

The Effect of Meperidine and Promethazine on Fetal Heart Rate Indices during the Active Phase of Labor

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Abstract

Background: Visual interpretation of fetal heart rate monitoring is subject to intra- and inter-observer variability.

Objective: To examine the effect of intrapartum administration of meperidine and promethazine on fetal heart activity measured objectively by a computerized system.

Methods: Fourteen healthy women with normal pregnancies at term were studied during the active phase of labor. Fetal heart rate was recorded with the Oxford Sonicaid system 8000. Recordings were performed for 40 minutes prior to and after maternal intravenous administration of meperidine 50 mg with promethazine 25 mg.

Results: The combination of meperidine and promethazine caused a significant decrease in the number of accelerations of 10 beats per minute (9.7 versus 2.6, $P = 0.002$) and 15 beats per minute (5.2 vs. 1.4, $P = 0.003$), time spent in episodes of high variation (14.8 vs. 2.0, $P = 0.005$) and short-term variation (7.8 vs. 5.0, $P = 0.003$). On the other hand there was an increase in the time spent in episodes of low variation (5.3 vs. 19.7, $P = 0.009$).

Conclusions: Maternal administration of meperidine with promethazine has a significant effect on FHR indices during the active phase of normal labor.

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Meperidine and promethazine are widely used to relieve pain during labor. The addition of promethazine potentiates the sedative effect of meperidine and may shorten the duration of labor [1-4]. Previous studies have shown various effects of both these drugs (given as a single agent or in combination) on the mother and fetus during labor [5-9]. However, in several studies the interpretation of fetal heart rate parameters has used visual assessment, which is subject to intra- and inter-observer variability [10]. The introduction of computerized fetal monitoring systems enables an objective assessment of FHR indices [11,12]. The purpose of the present study was to objectively assess the effect of meperidine and promethazine on FHR indices in active labor.

Patients and Methods

The study group consisted of 14 healthy women with a singleton pregnancy and no obstetric complications. All fetuses were normal, in vertex presentation and had a reactive FHR tracing prior to enrollment in the study. No patient had received any medication (narcotics or sedatives) prior to the study period. All patients were in active phase of labor with a cervical dilation of 4-7 cm.

FHR = fetal heart rate

Fetal monitoring was performed with the System 8000 (Oxford, Sonicaid, UK). This system measures pulse interval, and calculation of FHR is reported in milliseconds. Pulse intervals are averaged over periods of 3.75 seconds and the baseline is fitted. Accelerations are defined as changes in heart rate of more than 10 beats/minute above the baseline for at least 15 seconds. Decelerations are defined as changes of heart rate above 10 beats/minute under the baseline for at least 1 minute, 20 beats/minute for at least 0.5 minute, or 25 beats/minute for at least 0.25 minute. The minute range is defined as the difference between minimum and maximum pulse interval (or the baseline when higher) in one minute. The average pulse interval between 3.75 second epochs is defined as short-term variation. Decelerations are excluded while calculating FHR variation. Episodes of high or low FHR variation are also reported. An episode of high or low FHR variation is identified when in 5 of 6 consecutive minutes the mean minute range is >32 or <30 milliseconds, respectively. The percentage of signal loss is continuously reported [11,12].

Upon the patient's request a combination of meperidine 50 mg and promethazine 25 mg was administered intravenously, according to the standard protocol in our department. Analysis of recordings was done for 40 minutes prior to and after maternal drug administration. Statistical analysis was performed using the Wilcoxon signed-rank test. Statistical significance was set at $P < 0.05$.

Results

All 14 women spontaneously delivered normal fetuses. The Apgar score at 5 minutes after delivery was 10 in 13 cases and 8 in one case. Sufficient tracing for analysis was obtained in all cases. The mean signal loss rate was 6.6% before treatment and 5.3% after treatment. This difference is not significant.

The data on the various FHR indices before and after medical treatment are presented in Table 1. There was a significant change in the following indices: accelerations of at least 10 beats/min, accelerations of at least 15 beats/min, episodes of high and low variation and short-term variation, and no significant change noted in the baseline FHR.

There were no cases of FHR decelerations during the pretreatment period. During the post-treatment period a single FHR deceleration was recorded in three cases. This difference was not significant. There was no difference between the number of uterine contractions before and after treatment (11.42 ± 3.48 vs. 11.17 ± 3.30).

Table 1. Effects of meperidine and promethazine on FHR indices in labor

FHR index	Pretreatment	Post-treatment	P
Baseline FHR (bpm)	135.08 ± 8.54	136.33 ± 8.25	NS
Accelerations of at least 10 bpm	9.75 ± 4.39	2.58 ± 1.98	0.002
Accelerations of at least 15 bpm	5.25 ± 4.59	1.42 ± 1.38	0.003
Episodes of high variation (min)	14.83 ± 11.17	2.0 ± 3.28	0.005
Episodes of low variation (min)	5.33 ± 5.68	19.75 ± 13.30	0.009
Short-term variation (msec)	7.82 ± 2.16	5.03 ± 1.19	0.003
No. of contractions	11.42 ± 3.48	11.17 ± 3.30	NS

Recording period was 40 minutes. Data are presented as mean and standard deviation. bpm = beat per minute, NS = not significant.

Discussion

Numerous studies have attempted to quantify the effect of meperidine and/or promethazine on the mother and fetus. In the present study meperidine was administered together with promethazine. The addition of promethazine has been shown to potentiate the sedative effect of meperidine [1,2] and enabled a reduction of the dose of meperidine [2]. Moreover, cervical dilation and shortening of labor was reported in several studies that used the combination of meperidine and promethazine [3,4]. The recording period in our study was too short to evaluate the effect of these drugs on progress of labor. Furthermore, the external recording performed by the Sonicaid machine does not enable a quantitative measurement of the intensity of uterine contractions. Zimmer et al. [13] demonstrated that the intensity and duration of the uterine contractions can affect FHR variability. In view of these limitations our study was designed to evaluate primarily the effect of meperidine and promethazine on fetal heart activity during labor.

There are conflicting data regarding the effect of meperidine on the different FHR indices. Lindblad and colleagues [14] noted a decrease in the mean FHR following administration of meperidine, while Ballas et al. [15] could not find such an effect. Lieberman and co-workers [16] reported that meperidine had no effect on the FHR in cases with normal uterine activity. A decrease in FHR and decelerations were observed only in cases where uterine hyperstimulation occurred following administration of the drug. Considering the possible effect of meperidine on the FHR short-term beat-to-beat variability, a decrease was found in the studies of Huch et al. [17] and Petrie et al. [9], while Kariniemi and Ammala [18] and Giannina et al. [19] did not find such a change. Regarding the long-term beat-to-beat variability, Riffel and associates [20] found a reduction in this index after meperidine, but Giannina et al. [19] did not find such a change. The results reported by Giannina's group [19] are of special interest as these investigators used the same computerized recording system (System 8000 Oxford) that we used in our study. The advantage of this recording modality is the objective evaluation of FHR and the elimination of possible intra-observer or inter-observer variability in the interpretation of FHR indices [10–12]. Therefore, the difference in results between our study and the study of Giannina et al. [19] cannot be attributed to the method used for FHR analysis.

It may be speculated that the differences between the studies are due to the different drugs used. Giannina et al. [19] evaluated the effect of meperidine while we examined the effect of meperidine

and promethazine. As noted before, promethazine may reduce the FHR variability [9,20]. It is therefore possible that the combination of promethazine and meperidine has a significant effect on FHR indices.

A reduction in FHR reactivity may indicate a state of fetal compromise. However, in our study we examined only healthy patients with normal fetuses, and the outcome of all infants was favorable. We therefore believe that the

changes in FHR indices were a result of maternal medication and not a sign of fetal compromise.

The timing of FHR analysis in our study (40 minutes prior to and after drug administration) was chosen in order to evaluate the maximal effect of meperidine and promethazine on the mothers and fetuses. The peak analgesic effect of meperidine occurs within 5–10 minutes after IV administration. Since the placental transfer is rapid, the drug was measured in the fetal circulation within 2 minutes of administration to the mother and equilibration occurred within 7 minutes [21,22]. Petrie and co-workers [9] noted that the main effect of meperidine and promethazine (given as single agents) on FHR variability was recorded in the first 30 minutes after injection.

In conclusion, objective analysis of FHR tracings indicates that maternal administration of meperidine with promethazine has a significant effect on FHR indices in the active phase of labor. It is still unclear whether this effect is due primarily to promethazine or is a result of the combination of both these drugs.

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