Knee–chest vs horizontal side position during induction of spinal anaesthesia in patients undergoing lumbar disc surgery

E. LAAKSO, M. PITKÄNEN, J. KYTTÄ AND P. H. ROSENBERG

Summary

In the prone knee–chest position the spread of plain 0.5% bupivacaine in the cerebrospinal fluid and associated haemodynamic changes may be different compared with the horizontal position. A randomized comparison was performed in 40 ASA I–II patients, aged 24–61 yr, undergoing lumbar disc surgery. Subarachnoid injection (27-gauge needle) at the L2–3 interspace with 3 ml of 0.5% bupivacaine was performed with the patient in the operative knee–chest position (prone knee–chest group, n=20) or in the horizontal side position (supine side horizontal group, n=20). Patients in the supine side horizontal group were turned into the horizontal supine position for 20 min, and subsequently they were placed in the operative knee–chest position. In three patients in the prone knee–chest group, the spinal needle was replaced by a larger needle (25-gauge). The final cephalad extension of sensory analgesia on skin tested by pinprick was T5 (median) in the prone knee–chest group and T6 in the supine side horizontal group. Recovery was also similar, on average 210 min from injection in both groups. The mean decrease in systolic arterial pressure was somewhat greater in the prone knee–chest group (30 mm Hg) than in the supine side horizontal group (13 mm Hg). The need for ephedrine occurred earlier in the supine side horizontal group (three patients, all within 10 min from local anaesthetic injection) than in the prone knee–chest group (six patients, all after 15 min). Four of the latter patients also required administration of an anticholinergic for bradycardia compared with two patients in the supine side horizontal group. Light sedation was given to five patients in the prone knee–chest group and to four in the supine side horizontal group because of numbness and aching in the shoulders. We conclude that spinal block was similar in the two groups but there was a tendency to more frequent episodes of haemodynamic deterioration in the knee–chest position. (Br. J. Anaesth. 1997; 79: 609–611).

Key words


Although general anaesthesia is used more often than spinal anaesthesia, the latter is gaining popularity in microscope-assisted surgery of herniated lumbar discs.1,2 Intrathecal puncture can be performed before positioning for surgery or with the patient in the prone knee–chest position.

The spread of spinal anaesthesia with the slightly hypobaric bupivacaine solution and associated haemodynamic changes may be different in the knee–chest position compared with the supine horizontal position. In addition, decreased venous flow in the lower extremities of patients in the knee–chest position3 may predispose to lowering of cardiac output4 and arterial pressure.

In this randomized study, we have compared spinal anaesthesia with plain bupivacaine performed in patients in the knee–chest and horizontal side positions during induction of block.

Patients and methods

The study was approved by the Ethics Committee of the hospital. After obtaining informed consent, we studied 40 patients, ASA I–II, aged 24–61 yr, undergoing primary lumbar disc surgery under spinal anaesthesia (table 1). All patients received diazepam 0.15–0.2 mg kg\(^{-1}\) orally as premedication, 45–60 min before anaesthesia. Clinical monitoring included ECG, non-invasive arterial pressure (oscillotonometer) and haemoglobin oxygen saturation (\(S({_O}2)\)). Ringer’s acetate 100–200 ml was given i.v. before local anaesthetic injection and then approximately 8 ml kg\(^{-1}\) in 20 min. Thereafter the infusion rate was reduced to 100–200 ml h\(^{-1}\).

Patients were allocated randomized to one of two groups. In the prone knee–chest group, patients received the subarachnoid injection after first positioning themselves in the knee–chest position on the operation table. Because of this position and the small size of the spinal needle there was usually no free flow of cerebrospinal fluid (CSF) and hence the correct position of the needle tip was ascertained by aspirating CSF (0.2–0.3 ml) through the needle before injecting the anaesthetic. The table was then...
turned so that the “hip–shoulder joint” line was 20° head-up with respect to the horizontal line.

Patients in the supine side horizontal group received the subarachnoid local anaesthetic injection in the horizontal side position and were turned immediately into the supine position for 20 min. These patients were then placed in the knee–chest position with the assistance of personnel.

In both groups subarachnoid block was performed with a 27-gauge Quincke-type needle in the L2–3 interspace and 3.0 ml of 0.5% bupivacaine were injected. The level of spinal analgesia was tested by pinprick at 5, 10, 15, 20, 30, 45 and 60 min, and thereafter at 30 min intervals after the subarachnoid injection.

If systolic arterial pressure decreased by more than 25% from the preoperative value and the patient had clinical symptoms of arterial hypotension, or systolic arterial pressure decreased to less than 90 mm Hg, ephedrine 5 mg was given i.v. If heart rate decreased to >25% or less than 45 beat min⁻¹, atropine 0.5 mg was given i.v.

All comments by patients were recorded and patients were interviewed by one of the investigators on the next day. Patients left hospital on the second day after operation, or later, and they were asked to report any further symptoms possibly associated with anaesthesia.

For data analysis, descriptive statistics were used. For comparisons between groups, ANOVA and the Mann–Whitney U test were used, where appropriate. P<0.05 was considered statistically significant.

Results

Patients characteristics were comparable in the two groups (table 1). In three cases in the prone knee–chest group the 27-gauge needle was changed for a 25-gauge needle because of difficulties with identification of the subarachnoid space and multiple puncture attempts. There was no significant difference in the maximum median level of analgesia between the groups (fig. 1). The time to maximum spread (median dermatomal level) of analgesia was 45 min in both groups. The highest individual level of analgesia was T3 in the prone knee–chest group and T1 in the supine side horizontal group.

Recovery from spinal anaesthesia was similar in both groups, the median dermatomal level of pinprick analgesia was L2, 210 min after spinal block in both groups.

The mean maximum decrease in systolic arterial pressure from baseline was 30 mm Hg (SD 17, individual maximum decrease 79 mm Hg) in the supine side horizontal group. This difference, calculated using the Mann–Whitney U test, was significant (P=0.0398).

In the prone knee–chest group, ephedrine was needed in six patients compared with three in the supine side horizontal group. It should also be noted that vasopressors in the prone knee–chest group were not given earlier than 15 min from injection of the spinal anaesthetic. In the supine side horizontal group, all three patients needing vasopressor received it within the first 10 min from spinal injection.

Six patients in the prone knee–chest group needed atropine or glycopyrrollonium (four of these also received ephedrine) and two in the supine side horizontal group (one patient also received ephedrine) received atropine for bradycardia.

Because of mild incisional pain, the skin was infiltrated with local anaesthetic in one patient in the supine side horizontal group. One patient in the prone knee–chest group had insufficient cephalad spread of analgesia and was given an extra intrathecal dose of 1.0 ml of 0.5% bupivacaine 40 min after the initial spinal anaesthetic injection, before the start of operation. Another patient in the prone knee–chest group received 1.5 ml of 0.5% bupivacaine extradurally during surgery, 60 min after the intrathecal injection and was pain free within 2–3 min.

One patient in the prone knee–chest group had a sudden decrease in the level of analgesia from T12 to L3 after leakage of cerebrospinal fluid (CSF) through an unintentional tear in the dura. Soon after the patient complained of mild pain and was given two doses of fentanyl 50 μg.

Duration of surgery varied between 20 and 112

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Patient characteristics (mean (SD or range) or number)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex (F/M)</td>
<td>7/13</td>
</tr>
<tr>
<td>Prone knee–chest group</td>
<td></td>
</tr>
<tr>
<td>Supine side horizontal group</td>
<td>6/14</td>
</tr>
</tbody>
</table>
min (mean 56 min). The main complaint of patients during surgery was numbness and ache in the arms and shoulders because of the position on the operating table. Seven patients (four in the prone knee–chest group, three in the supine horizontal group) received light sedation, either diazepam 2.5–5.0 mg or midazolam 1.0–4.0 mg i.v. Two patients (both in the prone knee–chest group) also received a short infusion of propofol at a rate of 2 mg kg\(^{-1}\) h\(^{-1}\) or less near the end of operation.

All patients had complete sensory and motor recovery from spinal anaesthesia and none reported symptoms of radiating aching or pain in the buttocks or legs, or post-dural puncture headache (PDPH). None of the study patients reported backache or PDPH at a later stage. All patients were satisfied with this type of anaesthesia.

**Discussion**

We have found that there was no difference in the rate and spread of anaesthesia whether the subarachnoid local anaesthetic injection was performed with the patient in the horizontal side position or in the knee–chest position. However, when the patient was in the knee–chest position during induction of anaesthesia there was a tendency to greater hypotension and bradycardia compared with the horizontal position. It can be postulated that when the horizontal position is used for the first 20 min, patients have more time to accommodate to vasodilatation of the lower limbs. As was demonstrated in our earlier ultrasonographic study with healthy unanaesthetized volunteers,\(^5\) there seems to be a tendency to venous blood pooling in the lower limbs in the knee–chest position. When this is combined with vasodilatation caused by anaesthesia the effect on venous return to the heart can be severely impaired.\(^5\) In fact, even without anaesthesia, Wadsworth, Anderton and Vohra\(^4\) were able to demonstrate a 20% reduction in cardiac index of volunteers placed in the knee–chest position.

The quality of anaesthesia was good for surgical purposes in all but one patient who needed an additional intrathecal dose of bupivacaine. Another patient received bupivacaine 7.5 mg into the exposed extradural space at the site of surgery 60 min after the original spinal anaesthesia. It is interesting that such a small extradural dose sufficed to abolish painful sensations within a few minutes, suggesting that this was a direct local effect on a painful spot rather than a spinal effect. The sedation needed in seven patients was based mostly on inconvenience felt in the hands and shoulders. Mild sedation with benzodiazepines or propofol appears to be beneficial in such cases. However, it is important that the depth of sedation is kept so light that the patient remains co-operative and maintains good spontaneous breathing.

The case of dural leakage during surgery was interesting. It was assumed that the dural lesion allowed leakage of CSF and local anaesthetic and this resulted in an immediate reduction in cephalic extension of sensory analgesia. After closure of the lesion the local anaesthetic seemed to have been redistributed within the cerebrospinal fluid and the previous level of analgesia was re-instated. The loss of some bupivacaine by leakage may have reduced the duration of block.

Spinal anaesthesia performed before the patient has assumed the surgical position has been a routine for low back operations, including laminectomy, lumbar disc operations and spinal fusions.\(^2,7,8\) In a survey of 28 395 patients undergoing lumbar laminectomy for discogenic radiculopathy, Ramirez and Thisted reported that 7% of operations (1988 operations) were performed under spinal anaesthesia. No complications could be related exclusively to this technique.\(^9\) In another retrospective review, Tezlaff and colleagues\(^2\) reported 23 patients whose operations were performed during spinal anaesthesia, including laminectomies, lumbar disc operations and fusions. There were no failures of spinal anaesthesia, anaesthetic complications or PDPH.

**References**