ACCIDENTAL SUBDURAL CATHETERIZATION: RADILOGICAL EVIDENCE OF A POSSIBLE MECHANISM FOR SPINAL CORD DAMAGE

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SUMMARY

We describe the inadvertent subdural insertion of a lumbar extradural catheter in a primiparous woman in labour. A small quantity of local anaesthetic resulted in extensive motor and sensory block. Computed tomography performed after contrast injection demonstrated unequivocally that the catheter was in the subdural space. The catheter and injected fluid produced considerable displacement of the arachnoid within the thecal sac. We postulate that this could result in arterial compression or direct damage to the spinal nerve roots. Such a mechanism might explain some of the cases of permanent neurological damage associated with extradural analgesia.

KEY WORDS


Accidental subdural placement of an extradural catheter is a well-described complication, although the actual incidence is not known [1—4]. Provided the extensive block produced by small volumes of local anaesthetic is recognized and any symptoms treated, full recovery may be expected. It has been suggested that a volume of fluid in the subdural space may lead to compression of the subarachnoid contents [5]. This case report demonstrates radiologically that this could easily occur.

CASE REPORT

A 21-yr-old primiparous woman was admitted to the labour suite after spontaneous rupture of membranes. Pain was managed initially with pethidine 100 mg i.r. at 02:00. By 05:30, labour had progressed to cervical dilatation of 4 cm. At this point a request was made for extradural analgesia.

The patient was 160 cm tall, of slim build (54 kg in early-pregnancy) and had easily identifiable spinal features. There was no relevant past medical history. With the patient in the sitting position, a 16-gauge Tuohy needle was inserted into the L2-3 interspace, the extradural space was identified by loss of resistance to air and 0.25 % plain bupivacaine 8 ml was injected through the needle. A proportion of this flowed back after the syringe was removed. At this point the patient complained of a slight frontal headache. A three-holed catheter was inserted through the needle to a depth of 4 cm within the spinal canal. Some paraesthesiae were noted in the right leg when the catheter was inserted. Another 3 ml of 0.25 % bupivacaine was injected through the catheter. Satisfactory analgesia was achieved and the headache, which had been associated with slight nausea, resolved over 30 min. Although no formal assessment of the block achieved was made, the patient did not complain of excessive leg weakness and her arterial pressure remained stable.

At 07:30, after about 90 min of satisfactory pain relief, a further request for analgesia was made. The attending midwife aspirated 1 ml of clear fluid from the extradural catheter and therefore sought medical assistance. Another aspiration was negative and a 3-ml test dose of 0.125 % bupivacaine with pethidine 2.5 mg ml⁻¹ was given. After 20 min, pain relief was unsatisfactory, motor function was unaffected and there was no evidence of extensive block. Aspiration of the catheter was negative. A 3-ml test dose of 0.5 % bupivacaine was administered. After 20 min, the patient had developed extensive leg weakness (right > left) and had bilateral pinprick analgesia to T2. Over the next 15 min she complained of tingling in the arms and fingers, heavy eyelids and sleepiness. Bilateral, marked leg weakness was present and ephedrine 12 mg i.v. was administered to treat hypotension (90/60 mm Hg). At this stage the catheter was presumed to lie in the subarachnoid space, although the repeated negative aspiration tests made subdural placement possible.

Over the next 2 h, the degree of neural block receded gradually. A healthy female infant was delivered by Ventouse extraction at 11:30. After delivery, the position of the catheter was assessed radiologically (see below) and the catheter was removed. There was full recovery of neurological...
Fig. 1. Frontal (A) and lateral (B) radiographs of upper lumbal region, showing contrast-filled extradural catheter (large arrows) and contrast in the subdural space (small arrows).

Fig. 2. Axial CT scan at the L1-2 disc level showing catheter tip (large arrow) indenting the subarachnoid space (s). The subdural contrast collection (c) has a tented appearance. The extradural space (small arrows) appears normal.

Fig. 3. Lateral CT tomogram, showing contrast layering posteriorly in the thoracic spinal canal.

Fig. 4. Axial CT scan at T7, showing contrast (c) in subdural space displacing subarachnoid contents (s) anteriorly. The extradural space (small arrows) is intact.

The frontal radiograph (fig. 1A) showed the catheter lying close to the midline with the tip at the level of inferior endplate of L1. The lateral radiograph of the lumbar spine (fig. 1B) showed the catheter lying in a relatively anterior position within the spinal canal. Contrast was seen lying posteriorly and mainly to the left within the thecal sac. The subdural location of the catheter was confirmed by an axial CT slice at the L1-2 level (fig. 2). The catheter tip indented the arachnoid layer from the posterior direction, giving rise to a “tented” configuration of the contrast collection. A lateral CT tomogram (fig. 3) showed that much of the contrast had tracked gravitationally into the thoracic region, producing a long fluid level within the spinal canal. The subdural location of the contrast was also demonstrated by a single axial CT slice at the level of greatest dependency at T7 (fig. 4). The spinal cord, within the subarachnoid space, was displaced anteriorly and of normal density. The extradural fat function and mother and daughter were discharged 5 days later. At no stage after delivery did the patient complain of a spinal headache.

RADIOLOGICAL FINDINGS

The range of computed tomography (CT) appearances from inadvertent subdural and extradural contrast injection during myelography have been described previously [6]. In this patient, 5 ml of the non-ionic iodinated contrast agent Iopamidol (Schering) was injected into the extradural catheter under fluoroscopic control. This was performed in the labour suite. About 1 h later, the patient was transferred to the CT scanning room, without additional injection of dye.
planes were intact, outlining the outer margins of the thecal sac. No contrast was seen in the extradural space.

DISCUSSION

This case report demonstrates the difficulties associated with identification of the extradural space. The only possible clue to abnormal placement on insertion was the frontal headache experienced on injection of bupivacaine through the needle. It is possible that CSF may have been displaced intracranially to cause symptoms of a high pressure headache. Williamson [7] reported a severe frontal headache which persisted for several days after inadvertent subdural injection of a steroid mixture.

Abnormal placement was suspected after the test dose of 0.5% bupivacaine. The extensive block produced was unlikely to have been caused by extradural insertion. Assessment of the block height was made only after the catheter was thought not to be in the extradural space. It is possible that, if no local anaesthetic were given “through the needle” at the start of the procedure and a test dose of bupivacaine were given via the catheter followed by careful assessment of the level of the block, the misplacement may have been identified sooner. The failure of the weaker solution of bupivacaine to produce evidence of catheter position demonstrates the importance of using an appropriate concentration when using a test dose—that is, one that should produce unequivocal symptoms and signs.

Collier [8] described the clinical indicators of subdural injection, notably: moderate hypotension, onset of symptoms from 15 to 30 min, progressive respiratory depression and complete recovery after 2 h. In this patient, there were no respiratory problems. The complaint of heavy eyelids and the observation of small pupils could be related to Horner’s syndrome, although the small quantity of pethidine (7.5 mg) injected beforehand may have contributed to the miosis. There was no complaint of nasal congestion.

One of the peculiar aspects of this case was the aspiration of 1 ml of clear fluid before the top-up dose was to be injected. Given that the catheter was demonstrated to be subdural, this fluid was probably the remainder of the initial injection of bupivacaine. A negative catheter aspiration test does not exclude subarachnoid placement, as the catheter could kink or the filter may not permit free retrograde flow. On this occasion, it was the positive aspiration test that alerted staff to there being a malposition of the catheter. In a case reported previously [9], clear fluid was aspirated from a catheter thought to be subdural; however, the fluid was not tested and the catheter position not confirmed.

As illustrated by the CT scan, the 5 ml of injected contrast medium represented a significant space-occupying mass within the thecal sac. If a large volume of local anaesthetic liquid were injected into the space, it is possible that pressure could be exerted on the spinal nerve roots or on the cord itself. Alternatively, compression of spinal vessels could lead to ischaemia. Both mechanisms could result in neurological damage. After the local anaesthetic diffused out of the space, there would be no evidence of the cause. This may explain some of the rare causes of permanent neural damage after an apparently straightforward extradural anaesthetic. While the exact volume required to cause damage is a matter for conjecture, the 5 ml of contrast administered in this patient does seem to be occupying a considerable volume within the spinal canal.

In summary, this case report demonstrates the occurrence of subdural insertion of an extradural catheter. Identification of subdural placement is difficult, but should always be considered if a more extensive block occurs than would normally be expected with a given dose of local anaesthetic. This case emphasizes the importance of having appropriately trained staff in attendance or immediately available at all times when managing extradural analgesia. A high index of suspicion should be maintained if any abnormal symptoms or signs are reported.

REFERENCES