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ORIGINAL ARTICLE

Influence of maternal position during epidural labor analgesia

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SUMMARY. The influence of maternal position on the spread of local anesthetics in low concentration has not been well examined during epidural analgesia for labor. This study was designed to investigate the differences in sensory block, pain relief and incidence of supine hypotensive syndrome between parturients in the left lateral position and in a modified supine position. Sixty-seven parturients were randomly assigned to lie either in the left lateral position ($n = 34$) or in a modified supine position ($n = 33$), and received 0.125% bupivacaine 10 mL with epinephrine 1:800 000 and sufentanil 7.5 μg. At 20 min parturients in the modified supine position turned to the left lateral position and a second investigator, unaware of the initial position, measured the extent of the sensory block at 20 and 30 min and just before a second epidural injection was requested. More dermatomes were blocked on the dependent side when the dose was injected in the left lateral position (at 20 and 30 min: $P < 0.05$; before the second epidural injection: $P < 0.0005$). In the modified supine position the incidence of bilaterally blocked dermatomes T10–L1 was greater at 20 and 30 min ($P < 0.05$) and the pain on a visual analogue scale was better at 30 min ($P < 0.05$). Three parturients in the modified supine position had signs and symptoms of supine hypotensive syndrome. We conclude that injecting in the modified supine position results in a more equal spread of local anesthetic and better pain relief.

INTRODUCTION

The position of the patient plays a minor role in the spread of solution within the epidural space, unlike with hyperbaric spinal anesthesia. When differences have been found, sensory and motor block were more profound and extensive on the dependent side, independent of the local anesthetic used.[1–3] During epidural analgesia for labor, previous studies comparing the left lateral position with a modified supine position[4–6] used a volume over 10 ml and/or a concentration of bupivacaine over 0.125%; results were contradictory. In a modified supine position, the parturient is more prone to develop supine hypotensive syndrome.[4] The purpose of this study was to investigate differences in sensory block, pain relief and incidence of supine hypotensive syndrome during epidural analgesia with a low concentration of local anesthetic, between parturients studied in the left lateral and in a modified supine position.

METHODS

After approval of the local ethics committee and informed consent were obtained, 67 healthy (ASA Class I or II), term (37 weeks' gestation or greater), nulli- and multiparous women with uncomplicated pregnancies in active labor (cervical dilatation $\leqslant 6$ cm), who requested epidural analgesia, were included in this study. Parturients with breech presentation or twin pregnancy were also included. Age, ASA classification, weight, height, parity, duration of pregnancy and use of prostaglandin or oxytocin were recorded.

The parturient was positioned on her left side. After skin disinfection, a 16-gauge Tuohy needle (Becton

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Dickinson) was introduced in the L3–L4 interspace in the mid-line and advanced until the epidural space was identified using the loss-of-resistance to saline technique. The depth of the epidural space was recorded. The epidural catheter (Portex catheter with three lateral eyes) was positioned 4 cm in the epidural space. After fluid loading with 500 mL of normal saline, parturients were consecutively included in random order either in the left lateral or in the modified supine position and received 0.125% bupivacaine 10 mL with 1:800 000 epinephrine and sufentanil 7.5 μg. To achieve the modified supine position, a firm foam rubber wedge was placed under the right buttock to tilt the parturient 15° to the left. The epidural local anesthetic solution was injected over 30–40 s between uterine contractions. Immediately preceding the first epidural injection, the cervical dilatation was determined by the obstetrician.

After 20 min, the parturients in the modified supine position were turned to the left lateral position. A second investigator, blinded to the initial position, entered the room and measured the extent of the sensory block to pinprick bilaterally in the mid-clavicular line, using the stylet of the Tuohy needle. All parturients remained in the left lateral position and the measurement was repeated after 30 min. A particular dermatome was considered blocked if a pinprick at this dermatome felt less sharp than on the forearm. The following reference points[7] were used: T4: nipple; T6: xiphoid; T10: umbilicus; L1: groin; L4: patella; L5: area between second and third toe; S1: small toe; S2: medial knee notch; S3–S4: labia majora; S5: anal region. The numbers of dermatomes blocked on each side were counted. The incidence of bilaterally blocked dermatomes T10–L1 (required for labor) and S2–S4 (required for delivery), symmetry and asymmetry ($\geqslant 2$ dermatomes difference between the left and the right side) on the cephalad and caudad end of the sensory block, were also determined.

Maternal heart rate, blood pressure (measured non-invasively on the left arm), peripheral oxygen saturation and fetal heart rate were measured before and 1, 3, 5, 7, 10, 15, 20 and 30 min after the first epidural injection. Pain was assessed on a self-rating Visual Analogue Scale (VAS) before and at 10, 20 and 30 min after the first epidural injection. The VAS consisted of a 10-cm line without graduations, with 0 cm corresponding to ''no pain'' and 10 cm corresponding to ''unbearable pain.''

If signs or symptoms of supine hypotensive syndrome occurred (a fall in systolic blood pressure of >30% from baseline or a systolic blood pressure of <100 mmHg, pallor, sweating, nausea and vomiting, changes in mental status, dizziness and signs of fetal distress: loss of beat-to-beat variability and late or variable decelerations lasting >2 min), the parturient was immediately turned to the left lateral position.

If analgesia at 30 min (VAS score >3) was insufficient, the parturient was turned to the side with the least sensory block and the same dose was re-injected. When a top-up was requested, the sensory block and cervical dilatation were measured before the re-injection and the time interval between the first and second epidural injection was calculated.

Sample size was computed using a power estimate of 90%, with a standard difference of 1.8 and an estimated effect of four segments. Student's t test and Pearson χ^2 test were used to analyze the data, depending on the scale of measurement. All tests were two-tailed with a significance of 95% ($P < 0.05$). Statistics were performed using the statistical package for social sciences version 9.0 (SpSSV.9.0). A P-value of < 0.05 was considered significant.

RESULTS

Sixty-seven women were recruited, 34 in the left lateral group and 33 in the modified supine group. One parturient in the modified supine group was excluded because of early (4 min after the first injection) signs and symptoms of supine hypotensive syndrome. The data at the time of the second epidural injection were not used in four parturients, all in the modified supine group, because three parturients received a top-up in order to obtain sufficient sacral analgesia for delivery and in one parturient the sensory block was measured inaccurately. The data for sensory block at the time of the second epidural injection were not used in two patients, one in each group, because they were not pain-free at 30 min and immediately received a top-up. The data at all measurement points were available in 33 parturients in the left lateral group and in 27 in the modified supine group.

Parturient's demographics before the first epidural injection of local anesthetic mixture were similar in the two groups (Table 1). Maternal heart rate, blood pressure, peripheral oxygen saturation and fetal heart rate proved to be similar before and during the study, except for the maternal heart rate at 30 min: 82 beats/min in the left lateral group versus 76 in the modified supine group ($P < 0.05$).

The VAS scores are shown in Table 2. At 30 min the difference between the groups was significant ($P < 0.05$). In the left lateral group, 7 patients (21%) had a VAS score of $\geqslant 2$ at 30 min versus one patient (3%) in the modified supine group. Because of insufficient analgesia (VAS score >3), one patient in each group received a further dose after 30 min. The mean duration of analgesia after the first injection was slightly longer in the modified supine group, although statistical significance was not reached (126 vs. 109 min, $P = 0.09$). Progress of labor between the first and the

Table 1. Parturient's demographics. Mean (SD) or numbers

	Left lateral group	Modified supine group
Number of patients	34	32
Age (years)	27 (4.0)	27 (4.3)
ASA PS score (I/II)*	32/2	30/2
Weight (kg)	74 (12.5)	74 (9.1)
Height (cm)	167 (6.9)	166 (6.5)
Parity (nulliparous/multiparous)	17/17	14/18
Spontaneous/accelerated**	4/30	6/26
Breech/twin pregnancy	2/2	0/1
Depth skin-epidural space (cm)	5 (0.7)	5 (0.6)
Cervical dilatation (cm)	3 (0.9)	3 (1.6)

There were no significant differences between the treatment groups.
* ASA PS score = American Society of Anesthesiologists Physical Status Score.
** Prostaglandin or oxytocin.

Table 2. Mean visual analogue scores (cm)

	Left lateral group	Modified supine group
Before first injection	5	5
10 min	2	2
20 min	1	1
30 min	1	0*

* $P < 0.05$ (Student's t test).

second epidural injections was similar in the two groups (mean cervical dilatation 2 cm in both groups).

The mean total number of skin dermatomes blocked is shown in Table 3. In the left lateral group significantly more dermatomes were blocked on the left side of the body than on the right side at each measurement ($P < 0.05$). In the modified supine group, distribution was uniform between the left and right side of the body. There were no significant differences in the number of dermatomes blocked on the right side between the left lateral and the modified supine groups. On the left side significantly more dermatomes were blocked immediately before the second epidural injection in the left lateral group ($P < 0.05$).

The frequency of bilateral blocked dermatomes T10–L1 and S2–S4 at each time point and position are shown in Fig. 1. At 20 and 30 min dermatomes T10–L1 were blocked in more parturients in the modified supine

Table 3. Mean total number of dermatomes blocked on the left and the right side

	Left lateral group		Modified supine group	
	L	R	L	R
20 min	10	8*	10	10
30 min	11	10*	12	11
Before 2nd injection	7	4*	5**	4

* $P < 0.05$ compared with left side (Student's t test).
** $P < 0.05$ compared with left side in left lateral group (Student's t test).

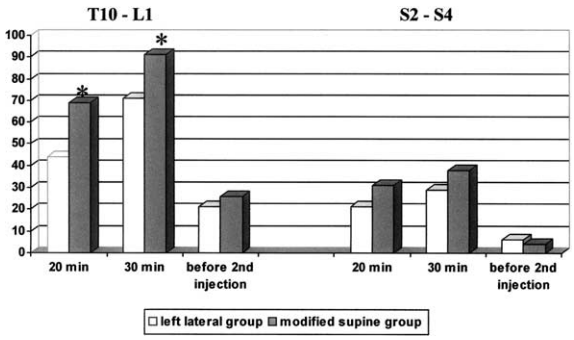

Fig. 1 Proportions of parturients with bilateral sensory analgesia in segments T10–L1 and S2–S4. * $P < 0.05$ (χ^2 test).

group than in the left lateral group. Sacral analgesia was not significantly different between the two groups. The frequency of symmetrical sensory analgesia levels is shown in Fig. 2. In the modified supine group, the upper extent of the sensory blockade tended to be more symmetrical at 20 min ($P = 0.05$) and was more symmetrical immediately before the second epidural injection ($P < 0.01$), as well as immediately before the second epidural injection at the lower extent of the sensory blockade ($P < 0.01$). If there was an asymmetrical block in the left lateral group more segments on the left side were consistently blocked, whereas in the modified supine group this was not so obvious.

Three parturients in the modified supine group experienced signs and symptoms of supine hypotensive syndrome. One parturient showed fetal bradycardia after 17 min and the two others experienced nausea and dizziness, respectively, after 4 and 19 min; all symptoms rapidly disappeared after turning the parturients in the left lateral position, without the use of ephedrine.

DISCUSSION

Previous studies have investigated the influence of the lateral position on the spread of local anesthetics in the

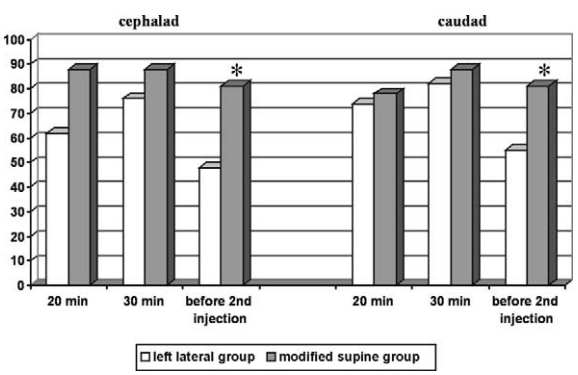

Fig. 2 Proportions of parturients with symmetrical sensory analgesia at the upper (cephalad) and lower (caudad) ends. * $P < 0.05$ (χ^2 test).

epidural space during surgery.[1–3] Only the dependent versus the non-dependent side was examined; as a consequence these studies were not blinded. They found that sensory block appeared faster (±2 min), spread higher (±2 segments) and lasted longer on the dependent side. Although Apostolou et al.[2] concluded that these differences were only of statistical significance and not clinically important, Grundy et al.[1] and Seow et al.[3] advised practitioners to inject the local anesthetics with the patient on the operative side. During epidural analgesia for labor, several studies have compared the left lateral position with a modified supine position; they all used bupivacaine 0.25% in different volumes without the addition of epinephrine or opioids.[4–6] Eberle et al.[5] found that sensory block on the left side was more extensive in the left lateral position. In the study of Beilin et al.[6] fewer parturients required a top-up after 15 min in the modified supine group. In contrast, Preston et al.[4] found no difference in the quality of analgesia or in the occurrence of asymmetrical blocks.

Our study, using a lower concentration of bupivacaine (0.125%) with sufentanil (7.5 μg) and epinephrine (12.5 μg), measured the extent of the sensory block at 3 time points: at 20 and 30 min and just before the second epidural injection. At 20 and 30 min the dermatomes T10–L1 were blocked in more parturients in the modified supine group. A sensory block above T10 must be attained to achieve adequate analgesia in early labor. As a consequence, pain relief after 30 min was better. The lower heart rate in the modified supine group at 30 min could also be an indication of less pain. Including both nulliparous and multiparous women could bias these findings, particularly if the quality of pain relief and the need for supplementation are examined. In both groups, however, the ratio nulliparous to multiparous women was the same.

In the left lateral group, sensory block was more extensive on the dependent than on the non-dependent side. The difference in residual block before the second injection was even more pronounced with considerably more dermatomes involved on the dependent side. It may be worthwhile to measure residual sensory block before a subsequent epidural injection, and depending upon the result, administer a top-up with the parturient lying in the modified supine position or on the side with the least extended sensory block in order to achieve a symmetrical block.

Unlike Eberle et al.[5] and Beilin et al.[6] Preston et al.[4] found that only parturients in the supine position experienced signs and symptoms of aortocaval compression. In this present study, three parturients in the modified supine group experienced signs and symptoms related to aortocaval compression, but it was not clinically important because it was easily treated by turning the parturient on her left side. Twin pregnancies should have been one of the exclusion criteria as they are associated with greater aortocaval compression. All three women with twin pregnancies, however, had an uneventful first epidural injection with no evidence of supine hypotensive syndrome, with a sensory block and pain scores no different from those of singleton pregnancies. If the parturient is at high-risk of developing supine hypotension, a symmetrical sensory block with adequate pain relief can be obtained by turning her to the contralateral side immediately after the epidural injection.[8–9] We suggest alternating sides whenever a top-up is given with a PCEA device or every 30–40 min if a continuous infusion is used.

In conclusion, this study suggests that administering an epidural bolus in the modified supine position is preferred because of a more equal spread of the local anesthetic solution, less asymmetrical sensory block and better analgesia. This may be at the expense of a higher incidence of the supine hypotensive syndrome, but this is clinically not detrimental, as it is easily treated by turning the parturient on her side. More studies are warranted to find out the effects of position with subsequent epidural injections or during continuous epidural infusion or PCEA.

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