# Direct Visualization of the Dural Puncture Site During Lumbar Spine Surgery Performed Under Spinal Anesthesia: A Case Report

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Spinal anesthesia (SA) has been utilized for lumbar surgical procedures; however, postdural puncture headache (PDPH) and subdural hemorrhage (SDH) are potential consequences. We present the case of a 76-year-old with progressive neurogenic claudication secondary to lumbar spinal stenosis who received SA for a 2-level lumbar posterior decompression. After decompression, the site of dural puncture from a 24-gauge Sprotte spinal needle was identified. Our intraoperative image demonstrates the submillimeter dural defect that can potentially engender complications as significant as PDPH and/or SDH. We recommend searching for, and preemptively sealing, the dural puncture site when SA is used for lumbar spine surgery. (A&A Practice. 2021;15:e01397.)

## GLOSSARY

**CSF** = cerebral spinal fluid; **EBP** = epidural blood patch; **EQUATOR** = Enhancing the Quality and Transparency of Research; **Inf** = inferior; **MRI** = magnetic resonance imaging; **PACU** = postanesthesia care unit; **PDPH** = postdural puncture headache; **SA** = spinal anesthesia; **SDH** = subdural hemorrhage; **Sup** = superior

The utilization of spinal anesthesia (SA) has been extended to lumbar surgical procedures due to the numerous potential benefits, including enhanced hemodynamic stability along with reduced urinary retention, blood loss, postoperative nausea and vomiting, anesthetic requirements, perioperative costs, procedure time, complications, and duration of hospitalization.[1–4] SA may be elected for single microdiscectomies, foraminotomies, simple fusions, and multilevel decompressions. Postdural puncture headache (PDPH) is a potentially debilitating consequence, affecting as many as 35% of patients undergoing SA.[5,6] Subdural hemorrhage (SDH), while rare, is a potentially life-threatening complication.[5,6] The use of pencil-point needles and concurrent reduction of needle diameter reduces dural trauma and cerebral spinal fluid (CSF) leakage.[7–10] Despite the implementation of current technical recommendations for dural puncture, a PDPH and/or SDH may result secondary to CSF leakage and subsequent intracranial hypotension.[11]

This report presents the case of a 76-year-old man who received SA for a multilevel lumbar spine decompression surgery. Subsequent to decompression, the surgical team identified the site of dural puncture from the spinal needle. We obtained an intraoperative image demonstrating the submillimeter dural defect that can potentially engender complications as significant as PDPH and/or SDH.

The Health Insurance Portability and Accountability Act authorization was obtained before the completion of this case report, and the patient provided a written informed consent for publication.

This article adheres to the applicable Enhancing the Quality and Transparency of Research (EQUATOR) guideline.

## CASE DESCRIPTION

A 76-year-old man (183 cm and 90 kg) with a history of hypertension, diabetes mellitus, hyperlipidemia, 1° AV block, cervical stenosis, and lumbar osteomyelitis (treated with antibiotics only) suffered progressive neurogenic claudication attributed to lumbar spinal stenosis. The initial symptomatic presentation included complaint of medial gluteal pain and lower extremity weakness. Examination revealed 5/5 strength in bilateral hip flexion, ankle dorsiflexion, inversion, eversion and 4+/5 strength in hip abduction, hip adduction, and knee flexion. Magnetic resonance imaging (MRI) was notable for lumbar stenosis affecting the central canal and lateral recess at both L3–L4 and L4–L5. The patient's home medications were significant for lisinopril, metformin, and simvastatin, but no anticoagulant or antiplatelet medications. The patient was scheduled for a L3–L4 and L4–L5 lumbar posterior decompression including central canal and lateral recess (bilateral medial facetectomy) with microdissection.

In an informed consent discussion, we offered the patient the options of general or SA. The patient elected to proceed with SA. With the patient in the seated position, prepped and draped, the L3–4 interspace location was estimated using surface landmarks. A 24-gauge (length 90 mm)

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Sprotte tip needle (Pajunk Medical Systems L.P., Norcross, GA), guided by an introducer, was inserted into the thecal sac (1 attempt) with a return of clear CSF. Bupivacaine (0.5% plain solution) was injected in divided doses (3.5 mL total) achieving a T9 sensory level and a successful SA for a multilevel lumbar decompression. The patient positioned himself comfortably in the prone position. The SA was supplemented with a bolus of intravenous fentanyl (100 µg), a propofol infusion (40 µg/kg/min), and local anesthetic injected in the surgical field.

Intraoperatively, after laminectomy and clearance of ligamentum flavum at L3–4, the dural puncture site was observed with a bead of CSF (Figure A). On completion of the 2-level lumbar decompression, we left a small epidural fat graft over the puncture site to minimize CSF leakage (Figure B).

After an unremarkable intraoperative period, the patient was transferred to the postanesthesia care unit (PACU). A postoperative examination, after the effects of SA dissipated, revealed no neurological deficits (alert and oriented, cranial nerve examination unremarkable) with bilateral upper extremity 5/5 strength and 5/5 bilateral lower extremity strength. The patient denied orthostatic headache, numbness, tingling, or nausea, or any symptoms that may have suggested PDPH or SDH. In the PACU, the patient was medicated with acetaminophen and ketorolac for 2/10 postoperative pain. The patient was admitted for routine observation, resumed a regular diet, ambulated with assistance, and was discharged on postoperative day 3.

An examination at the 1-month postoperative visit revealed 5/5 strength in bilateral hip flexion, ankle dorsiflexion, ankle inversion, ankle eversion, hip abduction, hip adduction, and knee flexion. The patient denied symptoms such as orthostatic headache, numbness, or tingling. In the 6-week postoperative follow-up visit, the patient expressed satisfaction with his progress and reported walking several times per week for 45 minutes duration. In the 3-month postoperative follow-up, the patient reported a return to all activities of daily living and walking an hour daily without pain.

## DISCUSSION

This clinical scenario permitted the direct visualization of a dural puncture from SA. Surgeons may observe the dural puncture site during the operation; however, a depiction of the puncture site, along with subsequent management, has not yet been specifically presented to the anesthesia community. Surgical exposure in lumbar surgery presents the opportunity to locate the dural puncture site and preemptively provide a prophylactic epidural fat graft patch as a seal. The 24-gauge (length 90 mm) Sprotte needle produces a 0.55-mm diameter puncture site (Figure A).[12] It is remarkable that a puncture of this size can produce adverse events, such as PDPH or SDH.

In rare instances, the authors have used intraoperative redosing of the SA when a multilevel lumbar procedure exceeds the duration of the SA. This has been done under direct visualization by the surgeon with an injection using a 27-gauge needle with guidance by the anesthesiologist. In these cases, we have also sealed the puncture hole with a small piece of fat graft at the conclusion of the surgery to preempt complications from a CSF leak. The grafting of a free flap of epidural fat is a straightforward, rapid, and established method to patch dural defects safely and effectively.[13,14] Alternatively, the puncture site can be sutured, or a small surgical clip can be applied to close the hole.

In contrast, an epidural blood patch (EBP) treats symptomatic CSF leaks after a neuraxial anesthetic. The EBP effectively tamponades a persistent dural defect secondary to delay in the natural sealing process, resulting in a restoration of CSF pressure and subsequent patient symptom relief.[15] This treatment procedure may not be effective when a laminectomy has previously been performed at the level of the neuraxial anesthetic since the epidural space has been unroofed and one cannot rely on the tamponade effect afforded by the posterior spinal canal.

SA may be elected for single lumbar microdiscectomies, foraminotomies, simple fusions, and as in this case, may be extended to use in multilevel lumbar spine decompressions. If feasible, administration of the SA should be undertaken

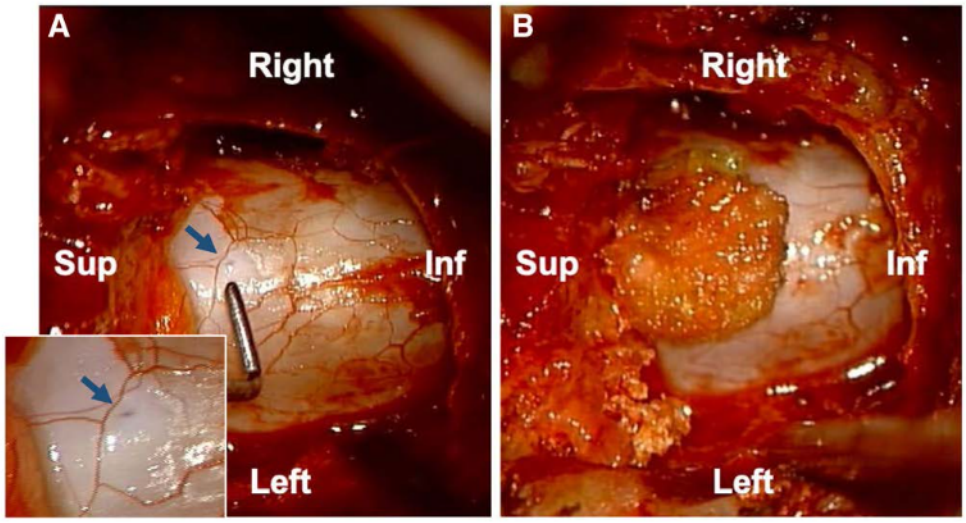


**Figure.** Direct visualization of L3–L4 dural puncture. A, The L3–4 dural puncture site indicated by blue arrow as well as by microdissection blunt nerve hook instrument with 0.64-mm tip width. Inset: Dural puncture site indicated by blue arrow. B, Epidural fat graft placed over the dural puncture site. Inf indicates inferior; Sup, superior.

rostral to the planned decompression to avoid CSF leakage into the surgical field. Removal of the ligamentum flavum and bone in laminectomy decreases pressure within the spinal canal and can potentially worsen leakage at a laminectomy site.

When performing lumbar surgery under SA, after laminectomy and clearance of the ligamentum flavum, we strongly recommend the clinical practice of searching for the dural puncture site. If the dural puncture site is identified, we recommend preemptively placing an epidural fat graft or alternative sealing method before surgical closure to serve as a prophylactic technique to prevent PDPH and/or SDH. While more definitive data are needed, the potential utility of a preemptive treatment to reduce potential adverse consequences further supports the SA approach for patients presenting for lumbar spinal surgery.

## DISCLOSURES

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