EFFECTS OF EPIDURAL ANALGESIA WITH LOW-DOSE BUPIVACAINE AND FENTANYL ON THE PROGRESS OF LABOR AND MODE OF DELIVERY

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ABSTRACT

Background and Objective: Epidural analgesia (EA) has been used to relieve labor pain in many obstetric units, yet controversy persists about its effect on progress and outcome in labor. The purpose of the current study was to evaluate the effect of EA on the rate of cervical dilation and myometrial contractility.

Methods: In a 6-month period, 36 women who received standardized EA were matched with the next two delivering women of 72 patients of the same parity who did not receive EA. The outcome variables were uterine activity, rate of cervical dilation, oxytocin therapy, and operative deliveries.

Results: Intermittent EA with bupivacaine and fentanyl did not result in a change in myometrial contractility and the rate of cervical dilation. Oxytocin therapy was significantly higher in the epidural group than in the nonepidural group (p<0.002). Operative deliveries were not more common in those without it (p>0.05).

Conclusion: After intermittent low-dose bupivacaine and fentanyl EA, myometrial contractility and the ability of the uterus to dilate the cervix are maintained with oxytocin. Despite prolongation of the second stage of labor, cesarean delivery was not common in the epidural group.


Keywords: Labor, Epidural analgesia, Bupivacaine, Fentanyl.

INTRODUCTION

Epidural analgesia (EA) provides excellent relief from the pain of labor and is being used in a large percentage of laboring women. However, the trade-off for pain relief may be longer labor and more operative deliveries.1,2 Properly administered EA provides adequate pain relief during labor and delivery, avoids adverse effects of narcotics, hypnotics, or inhalation drugs and it could be used as anesthesia in case a cesarean section (CS) is required.3

The potential effects of EA on the progress of labor and the incidence of operative or instrumental delivery have been a subject of lasting controversy, particularly between obstetricians and anesthesiologists.4,6 One of the oldest and most controversial questions concerns the timing of initiation of an epidural block for labor analgesia. Conventional wisdom holds that if started too
early in labor (during the latent phase), EA may mark-
edly slow or even arrest the progress of labor.\textsuperscript{1,2} Chest-
nut and colleagues\textsuperscript{1,2} randomized women requesting EA
to early or late groups (approximately 4 and 5 cm dilata-
tion). No differences in labor outcome were seen in ei-
ther spontaneous or induced labors.

Because EA may be initiated at very different times
during the first stage (i.e., 3-versus 8-cm cervical dilata-
tion), and because uterine contractility increases during
labor, much of the variability in labor duration may exist
before the EA is administered.\textsuperscript{1} Norris et al.\textsuperscript{4}
reported that when analgesia was initiated at a greater cervical
dilation (4.0-4.5 cm), it was associated with faster cervi-
cal dilation. This underlying dilation rate may have mini-
mized the impact of analgesia technique. In addition, ob-
stetrical management of labor, including using oxytocin
for induction and assisting membrane rupture, may play
significant roles in the progress and outcome of labor.\textsuperscript{4}

New variations of the techniques are EA with local
anesthetic plus short acting opioids, the combined spi-
nal epidural (CSE), patient-controlled EA (PCEA), and
the use of regional anesthetics (i.e., midazolam) instead
of local anesthetics. In these, because of the using of
low-doses of local anesthetics, mothers to be have a bet-
ter chance of being truly ambulant during labor, and de-
crease mother and fetus/neonate morbidity.\textsuperscript{10,12}

The purpose of this study was to examine the effect
of intermittent EA with low-dose bupivacaine and fenta-
nyl on the rate of cervical dilation and myometrial con-
tractility at the initiation of EA and during the remainder
of labor.

PATIENTS AND METHODS

Forty consecutive generally healthy parturients fol-
lowing normal pregnancy were included in this prospec-
tive, randomized, and case-controlled study. Before pa-
ients were enrolled, we standardized the methods of
EA. Consecutive patients who received EA (EA group,
n= 40) were identified within a 6-months period. Each
study patient was matched with the next two delivering
patients (control group), regardless of the mode of de-
ivery, who did not receive EA during labor and were of
the same parity as the study patients.

The following protocol was used for EA. Once labor
was well established (active phase; cervical dilation at
4-5 cm) patients received a 750 mL bolus of normosol.
With patients in the left lateral decubitus or sitting posi-
tion and after sterile preparation and drape, the epidural
space was identified. Under local anesthesia, an 18-gauge
Tuohy needle was inserted in the epidural space at the
L\textsubscript{1-4} or L\textsubscript{4-5} lumbar interspaces using a midline approach
with a loss of resistance technique. Then the epidural

catheter was inserted. A 3 mL test dose of 1% lidocaine
with 1: 200,000 epinephrine was given after no aspira-
tion of cerebrospinal fluid or blood. Vital signs were ob-
served for evidence of subarachnoid injection or intra-
vascular injection. If the test dose was negative, a 10 mL
bolus of 0.125% bupivacaine with 20 μg fentanyl was
injected through the catheter. The level of sensory block-
ade (as assisted by a pinprick) at 5 and 20 minutes after
the initial dose extended to at least the tenth thoracic
dermatome (T\textsubscript{10}), but not above T\textsubscript{4}. Repeat injections were
given when the women requested additional pain relief.

Women in the subject group were allowed to walk
after fulfilling acceptable analgesia, acceptable systolic
blood pressure (>100 mmHg), and the ability to stand on
one leg. Each laboring patient in the study and control
groups had pelvic examinations every 1-2 hours during
the active phase to follow their progress. One physician
performed these examinations. The goal of manage-
ment was to maintain a rate of cervical dilation greater
than 1 cm/hour. If this was not achieved, augmentation
with oxytocin was initiated. Four outcome variables were
used to demonstrate the effect of intermittent EA on myo-
metrial function: the rate of cervical change, uterine ac-
tivity, dose of oxytocin, and the incidence of operative
delivery.

Fetal heart rate was monitored throughout labor with
an external monitoring system. Need for oxytocin, amount
of local anesthetics used, labor duration (time elapsed
between cervical dilation at 4-5 cm and delivery), and
mode of delivery (spontaneous, instrumental, or CS) were
recorded. Apgar scores were recorded at 1-min and 5-
min after birth.

Statistical analysis was performed using Chi-square,
and student t test for normally distributed continuous
data, and Mann-Whitney U test for nonnormally distrib-
ted continuous data. p<0.05 was considered significant.

RESULTS

In the 6-months study period, 40 patients received
EA. Four patients were failed EA, and were excluded.
The remaining 36 study patients were matched with 72
control patients. Five (7.2%) patients with EA received
ephedrine for hypotension. No patient had her EA dis-
continued because of hypotension.

Table I shows participant’s demographic data. No dif-
fferences were noted with respect to parity, age, height,
and weight at the time of labor, and cervical dilation at
the time of EA.

Table II shows the effect of EA on the progress of
labor after cervical dilation at 4-5 cm. The mean number
of contractions was 0.37±0.1/min, 0.38±0.1/min (p>0.05)
in the study and control patients, respectively. Patients
who received EA had a slower mean rate of cervical dilation at one hour after EA (0.8±0.4) versus 1.3±0.5 cm/h for EA and control groups, respectively, (p= 0.03). No statistically significant differences were observed between the two groups with regard to mean cervical dilation rate, after oxytocin therapy (2.3±0.7 and 2.7±1.1 cm/h in the study and control patients, respectively); (p>0.05). The duration of second stage in the control group was 30±10 min, and in the study patients was 42±15 min (p<0.001 after EA (0.8±0.4 versus 1.3±0.5 cm/h for EA and control groups, respectively; p= 0.03; no statistically significant differences) (Table II).

Oxytocin was increased or initiated more after EA in the study patients than in the control women (25 of 36 versus 22 of 72; p<0.002), with maximum dose of oxytocin being higher in study patients (7.6±2.3 mu/min) than in control patients (4.2±1.4 mu/min) (p<0.002) (Table III).

No statistically significant differences were observed with regard to operative deliveries in the two groups (3 of 36 versus 5 of 72 in study and control women, respectively; p>0.05). All operative deliveries were for fetal distress. No patients were delivered by assisted vaginal deliveries with vacuum or forceps.

Mean of neonates Apgar scores in study patients was 8.53±0.9 at 1-min and 9.4±0.3 at 5-min, and in control patients was 8.80±0.8 at 1-min and 9.50±0.6 at 5-min (p>0.05) (Table III).

DISCUSSION

The potential effects of EA on progress, operative or instrumental delivery has been a subject of lasting controversy. Most studies indicated that EA is associated with longer labors and/or increased incidence of associated delivery or CS. Newton et al. showed that despite a lack of change in uterine activity, continuous fentanyl-bupivacaine EA blunted the normal increase in the rate of cervical dilation in the first stage and prolonged the time to complete dilation. There are several reports indicating that EA has no adverse effects on vaginal delivery. Studd et al. noted that EA did not effect the rate of cervical dilation in women with spontaneous labor or with labors augmented with oxytocin.

Table I. Demographic data.

<table>
<thead>
<tr>
<th></th>
<th>EA group (N=36)</th>
<th>Controls (N=72)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maternal height (cm±SD)</td>
<td>160±6</td>
<td>162±6</td>
<td>NS</td>
</tr>
<tr>
<td>Nulliparus (%)</td>
<td>14(38.8)</td>
<td>30(41.6)</td>
<td>NS</td>
</tr>
<tr>
<td>Age (years)</td>
<td>25.4±4.2</td>
<td>25.5±4.3</td>
<td>NS</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>84.7±9.6</td>
<td>85.6±12.7</td>
<td>NS</td>
</tr>
<tr>
<td>Cervical dilation at EA onset (cm)</td>
<td>4.2±1.3</td>
<td>4.3±1.4</td>
<td>NS</td>
</tr>
<tr>
<td>Birth weight (g±SD)</td>
<td>3230±510</td>
<td>3370±612</td>
<td>NS</td>
</tr>
</tbody>
</table>

SD=standard deviation; NS=not significant.

Table II. Rate of cervical dilation after epidural insertion, uterine activity, and duration of labor.

<table>
<thead>
<tr>
<th>Time period</th>
<th>EA group (N=36)</th>
<th>Controls (N=72)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cervical dilation rate one hour after EA (cm/h±SD)</td>
<td>0.8±0.4</td>
<td>1.3±0.5</td>
<td>0.03*</td>
</tr>
<tr>
<td>Mean of cervical dilation rate from EA onset to 10 (cm/h±SD)</td>
<td>2.3±0.7</td>
<td>2.7±1.1</td>
<td>NS</td>
</tr>
<tr>
<td>Uterine contractions/min after EA onset</td>
<td>0.37±0.1</td>
<td>0.38±0.1</td>
<td>NS</td>
</tr>
<tr>
<td>Duration of labor after RA (min)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>First stage</td>
<td>187.5±32.2</td>
<td>157.8±25.3</td>
<td>NS</td>
</tr>
<tr>
<td>Second stage</td>
<td>42±15</td>
<td>30±10</td>
<td>&lt;0.001*</td>
</tr>
</tbody>
</table>

NS=not significant. * Mann-Whitney u test

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Table III. Oxytocin requirements, operative delivery, and neonate Apgar scores.

<table>
<thead>
<tr>
<th></th>
<th>EA group (N=36)</th>
<th>Controls (N=72)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients given oxytocin (%)</td>
<td>25(69.44)</td>
<td>22(30.55)</td>
<td>&lt;0.002*</td>
</tr>
<tr>
<td>Maximum dose of oxytocin before EA (mu/min)</td>
<td>3.9±1.4</td>
<td>4.1±1.3</td>
<td>NS</td>
</tr>
<tr>
<td>Maximum dose of oxytocin after EA (mu/min)</td>
<td>7.6±2.3</td>
<td>4.2±1.4</td>
<td>&lt;0.002*</td>
</tr>
<tr>
<td>Operative delivery (%)</td>
<td>3(8.33)</td>
<td>5(6.9)</td>
<td>NS</td>
</tr>
<tr>
<td>Mean of neonate Apgar score</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>At 1 min</td>
<td>8.5±0.9</td>
<td>8.8±0.8</td>
<td>NS</td>
</tr>
<tr>
<td>At 5 min</td>
<td>9.40±0.3</td>
<td>9.5±0.6</td>
<td>NS</td>
</tr>
</tbody>
</table>

NS=not significant. * Mann Whitney u test

Uterine activity usually has significant effects on the progress of labor. This activity may be modified by many factors. Estrogen, oxytocin, α-adrenergic drugs, mechanical manipulation of the cervix, stimulates uterine contractions. Progesterone, magnesium sulfate, β-adrenergic drugs and decrease in uterine blood flow due to hypotension can decrease uterine contractions. Matadial and Cibils noted no significant changes in uterine activity when 1.0-1.5% lidocaine without epinephrine was administered epidurally. However, when 1.0-1.5% lidocaine with epinephrine was used, a decrease in uterine activity was noted. Vasika and Kretchmer showed that in the absence of hypotension, EA did not interfere with uterine contractions. In another study, Schellenbery stressed the avoidance of aortocaval compression during labor when evaluating the effect of an epidural anesthetic on uterine activity. Wildeck-Lund et al reported that EA caused a transitory decrease in uterine activity irrespective of the local anesthetic used. It has been shown that changing the high concentration of bupivacaine to a lower concentration, and adding an opioid, significantly decreased instrumental and cesarean delivery rates. Some obstetrical studies have shown the benefits of ambulation on labor and encouraged its use. One study found that ambulation shortens labor duration, reduces the need for analgesia, and improves Apgar scores as well; another found that ambulation is as effective as oxytocin for the enhancement of labor and that walking during labor decreases the rate of operative delivery. In addition, studies show that EA early in labor (before 5-cm cervical dilation) increased instrumental and CS rates. Obstetrical management of labor, including oxytocin injection for induction, and assisting membrane rupture, may play significant roles in the progress and outcome of labor. Furthermore, the intermittent bolus technique has been shown to be associated with lower consumption of drugs than the continuous infusion technique and PCEA, which decreases instrumental and cesarean delivery rates.

In summary, the available data indicate that the effects of epidural analgesia may vary, depending on the timing and extent of block, position of the patient, the choice and concentration of local anesthetic, and the addition of epinephrine or an opioid. Finally, premature rupture of membranes and the choice of obstetrical service may be the most important factors affecting the course of labor and delivery. Results of this study concerning the outcome of labor agree with previous findings. In this study, intermittent low-dose epidural analgesia with bupivacaine and fentanyl was used. Furthermore, regarding starting of EA at 5-cm cervical dilation, not using epinephrine, use of low-dose bupivacaine (thus reducing the concentration of drug), using high-dose oxytocin in the EA patients, and walking during labor, didn’t change the duration of the first stage of labor. Although the duration of the second stage in the EA group was significantly longer than the control group, this didn’t increase operative delivery rate in EA parturients. In conclusion, after intermittent low-dose bupivacaine and fentanyl EA, myometrial contractility and the ability of the uterus to dilate the cervix are maintained with oxytocin. Despite prolongation of the second stage of labor, cesarean delivery was not common in the epidural group.

REFERENCES


