Evaluation of the usefulness of intrathecal bupivacaine infusion for analgesia after hip and knee arthroplasty

L. NIEMI, M. PITKÄNEN, P. DUNKEL, E. LAAKSO AND P.H. ROSENBERG

Summary
Spinal anaesthesia in 47 ASA I–III patients was induced with 0.5% bupivacaine 2 ml via a 28-gauge spinal catheter (L3–4 interspace) and 0.5-ml increments were given if needed before or during hip or knee arthroplasty. Intrathecal 24-h infusions consisted of 0.5% bupivacaine 0.4 ml h⁻¹ (2 mg h⁻¹) (n=12), 0.5% bupivacaine 0.2 ml h⁻¹ (1 mg h⁻¹) (n=12) or saline (n=11) (12 exclusions). Patients received oxycodone 0.1–0.14 mg kg⁻¹ i.m. for rescue analgesia. Infusion of bupivacaine 2 mg h⁻¹ provided significantly better postoperative analgesia (19 oxycodone doses per group in 24 h) compared with bupivacaine 1 mg h⁻¹ (36 doses of oxycodone per group) and saline (52 doses per group) (P<0.05). Five patients in the bupivacaine 2-mg h⁻¹ group and none in the other groups had measurable sensory block 24 h after the infusion was started. Three patients in the bupivacaine 2-mg h⁻¹ group, two with concomitant arterial hypotension, and one patient in the bupivacaine 1-mg h⁻¹ group experienced an increase in block on the ward. The incidence of nausea and vomiting was similar in all groups. Although an effective analgesic, intrathecal infusion of bupivacaine 2 mg h⁻¹ cannot be recommended for routine pain relief because of the risk of increasing spinal block. Technical problems (19%) also reduced the overall efficacy of the continuous intrathecal analgesic regimen. (Br. J. Anaesth. 1996;77:544–545)

Key words

Spinal catheter techniques permit flexibility in titrating the extent of spinal anaesthesia and increasing its duration as needed. Spinal catheters can also be used for postoperative pain relief. Opioids are the drugs most often administered intrathecally for postoperative pain¹². However, technical problems with the microcatheters¹³ and opioid side effects¹² are disturbingly frequent.

We decided therefore to evaluate the use of continuous low-dose intrathecal bupivacaine infusion in the treatment of postoperative pain after hip and knee arthroplasty.

Methods and results
The study was approved by the local Ethics Committee and patients gave their verbal informed consent.

We studied 47 ASA I–III patients undergoing hip or knee arthroplasty. All patients were premedicated with oral diazepam 5–15 mg depending on the patient’s weight and age. Subarachnoid puncture was performed in the midline at the L3–4 interspace with the patient in the lateral position. A 28-gauge spinal catheter (CoSPAN Kendall, Basingstoke, UK) was inserted via a 22-gauge spinal needle. The catheters were advanced 3–4 cm past the needle tip into the subarachnoid space. Plain 0.5% bupivacaine 2 ml was administered via the catheter and incremental doses of bupivacaine 0.5 ml (maximum four doses=2 ml) were administered with the aim of reaching T6.

Patients were allocated randomly to one of three groups. Patients in group 1 received an intrathecal infusion of plain 0.5% bupivacaine 0.4 ml h⁻¹ (2 mg h⁻¹), those in group 2 received 0.5% bupivacaine 0.2 ml h⁻¹ (1 mg h⁻¹) and those in group 3 received an intrathecal infusion of saline 0.2 ml h⁻¹. The infusion was given using a syringe pump (JMS Syringe pump SP-100, JMS Company Ltd, Hiroshima, Japan) which was started 60 min after induction of spinal anaesthesia, if the level of spinal block was less than T6. If not, the infusion was started after the block had decreased to less than T6. Increments of bupivacaine 0.5 ml were administered via the catheter during surgery, if needed. All patients had a urinary catheter in place during the study. For postoperative pain (at the operation site), oxycodone 0.1–0.14 mg kg⁻¹ i.m. was given on request.

Patients were interviewed by the authors 3, 6, 12 and 24 h after intrathecal infusion was started. Each interview included an assessment of the intensity of pain at rest and on movement of the operated leg using a 20-cm visual analogue scale (VAS) (0–10). Cephalad extension of the sensory and degree of motor block in the lower extremities were recorded. If the spinal block was increasing, the infusion rate was decreased by 50%. Heart rate, arterial pressure, nausea and vomiting were also recorded.

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Postoperative intrathecal bupivacaine infusion

The spinal catheters were removed by one of the investigators on the first day after operation. For removal, the patient was in the same flexed recumbent position as during spinal puncture.

The Student’s t test was used for comparison of the differences between mean values for weight, height and age. Fisher’s exact test was used for comparison between frequencies. For other data comparisons, the Kruskal–Wallis one-way analysis of variance was applied followed by Dunn’s test.

The study was terminated after the 47th patient because of two cases of hypotension related to the reappearance of spinal block during infusion (see below). Twelve patients were excluded from assessment of analgesia, mainly because of technical problems (five accidental disconnections of the catheter, adequate level of spinal analgesia was not reached in three patients and single-dose spinal anaesthesia was given, one failure to insert the catheter and two patients needed intensive care because of haemodynamic instability). One patient wanted the infusion interrupted (bupivacaine 1 mg h⁻¹) because of the disturbing reappearance of sensory and motor block.

Patients receiving bupivacaine 2 mg h⁻¹ required significantly less oxycodone (19 doses in 12 patients) than those receiving bupivacaine 1 mg h⁻¹ (36 doses in 12 patients) and saline (52 doses in 11 patients) (P<0.05). Mean time to administration of i.m. opioid from induction of spinal anaesthesia was comparable in the three groups (table 1). Median VAS scores at 6, 12 and 24 h were comparable.

Table 1: Postoperative 24-h requirement of oxycodone and mean (range) time to first dose in the three intrathecal infusion groups. **P < 0.01 compared with saline

<table>
<thead>
<tr>
<th></th>
<th>Bupivacaine 2 mg h⁻¹</th>
<th>Bupivacaine 1 mg h⁻¹</th>
<th>Saline</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of patients needing oxycodone</td>
<td>7/12</td>
<td>11/12</td>
<td>10/11</td>
</tr>
<tr>
<td>No. of doses per group</td>
<td>19**</td>
<td>36</td>
<td>52</td>
</tr>
<tr>
<td>No. of doses per patient</td>
<td>1.6 (0–8)</td>
<td>3 (0–9)</td>
<td>4.7 (0–9)</td>
</tr>
<tr>
<td>Mean time to first dose (min)</td>
<td>498 (195–940)</td>
<td>408 (30–675)</td>
<td>428 (140–1470)</td>
</tr>
</tbody>
</table>

Five patients receiving bupivacaine 2 mg h⁻¹ had apparent sensory and motor block 12 h after the infusion was started compared with two patients receiving bupivacaine 1 mg h⁻¹ and none receiving saline. Four patients experienced an increase in spinal block on the ward (three in the bupivacaine 2-mg h⁻¹ group and one in the bupivacaine 1-mg h⁻¹ group). All of these patients also had motor block. The intrathecal infusion was halved at 6.5 h, 8 h and 9.3 h, respectively. Two patients in the bupivacaine 2-mg h⁻¹ group developed transient hypotension associated with the increase in block. Five patients in the bupivacaine 2-mg h⁻¹ group had detectable sensory block at 24 h. In the bupivacaine groups, of those patients who did not receive any opioid, two of six patients experienced PONV.

Comment

Intrathecal infusion of bupivacaine 2 mg h⁻¹ for 24 h provided satisfactory postoperative analgesia in patients undergoing hip or knee arthroplasty. However, because of technical problems, unpredictability of the spread of intrathecal bupivacaine with reappearance of spinal block in some instances, and occasional sudden hypotension, this regimen cannot be recommended as a routine method for postoperative pain relief.

References