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The Partograph for the Prevention of Obstructed Labor

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Abstract: Obstructed labor is an important cause of maternal and perinatal mortality and morbidity. The partograph graphically represents key events in labor and provides an early warning system. The World Health Organization partographs are the best known partographs in low resource settings. Experiences with World Health Organization and other types of partographs in low resource settings suggest that when used with defined management protocols, this inexpensive tool can effectively monitor labor and prevent obstructed labor. However, challenges to implementation exist and these should be addressed urgently.
Key words: partograph, obstructed labour, maternal mortality, maternal morbidity, perinatal mortality, perinatal morbidity, low resource settings, World Health Organization

The partograph (or partogram) is a tool that graphically represents key events during labor. This tool is recommended for routine monitoring of labor to provide an early warning system. The partograph helps the care provider to identify slow progress in labor early, and to initiate appropriate interventions to prevent prolonged and obstructed labor.[1,2]

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Global Burden of Obstructed Labor

Obstructed labor occurs when there is a significant disproportion between the dimensions of the fetal presentation and the mother's pelvis during labor. Information on the incidence of and mortality from prolonged and obstructed labor is incomplete and patchy. The reported incidence of obstructed labor varies widely: from as low as 1% in some populations to up to 20% in others.[3] About 42000 deaths or 8% of all maternal deaths in 2000 were estimated to be due to obstructed labor.[3] Often, there is paucity of vital registration data in settings where obstructed labor and maternal deaths are common.[4] Moreover, when a woman dies as a result of obstructed labor, the death may not be so classified under the final cause of death. Death may be reported as caused by sepsis, ruptured uterus or hemorrhage rather than owing to the underlying cause,

which may be cephalopelvic disproportion or abnormal presentation. Use of proxy markers, like cesarean delivery rates or instrumental delivery rates, are no longer valid given the wide variations in these rates resulting from varying practices.[5,6]

Obstructed labor is an important cause of maternal morbidity. Obstetric fistula is a devastating yet often neglected injury that occurs as a result of prolonged or obstructed labor. Without surgical repair, the physical consequences of fistula are severe-urinary and/or fecal incontinence, fetid odor, frequent pelvic and/or urinary infection, pain, infertility, and often-early mortality. The social consequences of fistula are immense: these women are often ostracized from society, abandoned by husbands, families, and communities, destitute, and poor.[3] An estimated 2,951,000 disability adjusted life years were lost in 2000 owing to obstructed labor.[3]

Prolonged and obstructed labor is also associated with fetal hypoxia, birth trauma, and infection resulting in intrapartum or early newborn deaths and perinatal morbidity. Therefore, prevention of obstructed labor is an important intervention towards reducing maternal and perinatal mortality and morbidity, and in achieving the Millennium Development Goals 4 and 5.

Approaches for the Prediction of Obstructed Labor

Attempts have been made in the past to identify women at risk for obstructed labor. Short stature and small shoe size have been used as indirect markers of a small pelvis and potential cephalopelvic disproportion and thus as markers of risk of obstructed labor.[7] The predictive values of these criteria are too low to justify direct obstetric indication.[7]

External and internal pelvimetry, either by clinical measurements or by imaging techniques to identify women at high risk of obstructed labor are described in text books.[8,9] The x-ray pelvimetry has been found insufficiently predictive of fetopelvic disproportion to justify obstetric intervention and is associated with more cesarean sections and no improvement in perinatal outcomes.[10] Neither clinical nor ultrasound estimation of fetal weight have been shown to be effective in predicting obstructed labor.[7]

All these methods have poor predictive values, as the changes that occur in the dimensions of the fetal head and the maternal pelvis during labor cannot be successfully predicted by any of these screening methods. Labor is perhaps the best test for the diagnosis of disproportion. During labor, a decrease in the presenting dimensions of the fetal head brought about by increasing flexion, asynclitism and molding, and the increase in maternal pelvic dimensions through relaxation of pelvic joints (''give of the pelvis'') help to overcome many cases of cephalopelvic disproportion suspected before onset of labor.

Assessment of progress in labor should therefore identify those women who are less likely to deliver normally. Early diagnosis of slow progress and appropriate interventions should therefore help in preventing obstructed labor. The partograph (or partogram) is a simple tool that has been used for this purpose.

Historical Background

Friedman was the first obstetrician to describe the progress of labor graphically.[11] He reported the change in cervical dilatation occurring in labor. The progress was recorded in centimeters of dilatation per hour. The resulting graph was an S-shaped curve.

Philpott subsequently used this information to develop a tool initially referred to as cervicograph.[12–14] He used this tool in Zimbabwe (then Rhodesia) in an

attempt to use the service of midwives efficiently in the health services where doctors were in short supply. From this original cervicograph, Philpott developed a partograph, a practical tool for recording all intrapartum details, not just cervical dilatation.

Philpott subsequently added an "alert line". This was a straight line, not curved like Friedman's cervicographs, and was a modification of the mean rate of cervical dilatation of the slowest 10% of primigravid women in the active phase of labor. The alert line represented a progress rate of 1 cm per hour. The purpose of the alert line was "to aid the midwife in a peripheral unit…., or a general practitioner, midwife, or house surgeon in any hospital to detect at the earliest possible moment the abnormal labor".[14] Should a woman's cervical dilatation progress more slowly than 1 cm per hour, it would cross this alert line and arrangements made to transfer her from a peripheral unit to a central unit where slow progress in labor could be managed.

The next stage in the development of the partograph was the introduction of an "action line", 4 hours to the right of the alert line. This allowed "time to transfer the patient without impairing the success of the essential active management",[14] and also allowed "many normal patients to deliver vaginally without active intervention".[14] Appropriate action could include correction of primary inefficient uterine activity with an intervention such as amniotomy and/or oxytocin infusion.

Although the alert and action lines were originally designed for primigravidas, Philpott also used them in the management of the multigravidas, who normally progress more quickly than primigravidas. However as he noted, "The difference in application occurs at the time of crossing the action line, for the use of oxytocic augmentation can be hazardous in the multigravid patient".[14]

Hendricks et al[15] proposed designating time of arrival at hospital rather than reported time of onset of labor as 0 time and this concept has been included in the commonly used partographs. No differences in progress of cervical dilatation rates have been observed among the different racial groups studied[16]; therefore the basic concepts of the partograph are universally applicable.

Types of Partographs

Various types of partographs have been described. Preprinted paper versions of the partograph are available. In the absence of preprinted partographs, users have manually drawn key features of the cervicograph on blank paper and have successfully plotted progress of labor. Stencils with different cervical dilatation-time curves, constructed with reference to cervical dilatation on admission to the labor ward,[16] as well as circular partographs[17] and an electronic partograph (*www.epartograph.eu*) (P Gastaldi, personal communication) have been used for labor monitoring.

The way a partograph is presented may affect the user's perception of labor progress and thus influence the decision making.[18–21] Interventions are more likely if the slope of the labor progress curve seems flat[18,19] and if the latent phase is included.[18]

The alert and action lines must also satisfy 2 criteria: must be simple to use; must separate efficiently the majority of normal patients from the abnormal patients in sufficient time to transfer the latter safely to the central unit for treatment. The position of the action line has an impact on cesarean section, intervention, and maternal satisfaction. When compared with the 4-hour action line, the 2 hours action line increases the need for intervention without improving maternal and neonatal outcomes.[20–22]

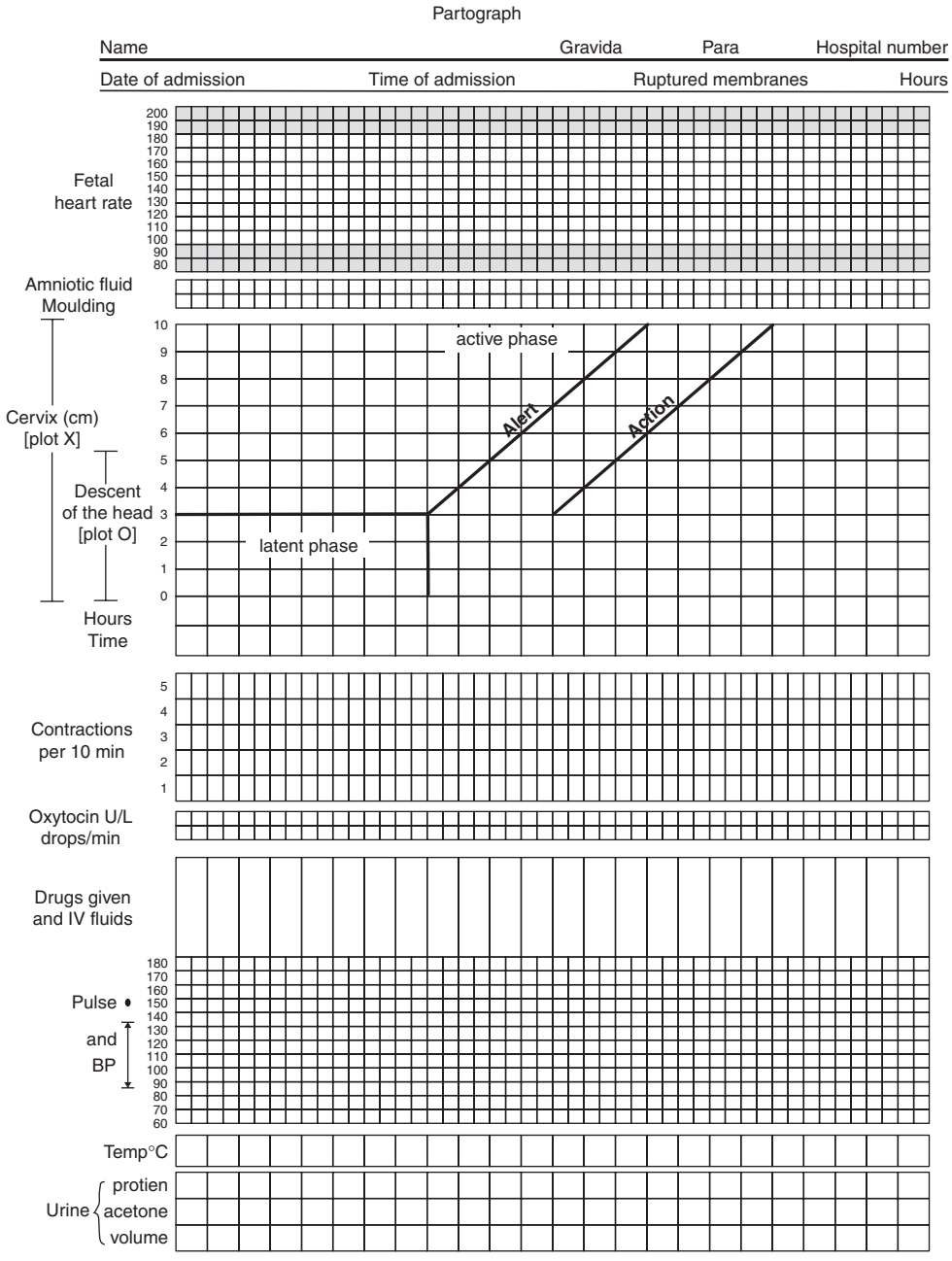

FIGURE 1. The "composite" World Health Organization partograph.[23]

WORLD HEALTH ORGANIZATION PARTOGRAPHS

The World Health Organization (WHO) partographs are probably the best known in most low resource countries and are therefore described in more detail. Since the 1990's, WHO has published 3 different types of the partograph.

- The first of these partographs[23] (the composite partograph) includes a latent phase of 8 hours and an active phase starting at 3 cm cervical dilatation (Fig. 1). The alert line with a slope of 1 cm per hour commences at 3 cm dilatation; the action line is 4 hours to the right of the alert line and parallel to it. This composite partograph also provides space for recording descent of the fetal head, indicators of maternal and fetal well-being and medications administered. Cervical dilatation is recorded on the partograph at each vaginal examination (usually once in 4 h). If the cervix is less than 3 cm dilated, the first recording of cervical dilatation (on the y-axis) is at 0 hour. If the cervix has dilated to 3 cm or more at the next examination, the next recording of cervical dilatation is made on the corresponding point on the alert line. The 2 points are then joined by a broken line to indicate transfer from latent phase to active phase. This partograph was used successfully in an international study of over 35000 women in South East Asia[23] (see details below).
- The modified WHO partograph for use in hospitals was published in 2000.[2] The latent phase was excluded in this partograph (Fig. 2). The active phase commences at 4 cm dilatation. The other features are the same as the composite WHO partograph. The reason for excluding the latent phase were that interventions are more likely if the latent phase is included and because staff reported difficulties in transferring from latent to active phase.[18,24,25] The choice of 4 cm was made to reduce the risk of interventions in multiparous women with patulous cervices (less than 4 cm) who were not yet in labor. A study of the modified WHO partograph in Wolisso Town, Ethiopia[26] concluded that labor could be managed without the latent phase being plotted on a partograph. However, a labor management protocol for the latent phase should be instituted with clear guidelines on the frequency of observations, as women with less than 4 cm cervical dilatation on first examination in labor are more likely to experience complicated deliveries. A study in Nigeria reported that labor progress and duration were similar for nulliparas and multiparas when monitored with the modified WHO partograph.[27]
- Further modification was made to develop the third WHO partograph for use by skilled attendants in health centers.[1] This simplified partograph is color coded (Fig. 3). The area to the left of the alert line in the cervicograph is colored green, representing normal progress. The area to the right of the action line is colored red, indicating dangerously slow progress in labor. The area in between the alert and action line is colored amber, indicating the need for greater vigilance. Cervical dilatation but not descent of the head is recorded on this graph, which is part of a labor record. Other indicators of maternal and fetal well-being are recorded elsewhere in the labor record. The composite WHO partograph and the simplified WHO partograph were compared in a cross over trial[28] in Vellore, India. The composite partograph was rated as less user-friendly than the simplified partograph. Although most maternal and perinatal outcomes were similar, labor values crossed action line significantly more often when the composite partograph was used and women were more likely to undergo cesarean delivery. The simplified partograph was more likely to be completed.

SOME OTHER PARTOGRAPHS

- A simplified round partogram was compared with the composite WHO partograph in Seno province, Burkina Faso.[17] The 2 most common errors in the utilization of the composite WHO partograph-incorrect recording at the initial examination and at the transition from latent to active phase were largely avoided with use of the round partogram. However this partograph is not widely used.
- A second-stage partogram has been described.[29] This is on the basis of descent and position of the fetal head. Normograms have been developed for nulliparous and multiparous women. The best scores are associated with occipito-anterior presentation and stations below + 1 cm.

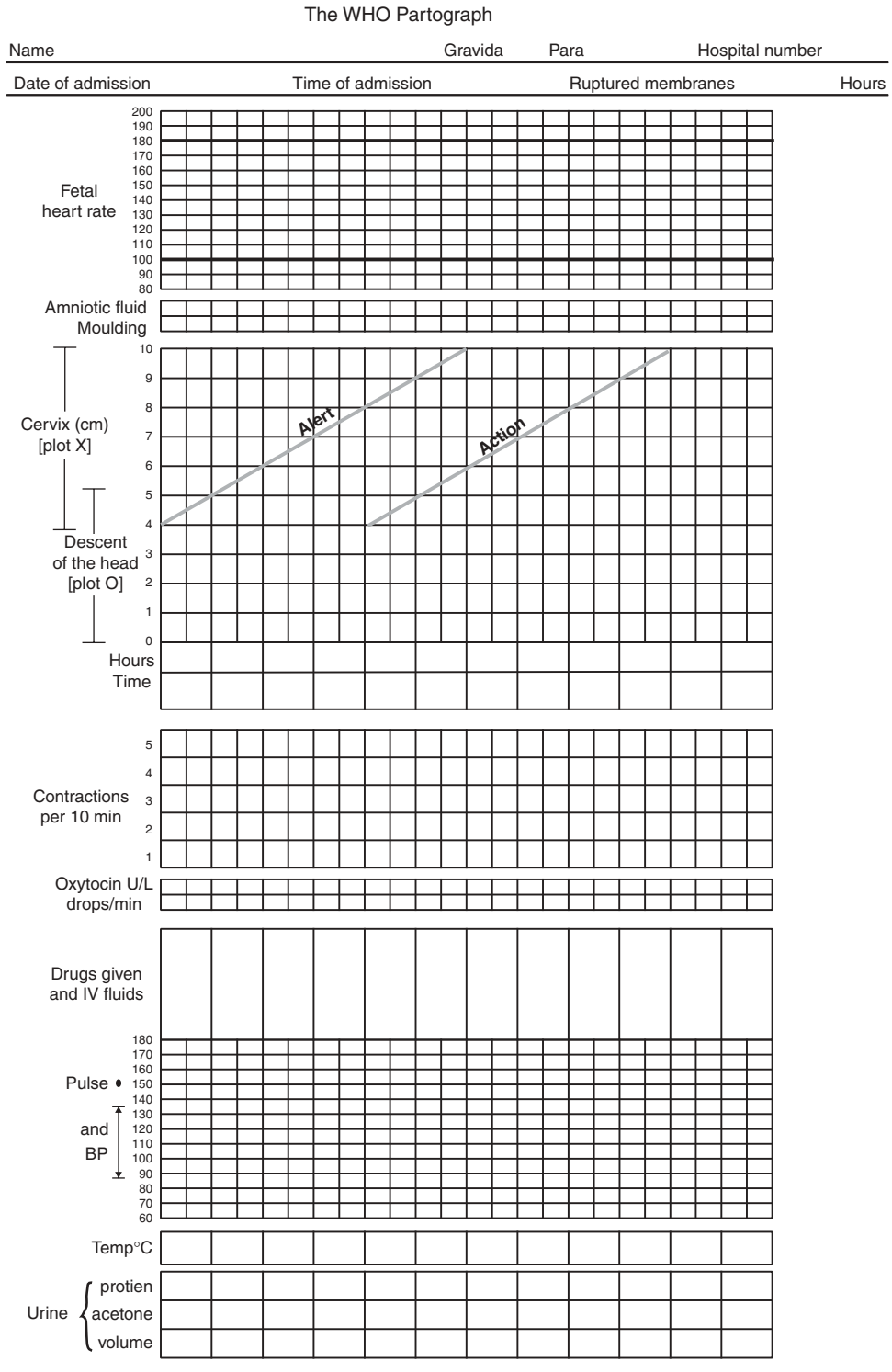

FIGURE 2. The "modified" World Health Organization partograph.[2]

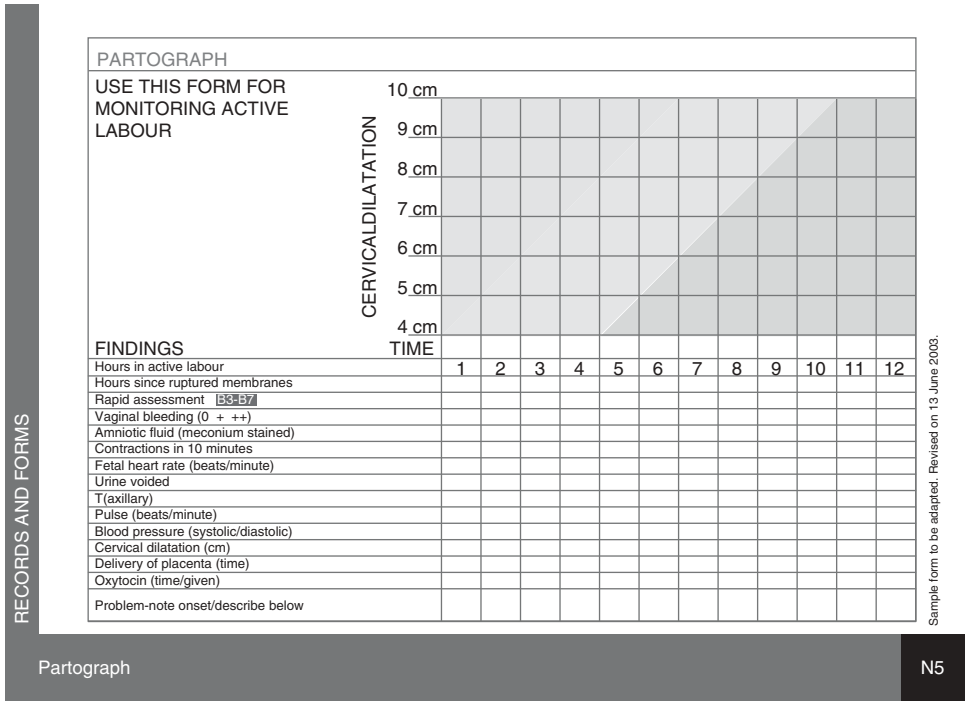

FIGURE 3. The "simplified" World Health Organization partograph.[1]

Increasing total scores at the start of the second-stage of labor were associated with increasing chance of spontaneous vaginal delivery (odds ratio (OR) 1.68 for nulliparas and 1.59 for multiparas), decreasing chance of instrumental vaginal delivery (OR 0.67 for nulliparas and 0.64 for multiparas), and emergency cesarean delivery (OR 0.39 for nulliparas).

- An electronic partograph (*www.eparto graph.eu*) is currently being evaluated (P Gastaldi, personal communication).

Experiences With the Partograph

Before any rigorous evaluation,[20] the availability of the partograph was considered an important advance in modern obstetrics that was applicable in all settings. There were several reports of its usefulness from low and high resource settings.[30–40] The majority of early studies took place in hospital settings. It was not until over 2 decades after Philpott's reports[12,13] that a very large field trial of the partograph was conducted by the WHO to establish its effectiveness.[23] The partograph used was the composite partograph (described earlier) based on the principles of Philpott's partograph.

In this prospective multicenter study, the composite WHO partograph was tested in 35,484 women in South East Asia. The study was conducted using an agreed management protocol on actions to be taken on the basis of partograph findings. This composite intervention reduced prolonged labor from 6.4% to 3.4% and the proportion of augmented labor from 20.7% to 9.1%. Emergency cesarean births decreased from 9.9% to 8.3% and intrapartum stillbirths from 0.5% to 0.3%. Among singleton low risk pregnancies, cesarean births fell from 6.2% to 4.5%.

The use of this partograph in breech presentations reduced prolonged labor and cesarean births (among multiparas), and improved perinatal outcomes.[41]

Another study aimed to assess the effectiveness of promoting use of the modified WHO partograph[2] by midwives conducting childbirth in maternity homes in Medan, Indonesia.[42] This cluster randomized trial included 20 midwives who regularly conducted births. Midwives in the intervention group were trained in the use of the partograph and advised to use it while providing care in labor. There were 304 parturient women in the intervention group and 322 in the control group. Referral rate in the partograph group increased (adjusted OR 4.2; 95% confidence interval (CI) 2.1-8.7) and there were decreases in vaginal examinations performed (adjusted OR 0.24; 95% CI 0.12-0.48), augmented (adjusted OR 0.21; 95% CI 0.12-0.36) and obstructed labor (adjusted OR 0.38; 95% CI 0.15-0.96). There were fewer cesarean births and neonatal resuscitation in the partograph group but the differences were not statistically significant.

A study in Tanzania[43] on the use of the partograph in 3 hospitals reported significantly lower Apgar scores and poorer maternal outcomes among women who had poor quality partograph-based monitoring. Five of the 7 perinatal deaths in this study occurred among women with poor partograph-based monitoring. There was a slight but statistically nonsignificant increase in cesarean sections among those who had poor monitoring. Positive maternal and perinatal outcomes were reported with the use of partograph from Nigeria.[44]

These findings lend support for the use of partograph in the routine management of labor.

OTHER BENEFITS OF THE PARTOGRAPH

Unlike other interventions in maternal health, use of the partograph does not require expensive technology, which may malfunction.

A picture is worth a thousand words. A partograph review (if well recorded) provides rapid, comprehensive information about progress in labor when compared with a review of detailed hand written case notes.

Midwives find the partograph to have practical benefits in terms of ease of use, time resourcefulness, continuity of care and educational assistance,[45] and these positive aspects may contribute to improving maternal and fetal outcomes. In contrast, it has also been reported that the partograph's status within some obstetric units is such that they may restrict clinical practice, reduce midwife autonomy and limit the flexibility to treat each woman as an individual, factors that could also impact on clinical and psychologic outcomes. Routine use of the partograph tends to assume that all women will progress in labor at the same rate, and this could increase interventions such as amniotomy and oxytocin augmentation, and use of analgesia resulting in a more negative labor experience.

Some have questioned the effectiveness of partographs, particularly when used in high-income countries.[46,47] Also, given that partographs were introduced to assist in rural settings with limited medical input and/or resources, the transferability of such a tool to high resource settings may need consideration.[48]

Evidence From Systematic Reviews

A systematic review by Lavender et al[48] aimed to determine the effect of using the partograph on perinatal and maternal morbidity and mortality, in addition to the effect of partograph design on outcomes. Randomized and quasi-randomized controlled trials involving comparisons of partograph with no partograph, and comparisons between different partograph

designs were included. The primary maternal outcomes were cesarean section; oxytocin augmentation; duration of first stage of labor (length of labor greater than 18 h, length of labor greater than 12 h) and negative experience of childbirth (as defined by trial authors). The primary outcome for the baby was low Apgar score (less than 7 at 5 min). A total of 5 studies involving 6187 women were included in the review.

PARTOGRAPH OR NO PARTOGRAPH

Two studies assessed partograph versus no partograph. There was no evidence of any difference between partograph and no partograph groups in cesarean section [risk ratio (RR) 0.64, 95% CI 0.24-1.70]; instrumental vaginal delivery (RR 1.00, 95% CI 0.85-1.17) or Apgar score less than 7 at 5 minutes (RR 0.77, 95% CI 0.29-2.06).

The larger of the 2 trials included in the systematic review was conducted in 2 sites in Toronto, Canada.[49] A total of 1932 primiparous women from 36 to 42 weeks gestation and cephalic presentations were randomized to 2 groups. In the standard care (control) group, labor progress was documented by standard sequential notes. Caregivers referred to these notes when deciding on interventions for slow progress in labor. In the partograph group, a partograph with a 2 hours alert line, but no action line, was used in addition to the standard sequential notes. Caregivers were requested to use the partograph as primary caregiver tool for following progress in labor and for counseling women about progress in labor and any proposed interventions. No mandatory action was required if progress was slow enough to cross the alert line but the authors advocated adherence to the guidelines of the Society of Obstetricians and Gynaecologists of Canada.

The trial was designed to demonstrate 25% reduction in cesarean delivery from 17% to 12.75% or lower. Among the 962 women in the standard care group and the 970 women in the partograph group, the cesarean delivery rates were 25% and 24%, respectively. No differences were reported in number of vaginal examinations, amniotomy, administration of oxytocin for augmentation, or significant neonatal or maternal morbidity. For the purposes of the systematic review, only data from 1156 women in spontaneous labor-560 in the partograph group and 576 in the control group were included in the analyses. The cesarean section rates in both groups were 13%.

There are possible explanations for false negative results that include the close monitoring of both groups and absence of mandatory interventions in either group and the Hawthorne effect. It is also possible that users may not have considered the partograph central to decision making. Use of the partograph is on the basis of the assumption that it facilitates the recognition of dystocia, thereby optimizing the timing of appropriate interventions, such as amniotomy, oxytocin augmentation or, most importantly, cesarean section. Therefore, the partograph may be effective only when it is part of a rigorously applied management protocol as in the case of the WHO trial in South East Asia.[23]

The second trial, from Mexico,[50] reported on only 3 outcomes relevant to the systematic review.[48] Overall the quality of this study was low.[48]

The results for this review were only pooled for the 3 specified outcomes. There were no significant differences between groups in cesarean section (RR 0.64, 95% CI 0.24-1.70, n = 1590, 2 trials); instrumental vaginal delivery (RR 1.00, 95% CI 0.85-1.17, n = 1590, 2 trials) or Apgar score less than 7 at 5 minutes (RR 0.77, 95% CI 0.29-2.06). There were high levels of heterogeneity for the results relating to cesarean section ($I^2 = 93\%$). The smaller study on 434 women in a resource-limited setting reported a reduction

in cesarean section rate with the partograph (RR 0.38; 95% CI 0.24, 0.61). In the high-resource setting,[49] there was no difference between groups (RR 1.03, 95% CI 0.82 -1.28).

DESIGN OF THE PARTOGRAPH

Among the trials included in the comparison of partograph designs, second[20,21] were from the same high resource setting (Liverpool, UK) whereas the third[51] was from a resource-limited setting (Pretoria, South Africa). In the high resource setting, women in the 2-hour action line group were more likely to require oxytocin augmentation than in the 4-hour action line group, (RR 1.14, 95% CI 1.05-1.22). When the 3-hour action and 4-hour action line were compared, cesarean section rate was lowest in the 4-hour action line group and this difference was statistically significant (RR 1.70, 95% CI 1.07-2.70, n = 613, 1 trial).

In the third study,[51] the objective was to compare labor outcomes using aggressive or expectant management protocols in healthy nulliparous women in active labor at term, with healthy singleton pregnancies in cephalic presentation. Women were randomized to either aggressive (n = 344) or expectant (n = 350) management protocols. Aggressive management entailed using a single line partograph, a vaginal examination every 2 hours and use of oxytocin if the line was crossed. Expectant management entailed using a 2-line partograph, with the alert line and a parallel action line 4 hours to the right, with a vaginal examination every 4 hours. If the action line was reached, oxytocin was started and women were reassessed every 2 hours thereafter.

The main outcome measures were mode of birth, use of oxytocin, analgesia, and neonatal outcome. Significantly fewer women managed aggressively had cesarean deliveries (16%) than those managed expectantly (23.4%) (RR 0.68; 95% CI 0.5-0.93). Oxytocin was used significantly more often in the aggressive management group but there was no difference in use of analgesia or Apgar scores. Compliance by staff was poor in the aggressive management group. Thus whereas aggressive management reduces cesarean deliveries in low resource settings, it requires more intensive midwifery care.

Should the Partograph be Recommended for Prevention of Obstructed Labor?

On the basis of results of the systematic review, Lavender and her colleagues[48] concluded that given the limited number of trials in this area and the heterogeneity, it was difficult to offer any recommendations for the routine use of the partograph or the use of specific types of partograph. In developed countries, the focus of management in labor concentrates on early identification and management of dystocia to offer interventions and avoid cesarean section.[49] What do the conclusions of the systematic review mean for developing countries where the focus of managing labor is on preventing maternal and perinatal death related to prolonged labor?

The partograph has its origins in Africa, a continent where access to skilled care in childbirth has been limited. Currently only 46.5% of births in the African continent are managed by skilled attendants, but there are wide regional variations in coverage rates.[52] Prolonged and neglected labor is common in these settings as are its consequences-high maternal mortality and morbidity, including obstetric fistula.

As already discussed, data from the largest study of the partograph in low resource settings[23] which reported beneficial effects, were not available for further evaluation. The 2 studies[50,51] from low resource settings included in the systematic review showed a statistically significant difference in cesarean section rates which merits further studies on the

role of the partograph in low resource settings. None of these studies reported any harmful outcomes related to use of the partograph.

REQUIREMENTS FOR IMPLEMENTATION

The partograph requires no major capital investment or expensive maintenance. The only resource required is a skilled attendant. Coverage of births by skilled workers is increasing in many low resource settings.[52] A skilled attendant is competent to record the progress of labor, interpret the findings and act appropriately when required. Appropriate actions may vary depending on the setting-augmentation of labor, operative delivery or just timely referral to a higher level of care. Standard management protocols on the actions to be taken on the basis of partograph that are available for use at first and referral level[1,2] and should be used to help in decision making.

Training (including use of a self-directed learning program) improves the ability of midwives to interpret partographs.[53] The use of the partograph should be an integral part of preservice midwifery and obstetric training. Midwifery and obstetric teachers should ensure that partographs are used routinely in all teaching facilities. A midwifery-training module on use of the partograph is available.[54]

Regular supervision and monitoring of use of the partograph and delivery outcomes are important for better implementation. Routine reviews of all partographs provide opportunities for individual and group learning and to implement changes in practices. If it is not possible to review all partographs, at least all partographs from cases of operative deliveries, intrapartum stillbirths, and asphyxia related neonatal deaths or morbidity, severe maternal morbidity and mortality, should be reviewed.

Lack of use of the partograph was identified as a prominent avoidable factor in deaths from sepsis and hemorrhage in South Africa.[7] One of the recommendations from the confidential reviews in maternal deaths was that correct use of the partograph should become a norm in all institutions and that a quality assurance program should be implemented.[55] The implementation strategy should also include policy level interventions to ensure that quality assurance activities are included in the key performance indicators of program managers.

CHALLENGES TO IMPLEMENTATION

Although the partograph is a simple and inexpensive tool, it is not as widely implemented, as it should be. Studies from Nigeria[56,57] reported that only 25% to 33% of caregivers surveyed were using the partograph for routine monitoring. Use of the partograph was more in tertiary level facilities and less at primary and secondary levels[57] where early identification of labor problems are perhaps more important.

Caregivers may resist using the tool if they have insufficient knowledge and do not fully understand why they have been asked to use the tool. Only one third of care givers surveyed in Nigeria[56,57] had sufficient depth of knowledge about the partograph.

Nonavailability of preprinted partographs has also been reported as a cause for nonutilization.[56] Preprinted partographs, whereas useful are not a must. Well-motivated caregivers have worked well with hand-drawn cervicographs.

Caregivers may be asked to first record their detailed findings elsewhere in the case notes and then fill in the partograph. Filling the partograph is seen as an additional chore for a busy health worker in such a situation and may not be motivated to complete the partograph.

Challenges to the implementation of the partograph, including insufficient

knowledge, nonavailability of preprinted partographs and workload pressure, could be addressed with further education on the purpose of the partograph and local managerial support.

SUMMARY

The partograph is an inexpensive and accessible tool that can effectively monitor the progress of labor. Further research should be carried out to understand the role of the partograph on outcomes of labor in different settings. Further analysis of partograph design should also be undertaken. However, until there is strong evidence of harms outweighing the potential benefits of this tool in the prevention of prolonged and obstructed labor, the partograph with the 4-hour action line and an agreed management protocol should be used routinely whereas providing care during labor.

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