MIGRATION OF AN EXTRADURAL CATHETER INTO THE SUBDURAL SPACE

A Case Report

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The subdural space is a potential space between the arachnoid mater and the dura mater. It contains a minute quantity of serous fluid which moistens the smooth surfaces of the two membranes. The space ends at the lower border of the second sacral vertebra, where the filum terminale becomes invested closely by the dura mater (Gray, 1985), and extends into the cranial cavity (Mehta and Maher, 1977). Thus a local anaesthetic injected to the subdural space may spread cephalad and block the cranial nerves. Several cases of extensive blockade occurring after an intended extradural injection of local anaesthetic have been attributed to inadvertent subdural injection (Dawkins, 1969; Conklin and van der Wal, 1980; Soni and Holland, 1981; Collier, 1982; Findley and Shandro, 1982; Pearson, 1984), but there are only a few in which the position of the catheter has been confirmed radiologically (Boys and Norman, 1975; Bridle-Smith, Barton and Watt, 1984; Stevens and Stanton-Hicks, 1985), two of them in obstetric patients (Boys and Norman, 1975; Bridle-Smith, Barton and Watt, 1984).

After repeated successful extradural injections, an extradural catheter has been known to migrate into a blood vessel to produce a toxic reaction after the injection of local anaesthetic (Ravindran, Albrecht and McKay, 1979; Zebrowski and Gutsche, 1979), or into the subarachnoid space to cause extensive spinal blockade (Kalas and Hehre, 1972). Although Hattrick and colleagues (1985) described a patient in whom injection of metrizamide showed both subdural and subarachnoid spread of the dye, no report has, to our knowledge, described the migration of an extradural catheter into the subdural space alone, despite the fact that this space has to be traversed before reaching the subarachnoid space. Our case report describes the migration of an extradural catheter into the subdural space after successful repeated extradural injections in an obstetric patient.

CASE REPORT

A 22-year-old, 69-kg, 165-cm tall patient, who had had a Caesarean section 2 years earlier for cephalo-pelvic disproportion, was admitted to the Labour and Delivery Suite at 41 weeks gestation. Labour was induced by artificial rupture of the membranes and an infusion of oxytocin. At 20.20 h (approximately 4.5 h after admission), pethidine 25 mg and promethazine 12.5 mg were administered i.v. for pain relief. At 01.30 h, the cervix was 4 cm dilated, 80% effaced and the fetal head was at the −1 position. Because of the pain...
associated with uterine contraction, extradural analgesia was instituted.

With the patient in the left lateral position, a midline approach was made at the third lumbar space using an 18-gauge Tuohy needle and the extradural space was identified by the loss of resistance to the injection of air. The needle was not rotated in the extradural space and aspiration was negative for both blood and cerebrospinal fluid. No paraesthesiae were reported. A 20-gauge Teflon catheter with a single terminal orifice was inserted without resistance. Eight millilitre of 0.5% bupivacaine was injected in 2-ml increments over 5 min. Twenty minutes later, pain relief was obtained with blockade extending from T10 to L4 bilaterally. Systemic arterial pressure remained stable at around 120/60 mm Hg, as measured repeatedly (Dinamap). At 04.10 h, 0.5 % bupivacaine 8 ml was injected in the same manner with the same effect as the initial dose. Twenty minutes after the injection the arterial pressure was 122/60 mm Hg. At 08.10 h, 0.5% bupivacaine 10 ml was injected and produced a block to T8, with an arterial pressure of 125/63 mm Hg.

At 08.30 h, fetal scalp pH was measured because of decreased beat-to-beat variability, the probability of late decelerations, and the presence of light meconium staining. The pH was 7.32. At 10.30 h, the fetal scalp pH measurement was repeated because of persistent late decelerations and the patient was sent to the Delivery Room for possible operative intervention. At 10.40 h, 2% chloroprocaine 6 ml was injected through the extradural catheter and produced a block to T8 in 10 min. At 10.50 h the scalp capillary blood sample that had been sent earlier was reported to have “clotted” and a Caesarean section was decided upon because of increasing late decelerations. Ten millilitre of 3% chloroprocaine was injected to the extradural space in 5-ml increments in an attempt to intensify the blockade and extend the dermatomal level to T4. This was reached at 11.00 h, when the arterial pressure was 118/55 mm Hg. Oxygen was administered at a flow rate of 5 litre min⁻¹ by a plastic face-mask, and surgery started.

At 11.08 h, a 3180-gm male infant was delivered with Apgar scores of 8 and 9. The fetal blood-gas tensions and acid–base status were normal. At 11.15 h, the patient complained of difficulty in breathing. Examination of the dermatomal level using pin-prick indicated an extensive block which included the trigeminal nerves. Phonation rapidly became weaker, but the arterial pressure decreased from 115/50 mm Hg to 105/50 mm Hg only. At 11.20 h, because of inadequacy of ventilation, rapid sequence induction using thiopentone 250 mg, suxamethonium 100 mg and tracheal intubation was performed. Ventilation (with 60% nitrous oxide in oxygen) was controlled until 12.00 h, when it was assisted as the respiratory muscles started to recover. At 12.15 h, surgery ended. At 12.30 h, respiration was normal and the trachea was extubated. At 12.40 h, the patient complained of incisional pain, and was given morphine sulphate 10 mg i.m.

Next morning, with the patient’s consent, the position of the extradural catheter was examined by injecting 190 mg% metrizamide 3.5 ml under fluoroscopic control. The lateral view showed the dye spreading in the anterior subdural space, just posterior to the vertebral bodies (fig. 1).
figure 2. Anteroposterior view of the vertebral column showing the “rail-road track” appearance and spread of the dye into the subdural space.

anteroposterior view showed the characteristic “rail-road track” appearance with cephalad extension of the dye bilaterally into the upper thoracic region (fig. 2). Fluoroscopy also showed that the dye extended to the upper sacral region and that the tip of the catheter was just behind the body of the 4th lumbar vertebra.

The patient’s further stay in hospital was uneventful and she was discharged with her baby on the 5th day postpartum.

DISCUSSION

The differential diagnosis in this case was either migration of the catheter into the subarachnoid space or massive extradural blockade.

The former was excluded in two ways. First, aspiration for cerebrospinal fluid was negative before and after injection, although a negative aspiration test does not always exclude the presence of an extradural catheter in the subarachnoid space. Second, a subarachnoid position of the catheter may be excluded by the time sequence of events. Had the last dose, 3% chloroprocaine 10 ml, been injected to the subarachnoid space, total spinal blockade would have developed within minutes and the patient would have required ventilation for hours. In our patient, the difficulty in breathing occurred 20 min after the injection and lasted for only 40 min. The block regressed so rapidly that the patient required morphine for postoperative pain within 2 h of surgery.

The second possibility was massive extradural blockade. Against this was that the sum of the last two doses, 16 ml of 3% chloroprocaine, could not be considered excessive for a 165-cm woman. Finally, a trigeminal nerve block would not be expected with an extradural block, since the extradural space terminates at the foramen magnum (Mehta and Maher, 1977).

The mechanism for the extensive spread associated with the subdural injection of a solution, whether dye or local anaesthetic, is unknown. We think it is related to the limited capacity of this potential space, which has almost no “escape routes”. In contrast, the extradural space is much wider, being about 5 mm posteriorly, and solution may spread out through the intervertebral foramina.

The site of action of a local anaesthetic injected to the subdural space is unknown. In the subarachnoid space, the nerve roots are covered only by the pia mater; in the subdural space they are covered by the pia and arachnoid maters; while in the extradural space they are covered by these two thin layers and the thicker dura. This difference in the sheathing of the nerve roots may explain the clinical picture of subdural injection as being midway between that of an intrathecal and an extradural blockade. It is stated that the subdural space has more potential capacity posteriorly and laterally (Shapiro, 1975). This explains the rarity of motor paralysis and hypotension because of sparing of the anterior nerve roots which transmit the motor and sympathetic nerve fibres (Boys and Norman, 1975). However, in this case, motor paralysis was evident because of the anterior spread of the local anaesthetic, the high concentration, and the large dose. The anterior, rather than posterior, spread...
of the local anaesthetic is difficult to explain, considering the posterior approach to the subdural space. However, adhesions or difference in the resilience of tissues might have been the cause. With subdural injection, the systemic arterial pressure is usually stable or is accompanied by a gradual and mild degree of hypotension (Boys and Norman, 1975; Machanda et al., 1983; Bridle-Smith, Barton and Watt, 1984; Stevens and Stanton-Hicks, 1985). In our case, hypotension was expected because of the extensive sympathetic blockade associated with spread of solution to the anterior nerve roots. However, despite warm dry hands and bilateral miosis, arterial pressure did not decrease significantly. This might have been the result of the fact that the patient was in labour, cardiac output was increased, the fetal membranes were ruptured (Abouleish, 1977), the main episode occurred after the baby had been delivered, and the patient was adequately hydrated by the administration of 2000 ml of fluid during the 1 h before the final injection.

With extradural anaesthesia, a test dose is recommended to exclude an intravascular or subarachnoid catheter position. Although it would be ideal to test for subdural injection, this cannot be done routinely because of the long latent period, 15–20 min, and the extreme rarity of the condition. With subarachnoid injection, whether for anaesthesia or radiology, the incidence of subdural injection (1–13%) is much greater (Bromage, 1978). The reason is that, each time a subarachnoid injection is attempted, the subdural space has to be traversed, and unintentionally the injectate may be totally or partially placed in the subdural space. On the other hand, with extradural injections the intention is to stay posterior to the dura and the subdural space.

In conclusion, subdural migration of an extradural catheter is possible and should be borne in mind. It should be suspected when an aspiration test for cerebrospinal fluid is negative, a test dose for subarachnoid block is negative, and when a block too extensive to be explained on the basis of an extradural injection occurs 15–20 min after injection. Respiration and circulation should be supported until the block wears off. The position of the catheter can be confirmed by injecting a water-soluble radiopaque dye under fluoroscopic control. This will show a “rail-road track” appearance with subdural injection, compared with the “sausage-like” appearance of subarachnoid injection (as the dye collects in the cul-de-sac of the cauda equina region), and the “tree-like” appearance of extradural injection (as the dye spreads to the paravertebral region along the nerve roots through the intervertebral foramina).

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REFERENCES


