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## Human fetal transcutaneous pO<sub>2</sub> during paracervical block

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Paracervical block is a controversial method for obstetrical analgesia, warmly advocated by some groups but abandoned or even forbidden by others because of its inherent risk for fetal bradycardia and asphyxia. In Sweden about 6000 women in labour are given paracervical block each year. An extensive survey of the literature failed to reveal any specific negative factors [4]. In a study of the biochemical changes of maternal and fetal blood during paracervical block fetal bradycardia was encountered in 50 per cent and was strongly correlated to maternal hyperventilation [2]. The apparently final condemnation of the technique came when a fall in fetal transcutaneous pO<sub>2</sub> (tcpO<sub>2</sub>) was noted in all the ten cases studied [1]. If fetal tcpO<sub>2</sub> always falls after paracervical block additional negative factors, such as placental insufficiency or maternal hyperventilation would reduce fetal oxygenation below a critical threshold. Because of the importance of the problem and our experience with the fetal tcpO<sub>2</sub> technique we repeated these studies:

### 1 Material and methods

Ten healthy term women between 20 and 36 years of age who wanted analgesia were randomly selected. Seven were nulliparae. In all the women pregnancy had been uncomplicated and labor was normal at the time of application of the paracervical block. The block was applied at a cervical dilatation of 4–6 cm. Three times the blocks were repeated at a dilatation of 6–8 cm.

### Curriculum vitae

BOTH BOEL STÅLNACKE and RUTH JACOBS are midwives. In Sweden, during the last couple of years midwives and nurses have been given better opportunity to do research and they may also obtain a doctors degree.

BOEL STÅLNACKE was born in 1950 and finished school in 1969. The same year she entered the Samariterhemmet School for Nursing in Uppsala and became registered nurse in 1972. In 1974 she finished her training at the Örebro School of Midwifery. Since then she is midwife at the Department of Obstetrics and Gynaecology, University Hospital, Uppsala, Sweden.



Bupivacaine 10 ml 2.5 mg/ml (0.25 per cent) without epinephrine was used. 2.5 ml were given in two injections on each lateral side of the cervix at the 2, 4, 8, and 10 o'clock positions. Using a short KOBAK needle the depth of the injection was 2 mm. Immediately after the paracervical block was given the patients were turned from the supine to the left lateral position. Fetal heart rate and intrauterine pressure were monitored. Fetal tcpO<sub>2</sub> was also monitored using the technique recommended by HUCH et al. [4]. The four signals, fetal heart rate, fetal tcpO<sub>2</sub>, "flow" and intrauterine pressure were recorded on the same chart with a speed of 1 cm/min. "Flow" is defined as the relative changes in the energy needed to maintain the

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O<sub>2</sub> electrode at 44 °C, and it indicates the changes in the blood flow under the electrode. The "Flow" curve has been followed in order to ascertain the correctness of fetal tcpO<sub>2</sub> monitoring and for detailed analysis of the tcpO<sub>2</sub>.

The informed consent was obtained from all the mothers, and fathers, when present. The investigation was approved by the Ethical Committee of the Medical Faculty, University of Uppsala. No complications due to fetal tcpO<sub>2</sub> monitoring was seen. One minute APGAR score was  $\geq 8$  in all the infants.

## 2 Results

Similar results to those illustrated in Figs 1 and 2 were seen in 12 of the 13 paracervical blocks administered. An increase in fetal tcpO<sub>2</sub> at the onset of the contraction was followed by a drop beginning 50–60 seconds later. No fetal heart rate changes were seen. Tab. I shows the fetal tcpO<sub>2</sub> level before and the lowest level within 15 minutes after paracervical block. The slightly lower values noted after the block were not significant and were probably due to the longer observation time after than before the block. With the marked

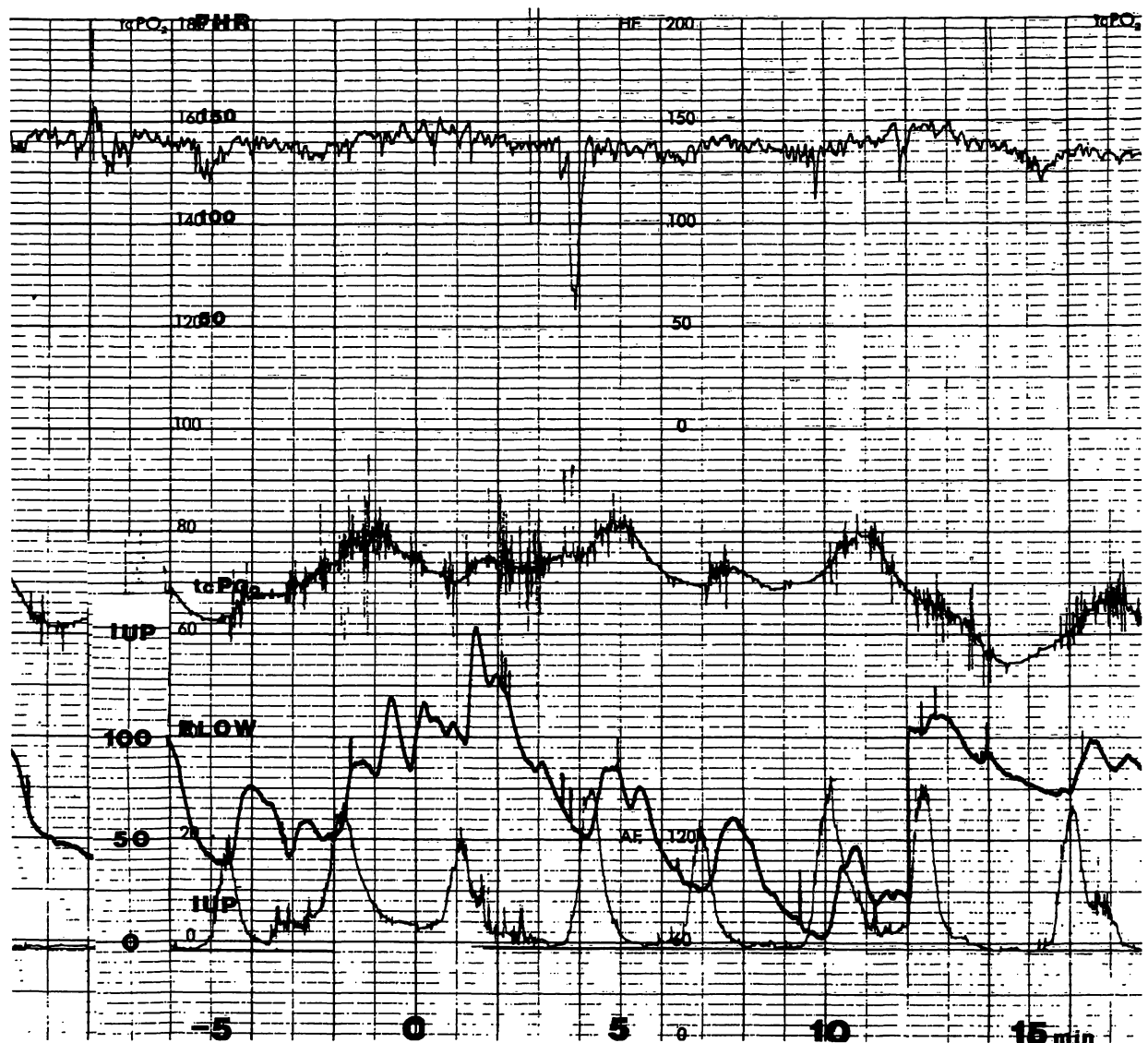


Fig. 1. The curves are read from top to bottom: 1. fetal heart rate, 2. fetal transcutaneous pO<sub>2</sub>, 3. "Flow" and 4. intrauterine pressure. The paracervical block was given at time 0. Fetal tcpO<sub>2</sub> shows distinct changes with the contractions.

Tab. I. Fetal tcpO<sub>2</sub> level before and after paracervical block.

Case no.	Before mm Hg	Lowest level within 15 min after block mm Hg
1	23	20
2	18	14
3	19	17
4	15	16
5	13	12
6	12	12
7	19	23
8	13	14
9	11	8
10	11	11
9	3	2
10	17	8
	19	18

changes in fetal tcpO<sub>2</sub> a lower nadir is more likely to be found if the recording time is more prolonged. The level in Case no. 9 was low but the normal changes in fetal tcpO<sub>2</sub> during contractions were present. The low level is attributed to stasis in the fetal scalp resulting in insufficient blood flow under the electrode. In case no. 10 (Fig. 3) fetal tcpO<sub>2</sub> fell consistently for 10 minutes after the paracervical block. The total drop was 10 mm Hg. However, a repeated block one hour later revealed no tcpO<sub>2</sub> fall. Clinically only one patient hyperventilated.

### 3 Discussion

The difference between the results from the previous series [1] of healthy mothers at term moni-

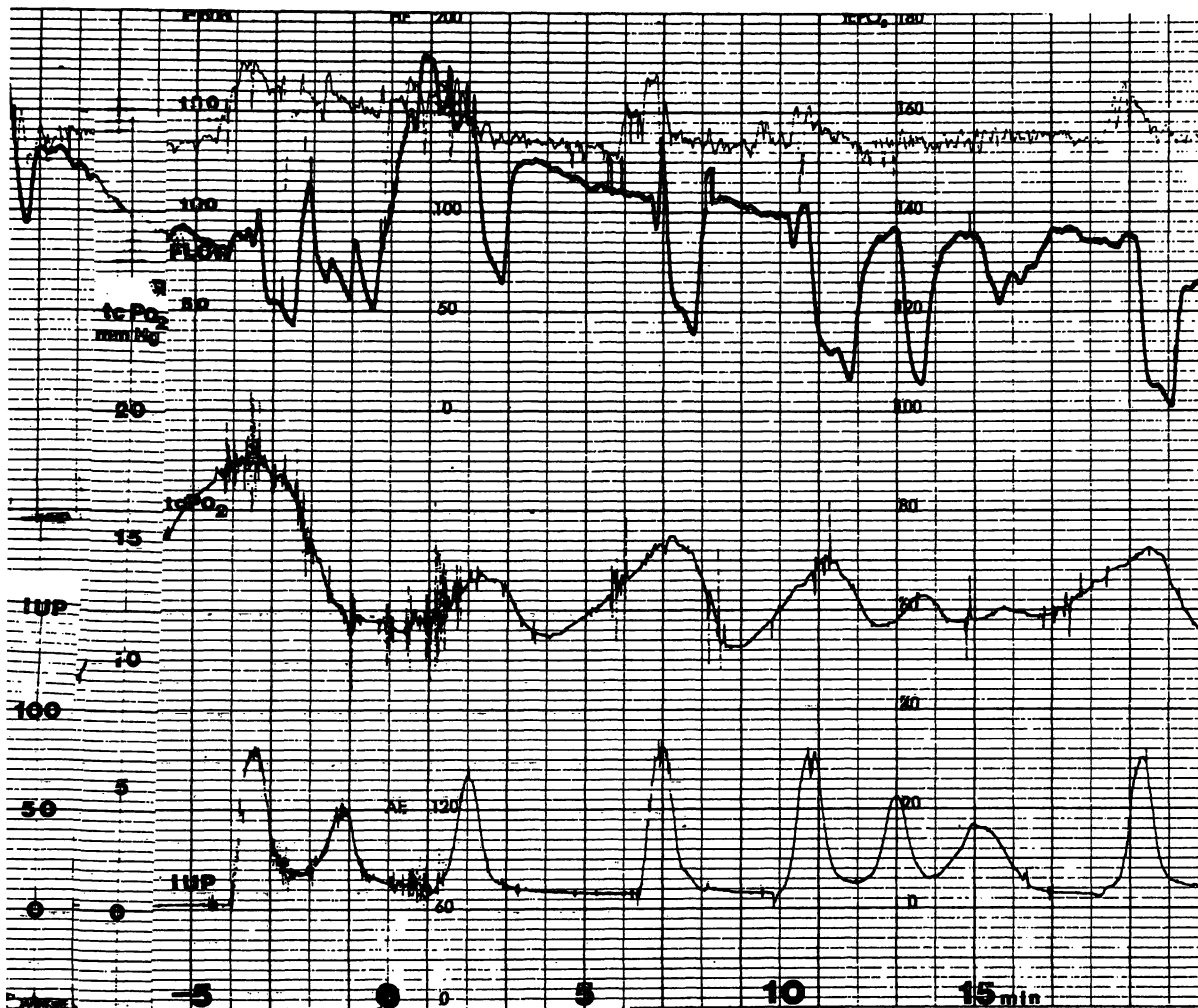


Fig. 2. The curves are read from top to bottom: 1. Fetal heart rate, 2. "Flow", 3. fetal transcutaneous pO<sub>2</sub>, 4. intrauterine pressure. Fetal tcpO<sub>2</sub> fell by 6 mm Hg before the paracervical block, but then remained at the same level, with waves corresponding to the contractions.

tored by fetal transcutaneous pO<sub>2</sub> and the present one suggest that the hazard of paracervical block lies not in the method, *per se*, but rather in the technique of inducing block. In their survey THIERY and VROMAN [4] tabulated different drugs and dosage, as well as the incidence of fetal bradycardia. The lowest dose of bupivacaine in their report was 100 mg whereas only 25 mg was used in our study and was found sufficient for adequate analgesia. When 200 mg of lidocaine was administered by BAXI et al. [1] fetal tcpO<sub>2</sub> fell in all the ten patients. With the use of only half this dosage, i.e. 100 mg, fetal bradycardia was noted in half of the cases [2]. If the fall in fetal oxygena-

tion is dose related – which seems reasonable to assume although as yet not proven – the results of BAXI et al. [1] are not surprising.

In this study the following steps have been considered in order to reduce the risk of fetal distress after paracervical block:

1. The minimal effective dose of bupivacaine was used.
2. Administering the same total dosage in four injections instead of two diminished the risk of achieving toxic blood concentrations. The superficial injection technique also reduces the risk of intravascular injections.

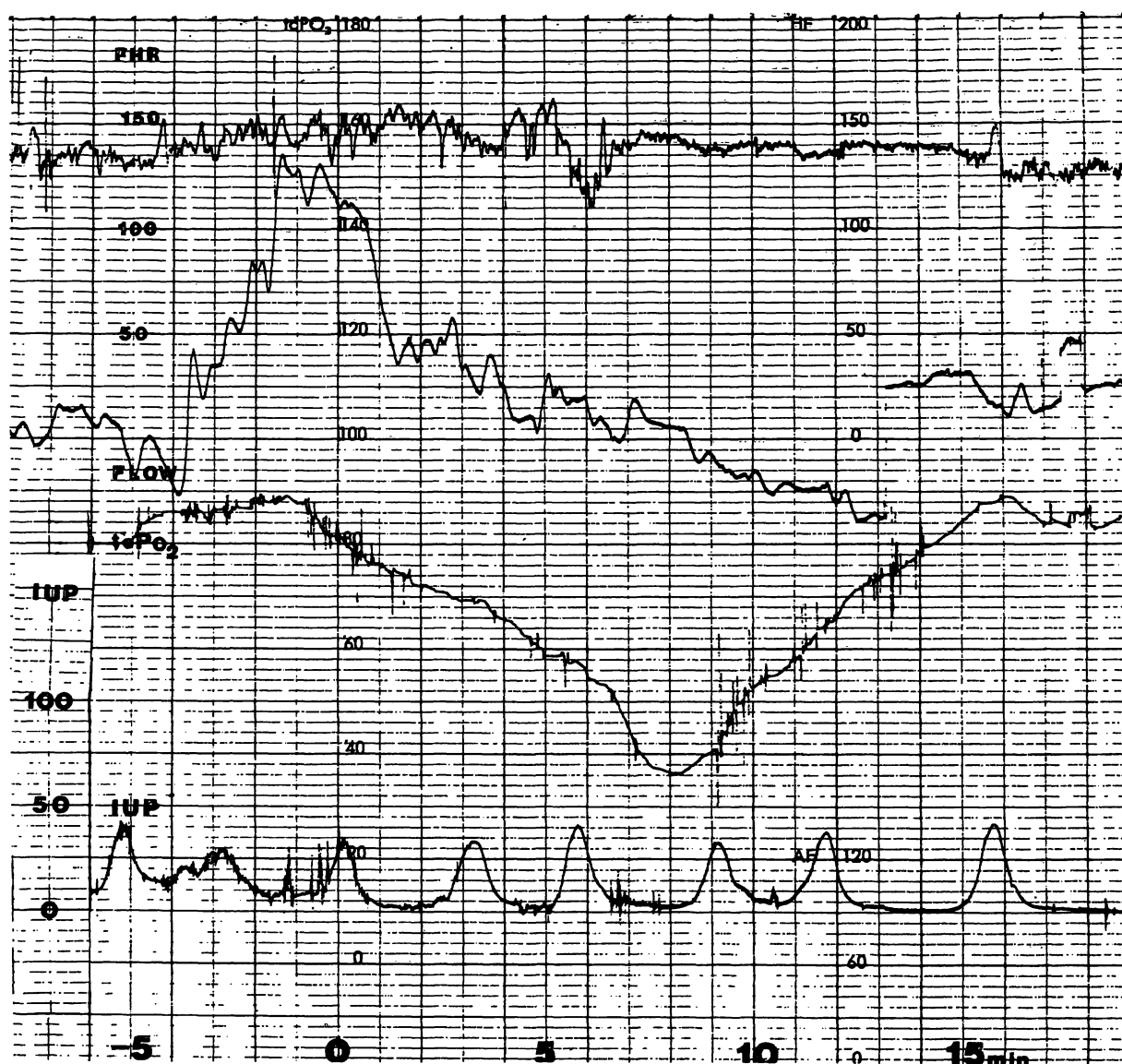


Fig. 3. The same sequence of channels as in Fig. 2. Note the consistent fall in fetal tcpO<sub>2</sub> after the paracervical block.

3. Since the supine position often reduces the oxygenation of the fetus the parturients were kept supine as little as possible.

4. Paracervical block was only given to healthy mothers with normal pregnancies and uncomplicated labor.

It seems likely to us that the difference in the result thus is a question mainly of the dosage of the drug, and that we in 12 of the 13 cases were

below the danger level. By giving the injections in four instead of in two injections the risk of toxic reactions should be reduced by a factor of four. However it would hardly be ethical to test a dose response relationship.

The results of this study neither recommend nor discredit the use of paracervical block; they indicate that the technique should be further evaluated.

### Summary

The transcutaneous fetal pO<sub>2</sub> monitoring technique is suitable for studying the influence of analgesia during labor. In spite of the universal fall in fetal transcutaneous pO<sub>2</sub> (tcpO<sub>2</sub>) reported in the recent publication, we decided to repeat the study. Paracervical block was given 13 times to 10 mothers. A fall in fetal tcpO<sub>2</sub> was seen only once. Furthermore, a repeat block one hour later

in the same mother resulted in no decrease in fetal oxygenation. No fetal heart rate changes were noted. The analgesic effect was good. By systematic monitoring, including the transcutaneous technique it should be possible to eliminate some of the adverse factors encountered in paracervical block analgesia thereby making this convenient technique less hazardous.

**Keywords:** Fetal transcutaneous pO<sub>2</sub>, paracervical block, transcutaneous technique.

### Zusammenfassung

**Der transcutane pO<sub>2</sub> beim menschlichen Feten während eines paracervikalen Blicks**

Wir halten die Aufzeichnung des transcutanen fetalen pO<sub>2</sub> für geeignet, den Einfluß der Analgesie während der Wehen zu untersuchen. Obwohl in neueren Publikationen wiederholt von einem generellen Abfall des transcutanen pO<sub>2</sub> berichtet wird, entschieden wir uns, die Untersuchung zu wiederholen. Wir setzten 13 Mal bei 10 Frauen einen paracervikalen Block. Nur einmal erfolgte ein Abfall des fetalen tc-pO<sub>2</sub>. Darüberhinaus stellten wir fest,

daß auch ein wiederholter paracervikaler Block bei der gleichen Patientin keine Verschlechterung der fetalen Oxigenierung zur Folge hatte. **Bezüglich der fetalen Herzfrequenz registrierten wir keine Veränderungen.** Der analgetische Effekt war gut. Durch ein systematisches Monitoring einschließlich der transcutanen Messungen sollte es möglich sein, rechtzeitig seine Aufmerksamkeit auf kritische Faktoren im Zusammenhang mit der Analgesie durch einen paracervikalen Block zu lenken, damit diese an sich geeignete analgetische Technik weniger gefährlich wird.

**Schlüsselwörter:** Fetaler transcutaner pO<sub>2</sub>, paracervikaler Block, transcutane Messung.

### Résumé

**pO<sub>2</sub> transcutanée du foetus humain lors des blocs paracervicaux**

Les techniques de surveillance de la pO<sub>2</sub> foetale transcutanée sont appropriées pour étudier l'influence de l'analgésie pendant le travail. Malgré la chute universelle de la pO<sub>2</sub> foetale transcutanée (pO<sub>2</sub> tc) rapporté dans les publications récentes, les auteurs ont décidé de recommencer l'étude. Un bloc paracervical a été réalisé 13 fois chez 10 mères. Une chute de la pO<sub>2</sub> tc foetale n'a été

observée qu'une fois. En outre, la répétition du bloc une heure après chez la même mère n'a pas entraîné de diminution de l'oxygénation foetale. Il n'a pas été observé de modifications du rythme cardiaque foetal. L'analgésie a été satisfaisante. Il devrait être possible d'éliminer certains des effets nocifs liés à l'analgésie par bloc paracervical par un monitoring systématique, incluant cette technique transcutanée, et de cette façon, de rendre cette méthode adaptée, moins hasardeuse.

**Mots-clés:** Bloc paracervical, pO<sub>2</sub> transcutanée, technique transcutanée.

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