

Intrapartum vibratory acoustic stimulation after maternal meperidine administration

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Summary

Objective: To examine the effectiveness of the acoustic stimulation test in the interpretation of suspicious cardiotocograms obtained after meperidine administration to the mother during the first stage of labor.

Subjects and methods: We studied 45 unselected parturients who received 50 mg meperidine i.m. when cervical dilatation was 5 cm. In all cases a decreased beat-to-beat variability of the fetal heart rate and fetal movements was noted after the injection of meperidine. A vibratory acoustic stimulation was performed in 25 patients (group A) while the remaining 20 (group B) had no stimulation.

Results: After the meperidine injection, the acoustic-induced reactivity returned immediately in group A, while the spontaneous reactivity returned 30 minutes later. The mean number of fetal movements in all parturients was 8.71 ± 2.18 before meperidine administration. Sixty minutes after the meperidine injection the mean number was 8.52 ± 2.48 in group A and 1.65 ± 1.81 in group B ($p < 0.0001$).

Conclusion: The acoustic stimulation test is an effective method of interpreting suspicious CTG's obtained after meperidine administration to the mother during the first stage of labour.

Key words: Meperidine; Acoustic stimulation test; Fetal movements.

Introduction

Fetal heart rate (FHR) monitoring was established long ago as a main diagnostic method of fetal well-being during pregnancy as well as during labor. A normal cardiotocogram (CTG) is connected to normal progress in labor, while an abnormal CTG is not always associated to an impending or established endometrial hypoxia [1].

Abnormal FHR tracings may be produced after administration of an opiate and mainly, meperidine, to the mother. Meperidine administered either i.m. or i.v. during the first stage of labor can cause a transient decrease in fetal movements and variability, producing a suspicious CTG [2]. Such CTG's need correct interpretation with the aid of other methods, such as fetal oximetry [3] and fetal scalp blood pH measurements [4, 5]. These methods, however, present certain technical difficulties and demand high levels of experience and technical know-how [6].

The purpose of this study was to examine the effectiveness of the acoustic stimulation test (AST), a simple and non-invasive method, in the interpretation of suspicious CTG's obtained after meperidine administration to the mother during labor.

Subjects and Methods

The study was performed in a University Hospital. Analgesia during labour is usually applied either by epidural block or by meperidine i.m. or i.v. administration. During the first stage of labor two doses of meperidine are usually administered and

care is taken to avoid meperidine injection within the last two hours before delivery.

We studied 45 unselected parturients with uncomplicated pregnancies and spontaneous onset of labor. The mean maternal age was 25 ± 4.41 years (range 18-38) and mean gestational age was 39.25 ± 1.09 weeks (range 37-42). All had normal delivery and the mean neonatal weight was $3,306.66 \pm 231.98$ gr (range 2,900-3,800) and Apgar score ≥ 9 in the first minute. All parturients had continuous FHR monitoring during labor with a Corometrics 115 monitor combined with a fetal movement detector. They were requested to press the event-marker at every fetal movement, 30 minutes prior to the administration of meperidine. All parturients received 50 mg meperidine i.m. when the cervical dilatation was at approximately 5 cm. In all cases a decreased beat-to-beat variability of less than 5 beats per minute was noted after the injection of meperidine. As soon as this tracing was observed a vibratory acoustic stimulation was applied in 25 patients (group A), using a fetal acoustic stimulator (corometrics 146). The remaining 20 patients (group B) did not receive an AST. The stimulator was placed on the abdominal wall above the fetal vertex for 5 seconds. Both groups of patients were requested to press the event-marker at every fetal movement for at least 60 minutes after the administration of meperidine.

Statistical analysis of the results was made using the t-test.

Results

Beat-to-beat variability returned to normal (higher than 5 beats per minute) immediately after the vibroacoustic stimulation test in all fetuses of group A patients. On the contrary, in group B beat-to-beat variability returned to normal at a time interval of ≥ 30 minutes after the meperidine injection.

The mean number of fetal movements recorded in the FHR tracings of 45 parturients 30 minutes before mepe-

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Table 1. — *Fetal movements before and after meperidine administration, with and without acoustic stimulation*

No.	Meperidine	AST	Fetal Movements (means±SD)	Range
45	—	—	8.71±2.18	5-12
25	+	+	8.52±2.48*	3-12
20	+	—	1.65±1.81*	0-5

* p<0.0001

ridine administration was 8.71±2.18 (range 5-12). Sixty minutes after the meperidine injection the mean number of fetal movements was 8.52±2.48 (range 3-12) in group A and 1.65±1.81 (range 0-5) in group B (Table 1). A statistically significant difference was noted between these two groups (p<0.0001).

Discussion

During the antepartum period a decrease in fetal movements and FHR reactivity is often noted and different modes of fetal stimulation have been applied to assess fetal status. The main methods for the assessment of fetal well-being are the biophysical profile [7], the umbilical artery doppler velocimetry [8], the fetal movement profile [9], the 10-to-count Cardiff diagram and the acoustic stimulation test (AST) [10]. Among these methods, the vibratory acoustic stimulation consists of an effective and non-invasive way to evoke fetal activity in cases not related to intrauterine hypoxia [6]. The real decrease of fetal activity has a direct relation to fetal acidemia [1, 11] but no fetus who responds with an acceptable FHR acceleration has an acidotic pH [12]. Using electronic fetal monitoring and ultrasound, fetal behavioral states have been described with the combination of fetal gross body movements, FHR patterns and eye movements [10, 13]. The first two behavioral states define the fetal activity which can be recorded on FHR patterns.

During the intrapartum period a decrease of fetal movements and baseline variability may be seen on the CTG tracings after administration of opiate analgesia [2] to the mother, although fetal movements during the first stage of labor do appear to decrease as labor progresses [14]. A common opiate medication administered during the first stage of labor is meperidine. The intramuscular administrated meperidine reaches its highest plasma concentration and consequently its peak of action ten minutes after the injection. During the period it rapidly crosses the placenta reaching the fetus. Its presence in the maternal and fetal circulation lasts for 30 minutes. During this period it produces analgesia to the mother and sometimes depression to the fetus [1, 15].

According to our results a decrease in fetal activity was noted in all cases after meperidine injection to the mother for analgesia during the first stage of labor. The AST provokes the reappearance of fetal activity immediately after its application. Spontaneous reactivity appears within a period of ≥30 minutes after the meperidine injection in cases where an AST is not applied.

During labor, these are situations causing a decrease in fetal activity without the presence of acidemia. Opiate analgesia is one of these.

This study indicates that AST is an accurate method of provoking fetal reactivity in cases with a decrease of fetal movements and baseline variability not associated with fetal hypoxia. Fetal reactivity produced by vibratory acoustic stimulation is significantly associated with a normal scalp blood pH [6, 12, 16, 17].

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