EFFECT OF POSTURE DURING THE INDUCTION OF SUBARACHNOID ANALGESIA FOR CAESAREAN SECTION

Right v. Left Lateral

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Subarachnoid analgesia is gaining popularity in many branches of anaesthetic practice. Its use in obstetrics was encouraged by Crawford (1984) for those situations where the alternative is general anaesthesia. However, Crawford (1984) did not advocate its use for Caesarean section because of the risk of arterial hypotension and the incidence of inadequate analgesia—which necessitates subsequent general anaesthesia. Shnider (1973), for example, quoted that 10% of patients required a superimposed general anaesthetic and that a further 55% required some form of supplementary analgesia. More recent evidence suggested the likely reason for this is that the dose of amethocaine advocated for Caesarean section in America was inadequate (Chantigian et al., 1984). On the other hand the greater use of subarachnoid analgesia for Caesarean section has been advocated (Brownridge, 1981; Abouleish and Bourke, 1984; Moore and Batra, 1984), especially if no extradural catheter is in place, because of its speed of onset and absence of any risk of toxicity. If this advice is to be followed, it is essential that adequate analgesia should be provided and, in this context, the posture of the patient during and immediately after the induction of subarachnoid analgesia may be important. Sprague (1976) drew attention to the importance of technique and pointed out that the induction of subarachnoid analgesia in the left lateral position followed by the supine left semi-lateral position (a wedge under the right hip) gave very poor spread of analgesia, and he abandoned this posture in his study when three out of four patients required general anaesthesia to permit the completion of surgery. No such problems were encountered with induction in the right lateral position. Personal observations over 10 yr suggest that the left lateral is the position in which patients are placed most commonly during the performance of subarachnoid analgesia for Caesarean section, and this may be a possible reason for the poor results. Although Sprague (1976) gave no explanation for the different pattern of analgesia in the two groups, an effect of gravity on the heavy amethocaine was implied.

Recently, it has been suggested that posture, independent of gravity, can influence vertebral venous volume and thus affect the dermatomal spread of analgesia (Russell, 1983, 1984). More significant caval occlusion seems likely when turning from the right lateral to the left semi-lateral position than would occur when turning to this position from the left lateral position. If this is so, it should be possible to detect a difference in the behaviour of an isobaric solution placed in the subarachnoid space, depending on the original position of the patient during the actual intrathecal injection. Also, by using an essentially isobaric solution, any significant effect of gravity could be excluded.

SUMMARY

Thirty-five women scheduled for elective Caesarean section were randomly assigned to have subarachnoid analgesia induced in either the right or left lateral position. They were then turned supine with a wedge under the right hip. No patient in the right-sided group required further analgesia. Five patients in the left-sided group required postural manipulation to encourage the spread of analgesia and two required supplementary analgesia (P < 0.01).
POSTURE AND SUBARACHNOID ANALGESIA

Although it is accepted that 0.75% plain bupivacaine may be slightly hypobaric in relation to CSF at body temperature, the effect of this hypobaricity is likely to be minimal in the horizontal position (Scott and Sinclair, 1982). For those who do not accept this lack of gravitational effects, the hypobaric tendency would tend to restrict the cranial spread of analgesia both during induction (hips are said to be wider than shoulders in the female (Greene, 1985)), and while lying supine on a wedge.

PATIENTS AND METHODS

The 35 patients who are the subject of this report form a part of a larger group, 80 in all, in whom subarachnoid analgesia was induced with volumes of 0.75% bupivacaine varying from 1.0 to 2.0 ml before the drug was withdrawn for use in obstetric anaesthesia. These 35 patients formed the largest homogeneous group in that they all received 1.5 ml, and all were undergoing an elective Caesarean section within 2 weeks of term. The women were randomly assigned to have subarachnoid analgesia induced in either the right or the left lateral position.

Following the injection of 0.75% plain bupivacaine 1.5 ml through a 25-gauge needle at L2–3, the patients were immediately turned supine and a wedge was placed under the right hip. Analgesia to pin prick was assessed bilaterally at 2, 5, 10, 15, 20 and 30 min. Analgesia was defined as loss of pin-prick sensation.

An i.v. fluid preload was administered immediately before induction. This consisted of either Hartmann's solution 2 litre or Hartmann 1 litre plus Haemaccel 0.5 litre. Oxygen 6 litre min⁻¹ was administered via a Hudson mask, until delivery of the baby. After delivery, supplementary analgesia was provided via this mask when required (oxygen 2 litre min⁻¹, nitrous oxide 6 litre min⁻¹ and trichloroethylene, as necessary). Verbal contact with the patient was maintained at all times.

At 10 min, if the upper level of analgesia was T10 or below and had extended by less than two segments from the 5-min assessment, the wedge was removed and the patient rolled slowly from a right- to a left-tilted position several times before being repositioned on the wedge (postural manipulation).

The author worked single-handed throughout this study and was aware of the position of the patient during induction.

RESULTS

Seventeen women had subarachnoid analgesia induced while lying on their left side initially (group L); 18 women had subarachnoid analgesia induced while lying on their right side initially (group R). One patient from each group was excluded from the final analysis because of technical difficulties during the performance of the block, in that no free flow of CSF was obtained. Subsequent analgesia in these two patients was very limited. One of these patients had spinal analgesia induced successfully via another interspace and gave no further problems. The other patient received a successful extradural following a second "dry" tap.

Student's t test for unpaired data revealed no significant difference between the mean analgesic levels of the remaining patients in the two groups at any time (table I). However, in group L, five patients required postural manipulation. This resulted in a sudden rapid extension of a previously static or slowly extending blockade. One of these patients, and one other from group L, subsequently required supplementary analgesia. No patient from group R required either postural manipulation or supplementary analgesia (P < 0.01). Table II shows the difference in mean segmental levels of analgesia between the five patients requiring postural manipulation and the rest of group L. These differences were significant.

The incidence of hypotension was the same in both groups (50%), although this was always short lived and responded rapidly to ephedrine 5–15 mg i.v.

Seven patients (20%) developed post-spinal

<table>
<thead>
<tr>
<th>Time (min)</th>
<th>Right side</th>
<th>Left side</th>
</tr>
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<tbody>
<tr>
<td>2</td>
<td>T10.7 (±1.9)</td>
<td>T10.3 (±4.2)</td>
</tr>
<tr>
<td>5</td>
<td>T7.4 (±3.1)</td>
<td>T6.8 (±4.8)</td>
</tr>
<tr>
<td>10</td>
<td>T4.9 (±3.4)</td>
<td>T5.1 (±5.4)</td>
</tr>
<tr>
<td>15</td>
<td>T3.0 (±2.6)</td>
<td>T2.8 (±3.9)</td>
</tr>
<tr>
<td>20</td>
<td>T2.5 (±2.5)</td>
<td>T1.8 (±2.7)</td>
</tr>
<tr>
<td>30</td>
<td>T2.4 (±2.6)</td>
<td>T1.8 (±2.7)</td>
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TABLE II. Mean segmental levels of analgesia (± standard deviation) found in women having subarachnoid analgesia induced with 0.75% plain bupivacaine 1.5 ml, lying on their left side initially. The "intervention" group required postural manipulation (PM) at 10 min* to encourage the spread of analgesia. The "no intervention" group did not require manipulation. The significance of the difference in analgesic levels between these two sub-groups is also shown (Student's t test)

<table>
<thead>
<tr>
<th>Time (min)</th>
<th>Intervention (PM)</th>
<th>No intervention</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>L2 (± 2.5)</td>
<td>T8.6 (± 3.7)</td>
<td>&lt; 0.05</td>
</tr>
<tr>
<td>5</td>
<td>T12.2 (± 2.4)</td>
<td>T4.3 (± 3.2)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>10</td>
<td>T10.8 (± 3.2)*</td>
<td>T2.0 (± 3.6)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>15</td>
<td>T6.4 (± 3.3)</td>
<td>T1.2 (± 3.0)</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>20</td>
<td>T3.4 (± 0.6)</td>
<td>T1.1 (± 3.0)</td>
<td>&lt; 0.05</td>
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<tr>
<td>30</td>
<td>T3.4 (± 0.5)</td>
<td>T1.1 (± 3.0)</td>
<td>&lt; 0.05</td>
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headaches (four in group R; three in group L). Three of these were readily relieved by paracetamol by mouth; four (11%) were given a blood patch.

DISCUSSION

These results support Sprague's (1976) findings that for Caesarean section with the patient in a left semi-lateral position, the spread of analgesia is enhanced if the subarachnoid injection is made while the patient lies in the right lateral position. Although only two patients (not statistically significant) in group L required supplementary analgesia, this number would undoubtedly have been much greater had postural manipulation not been used. This supposition is based on the fact that, at 10 min, analgesia was within three segments of its highest level in the remaining 28 patients and within two segments in 22 of these. Thus, without intervention, the five patients in group L who were subjected to postural manipulation may only have achieved a final level of T7/8, which in most cases would be inadequate for Caesarean section. It would have been scientifically more correct to have left these patients alone and to have observed the total undisturbed spread of analgesia, but it is doubtful if this would have been ethically justifiable, since it was already evident that the spread of analgesia was reduced.

The limited spread of analgesia in the five patients is unlikely to be a gravitational effect since, in all probability, gravity has no clinically discernible effect on isobaric or hypobaric solutions while the patient is in a horizontal position.

Despite the hypothesis that the induction of subarachnoid anaesthesia in the left lateral position may limit spread, there were no significant differences in the mean analgesic levels between groups R and L, although one short patient (4 ft 11.5; 151 cm) in group L achieved total analgesia to pin prick up to C2 with no ventilatory embarrassment or weakness of the arms (she could only feel pin prick on her face).

It has been suggested that changes in venous pressure associated with changes in posture are unlikely to be the cause of the facilitated spread of subarachnoid drugs during pregnancy (Marx, Zematis and Orkin, 1961; Shah, 1984). However, the relationship between CSF pressure and venous pressure may be complicated by reciprocal volume changes within the different compartments and neither author considered that a greater increase in CSF pressure in the pregnant patient may have been prevented by compensatory displacement of CSF in a cranial direction with a complementary decrease in vertebral venous volume above the level of the vena caval obstruction.

The importance of venous pressure was emphasized by Barclay, Renegar and Nelson (1968), who showed that the spread of subarachnoid analgesia is related to femoral venous pressure. High segmental levels of analgesia could be obtained in non-pregnant subjects by inflating an abdominal binder until the femoral venous pressure of the non-pregnant patient was the same as the mean pressure found in a group of pregnant patients (Barclay, Renegar and Nelson, 1968). There is also a marked difference in the behaviour of previously stable analgesic levels between pregnant and non-pregnant subjects turned from the lateral to the supine position. With patients in a lateral position, 0.5% plain bupivacaine 3.0 ml produced a stable level of T11 and T10 in non-pregnant and pregnant patients, respectively, but on being placed supine the non-pregnant group had a mean (Scott and Sinclair, 1982). A more likely reason is the avoidance of any significant caval occlusion in this sub-group, since none developed hypotension before postural manipulation, although the absence of hypotension may only reflect the restricted degree of blockade.

If the restricted blocks were attributable to gravitational effects, then this merely emphasizes the importance of postural manipulation in causing the analgesic levels to extend against the effects of gravity.
analgesic level of T8 only, while the analgesic levels in the supine pregnant group rose to a mean of T3 (Russell, 1983, 1984).

The only way this rapid rise in analgesic levels can be explained is by some kind of physical displacement of the anaesthetic agent. In the present study it would appear that, at least in some patients, this physical displacement is decreased when turning from the left lateral to the supine left tilt position. This would fit in with a vena caval occlusion hypothesis, since turning from the left lateral to the left semi-lateral tilted position always tends to leave the uterus lagging behind to the left, thus minimizing caval occlusion. Turning from the right lateral, however, results in the uterus tending to lie on the vena cava until it is displaced by insertion of the wedge under the left hip.

The mean levels of analgesia obtained in this study were similar to those observed in a previous study (Russell, 1983) using 0.5% plain bupivacaine 3.0 ml, and are similar to as yet unpublished results using 2–2.5 ml of 0.5% bupivacaine in dextrose. These high levels may cause anxiety to many anaesthetists, but (apart from transient and easily treatable hypotension) appear to be necessary to achieve satisfactory analgesia and to allow certain forms of surgical manipulation such as the routine insertion of bilateral abdominal packs by one obstetrician or the occasional delivery of the uterus onto the abdominal wall—when little if any change in maternal arterial pressure or heart rate occurs. Interestingly, the unpublished results of the remaining 55 patients reveal no significant differences between the highest mean levels of analgesia obtained with 2.0 ml, 1.5 ml or 1.0 ml, although four of the seven patients receiving 1.0 ml required supplementary analgesia and two of these had general anaesthesia induced to allow the completion of surgery. Two of the 1.0 ml group also became hypotensive (29%). This small volume was abandoned after the second general anaesthetic.

The high incidence of hypotension (50%) was similar to that observed in other studies (Russell, 1983), but deserves comment. Hypotension is a recognized complication of subarachnoid analgesia and, although its incidence is high in this study, it can be reduced markedly by the use of i.v. ephedrine at the first sign of a decrease in arterial pressure, or by the prophylactic use of ephedrine (Kang, Abouleish and Caritis, 1982). Prolonged hypotension with a reduction in uteroplacental blood flow will inevitably result in fetal acidosis. Since in this investigation the hypotension was always of short duration, and all infants had high Apgar scores, with times to sustained ventilation well below 60 s, fetal blood-gas tensions were not measured.

The incidence of headaches (20%) was disappointing, but it is similar to that noted in previous studies on young women (Chambers, Edstrom and Scott, 1981; Russell, 1983), with about half of these receiving an extradural blood patch. This is certainly the biggest drawback to the widespread acceptance of subarachnoid anaesthesia for Caesarean section. Some authors do not seem to have this problem with their obstetric patients (Brownridge, 1981). Others, presumably because of the low incidence, do not mention it (Chantigian et al., 1984). Why there is such variation in the incidence of headaches is not clear, but it is possible that the use of a 26-gauge needle may result in a lower incidence of post-spinal headaches (Carrie, personal communication).

While delay in the treatment of hypotension and the problem of post-spinal headaches limit the use of the technique as described, the results do support Sprague's (1976) findings that the posture of the patient during the subarachnoid injection has a significant effect on the adequacy of the resultant analgesia. The effect of postural manipulation in encouraging the spread of analgesia should also be noted.

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REFERENCES


