100	78	64	100	100	78	92	67	62	89	89	57	32
O2	94	100	94	79	78	96	100	100	100	90	40	94	89	95	99	100	92	99	98	100	100	94	92	100	54	100	78	64	100	100	78	92	67	62	89	89	57	32
P1	86	78	61	97	98	83	78	78	78	91	65	86	60	84	78	78	93	78	77	78	78	86	92	78	75	78	85	94	78	78	100	93	85	83	60	60	34	23
P2	94	92	78	93	95	93	92	92	92	97	58	95	76	94	92	92	99	91	89	92	92	95	98	92	71	92	87	83	92	92	93	100	76	74	76	76	42	28
Q1	67	67	61	78	80	73	67	67	67	76	51	66	60	73	67	67	76	67	66	67	66	67	76	66	53	67	62	81	67	67	85	76	100	97	60	60	40	28
Q2	60	62	60	74	78	72	62	62	62	77	46	59	58	72	63	62	75	63	64	62	62	60	74	62	44	62	54	77	62	62	83	74	97	100	58	58	42	22
S1	74	89	94	56	59	88	89	89	89	73	30	76	100	92	89	89	75	88	84	89	90	75	73	90	31	89	54	43	89	89	60	76	60	58	100	100	69	34
S2	74	89	94	56	59	88	89	89	89	73	30	76	100	92	89	89	75	88	84	89	90	75	73	90	31	89	54	43	89	89	60	76	60	58	100	100	69	34
R1	40	57	68	28	33	58	57	57	57	44	20	39	69	59	57	57	43	57	55	57	56	40	42	56	18	57	20	28	57	57	34	42	40	42	69	69	100	46
R2	34	32	30	30	24	26	32	32	32	28	35	34	34	29	33	32	28	32	28	32	32	34	25	32	37	32	36	23	32	32	23	28	28	22	34	34	46	100

Case 44 2129

Mrs L.C. is a 34 year old lady expecting her third baby. She is fit and well, but smokes 10 cigarettes per day. Her two previous children were born normally at term, and weighed 8lb 7oz and 9lb respectively. Her current pregnancy was straightforward until the development of mild hypertension at 38 weeks. By 39 weeks her BP was 150/100 and there was 2+ proteinuria. She was asymptomatic and reflexes were normal. The fetus was felt to be slightly small for dates (fundal height 37cm). Labour was induced at this stage on the grounds of proteinuric hypertension. Presentation cephalic 2/5. VE Cx 1cm dilated, 1cm long. Prostin tablet 3mg was given PV at 06.45hrs on 3.10.91. ARM at 12.00hrs; clear liquor. FSE applied.

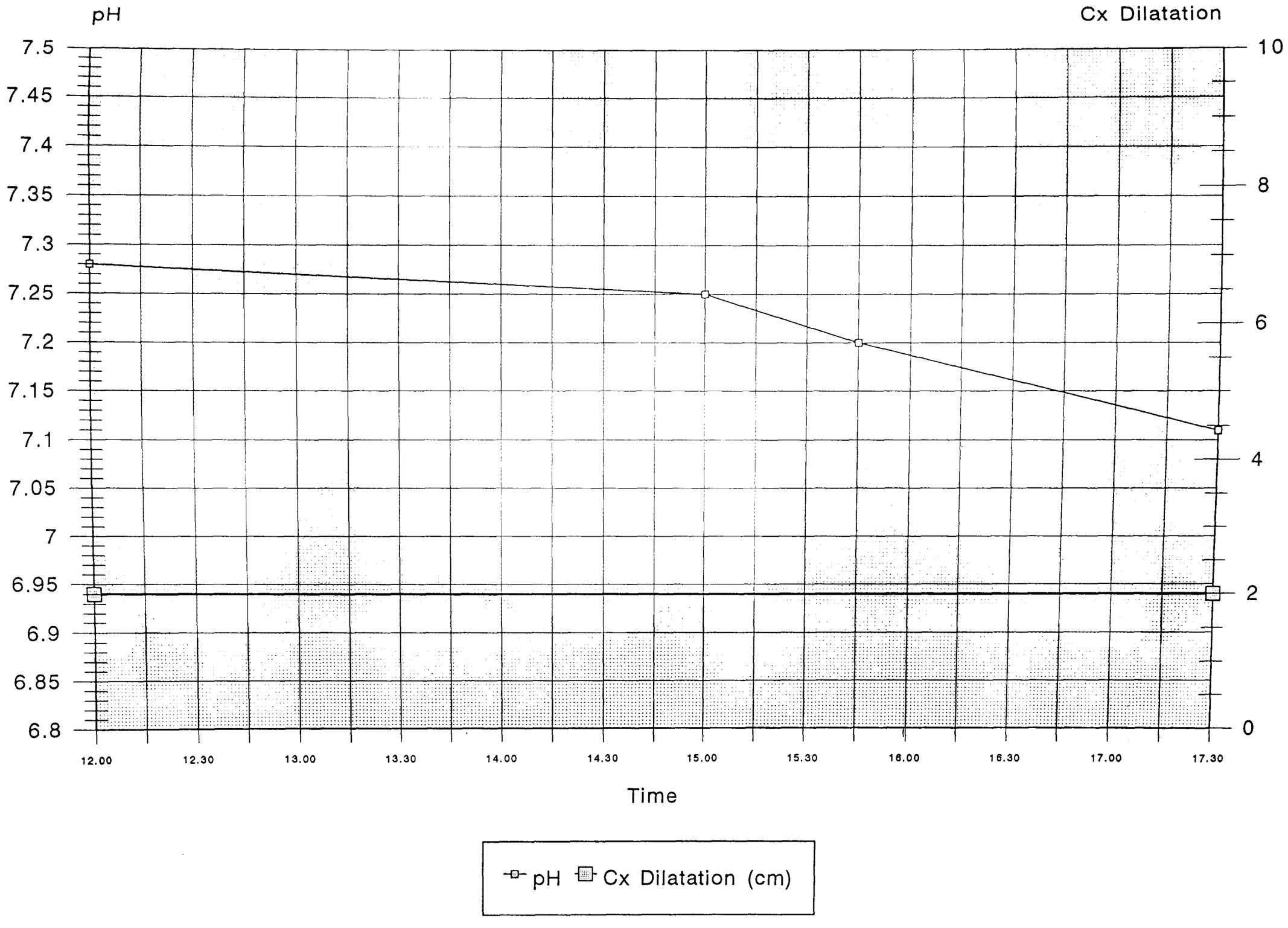
Labour events

Note; maternal condition gave rise to no concern during labour.

12.30	Syntocinon begun.
15.30	VE Cx 2cm dilated, thick. Station -2.
16.40	Decision for C/S
17.30	Male infant delivered by emergency C/S under GA. Indication; fetal tachycardia with decelerations at 2cm dilatation.

Outcome

Birth weight 2.13kg
Apgar 6 & 9
Cord gases pH 7.11 / 7.15 BD(ecf) 8 / 7


pH
Cx Dilatation
7.5
7.45
7.4
7.35
7.3
7.25
7.2
7.15
7.1
7.05
7
6.95
6.9
6.85
6.8
10
8
6
4
2
0
12.00
12.30
13.00
13.30
14.00
14.30
15.00
15.30
16.00
16.30
17.00
17.30
Time
pH
Cx Dilatation (cm)

Case 44

REVIEWER	SEGMENT 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
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D2	2	1	1	1	1	2	2	1	2	2	2	2	3	5																																													
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G2	2	2	2	2	2	2	2	2	2	2	2	2	3	2	2	2	4	5																																										
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L1	1	1	1	1	2	2	2	1	2	3	2	2	2	3	5																																												
L2	1	1	1	1	2	2	2	1	2	2	2	2	3	4	4	3	5																																											
M1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	3	5																																										
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S1	2	1	1	1	2	1	2	1	1	2	1	1	1	2	2	2	2	2	1	2																																								
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R2	1	1	2	1	2	1	1	1	2	1	2	2	2	1	5																																													
Clinical	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	C																																							

Agreement results matrix for case 44

REVIEWER	A1	A2	B1	B2	C1	C2	D1	D2	E1	E2	F1	F2	G1	G2	H1	H2	I1	I2	J1	J2	K1	K2	L1	L2	M1	M2	N1	N2	O1	O2	P1	P2	Q1	Q2	S1	S2	R1	R2
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A2	99	100	72	79	85	94	90	76	95	78	50	92	73	76	33	56	92	75	73	87	88	94	94	86	72	74	59	73	77	79	28	75	70	35	37	37	36	83
B1	72	72	100	89	81	78	61	56	65	67	27	60	44	53	42	57	77	63	64	75	78	71	74	72	42	48	64	74	71	67	13	61	68	74	14	14	14	56
B2	80	79	89	100	90	84	72	69	77	75	33	72	51	62	44	62	84	67	74	88	88	79	81	86	50	58	71	82	77	75	16	67	80	62	19	19	18	70
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E1	96	95	65	77	85	90	94	80	100	78	50	95	73	80	26	55	88	73	75	88	87	92	90	89	71	77	61	74	75	78	28	75	72	33	36	36	35	84
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K1	87	88	78	88	97	84	88	63	87	64	56	82	71	82	31	48	82	75	60	94	100	81	80	99	71	77	84	92	65	65	37	81	90	52	24	25	24	68
K2	94	94	71	79	78	89	79	92	92	92	25	87	50	59	34	76	87	54	86	76	81	100	99	79	50	54	53	62	91	93	26	60	59	34	35	35	36	87
L1	93	94	74	81	80	90	77	90	90	94	25	87	50	58	35	76	88	55	85	74	80	99	100	77	50	54	54	64	92	94	26	62	59	35	34	34	35	87
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N1	60	59	64	71	86	63	72	48	61	50	67	58	70	83	24	46	60	75	50	76	84	53	54	83	70	74	100	96	54	51	54	81	91	64	20	20	19	46
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O1	77	77	71	77	66	81	57	91	75	96	19	66	24	39	58	94	76	43	94	59	65	91	92	60	22	28	54	56	100	97	23	44	47	39	29	29	30	76
O2	79	79	67	75	66	76	58	95	78	100	21	70	26	40	58	90	74	37	89	61	65	93	94	62	24	29	51	54	97	100	25	43	49	34	31	31	32	81
P1	28	28	13	16	37	26	51	26	28	25	87	27	76	69	22	23	25	66	24	46	37	26	26	39	73	67	54	48	23	25	100	65	46	18	52	53	50	29
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R2	82	83	56	70	68	77	71	87	84	81	29	89	53	53	21	66	77	46	82	68	68	87	87	72	54	52	46	54	76	81	29	48	60	26	43	43	45	100

Case 45 2337

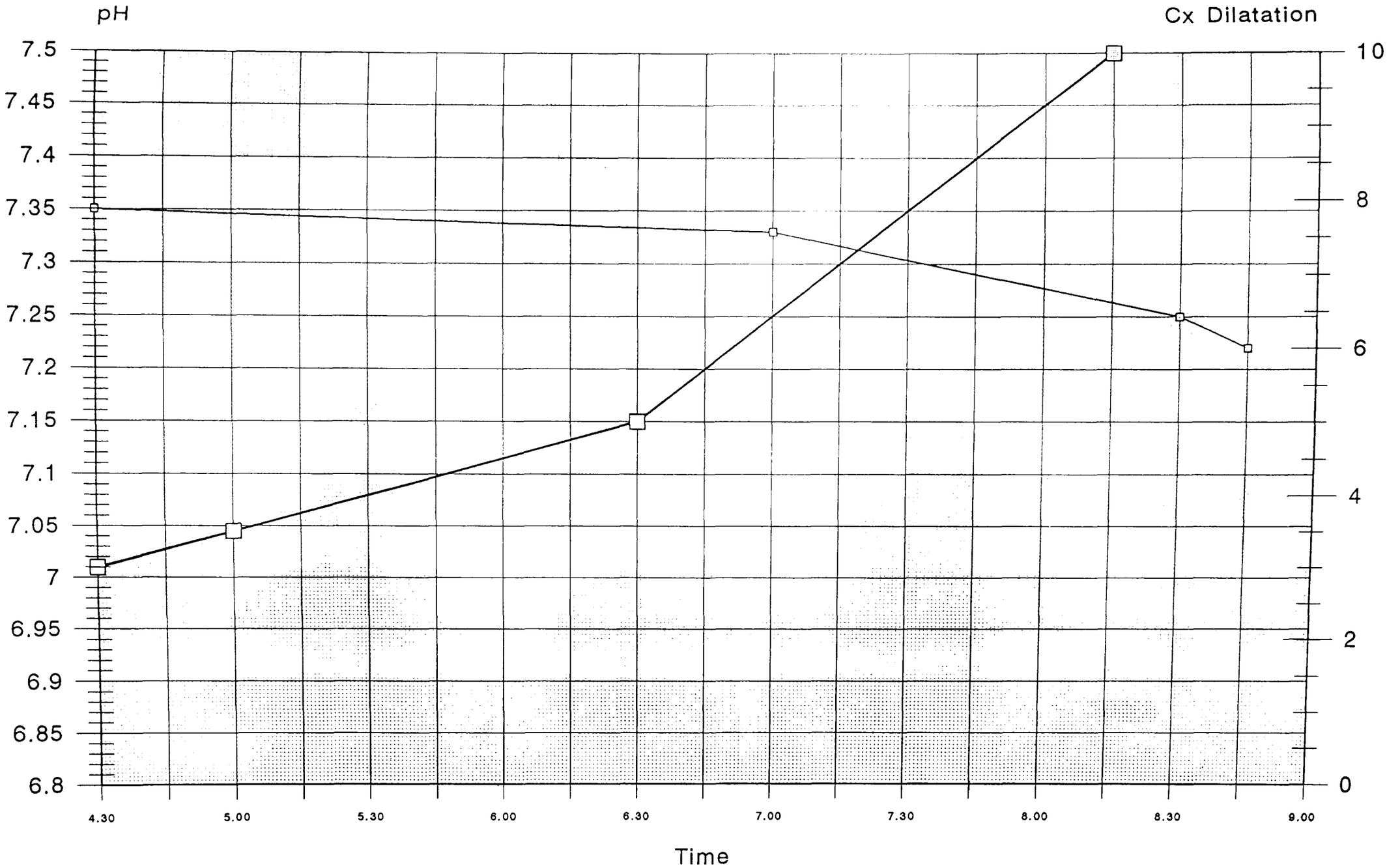
Mrs R.S. is a 23 year old primigravida. She has serious social difficulties and is under psychiatric care because of anxiety and depression. She smokes 20 cigarettes per day. At 38 weeks there was a suspicion of intrauterine growth retardation. An ultrasound scan estimated fetal weight to be 2.4kg, with normal liquor volume. Labour was induced at 41 weeks on the grounds of postmaturity. On admission the fetus was judged to be slightly small for dates (fundal height 36cm). Presentation cephalic 3/5. VE Cx 1cm dilated, 2cm long. A prostin tablet 3mg was given at 15.00hrs on 13.11.91. She was taken to the labour ward at 04.45hrs the following morning with regular contractions. The membranes ruptured spontaneously.

Labour events

04.35	VE Cx 3cm dilated, thick. Station -3. Clear liquor.
05.00	VE Cx 3-4cm dilated. FSE applied.
05.50	Epidural begun.
06.20	Epidural complete. Maternal hypotension; IV fluids increased; oxygen given.
06.35	VE Cx 5cm dilated, thick. Station -2 / -3
07.00	FBS; pH 7.33 BE -2
07.40	Top up.
08.05	Maternal position changed.
08.10	VE Cx fully dilated. Station 0.
08.25	Decision for forceps.
08.47	Male infant delivered by Neville Barnes forceps. Indication; prolonged bradycardia.

Outcome

Birth weight	2.60kg
Apgar	9 & 9
Cord gases	pH 7.22 / 7.36 BD(ecf) 4 / 0


pH
Cx Dilatation
7.5
7.45
7.4
7.35
7.3
7.25
7.2
7.15
7.1
7.05
7
6.95
6.9
6.85
6.8
10
8
6
4
2
0
4.30
5.00
5.30
6.00
6.30
7.00
7.30
8.00
8.30
9.00
Time
pH
Cx Dilatation (cm)

Case 45

SEGMENT

REVIEWER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
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E1	2	2	2	3	2	2	3	2	2	2	2	2	2	6																																													
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I2	2	2	2	3	2	2	2	3	2	2	2	2	2	6																																													
J1	3	1	2	4	4	3	1	2	2	1	2	4	6																																													
J2	2	2	2	3	4	4	2	2	2	2	3	1	2	2																																													
K1	2	1	2	3	2	2	3	2	2	2	2	3	6																																													
K2	2	1	2	3	2	2	2	3	2	1	2	2	6																																													
L1	2	1	2	3	2	2	2	2	2	2	2	2	2	6																																													
L2	2	1	2	2	2	3	2	2	1	1	2	2	2	6																																													
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P2	2	1	2	2	2	3	2	2	2	2	2	2	4	6																																													
Q1	2	2	2	4	4	4	4	4	2	2	4	4	6																																													
Q2	2	2	2	2	4	4	4	4	4	4	4	6																																															
S1	2	1	1	2	2	3	3	2	2	2	2	1	4	6																																													
S2	2	1	1	2	2	3	3	2	2	2	2	1	4	6																																													
R1	2	2	2	1	1	1	1	2	2	1	2	1	1	2																																													
R2	2	1	2	5																																																								
Clinical	0	0	0	0	0	0	3	0	0	0	0	0	0	6																																													

Agreement results matrix for case 45

REVIEWER	A1	A2	B1	B2	C1	C2	D1	D2	E1	E2	F1	F2	G1	G2	H1	H2	I1	I2	J1	J2	K1	K2	L1	L2	M1	M2	N1	N2	O1	O2	P1	P2	Q1	Q2	S1	S2	R1	R2
A1	100	69	78	81	89	63	72	72	71	72	59	71	47	71	65	65	64	68	71	55	71	69	72	73	42	59	94	81	86	64	81	94	59	44	92	92	40	16
A2	69	100	58	67	75	78	90	97	83	89	71	80	59	53	93	93	95	79	63	72	91	86	90	82	60	79	72	83	64	89	53	73	45	39	68	68	57	21
B1	78	58	100	94	78	80	61	61	69	69	40	61	60	87	58	58	54	66	93	78	69	66	61	62	21	45	82	74	74	58	46	81	93	81	82	82	21	31
B2	81	67	94	100	82	82	70	69	76	76	52	68	65	81	71	71	67	79	81	81	75	78	71	70	32	53	85	80	81	71	56	83	86	74	83	83	31	27
C1	89	75	78	82	100	74	73	77	76	78	68	82	45	68	73	73	71	72	73	60	81	75	73	81	39	53	89	83	76	73	63	93	61	53	92	92	38	14
C2	63	78	80	82	74	100	71	77	81	86	49	77	78	68	70	70	75	78	79	91	87	83	71	77	36	66	62	65	68	67	35	69	78	72	72	72	36	33
D1	72	90	61	70	73	71	100	97	92	89	80	88	62	54	88	88	82	88	61	64	86	86	99	91	63	82	77	76	71	89	67	80	42	30	74	74	62	20
D2	72	97	61	69	77	77	97	100	89	91	80	88	60	55	92	92	90	85	63	69	91	88	96	89	62	80	76	81	69	89	60	78	45	35	73	73	59	21
E1	71	83	69	76	76	81	92	89	100	98	68	90	64	55	79	79	77	98	64	66	94	95	92	93	52	81	73	69	80	80	60	83	50	43	84	84	52	20
E2	72	89	69	76	78	86	89	91	98	100	67	89	63	57	83	83	84	96	67	70	99	98	90	91	52	79	73	75	78	81	54	83	53	46	84	84	49	20
F1	59	71	40	52	68	49	80	80	68	67	100	83	51	40	71	71	60	68	41	37	67	68	79	82	77	58	61	61	57	72	70	70	26	18	64	64	72	15
F2	71	80	61	68	82	77	88	88	90	89	83	100	64	50	70	70	71	85	62	59	86	85	87	98	62	77	68	61	69	71	63	84	46	37	84	84	61	19
G1	47	59	60	65	45	78	62	60	64	63	51	64	100	52	48	48	63	60	61	84	55	59	63	68	64	76	39	37	48	48	51	54	65	59	53	53	61	37
G2	71	53	87	81	68	68	54	55	55	57	40	50	52	100	55	55	49	53	87	69	59	55	54	52	21	34	74	70	64	54	50	69	89	74	68	68	21	33
H1	65	93	58	71	73	70	88	92	79	83	71	70	48	55	100	100	93	82	61	70	86	86	88	73	51	65	75	89	69	97	55	69	45	41	62	62	50	18
H2	65	93	58	71	73	70	88	92	79	83	71	70	48	55	100	100	93	82	61	70	86	86	88	73	51	65	75	89	69	97	55	69	45	41	62	62	50	18
I1	64	95	54	67	71	75	82	90	77	84	60	71	63	49	93	93	100	77	58	76	87	84	83	74	63	82	67	81	64	89	51	66	44	43	62	62	60	20
I2	68	79	66	79	72	78	88	85	98	96	68	85	60	53	82	82	77	100	61	63	93	97	88	87	52	77	71	72	82	83	60	79	49	45	81	81	52	18
J1	71	63	93	81	73	79	61	63	64	67	41	62	61	87	61	61	58	61	100	78	68	64	61	62	24	48	76	73	64	60	35	73	87	75	74	74	25	37
J2	55	72	78	81	60	91	64	69	66	70	37	59	84	69	70	70	76	63	78	100	73	67	64	60	36	66	57	64	54	68	32	56	81	75	56	56	37	41
K1	71	91	69	75	81	87	86	91	94	99	67	86	55	59	86	86	87	93	68	73	100	97	87	88	44	69	74	79	75	84	50	81	56	52	83	83	42	19
K2	69	86	66	78	75	83	86	88	95	98	68	85	59	55	86	86	84	97	64	67	97	100	86	87	53	74	70	77	81	84	54	78	52	48	80	80	50	19
L1	72	90	61	71	73	71	99	96	92	90	79	87	63	54	88	88	83	88	61	64	87	86	100	91	63	82	77	76	69	89	67	81	42	30	75	75	60	20
L2	73	82	62	70	81	77	91	89	93	91	82	98	68	52	73	73	74	87	62	60	88	87	91	100	63	81	70	64	69	74	66	86	47	38	86	86	60	19
M1	42	60	21	32	39	36	63	62	52	52	77	62	64	21	51	51	63	52	24	36	44	53	63	63	100	74	35	37	48	54	63	46	13	9	41	41	92	16
M2	59	79	45	53	53	66	82	80	81	79	58	77	76	34	65	65	82	77	48	66	69	74	82	81	74	100	51	50	60	65	59	64	34	27	62	62	73	22
N1	94	72	82	85	89	62	77	76	73	73	61	68	39	74	75	75	67	71	76	57	74	70	77	70	35	51	100	94	80	75	67	94	64	54	89	89	34	14
N2	81	83	74	80	83	65	76	81	69	75	61	61	37	70	89	89	81	72	73	64	79	77	76	64	37	50	94	100	73	86	52	80	60	54	73	73	36	15
O1	86	64	74	81	76	68	71	69	80	78	57	69	48	64	69	69	64	82	64	54	75	81	69	69	48	60	80	73	100	72	73	80	51	41	82	82	47	15
O2	64	89	58	71	73	67	89	89	80	81	72	71	48	54	97	97	89	83	60	68	84	84	89	74	54	65	75	86	72	100	58	69	44	40	62	62	54	17
P1	81	53	46	56	63	35	67	60	60	54	70	63	51	50	55	55	51	60	35	32	50	54	67	66	63	59	67	52	73	58	100	73	23	13	65	65	63	13
P2	94	73	81	83	93	69	80	78	83	83	70	84	54	69	69	69	66	79	73	56	81	78	81	86	46	64	94	80	80	69	73	100	63	50	99	99	44	16
Q1	59	45	93	86	61	78	42	45	50	53	26	46	65	89	45	45	44	49	87	81	56	52	42	47	13	34	64	60	51	44	23	63	100	97	64	64	13	35
Q2	44	39	81	74	53	72	30	35	43	46	18	37	59	74	41	41	43	45	75	75	52	48	30	38	9	27	54	54	41	40	13	50	97	100	52	52	9	27
S1	92	68	82	83	92	72	74	73	84	84	64	84	53	68	62	62	62	81	74	56	83	80	75	86	41	62	89	73	82	62	65	99	64	52	100	100	39	16
S2	92	68	82	83	92	72	74	73	84	84	64	84	53	68	62	62	62	81	74	56	83	80	75	86	41	62	89	73	82	62	65	99	64	52	100	100	39	16
R1	40	57	21	31	38	36	62	59	52	49	72	61	61	21	50	50	60	52	25	37	42	50	60	60	92	73	34	36	47	54	63	44	13	9	39	39	100	15
R2	16	21	31	27	14	33	20	21	20	20	15	19	37	33	18	18	20	18	37	41	19	19	20	19	16	22	14	15	15	17	13	16	35	27	16	16	15	100

Case 46 180

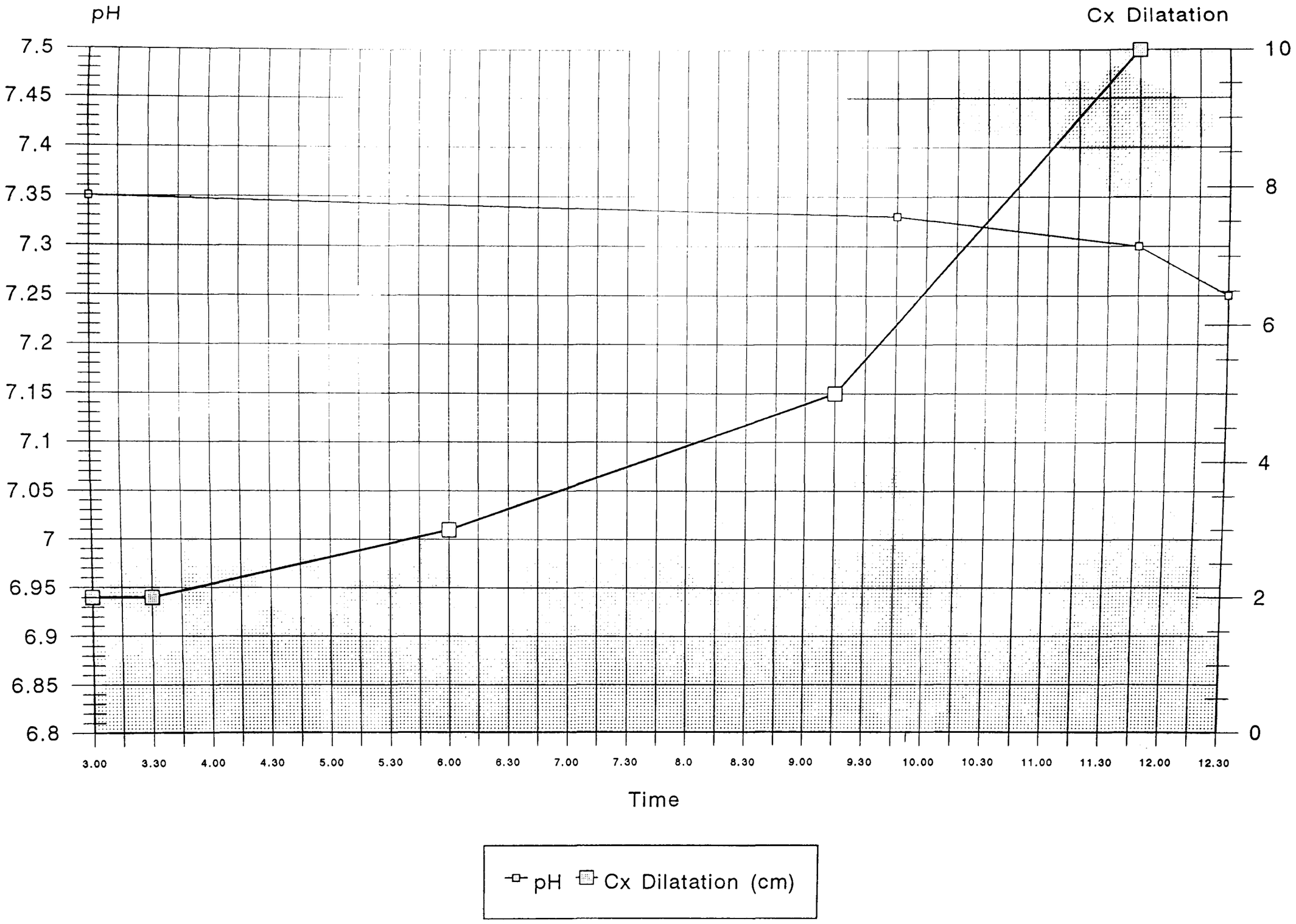
Miss D.R. is a 27 year old primigravida; a fit lady, and a nonsmoker. Her antenatal progress was quite straightforward, and she went into spontaneous labour at 40 weeks. She was admitted on 6/8/90 at 03.05hrs with regular contractions. Membranes had probably ruptured 48 hours previously. Cephalic 2/5. VE Cx 2cm dilated, thick. Station -2. Clear liquor seen.

Labour events

03.30	VE No change. FSE applied.
04.15	Pethidine 100mg, phenergan 25mg im.
04.30	Syntocinon started.
04.45	Vomiting.
06.00	VE Cx 3cm dilated, effaced. Station -2.
07.20	Epidural begun.
07.50	Epidural complete.
09.05	Top up.
09.20	VE Cx 5cm dilated, thick. Station -2. FSE reapplied.
09.50	FBS; pH 7.33 BE -3
10.35	Vomiting.
11.05	Top up.
11.40	Prepared for FBS; Cx found to be fully dilated. Head low and descending well
with	pushing.
11.50	Pushing begun in earnest.
12.25	Episiotomy.
12.27	Normal delivery of male infant.

Outcome

Birth weight 3.02kg
Apgar 9 & 9
Cord gases pH 7.23 / 7.29 BD(ecf) 2 / 4


pH
Cx Dilatation
7.5
7.45
7.4
7.35
7.3
7.25
7.2
7.15
7.1
7.05
7
6.95
6.9
6.85
6.8
10
8
6
4
2
0
3.00
3.30
4.00
4.30
5.00
5.30
6.00
6.30
7.00
7.30
8.0
8.30
9.00
9.30
10.00
10.30
11.00
11.30
12.00
12.30
Time
pH
Cx Dilatation (cm)

Case 46

SEGMENT

REVIEWER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
A1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	3	2	2	2	2	1	2	2	3	2	2	2	2																										
A2	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	1	2	2	2	2	3	2	2	1	2	2	3	2	2	2	1																										
B1	1	1	1	2	2	2	1	1	1	1	1	1	1	1	2	2	2	2	2	1	1	2	3	2	2	2	2	3	1	2	2	2	4	4																										
B2	1	1	1	1	2	2	1	2	1	1	1	1	1	2	2	3	2	1	2	1	1	2	2	3	1	2	1	2	2	1	1	2	2	4																										
C1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	1	1	1	1	2	2	2	2	1	1	2	2	1	2	2	2	6																										
C2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	1	2	2	1	2	2	3	2	1	1	1	1	1	1	2	2	6																										
D1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	1	1	1	1	2	2	3	2	1	1	1	1	1	1	1	1	2																										
D2	1	1	1	2	2	2	1	1	1	1	1	1	1	2	2	2	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2																										
E1	1	1	1	1	2	2	2	2	2	1	2	2	2	2	2	3	2	2	1	1	1	2	2	2	3	2	2	2	2	2	1	2	2	6																										
E2	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	2	2																										
F1	1	1	1	1	1	2	1	2	2	1	1	1	1	1	1	2	2	1	1	1	1	1	1	1	1	1	2	2	1	2	2	2	1	1																										
F2	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2																										
G1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	1	2	2	2	3	2	1	2	2	2	2	2	2	2																										
G2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2																										
H1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	3	1	1	2	2	2	2	2	2	2	2	2	2	2	1	1	1																										
H2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	3	2	2	2	2	2	2	2	1	2																										
I1	1	1	2	1	1	2	1	1	1	1	1	2	1	2	2	2	2	2	2	2	1	2	2	2	3	2	1	2	2	2	2	2	2	2																										
I2	1	1	2	1	2	2	1	1	2	1	1	2	1	2	2	2	3	1	2	2	1	2	2	2	3	2	2	2	2	1	2	2	2	2																										
J1	1	1	1	1	1	2	2	1	2	1	1	2	2	2	3	4	2	2	3	2	2	2	2	2	3	2	2	2	2	1	2	2	2	6																										
J2	1	1	1	1	1	1	1	1	2	1	1	2	2	2	2	2	2	1	2	2	2	2	2	2	3	1	1	2	2	1	2	2	1	1																										
K1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	3	2	2	2	1	1	2	2	2	2	2	1	1	1	2	2	2	1	2																										
K2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	1	1	1	2	2	2	1	2	2	1	1	1	1	1	1	1	1																										
L1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	1	1	2	2	3	2	2	1	2	2	2	2	2	2	2																										
L2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	1	2	2	2	3	1	2	2	2	1	2	2	2	2	2	2	2																										
M1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	1	1	1	1	1	2																										
M2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2																										
N1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	3	2	2	2	2	2	2	2	3	2	2	2	2																										
N2	1	1	1	1	1	1	1	1	1	2	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	2	2	2	2	2																										
O1	1	1	1	1	1	1	1	1	1	1	1	2	1	2	2	2	2	3	1	1	1	2	2	2	3	1	1	2	2	1	2	2	1	2																										
O2	1	1	1	1	1	1	1	1	1	1	1	2	1	1	2	2	2	3	1	1	1	1	2	2	2	2	1	1	2	1	2	2	2	2																										
P1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	1	1	1	1	1	2	1	1	2	2	1	1	2	1	1	1	1	1																										
P2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	1	1	1	1	2	2	2	2	1	1	2	2	1	1	1	1	1																										
Q1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2																										
Q2	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	4	4	2	4	4	4	2	2	2	4																										
S1	1	1	1	1	1	2	2	1	1	1	1	1	1	1	2	2	2	2	1	1	1	1	1	1	1	1	1	2	1	2	2	2	1	2																										
S2	1	1	1	1	1	2	2	1	1	1	1	1	1	1	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	2	2	2	1	2																										
R1	1	1	4	2	2	1	1	2	2	4	2	2	3	4	1	1	2	1	2	2	1	3	4	2	1	2	2	1	2	1	1	2	1	1																										
R2	2	3	2	2	1	2	1	2	1	1	1	2	2	1	1	2	2	3	2	2	2	1	2	1	1	1	2	1	1	1	3	2	2	6																										
Clinical	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	D																									

Agreement results matrix for case 46

REVIEWER	A1	A2	B1	B2	C1	C2	D1	D2	E1	E2	F1	F2	G1	G2	H1	H2	I1	I2	J1	J2	K1	K2	L1	L2	M1	M2	N1	N2	O1	O2	P1	P2	Q1	Q2	S1	S2	R1	R2
A1	100	95	72	68	73	77	81	79	66	71	74	75	79	82	73	81	81	73	59	80	74	76	86	91	75	80	99	89	73	74	77	78	77	52	76	76	53	68
A2	95	100	72	72	73	81	86	79	75	71	76	75	87	81	74	88	89	81	63	89	73	77	90	85	76	80	94	88	82	74	78	79	77	58	76	76	50	68
B1	72	72	100	86	69	75	65	61	70	54	58	58	66	61	56	67	67	63	60	64	57	58	68	67	58	60	73	67	62	56	58	59	58	69	59	58	44	61
B2	68	72	86	100	74	82	77	69	88	76	68	68	76	68	72	75	77	84	79	76	77	68	78	73	67	68	68	63	80	73	68	69	66	57	68	68	52	68
C1	73	73	69	74	100	91	81	87	80	73	86	88	81	87	80	80	79	73	66	79	81	87	82	81	88	90	73	80	75	82	86	88	79	44	87	86	42	76
C2	77	81	75	82	91	100	91	77	85	67	77	80	88	79	72	87	87	80	72	87	75	80	90	84	80	79	77	73	81	75	78	80	72	50	78	78	50	72
D1	81	86	65	77	81	91	100	84	76	71	85	87	93	84	79	92	91	84	63	93	81	90	95	89	89	86	80	76	88	81	88	90	76	44	85	86	53	59
D2	79	79	61	69	87	77	84	100	73	84	92	92	86	95	87	86	87	81	58	84	85	91	87	87	93	97	79	86	79	87	93	93	92	41	93	92	44	63
E1	66	75	70	88	80	85	76	73	100	84	70	68	79	71	75	80	82	90	88	81	79	68	79	70	69	71	66	66	85	77	69	70	74	54	70	69	51	74
E2	71	71	54	76	73	67	71	84	84	100	79	76	74	84	86	76	78	88	74	77	90	77	75	75	77	81	71	78	80	86	78	79	90	42	79	78	50	69
F1	74	76	58	68	86	77	85	92	70	79	100	97	84	91	85	83	83	77	56	84	85	94	84	84	92	94	75	83	78	85	94	94	86	39	98	97	45	65
F2	75	75	58	68	88	80	87	92	68	76	97	100	84	90	82	81	83	76	55	82	86	94	85	85	92	93	74	82	78	87	94	93	83	38	98	99	44	66
G1	79	87	66	76	81	88	93	86	79	74	84	84	100	89	79	97	97	88	66	94	82	84	97	87	86	89	79	81	88	80	84	85	81	49	84	83	49	60
G2	82	81	61	68	87	79	84	95	71	84	91	90	89	100	88	91	89	80	60	86	88	92	90	90	92	97	83	91	79	87	91	93	92	41	92	91	44	65
H1	73	74	56	72	80	72	79	87	75	86	85	82	79	88	100	82	79	86	71	79	92	88	81	80	86	89	74	80	90	96	87	89	81	38	85	84	42	71
H2	81	88	67	75	80	87	92	86	80	76	83	81	97	91	82	100	97	89	68	96	81	85	97	87	85	88	82	83	89	79	84	86	83	50	84	83	49	60
I1	81	89	67	77	79	87	91	87	82	78	83	83	97	89	79	97	100	91	69	96	80	82	97	86	82	87	80	81	89	81	83	85	86	51	85	84	49	62
I2	73	81	63	84	73	80	84	81	90	88	77	76	88	80	86	89	91	100	81	89	86	76	88	79	77	79	73	74	95	88	77	77	80	49	77	76	50	69
J1	59	63	60	79	66	72	63	58	88	74	56	55	66	60	71	68	69	81	100	68	72	56	66	61	56	58	59	56	79	71	55	56	60	47	56	56	57	71
J2	80	89	64	76	79	87	93	84	81	77	84	82	94	86	79	96	96	89	68	100	78	85	94	85	83	84	78	79	90	79	86	87	84	51	83	82	51	61
K1	74	73	57	77	81	75	81	85	79	90	85	86	82	88	92	81	80	86	72	78	100	88	82	80	86	88	74	80	85	92	86	87	80	37	86	87	50	70
K2	76	77	58	68	87	80	90	91	68	77	94	94	84	92	88	85	82	76	56	85	88	100	85	85	97	94	76	83	79	86	98	98	83	38	93	94	45	63
L1	86	90	68	78	82	90	95	87	79	75	84	85	97	90	81	97	97	88	66	94	82	85	100	93	85	90	86	82	89	82	85	87	82	47	86	85	52	60
L2	91	85	67	73	81	84	89	87	70	75	84	85	87	90	80	87	86	79	61	85	80	85	93	100	84	88	91	82	79	81	86	86	82	41	85	85	55	60
M1	75	76	58	67	88	80	89	93	69	77	92	92	86	92	86	85	82	77	56	83	86	97	85	84	100	96	76	84	78	86	96	97	83	37	91	90	45	62
M2	80	80	60	68	90	79	86	97	71	81	94	93	89	97	89	88	87	79	58	84	88	94	90	88	96	100	81	88	80	89	93	95	89	39	94	93	44	63
N1	99	94	73	68	73	77	80	79	66	71	75	74	79	83	74	82	80	73	59	78	74	76	86	91	76	81	100	90	73	73	76	78	77	51	76	75	52	68
N2	89	88	67	63	80	73	76	86	66	78	83	82	81	91	80	83	81	74	56	79	80	83	82	82	84	88	90	100	73	79	83	84	85	54	83	82	42	69
O1	73	82	62	80	75	81	88	79	85	80	78	78	88	79	90	89	89	95	79	90	85	79	89	79	78	80	73	73	100	91	80	82	74	47	80	79	47	69
O2	74	74	56	73	82	75	81	87	77	86	85	87	80	87	96	79	81	88	71	79	92	86	82	81	86	89	73	79	91	100	87	88	81	38	87	87	43	74
P1	77	78	58	68	86	78	88	93	69	78	94	94	84	91	87	84	83	77	55	86	86	98	85	86	96	93	76	83	80	87	100	98	84	37	94	94	45	62
P2	78	79	59	69	88	80	90	93	70	79	94	93	85	93	89	86	85	77	56	87	87	98	87	86	97	95	78	84	82	88	98	100	85	38	94	94	45	62
Q1	77	77	58	66	79	72	76	92	74	90	86	83	81	92	81	83	86	80	60	84	80	83	82	82	83	89	77	85	74	81	84	85	100	45	87	86	46	65
Q2	52	58	69	57	44	50	44	41	54	42	39	38	49	41	38	50	51	49	47	51	37	38	47	41	37	39	51	54	47	38	37	38	45	100	39	39	39	48
S1	76	76	59	68	87	78	85	93	70	79	98	98	84	92	85	84	85	77	56	83	86	93	86	85	91	94	76	83	80	87	94	94	87	39	100	100	44	65
S2	76	76	58	68	86	78	86	92	69	78	97	99	83	91	84	83	84	76	56	82	87	94	85	85	90	93	75	82	79	87	94	94	86	39	100	100	44	65
R1	53	50	44	52	42	50	53	44	51	50	45	44	49	44	42	49	49	50	57	51	50	45	52	55	45	44	52	42	47	43	45	45	46	39	44	44	100	43
R2	68	68	61	68	76	72	59	63	74	69	65	66	60	65	71	60	62	69	71	61	70	63	60	60	62	63	68	69	69	74	62	62	65	48	65	65	43	100

Case 47 1535

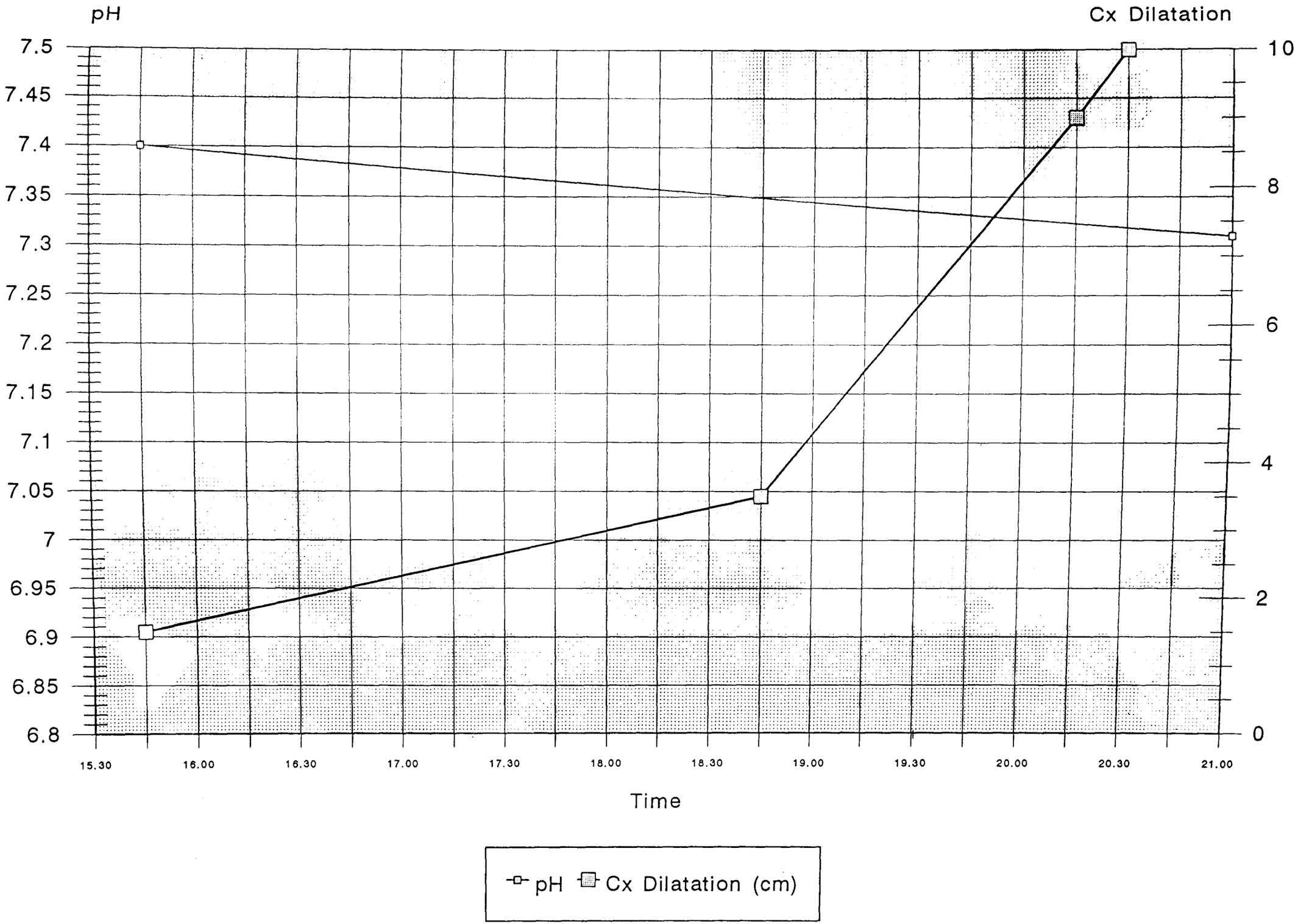
Mrs P.S. is a 30 year old lady expecting her third baby. She is a fit lady and does not smoke. Her two previous children were delivered normally at term, weighing 6lb 11oz and 7lb 6oz respectively. No problems were identified during her current pregnancy. She was admitted on 21.5.91, at 40 weeks gestation with spontaneous rupture of the membranes. Contractions had still not begun 7 hours later and the cervix was just 1-2cm dilated, uneffaced. The liquor was clear. A prostin tablet 3mg was given PV to induce labour. After a further 5 hours no contractions had occurred and VE was unchanged. Labour was therefore induced with intravenous syntocinon, which was commenced at 15.45hrs.

Labour events

18.45	VE Cx 3-4cm dilated, thin. Station -2.
18.55	Pethidine 100mg, phenergan 25mg im.
20.15	VE Cx 9cm dilated. Station -1.
20.35	VE Cx fully dilated. Vertex visible.
20.54	Normal delivery of female infant.

Outcome

Birth weight	3.20kg
Apgar	9 & 9
Cords	pH 7.39 BD(ecf) - / 1


pH
Cx Dilatation
7.5
7.45
7.4
7.35
7.3
7.25
7.2
7.15
7.1
7.05
7
6.95
6.9
6.85
6.8
10
8
6
4
2
0
15.30
16.00
16.30
17.00
17.30
18.00
18.30
19.00
19.30
20.00
20.30
21.00
Time
pH
Cx Dilatation (cm)

Case 47

SEGMENT

REVIEWER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
A1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	1	2	1	1	1																																								
A2	1	1	2	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	1	1																																								
B1	1	1	1	1	1	2	1	1	2	2	1	1	1	2	2	1	1	1	1	1																																								
B2	2	1	2	1	1	1	1	1	1	2	2	2	1	2	2	1	1	1	1	1																																								
C1	1	1	1	1	1	1	1	1	1	2	1	1	1	2	2	1	1	1	1	1																																								
C2	1	1	1	1	1	1	1	1	1	2	2	2	2	2	3	1	1	1	1	1																																								
D1	1	1	1	1	1	1	1	1	1	1	1	2	2	1	1	2	2	2	2	1																																								
D2	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	1	1	1																																								
E1	1	1	2	2	1	2	1	1	2	2	1	2	2	2	2	1	1	1	2	2																																								
E2	1	1	2	2	2	2	1	1	2	2	1	2	2	2	2	2	2	2	2	1																																								
F1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	1	2	1	1	1																																								
F2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																								
G1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2																																								
G2	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	1																																								
H1	1	1	1	1	1	1	1	1	2	1	1	1	2	2	2	1	2	2	1	1																																								
H2	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2																																								
I1	1	1	1	1	1	1	1	1	1	2	2	1	1	2	2	1	2	1	1	1																																								
I2	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	1	2	1	1	1																																								
J1	1	1	2	1	1	1	1	1	2	2	2	2	2	2	3	1	2	2	1	1																																								
J2	2	1	2	1	1	1	1	1	1	2	2	2	2	2	2	1	1	2	1	1																																								
K1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																								
K2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																								
L1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	2	1	2	2	1	1																																								
L2	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	1	1	1	1	1																																								
M1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																								
M2	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	1	1	1	1																																								
N1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	1	1	1	1	1																																								
N2	1	1	1	1	1	1	1	1	1	2	1	1	2	2	2	1	1	1	1	2																																								
O1	2	1	2	1	1	1	1	1	1	2	1	1	1	2	2	1	1	1	1	1																																								
O2	2	1	2	1	1	1	1	1	2	2	1	2	2	2	2	1	1	1	1	1																																								
P1	2	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																								
P2	1	1	2	1	1	1	1	1	1	1	1	1	2	1	1	1	2	2	2	1																																								
Q1	2	2	2	2	1	1	1	1	2	2	2	2	2	2	2	1	2	1	1	1																																								
Q2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2																																								
S1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																								
S2	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																								
R1	2	1	2	3	2	1	2	1	1	1	4	3	2	2	1	1	1	1	1	6																																								
R2	1	1	1	1	3	2	1	1	1	1	1	1	1	1	3	2	1	2	1	1																																								
Clinical	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	D																																							

Agreement results matrix for case 47

REVIEWER	A1	A2	B1	B2	C1	C2	D1	D2	E1	E2	F1	F2	G1	G2	H1	H2	I1	I2	J1	J2	K1	K2	L1	L2	M1	M2	N1	N2	O1	O2	P1	P2	Q1	Q2	S1	S2	R1	R2
A1	100	98	95	97	96	85	95	98	93	92	96	93	96	97	97	96	98	100	84	98	93	93	96	98	93	95	96	97	95	96	91	93	95	87	92	92	49	68
A2	98	100	92	95	93	82	96	97	94	96	94	89	97	98	96	97	96	98	85	98	89	89	95	95	89	93	93	94	93	95	88	94	96	91	90	90	48	68
B1	95	92	100	96	99	82	92	94	95	91	97	96	90	91	97	90	98	95	80	93	96	96	95	96	96	97	97	98	97	96	94	92	91	86	95	95	49	72
B2	97	95	96	100	97	84	92	94	94	90	95	94	92	93	94	92	97	96	83	98	94	94	95	96	94	95	96	96	98	98	95	92	97	86	95	95	50	69
C1	96	93	99	97	100	83	94	96	93	90	98	98	91	93	97	91	99	96	81	95	98	98	96	98	98	99	99	99	98	96	96	94	91	82	97	97	48	71
C2	85	82	82	84	83	100	80	82	81	77	81	80	80	81	82	80	84	85	98	84	80	80	81	84	80	81	83	84	82	83	78	79	81	72	79	79	50	82
D1	95	96	92	92	94	80	100	97	91	93	96	94	96	98	97	96	95	94	81	94	94	94	98	95	94	95	95	94	92	92	93	98	89	86	93	93	48	71
D2	98	97	94	94	96	82	97	100	92	93	98	93	95	98	98	95	97	96	81	95	93	93	97	98	93	98	98	96	94	95	92	94	92	85	93	93	49	70
E1	93	94	95	94	93	81	91	92	100	95	91	90	93	92	94	93	93	94	81	95	90	90	91	94	90	92	93	96	94	96	90	93	93	93	91	91	50	68
E2	92	96	91	90	90	77	93	93	95	100	90	85	94	94	94	94	91	93	81	93	85	85	91	90	85	90	90	91	90	92	86	92	93	96	86	86	49	68
F1	96	94	97	95	98	81	96	98	91	90	100	98	92	95	98	92	98	95	80	93	98	98	98	98	98	99	99	97	97	94	96	96	90	82	97	97	48	72
F2	93	89	96	94	98	80	94	93	90	85	98	100	87	90	95	87	96	91	76	91	100	100	97	96	100	97	97	95	96	93	98	95	87	77	99	99	48	71
G1	96	97	90	92	91	80	96	95	93	94	92	87	100	99	94	100	94	95	82	95	87	87	94	93	87	91	91	94	90	91	85	93	91	91	86	86	46	66
G2	97	98	91	93	93	81	98	98	92	94	95	90	99	100	96	99	96	96	83	96	90	90	97	95	90	94	94	94	91	93	88	95	91	89	89	89	47	69
H1	97	96	97	94	97	82	97	98	94	94	98	95	94	96	100	94	98	97	82	95	95	95	98	97	95	97	98	97	96	96	93	96	92	86	94	94	48	70
H2	96	97	90	92	91	80	96	95	93	94	92	87	100	99	94	100	94	95	82	95	87	87	94	93	87	91	91	94	90	91	85	93	91	91	86	86	46	66
I1	98	96	98	97	99	84	95	97	93	91	98	96	94	96	98	94	100	98	83	96	96	96	98	97	96	98	97	98	97	96	94	94	93	85	95	95	48	70
I2	100	98	95	96	96	85	94	96	94	93	95	91	95	96	97	95	98	100	85	97	91	91	95	96	91	94	95	96	94	97	90	92	95	88	90	90	48	67
J1	84	85	80	83	81	98	81	81	81	81	80	76	82	83	82	82	83	85	100	84	76	76	81	81	76	79	80	81	81	83	76	81	83	78	77	77	50	82
J2	98	98	93	98	95	84	94	95	95	93	93	91	95	96	95	95	96	97	84	100	91	91	95	96	91	93	95	95	96	98	92	94	98	89	92	92	51	68
K1	93	89	96	94	98	80	94	93	90	85	98	100	87	90	95	87	96	91	76	91	100	100	97	96	100	97	97	95	96	93	98	95	87	77	99	99	48	71
K2	93	89	96	94	98	80	94	93	90	85	98	100	87	90	95	87	96	91	76	91	100	100	97	96	100	97	97	95	96	93	98	95	87	77	99	99	48	71
L1	96	95	95	95	96	81	98	97	91	91	98	97	94	97	98	94	98	95	81	95	97	97	100	97	97	97	97	95	95	93	95	97	91	84	96	96	49	72
L2	98	95	96	96	98	84	95	98	94	90	98	96	93	95	97	93	97	96	81	96	96	96	97	100	96	98	100	98	96	97	94	94	92	83	95	95	50	70
M1	93	89	96	94	98	80	94	93	90	85	98	100	87	90	95	87	96	91	76	91	100	100	97	96	100	97	97	95	96	93	98	95	87	77	99	99	48	71
M2	95	93	97	95	99	81	95	98	92	90	99	97	91	94	97	91	98	94	79	93	97	97	97	98	97	100	99	98	97	95	95	94	89	81	96	96	48	72
N1	96	93	97	96	99	83	95	98	93	90	99	97	91	94	98	91	97	95	80	95	97	97	97	100	97	99	100	98	97	96	95	95	90	81	96	96	49	71
N2	97	94	98	96	99	84	94	96	96	91	97	95	94	94	97	94	98	96	81	95	95	95	95	98	95	98	98	100	97	97	94	94	92	85	95	95	49	69
O1	95	93	97	98	98	82	92	94	94	90	97	96	90	91	96	90	97	94	81	96	96	96	95	96	96	97	97	97	100	98	97	94	95	84	97	97	50	70
O2	96	95	96	98	96	83	92	95	96	92	94	93	91	93	96	91	96	97	83	98	93	93	93	97	93	95	96	97	98	100	93	93	97	87	93	93	50	68
P1	91	88	94	95	96	78	93	92	90	86	96	98	85	88	93	85	94	90	76	92	98	98	95	94	98	95	95	94	97	93	100	95	90	79	98	98	50	71
P2	93	94	92	92	94	79	98	94	93	92	96	95	93	95	96	93	94	92	81	94	95	95	97	94	95	94	95	94	94	93	95	100	90	86	96	96	49	71
Q1	95	96	91	97	91	81	89	92	93	93	90	87	91	91	92	91	93	95	83	98	87	87	91	92	87	89	90	92	95	97	90	90	100	91	89	89	50	64
Q2	87	91	86	86	82	72	86	85	93	96	82	77	91	89	86	91	85	88	78	89	77	77	84	83	77	81	81	85	84	87	79	86	91	100	79	79	47	63
S1	92	90	95	95	97	79	93	93	91	86	97	99	86	89	94	86	95	90	77	92	99	99	96	95	99	96	96	95	97	93	98	96	89	79	100	100	49	71
S2	92	90	95	95	97	79	93	93	91	86	97	99	86	89	94	86	95	90	77	92	99	99	96	95	99	96	96	95	97	93	98	96	89	79	100	100	49	71
R1	49	48	49	50	48	50	48	49	50	49	48	48	46	47	48	46	48	48	50	51	48	48	49	50	48	48	49	49	50	50	50	49	50	47	49	49	100	61
R2	68	68	72	69	71	82	71	70	68	68	72	71	66	69	70	66	70	67	82	68	71	71	72	70	71	72	71	69	70	68	71	71	64	63	71	71	61	100

Case 48 1337

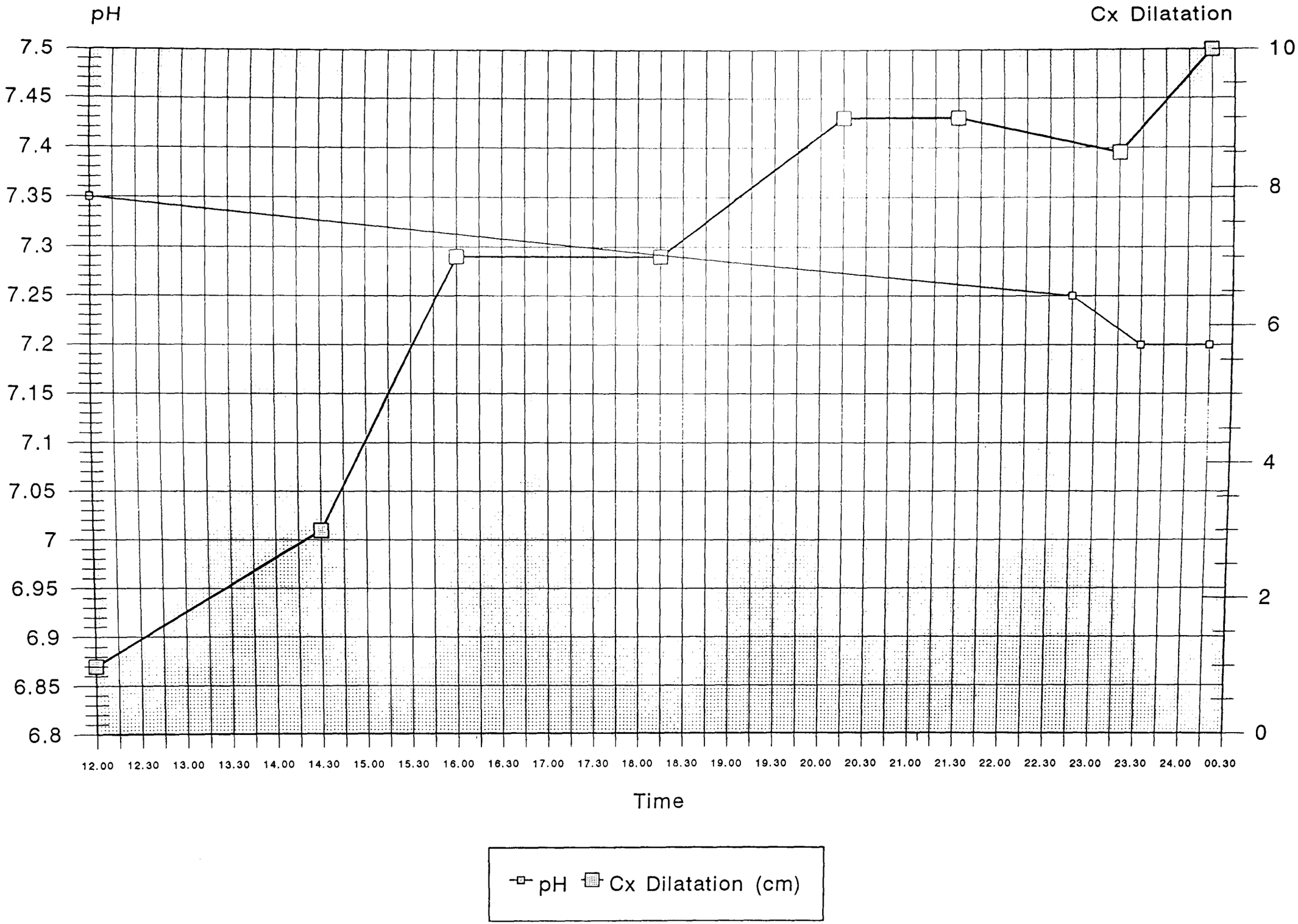
Mrs S.M. is a 25 year old primigravida; a fit lady, and a nonsmoker. Her pregnancy was entirely straightforward and she was admitted in spontaneous labour at 40 weeks on 10/4/91 at 11.30hrs. The uterus was term size; cephalic 3/5. VE (at 12.00hrs) Cx 1cm dilated, effaced and thin. Station -3.

Labour events

12.45	Pethidine 100mg phenergan 25mg im.
14.30	VE Cx 3cm dilated, thin. Station -2. ARM; clear liquor. FSE applied.
15.40	Epidural inserted.
15.55	Maternal oxygen given; position changed.
16.00	VE Cx 7cm dilated. Station -1. FSE reapplied.
18.05	Sat up.
18.15	VE No change.
18.45	Top up.
20.10	Bed pan.
20.15	VE Cx 9cm dilated. Station 0. LOT position.
20.25	Top up.
21.45	VE No change.
22.10	Syntocinon started.
22.50	Syntocinon stopped, maternal position changed, oxygen given.
23.10	VE Cx 8-9cm dilated, thick & oedematous. Station 0. Little caput or moulding.
23.25	FBS; pH 7.20 BE -6
	Decision for C/S. Indication; secondary arrest of labour, borderline scalp pH.
00.15	VE in theatre; Cx now fully dilated and vaginal delivery possible.
00.22	Male infant delivered by Neville Barnes forceps.

Outcome

Birth weight	3.13kg
Apgar	6 & 7 (8 at 8 minutes)
Cords	pH 7.20 / 7.25 BD(ecf) 4 / 3


pH
Cx Dilatation
7.5
7.45
7.4
7.35
7.3
7.25
7.2
7.15
7.1
7.05
7
6.95
6.9
6.85
6.8
10
8
6
4
2
0
12.00 12.30 13.00 13.30 14.00 14.30 15.00 15.30 16.00 16.30 17.00 17.30 18.00 18.30 19.00 19.30 20.00 20.30 21.00 21.30 22.00 22.30 23.00 23.30 24.00 00.30
Time
pH
Cx Dilatation (cm)

Case 48

SEGMENT

REVIEWER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
A1	1	1	1	1	1	4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	2	1	2	4	3	2
A2	1	1	1	1	1	4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	1	2	1	2	4	3	2
B1	1	2	1	1	1	4	3	2	1	1	1	1	1	1	2	1	1	1	1	1	1	2	2	1	2	1	2	3	4	4
B2	1	1	1	1	1	4	3	2	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	2	1	2	2	3	2
C1	1	1	1	1	1	4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	3	2	2
C2	1	1	1	1	1	4	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	3	2
D1	1	1	1	1	1	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	3	2
D2	2	2	2	2	1	4	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	1	2	2	2	3	2	2
E1	1	1	1	1	1	4	3	1	1	1	1	1	1	2	2	1	2	1	1	1	2	2	2	1	2	2	3	2	3	2
E2	2	2	2	2	1	4	3	2	2	2	2	2	2	2	2	1	2	1	1	2	2	2	2	1	2	1	2	3	2	2
F1	1	1	1	2	1	1	1	1	1	1	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	2	3	1	2	1
F2	1	1	2	1	1	2	2	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	1	2	3	1
G1	1	1	2	1	1	4	2	1	1	1	1	1	1	1	2	1	1	1	1	1	1	2	2	2	2	2	2	2	3	2
G2	1	1	2	2	1	4	2	2	1	1	1	1	1	1	2	1	1	1	1	1	1	1	2	1	2	2	2	2	3	2
H1	1	1	1	1	1	4	2	1	1	1	1	1	1	1	2	1	2	1	1	1	1	2	1	1	2	1	2	3	2	2
H2	1	1	1	1	1	2	2	1	1	1	1	1	1	1	2	1	1	1	1	1	1	2	2	1	2	2	3	2	2	2
I1	1	2	1	1	1	2	2	1	1	1	2	1	1	1	2	1	1	1	1	1	1	2	1	1	2	1	2	2	2	3
I2	1	2	1	1	1	2	2	1	1	1	2	1	1	1	2	1	2	1	1	1	2	2	2	2	2	1	2	2	2	2
J1	2	2	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	2
J2	1	1	1	1	1	4	2	2	2	1	1	2	1	1	2	1	1	1	1	1	1	2	1	1	2	1	2	2	2	3
K1	1	1	1	1	1	3	2	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	2	1	2	3	2	2
K2	1	1	1	1	1	4	3	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	2	1	2	2	2	3
L1	1	1	1	1	1	4	3	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	2	3	2	2
L2	1	1	1	1	1	5																								
M1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2
M2	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
N1	1	1	1	1	1	2	2	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	2	1	2	1	2	3	2	2
N2	1	1	1	1	1	2	2	1	1	1	1	1	1	1	2	1	1	1	1	1	2	1	2	1	2	1	2	3	2	2
O1	1	1	2	1	1	5																								
O2	1	1	1	1	1	3	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	2	1	1	2	1	2	2	3	2
P1	1	1	1	1	1	4	2	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	2	2	2	2
P2	1	1	1	1	1	2	2	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	2	1	2	2	3	2
Q1	2	2	2	1	1	4	2	2	1	2	2	2	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	4	4
Q2	2	2	2	2	2	4	4	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	4	4	4	4
S1	2	2	2	1	1	4	4	1	1	2	2	2	1	1	2	1	1	1	1	1	1	1	1	1	2	2	2	2	5	
S2	2	2	2	2	1	4	4	1	1	2	2	2	2	1	2	1	1	1	1	1	1	1	1	1	2	2	2	2	5	
R1	1	2	1	1	3	2	1	2	2	2	2	2	1	1	1	1	1	2	1	1	1	1	2	3	2	1	1	1	2	1
R2	2	2	1	1	1	1	1	2	4	2	2	1	2	1	1	1	1	1	1	1	2	2	2	2	1	3	2	1	1	2
Clinical	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

REVIEWER	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
A1	1	3	2	4	3	1	3	5																						
A2	2	3	2	4	3	2	3	5																						
B1	4	3	4	5																										
B2	2	4	3	5																										
C1	2	3	2	5																										
C2	1	2	3	4	5																									
D1	2	2	3	5																										
D2	2	3	5																											
E1	2	3	2	5																										
E2	3	2	3	5																										
F1	1	3	2	5																										
F2	1	1	1	5																										
G1	2	2	2	5																										
G2	2	2	2	4	4	2	2																							
H1	2	3	2	4	2	2	3	5																						
H2	2	3	2	4	4	2	3	5																						
I1	2	2	2	4	3	2	3	5																						
I2	3	2	2	3	2	2	3	5																						
J1	2	2	2	3	4	2	2																							
J2	1	2	2	4	2	2	3	5																						
K1	2	3	2	3	4	2	2																							
K2	1	2	2	4	3	5																								
L1	2	3	2	5																										
L2																														
M1	2	2	2	3	2	2	2																							
M2	1	2	2	2	3	2	2																							
N1	2	3	4	5																										
N2	2	3	2	5																										
O1																														
O2	1	2	2	3	2	2	3	5																						
P1	2	2	2	4	5																									
P2	1	2	2	4	3	2	2																							
Q1	4	4	4	4	4	2	2																							
Q2	4	4	4	5																										
S1																														
S2																														
R1	2	1	2	1	2	2	1																							
R2	1	2	1	2	2	2	1																							
Clinical	0	0	0	0	0	3	5	n	n	6																				

Agreement results matrix for case 48

REVIEWER	A1	A2	B1	B2	C1	C2	D1	D2	E1	E2	F1	F2	G1	G2	H1	H2	I1	I2	J1	J2	K1	K2	L1	L2	M1	M2	N1	N2	O1	O2	P1	P2	Q1	Q2	S1	S2	R1	R2
A1	100	100	69	66	65	75	58	63	65	64	55	53	62	77	95	87	88	82	64	92	73	85	65	19	53	54	60	57	19	86	67	69	75	66	52	52	41	45
A2	100	100	69	66	66	75	58	63	65	64	54	52	62	77	95	88	88	82	65	93	74	84	65	19	54	53	60	57	19	87	67	69	75	67	52	52	41	45
B1	69	69	100	92	85	84	75	84	87	86	74	72	82	72	64	55	52	43	56	61	68	77	86	19	40	36	82	77	19	50	75	61	85	93	59	58	35	39
B2	66	66	92	100	94	93	86	92	94	92	81	81	92	79	67	56	56	47	62	65	74	86	95	23	54	49	87	84	23	56	88	68	76	82	55	54	46	46
C1	65	66	85	94	100	94	90	95	96	93	90	86	95	79	69	60	54	48	63	64	76	82	98	26	59	53	90	91	25	55	90	68	65	73	56	55	50	55
C2	75	75	84	93	94	100	89	86	92	89	84	84	92	84	77	69	68	60	69	76	78	94	93	23	59	56	88	86	23	67	95	75	72	74	51	50	46	47
D1	58	58	75	86	90	89	100	86	85	82	94	95	87	71	58	62	61	54	72	56	76	75	87	11	67	64	96	98	10	55	82	78	57	61	36	35	48	49
D2	63	63	84	92	95	86	86	100	93	93	86	83	93	77	66	57	52	47	62	61	71	70	94	24	55	49	87	87	25	52	80	65	68	75	56	56	48	54
E1	65	65	87	94	96	92	85	93	100	96	85	82	94	78	69	59	53	47	64	64	76	83	98	24	51	46	86	87	24	57	84	65	67	75	54	54	51	56
E2	64	64	86	92	93	89	82	93	96	100	83	79	91	77	66	56	54	49	68	64	74	83	95	23	51	46	83	84	24	55	83	63	68	77	54	54	48	52
F1	55	54	74	81	90	84	94	86	85	83	100	93	84	66	58	64	56	50	67	53	74	70	86	11	64	60	95	97	11	51	80	71	56	62	36	36	53	56
F2	53	52	72	81	86	84	95	83	82	79	93	100	89	70	54	58	59	49	68	55	68	73	82	11	60	61	92	94	11	51	81	76	58	62	38	38	53	52
G1	62	62	82	92	95	92	87	93	94	91	84	89	100	82	65	55	55	47	65	65	69	83	93	26	54	52	86	87	27	53	90	69	67	74	57	57	53	55
G2	77	77	72	79	79	84	71	77	78	77	66	70	82	100	80	72	72	59	84	81	88	83	78	27	67	65	72	70	27	65	81	87	82	65	58	58	57	58
H1	95	95	64	67	69	77	58	66	69	66	58	54	65	80	100	93	89	85	66	96	76	85	69	22	56	55	62	60	21	88	72	69	70	56	49	48	46	50
H2	87	88	55	56	60	69	62	57	59	56	64	58	55	72	93	100	94	86	72	89	77	75	58	8	58	58	67	65	8	84	65	74	64	46	29	29	43	46
I1	88	88	52	56	54	68	61	52	53	54	56	59	55	72	89	94	100	94	74	92	72	80	52	9	63	65	62	59	9	90	64	79	64	44	33	32	45	43
I2	82	82	43	47	48	60	54	47	47	49	50	49	47	59	85	86	94	100	68	86	67	72	47	9	66	65	52	54	9	92	57	68	50	33	33	33	50	48
J1	64	65	56	62	63	69	72	62	64	68	67	68	65	84	66	72	74	68	100	66	85	67	60	10	74	72	70	71	11	64	63	89	70	50	38	38	58	59
J2	92	93	61	65	64	76	56	61	64	64	53	55	65	81	96	89	92	86	66	100	71	87	63	22	54	56	57	55	22	89	73	70	71	55	50	50	49	47
K1	73	74	68	74	76	78	76	71	76	74	74	68	69	88	76	77	72	67	85	71	100	77	77	15	78	75	76	76	14	74	71	89	69	52	46	46	63	59
K2	85	84	77	86	82	94	75	70	83	83	70	73	83	83	85	75	80	72	67	87	77	100	84	23	56	56	74	72	23	80	91	73	71	68	52	51	47	45
L1	65	65	86	95	98	93	87	94	98	95	86	82	93	78	69	58	52	47	60	63	77	84	100	26	56	51	86	87	25	56	89	65	65	73	55	55	51	54
L2	19	19	19	23	26	23	11	24	24	23	11	11	26	27	22	8	9	9	10	22	15	23	26	100	15	15	10	11	100	13	25	12	18	18	33	33	18	21
M1	53	54	40	54	59	59	67	55	51	51	64	60	54	67	56	58	63	66	74	54	78	56	56	15	100	96	61	64	15	63	60	84	45	27	42	41	72	68
M2	54	53	36	49	53	56	64	49	46	46	60	61	52	65	55	58	65	65	72	56	75	56	51	15	96	100	56	59	15	64	58	84	42	24	41	40	73	67
N1	60	60	82	87	90	88	96	87	86	83	95	92	86	72	62	67	62	52	70	57	76	74	86	10	61	56	100	98	9	51	82	78	67	70	34	33	43	47
N2	57	57	77	84	91	86	98	87	87	84	97	94	87	70	60	65	59	54	71	55	76	72	87	11	64	59	98	100	10	53	81	75	58	63	36	36	49	53
O1	19	19	19	23	25	23	10	25	24	24	11	11	27	27	21	8	9	9	11	22	14	23	25	100	15	15	9	10	100	13	25	12	18	19	33	33	18	21
O2	86	87	50	56	55	67	55	52	57	55	51	51	53	65	88	84	90	92	64	89	74	80	56	13	63	64	51	53	13	100	61	69	50	38	41	40	55	50
P1	67	67	75	88	90	95	82	80	84	83	80	81	90	81	72	65	64	57	63	73	71	91	89	25	60	58	82	81	25	61	100	70	67	67	52	52	51	49
P2	69	69	61	68	68	75	78	65	65	63	71	76	69	87	69	74	79	68	89	70	89	73	65	12	84	84	78	75	12	69	70	100	71	50	40	39	60	60
Q1	75	75	85	76	65	72	57	68	67	68	56	58	67	82	70	64	64	50	70	71	69	71	65	18	45	42	67	58	18	50	67	71	100	88	60	60	37	38
Q2	66	67	93	82	73	74	61	75	75	77	62	62	74	65	56	46	44	33	50	55	52	68	73	18	27	24	70	63	19	38	67	50	88	100	60	61	28	37
S1	52	52	59	55	56	51	36	56	54	54	36	38	57	58	49	29	33	33	38	50	46	52	55	33	42	41	34	36	33	41	52	40	60	60	100	100	49	55
S2	52	52	58	54	55	50	35	56	54	54	36	38	57	58	48	29	32	33	38	50	46	51	55	33	41	40	33	36	33	40	52	39	60	61	100	100	48	55
R1	41	41	35	46	50	46	48	48	51	48	53	53	53	57	46	43	45	50	58	49	63	47	51	18	72	73	43	49	18	55	51	60	37	28	49	48	100	74
R2	45	45	39	46	55	47	49	54	56	52	56	52	55	58	50	46	43	48	59	47	59	45	54	21	68	67	47	53	21	50	49	60	38	37	55	55	74	100

Case 49 1542

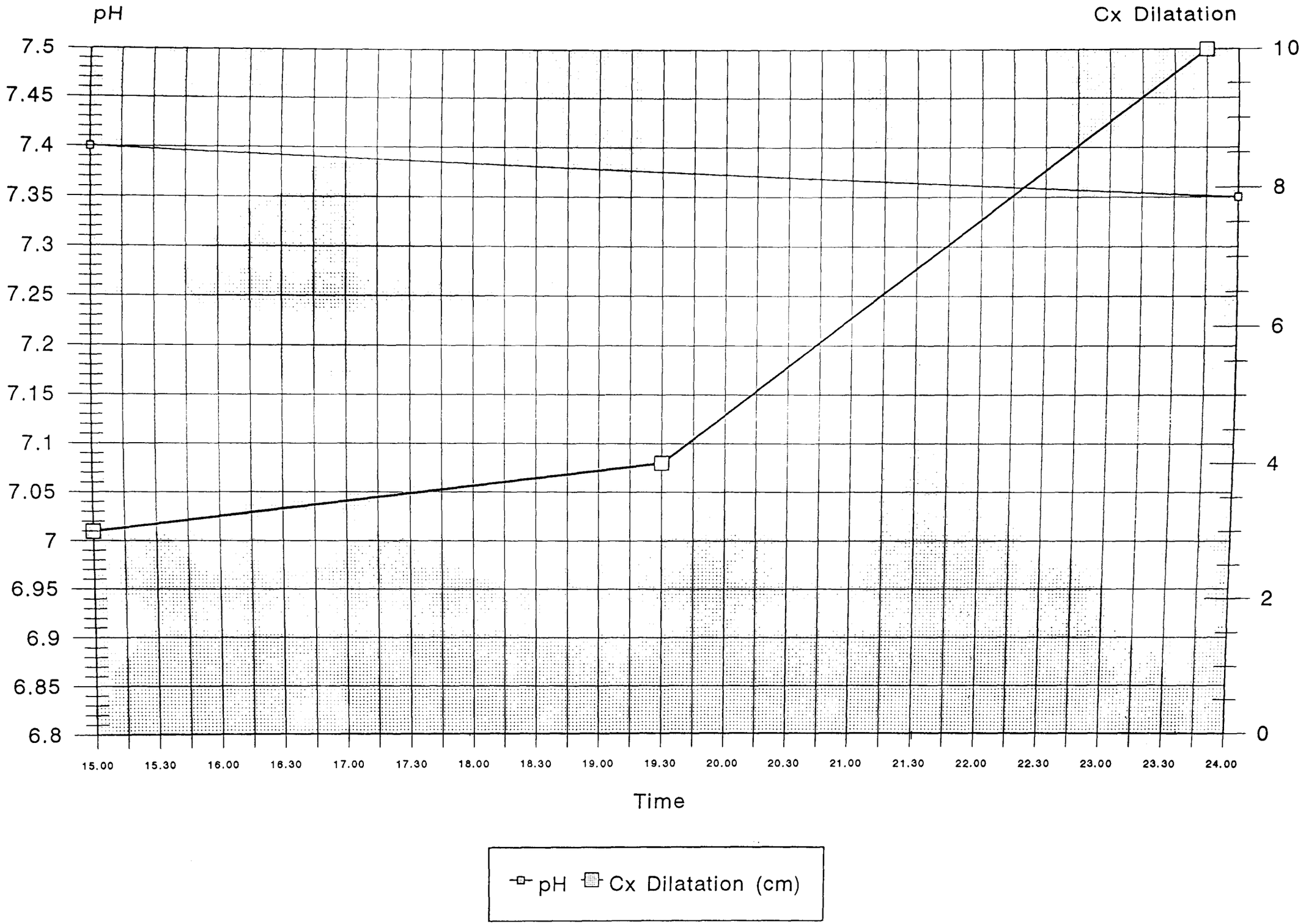
Miss J.M. is a 25 year old lady expecting her fourth child. She smokes 10 cigarettes per day. Her three previous children were delivered normally at term and were well grown. During her current pregnancy there was the suspicion of intrauterine growth retardation and the fetus was monitored with serial ultrasound scans. By 39 weeks there was evidence of asymmetrical growth retardation; estimated fetal weight being 2.1kg. The baby was active and liquor volume normal. It was felt best to induce labour at this stage, but the fetal head was high, the cervix unfavourable, and 12 doses of prostaglandin were required over a period of several days. ARM was eventually performed on 22.5.91 at 15.00hrs; she had reached 40 weeks gestation. The cervix was by now 3cm dilated, 1cm thick. Clear liquor drained in copious amounts.

Labour events

16.40	Syntocinon started.
19.30	VE Cx 4cm dilated, thick. Station -2.
20.20	Failed attempt to insert epidural.
21.10	Pethidine 100mg, phenergan 25mg im.
23.40	VE Cx fully dilated. Vertex visible.
23.50	Pushing begun.
00.09	Normal delivery of female infant.

Outcome

Birth weight 2.48kg
Apgar 8 & 10
Cord gases pH 7.35 / 7.43 BD(ecf) -1 / 3


pH
Cx Dilatation
7.5
7.45
7.4
7.35
7.3
7.25
7.2
7.15
7.1
7.05
7
6.95
6.9
6.85
6.8
10
8
6
4
2
0
15.00
15.30
16.00
16.30
17.00
17.30
18.00
18.30
19.00
19.30
20.00
20.30
21.00
21.30
22.00
22.30
23.00
23.30
24.00
Time
pH
Cx Dilatation (cm)

Case 49

SEGMENT

REVIEWER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
A1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	1	1	2	2	2	2	2	1	2	2	2	1																															
A2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	1	1	1	1	1	2	1	1	2	1	1	1																															
B1	1	1	1	1	1	1	1	1	1	2	2	2	3	2	2	2	2	1	2	2	2	2	2	2	2	2	3	2	1																															
B2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	1	1	2	2	2	3	2	2	2	1	1																															
C1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1																															
C2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1																															
D1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	2	1	1	2	2	1	1																															
D2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2																															
E1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	1	1	1	2	1	1	1	2	2	1	1	1																															
E2	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	2	1	2	2	2	2	2	2	2	2	2	2	2																															
F1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	2	2	2	2	2	3	1	1	1																															
F2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	3	1	1	1	1	1																															
G1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	2	1	1	1																															
G2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	1	1	1	1	1	1	2	2	2	2	1																															
H1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	1	1	1	1	1	2	2	2	2	1	1	1																															
H2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	1	1	2	2	1	2	2	2	2	2	2	2																															
I1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	2	3	1	1	1	1	1	2	2	2	2	2	1	1																															
I2	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	1	1	1	1	1	2	2	2	2	1	2	1																															
J1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	1	1	1	1	2	2	3	2	2	2	1																															
J2	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	2	2	1	1	1	1	1	2	2	2	2	1	1	1																															
K1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	1	1	1	1	1	1	1	1																															
K2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																															
L1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	1	1	1	2	1	1	2	2	2	1	1	1																															
L2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1																															
M1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																															
M2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	1																															
N1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	2	2	2	1	1	2	2	1	1	1																															
N2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																															
O1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	2	2	1	1	1																															
O2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	1	1	1	1	1	1	1	1	2	1	1	1																															
P1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																															
P2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1																															
Q1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	2	2	2	1	2	2	2	2	2	2	2	2	2	1																															
Q2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	4	4	4	4	2	2																															
S1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	2	2	2	1	1	1	1	1	1	1																															
S2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	2	2	2	1	1	1	1	1	1	1																															
R1	2	1	1	2	1	1	4	4	4	1	1	1	2	2	2	3	2	2	2	1	2	1	1	2	1	2	1	2	2																															
R2	2	3	2	2	2	2	1	3	4	4	1	2	2	1	1	4	1	2	3	2	2	1	1	2	2	5																																
Clinical	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	D																														

Agreement results matrix for case 49

REVIEWER	A1	A2	B1	B2	C1	C2	D1	D2	E1	E2	F1	F2	G1	G2	H1	H2	I1	I2	J1	J2	K1	K2	L1	L2	M1	M2	N1	N2	O1	O2	P1	P2	Q1	Q2	S1	S2	R1	R2
A1	100	96	78	88	93	93	97	96	96	97	87	86	94	95	96	98	86	96	87	96	94	92	97	93	92	96	97	92	94	95	92	93	98	44	96	96	52	30
A2	96	100	73	87	98	98	98	92	99	93	87	86	99	98	99	95	88	98	88	98	97	98	98	98	98	96	98	98	99	99	98	98	95	41	97	97	51	29
B1	78	73	100	75	70	70	73	75	74	78	84	72	71	73	74	76	68	74	80	76	71	69	76	70	69	74	75	69	72	72	69	70	78	58	72	72	48	33
B2	88	87	75	100	85	85	86	86	88	87	93	96	86	87	88	87	79	87	97	88	83	83	88	85	83	87	87	83	87	86	83	83	89	58	86	86	48	30
C1	93	98	70	85	100	100	99	91	98	91	86	86	99	97	97	93	86	96	85	96	98	99	96	100	99	96	97	99	99	99	99	99	98	92	39	97	97	49	29
C2	93	98	70	85	100	100	99	91	98	91	86	86	99	97	97	93	86	96	85	96	98	99	96	100	99	96	97	99	99	99	99	99	98	92	39	97	97	49	29
D1	97	98	73	86	99	99	100	95	98	95	87	88	98	97	97	96	86	96	86	96	98	98	97	99	98	98	98	98	98	97	98	97	95	40	98	98	50	30
D2	96	92	75	86	91	91	95	100	93	99	86	85	91	95	93	98	84	94	86	93	92	90	93	91	90	97	95	90	92	91	90	89	97	43	93	93	50	31
E1	96	99	74	88	98	98	98	93	100	94	88	86	99	98	98	96	87	97	87	98	97	97	99	98	97	96	99	97	99	99	97	97	96	41	98	98	51	30
E2	97	93	78	87	91	91	95	99	94	100	86	85	92	94	94	98	85	95	86	95	92	90	94	91	90	96	95	90	93	91	90	89	99	44	93	93	50	31
F1	87	87	84	93	86	86	87	86	88	86	100	93	86	86	88	86	79	87	96	88	85	85	88	86	85	88	88	85	87	86	85	84	87	59	87	87	47	31
F2	86	86	72	96	86	86	88	85	86	85	93	100	86	83	86	84	76	85	93	85	88	86	85	86	86	86	88	86	85	85	86	85	85	56	88	88	46	30
G1	94	99	71	86	99	99	98	91	99	92	86	86	100	98	98	94	87	97	87	97	98	99	97	99	99	95	97	99	100	100	99	98	93	39	97	97	50	29
G2	95	98	73	87	97	97	97	95	98	94	86	83	98	100	97	97	87	97	88	97	95	96	97	97	96	97	96	96	99	98	96	96	95	41	95	95	51	30
H1	96	99	74	88	97	97	97	93	98	94	88	86	98	97	100	97	89	99	88	99	95	96	99	97	96	97	97	96	99	98	96	96	96	41	96	96	51	30
H2	98	95	76	87	93	93	96	98	96	98	86	84	94	97	97	100	87	97	88	96	93	92	97	93	92	97	96	92	95	95	92	92	98	43	94	94	52	31
I1	86	88	68	79	86	86	86	84	87	85	79	76	87	87	89	87	100	89	80	88	84	85	88	86	85	87	87	85	88	87	85	86	86	39	84	84	58	38
I2	96	98	74	87	96	96	96	94	97	95	87	85	97	97	99	97	89	100	88	98	94	95	98	96	95	97	96	95	97	97	95	96	96	42	94	94	51	31
J1	87	88	80	97	85	85	86	86	87	86	96	93	87	88	88	88	80	88	100	88	82	83	87	85	83	88	85	83	87	87	83	84	87	60	84	84	48	31
J2	96	98	76	88	96	96	96	93	98	95	88	85	97	97	99	96	88	98	88	100	94	95	98	96	95	97	97	95	98	97	95	96	97	42	95	95	50	30
K1	94	97	71	83	98	98	98	92	97	92	85	88	98	95	95	93	84	94	82	94	100	99	96	98	99	94	98	99	97	97	99	98	92	40	99	99	49	30
K2	92	98	69	83	99	99	98	90	97	90	85	86	99	96	96	92	85	95	83	95	99	100	95	99	100	95	96	100	98	98	100	99	90	38	97	97	49	29
L1	97	98	76	88	96	96	97	93	99	94	88	85	97	97	99	97	88	98	87	98	96	95	100	96	95	96	99	95	98	98	95	96	96	42	96	96	52	30
L2	93	98	70	85	100	100	99	91	98	91	86	86	99	97	97	93	86	96	85	96	98	99	96	100	99	96	97	99	99	99	99	98	92	39	97	97	49	29
M1	92	98	69	83	99	99	98	90	97	90	85	86	99	96	96	92	85	95	83	95	99	100	95	99	100	95	96	100	98	98	100	99	90	38	97	97	49	29
M2	96	96	74	87	96	96	98	97	96	96	88	86	95	97	97	97	87	97	88	97	94	95	96	96	95	100	96	95	96	95	95	93	96	41	94	94	49	30
N1	97	98	75	87	97	97	98	95	99	95	88	88	97	96	97	96	87	96	85	97	98	96	99	97	96	96	100	96	97	97	96	96	96	41	98	98	51	30
N2	92	98	69	83	99	99	98	90	97	90	85	86	99	96	96	92	85	95	83	95	99	100	95	99	100	95	96	100	98	98	100	99	90	38	97	97	49	29
O1	94	99	72	87	99	99	98	92	99	93	87	85	100	99	99	95	88	97	87	98	97	98	98	99	98	96	97	98	100	99	98	98	94	40	97	97	50	30
O2	95	99	72	86	99	99	97	91	99	91	86	85	100	98	98	95	87	97	87	97	97	98	98	99	98	95	97	98	99	100	98	99	93	40	97	97	51	29
P1	92	98	69	83	99	99	98	90	97	90	85	86	99	96	96	92	85	95	83	95	99	100	95	99	100	95	96	100	98	98	100	99	90	38	97	97	49	29
P2	93	98	70	83	98	98	97	89	97	89	84	85	98	96	96	92	86	96	84	96	98	99	96	98	99	93	96	99	98	99	99	100	91	40	97	97	50	30
Q1	98	95	78	89	92	92	95	97	96	99	87	85	93	95	96	98	86	96	87	97	92	90	96	92	90	96	96	90	94	93	90	91	100	44	94	94	51	30
Q2	44	41	58	58	39	39	40	43	41	44	59	56	39	41	41	43	39	42	60	42	40	38	42	39	38	41	41	38	40	40	38	40	44	100	41	41	31	47
S1	96	97	72	86	97	97	98	93	98	93	87	88	97	95	96	94	84	94	84	95	99	97	96	97	97	94	98	97	97	97	97	97	94	41	100	100	50	30
S2	96	97	72	86	97	97	98	93	98	93	87	88	97	95	96	94	84	94	84	95	99	97	96	97	97	94	98	97	97	97	97	97	94	41	100	100	50	30
R1	52	51	48	48	49	49	50	50	51	50	47	46	50	51	51	52	58	51	48	50	49	49	52	49	49	49	51	49	50	51	49	50	51	31	50	50	100	64
R2	30	29	33	30	29	29	30	31	30	31	31	30	29	30	30	31	38	31	31	30	30	29	30	29	29	30	30	29	30	29	29	30	30	47	30	30	64	100

Case 50 1302

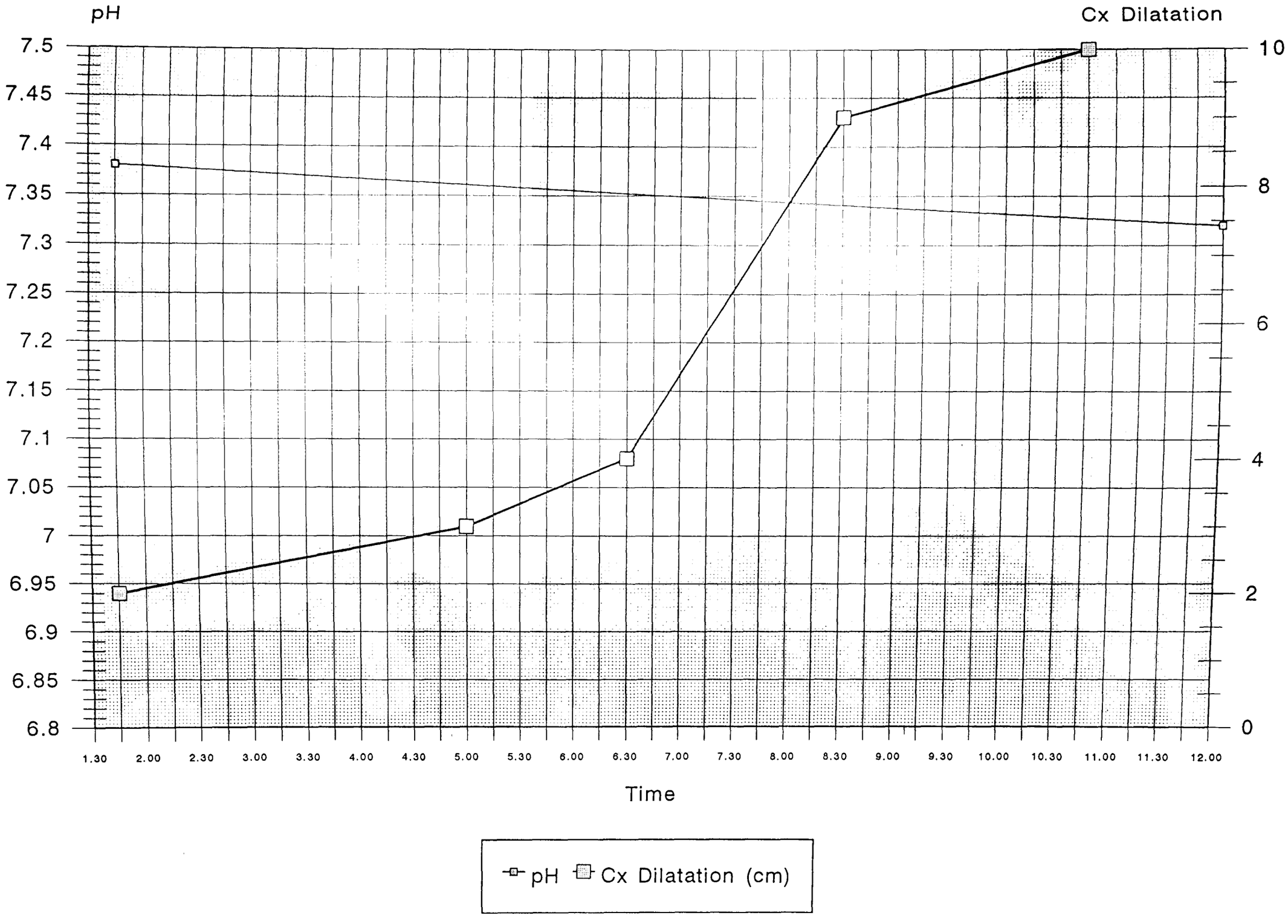
Mrs M.L. is a 31 year old primigravida; fit, and a nonsmoker. There were no antenatal problems, and she laboured spontaneously at 39 weeks. On admission on 3.7.91 the uterus was found to be term size, presentation cephalic 3/5. VE (at 01.50hrs) Cx 2cm dilated, effaced. Station -2.

Labour events

04.55	VE Cx 3cm dilated, effaced. Station -1. ARM; meconium stained liquor. FSE applied.
05.05	Pethidine 100mg, phenergan 25mg im.
06.02	Epidural inserted.
06.35	VE Cx 4cm dilated. Station -1. OP position. FSE reapplied.
06.50	Syntocinon begun.
07.10	Vomited.
08.30	VE Cx 9cm dilated. Station 0. OP position.
08.45	Top up.
09.50	Vomited.
10.30	Bedpan.
10.40	VE Cx fully dilated. Station +1. OA position.
11.00	Vomited.
11.05	Pushing begun.
12.04	Normal delivery of female infant.

Outcome

Birth weight 3.30kg
Apgar 9 & 9
Cord gases pH 7.32 / 7.39 BD(ecf) -1 / 0


pH
Cx Dilatation
7.5
7.45
7.4
7.35
7.3
7.25
7.2
7.15
7.1
7.05
7
6.95
6.9
6.85
6.8
10
8
6
4
2
0
1.30
2.00
2.30
3.00
3.30
4.00
4.30
5.00
5.30
6.00
6.30
7.00
7.30
8.00
8.30
9.00
9.30
10.00
10.30
11.00
11.30
12.00
Time
pH
Cx Dilatation (cm)

Case 50

REVIEWER	SEGMENT																										
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
A1	1	1	1	1	2	2	1	1	1	1	1	1	2	2	2	1	1	1	1	2	2	1	2	2	1	1	1	1
A2	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	1	1	1	1	2	2	1	2	4	6			
B1	1	1	1	1	2	2	2	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1
B2	1	1	1	1	1	2	1	1	1	1	1	1	1	2	2	1	1	1	1	1	1	1	2	1	1	1	1	1
C1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C2	2	2	1	1	1	2	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1
D1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
D2	1	1	1	1	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	1	1	1
E1	1	1	1	1	1	2	1	1	1	1	1	1	1	2	2	1	1	1	1	1	2	1	2	2	2	1	2	1
E2	1	1	1	1	1	2	2	1	1	1	1	1	2	2	1	1	1	1	1	1	2	1	2	2	1	1	2	2
F1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
F2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
G1	1	1	1	1	1	2	1	1	1	1	1	1	1	2	2	2	1	1	1	1	2	1	2	2	2	2	2	2
G2	2	1	1	1	1	1	1	1	1	1	1	1	1	2	2	1	1	1	1	1	2	2	2	2	2	2	2	2
H1	1	1	1	1	1	1	1	1	1	1	2	1	2	2	3	1	1	1	1	1	2	2	2	2	2	1	2	1
H2	1	1	1	1	1	2	2	1	1	1	1	1	2	2	2	1	1	1	1	1	1	1	2	2	2	1	2	1
I1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	2	1	2	2	2	1	1	1
I2	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	2	1	2	2	2	1	2	2
J1	1	1	1	1	2	2	1	1	1	1	1	1	1	2	2	1	1	1	1	1	2	1	2	1	1	1	2	2
J2	1	1	1	1	2	2	1	1	1	1	1	1	1	2	1	1	1	1	1	1	2	1	2	2	1	1	1	1
K1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
K2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	1	1	1	1	1	1	1	1	1	1	1	1
L1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	1	1	1	2	1	2	1	2	6				
L2	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	2	1	1	1	2	3	1	2	2	2	1	1	1
M1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
M2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
N1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	1	1	1	2	1
N2	1	1	1	1	1	1	1	2	1	1	1	1	2	2	3	1	1	1	1	2	2	2	1	1	1	1	2	1
O1	1	1	1	1	2	2	1	1	1	1	1	1	1	2	2	1	1	2	2	2	3	1	1	1	1	1	1	1
O2	1	1	1	1	2	2	1	1	1	1	1	1	1	1	2	1	1	1	1	1	2	1	2	2	2	1	1	1
P1	1	2	2	1	2	2	2	2	2	2	2	2	2	2	3	2	2	2	2	2	2	2	2	2	2	2	2	2
P2	2	2	1	1	2	2	2	2	1	1	1	1	1	3	2	2	1	1	1	2	2	1	2	1	1	1	1	1
Q1	2	2	2	2	2	2	2	2	2	2	1	1	1	2	2	1	1	2	1	1	2	1	2	2	2	2	2	2
Q2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
S1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
S2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
R1	2	2	1	1	4	1	2	2	1	2	2	3	1	2	2	3	3	2	3	2	1	2	3	2	1	3	2	2
R2	3	2	2	2	1	2	1	2	1	2	3	2	2	2	1	3	3	2	1	2	1	1	1	1	2	2	1	2
Clinical	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

D

Agreement results matrix for case 50

REVIEWER	A1	A2	B1	B2	C1	C2	D1	D2	E1	E2	F1	F2	G1	G2	H1	H2	I1	I2	J1	J2	K1	K2	L1	L2	M1	M2	N1	N2	O1	O2	P1	P2	Q1	Q2	S1	S2	R1	R2
A1	100	67	96	98	94	95	94	97	98	97	94	93	96	94	86	97	98	96	98	99	94	95	81	87	95	94	94	86	87	98	78	86	89	85	94	94	44	60
A2	67	100	63	66	64	63	64	65	68	68	64	63	69	68	62	67	68	69	67	67	64	65	88	66	64	64	66	61	63	67	55	58	62	59	64	64	52	44
B1	96	63	100	99	97	98	97	97	96	95	97	96	93	90	82	96	95	93	97	97	97	98	76	84	99	97	90	84	86	97	73	86	88	80	97	97	42	59
B2	98	66	99	100	98	98	98	97	98	97	98	96	95	94	85	98	97	96	98	99	98	98	80	87	98	98	93	86	86	98	74	85	88	80	98	98	44	59
C1	94	64	97	98	100	97	100	97	95	94	100	99	92	91	83	94	97	95	95	97	100	99	77	85	99	100	90	84	84	96	69	82	84	75	100	100	41	57
C2	95	63	98	98	97	100	97	96	95	94	97	99	92	92	82	94	95	93	95	96	97	98	76	84	98	97	90	84	85	96	72	86	89	80	97	97	43	60
D1	94	64	97	98	100	97	100	97	95	94	100	99	92	91	83	94	97	95	95	97	100	99	77	85	99	100	90	84	84	96	69	82	84	75	100	100	41	57
D2	97	65	97	97	97	96	97	100	97	96	97	95	95	94	84	97	98	96	96	99	97	96	78	87	98	97	89	82	84	99	73	83	89	81	97	97	42	57
E1	98	68	96	98	95	95	95	97	100	98	95	94	99	97	88	99	99	99	98	99	95	96	82	88	96	95	94	86	85	99	78	85	91	85	95	95	45	59
E2	97	68	95	97	94	94	94	96	98	100	94	93	97	96	86	98	97	98	99	98	94	94	81	86	95	94	93	87	84	97	79	84	91	86	94	94	45	60
F1	94	64	97	98	100	97	100	97	95	94	100	99	92	91	83	94	97	95	95	97	100	99	77	85	99	100	90	84	84	96	69	82	84	75	100	100	41	57
F2	93	63	96	96	99	99	99	95	94	93	99	100	90	92	81	93	95	94	94	95	99	97	76	84	98	99	89	83	83	94	69	83	86	77	99	99	41	59
G1	96	69	93	95	92	92	92	95	99	97	92	90	100	98	86	97	96	98	97	95	92	94	81	86	92	92	93	84	82	97	80	83	92	87	92	92	46	59
G2	94	68	90	94	91	92	91	94	97	96	91	92	98	100	87	96	96	98	96	94	91	92	81	85	91	91	93	85	80	95	78	82	91	86	91	91	46	59
H1	86	62	82	85	83	82	83	84	88	86	83	81	86	87	100	87	88	88	85	86	83	83	74	78	82	83	84	97	74	86	90	91	79	76	83	83	60	74
H2	97	67	96	98	94	94	94	97	99	98	94	93	97	96	87	100	97	97	97	97	94	95	81	86	95	94	92	85	84	97	78	84	91	85	94	94	45	60
I1	98	68	95	97	97	95	97	98	99	97	97	95	96	96	88	97	100	99	96	99	97	96	82	89	96	97	93	86	84	98	75	83	88	81	97	97	44	59
I2	96	69	93	96	95	93	95	96	99	98	95	94	98	98	88	97	99	100	97	97	95	95	82	87	95	95	93	86	83	97	76	82	90	83	95	95	45	59
J1	98	67	97	98	95	95	95	96	98	99	95	94	97	96	85	97	96	97	100	98	95	96	80	85	96	95	94	86	86	97	77	85	91	85	95	95	45	59
J2	99	67	97	99	97	96	97	99	99	98	97	95	95	94	86	97	99	97	98	100	97	96	80	87	97	97	92	86	86	99	76	85	90	83	97	97	44	59
K1	94	64	97	98	100	97	100	97	95	94	100	99	92	91	83	94	97	95	95	97	100	99	77	85	99	100	90	84	84	96	69	82	84	75	100	100	41	57
K2	95	65	98	98	99	98	99	96	96	94	99	97	94	92	83	95	96	95	96	96	99	100	78	86	98	99	93	85	85	96	71	84	85	77	99	99	43	58
L1	81	88	76	80	77	76	77	78	82	81	77	76	81	81	74	81	82	82	80	80	77	78	100	80	77	77	80	73	78	80	66	68	74	72	77	77	54	50
L2	87	66	84	87	85	84	85	87	88	86	85	84	86	85	78	86	89	87	85	87	85	86	80	100	85	85	85	77	96	87	69	76	78	74	85	85	54	54
M1	95	64	99	98	99	98	99	98	96	95	99	98	92	91	82	95	96	95	96	97	99	98	77	85	100	99	90	84	85	97	70	83	86	77	99	99	41	58
M2	94	64	97	98	100	97	100	97	95	94	100	99	92	91	83	94	97	95	95	97	100	99	77	85	99	100	90	84	84	96	69	82	84	75	100	100	41	57
N1	94	66	90	93	90	90	90	89	94	93	90	89	93	93	84	92	93	93	94	92	90	93	80	85	90	90	100	86	85	91	80	82	86	87	90	90	47	59
N2	86	61	84	86	84	84	84	82	86	87	84	83	84	85	97	85	86	86	86	86	84	85	73	77	84	84	86	100	77	84	89	93	79	75	84	84	59	75
O1	87	63	86	86	84	85	84	84	85	84	84	83	82	80	74	84	84	83	86	86	84	85	78	96	85	84	85	77	100	85	69	77	78	75	84	84	54	55
O2	98	67	97	98	96	96	96	99	99	97	96	94	97	95	86	97	98	97	97	99	96	96	80	87	97	96	91	84	85	100	76	85	91	83	96	96	44	59
P1	78	55	73	74	69	72	69	73	78	79	69	69	80	78	90	78	75	76	77	76	69	71	66	69	70	69	80	89	69	76	100	88	84	88	69	69	61	76
P2	86	58	86	85	82	86	82	83	85	84	82	83	83	82	91	84	83	82	85	85	82	84	68	76	83	82	82	93	77	85	88	100	83	78	82	82	57	71
Q1	89	62	88	88	84	89	84	89	91	91	84	86	92	91	79	91	88	90	91	90	84	85	74	78	86	84	86	79	78	91	84	83	100	95	84	84	46	62
Q2	85	59	80	80	75	80	75	81	85	86	75	77	87	86	76	85	81	83	85	83	75	77	72	74	77	75	87	75	75	83	88	78	95	100	75	75	47	62
S1	94	64	97	98	100	97	100	97	95	94	100	99	92	91	83	94	97	95	95	97	100	99	77	85	99	100	90	84	84	96	69	82	84	75	100	100	41	57
S2	94	64	97	98	100	97	100	97	95	94	100	99	92	91	83	94	97	95	95	97	100	99	77	85	99	100	90	84	84	96	69	82	84	75	100	100	41	57
R1	44	52	42	44	41	43	41	42	45	45	41	41	46	46	60	45	44	45	45	44	41	43	54	54	41	41	47	59	54	44	61	57	46	47	41	41	100	70
R2	60	44	59	59	57	60	57	57	59	60	57	59	59	59	74	60	59	59	59	59	57	58	50	54	58	57	59	75	55	59	76	71	62	62	57	57	70	100

APPENDIX I

'C' software to calculate the chance expected agreement.

A 'C'-program to calculate the expected chance agreement between 2 reviewers at time t.

```
#include <stdio.h>
#include <stdlib.h>
#include <math.h>


#define NSCORE    5
#define WWIDTH    3

double calc_e(void);
double E(int i, int j);
double pr(int i, int j, int k, int t);
int    f(int i, int k1, int t1, int k2, int t2);
double p1(int k, int t);
double p2(int k, int m, int n);

double prob[NSCORE + 1]=
{
      0, 0.435, 0.438, 0.071, 0.039, 0.017
};


double w[WWIDTH + 1]=
{
      1.00, 0.924, 0.707, 0.383
};


int matrix[NSCORE + 1][NSCORE + 1]=
// Note: this is a doubled matrix to implement as ints.
{
      0,  0,  0,  0,  0,  0,
      0,  4,  3,  0,  0,  0,
      0,  3,  4,  2,  0,  0,
      0,  0,  2, 28, 20, 10,
      0,  0,  0, 20, 50, 40,
      0,  0,  0, 10, 40,120,
};


int main(int argi, char *argv[])
{
      printf("The expected value is %f\n", calc_e());

      return 0;
}


double calc_e(void)
{
      int i, j;
      double cce= 0, ace= 0;

      for ( i= 1; i <= NSCORE; i++ )
```

```
	{
		for ( j= 1; j <= NSCORE; j++ )
		{
			cce+= prob[i] * prob[j] * E(i, j);
		}

		ace+= prob[i] * matrix[i][i];
	}

	return cce / ace;
}


double E(int i, int j)
{
	int k, t;
	double e= 0;

	for ( k= 1; k <= NSCORE; k++ )
	{
		for ( t= 0; t <= WWIDTH; t++ )
		{
			e+= w[t] * matrix[i][k] * pr(i, j, k, t);
			// To find E[X*X], this line is modified to
			//  e+=  w[t]*w[t]*matrix[i][k]*matrix[i][k]*pr(i,  j,  k,
t);

		}
	}

	return e;
}


double pr(int i, int j, int k, int t)
{
	int k1, t1;
	int k2, t2;
	int m, n;
	double pi= 1;

	for ( k1= 1; k1 <= NSCORE; k1++ )
	{
		for ( t1= 1; t1 <= WWIDTH; t1++ )
		{
			for ( m= n= 0, k2= 1; k2 <= NSCORE; k2++ )
			{
				for ( t2= 0; t2 <= WWIDTH; t2++ )
				{
					m+= f(i, k1, t1, k2, t2);
					n+= f(i, k,  t , k2, t2);
				}
			}

			pi*= p2(k1, m, n);
		}
	}
```

```
        return f(i, j, 0, k, t) * p1(k, t) * pi;
}


int f(int i, int k1, int t1, int k2, int t2)
{
        if ( t2 == 0 && k1 == k2 )
                return 1;
        else if ( t2 != 0 && w[t2] * matrix[i][k2] > w[t1] * matrix[i][k1] )
                return 1;
        else
                return 0;
}


double p1(int k, int t)
{
        if ( t != 0 )
                return 1 - (1 - prob[k]) * (1 - prob[k]);
        else
                return 1;
}


double p2(int k, int m, int n)
{
        if ( m < n )
                return (1 - prob[k]) * (1 - prob[k]);
        else
                return 1;
}
```

Appendix J

Tables of results obtained for the Kruskall-Wallis test of inter-agreeemnt.

Tables detailing each reviewers recommendations for caesarean section delivery.

case	review	θ	Reviews which have significantly higher agreement	total
4	A1	46	E1 E2 G1 I2 J2 K1 L1 O1 O2	9
9	A2	73	A1 B2 C1 F1 F2 G1 I1 I2 K2 L1 L2 M2 N2 O1 O2 P2	16
11	A1	68	A2 B2 C1 C2 D1 E1 E2 F2 G1 H1 I1 I2 K1 L1 M2 N2	16
20	A1	64	C2 D1 D2 E1 E2 H1 H2 K1 N1 N2 O2 P2 S1 S2	14
21	A1	68	A2 B1 B2 C1 C2 D1 D2 E1 E2 F1 F2 G1 G2 H1 H2 I1 I2 J2 K1 K2 L1 L2 M1 M2 N1 N2 O1 O2 P1 P2 S1 S2 S1 S2	32
23	A1	75	A2	1
25	A2	72	B2 D1 D2 E1 E2 G1 H2 J1 J2 K1 L1 L2 M1 N1 N2	15
27	A2	52	A1 B2 C1 C2 D1 D2 E1 E2 F1 F2 G1 H1 H2 I2 J2 K1 K2 L1 L2 M2 N1 O1 O2 P2 Q1	25
28	A1	63	B2 D1 E1 E2 F2 G1 G2 I1 J2 K2 L2 M2 N2 O1 O2 P2 Q1 S1 S2	19
29	A2	83	D2 L2	2
30	A1	42	A2 D1 D2 E1 H2 J2 L1 L2 M1 M2 O2 P1	12
34	A1	56	A2 C2 D1 D2 E1 E2 G1 H2 I1 I2 K2 L1 L2 M1 M2 O2 P2 S1 S2	19
35	A1	70	A2 D1 D2 E1 E2 G1 H1 I2 J1 J2 K2 L1 N2 O2	14
37	A1	50	C2 D2 H2 L1 L2 O1	6
38	A1	70	C1 C2 D1 D2 E1 E2 I1 I2 N2	9
39	A1	89	B1 B2 C1 D1 D2 E1 E2 F1 F2 G1 G2 H2 I1 I2 J2 K1 K2 L1 L2 M1 M2 N2 O1 P1 P2 S1 S2	27
39	A2	85	B1 B2 C1 D1 D2 E1 E2 H2 I1 I2 J2 K1 L1 L2 O1 P1 P2 S1 S2	19
50	A2	64	A1 B1 B2 C1 C2 D1 D2 E1 E2 F1 F2 G1 G2 H2 I1 I2 J1 J2 K1 K2 M1 M2 N1 O2 Q1 S1 S2	27

Table J.1: Cases where at least 1 review obtained higher agreements than expert A.

Summary. The majority of other reviews obtained significantly higher agreement than expert A in 6 cases (7 reviews).

case	review	θ	Reviews which have significantly higher agreement	total
2	B1	28	E2 O2	2
3	B1	35	C1 D2 E2 H2 I1 J2 K2 O2	8
4	B2	25	A2 B1 C1 C2 D1 D2 E1 E2 G1 I1 I2 J2 K1 L1 L2 M2 N1 O1 O2 S1 S2	21
5	B1	50	A2 D1 I2 L1 O2	5
5	B2	40	A2 C1 C2 D1 F2 I1 I2 J2 L1 L2 N2 O2 S1 S2	14
8	B2	67	E2 I1	2
11	B1	68	A2 B2 C1 C2 D1 E1 E2 F2 G1 H1 I1 I2 K1 L1 M2 N2	16
12	B1	35	A2 E1 G1 G2 I2 K1 L1 L2 O1 O2 P2 S1 S2	13
12	B2	23	A1 A2 C2 D1 E1 F2 G1 G2 H1 H2 I1 I2 K1 K2 L1 L2 M1 M2 N1 N2 O1 O2 P2 S1 S2	25
13	B2	40	A1 A2 C1 C2 E2 F1 G1 G2 H1 H2 I1 I2 J1 K1 K2 L1 L2 M1 M2 O1 O2 P1 P2 S1 S2	25
14	B1	39	A1 C1 D1 D2 E1 E2 F1 F2 G1 G2 H2 I1 I2 J1 J2 K1 K2 L1 L2 M1 M2 N2 O1 O2 P1 P2 S1 S2	28
14	B2	44	A1 C1 D1 D2 E1 E2 F1 F2 G1 G2 H2 I1 I2 J1 J2 K1 K2 L1 L2 M1 M2 N2 O1 O2 P1 P2	26
15	B1	11	A1 A2 C1 D1 D2 E1 E2 F1 G1 G2 I1 I2 J1 J2 K2 L2 M1 M2 N1 N2 O1 O2 P1 P2 Q1 Q2 S1 S2	28
15	B2	23	A1 A2 C1 D1 D2 E1 E2 F1 G1 G2 I1 I2 J1 J2 K2 L2 M1 M2 N1 N2 O1 O2 P1 P2 Q1 Q2 S1 S2	28
16	B1	22	A1 A2 C1 C2 D1 E1 E2 F2 G1 G2 H1 H2 I1 I2 J1 K1 L1 L2 M1 M2 N2 O1 O2 P1 S1 S2	26
16	B2	31	A1 A2 E1 F2 H1 H2 M2 S1 S2	9
18	B1	41	A1 A2 C1 C2 D1 D2 E1 E2 F1 G1 G2 H1 H2 I1 I2 J1 K1 K2 L1 L2 M2 O1 O2 P1 P2 S1 S2	27
18	B2	43	A1 A2 C1 C2 D1 D2 E1 E2 F1 G1 G2 H1 H2 I1 I2 J1 K1 K2 L1 O1 O2 P1 P2	23
20	B1	71	D2 P2 S1 S2	4
22	B1	11	A1 A2 C1 D1 D2 E1 E2 F1 G1 G2 I1 I2 J1 J2 K2 L2 M1 M2 N1 N2 O1 O2 P1 P2 Q1 Q2 S1 S2	28
22	B2	23	A1 A2 C1 D1 D2 E1 E2 F1 G1 G2 I1 I2 J1 J2 K2 L2 M1 M2 N1 N2 O1 O2 P1 P2 Q1 Q2 S1 S2	28
24	B1	31	A1 A2 C1 C2 D1 E1 F1 F2 G1 G2 I1 I2 J1 J2 K1 K2 L1 L2 M2 N1 N2 O2 P2	23
26	B1	74	E2	1
26	B2	74	E2 G1 H1 I2 P2	5
27	B1	67	A1 C1 C2 D1 D2 E2 F1 F2 G1 H1 H2 I2 J2 K1 K2 L1 L2 M2 O1 O2 P2 Q1	22
28	B1	59	D1 E1 E2 F2 G1 G2 I1 J2 K2 L2 M2 N2 O1 O2 P2 Q1	16
29	B1	78	D2 L2 N2	3
29	B2	80	D2 E1 E2 H2 I1 J2 L2 N2 O1	9
30	B1	31	A2 B2 C2 D1 D2 E1 H1 H2 J2 K1 L1 L2 M1 M2 N2 O2 P1 Q2	18
33	B1	58	A1 A2 C1 D1 D2 E1 F1 F2 G1 G2 H2 J2 K1 K2 L1 L2 M1 M2 N1 N2 P1 P2 Q2	23
33	B2	44	A1 A2 C1 D1 D2 E1 F1 F2 G1 G2 H2 J2 K1 K2 L1 L2 M1 M2 N1 N2 P1 P2 Q2 S1 S2	25
34	B1	57	A2 C2 D1 G1 H2 I1 I2 K2 L1 O2 S1	11
34	B2	57	A2 C2 D1 G1 H2 I1 I2 K2 L1 O2 S1	11
35	B1	79	A2 D1 D2 H1 I2 J1 J2 K2 L1 N2 O2	11
35	B2	65	A2 D1 D2 E1 E2 G1 H1 H2 I2 J1 J2 K1 K2 L1 N1 N2 O1 O2 S2	19
36	B2	44	A1 A2 C1 C2 D1 D2 E1 E2 F1 F2 G1 G2 H1 H2 I1 I2 J2 K1 K2 L1 L2 M1 N1 N2 O1 O2 P1 S1 S2	29
37	B1	48	C2 D2 G1 H2 L1 L2 N1 O1	8
38	B1	61	C1 C2 D2 E1 I1 I2 N2	7
40	B1	22	A2 C2 D1 E1 F1 F2 G1 I2 J2 K1 L1 L2 M1 M2 N1 O2	16
41	B1	44	B2 C1 D1 D2 E1 E2 I2 J2 K1 L1 N1 O1 O2	13
46	B1	62	A2 C1 C2 D1 D2 F1 F2 G1 G2 H1 H2 I1 I2 J2 K1 K2 L1 L2 M1 M2 N2 O1 O2 P1 P2 Q1 S1 S2	28
46	B2	72	D1 D2 G1 G2 H2 I1 J2 K2 L1 M2 P2 S1 S2	13
49	B1	73	A1 A2 C1 C2 D1 D2 E1 E2 G1 G2 H1 H2 I2 J2 K1 K2 L1 L2 M1 M2 N1 N2 O1 O2 P1 P2 Q1 S1 S2	29
49	B2	87	A2 C1 C2 D1 E1 G1 H1 J2 K2 L1 L2 M1 N1 N2 O1 O2 P1 S1 S2	19

Table J.2: Cases where at least 1 review obtained higher agreements than expert B.

Summary. The majority of other reviews obtained significantly higher agreement than expert B in 16 cases (22 reviews).

case	review	θ	Reviews which have significantly higher agreement	total
2	C1	19	A1 A2 C2 D1 D2 E2 G1 G2 I1 I2 J1 K1 L1 L2 M1 M2 O2 P1 P2 S1 S2	21
8	C2	65	D2 E2 I1	3
25	C1	61	A1 B2 D1 D2 E1 E2 F2 G1 G2 H2 I2 J1 J2 K1 L1 L2 M1 M2 N1 N2 O2 Q1 Q2 S1 S2	25
25	C2	61	A1 B2 D1 D2 E1 E2 F2 G1 G2 H2 I2 J1 J2 K1 L1 L2 M1 M2 N1 N2 O2 Q1 Q2 S1 S2	25
26	C1	70	A2 D1 D2 E2 F1 F2 G1 H1 I2 M2 N1 N2 P1 P2	14
28	C1	0	A2 B2 C2 D1 E1 E2 F1 F2 G1 G2 H1 H2 I1 I2 J1 J2 K1 K2 L1 L2 M1 M2 N2 O1 O2 P1 P2 Q1 S1 S2	30
33	C2	49	A1 A2 C1 D1 D2 E1 F1 F2 G1 G2 H2 J2 K1 K2 L1 L2 M1 M2 N1 N2 P1 P2 Q2	23
39	C2	84	B1 B2 C1 D1 D2 E1 E2 F1 F2 G1 G2 H1 H2 I1 I2 J2 K1 K2 L1 L2 M1 M2 N1 N2 O1 P1 P2 S1 S2	29
47	C2	81	A1 A2 B1 B2 C1 D1 D2 F1 F2 G2 H1 I1 I2 J2 K1 K2 L1 L2 M1 M2 N1 N2 O1 O2 P1 P2 S1 S2	28

Table J.3: Cases where at least 1 review obtained higher agreements than expert C.

Summary. The majority of other reviews obtained significantly higher agreement than expert C in 6 cases (7 reviews).

case	review	θ	Reviews which have significantly higher agreement	total
6	D1	90	A2 B1 B2 C1 C2 D2 E1 E2 F1 F2 G1 G2 H1 I1 I2 K1 K2 L1 L2 N1 N2 O1 P1 P2	24
7	D1	37	A1 A2 B1 B2 C1 D2 E2 F1 F2 H2 I1 I2 J2 K1 M1 P1 P2 Q1 S1 S2	20
28	D2	63	D1 E1 F2 G2 I1 J2 K2 M2 N2 O1 O2 P2	12
31	D2	97	A1 C1 C2 D1 F1 F2 G1 G2 H2 I2 J1 J2 K1 K2 L1 L2 M1 M2 N2 O1 O2 P1 P2	23
32	D2	28	C2 H2 J2 L2	4
37	D1	50	C2 H2 L2 O1	4

Table J.4: Cases where at least 1 review obtained higher agreements than expert D.

Summary. The majority of other reviews obtained significantly higher agreement than expert D in 3 cases (3 reviews).

case	review	θ	Reviews which have significantly higher agreement	total
7	E1	40	C1 D2 E2 P1 S1 S2	6
12	E2	27	A1 A2 E1 G1 G2 H1 H2 I2 K1 K2 L1 L2 O1 O2 P2 S1 S2	17
31	E2	97	A1 C1 C2 D1 F1 F2 G1 G2 H2 I2 J1 J2 K1 K2 L1 L2 M1 M2 N2 O1 O2 P1 P2	23
37	E1	50	B2 C2 D2 F1 G1 H2 J1 K1 L1 L2 N1 O1 P1 P2	14
37	E2	51	C2 D2 G1 H2 L1 L2 N1 O1	8
46	E1	74	G2	1
47	E2	91	C1 F1 H1 I1 L2 N1	6

Table J.5: Cases where at least 1 review obtained higher agreements than expert E.

Summary. The majority of other reviews obtained significantly higher agreement than expert E in 1 case (1 review).

case	review	θ	Reviews which have significantly higher agreement	total
1	F1	54	B2 C2 E1 H1 I2 K1 N1 Q1	8
3	F2	16	A1 A2 C1 C2 D1 D2 E1 E2 G2 H2 I1 I2 J2 K2 L1 L2 N1 N2 O1 O2 P1 S1 S2	23
8	F1	66	A1 A2 B1 C1 D2 E2 F2 G1 H1 H2 I1 J2 K1 K2 L2 M1 M2 N1 O1 P1 P2 Q2	22
10	F1	10	A1 A2 B1 B2 C1 C2 D1 D2 E1 E2 F2 G1 G2 H1 H2 I1 I2 J1 J2 K1 K2 L1 L2 N2 O1 O2 P1 P2 Q1 S1 S2	31
12	F1	33	A1 A2 E1 G1 G2 H1 H2 I2 K1 K2 L1 L2 O1 O2 P2 S1 S2	17
16	F1	35	S1 S2	2
19	F1	39	I1 I2 J1 K2 L2 M2 P1	7
23	F1	73	A2 I2	2
23	F2	73	A2 I2	2
41	F1	46	B2 C1 D1 D2 E1 E2 I2 J2 K1 K2 L1 N1 O1 O2	14
42	F1	46	C1 C2 D2 H1 I1 I2 J2 N2 P1 P2	10
42	F2	48	C1 C2 D2 I1 J2 N2 P1 P2	8
43	F1	40	A1 A2 B1 B2 C1 C2 D1 D2 E1 E2 F2 G2 H1 H2 I1 I2 J1 J2 K1 K2 L1 L2 M2 O1 O2 P2	26
49	F1	86	A2 C1 C2 D1 E1 G1 G2 H1 J2 K2 L1 L2 M1 N1 N2 O1 O2 P1 S1 S2	20
49	F2	86	A2 C1 C2 D1 E1 G1 G2 H1 I2 J2 K1 K2 L1 L2 M1 N1 N2 O1 O2 P1 P2 S1 S2	23

Table J.6: Cases where at least 1 review obtained higher agreements than expert F.

Summary. The majority of other reviews obtained significantly higher agreement than expert F in 5 cases (6 reviews).

case	review	θ	Reviews which have significantly higher agreement	total
7	G2	52	A1 A2 B1 B2 C1 C2 D2 E2 F1 F2 H2 I1 I2 J2 K1 K2 M1 M2 N1 N2 P1 P2 Q1 Q2 S1 S2	26
8	G2	52	A1 A2 B1 C1 D1 D2 E1 E2 F2 G1 H1 H2 I1 I2 J2 K1 K2 L2 M1 M2 N1 O1 O2 P1 P2 Q2	26
26	G2	72	D2 E2 F1 G1 H1 I2 N2 P2	8
29	G2	83	D2 L2	2
34	G2	59	D1 G1 K2 S1	4
40	G2	26	C2 L1 O2	3
43	G1	88	A2 D1 D2 E1 H2 J2 L2 M2 O1 O2	10
45	G1	60	A2 D1 D2 E1 E2 I2 K1 K2 L1 L2 P2 S1 S2	13
45	G2	57	E2	1

Table J.7: Cases where at least 1 review obtained higher agreements than expert G.

Summary. The majority of other reviews obtained significantly higher agreement than expert G in 2 cases (2 reviews).

case	review	θ	Reviews which have significantly higher agreement	total
2	H1	5	A1 A2 B2 C2 D1 D2 E1 E2 F1 F2 G1 G2 I1 I2 J1 K1 L1 L2 M1 M2 N1 N2 O1 O2 P1 P2 S1 S2	28
2	H2	5	A1 A2 B2 C2 D1 D2 E1 E2 F1 F2 G1 G2 I1 I2 J1 K1 L1 L2 M1 M2 N1 N2 O1 O2 P1 P2 S1 S2	28
4	H1	29	C1 C2 D1 D2 E1 E2 G1 I1 I2 J2 K1 L1 L2 M2 O1 O2 S1 S2	18
4	H2	29	C1 C2 D1 D2 E1 E2 G1 I1 I2 J2 K1 L1 L2 M2 O1 O2 S1 S2	18
6	H2	89	A2 B1 B2 C1 C2 D2 E1 E2 F1 F2 G1 G2 H1 I1 I2 K1 K2 L1 L2 N1 N2 O1 P1 P2	24
15	H1	4	A1 A2 C1 C2 D1 D2 E1 E2 F1 F2 G1 G2 I1 I2 J1 J2 K1 K2 L2 M1 M2 N1 N2 O1 O2 P1 P2 Q1 Q2 S1 S2	31
15	H2	35	A1 A2 C1 D1 D2 E1 E2 F1 G1 G2 I1 I2 J1 J2 K2 L2 M1 M2 N1 N2 O1 O2 P1 P2 Q1 Q2 S1 S2	28
17	H1	28	A1 A2 C1 C2 D1 F2 G2 H2 I1 I2 J1 K1 L1 L2 N1 N2 O2	17
19	H1	34	K2 L2	2
22	H1	4	A1 A2 C1 C2 D1 D2 E1 E2 F1 F2 G1 G2 I1 I2 J1 J2 K1 K2 L2 M1 M2 N1 N2 O1 O2 P1 P2 Q1 Q2 S1 S2	31
22	H2	35	A1 A2 C1 D1 D2 E1 E2 F1 G1 G2 I1 I2 J1 J2 K2 L2 M1 M2 N1 N2 O1 O2 P1 P2 Q1 Q2 S1 S2	28
24	H1	46	A2 G1 J2 L2 N2 P2	6
24	H2	23	A1 A2 B2 C1 C2 D1 D2 E1 E2 F1 F2 G1 G2 I1 I2 J1 J2 K1 K2 L1 L2 M2 N1 N2 O2 P2	26
25	H1	77	B2 D1 E1 E2 G1 H2 J1 K1 L1 L2 N1 N2	12
37	H1	41	A2 B2 C1 C2 D2 F1 F2 G1 G2 H2 I1 I2 J1 J2 K1 K2 L1 L2 N1 N2 O1 O2 P1 P2 S1 S2	26
38	H1	62	C1 C2 D2 E1 I1 I2 N2	7
38	H2	65	C1 C2 D1 D2 E1 E2 G1 I1 I2 N2	10
41	H1	37	A2 B2 C1 C2 D1 D2 E1 E2 F2 G1 G2 I1 I2 J1 J2 K1 K2 L1 N1 N2 O1 O2 Q2 S1 S2	25
44	H1	31	A1 A2 B1 B2 C1 C2 D1 D2 E1 E2 F2 G1 G2 I1 I2 J1 J2 K1 K2 L1 L2 M1 M2 N1 N2 O1 O2 P2 Q1	29
50	H1	83	A1 B2 E1 I1 J2 O2 S1 S2	8

Table J.8: Cases where at least 1 review obtained higher agreements than expert H.

Summary. The majority of other reviews obtained significantly higher agreement than expert H in 9 cases (13 reviews).

case	review	θ	Reviews which have significantly higher agreement	total
20	I1	72	C2 D2 E2 H2 P2 S1 S2	7
20	I2	69	C2 D2 E2 H2 P2 S1 S2	7
27	I1	71	A1 C1 D1 D2 F1 F2 G1 H1 K1 L1 L2 O2	12
31	I1	98	A1 C1 D1 G1 H2 L1 N2 O1	8
48	I2	54	C2	1
49	I1	86	A2 C1 C2 D1 E1 G1 G2 H1 I2 J2 K1 K2 L1 L2 M1 M2 N1 N2 O1 O2 P1 P2 S1 S2	24

Table J.9: Cases where at least 1 review obtained higher agreements than expert I.

Summary. The majority of other reviews obtained significantly higher agreement than expert I in 1 case (1 review).

case	review	θ	Reviews which have significantly higher agreement	total
3	J1	24	A1 A2 C1 C2 D1 D2 E1 E2 G2 H2 I1 I2 J2 K2 L1 L2 N1 N2 O1 O2 P1 S1 S2	23
6	J1	94	A2 D2 H1 O1	4
6	J2	88	A2 B1 B2 C1 C2 D2 E1 E2 F1 F2 G1 G2 H1 I1 I2 K1 K2 L1 L2 N1 N2 O1 P1 P2	24
18	J2	46	A1 A2 C1 C2 D1 D2 E1 E2 F1 G1 G2 H1 H2 I1 I2 J1 K1 K2 L1 O1 O2 P1 P2	23
20	J2	69	D2 P2 S1 S2	4
21	J1	58	A2 B1 B2 C1 C2 D1 D2 E1 E2 F1 F2 G1 G2 H1 H2 I1 I2 J2 K1 K2 L1 L2 M1 M2 N1 N2 O1 O2 P1 P2 S1 S2	32
23	J2	70	A2 E2 G1 I1 I2 M2	6
26	J1	61	A2 D1 D2 E1 E2 F1 F2 G1 H1 H2 I1 I2 K2 L2 M1 M2 N1 N2 O2 P1 P2 Q1 S1 S2	24
33	J1	62	A1 A2 C1 D1 D2 E1 F1 F2 G1 G2 H2 J2 K1 K2 L1 L2 M1 M2 N1 N2 P1 P2 Q2	23
34	J1	42	A2 C1 C2 D1 D2 E1 E2 F1 F2 G1 H1 H2 I1 I2 K1 K2 L1 L2 M1 M2 N1 N2 O2 P1 P2 S1 S2	27
39	J1	84	B1 B2 C1 D1 D2 E1 E2 F1 F2 G1 G2 H2 I1 I2 J2 K1 K2 L1 L2 M1 M2 N2 O1 P1 P2 S1 S2	27
46	J1	61	C1 D1 D2 F1 F2 G1 G2 H1 H2 I1 I2 J2 K1 K2 L1 L2 M1 M2 O1 O2 P1 P2 Q1 S1 S2	25
47	J1	81	A1 A2 B1 B2 C1 D1 D2 F1 F2 G2 H1 H2 I1 I2 J2 K1 K2 L1 L2 M1 M2 N1 N2 O1 O2 P1 P2 S1 S2	29
49	J1	86	A2 C1 C2 D1 E1 G1 G2 H1 J2 K2 L1 L2 M1 N1 N2 O1 O2 P1 S1 S2	20

Table J.10: Cases where at least 1 review obtained higher agreements than expert J.

Summary. The majority of other reviews obtained significantly higher agreement than expert J in 11 cases (11 reviews).

case	review	θ	Reviews which have significantly higher agreement	total
1	K2	56	K1	1
3	K1	8	A1 A2 B2 C1 C2 D1 D2 E1 E2 F1 G1 G2 H2 I1 I2 J2 K2 L1 L2 N1 N2 O1 O2 P1 P2 S1 S2	27
25	K2	61	A1 B2 D1 D2 E1 E2 F2 G1 G2 H2 I2 J1 J2 K1 L1 L2 M1 M2 N1 N2 O2 Q1 Q2 S1 S2	25
29	K2	78	A1 C1 C2 D2 E1 E2 H2 I1 I2 J2 L2 N2 O1 P1	14
38	K2	70	C1 C2 D1 D2 E1 E2 I1 I2 N2	9

Table J.11: Cases where at least 1 review obtained higher agreements than expert K.

Summary. The majority of other reviews obtained significantly higher agreement than expert K in 2 cases (2 reviews).

case	review	θ	Reviews which have significantly higher agreement	total
7	L1	41	C1 D2 E2 P1 S1 S2	6
7	L2	28	A1 A2 B1 B2 C1 D2 E2 F1 F2 H2 I1 I2 J2 K1 K2 M1 N1 N2 P1 P2 Q1 Q2 S1 S2	24
8	L1	72	A2 D2 E2 I1 P1	5
15	L1	58	A1 D2 E1 E2 G1 G2 L2 M1 M2 N1 Q1 Q2	12
20	L2	72	D2 P2 S1 S2	4
22	L1	58	A1 D2 E1 E2 G1 G2 L2 M1 M2 N1 Q1 Q2	12
26	L1	69	A2 D1 D2 E2 F1 F2 G1 H1 I1 I2 M2 N1 N2 P1 P2	15
28	L1	67	I1 O1	2
48	L2	19	A1 A2 B1 B2 C1 C2 D1 D2 E1 E2 F1 F2 G1 G2 H1 H2 I1 J1 J2 K1 K2 L1 N1 N2 O2 P1 P2 Q1 Q2	29
50	L1	78	A1 B1 B2 C1 C2 D1 D2 E1 E2 F1 F2 G1 G2 H2 I1 I2 J1 J2 K1 K2 M1 M2 O2 S1 S2	25
50	L2	85	B2 J2 S1 S2	4

Table J.12: Cases where at least 1 review obtained higher agreements than expert L.

Summary. The majority of other reviews obtained significantly higher agreement than expert L in 3 cases (3 reviews).

case	review	θ	Reviews which have significantly higher agreement	total
1	M1	54	B2 C2 E1 H1 I2 K1 N1	7
3	M1	42	C1 D2 E2 H2 I1 I2 J2 K2 O1 O2	10
3	M2	42	C1 D2 E2 H2 I1 I2 J2 K2 O1 O2	10
6	M1	89	A2 B1 B2 C1 C2 D2 E1 E2 F1 F2 G1 G2 H1 I1 I2 K1 K2 L1 L2 N1 N2 O1 P1 P2	24
6	M2	32	A2 B1 B2 C1 C2 D2 E1 E2 F1 F2 G1 G2 H1 I1 I2 K1 K2 L1 L2 N1 N2 O1 P1 P2 Q1 Q2 S1 S2	28
10	M1	12	A2 B1 B2 C1 C2 D1 D2 E1 E2 F2 G1 G2 H1 H2 I1 I2 J1 K1 K2 L1 L2 N2 O1 O2 P1 P2 Q1 S1 S2	29
10	M2	25	A2 B1 C1 C2 D2 E2 G1 G2 H2 I1 I2 J1 K1 L1 L2 O1 P1 S1 S2	19
17	M1	36	A1 A2 C1 C2 D1 F2 G2 H2 I1 I2 J1 K1 L1 L2 N1 N2 O2	17
24	M1	44	A1 A2 C2 D1 E1 F1 F2 G1 I1 I2 J1 J2 K1 K2 L1 L2 M2 N1 N2 O2 P2	21
27	M1	42	A1 B2 C1 C2 D1 D2 E1 E2 F1 F2 G1 H1 H2 I2 J1 J2 K1 K2 L1 L2 M2 N1 N2 O1 O2 P2 Q1 S1 S2	29
28	M1	68	I1	1
32	M1	29	A2 C2 H2 J1 J2 L2	6
35	M1	69	A2 D1 D2 E1 E2 G1 H1 I2 J1 J2 K2 L1 N2 O2	14
41	M1	45	A2 B2 C1 D1 D2 E1 E2 G1 I1 I2 J1 J2 K1 K2 L1 N1 O1 O2	18
41	M2	48	B2 C1 D1 D2 E1 E2 I2 J2 L1 N1 O1 O2	12
42	M1	45	C1 C2 D2 H1 I1 I2 J2 N2 O1 P1 P2	11
42	M2	48	D2 N2	2
43	M1	54	A1 A2 C2 D1 D2 E1 E2 F2 G2 H1 H2 I1 I2 J1 J2 K1 K2 L1 L2 M2 O1 O2 P2	23
45	M1	51	A1 A2 B2 C1 C2 D1 D2 E1 E2 F2 H1 H2 I1 I2 K1 K2 L1 L2 N1 N2 O1 O2 P2 S1 S2	25
48	M1	56	C2 K2	2
48	M2	56	B2 C1 C2 G2 K2 L1 P1	7

Table J.13: Cases where at least 1 review obtained higher agreements than expert M.

Summary. The majority of other reviews obtained significantly higher agreement than expert M in 7 cases (9 reviews).

case	review	θ	Reviews which have significantly higher agreement	total
8	N2	52	A1 A2 B1 C1 D1 D2 E1 E2 F2 G1 H1 H2 I1 I2 J2 K1 K2 L2 M1 M2 N1 O1 O2 P1 P2 Q2	26
13	N1	39	A1 A2 C1 C2 E2 F1 G1 G2 H1 H2 I1 I2 J1 K1 K2 L1 L2 M1 M2 O1 O2 P1 P2 S1 S2	25
16	N1	33	S1 S2	2
28	N1	60	B2 D1 E1 E2 F2 G1 G2 H2 I1 J2 K2 L2 M2 N2 O1 O2 P2 Q1 S1 S2	20
29	N1	82	D2 L2	2
38	N1	65	C1 C2 D1 D2 E1 E2 I1 I2 N2	9
40	N2	23	A1 A2 C1 C2 D1 D2 E1 F1 F2 G1 I1 I2 J1 J2 K1 K2 L1 L2 M1 M2 N1 O2 P1 P2	24
43	N2	64	A2 D1 D2 E1 H1 H2 I2 J2 K1 L2 M2 O1 O2	13
50	N2	84	B2 E1 J2 O2 S1 S2	6

Table J.14: Cases where at least 1 review obtained higher agreements than expert N.

Summary. The majority of other reviews obtained significantly higher agreement than expert N in 4 cases (4 reviews).

case	review	θ	Reviews which have significantly higher agreement	total
6	O2	89	A2 B1 B2 C1 C2 D2 E1 E2 F1 F2 G1 G2 H1 I1 I2 K1 K2 L1 L2 N1 N2 O1 P1 P2	24
7	O1	43	D2 E2 S1 S2	4
23	O1	72	A2 I2	2
24	O1	23	A1 A2 B2 C1 C2 D1 D2 E1 E2 F1 F2 G1 G2 I1 I2 J1 J2 K1 K2 L1 L2 M2 N1 N2 O2 P2	26
25	O1	70	B2 D1 D2 E1 E2 G1 H2 J1 J2 K1 L1 L2 M1 N1 N2	15
26	O1	70	A2 D1 D2 E2 F1 F2 G1 H1 I1 I2 M2 N1 N2 P1 P2	15
34	O1	64	A2 C2 D1 G1 H2 I1 I2 K2 L1 O2 S1	11
39	O2	84	B1 B2 C1 D1 D2 E1 E2 F1 H2 I1 I2 J2 K1 L1 L2 O1 P1 P2 S1 S2	20
40	O1	23	A2 C2 D1 E1 F1 G1 J2 K1 L1 L2 M1 N1 O2	13
48	O1	19	A1 A2 B1 B2 C1 C2 D1 D2 E1 E2 F1 F2 G1 G2 H1 H2 I1 J1 J2 K1 K2 L1 N1 N2 O2 P1 P2 Q1 Q2	29
50	O1	84	A1 B2 C1 D1 D2 E1 E2 H2 I1 J1 J2 K2 M1 O2 S1 S2	16

Table J.15: Cases where at least 1 review obtained higher agreements than expert O.

Summary. The majority of other reviews obtained significantly higher agreement than expert O in 4 cases (4 reviews).

case	review	θ	Reviews which have significantly higher agreement	total
20	P1	70	D2	1
24	P1	24	A1 A2 B2 C1 C2 D1 D2 E1 E2 F1 F2 G1 G2 I1 I2 J1 J2 K1 K2 L1 L2 M2 N1 N2 O2 P2	26
25	P1	72	B2 D1 D2 E1 E2 G1 H2 J1 J2 K1 L1 L2 M1 N1 N2	15
27	P1	55	A1 C1 C2 D1 D2 E2 F1 F2 G1 H1 H2 I2 J2 K1 K2 L1 L2 M2 N1 O1 O2 P2 Q1	23
41	P1	47	B2 C1 D1 D2 E1 E2 I2 J2 K1 L1 N1 O1 O2	13
41	P2	46	B2 C1 D1 D2 E1 E2 I2 J2 K1 K2 L1 N1 O1 O2	14
44	P1	28	A1 A2 B2 C1 C2 D1 E1 F2 G2 I1 I2 J2 K1 K2 L1 L2 N2 P2 Q1	19
45	P1	58	A2 B2 C1 D1 D2 E1 E2 F2 H1 H2 I2 K1 K2 L1 L2 O2 P2 S1 S2	19
50	P1	74	A1 B1 B2 C1 C2 D1 D2 E1 E2 F1 F2 G1 G2 H2 I1 I2 J1 J2 K1 K2 M1 M2 N1 O2 S1 S2	26
50	P2	83	A1 B1 B2 C1 D1 D2 E1 E2 F1 H2 I1 I2 J1 J2 K1 K2 M1 M2 O2 S1 S2	21

Table J.16: Cases where at least 1 review obtained higher agreements than expert P.

Summary. The majority of other reviews obtained significantly higher agreement than expert P in 5 cases (6 reviews).

case	review	θ	Reviews which have significantly higher agreement	total
2	Q1	22	A1 C2 E2 I2 L1 L2 O2	7
3	Q1	15	A1 A2 C1 C2 D1 D2 E1 E2 G2 H2 I1 I2 J2 K2 L1 L2 N1 N2 O1 O2 P1 S1 S2	23
4	Q1	44	J2	1
5	Q1	8	A1 A2 C1 C2 D1 D2 E1 E2 F1 F2 G1 G2 H2 I1 I2 J1 J2 K2 L1 L2 M1 M2 N1 N2 O1 O2 P1 P2 S1 S2	30
5	Q2	35	A2 C1 C2 D1 D2 F1 F2 G1 G2 I1 I2 J1 J2 L1 L2 N2 O2 P2 S1 S2	20
8	Q1	38	A1 A2 B1 C1 D1 D2 E1 E2 F2 G1 H1 H2 I1 I2 J1 J2 K1 K2 L2 M1 M2 N1 O1 O2 P1 P2 Q2	27
9	Q2	73	A1 C1 I2 K2 N2 O1 O2 P2	8
11	Q1	67	A2 B2 C1 C2 D1 E1 E2 F2 G1 H1 H2 I1 I2 K1 L1 M2 N2	17
12	Q1	26	A1 A2 E1 G1 G2 H1 H2 I2 K1 K2 L1 L2 O1 O2 P2 S1 S2	17
12	Q2	26	A1 A2 D1 E1 G1 G2 H1 H2 I2 K1 K2 L1 L2 O1 O2 P2 S1 S2	18
13	Q1	21	A1 A2 C1 C2 D2 E1 E2 F1 F2 G1 G2 H1 H2 I1 I2 J1 J2 K1 K2 L1 L2 M1 M2 N2 O1 O2 P1 P2 S1 S2	30
13	Q2	21	A1 A2 C1 C2 D2 E1 E2 F1 F2 G1 G2 H1 H2 I1 I2 J1 J2 K1 K2 L1 L2 M1 M2 N2 O1 O2 P1 P2 S1 S2	30
14	Q1	16	A1 A2 C1 C2 D1 D2 E1 E2 F1 F2 G1 G2 H1 H2 I1 I2 J1 J2 K1 K2 L1 L2 M1 M2 N1 N2 O1 O2 P1 P2 Q2 S1 S2	33
16	Q1	17	A1 A2 C1 C2 D1 E1 E2 F2 G1 G2 H1 H2 I1 I2 J1 J2 K1 K2 L1 L2 M1 M2 N2 O1 O2 P1 P2 S1 S2	29
16	Q2	19	A1 A2 C1 C2 D1 E1 E2 F2 G1 G2 H1 H2 I1 I2 J1 J2 K1 K2 L1 L2 M1 M2 N2 O1 O2 P1 P2 S1 S2	29
17	Q1	33	A1 C1 D1 G2 I1 J1 K1 L1 L2 N1 N2	11
18	Q1	34	A1 A2 C1 C2 D1 D2 E1 E2 F1 G1 G2 H1 H2 I1 I2 J1 K1 K2 L1 L2 M1 M2 N1 N2 O1 O2 P1 P2 S1 S2	30
18	Q2	30	A1 A2 C1 C2 D1 D2 E1 E2 F1 G1 G2 H1 H2 I1 I2 J1 K1 K2 L1 L2 M1 M2 N1 N2 O1 O2 P1 P2 S1 S2	30
20	Q1	67	D2 P2	2
21	Q1	88	A2 C2 D1 D2 E1 E2 H2 J2 K1 O1 O2 P1 P2 S1 S2	15
21	Q2	83	A2 B1 B2 C1 C2 D1 D2 E1 E2 F1 F2 G2 H2 J2 K1 K2 L1 L2 M1 M2 N1 N2 O1 O2 P1 P2 S1 S2	28
23	Q1	11	A1 A2 B1 B2 C1 C2 D1 D2 E1 E2 G1 G2 H1 H2 I1 I2 J1 K1 K2 L1 L2 M1 M2 N1 N2 O2 P1 P2 S1 S2	30
23	Q2	3	A1 A2 B1 B2 C1 C2 D1 D2 E1 E2 F2 G1 G2 H1 H2 I1 I2 J1 K1 K2 L1 L2 M1 M2 N1 N2 O2 P1 P2 S1 S2	31
26	Q2	26	A1 A2 B1 C2 D1 D2 E1 E2 F1 F2 G1 H1 H2 I1 I2 J2 K1 K2 L2 M1 M2 N1 N2 O2 P1 P2 Q1 S1 S2	29
27	Q2	53	A1 B2 C1 C2 D1 D2 E1 E2 F1 F2 G1 H1 H2 I2 J2 K1 K2 L1 L2 M2 N1 N2 O1 O2 P2 Q1	26
28	Q2	47	B2 D1 E1 E2 F2 G1 G2 H2 I1 I2 J1 J2 K2 L2 M2 N2 O1 O2 P1 P2 Q1 S1 S2	23
29	Q1	71	A1 C1 C2 D2 E1 E2 F2 G1 H1 H2 I1 I2 J1 J2 K1 L1 L2 M1 M2 N2 O1 O2 P1 P2	24
29	Q2	64	A1 C1 C2 D2 E1 E2 F1 F2 G1 H1 H2 I1 I2 J1 J2 K1 L1 L2 M1 M2 N2 O1 O2 P1 P2	25
31	Q1	87	A1 A2 B1 B2 C1 C2 D1 E1 F1 F2 G1 G2 H2 I2 J1 J2 K1 K2 L1 L2 M1 M2 N1 N2 O1 O2 P1 P2 S1	29
31	Q2	75	A1 A2 B1 B2 C1 C2 D1 E1 F1 F2 G1 G2 H1 H2 I2 J1 J2 K1 K2 L1 L2 M1 M2 N1 N2 O1 O2 P1 P2 S1 S2	31
33	Q1	36	A1 A2 C1 D1 D2 E1 F1 F2 G1 G2 H2 J2 K1 K2 L1 L2 M1 M2 N1 N2 P1 P2 Q2 S1 S2	25
35	Q1	66	A2 C2 D1 D2 E1 E2 F2 G1 G2 H1 H2 I1 I2 J1 J2 K1 K2 L1 M2 N1 N2 O1 O2 P2 S2	25
35	Q2	79	A2 D1 D2 H1 I2 J2 K2 L1 N2 O2	10
36	Q1	47	E1 F1 G2 H1 H2 K1 L1 O2 P1	9
36	Q2	25	A1 A2 B1 C1 C2 D1 D2 E1 E2 F1 F2 G1 G2 H1 H2 I1 I2 J1 J2 K1 K2 L1 L2 M1 M2 N1 N2 O1 O2 P1 P2 S1 S2	33
37	Q2	38	A2 B2 C1 C2 D2 F1 F2 G1 G2 H2 I1 I2 J1 J2 K1 K2 L1 L2 N1 N2 O1 O2 P1 P2 S1 S2	26
38	Q1	63	C1 C2 D1 D2 E1 E2 F2 G1 I1 I2 N2	11
38	Q2	55	A2 B2 C1 C2 D1 D2 E1 E2 F1 F2 G1 G2 I1 I2 J1 J2 K1 L1 L2 M1 M2 N2 O1 O2 P1 P2	26
39	Q2	82	B1 B2 C1 D1 D2 E1 E2 F1 F2 G1 G2 H2 I1 I2 J2 K1 K2 L1 L2 M1 M2 N2 O1 P1 P2 S1 S2	27
43	Q1	67	A1 A2 C2 D1 D2 E1 F2 G2 H1 H2 I1 I2 J1 J2 K1 K2 L1 L2 M2 O1 O2 P2	22
43	Q2	62	A1 A2 C2 D1 D2 E1 E2 F2 G2 H1 H2 I1 I2 J1 J2 K1 K2 L1 L2 M2 O1 O2 P2	23
44	Q2	35	A1 A2 B2 C1 C2 D1 E1 F2 G2 I1 J2 K1 K2 L1 L2 N2 P2 Q1	18
45	Q1	52	A2 D1 D2 E1 E2 I2 K1 K2 L1 L2 P2 S1 S2	13
45	Q2	45	A1 A2 B2 C1 C2 D1 D2 E1 E2 F2 H1 H2 I1 I2 K1 K2 L1 L2 N1 N2 O2 P2 S1 S2	24
46	Q2	44	A1 A2 C1 C2 D1 D2 E2 F1 F2 G1 G2 H1 H2 I1 I2 J2 K1 K2 L1 L2 M1 M2 N1 N2 O1 O2 P1 P2 Q1 S1 S2	31
47	Q2	85	A1 A2 B1 B2 C1 D1 D2 F1 F2 G2 H1 I1 I2 J2 K1 K2 L1 L2 M1 M2 N1 N2 O1 O2 P2 S1 S2	27
49	Q2	41	A1 A2 C1 C2 D1 D2 E1 E2 G1 G2 H1 H2 I2 J2 K1 K2 L1 L2 M1 M2 N1 N2 O1 O2 P1 P2 Q1 S1 S2	29
50	Q2	80	A1 B1 B2 C1 C2 D1 D2 E1 E2 F1 F2 G1 H2 I1 I2 J1 J2 K1 K2 M1 M2 O2 S1 S2	24

Table J.17: Cases where at least 1 review obtained higher agreements than expert A.

Summary. The majority of other reviews obtained significantly higher agreement than expert Q in 28 cases (36 reviews).

case	review	θ	Reviews which have significantly higher agreement	total
8	S1	65	A1 A2 B1 D2 E2 F2 G1 H2 I1 J2 K2 L2 M1 M2 N1 O1 P1 P2 Q2	19
8	S2	65	A1 A2 B1 D2 E2 F2 G1 H2 I1 J2 K2 L2 M1 M2 N1 O1 P1 P2 Q2	19
11	S1	65	A2 B2 C1 C2 D1 E1 E2 F2 G1 H1 H2 I1 I2 K1 L1 M2 N2 P2	18
11	S2	65	A2 B2 C1 C2 D1 E1 E2 F2 G1 H1 H2 I1 I2 K1 L1 M2 N2 P2	18
29	S1	79	A1 C1 C2 D2 E1 E2 H2 I1 I2 J2 L2 N2 O1 O2 P1	15
29	S2	79	A1 C1 C2 D2 E1 E2 H2 I1 I2 J2 K1 L1 L2 N2 O1 O2 P1	17
35	S1	68	A2 D1 D2 E1 E2 G1 H1 I2 J1 J2 K2 L1 N2 O2	14
38	S1	32	A2 B2 C1 C2 D1 D2 E1 E2 F1 F2 G1 G2 I1 I2 J1 J2 K1 L1 L2 M1 M2 N2 O1 O2 P1 P2	26
38	S2	32	A2 B2 C1 C2 D1 D2 E1 E2 F1 F2 G1 G2 I1 I2 J1 J2 K1 L1 L2 M1 M2 N2 O1 O2 P1 P2	26
44	S1	33	A1 A2 B2 C1 C2 D1 D2 E1 E2 F2 G1 G2 I1 I2 J2 K1 K2 L1 L2 M2 N1 N2 O1 O2 P2 Q1	26
44	S2	33	A1 A2 B2 C1 C2 D1 D2 E1 E2 F2 G1 G2 I1 I2 J2 K1 K2 L1 L2 M2 N1 N2 O1 O2 P2 Q1	26
48	S1	50	A2 B1 B2 C1 C2 D1 D2 E1 E2 F1 F2 G1 G2 H1 J2 K1 K2 L1 N1 N2 P1 P2	22
48	S2	50	A1 A2 B1 B2 C1 C2 D1 D2 E1 E2 F1 F2 G1 G2 H1 J2 K1 K2 L1 N1 N2 P1 P2	23

Table J.18: Cases where at least 1 review obtained higher agreements than the system.

Summary. The majority of other reviews obtained significantly higher agreement than the System in 5 cases (10 reviews).

Case Number	INTRA - AGREEMENT		INTER - AGREEMENTS									
			OVERALL - AGREEMENTS		TIMING OF AGREEMENTS							
					Agreement with C/S specified in A1				Agreement with C/S specified in A2			
	Was a C/S specified in both reviews ?	δ_t Intra - agreement (segs)	Num. other experts recommending C/S Max. = 16	Num. reviews recommending C/S. Max. = 32	Num. other reviews with C/S within (segs) ±1	±2	±4	δ_t System (segs)	Num. other reviews with C/S within (segs) ±1	±2	±4	δ_t System (segs)
3	YES	1	14	24	11	4	3	2	11	3	4	1
4	NO	-	2	3	0	0	3	-	-	-	-	-
5	NO	-	6	9	3	0	2	-	-	-	-	-
6	YES	0	16	31	31	0	0	0	31	0	0	0
9	YES	2	16	32	24	8	0	1	5	14	13	1
10	YES	2	16	30	10	6	14	3	19	9	2	1
16	YES	4	16	31	2	2	10	-	4	4	0	-
17	YES	0	16	32	17	0	5	1	17	0	5	1
19	YES	3	13	24	13	3	7	3	9	6	8	0
24	YES	1	15	28	15	10	1	-	22	2	2	-
29	YES	2	16	32	31	1	0	1	12	18	2	1
32	YES	4	13	24	5	3	9	-	12	6	4	-
34	NO	-	4	5	4	1	0	-	-	-	-	-
35	YES	2	16	32	6	15	11	4	30	2	0	2
37	NO	-	15	25	5	0	1	-	-	-	-	-
38	NO	-	16	30	-	-	-	-	24	1	5	-
40	YES	1	16	29	13	4	5	6	17	2	6	5
41	NO	-	2	3	2	1	0	-	-	-	-	-
43	YES	1	15	30	25	4	1	2	23	4	3	1
44	YES	0	16	31	13	13	4	-	13	13	4	-
48	YES	0	15	25	6	1	15	9	6	1	15	9

Detailed assessment of the cases recommended for CS by expert A.

Case Number	INTRA - AGREEMENT		INTER - AGREEMENTS									
			OVERALL - AGREEMENTS		TIMING OF AGREEMENTS							
					Agreement with C/S specified in B1				Agreement with C/S specified in B2			
	Was a C/S specified in both reviews ?	δ_t Intra - agreement (segs)	Num. other experts recommending C/S Max. = 16	Num. reviews recommending C/S. Max. = 32	Num. other reviews with C/S within (segs)			δ_t System (segs)	Num. other reviews with C/S within (segs)			δ_t System (segs)
					±1	±2	±4		±1	±2	±4	
2	YES	2	11	16	1	1	2	-	1	3	1	-
3	YES	3	14	24	1	0	3	8	3	2	12	5
4	NO	-	2	3	-	-	-	-	2	0	1	-
5	YES	1	6	8	1	2	4	-	2	1	2	-
6	YES	0	16	31	31	0	0	0	31	0	0	0
9	YES	1	16	32	26	5	1	2	23	9	0	1
10	YES	0	16	30	18	4	7	0	18	4	7	0
12	YES	4	3	3	1	0	2	-	2	0	0	-
13	YES	9	8	13	4	2	3	-	1	0	1	-
15	NO	-	1	2	1	0	0	-	-	-	-	-
16	YES	3	16	31	1	1	0	-	1	1	0	-
17	YES	1	16	32	5	4	2	7	8	2	9	6
18	YES	1	2	2	0	0	1	-	0	0	0	-
19	YES	1	13	24	12	3	8	3	8	5	3	4
22	NO	-	1	2	1	0	0	-	-	-	-	-
24	YES	3	15	28	1	4	14	-	16	10	0	-
29	YES	1	16	32	19	11	2	2	30	2	0	1
32	YES	0	13	24	7	8	8	-	7	8	8	-
34	YES	0	4	4	3	1	0	-	3	1	0	-
35	YES	1	16	32	21	10	1	3	5	16	11	4
37	YES	15	15	24	5	0	1	-	17	1	0	-

Detailed assessment of the cases recommended for CS by expert B.

Case Number	INTRA - AGREEMENT		INTER - AGREEMENTS									
			OVERALL - AGREEMENTS		TIMING OF AGREEMENTS							
					Agreement with C/S specified in B1				Agreement with C/S specified in B2			
	Was a C/S specified in both reviews ?	δ_t Intra - agreement (segs)	Num. other experts recommending C/S Max. = 16	Num. reviews recommending C/S. Max. = 32	Num. other reviews with C/S within (segs)			δ_t System (segs)	Num. other reviews with C/S within (segs)			δ_t System (segs)
					±1	±2	±4		±1	±2	±4	
38	YES	1	16	29	4	12	13	-	16	13	0	-
40	YES	3	16	29	3	3	4	1	7	6	16	2
41	NO	-	2	3	2	1	0	-	-	-	-	-
43	YES	3	15	30	17	7	5	0	12	17	1	3
44	YES	0	16	31	13	13	4	-	13	13	4	-
48	YES	0	15	25	14	1	8	5	14	1	8	5

Detailed assessment of the cases recommended for CS by expert B (continued).

Case Number	INTRA - AGREEMENT		INTER - AGREEMENTS									
			OVERALL - AGREEMENTS		TIMING OF AGREEMENTS							
					Agreement with C/S specified C1				Agreement with C/S specified C2			
	Was a C/S specified in both reviews ?	δ_t Intra - agreement (segs)	Num. other experts recommending C/S Max. = 16	Num. reviews recommending C/S. Max. = 32	Num. other reviews with C/S within (segs)			δ_t System (segs)	Num. other reviews with C/S within (segs)			δ_t System (segs)
					±1	±2	±4		±1	±2	±4	
2	NO	-	11	17	0	0	0	-	-	-	-	-
3	YES	2	14	24	12	3	3	2	8	4	4	0
6	YES	0	16	31	31	0	0	0	31	0	0	0
9	YES	2	16	32	24	8	0	1	12	14	6	3
10	YES	0	16	30	18	4	7	0	18	4	7	0
13	NO	-	8	14	4	4	3	-	-	-	-	-
16	YES	9	16	31	2	3	3	-	4	4	1	-
17	YES	1	16	32	14	5	8	2	17	0	5	1
19	YES	5	13	24	9	5	3	4	8	2	11	1
24	YES	1	15	28	17	5	3	-	22	2	2	-
28	NO	-	0	0	0	0	0	-	-	-	-	-
29	YES	0	16	32	30	2	0	1	30	2	0	1
32	YES	1	13	24	9	6	4	-	11	6	5	-
35	YES	1	16	32	21	10	1	3	29	3	0	2
37	NO	-	15	25	-	-	-	-	17	1	0	-
38	YES	0	16	29	24	5	0	-	24	5	0	-
40	NO	-	16	30	-	-	-	-	18	2	0	5
43	YES	2	15	30	12	16	2	3	24	3	3	1
44	YES	1	16	31	19	4	7	-	13	13	4	-
48	YES	1	15	25	14	1	8	5	14	1	8	6

Detailed assessment of the cases recommended for CS by expert C.

Case Number	INTRA - AGREEMENT		INTER - AGREEMENTS									
			OVERALL - AGREEMENTS		TIMING OF AGREEMENTS							
					Agreement with C/S specified in D1				Agreement with C/S specified in D2			
	Was a C/S specified in both reviews ?	δ_t Intra - agreement (segs)	Num. other experts recommending C/S max. = 16	Num. reviews recommending C/S. Max. = 32	Num. other reviews with C/S within (segs)			δ_t System (segs)	Num. other reviews with C/S within (segs)			δ_t System (segs)
					±1	±2	±4		±1	±2	±4	
2	NO	-	11	17	3	1	0	-	-	-	-	-
3	YES	3	14	24	5	5	9	4	12	3	3	1
6	YES	1	16	31	26	5	0	1	31	0	0	0
7	NO	-	6	8	4	1	2	-	-	-	-	-
9	YES	0	16	32	11	15	6	3	11	15	6	3
10	YES	3	16	30	13	6	9	1	15	11	4	2
13	YES	4	8	13	2	2	4	-	4	4	2	-
16	YES	10	16	31	6	0	3	-	6	1	1	-
17	YES	2	16	32	4	12	13	4	9	1	9	6
19	YES	4	13	24	8	2	10	1	13	3	7	3
24	YES	1	15	28	15	10	1	-	6	11	11	-
29	YES	1	16	32	19	11	2	2	30	2	0	1
32	YES	1	13	24	4	3	10	-	3	1	8	-
35	YES	0	16	32	29	3	0	2	29	3	0	2
37	YES	15	15	24	5	0	1	-	17	1	0	-
38	YES	0	16	29	24	5	0	-	24	5	0	-
40	YES	1	16	29	10	12	5	4	7	9	13	3
43	YES	0	15	30	23	4	3	1	23	4	3	1
44	YES	3	16	31	20	4	6	-	7	8	13	-
48	YES	1	15	25	14	1	8	5	12	2	1	4

Detailed assessment of the cases recommended for CS by expert D.

Case Number	INTRA - AGREEMENT		INTER - AGREEMENTS									
			OVERALL - AGREEMENTS		TIMING OF AGREEMENTS							
					Agreement with C/S specified in E1				Agreement with C/S specified in E2			
	Was a C/S specified in both reviews ?	δ_t Intra - agreement (segs)	Num. other experts recommending C/S max. = 16	Num. reviews recommending C/S. Max. = 32	Num. other reviews with C/S within (segs)			δ_t System (segs)	Num. other reviews with C/S within (segs)			δ_t System (segs)
					±1	±2	±4		±1	±2	±4	
2	NO	-	11	17	1	3	2	-	-	-	-	-
3	YES	3	14	24	5	5	9	4	12	3	3	1
5	NO	-	6	9	1	3	4	-	-	-	-	-
6	YES	0	16	31	31	0	0	0	31	0	0	0
7	NO	-	6	8	4	1	2	-	-	-	-	-
9	YES	0	16	32	11	15	6	3	11	15	6	3
10	YES	2	16	30	13	5	10	1	19	9	2	1
12	NO	-	3	4	-	-	-	-	2	0	2	-
13	YES	6	8	13	2	2	5	-	2	2	4	-
16	YES	11	16	31	4	4	1	-	6	1	1	-
17	YES	1	16	32	8	2	17	5	8	2	9	6
19	YES	4	13	24	8	2	10	1	13	3	7	3
24	YES	1	15	28	15	10	1	-	6	11	11	-
29	YES	0	16	32	30	2	0	1	30	2	0	1
32	YES	0	13	24	11	4	9	-	11	4	9	-
35	YES	0	16	32	29	3	0	2	29	3	0	2
37	YES	1	15	24	3	1	1	-	4	0	1	-
38	YES	0	16	29	24	5	0	-	24	5	0	-
40	YES	4	16	29	18	2	5	5	7	4	9	1
43	YES	1	15	30	23	4	3	1	25	4	1	2
44	YES	2	16	31	14	12	4	-	7	7	14	-
48	YES	0	15	25	14	1	8	5	14	1	8	5

Detailed assessment of the cases recommended for CS by expert E.

Case Number	INTRA - AGREEMENT		INTER - AGREEMENTS									
			OVERALL - AGREEMENTS		TIMING OF AGREEMENTS							
					Agreement with C/S specified in F1				Agreement with C/S specified in F2			
	Was a C/S specified in both reviews ?	δ_t Intra - agreement (segs)	Num. other experts recommending C/S max = 16	Num. reviews recommending C/S. Max = 32	Num. other reviews with C/S within (segs)			δ_t System (segs)	Num. other reviews with C/S within (segs)			δ_t System (segs)
					±1	±2	±4		±1	±2	±4	
2	YES	17	11	16	0	0	0	-	0	4	1	-
3	YES	31	14	24	3	2	13	5	1	1	0	36
6	YES	0	16	31	31	0	0	0	31	0	0	0
9	YES	0	16	32	26	5	1	2	26	5	1	2
10	NO	-	16	31	-	-	-	-	15	11	5	2
12	NO	-	3	4	2	0	2	-	-	-	-	-
13	YES	1	8	13	3	2	3	-	1	2	4	-
16	YES	14	16	31	0	2	5	-	4	4	1	-
17	YES	1	16	32	17	0	5	1	9	8	3	0
19	NO	-	13	25	-	-	-	-	7	1	7	2
24	YES	1	15	28	17	5	3	-	22	2	2	-
29	YES	1	16	32	30	2	0	0	30	2	0	1
35	YES	0	16	32	25	5	2	1	25	5	2	1
37	YES	0	15	24	16	1	0	-	16	1	0	-
38	YES	1	16	29	23	1	5	-	24	5	0	-
40	YES	1	16	29	17	2	6	5	13	4	5	6
43	YES	3	15	30	2	4	22	5	26	4	0	2
44	YES	3	16	31	10	5	9	-	14	13	3	-
48	YES	0	15	25	14	1	8	5	14	1	8	5

Detailed assessment of the cases recommended for CS by expert F.

Case Number	INTRA - AGREEMENT		INTER - AGREEMENTS									
			OVERALL - AGREEMENTS		TIMING OF AGREEMENTS							
					Agreement with C/S specified in G1				Agreement with C/S specified in G2			
					Num. other reviews with C/S within (segs)				Num. other reviews with C/S within (segs)			
	Was a C/S specified in both reviews ?	δ_t Intra - agreement (segs)	Num. other experts recommending C/S max = 16	Num. reviews recommending C/S. Max = 32	±1	±2	±4	δ_t System (segs)	±1	±2	±4	δ_t System (segs)
3	NO	-	14	25	-	-	-	-	2	6	7	1
6	YES	0	16	31	31	0	0	0	31	0	0	0
7	NO	-	6	8	4	1	2	-	-	-	-	-
9	YES	1	16	32	26	5	1	2	11	15	6	3
10	YES	2	16	30	15	10	5	2	19	3	7	0
16	NO	-	16	32	-	-	-	-	6	2	1	-
17	YES	6	16	32	1	0	0	5	18	0	5	1
19	YES	0	13	24	7	2	11	1	7	2	11	1
24	YES	1	15	28	22	2	2	-	17	5	3	-
29	YES	1	16	32	30	2	0	1	30	2	0	0
32	NO	-	13	25	-	-	-	-	6	5	8	-
34	NO	-	4	5	-	-	-	-	4	1	0	-
35	YES	1	16	32	29	3	0	2	21	10	1	3
37	NO	-	15	25	17	1	0	-	-	-	-	-
38	YES	0	16	29	23	1	5	-	23	1	5	-
40	YES	6	16	29	14	4	5	6	6	3	6	0
43	YES	1	15	30	16	7	6	0	23	4	3	1
44	YES	0	16	31	13	9	7	-	13	9	7	-
48	NO	-	15	26	15	1	8	5	-	-	-	-

Detailed assessment of the cases recommended for CS by expert G.

Case Number	INTRA - AGREEMENT		INTER - AGREEMENTS									
			OVERALL - AGREEMENTS		TIMING OF AGREEMENTS							
					Agreement with C/S specified in H1				Agreement with C/S specified in H2			
					Num. other reviews with C/S within (segs)				Num. other reviews with C/S within (segs)			
	Was a C/S specified in both reviews ?	δ_t Intra - agreement (segs)	Num. other experts recommending C/S max = 16	Num. reviews recommending C/S. Max = 32	±1	±2	±4	δ_t System (segs)	±1	±2	±4	δ_t System (segs)
2	YES	0	11	16	0	0	0	-	0	0	0	-
3	YES	5	14	24	1	0	4	8	8	8	3	3
4	YES	0	2	2	1	0	1	-	1	0	1	-
5	YES	6	6	8	2	1	1	-	3	0	2	-
6	YES	1	16	31	31	0	0	0	30	1	0	1
7	NO	-	6	8	2	2	4	-	-	-	-	-
9	YES	0	16	32	11	15	6	3	11	15	6	3
10	YES	1	16	30	12	6	10	1	18	4	7	0
13	YES	1	8	13	4	2	4	-	3	4	3	-
15	YES	11	1	1	0	0	0	-	1	0	0	-
16	YES	0	16	31	0	5	5	-	0	5	5	-
17	YES	5	16	32	0	2	8	9	4	13	13	4
19	YES	2	13	24	3	5	7	5	13	2	8	3
22	YES	11	1	1	0	0	0	-	1	0	0	-
24	YES	3	15	28	3	5	20	-	1	1	2	-
29	YES	1	16	32	30	2	0	1	30	2	0	0
32	YES	4	13	24	4	1	7	-	12	4	8	-
35	YES	1	16	32	29	3	0	2	25	5	2	1
37	YES	20	15	24	0	0	5	-	18	0	0	-
38	YES	0	16	29	4	12	13	-	4	12	13	-

Detailed assessment of the cases recommended for CS by expert H.

Case Number	INTRA - AGREEMENT		INTER - AGREEMENTS									
			OVERALL - AGREEMENTS		TIMING OF AGREEMENTS							
					Agreement with C/S specified in H1				Agreement with C/S specified in H2			
					Num. other reviews with C/S within (segs)				Num. other reviews with C/S within (segs)			
	Was a C/S specified in both reviews ?	δ_t Intra - agreement (segs)	Num. other experts recommending C/S max = 16	Num. reviews recommending C/S. Max = 32	±1	±2	±4	δ_t System (segs)	±1	±2	±4	δ_t System (segs)
40	YES	1	16	29	5	3	6	0	6	4	10	1
41	YES	3	2	2	0	2	0	-	2	0	0	-
43	YES	0	15	30	23	4	3	1	23	4	3	1
44	YES	2	16	31	0	0	7	-	5	2	13	-
48	YES	0	15	25	6	1	15	9	6	1	15	9

Detailed assessment of the cases recommended for CS by expert H (continued).

Case Number	INTRA - AGREEMENT		INTER - AGREEMENTS									
			OVERALL - AGREEMENTS		TIMING OF AGREEMENTS							
					Agreement with C/S specified in I1				Agreement with C/S specified in I2			
					Num. other reviews with C/S within (segs)				Num. other reviews with C/S within (segs)			
	Was a C/S specified in both reviews ?	δ_t Intra - agreement (segs)	Num. other experts recommending C/S max = 16	Num. reviews recommending C/S. Max = 32	±1	±2	±4	δ_t System (segs)	±1	±2	±4	δ_t System (segs)
3	YES	0	14	24	11	4	3	2	11	4	3	2
6	YES	0	16	31	31	0	0	0	31	0	0	0
9	YES	0	16	32	23	9	0	1	23	9	0	1
10	YES	2	16	30	19	3	7	0	15	10	5	2
16	YES	0	16	31	5	0	3	-	5	0	3	-
17	YES	1	16	32	14	5	8	2	17	0	5	1
19	YES	0	13	24	11	4	9	2	11	4	9	2
24	YES	0	15	28	17	5	3	-	17	5	3	-
29	YES	0	16	32	30	2	0	0	30	2	0	0
32	NO	-	13	25	-	-	-	-	8	8	8	-
35	YES	0	16	32	29	3	0	2	29	3	0	2
37	NO	-	15	25	3	15	0	-	-	-	-	-
38	YES	0	16	29	24	5	0	-	24	5	0	-
40	YES	1	16	29	6	6	17	2	7	9	13	3
43	YES	1	15	30	25	4	1	2	23	4	3	1
44	YES	2	16	31	14	12	4	-	14	8	7	-
48	YES	0	15	25	6	1	15	9	6	1	15	9

Detailed assessment of the cases recommended for CS by expert I.

Case Number	INTRA - AGREEMENT		INTER - AGREEMENTS									
			OVERALL - AGREEMENTS		TIMING OF AGREEMENTS							
					Agreement with C/S specified in J1				Agreement with C/S specified in J2			
	Was a C/S specified in both reviews ?	δ_t Intra - agreement (segs)	Num. other experts recommending C/S max = 16	Num. reviews recommending C/S. Max = 32	Num. other reviews with C/S within (segs)			δ_t System (segs)	Num. other reviews with C/S within (segs)			δ_t System (segs)
					±1	±2	±4		±1	±2	±4	
2	NO	-	11	17	-	-	-	-	1	3	2	-
3	YES	28	14	24	0	0	0	30	12	4	3	2
6	YES	0	16	31	30	1	0	1	30	1	0	1
7	NO	-	6	8	0	2	2	-	-	-	-	-
9	YES	0	16	32	19	5	8	0	19	5	8	0
10	YES	2	16	30	19	9	2	1	10	6	14	3
16	YES	6	16	31	6	1	1	-	0	0	4	-
17	YES	4	16	32	15	5	7	2	9	2	8	6
18	NO	-	2	3	-	-	-	-	0	0	1	-
19	YES	2	13	24	12	3	9	2	9	4	3	4
24	YES	1	15	28	15	10	1	-	22	2	2	-
29	YES	1	16	32	30	2	0	0	30	2	0	1
32	YES	1	13	24	11	4	9	-	11	6	5	-
34	NO	-	4	5	0	5	0	-	-	-	-	-
35	YES	0	16	32	29	3	0	2	29	3	0	2
37	YES	1	15	24	16	1	0	-	17	0	0	-
38	YES	0	16	29	23	1	5	-	23	1	5	-
40	YES	4	16	29	7	6	16	2	14	4	4	6
43	YES	0	15	30	23	4	3	1	23	4	3	1
44	YES	3	16	31	7	8	13	-	20	4	6	-
48	NO	-	15	26	-	-	-	-	7	1	15	9

Detailed assessment of the cases recommended for CS by expert J.

Case Number	INTRA - AGREEMENT		INTER - AGREEMENTS									
			OVERALL - AGREEMENTS		TIMING OF AGREEMENTS							
					Agreement with C/S specified in K1				Agreement with C/S specified in K2			
	Was a C/S specified in both reviews ?	δ_t Intra - agreement (segs)	Num. other experts recommending C/S max = 16	Num. reviews recommending C/S. Max = 32	Num. other reviews with C/S within (segs)			δ_t System (segs)	Num. other reviews with C/S within (segs)			δ_t System (segs)
					±1	±2	±4		±1	±2	±4	
2	NO	-	11	17	-	-	-	-	3	1	0	-
3	YES	37	14	24	0	2	0	38	12	3	4	1
5	NO	-	6	9	3	1	2	-	-	-	-	-
6	YES	0	16	31	31	0	0	0	31	0	0	0
9	YES	1	16	32	19	5	8	0	23	9	0	1
10	YES	2	16	30	19	9	2	1	10	6	4	3
16	YES	2	16	31	5	1	1	-	4	2	1	-
17	YES	4	16	32	15	5	7	2	9	2	8	6
19	YES	2	13	24	8	1	11	1	7	12	5	1
24	YES	0	15	28	22	2	2	-	22	2	2	-
29	YES	2	16	32	31	1	0	1	12	18	2	1
32	YES	2	13	24	6	4	8	-	12	5	5	-
35	YES	1	16	32	21	10	1	3	29	3	0	2
37	YES	0	15	24	16	1	0	-	16	1	0	-
38	NO	-	16	30	25	5	0	-	-	-	-	-
40	YES	2	16	29	11	11	5	4	14	3	5	6
43	YES	1	15	30	23	4	3	1	25	4	1	2
44	YES	2	16	31	20	3	7	-	14	5	11	-
48	NO	-	15	26	-	-	-	-	2	21	1	7

Detailed assessment of the cases recommended for CS by expert K.

Case Number	INTRA - AGREEMENT		INTER - AGREEMENTS									
			OVERALL - AGREEMENTS		TIMING OF AGREEMENTS							
					Agreement with C/S specified in L1				Agreement with C/S specified in L2			
	Was a C/S specified in both reviews ?	δ_t Intra - agreement (segs)	Num. other experts recommending C/S max = 16	Num. reviews recommending C/S. Max = 32	Num. other reviews with C/S within (segs)			δ_t System (segs)	Num. other reviews with C/S within (segs)			δ_t System (segs)
					±1	±2	±4		±1	±2	±4	
3	NO	-	14	25	12	3	4	1	-	-	-	-
6	YES	0	16	31	31	0	0	0	31	0	0	0
7	YES	1	6	7	4	2	1	-	2	4	1	-
9	YES	0	16	32	23	9	0	1	23	9	0	1
10	YES	1	16	30	18	4	7	0	18	10	2	1
13	NO	-	8	14	-	-	-	-	4	4	3	-
16	YES	3	16	31	6	0	2	-	2	2	6	-
17	YES	0	16	32	14	5	8	2	14	5	8	2
19	YES	3	13	24	8	2	10	1	12	4	8	2
24	YES	1	15	28	17	5	3	-	22	2	2	-
29	YES	0	16	32	30	2	0	1	30	2	0	1
32	YES	2	13	24	6	6	8	-	12	3	9	-
35	YES	1	16	32	29	3	0	2	25	5	2	1
37	YES	0	15	24	16	1	0	-	16	1	0	-
38	YES	0	16	29	23	1	5	-	23	1	5	-
40	YES	1	16	29	17	2	6	5	10	12	5	4
43	YES	1	15	30	25	4	1	2	23	4	3	1
44	YES	2	16	31	14	5	11	-	20	3	7	-
48	YES	28	15	25	15	1	8	5	1	0	0	23

Detailed assessment of the cases recommended for CS by expert L.

Case Number	INTRA - AGREEMENT		INTER - AGREEMENTS									
			OVERALL - AGREEMENTS		TIMING OF AGREEMENTS							
					Agreement with C/S specified in M1				Agreement with C/S specified in M2			
	Was a C/S specified in both reviews ?	δ_t Intra - agreement (segs)	Num. other experts recommending C/S max = 16	Num. reviews recommending C/S. Max = 32	Num. other reviews with C/S within (segs)			δ_t System (segs)	Num. other reviews with C/S within (segs)			δ_t System (segs)
					±1	±2	±4		±1	±2	±4	
6	NO	-	16	32	31	1	0	1	-	-	-	-
9	YES	1	16	32	19	5	8	0	23	9	0	1
10	NO	-	16	31	-	-	-	-	1	6	10	5
16	YES	0	16	31	5	0	3	-	5	0	3	-
17	YES	4	16	32	1	0	2	4	10	8	2	0
19	NO	-	13	25	-	-	-	-	12	4	9	2
24	NO	-	15	29	-	-	-	-	18	5	3	-
29	YES	1	16	32	30	2	0	0	30	2	0	1
35	YES	1	16	32	9	16	7	0	25	5	2	1
38	YES	0	16	29	23	1	5	-	23	1	5	-
40	YES	0	16	29	13	4	5	6	13	4	5	6
43	YES	3	15	30	6	7	17	4	24	4	2	1
44	YES	0	16	31	13	9	7	-	13	9	7	-

Detailed assessment of the cases recommended for CS by expert M.

Case Number	INTRA - AGREEMENT		INTER - AGREEMENTS									
			OVERALL - AGREEMENTS		TIMING OF AGREEMENTS							
					Agreement with C/S specified in N1				Agreement with C/S specified in N2			
	Was a C/S specified in both reviews ?	δ_t Intra - agreement (segs)	Num. other experts recommending C/S max = 16	Num. reviews recommending C/S. Max = 32	Num. other reviews with C/S within (segs)			δ_t System (segs)	Num. other reviews with C/S within (segs)			δ_t System (segs)
					±1	±2	±4		±1	±2	±4	
2	YES	0	11	16	2	1	0	-	2	1	0	-
6	YES	0	16	31	31	0	0	0	31	0	0	0
9	YES	1	16	32	19	5	8	0	23	9	0	1
10	YES	1	16	30	6	4	16	4	9	7	14	3
13	NO	-	8	14	-	-	-	-	5	2	4	-
16	YES	2	16	31	4	2	1	-	5	1	1	-
17	YES	0	16	32	14	5	8	2	14	5	8	2
24	YES	1	15	28	17	5	3	-	22	2	2	-
29	YES	0	16	32	30	2	0	1	30	2	0	1
32	YES	2	13	24	3	2	10	-	10	5	4	-
35	YES	1	16	32	25	5	2	1	29	3	0	2
37	YES	1	15	24	17	0	0	-	16	1	0	-
38	YES	2	16	29	5	11	13	-	25	4	0	-
40	NO	-	16	30	14	4	5	6	-	-	-	-
43	YES	1	15	30	11	17	2	3	5	7	18	4
44	YES	1	16	31	9	5	10	-	13	9	7	-
48	YES	0	15	25	14	1	8	5	14	1	8	5

Detailed assessment of the cases recommended for CS by expert N.

Case Number	INTRA - AGREEMENT		INTER - AGREEMENTS									
			OVERALL - AGREEMENTS		TIMING OF AGREEMENTS							
					Agreement with C/S specified in O1				Agreement with C/S specified in O2			
	Was a C/S specified in both reviews ?	δ_t Intra - agreement (segs)	Num. other experts recommending C/S max = 16	Num. reviews recommending C/S. Max = 32	Num. other reviews with C/S within (segs)			δ_t System (segs)	Num. other reviews with C/S within (segs)			δ_t System (segs)
					±1	±2	±4		±1	±2	±4	
2	NO	-	11	17	1	4	1	-	-	-	-	-
3	YES	3	14	24	8	7	3	3	12	2	4	1
5	NO	-	6	9	3	1	2	-	-	-	-	-
6	YES	1	16	31	31	0	0	0	30	1	0	1
7	YES	3	6	7	2	2	3	-	4	1	1	-
9	YES	0	16	32	23	9	0	1	23	9	0	1
10	YES	1	16	30	18	4	7	0	12	6	10	1
16	YES	2	16	31	2	1	7	-	6	1	1	-
17	YES	4	16	32	9	2	16	5	18	0	4	1
24	YES	7	15	28	1	1	3	-	18	5	3	-
29	YES	1	16	32	30	2	0	1	30	2	0	0
32	YES	4	13	24	5	3	9	-	12	6	4	-
34	NO	-	4	5	4	1	0	-	-	-	-	-
35	YES	1	16	32	21	10	1	3	29	3	0	2
37	NO	-	15	25	17	1	0	-	-	-	-	-
38	YES	1	16	29	24	5	0	-	23	1	5	-
40	YES	5	16	29	3	3	5	1	11	12	5	4
43	YES	0	15	30	23	4	3	1	23	4	3	1
44	YES	0	16	31	6	8	14	-	6	8	14	-
48	YES	32	15	25	1	0	0	23	7	1	15	9

Detailed assessment of the cases recommended for CS by expert O.

Case Number	INTRA - AGREEMENT		INTER - AGREEMENTS									
			OVERALL - AGREEMENTS		TIMING OF AGREEMENTS							
					Agreement with C/S specified in P1				Agreement with C/S specified in P2			
					Num. other reviews with C/S within (segs)				Num. other reviews with C/S within (segs)			
	Was a C/S specified in both reviews ?	δ_t Intra - agreement (segs)	Num. other experts recommending C/S max = 16	Num. reviews recommending C/S. Max = 32	±1	±2	±4	δ_t System (segs)	±1	±2	±4	δ_t System (segs)
2	YES	2	11	16	0	0	0	-	0	0	1	-
3	NO	-	14	25	8	5	4	0	-	-	-	-
6	YES	0	16	31	31	0	0	0	31	0	0	0
9	YES	0	16	32	23	9	0	1	23	9	0	1
10	YES	2	16	30	19	9	2	1	10	6	14	3
16	YES	0	16	31	1	4	3	-	1	4	3	-
17	YES	1	16	32	9	8	3	0	17	0	5	1
19	YES	2	13	24	7	12	5	1	13	2	8	3
24	NO	-	15	29	-	-	-	-	23	2	2	-
29	YES	0	16	32	30	2	0	0	30	2	0	0
32	YES	1	13	24	5	5	8	-	9	6	4	-
35	YES	0	16	32	25	5	2	1	25	5	2	1
37	YES	0	15	24	16	1	0	-	16	1	0	-
38	YES	0	16	29	23	1	5	-	23	1	5	-
40	YES	1	16	29	17	2	6	5	13	4	5	6
43	YES	1	15	30	11	17	2	3	25	4	1	2
44	YES	2	16	31	2	7	13	-	14	8	7	-
48	NO	-	15	26	15	1	8	6	-	-	-	-

Detailed assessment of the cases recommended for CS by expert P.

Case Number	INTRA - AGREEMENT		INTER - AGREEMENTS									
			OVERALL - AGREEMENTS		TIMING OF AGREEMENTS							
					Agreement with C/S specified in Q1				Agreement with C/S specified in Q2			
					Num. other reviews with C/S within (segs)				Num. other reviews with C/S within (segs)			
	Was a C/S specified in both reviews ?	δ_t Intra - agreement (segs)	Num. other experts recommending C/S max = 16	Num. reviews recommending C/S. Max = 32	±1	±2	±4	δ_t System (segs)	±1	±2	±4	δ_t System (segs)
2	YES	6	11	16	1	2	2	-	0	2	2	-
3	NO	-	14	25	1	1	0	36	-	-	-	-
5	YES	12	6	8	0	0	0	-	2	1	1	-
6	YES	0	16	31	31	0	0	0	31	0	0	0
9	YES	1	16	32	26	5	1	2	23	9	0	1
10	YES	3	16	30	19	4	6	0	10	7	13	3
12	NO	-	3	4	1	0	2	-	-	-	-	-
13	YES	3	8	13	0	0	3	-	1	0	0	-
14	NO	-	0	0	0	0	0	-	-	-	-	-
16	YES	1	16	31	1	1	0	-	1	1	0	-
17	YES	2	16	32	6	3	2	7	9	1	17	5
18	NO	-	2	3	0	0	2	-	-	-	-	-
23	YES	8	0	0	0	0	0	-	0	0	0	-
29	YES	1	16	32	30	2	0	1	30	2	0	0
35	YES	0	16	32	25	5	2	1	25	5	2	1
37	NO	-	15	25	-	-	-	-	4	1	0	-
38	NO	-	16	30	-	-	-	-	5	12	13	-
40	NO	-	16	30	-	-	-	-	7	4	10	1
44	NO	-	16	32	14	9	7	-	-	-	-	-
48	NO	-	15	26	-	-	-	-	15	1	8	5

Detailed assessment of the cases recommended for CS by expert Q.

Case Number	INTRA - AGREEMENT		INTER - AGREEMENTS							
			OVERALL - AGREEMENTS		TIMING OF AGREEMENTS					
					Agreement for C/S of S1			Agreement for C/S of S2		
	Was a C/S specified in both reviews ?	δ_t Intra - agreement (segs)	Num. other experts recommending C/S max = 17	Num. reviews recommending C/S. Max = 34	Num. other reviews with C/S within (segs)			Num. other reviews with C/S within (segs)		
					±1	±2	±4	±1	±2	±4
3	YES	0	15	26	9	5	4	9	5	4
6	YES	0	17	33	33	0	0	33	0	0
9	YES	0	17	34	21	5	8	21	5	8
10	YES	0	17	32	20	4	7	20	4	7
17	YES	2	17	34	11	8	3	16	5	8
19	YES	0	14	26	10	6	9	10	6	9
29	YES	0	17	34	32	2	0	32	2	0
35	YES	1	17	34	11	16	7	27	5	2
40	YES	0	17	31	7	3	6	7	3	6
43	YES	0	16	32	18	7	6	18	7	6
48	YES	0	16	27	0	0	1	0	0	1

Detailed assessment of the cases recommended for CS by the system.

Case Number	INTRA - AGREEMENT		INTER - AGREEMENTS									
			OVERALL - AGREEMENTS		TIMING OF AGREEMENTS							
					Agreement with C/S specified in R1				Agreement with C/S specified in R2			
					Num. other reviews with C/S within (segs)				Num. other reviews with C/S within (segs)			
	Was a C/S specified in both reviews ?	δ_t Intra - agreement (segs)	Num. other experts recommending C/S max = 17	Num. reviews recommending C/S. Max = 34	±1	±2	±4	δ_t System (segs)	±1	±2	±4	δ_t System (segs)
2	YES	24	12	18	1	0	1	-	2	0	3	-
3	NO	-	15	26	0	0	0	15	-	-	-	-
4	NO	-	3	4	1	0	3	-	-	-	-	-
7	NO	-	7	9	0	0	0	-	-	-	-	-
8	NO	-	0	0	0	0	0	-	-	-	-	-
11	NO	-	0	0	0	0	0	-	-	-	-	-
13	NO	--	9	15	2	0	1	-	-	-	-	-
16	NO	-	17	33	1	1	2	-	-	-	-	-
21	NO	-	0	0	0	0	0	-	-	-	-	-
23	NO	-	1	2	-	-	-	-	1	0	0	-
31	NO	-	0	0	-	-	-	-	0	0	0	-
32	NO	-	14	26	-	-	-	-	0	0	0	-
34	NO	-	5	6	-	-	-	-	0	0	0	-
36	NO	-	0	0	0	0	0	-	-	-	-	-
39	NO	-	0	0	0	0	0	-	-	-	-	-
43	NO	-	16	32	2	16	11	1	-	-	-	-
44	NO	-	17	33	-	-	-	-	15	6	11	-
45	NO	-	0	0	-	-	-	-	0	0	0	-
49	NO	-	0	0	-	-	-	-	0	0	0	-

Detailed assessment of the cases recommended for CS by the plausible random numbers.