Reducing the potential morbidity of an unintentional spinal anaesthetic by aspirating cerebrospinal fluid

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Summary

We describe two cases where we attempted to reduce the adverse effects of inadvertent spinal anaesthesia by aspirating local anaesthetic-contaminated cerebrospinal fluid (CSF). Analysis of this CSF for its local anaesthetic concentration revealed that we were able to recover 51% and 39% of the administered lignocaine. It is suggested that such aspiration may be a helpful additional measure to the supportive management of this complication. (Br. J. Anaesth. 1996; 76: 467–469)

Key words


Injection of an appropriate dose of local anaesthetic for extradural anaesthesia into an extradural catheter which has perforated the dura mater may result in total spinal anaesthesia. On the last two occasions when this complication occurred in our institution, we immediately aspirated contaminated cerebrospinal fluid (CSF), in an attempt to reduce the height of the block. Because our patients did not develop total spinal anaesthesia and analysis of the aspirated CSF showed that significant amounts of injected local anaesthetic could be recovered by this means, we suggest that such aspiration may be a helpful adjunct to the conventional supportive management of patients in this situation.

Case report

PATIENT NO. 1

An extradural anaesthetic was planned for a repeat elective Caesarean section in a 28-yr-old healthy woman with a contracted pelvis and unstable fetal lie. With the patient in the left lateral position, the extradural space at L3–4 was identified with an extradural needle using the loss of resistance to saline technique. An extradural catheter was advanced 4 cm through this needle and aspiration was negative for CSF or blood. After the patient had been placed in the supine position with left uterine displacement and the i.v. fluid bolus had been completed, a test dose of 2% lignocaine 3 ml with adrenaline 1 : 200 000 was injected into the extradural catheter. This produced no sensory or motor block and no change in the patient’s heart rate, as monitored by an electrocardiogram and pulse oximeter, over the course of the next 4 min. Subsequently, 2% lignocaine 7 ml with adrenaline 1 : 200 000 and fentanyl 10 µg ml⁻¹ were injected through the catheter. Within 4–5 min, the patient stated that her legs had become completely numb and simultaneously her arterial pressure decreased from 120/80 to 70/50 mm Hg. Aspiration now revealed free-flowing CSF. A total of 20 ml of CSF was withdrawn over 40 s and sent in a glass bottle to the laboratory for analysis of lignocaine and fentanyl content.

Simultaneously, the patient’s hypotension was managed by exaggerating left uterine displacement, placing the patient in the Trendelenburg position, giving an additional i.v. fluid bolus and repeated i.v. injections of ephedrine 5 mg (35 mg in total). Oxygen had been administered continuously via a face mask since insertion of the extradural catheter. The patient’s arterial pressure stabilized at 110/70 mm Hg, she did not lose consciousness, her ventilatory frequency and laryngeal reflexes were normal and the fetal heart rate monitor revealed no evidence of fetal distress. On questioning, the patient complained that her arms felt heavier than usual but she had no demonstrable muscle weakness in either arm. By temperature discrimination, the spinal anaesthetic had extended to the C3–4 level.

Thirty-six minutes after the initial test dose of local anaesthetic, a 3650-g male infant was delivered, with Apgar scores of 7 and 8 at 1 and 5 min, respectively. After operation the catheter was removed intact and 3.75 h after receiving the local anaesthetic, the block had completely worn off. The patient had an uneventful postoperative course and did not develop a post-dural puncture headache.

PATIENT NO. 2

Extradural anaesthesia was planned for a 68-yr-old woman who was to undergo right total hip arthroplasty. With the patient lying on her side, the extradural space between L2–3 was identified with an extradural needle using the loss of resistance to saline technique. An extradural catheter was passed for administration of local anaesthetic.
easily through this needle and aspiration of the latter was negative for CSF and blood. A test dose of 2% lignocaine 3 ml with adrenaline 1 : 200 000 injected through the catheter produced no sensory or motor block and no change in heart rate, as monitored by an electrocardiogram and pulse oximeter after 3 min. In the subsequent 3 min, 2% lignocaine, 17 ml with adrenaline 1 : 200 000 was injected incrementally through the catheter. Eleven minutes later, arterial pressure decreased from 150/80 to 94/40 mm Hg. This was treated promptly with ephedrine 10 mg i.v., an i.v. fluid bolus of 500 ml and her arterial pressure stabilized at 120/70 mm Hg. Eighteen minutes after local anaesthetic administration, the patient could not move her hands and by sensory discrimination the level of block was at C5–6. Aspiration of the extradural catheter at this time revealed free flowing CSF and 30 ml was removed, placed in a glass bottle and sent to the laboratory for lignocaine assay. Ten minutes later she started recovering the use of her hands. Shortly afterwards, surgery commenced. Eighty-six minutes after the initial administration of lignocaine, the patient complained of some minor discomfort at the site of surgery. To treat this, 0.5% bupivacaine 1 ml was injected intrathecally through the catheter. A second 1 ml of 0.5% isobaric bupivacaine was administered 31 min later. This allowed surgery to be completed without discomfort. At the end of surgery, the extradural catheter was removed intact. The patient had an uneventful postoperative course and did not develop a post-dural puncture headache.

**LIGNOCAINE AND FENTANYL ASSAY**

Lignocaine concentration in CSF was measured by an enzyme multiplied immunoassay technique (EMIT) using calibrators and reagents obtained from Syva Company (San Jose, CA, USA) adapted to a Monarch automated chemistry analyser (Instrumentation Laboratory, Lexington, MA, USA). The assay, used routinely to measure lignocaine concentration in serum, was validated for use on CSF by assaying lignocaine standards of known concentration prepared by dissolving pure lignocaine in a solution designed to mimic the electrolyte composition, osmolality and pH of normal CSF. Percentage recovery (mean (sd)) at three concentrations spanning the assay linear range was 97.6 (7.1)%.

Fentanyl was extracted from CSF with chloroform:ethylacetate (80:20, v:v), and the organic phase was dried down under nitrogen. The residue was resuspended in methanol 100 μl and assayed for fentanyl by gas chromatography–mass spectrometry using a Hewlett-Packard (Palo Alto, CA, USA) 5980/5987 instrument. Deuterated fentanyl was added to CSF as an internal standard to correct for losses incurred during extraction and chromatography.

**Discussion**

The results are summarized in table 1. In the two patients, we recovered 51% and 39% of lignocaine administered intrathecally. Although definite conclusions cannot be drawn based on findings in two patients, the success in retrieving lignocaine combined with the lack of signs and symptoms of total spinal anaesthesia suggest that such CSF aspiration may be beneficial.

Withdrawal of CSF to control the level of continuous spinal anaesthesia was described in 1948 [1]. Contaminated CSF removal as part of the management of an inadvertent spinal anaesthetic was suggested originally in a 1980 editorial [2]. We believe this report is the first to support this suggestion. Such CSF aspiration has been used routinely to attempt to overcome the potentially fatal consequences resulting from inadvertent excess intrathecal methotrexate [3–5]. It has also been used to treat intrathecal morphine overdose [6].

In addition to the need for more patient-based data, several other questions need to be addressed before CSF aspiration is incorporated routinely in the treatment of inadvertent spinal anaesthesia. Pharmacokinetic principles have been used to predict the percentage of intrathecally injected methotrexate removed by different volumes of CSF aspiration when performed at various time intervals after drug administration [3]. We aspirated 20 ml of CSF in our first patient and 30 ml in the second. The ideal volume of CSF to be recovered in this clinical situation remains to be resolved. Presumably removal of larger volumes than we used is more likely to result in post-dural puncture headache. The immediacy of such aspirations to maximize recovery of drug may also be important. This report does not suggest how much time may elapse from injection of local anaesthetic before this manoeuvre loses its clinical benefit. Drug recovery also depends on drugs diffusibility and lipid solubility [7]. This is illustrated by patient No. 1 in whom we recovered 51% of the administered lignocaine, but were only able to retrieve 4.7% of the concomitantly administered fentanyl.

**Table 1** Lignocaine and fentanyl recovery by CSF aspiration

<table>
<thead>
<tr>
<th></th>
<th>Patient No. 1</th>
<th>Patient No. 2</th>
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<tbody>
<tr>
<td>Total dose lignocaine injected (mg)</td>
<td>200</td>
<td>400</td>
</tr>
<tr>
<td>Volume of CSF removed (ml)</td>
<td>20</td>
<td>30</td>
</tr>
<tr>
<td>Concentration of lignocaine in CSF recovered (mg ml⁻¹)</td>
<td>5.1</td>
<td>5.2</td>
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<tr>
<td>Total amount of lignocaine recovered mg</td>
<td>102</td>
<td>156</td>
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<tr>
<td>Percentage as injected</td>
<td>51</td>
<td>39</td>
</tr>
<tr>
<td>Total dose fentanyl injected (μg)</td>
<td>70</td>
<td>—</td>
</tr>
<tr>
<td>Concentration of fentanyl in CSF recovered (μg ml⁻¹)</td>
<td>0.16</td>
<td>—</td>
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<tr>
<td>Percentage fentanyl recovered</td>
<td>4.7</td>
<td>—</td>
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**References**

2. Covino BG, Marx GF, Finster M, Zsigmond EK. Editorial.


