Total spinal anaesthesia in association with insertion of a paravertebral catheter

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An association between intercostal nerve block and the development of a total spinal is rare. Usually, subarachnoid injection is considered to have followed intraneural placement or inadvertent entrance into a dural cuff extending beyond an intervertebral foramen. We report a patient that followed injection of local anaesthetic into a paravertebral catheter sited at surgery in the thoracic paravertebral space of a patient undergoing thoracotomy. This was a life-threatening event that occurred on two occasions before the definitive diagnosis was made. It is considered likely that the paravertebral catheter entered an intervertebral foramen and the tip perforated the dura.

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The thoracic paravertebral space is triangular in cross-section and bounded by the pleura, vertebral bodies and lateral processes of the vertebrae and contiguous ligaments. It has proved a useful site for the administration of local anaesthetics and catheter insertion as the contents include the proximal tracts of intercostal nerves and the sympathetic chain.1 The technique of placing catheters during thoracic surgery is proving increasingly popular and generally should be without complication if chest drains are present and low concentrations of local anaesthetic are used.2

Case report

A 62-yr-old woman was scheduled for right upper lobectomy for a bronchogenic carcinoma. This had been an incidental finding during a recent hospital admission for an infero-posterior myocardial infarction, from which she had made a good recovery. Other medical history of note was a right nephrectomy for tuberculosis 39 yr previously.

She was unpremedicated before surgery and anaesthesia was induced with remifentanil, thiopentone and vecuronium. She was ventilated via a medium left-sided Robertshaw tube and anaesthesia was maintained with isoflurane and a remifentanil infusion. Pre-operative paravertebral blocks at T4 and T7 were performed using ‘one shot’ percutaneous techniques, and a total of 18 ml of 0.5% bupivacaine with 1 in 200 000 adrenaline.

After an uncomplicated resection, a paravertebral catheter was inserted via a separate skin puncture and the catheter threaded under direct vision extrapleurally using
forceps, with no apparent problem. Chest drains were sited, and the chest wall was closed. At the end of surgery, 0.25% plain bupivacaine 20 ml was injected through the paravertebral catheter. Morphine 5 mg i.v. was administered, the remifentanil infusion stopped and neuromuscular block reversed.

As the patient was being transferred back onto her bed it was noted that her systolic blood pressure had decreased to 50 mm Hg. This hypotension responded to metaraminol (3 mg in 1 mg aliquots). Her trachea was still intubated and haemoglobin oxygen saturations were maintained at 98% with manual ventilation with 100% oxygen. Clinical examination excluded pneumothorax or acute haemorrhage as a cause of the hypotension and, as she was still making no respiratory effort after a further 20 min, arterial blood gases were checked and signs of opioid narcosis sought. Although her pupils were widely dilated and poorly reactive at this time, blood gases showed a $P_{aCO_2}$ of 11 kPa. Therefore, it was thought likely that this was the cause (i.e. carbon dioxide retention) of her persistent unresponsiveness and pupillary signs. Her double lumen tube was changed for an oral tracheal tube, with no cardiovascular response to intubation and no need for further drugs to be given. She was ventilated for another 30 min after which she woke up and began to breathe. Her pupils were now normal in size and reactivity and she was transferred to a high dependency unit. She had no recall of these events.

In view of her complicated recovery, the usual bupivacaine paravertebral infusion was not commenced immediately post-operatively. Two hours later, she complained of pain at her thoracotomy site. A 10 ml bolus of 0.25% plain bupivacaine was administered by an anaesthetist. Her pain relief was immediate which alerted the anaesthetist to the possibility of subarachnoid injection. Shortly after, she became apnoeic, unresponsive, hypotensive and developed fixed dilated pupils. Intubation and resuscitation were immediate. Her hypotension responded to a colloid bolus injection and, in addition, a 3 ml test dose of local anaesthetic was administered by an anaesthetist. Her pain relief was immediate which alerted the anaesthetist to the possibility of subarachnoid injection. Shortly after, she became apnoeic, unresponsive, hypotensive and developed fixed dilated pupils. Intubation and resuscitation were immediate. Her hypotension responded to a colloid bolus and adrenaline 100 µg i.v. She was given midazolam 10 mg and transferred to ITU.

Over the next 2 h she woke up and began to breathe again. Lower limb weakness persisted for a further hour, but by the following morning she had no residual neurological deficit of subarachnoid injection or adverse effects from dural puncture. Recovery to hospital discharge was unremarkable apart from a brief episode of supraventricular tachycardia, which was not felt to be related to her anaesthetic complications.

**Discussion**

The immediate response to the second critical incident, after resuscitation, was to remove the paravertebral catheter. Serum bupivacaine concentration measured on arrival in ITU was 0.72 mg litre$^{-1}$, which is well below toxic concentrations or those associated normally with regional block. The clinical presentation at the second incident was classical for a ‘total spinal’. However, this is an unusual complication of paravertebral block and would be difficult to diagnose in an unconscious patient immediately after surgery.

It is known that extradural spread is common with paravertebral block, because of the proximity of the extradural space to the injection site, but the clinical relevance of this association in acute pain relief is still a matter of debate. The volumes of drug administered and speed of onset of block makes it unlikely that these events were a result of what has been described as a massive extradural injection.

Lonnqvist and colleagues, looked at clinical problems associated with percutaneous paravertebral block in 367 patients. Thoracic surgery patients were included in their casemix, but no patient showed signs of subarachnoid injection. There have been some reports of postural headache after percutaneous paravertebral injection but without CSF aspiration, and there is a report of a series in which a medial approach to the paravertebral space resulted in a dural puncture incidence rate of less than 1.0%. In our patient, there had been no attempts at extradural injection and the pre-operative paravertebral injection had been via a relatively lateral approach, so it is thought unlikely that the patient had sustained any dural trauma explaining the spread of local anaesthetic from the paravertebral space, through an intervertebral foramen into the subarachnoid space.

There have been a few reports of subarachnoid spread after intercostal nerve blocks. As these cases involved direct injection at thoracotomy, it has been postulated that intraneural injection was responsible, but inadvertent injection via a dural cuff has not been ruled out as a possibility. It is unlikely that direct intraneural injection occurred in the above patient as the catheter sited was under direct vision.

We postulate that the catheter was sited in an intervertebral foramen initially, and the tip migrated into the subarachnoid space. The catheter commonly in use on our unit at this time was that used for arterial monitoring. It had the advantage of a Luer connection, which is easily coupled with the continuous analgesia infusion systems available. To facilitate placement, it had become common practice to fashion a pointed tip on the catheter. This pointed tip could have penetrated the dura itself or cannulated a dural cuff.

Four changes have been made in our practice since this incident. Catheters designed for extradural sitting are now used for paravertebral infusions. It is checked that the catheter tip lies in the paravertebral gutter before chest closure. This is usually visual though the use of a confirmation aid, such as a marked catheter tip, or observation of the overlying pleura on injection of saline, has been suggested. An aspiration test is performed before drug injection and, in addition, a 3 ml test dose of local anaesthetic is administered before the wound dressings are applied. Finally, the patient is monitored for evidence of subarachnoid injection before the therapeutic dose is given.
References
3 Collier C. Total spinal or massive subdural block? Anaesth Intens Care 1982; 10: 92
6 Sury MR, Bingham RM. Accidental spinal anaesthesia following intrathoracic intercostal nerve blockade. Anaesthesia 1986; 41: 401–3