The Breaking of an Intrathecaly-Placed Epidural Catheter During Extraction

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Despite considerable advances in catheter technology and improved safety of continuous epidural catheterization, there have been recent reports of problems during catheter removal (1–4). We present a case wherein a broken epidural catheter became entrapped in the subarachnoid space, requiring a lumbar laminectomy to remove the retained piece.

Case Report

A 74-yr-old, 160-cm, and 62-kg woman was admitted for an elective right total hip replacement. Her medical history was significant for pacemaker-dependent complete atrioventricular block, transient ischemic attacks, embolic stroke without residual deficits, osteoporosis, and severe osteoarthritis. Medications included warfarin, calcitonin, and calcium supplements. Warfarin had been withheld for 6 days before, and her coagulation profile was within normal limits.

Combined general and regional anesthesia was planned with the aim of using an epidural catheter for postoperative pain relief. In the sitting position and via a midline approach, an 18-gauge Tuohy needle failed to reach the epidural space at the L2-3 interspace. After encountering bone several times, the needle was advanced, without undue force, 4 cm to reach the epidural space at L3-4 on the second attempt using the midline approach and loss-of-resistance to air. Neither blood nor cerebrospinal fluid (CSF) was noted, and a 19-gauge reinforced epidural catheter was easily advanced after some initial resistance to the 10-cm mark. Soon afterwards, the patient started complaining of severe frontal headache. Aspiration through the catheter was negative.

Withdrawing the catheter to leave 4–5 cm of catheter in the epidural space could not be attempted because the patient demanded to return to the supine position. However, laying supine did not relieve her headache. We then elected not to administer a test dose and to proceed with the surgery exclusively under general anesthesia.

On admission to the postanesthesia care unit, the patient reported that her headache had gone. After negative aspiration through the catheter, a test dose of 3 mL of 1.5% lidocaine with 1:200,000 epinephrine was given. A profound sensory (T10 dermatome level) and motor block in both lower extremities suggested intrathecal positioning of the catheter. The patient remained hemodynamically stable. Approximately 2 h after the test dose, she regained full motor strength and sensory function in her lower extremities. It was decided to remove the catheter before transfer to the floor. With the patient in the left lateral decubitus position and limited degree of spine flexion, unusual resistance was felt during an initial attempt to remove the catheter. The patient’s spine was further flexed and on the second attempt a snap was felt, and the catheter broke without any noticeable stretching. Examination of the catheter revealed that approximately a 9-cm piece of polyurethane catheter had sheared off with uncoiling of the incorporated wire (Fig. 1). The patient exhibited neither sensory nor motor deficit, and no paresthesia was noted.

A lateral lumbar spine radiograph failed to reveal any catheter fragment. Computed axial tomography showed a section of the catheter next to the spinous process of L4 and between the left laminae of L3 and L4 (Fig. 2). A neurosurgical consultation was obtained, the catheter manufacturer was contacted, and after discussions with the patient and her family, a decision was made to surgically remove the retained piece. A lumbar laminectomy was performed during which the stretched wire was traced from the level of the L4 spinous process to the remnant of the catheter, which was trapped by the overlapping lips of the L3-4 laminae. The catheter and wire were removed after minimal drilling of the laminae. CSF was noted to be leaking from the catheter tip as well as from the site where the catheter was removed. The dural leak was sealed with tissue fibrin glue. After an uneventful postoperative course, the patient was discharged home 4 days after catheter removal.

Discussion

At our institution, we use the 19-gauge single open-hole (FlexTip Plus, Arrow International, Inc, Reading, PA) catheter (5). It is constructed with a circumferential stainless steel coil impregnated in soft polyurethane. These catheters have been shown in

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comparative studies to be superior to other types (6,7). They confer the advantage of minimal trauma to tissues as well as minimal risks of misplacement. They are easily inserted because of the circumferential steel wire reinforcement that delivers firmness while resisting collapse. The FlexTip Plus catheter also has superior tensile strength and elastic deformability and can be stretched to 300% of the original length before breakage, compared with nylon or radiopaque catheters that can stretch only up to 30% of original length (8). Breakage of epidural catheters has been associated with poor technique during insertion and/or withdrawal, faulty designs, partial shearing, kinking or knotting at the time of insertion, as well as with entrapment of the catheter by the tough supraspinous and intraspinous ligaments. The vertebral arches and processes, lumbar fascia, ligamentum flavum, posterior vertebral joints, and the lumbar nerve roots have all been implicated as sites where the catheter can be gripped on withdrawal.

Several means of preventing breakage of epidural catheters during removal have been proposed, including previous examination of catheters for defects and avoiding the insertion of excessive lengths in the epidural space, which has been shown to result in kinking and knotting. In the event of a difficult catheter removal, it has been suggested to discontinue efforts at removal for 15 to 30 min, allowing tissue relaxation, or to tie a tongue blade to the distal end in the hope that this might provide gentle traction. According to Morris et al. (9), the position of the patient during catheter insertion is the most important factor in determining the patient’s position during extraction, although a flexed lateral decubitus position is reported to be more effective than the sitting position, with withdrawal forces being as much as 2.5 times greater in the sitting position. In 1991, Shantha and Mani (10) described a method of removing errant epidural catheters in three cases by threading a sterile Tuohy needle over the catheter into the epidural space while maintaining gentle cephalad traction on the catheter; once the needle was in the epidural space, the catheter and needle are pulled out en bloc. Injection of normal saline through the catheter during removal attempts has also been reported to be effective (11). Current recommendations are not to attempt retrieval of a retained epidural catheter fragment in the asymptomatic patient unless the broken piece is at or just below the skin level, in which case it could serve as a potential tract for infection into the epidural space. In some cases, the broken distal fragment can be grasped with a hemostat and gently teased out via a small cutdown (12).

The present case report differs significantly from previous reports in that: (a) the epidural catheter had unintentionally been inserted into the subarachnoid space, (b) the catheter had been recently inserted, (c) the sitting position originally used for catheter insertion was not considered for catheter removal because of the nature of the surgery, (d) surgical intervention was required to remove the retained catheter fragment, and (e) the patient had severe osteoarthritis.

The force applied during catheter removal in the current case was not thought to be excessive (although this is a thoroughly subjective assessment). It was not until the patient underwent surgery that we discovered the catheter was entrapped between bony structures. Although osteoarthritis is not a contraindication to the use of an epidural technique, the degenerative structural changes may have contributed to the problem encountered in this case. We did not use a paramedian approach in this patient. In retrospect, this approach might have possibly avoided veering the catheter off its path and prevented its entrapment. Catheters in the lumbar region are often difficult to find at laminectomy. According to the manufacturer, leaving the retained piece in the epidural space was

Figure 1. The actual Arrow FlexTip Plus catheter missing approximately a 9-cm length from the distal end.

Figure 2. Computed tomography axial view at L3-4 facet joint level showing the catheter through the posterior epidural fat and piercing the thecal sac.

\[^1\] Anesthesia Patient Safety Foundation (APSF) Newsletter, Fall 2000, p. 35.
within the guidelines of safe practice. There have been no recommendations in the literature about the management of an intrathecally-placed epidural catheter that has sheared off and remained entrapped in the subarachnoid space with an incorporated broken steel wire. In the case we report, surgical exploration and retrieval of the broken fragment of the epidural catheter were mandated for two reasons: (a) the unknown long-term sequelae of an intrathecal polyurethane foreign body left in situ and (b) the possibility of serious complications because of the presence within the subarachnoid space of a sharp foreign body in a patient who requires aggressive postoperative anticoagulation. In addition, surgical exploration revealed that the retained catheter fragment served as a conduit for CSF leakage.

Avoiding misplacement and entrapment of epidural catheters, as well as their breakage during removal, would have obviously been ideal. However, in case of breakage of an intrathecal catheter, appropriate imaging and a neurosurgical consultation should be obtained. Aggressive surgical exploration and extraction of the retained piece are warranted, even in the asymptomatic patient, particularly when factors such as those encountered in our case are present.

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