

choline as observed in this patient is probably due to the reduced plasma cholinesterase activity. This may be related to hyperparathyroidism or may be a coincidental finding. The response to atracurium, however, was reduced with no apparent explanation.

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Rare Misplacements of Epidural Catheters

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Continuous epidural analgesia-anesthesia, even in skilled hands, has a failure rate as high as 8%.¹ Technical difficulties may result from abnormalities of the vertebral column and bands or sheaths within the epidural space. Furthermore, kinking, knots, and misplaced epidural catheters may cause incomplete or absent analgesia.²⁻¹⁰ We describe accidental misplacement of epidural catheters into the pleural cavity and the retroperitoneal space.

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REPORT OF TWO CASES

Case 1. A 61-yr-old, 106 kg man was scheduled for right thoracotomy for suspected pulmonary carcinoma in the right lower lobe. He had been treated for low back pain and had a moderate-to-severe lumbar scoliosis with convexity to the left. Prior to induction of general anesthesia, an anesthesiologist experienced in epidural anesthesia inserted an epidural catheter at the midthoracic level, using a paravertebral approach with the "loss-of-resistance" technique for identifying the epidural space. Some technical difficulties were encountered because of poor resistance of the deeper tissue layers. However a "loss-of-resistance" feeling was evident, and the catheter inserted. General anesthesia was maintained with halothane, N₂O, and O₂. Administration of 8 ml of bupivacaine 0.5%, given 20 min after induction of general anesthesia, did not alter arterial blood pressure or heart rate. Approximately 1 h after surgery had begun, the surgeon located the epidural catheter in the right pleural cavity. The catheter was immediately withdrawn. The remainder of the anesthetic and operative procedures were smooth and uneventful.

Case 2. A 59-yr-old man was undergoing emergency aortic surgery because of severe ischemia of the lower limbs. By clinical examination

preoperatively, the patient was dehydrated and showed signs of pneumonia. He had a history of low back pain and had had an unsuccessful laminectomy at L-4. A moderate degree of scoliosis of the lumbar spine was noticed. An epidural catheter was inserted in the L1-2 interspace with a midline approach, using the "hanging-drop" technique, by an anesthesiologist experienced in epidural anesthesia.

As the lumbar lordosis was flattened and because of the slight scoliosis, the Touhy needle had a rather oblique direction. The tip of the Touhy needle was presumed to have entered the epidural space, as the hanging drop was sucked inside. An epidural catheter was inserted approximately 12 cm against the usual resistance. General anesthesia was induced with fentanyl, etomidate, and pancuronium iv. Bupivacaine 0.5% 6 ml was injected without any circulatory changes.

Approximately 1 h later, 10 cm of the epidural catheter was seen protruding in close proximity to the abdominal aorta and was therefore withdrawn. A new epidural catheter was reinserted for postoperative pain relief between the T11-12 interspace with the "loss-of-resistance" technique. With 3 mg of epidural morphine given three times daily, sufficient pain relief was achieved. The subsequent postoperative course was uneventful.

DISCUSSION

Numerous authors have described a tendency toward kinking, curling up, and knot formation with increasing length of the epidural catheter inserted into the epidural space.²⁻⁹ In a large series, Hehre *et al.*⁴ reported a rather low incidence of failure (2.2%) to produce anesthesia. Using epidurography in those "failed epidurals," they found that two-thirds of the catheters were placed with the tip of the catheter going through the intervertebral foramina. The rest were placed within the ligaments posterior to the epidural space. In our first patient, the nonresistance, identified by the "loss-of-resistance" technique, was probably associated with the entrance of the Touhy needle into the pleural cavity after leaving the relative tight paravertebral tissue.¹⁰ Similarly, the negative pressure identified with the "hanging-drop" technique in the second patient must have been associated with the entrance of the needle tip into the looser tissues of the retroperitoneal space, while leaving the tight lumbar paravertebral tissues. In the latter case, therefore, even the use of the "loss-of-resistance" technique would presumably have resulted in identification of the retroperitoneal rather than

the epidural space. The correct insertion of catheters into the epidural space can only be verified by demonstrating a neural blockade. In our patients, the main objective for placing the epidural catheters was postoperative pain relief with morphine; therefore, we did not use a local anesthetic to verify the correct position of the catheter before inducing general anesthesia.

In regard to the immense numbers of epidural catheters in everyday use, misplacements of similar kind must be presumed as the reason for some of the cases of "failed epidurals," at least where no other obvious reason has been found. Especially when attempting epidural blockade in patients with abnormalities of the vertebral column, the risk of causing lesions of neighboring organs must be kept in mind.

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