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Case Report

Partial displacement of epidural catheter after patient position change: A case report

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ABSTRACT

Epidural catheter migration is a well-known cause of failed anesthesia and complications. One of the factors that affect catheter movement is when patients change their position after skin fixation. We report a case of an epidural catheter placed without evidence of intravascular or subdural insertion that produced an insufficient block. A 36-year-old woman presented for ankle surgery under epidural anesthesia. Epidural block was conducted at the L3-4 intervertebral space with a catheter threaded 3 cm into the epidural space with the patient in a back flexion and lateral position. The total volume of injected anesthetic was 28 mL, including a 3-mL test dose. The final anesthesia level was L1. The planned operation was completed without a pneumatic tourniquet. A postoperative C-arm fluoroscopic image revealed that 1 side hole of the catheter had moved out of the epidural space. We think that a positional change after catheter fixation was the reason for catheter outmigration leading to insufficient analgesia, which was incompatible with the amount of local anesthetic injected.

1. Introduction

Epidural anesthesia has been widely used for surgical anesthesia. Unfortunately, incomplete anesthesia is not very uncommon, affecting up to 15% of patients [1]. Many factors can cause failure of epidural anesthesia. Successful catheter insertion can be challenging for technical or anatomic reasons in some patients. Uneven block, such as unilateral block, is known to happen mostly because of catheter position [2]. In addition, the catheter can move out of the epidural space even after adequate insertion and fixation [3]. Catheters that have migrated into intravascular, subarachnoid [3], or subdural spaces [4] can lead to dangerous complications. Catheters that have escaped from the epidural space result in unsatisfactory or failed anesthesia [5]. We report a case of epidural catheter migration and partial displacement after the patient's position changed.

2. Case report

A 36-year-old woman (height, 160 cm; weight, 78 kg) was scheduled to undergo open reduction and internal fixation of a bimalleolar fracture of the right ankle under regional anesthesia. She had a history of intermittent asthma, usually well controlled with occasional use of a β2-agonist inhaler. However, she was taking oral corticosteroid because of recently developed wheezing after an upper respiratory tract infection. She refused spinal anesthesia because of previous experience of severe postdural puncture headache after cesarean delivery. Considering her medical condition and the fact that dural puncture is an important risk factor for postdural puncture headache [6], we decided to perform epidural anesthesia.

The patient was positioned in the right lateral decubitus position with lumbar flexion. Epidural anesthesia was performed at the L3-4 interspace by a midline approach. The epidural space was identified using the loss of resistance to air technique with a 17-gauge Tuohy needle (Perifix; B. Braun Medical Inc, Bethlehem, PA). A 20-gauge, closed-tip, 3-hole epidural catheter was inserted through the Tuohy needle. The measured length from the patient's skin to the epidural space was 5.5 cm. The catheter depth was adjusted to remain 3 cm in the epidural space after needle withdrawal. No blood or cerebrospinal fluid was observed during aspiration. The catheter was looped and secured with transparent adhesive dressing (Tegaderm; 3M Health Care, St Paul, MN) at the insertion site. The remaining catheter and in-line filter were taped to the patient's skin with medical adhesive tape. In the supine position, 3-mL lidocaine-bicarbonate-epinephrine mixture (2% lidocaine 20 mL; 8.4% sodium bicarbonate 2 mL; 1:200,000 epinephrine) was injected via epidural catheter as a test dose. There were no symptoms or signs indicative of intravascular or subdural injection such as complete motor block, tachycardia, tinnitus, metallic taste, or perioral numbness for 2 minutes. Then, 15 mL of the same solution

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was injected; 20 minutes after injection, the sensory analgesic level checked by pinprick was below L1. An additional 10 mL of the same solution was administered without catheter manipulation. The final sensory level checked via pinprick 15 minutes after additional injection was L1. Because the anesthetic level was not sufficient to apply the pneumatic tourniquet on the thigh, we discussed the problem with the orthopedic surgeon and decided to proceed with the operation without a tourniquet. After explaining this to the patient, surgery was completed without additional anesthesia. We assessed the catheter position with radiopaque contrast agent and C-arm fluoroscope postoperatively. After checking that no blood or cerebrospinal fluid was aspirated, 2 mL of a contrast agent (Iobrix injection 300; Taejoon Pharm, Korea) was injected through the epidural catheter. The fluoroscopic image showed both normal epidural spread and extra-epidural leakage of the contrast agent (Fig. 1). The epidural catheter was removed before the patient was transferred to a postanesthesia care unit.

3. Discussion

We presented a case of an unexpected low level of anesthesia after lumbar epidural block. Unsuccessful epidural anesthesia is associated with many factors [7]. Mechanical problems of the epidural catheter and inadequate dose of local anesthetics should be ruled out. Obesity complicates epidural anesthesia by increasing the technical difficulty of the procedure and the distance from the skin to the epidural space [8,9]. A variable anatomy of the epidural space such as a dorsal epidural midline band [10] may prevent the spread of local anesthetics. Unwanted intravascular, subdural, and subarachnoid placements of the epidural catheter have been reported [3,5]. A catheter that is inserted into the anterior epidural space or intervertebral space may cause uneven or unilateral block [2]. In addition, catheter migration may be closely related to inadequacy or failure of epidural anesthesia [2,11]. In 1 study, 45% of cases of failed epidural anesthesia resulted from migration of the epidural catheter [12].

Many authors have described epidural catheter migration before or after catheter fixation with various study designs. Phillips et al [13] concluded that 54% of catheters migrated, mostly less than 2 cm, and showed a tendency to move inward. Crosby [14] also reported 54% migrated catheters; 70% of them moved outward. Factors that may be associated with catheter migration have also been studied. The body mass index (BMI), patient weight, and distance between the skin and epidural space are related to catheter migration [3]. Position changes are also associated with catheter migration [11].

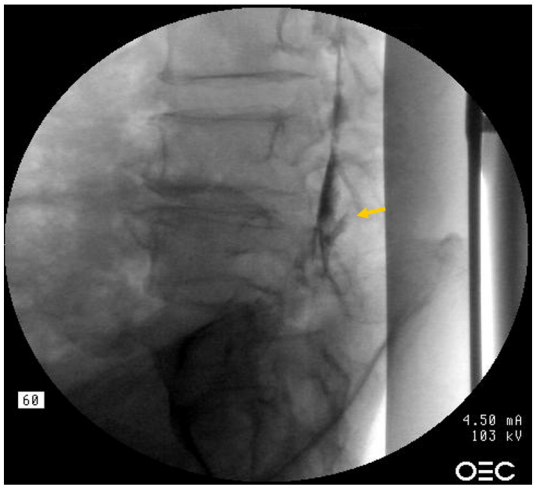

Fig. 1. C-arm fluoroscopic image showing leakage of contrast agent (white arrow).

In our case, the test and the first dose of the local anesthetic produced bilateral sensory block below the L1 segment. Our first assumption about the reason for insufficient block was an inadequate dose of local anesthetic, because there were no signs of catheter misplacement or complications. Supplemental administration of local anesthetics without additional catheter manipulation is an effective way to obtain adequate analgesia [5]. However, the second dose of local anesthetic was not successful in extending sensory block above L1. The patient had no history of spinal surgery or other musculoskeletal disease of the spine that could disturb anesthetic drug spread. Therefore, this insufficient response to the local anesthetic made us suspect catheter migration. A postoperative C-arm fluoroscopic image showed that 1 of 3 holes of the catheter was displaced out of the epidural space, confirming our suspicion.

We assumed that the reason for catheter migration was related to a change in the patient's position. Hamilton et al [11] reported that the movement of an epidural catheter is associated with positional changes (back flexed to straight and sitting to lateral position) mainly by the change of a distance to epidural space. We cannot directly compare the results of that study [11] with our case because of the different positions (sitting vs lateral decubitus) used during the epidural procedure. However, if the distance from the skin to the epidural space increases with back extension in a sitting position, it will probably increase with the same movement in the lateral decubitus position. The catheter we placed had 3 holes 1.4 cm from the tip (Fig. 2). Because we inserted the catheter 3 cm into the epidural space, the third hole had 1.6 cm as a safety margin against extra-epidural placement, at maximum. According to previous research [11], the distance of catheter movement increases with an increase in patient BMI. Our patient's BMI was 30.4. Along with a positional change, this could have also been a contributing factor to epidural catheter outmigration in our case.

Previous studies [11,13] have hypothesized that the ligamentum flavum might be fixing the epidural catheter before skin fixation. In other words, the portion of the catheter within the epidural space is not changing despite patient movement before fixing the catheter to the skin. We agree with that. Vaughan et al [15] traced pressure changes during epidural catheter placement (Fig. 3). The pressure trace showed the highest value while passing the ligamentum flavum, which means that it is not only difficult to penetrate during needle insertion but it also acts as a major anchoring point. However, if the catheter was fixed to the skin before position change, the major anchoring point would be the skin, not the ligamentum flavum. Consequently, outmigration would happen due to positional changes (Fig. 4).

Thomas et al measured epidural pressure during drug injection [16]. Two different volumes (2 mL and 6 mL) of local anesthetic were used. They showed that the epidural pressure increased more than 30 mm Hg in the 6-mL injection group. In our case, during the early phase of injection of local anesthetics, drug spread would happen mainly in the epidural space because of low pressure. However, the greater the volume of drug in the epidural space, the higher the pressure in the epidural space. Accordingly, in the later phase of injection, most of the injectate would be deposited outside the epidural space, causing inadequate anesthesia. This may be a possible explanation for our result of an unexpected low level of block after lumbar epidural anesthesia.

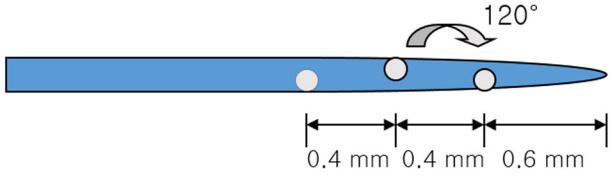

Fig. 2. Diagrammatic representation of the structure of the closed-tip, 3-hole epidural catheter.