Clinical Case Report

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Inadvertent epidural anesthesia associated with catheterization following continuous psoas compartment block in a patient with scoliosis

A Case report

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Abstract

Rationale: Psoas compartment block (PCB) is typically performed using surface anatomical landmarks and neurostimulation for guidance. However, anatomical anomalies, such as scoliosis, make this technique unreliable, posing a challenge for the anesthesiologist when inducing regional anesthesia.

Patient concerns: A 69-year-old woman with lumbar scoliosis scheduled for total hip arthroplasty underwent PCB with catheterization.

Diagnoses: Inadvertent epidural anesthesia with catheterization following PCB was diagnosed using a lumbar radiograph.

Interventions: Due to hypotension induced by local anesthetic (LA) epidural diffusion, the patient received intravenous hydration and vasopressor. Since bilateral sensory block was noted at the T3 level, with an incomplete motor blockade in both legs, the surgery was performed under epidural anesthesia.

Outcomes: The patient remained hemodynamically stable throughout the duration of the surgical procedure. The surgery was uneventful and without further complications.

Lessons: Patients with lumbar scoliosis are highly at risk of LA epidural diffusion, following PCB using traditional landmark-based approach. Other nerve-localizing technique can minimize the risk of this complication.

Abbreviations: CT = computed tomography, LA = local anesthetic, PCB = psoas compartment block.

Keywords: epidural diffusion, local anesthetic, psoas compartment block, scoliosis

1. Introduction

Psoas compartment block (PCB) can provide effective postoperative analgesia after hip and knee surgery.[1] However, the technique has been associated with several adverse effects, including spinal anesthesia, epidural diffusion, kidney puncture, retroperitoneal hematoma, and local anesthetic (LA) toxicity.[2]

In particular, LA epidural diffusion is a relatively frequent adverse effect of PCB, with an incidence of up to 26.7%.[3] This complication can lead to serious consequences, offsetting the advantages of the PCB.[4] Patients with spinal deformities, such as scoliosis, are especially susceptible to this complication because their surface anatomical landmarks are less reliable and their central neuraxis is rotated.[5]

In this report, a case of unintentional epidural anesthesia associated with catheterization following continuous PCB during hip surgery in a patient with lumbar scoliosis is presented. We also discuss the mechanism associated with this complication.

2. Consent

Written informed consent and agreement to publication were obtained from the patient.

3. Case report

A 69-year-old woman (height: 153 cm, weight: 45 kg, American Society of Anesthesiologists physical status: 3) was admitted for elective right total hip arthroplasty. Her medical history included controlled hypertension and coronary artery disease. All other laboratory results were within their respective normal ranges. As a postoperative analgesic technique, spinal anesthesia with continuous PCB was planned.

Upon arrival at the block room, blood pressure and heart rate were 123/83 mm Hg and 87 beats/min, respectively. Before the induction of spinal anesthesia, a continuous PCB was performed as described by Capdevila et al.[6] After mild sedation with intravenous midazolam (1 mg) and fentanyl (37.5 μg), she was

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Since this is a case report, institutional review board approval is not sought; however, written consent for publication was obtained from the patient.

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placed in the left lateral decubitus position. While identifying the relevant surface anatomical landmarks, the operator noted mild scoliosis at her spine (Cobbs angle; 20°). The lumbar plexus was then identified at the first attempt using an 18-G Touhy needle (Contiplex; B. Braun, Melsungen, Germany) at a current of <0.5 mA and during contraction of the quadriceps muscle. The depth of the needle was 4.8 cm. After a negative aspiration of blood and cerebrospinal fluid, 25 mL of ropivacaine (0.5%) was slowly injected through the needle without resistance. Some difficulty was then encountered in advancing the catheter (B. Braun) beyond the needle tip. The position of the needle tip was manipulated, and the catheter was advanced—without resistance—4 cm into the psoas muscle and secured with tape. No blood or cerebral spinal fluid was aspirated through the catheter. The patient reported no pain or paresthesia during needle placement, LA injection, or catheter insertion.

The patient was subsequently turned into supine position. Ten minutes later, her blood pressure and heart rate became 53/38 mm Hg and 68 beats/min, respectively. Neuraxial anesthesia was suspected, and 20 mg of ephedrine was therefore injected, with rapid intravenous fluid infusion. This improved the patient's blood pressure. She remained comfortable, with no complaints. Subsequently, the bilateral sensory block was noted at the T3 level, with incomplete motor blockade in both legs. Therefore, the surgery was started without performing another anesthesia. Surgery proceeded uneventfully without adverse effects.

Postoperatively, 5 mL of contrast medium was injected via the catheter to verify the catheter tip location. A lumbar radiograph showed that the contrast medium had spread into the epidural space; however, no opacification was observed in the psoas compartment, and the catheter tip was located in the intervertebral foramen (Fig. 1). The catheter was removed, and the pain was managed using patient-controlled intravenous fentanyl analgesia. The epidural block resolved 6 hours later. No neurological deficits were noted in the patient's lower extremities.

Figure 1. Postoperative lumbar radiograph showing that the contrast medium had spread into the epidural space. The arrow indicates the catheter tip position.

4. Discussion

LA epidural diffusion is a severe and fatal complication of PCB. In this regard, a previous retrospective study reported that PCB carries a high risk of cardiac arrest and respiratory failure caused by peripheral nerve block in the lower extremity.[4] The mechanism of this complication is unclear, although it may occur because the psoas compartment is anatomically contiguous with the epidural space via the intervertebral foramen. Alternatively, high injection pressure (>20 psi) is associated with the neuraxial spread of LA during PCB.[7] In rare cases, the medial orientation of the needle can lead to direct LA epidural injection.

Scoliosis is a complicated deformity characterized by both lateral curvature and vertebral rotation. As the disease progresses, the vertebrae and spinal processes in the major curve area rotate toward the concavity of the curve. This, in turn, renders unreliable surface landmarks, which can lead to increases in both block failure rate and incidence of complications when using surface landmarks and nerve stimulator guidance. Indeed, several previous studies[8,9] have reported that patients with scoliosis are susceptible to this complication, which may have been the case with this patient. The landmarks used in this patient was described by Capdevila et al, which may have resulted in a needle trajectory that led to direct needle placement in the epidural space due to vertebral body rotation. This assumption was confirmed in a postoperative radiograph, which showed that the catheter tip was in the epidural space next to the L4 intervertebral foramen. Thus, the quadriceps muscle response likely occurred in our patient during nerve localization that resulted not from lumbar plexus stimulation but from direct stimulation of the nerve root.

A previous computed tomography (CT)-based study[5] reported that bony surface landmarks greatly varied and that the lumbar plexus in patients with scoliosis is located more medially than expected when using traditional landmark-based approaches. Furthermore, a previous study found that the needle insertion point defined by Capdevila et al is too lateral.[10] To avoid such complications, CT or ultrasound should be performed to guide needle placement in patients with scoliosis. In particular,

ultrasound facilitated the placement of regional anesthesia in a patient with difficult anatomy.[11,12] Compared with other ultrasound guidance to perform PCB, the ultrasound-guided Shamrock technique is easier, faster, and can better visualize the lumbar plexus.[13,14] Thus, it might reduce the risk of severe complications such as LA epidural diffusion.

In summary, this case showed that patients with anatomical anomalies like scoliosis are susceptible to severe complications, including epidural blockade, following a PCB under the guidance of landmark-based nerve-localizing techniques. Preoperative evaluations of patients' spines are critical to avoid this complication. In addition, we recommend that other nerve-localizing techniques, such as CT or ultrasound, be used to ensure a safe and successful block.

Author contributions

Conceptualization: Chunwoo Yang.
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