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Intramuscular pethidine (meperidine) during labor associated with metabolic acidosis in the newborn

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1 Introduction

Intramuscular pethidine (meperidine) is one of the most common anesthetic agents used during labor in Finnish obstetric units. Paracervical blockades (PCB) are performed only by trained obstetricians. Intramuscular pethidine has been claimed to associate with neonatal hypercapnia and acidosis [5]. Fetal bradycardia and acidosis have been reported to occur frequently after PCB [6], but less frequently with smaller doses and more superficial application [4]. The present study was performed to determine, if the above mentioned two methods have any effect on FHR patterns and on umbilical vein respiratory gas values. Forty-eight percent of the parturients in our hospital receive no anesthetic agents at all and they provide a useful control group.

2 Patients and methods

Among 600 consecutive deliveries, there were 209 singleton nonoperative vaginal deliveries, for which umbilical vein analyses were performed and of which 27 received one dose (50 mg or 75 mg) of intramuscular pethidine, 47 received one PCB (3 ml of 0.5% marcaine both sides of the cervix with a Kobak's needle and less than 5 mm injection depth), and 135 had no anesthetic medication. The intramuscular pethidine injections were given by midwives, and PCBs were performed by two experienced obstetricians, if they were available. Both medications were used when cervical dilatation was 3 to 6 cm and they were avoided during last two hours of labor.

An ultrasound examination at gestational week 15 to 20 was performed for 80% of patients and the gestational weeks were corrected according to the result. An antepartum analysis of FHR variability at gestational weeks 36 to 38 was performed for 166 fetuses [3]. The labors of 179 patients were monitored by cardiotocography (CTG) throughout labor first with abdominal fetal electrocardiography (FECG) and after rupture of the membranes with direct FECG. The parturients were allowed to walk for short periods according to their own wish and they were disconnected from the monitors during ambulation. Cardiotocographs were conventional Hewlett-Packard 8030 A-monitors. They were connected with two special-purpose computers, by which the FHR variability was computed and printed in ten-minute periods [1]. These computers calculate the long term variation of FHR as the interval index and the short term variation as the differential index [7]. The visual evaluation of the CTG-tracings was performed by the first author. The number of late and variable decelerations was recorded. No attempt was made to evaluate the FHR variability visually.

The umbilical vein blood samples were drawn by the midwives to preheparinized syringes within one minute of birth. The samples were analyzed within 15 minutes by a Corning(R) autoanalyzer, which printed pH, pO2 (kPa), pCO2 (kPa), HCO3 (mmol/l) and BE (mmol/l).

All these measured parameters and 24 other clinical data obtained from the obstetric records were stored in the memory of a computer (Honeywell DPS 8) in the Computing Center of the Helsinki University Central Hospital. The data were handled by the BMDP software analysis system of University of California. The program computed the interval and differential indices for the last hour and for the five previous hours separately. The comparison of the means for continuous parameters was performed by the analysis of variance and the significance level was estimated by the Bonferroni test for multiple comparisons. The frequencies of the nominal parameters were compared with Pearson chi-square with Yates' correction.

3 Results

The three groups did not differ significantly in terms of gestational week at birth, birth weight, placental weight, placental/birth weight ratio, smoking and alcohol consumption habits, head circumference of the newborn, intra- and antepartum FHR variability and number of decelerations in the intrapartal CTGs. The incidence of low (< 8) Apgar scores was similar in all groups. The duration of labor was shortest in the control group, but there was no difference in duration of labor of the two anesthesized groups (table I). Umbilical vein pH in the pethidine-group was lowest (7.33 ± 0.08) when compared with the controls (7.38 ± 0.07) and the PCB-group (7.38 ± 0.07). The standard bicarbonate of the pethidine group was as well lower (19.1 ± 2.3 mmol/l) than that of the control group (21.0 ± 2.0 mmol/l) and that of the PCB-group (21.5 ± 2.5 mmol/l). Base excess, again, was lowest in the pethidine group (− 5.2 ± 2.9 mmol/l) when compared with the controls (− 2.9 ± 2.5 mmol/l) and the PCB-

Table I. The clinical data of three groups of pregnancies: controls without any medication for pain relief, those having received one intramuscular dose of pethidine and those having received one paracervical blockade.

	Controls	Pethidine	PCB
N	135	27	47
Gestation week at birth	40.3 ± 1.2	40.7 ± 1.1	40.3 ± 1.4
Birthweight (g)	3714 ± 508	3615 ± 449	3832 ± 554
Placental weight (g)	562 ± 105	529 ± 108	574 ± 118
Placental/birthweight ratio (%)	15.1 ± 2.1	14.7 ± 2.2	15.1 ± 2.4
Smokers (%)	18	28	7
Alcohol consumers (%)	10	18	6
Head circumference (cm)	35.0 ± 1.2	34.7 ± 1.7	35.1 ± 1.5
Antepartum DI	6.1 ± 2.1	6.7 ± 1.8	6.5 ± 3.0
(N)	(103)	(24)	(39)
Intrapartum DI (1st stage)	5.9 ± 1.8	5.9 ± 1.6	5.2 ± 1.3
Intrapartum DI (2nd stage)	6.2 ± 2.0	6.4 ± 1.8	5.7 ± 1.6
Late decelerations (%)	27	41	32
Variable decelerations (%)	47	44	60
Apgar score < 8/1 min age (%)	3.7	3.7	2.1
Duration of labor (h)	6.2 ± 3.3	9.7 ± 4.5**	8.5 ± 4.5*

Abbreviations: PCB = paracervical blockade, DI = differential index [7].
Significance levels: * = $p < 0.05$, ** = $p < 0.01$

group (− 2.4 ± 2.7). The partial oxygen tension in the pethidine-group (3.5 ± 0.7) was lower than that in the control group (3.9 ± 0.8) ($p = 0.0095$ by pooled t-test), but did not reach significance after Bonferroni's correction of multiple comparisons. The partial carbondioxide tensions of the three groups did not differ ($p = 0.2 - 0.4$). Distribution of the results of the umbilical gas analyses is shown in figure 1.

4 Discussion

The present study indicates that usage of intramuscular pethidine during labor is associated with metabolic acidosis in the newborn, estimated by umbilical vein gas analysis. The partial pressure of carbon dioxide in the umbilical vein is not significantly elevated, as would be expected on the basis of another study [5]. We have shown previously, that intramuscular pethidine during labor is followed by a decreasing long term variability of FHR [2], with a maximum change at forty minutes after the injection. The present study shows that this effect does not reflect in the mean values of FHR variability. Although the control group had the shortest duration of labor when compared with two other groups, there was no difference in duration of labor of the latter. Hence the duration of labor cannot solely explain the metabolic acidosis observed after pethidine injections. None of the newborn was severely acidotic (all pHs > 7.10) and the distribution of gas values shows, that the differences of means observed are based on many low values in the pethidine group. The differences may not have clinical importance during normal labors, but pethidine injections may have ominous effect on depressed fetuses.

The choice between the anesthetic method was dependent upon the availability of the obstetrician to perform PCB, hence the method was not randomly selected. **The result suggests that a randomized test between PCB and intramuscular pethidine should be performed.** Our clinical conclusion from the present study is, that PCB should be preferred to intramuscular pethidine, if a trained person to perform the blockade is available. We are also testing other intramuscular anesthetic agents instead of pethidine.

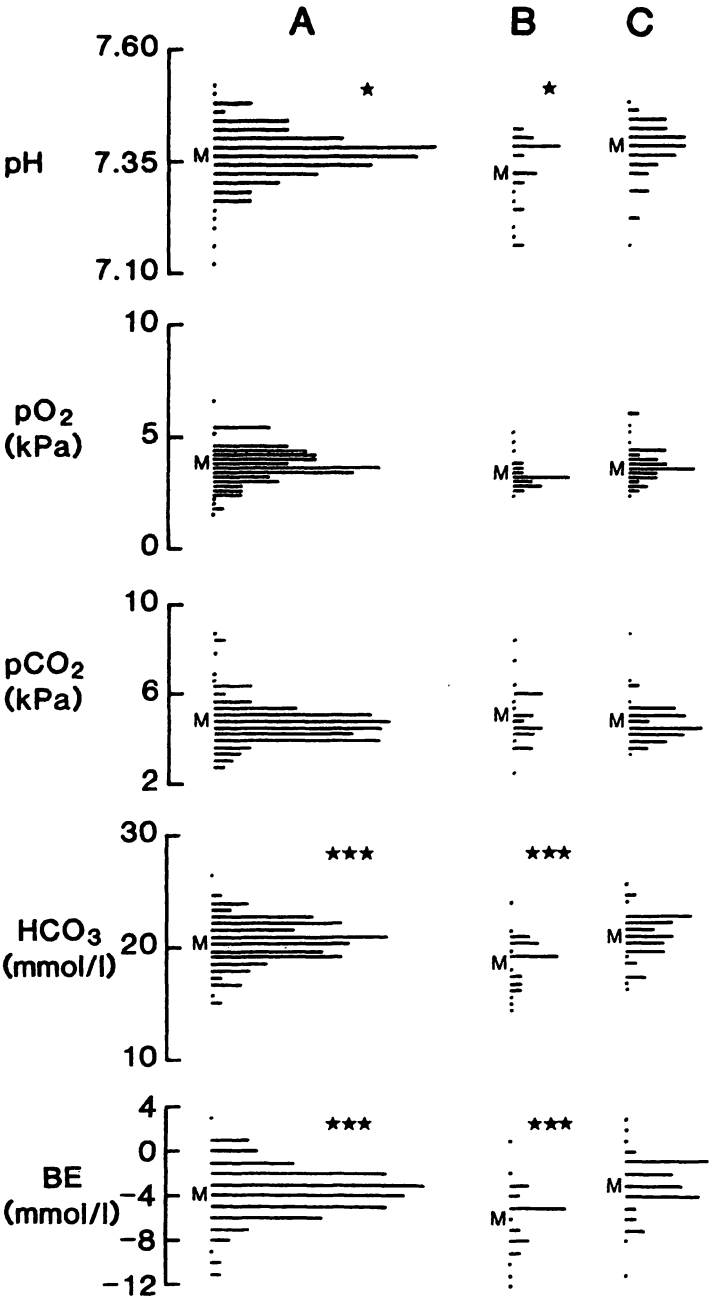

Figure 1. Distribution of values in the respiratory gas analysis of the umbilical vein in three groups of deliveries: (A) deliveries without any medication for pain relief, (B) 27 deliveries, where one dosis (50 or 75 mg) of pethidine was used for pain relief, (C) 47 deliveries with one paracervical blockade (3 ml + 3 ml 0.5% marcaine). Ms denote means. Significance levels were tested by the analysis of variance (* = $p < 0.05$, *** = $p < 0.001$). Abbreviations: kPa = kiloPascal

Summary

Analyses of fetal heart rate (FHR) variability, visual evaluation of FHR decelerations, and respiratory gas analyses of the umbilical vein were performed in 27 labors, where one dose (50 or 75 mg) of intramuscular pethidine was used for pain relief, in 47 labors with one paracervical blockade (6 ml 0.5% marcaine) and in a control group of 135 labors without any pain relief. Umbilical vein pH, standard bicarbonate and base excess were lowest in the pethidine group and highest in the PCB group. The duration of labor was shortest in the control group, but there was no difference in the duration of labor of the two anesthesized groups. **Intramuscular pethidine seems to associate with umbilical metabolic acidosis** and PCB should be preferred to it, when an obstetrician is available.

Keywords: Fetal heart, gas analysis, heart rate variability, pethidine, umbilical vein.

Zusammenfassung

Dolanthin i. m. sub partu und metabolische Azidose des Neugeborenen

Bei insgesamt 209 Geburten wurden die Variabilität der fetalen Herzfrequenz (FHR) analysiert, Dezelerationen der FHR visualisiert sowie Blutgasanalysen im Nabelvenenblut durchgeführt. 27 Frauen hatten zur Schmerzerleichterung eine einmalige Dosis Dolanthin i. m. (50 oder 75 mg) erhalten; bei 47 Frauen wurde ein Parazervikalblock (PCB) mit 6 ml 0.5%igem Marcain gesetzt. Die übrigen 135 Frauen bildeten die Kontrollgruppe ohne Schmerzerleichterung. In der Dolanthin-Gruppe lagen pH, Standardbicarbonat und Basenüberschuß am niedrigsten, in der PCB-Gruppe am höchsten. Die Geburtsdauer war in der Kontrollgruppe am kürzesten; zwischen den beiden anderen Gruppen gab es keine signifikanten Unterschiede. **Dolanthin i. m. scheint eine metabolische Azidose zu begünstigen.** Bei Anwesenheit eines in der Methode Erfahrenen sollte daher ein PCB vorgezogen werden.

Schlüsselwörter: Blutgasanalyse, Dolanthin, fetales Herz, Herzfrequenzvariabilität, Nabelvene.

Résumé

Injection intramusculaire de pethidine au cours du travail, associée avec une acidose métabolique chez le nouveau-né

On a réalisé l'analyse de la variabilité du rythme cardiaque fœtal (RCF), l'évaluation visuelle des décélérations du RCF, et l'analyse des gaz dans la veine ombilicale, au cours de 27 travail, pendant lesquels on a utilisé l'injection intramusculaire d'une dose (50 ou 75 mg) de pethidine pour soulager la douleur, au cours de 47 travail avec bloc paracervical (6 ml de marcaïne à 0,5%) et dans un groupe témoin de 135 travail sans traitement de la douleur. Le pH veineux ombilical, les bicarbonates standards et le base excess ont été plus bas dans le groupe pethidine que dans le groupe BPC. La durée du travail a été plus courte dans le groupe contrôle, mais il n'y a pas eu de différence dans la durée du travail entre les 2 groupes avec anesthésie. **L'injection intramusculaire de pethidine semble associée avec une acidose métabolique ombilicale,** et le BPC devrait lui être préféré.

Mots-clés: Coeur fœtal, dosages des gaz, pethidine, variabilité du rythme cardiaque, veine ombilicale.

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