FETAL HEART RATE AND UTERINE ACTIVITY FOLLOWING PARACERVICAL BLOCK

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Summary: Bupivacaine without adrenalin was used for paracervical block (PCB) anesthesia in 60 low-risk parturients in whom there were no signs of fetal asphyxia.

In order to evaluate its effects on fetus and uterine activity, 30 patients were given a "high dose" of 50 mg Bupivacaine, an amide-type local anesthetic agent, while 30 patients were given a "low dose" of 25 mg. Continuous fetal heart rate (FHR) monitoring in both study groups revealed nine patients with typically post PCB bradycardia and five patients with moderate PHR depression. All of them were born with excellent Apgar score. Although a decrease in fetal heart rate following PCB was noted in both groups more significant reduction was associated with the high dose block ($P<0.05$).

In 11 cases, FHR depression was clearly associated with increased uterine activity, while in another three cases it was not ($P<0.005$). Oxytocin administration during the block did not affect fetal heart rate or uterine activity. The results indicate that FHR depression following PCB using Bupivacaine is dose dependent, transient and not dangerous to a normal fetus. No adverse maternal effects were noted.

It is suggested that fetal heart rate depression following PCB using Bupivacaine is related to increased uterine activity.

INTRODUCTION

It is generally accepted that Bupivacaine is a good local anesthetic agent with a long duration of action and favorable fetal maternal blood ratios ([18]). Bupivacaine has been recommended as a drug of choice for paracervical block anesthesia in labor because of its high degree of protein binding and, therefore, limited placental transfer and negligible interference with the course of labor ([16, 24]). These properties make it preferable to other drugs such as esracaine or mepivacaine, that have been proved to be harmful to the fetus ([30]).

In reviewing the literature we found a lack of consistent information regarding the fetal and uterine response to PCB using Bupivacaine ithout adrenalin ([2, 5, 12, 15, 20, 22, 27]).

The purpose of this study was to determine if there is fetal heart depression following PCB using Bupivacaine without adrenalin, and if so, whether this depression is dose dependent: a secondary aim was to establish whether there is an influence on uterine activity and if so, does it effect fetal heart rate.

MATERIAL AND METHODS

60 healthy low-risk women in normal labor, with fetuses at full-term and in cephalic presentation, were divided into two randomized groups of 30 women each. Paracervical block was administered to both groups when the cervix was dilated at 4-5 cm, and if necessary was repeated once again before 8 cm dilation. The women of the first group were injected each with 20 ml of 0.25% Bupivacaine hydrochloride (Marcaine) without adrenalin ("high-dose" of 50 mg), the second group with 25 ml of 0.10% Bupivacaine without adrenalin ("low-dose" of 25 mg), at the 4 and 8 o'clock position in each lateral cervix. The block was performed using disposable trumpets that limited to superficial injection, to maximum depth of 5 mm. Patients labored on their left side after injection. Blood pressure was taken once before injection, and twice during the first 15 minutes following injection. The fetal heart rate was monitored using an intrauterine catheter for pressure recording, measuring the Montevideo units. The criteria for determination of fetal heart rate depression were:

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a. Onset of bradycardia within 15 minutes following the block.

b. An absolute mean FHR of less than 100 beats per minute for more than 3 minutes.

c. Decrease in variability of FHR of less than 6-8 bpm.

d. Appearance of late or variable decelerations.

To determine the effect of oxytocin administration, the women were divided into three groups:

A. Without Pitocin administration.

B. Pitocin drip was given and maintained during the block.

C. Pitocin drip given and stopped 20 minutes before the block.

Parturients graded the analgesic effect of the PCB as excellent (no pain) good (adequate pain relief) fair (some pain relief) and poor (no pain relief).

Newborn evaluation consisted of 1 and 5 minutes Apgar score, umbilical cord artery pH and neurological examination in the neonatal unit.

High-risk pregnancies and hyperventilating women in labor were not included in the study.

Student's t test and χ-square test were used to evaluate the data statistically.

RESULTS

The same analgestic effect (fig. 1) was recorded for both primipara and multiparas: 75% of parturients who received the "low-dose" as compared to 100% of the "high-dose" group graded the analgesia as good or excelent. No side effects on mothers have been detected.

14 fetuses (23%) developed a transitory post paracervical FHR depression which was not related to parity. The FHR in 9 women showed a severe depression, typical of post PCB – defined as a decrease in FHR (below 100 bpm) for a duration of 3 minutes or more (fig. 2). In five patients (8.3%) mild FHR depression, defined as a loss of variability and a baseline or mild bradycardia (100-120 bpm), was observed.

The "high-dose" group was associated with a higher rate of FHR depression as compared to the "low-dose" group ($P < 0.05$) (fig. 3).

There was a significant correlation between post PCB fetal heart depression and uterine activity. In 11 of the 14 cases of FHR depression, there was an increase in uterine activity of 100 Montevideo units during a 20 minute inspection period following the block. In 3 patients, FHR depression was noted without changes in uterine activity ($P < 0.005$).

Oxytocin administration did not influence FHR depression of the Montevideo units as shown in fig. 4.

All parturients gave birth by spontaneous vaginal delivery. Five minute Apgar scores were 7 or more in all cases. Neurological examinations of mothers and babies were normal.

The mean cord artery pH was identical (7.27 ± 0.06) in both study groups.

DISCUSSION

The reason for the selection of Bupivacaine as a drug of choice in PCB anesthesia was the expectation of satisfactory anesthesia with limited complications. Gudgeon ([12]) and Read and Mil-

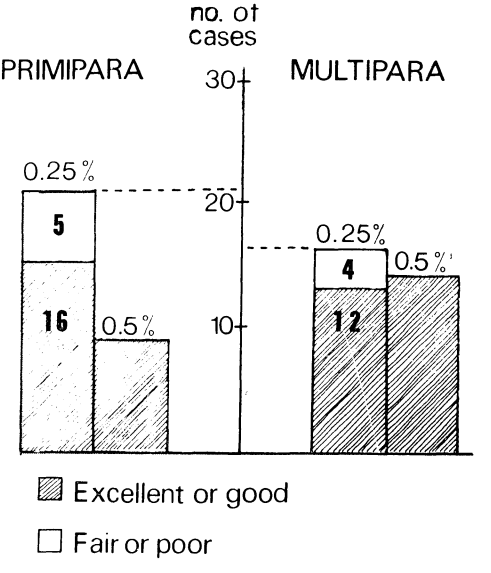


Fig. 1. — Analgesic effect according to parity and Bupivacaine concentration.

ler ([24]) obtained excellent pain relief in 80% of cases using 20 ml of 0.25% Bupivacaine solution with adrenalin. Westholm ([29]) however, concluded that the addition of adrenalin to Bupivacaine does not improve the effectiveness or duration of anesthesia. Adrenalin also has been claimed to suppress uterine contractions and to impair placental blood circulation, causing fetal distress ([17]).

group as compared to the «low-dose» group ($P<0.005$) (fig. 3).

Investigation of the fetal heart rate following paracervical block using various agents revealed a frequency of fetal bradycardia of 0% to 35% (24-30). In the present study, FHR depression was found in 23% of cases. Gordon ([10]) showed that the bradycardia in related to the time of the high drug concentration in fe-

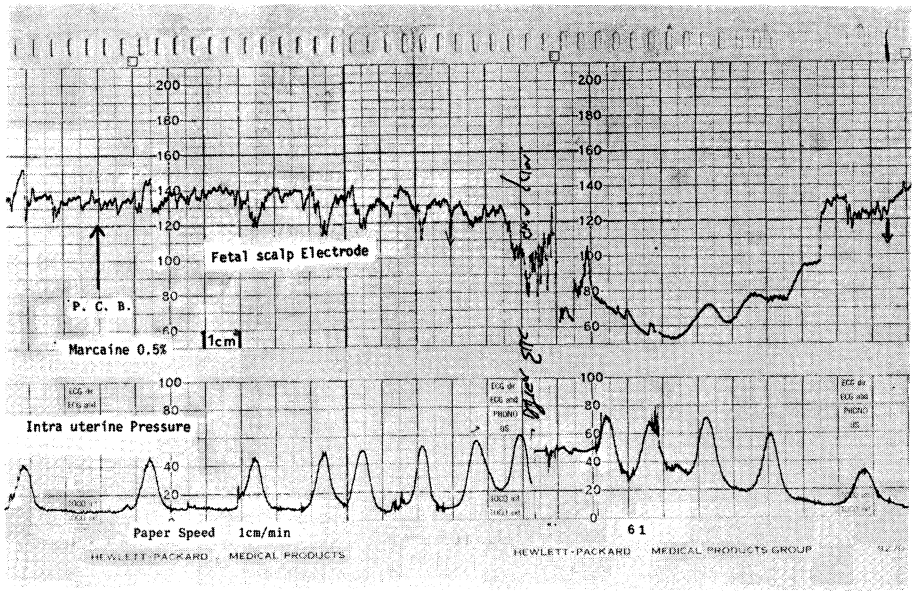


Fig. 2. — Typical fetal bradycardia associated with increased uterine activity, ten minutes following PCB.

In the present study, excellent or good anesthesia using the «low-dose» was obtained in 75% of cases. This result is comparable with the effect noted in other studies in which higher doses were used ([13]). Excellent or good anesthesia at the higher dose was obtained in 100% of cases. Beazley ([2]) warned against the use of concentrations of the drug higher than 0.25%, the data of our study reinforces this caution, as the rate of fetal heart depression was higher in the «high-dose»

tal blood and not to the procedure of injection. Thiery and Vroman ([28]) suggest that there is no single explanation to the bradycardia and that the etiology is multifactorial. Hypertonus of the uterus is one of these factors, but direct toxic effect of the local anesthetic agent on the fetus, vasoconstriction of the uterine arteries, changes in maternal pH in hyperventilating laboring women after PCB resulting in acidosis of the fetus and different injection techniques are other fac-

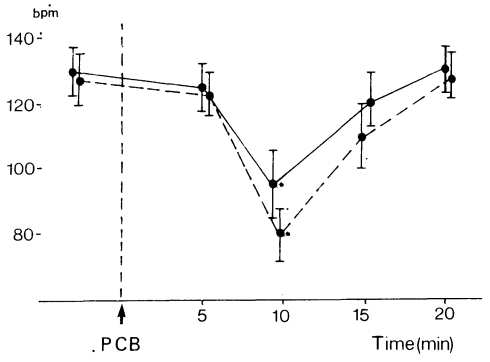
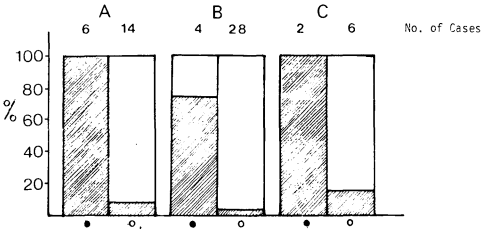


Fig. 3. — Fetal heart rate (bpm) before and after PCB. * = $P<0.05$ (Student's t test).
—— «low-dose» group, mean±2 S.E.
---- «high-dose» group, mean±2 S.E.



Group A: Oxytocin not administered
Group B: Oxytocin drip administered and maintained during the block
Group C: Oxytocin drip administered and stopped 20 minutes before the block
/// FHR Depression
● Increased uterine activity
☐ No change in FHR
O No change in uterine activity.

Fig. 4. — The relation between uterine activity, FHR and Pitocin administration.

tors, and a combination of the above has been presented as the etiology of fetal bradycardia. Zakut *et al.* ([30]) showed that in cases of fetal pronounced bradycardia following PCB, severe fetal acidosis was found. The peripheral blood in relatively rich in acid products from anaerobic metabolism. Local anesthetics when absorbed into the fetus, cause a peripheral vasodilation and acid products are delivered into the general circulation lowering the pt ([25]).

According to Freeman ([8]) the fetal electrocardiogram changes during the bradycardia resembled changes consistent with hypoxia rather than with a direct toxic effect on the fetal myocardium. This hypoxia is caused by the capability of local anesthetic drugs to produce uterine artery constriction and to reduce, significantly uterine blood flow ([5, 7, 11]). Baxi *et al.* ([1]) measuring continuous human fetal oxygenation using transcutaneous electrode, found that fetal transcutaneous PO_2 fell in all cases given the PCB using 1% lidocaine. In contrast, Pacobs and associates ([14]) used a total dose of 25 mg of Bupivacaine and there was no drop in fetal transcutaneous PO_2. They believe that it is a question of total dosage, the division of the drug in four site injections and the woman's position on the left lateral following the block.

The uterine and placental blood flow reduction may be also provoked by increase of uterine activity leading to hypertonus and secondary fetal hypoxia. Various studies ([19, 28, 29]) using either adbominal palpation or external tocography have noted different kinds of changes in increasing or decreasing frequency of uterine contractions after PCB with variable doses of Bupivacaine.

There is only one report ([20]) of intraamnioitc pressure measurement following PCB with Bupivacaine, and on the average there was a slightly decreased uterine activity. However, Miller *et al.* ([21]) noted a temporary increase in uterine activity following a PCB but with lidocaine.

Our study revealed an increase of uterine activity (of 100 Montevideo units) in 12 women (20%). Eleven (92%) developed fetal heart rate depression as compared to only 3 out of 48 (6%) women who demonstrated fetal bradycardia not

associated with increased uterine activity ($P<0.05$).

Local anesthetic drugs are found to have a depressive effect upon the uterine muscle [24]. In the present study, oxytocin administration had no harmful effect on uterine hypertonus or uterine activity and did not lead to secondary FHR depression. Therefore, oxytocin use is recommended in order to overcome uterine inertia caused by local anesthetics.

Short duration symptoms such as dizziness, pallor, respiratory difficulties, palpitation and anxiety have been reported after PCB with Bupivacaine and Epinephrine [13, 21]; a distinct clinical syndrome of buttock pain has been described, with onset 12 hours to 10 dyas following delivery in which a PCB had been given [9]. In the present series none of these were encountered.

It seems that Bupivacaine without adrenalin should not be used in cases where the uteroplacental unit is thought to be compromised or bordeline, in all cases, the low effective dosage should be utilized.

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