Case Report

Spinal subdural hematoma after interlaminar full-endoscopic decompression of lumbar spinal stenosis: a case report and literature review

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Abstract: The use of full-endoscopic decompression for lumbar spinal stenosis has been increasing recently. It is a minimally invasive surgical procedure that has few complications. Spinal subdural hematoma (SSH) following endoscopic surgery has never been reported. Previously described SSHs have occurred spontaneously or due to surgery-related iatrogenic injury. We describe the first case of SSH after endoscopic decompression. A 68-year-old woman presented with bilateral radiating pain and neurological claudication due to lumbar spinal stenosis at the L4–5 level. Full-endoscopic interlaminar decompression was performed without intraoperative complications. Preoperative leg pain improved after endoscopic decompression. However, two days after the index surgery, the patient complained of severe radiating pain in her right leg with urinary retention. The radiologic evaluation showed compressive subdural fluid collection at the index level. Open microscopic decompression was performed. No dural injury was observed. After durotomy, xanthochromic fluid gushed out at a high pressure. We found that the arachnoid was also intact. The patient recovered completely after surgical hematoma evacuation. Although SSH after endoscopic decompression is a very rare event, it is a reminder that suspicion and urgent imaging and intervention are necessary during the postoperative period upon development of unexpected, progressive neurological deterioration regardless of intraoperative problems. Additionally, early surgical decompression is necessary for optimal neurological recovery.

Keywords: Endoscopic decompression; inter-laminar endoscopic lumbar decompression (IELD) complication; postoperative complication; spinal subdural hematoma (SSH); subdural hematoma

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Introduction

As a result of the development of minimally invasive surgery, endoscopic surgery for lumbar spinal stenosis has been widely used. There are many recent research studies about the effectiveness and safety of endoscopic decompression of spinal stenosis (1-3). Although most of these endoscopic procedures are performed safely, one of the rare complications is hematoma. In particular, spinal subdural hematoma (SSH) is a very rare complication, and there are only a few reports of SSH cases occurring after conventional open lumbar surgery (4-9). To our knowledge, there have been no case reports of SSH after endoscopic decompression. Herein, we describe a case of SSH that occurred after full-endoscopic interlaminar decompression and review the literature accordingly.

We present the following case in accordance with the CARE reporting checklist (available at http://dx.doi.org/10.21037/jss-20-664).

Case presentation

The patient was a 68-year-old woman with a 3-year history

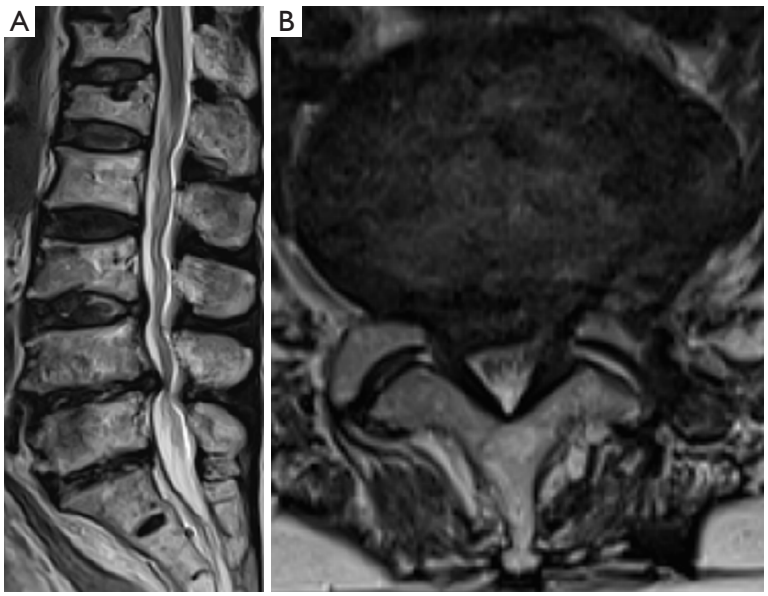

Figure 1 T2-weighted sagittal (A) and axial (B) magnetic resonance images show spinal stenosis with disc extrusion at the L4–5 level.

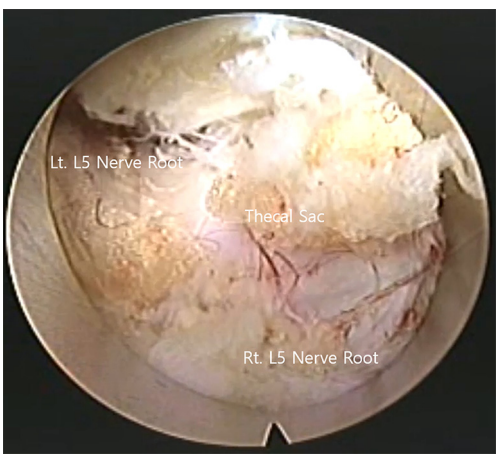

Figure 2 The full-endoscopic approach is performed under fluoroscopic guidance. Complete decompression of both L5 nerve roots and the thecal sac is achieved. Rt., right; Lt., left.

of radiating pain in her lower extremities. The neurological examination showed no motor grade impairment. She did not take any anticoagulant medications or have any underlying diseases. Her radiographs showed central canal and bilateral lateral recess stenosis with disc protrusion at the L4–5 level (*Figure 1*). Interlaminar full-endoscopic decompression was performed (*Figure 2*). Postoperatively, her radiating leg pain was improved (*Figure 3*). However, she began to complain of radiating pain on the right side 2 days after surgery. Physical therapy and pain medications were not effective. Furthermore, she had problems with urinary retention on postoperative day 7. Follow-up magnetic resonance imaging (MRI) was performed, and subdural fluid collection with compression of the cauda equina was observed at the index level (*Figure 4*). The fluid collection was T2 hyperintense, suggestive of a subdural hygroma or hematoma. We performed emergency open microscopic exploration at the index level and we found discolored dura matter without injury after L5 partial hemilaminectomy and flavectomy (*Figure 5*). Midline durotomy was conducted, and xanthrochromatic fluid flowed out immediately. After removing all of the fluid, we confirmed that the underlying arachnoid membrane was intact and pulsatile with no suspicious lesions. Then, the durotomy site was closed in a watertight fashion without cerebral spinal fluid leakage. The patient's symptoms gradually resolved after exploration, and she was discharged without further complications (*Figure 6*).

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee(s) and with the Helsinki Declaration (as revised in 2013). Written informed consent was obtained from the patient.

Discussion

There are several causes of SSH, and they may be primary

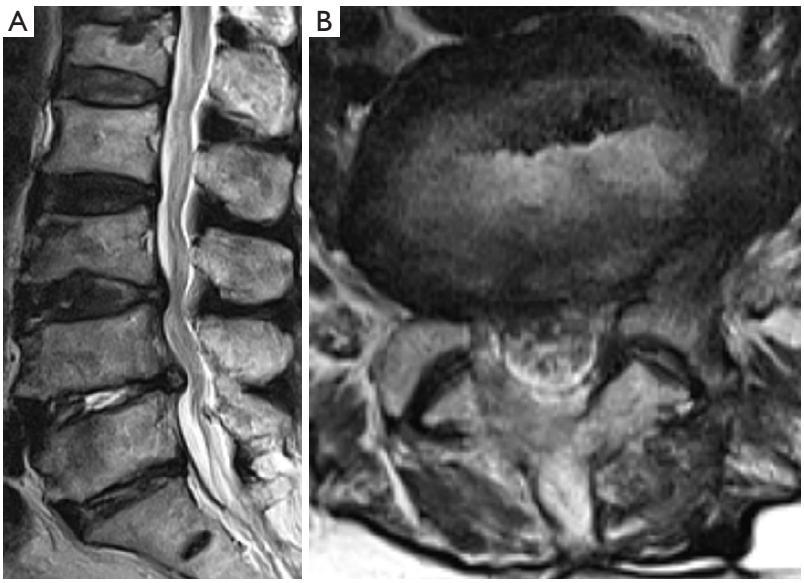

Figure 3 Postoperative sagittal (A) and axial (B) magnetic resonance images show the full decompression state without any abnormal findings.

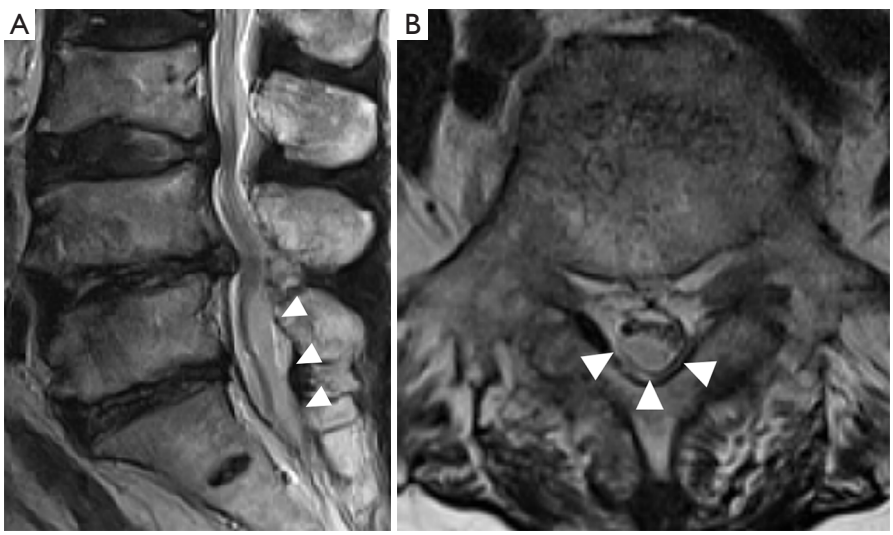

Figure 4 Sagittal (A) and axial (B) magnetic resonance images taken 7 days after full-endoscopic decompression surgery show development of the spinal subdural hematoma at the L5–S1 level.

(spontaneous) or secondary to iatrogenic injury. In iatrogenic injuries, lumbar puncture, epidural anesthesia, and direct injury during surgery have been reported (10-12). The present patient developed an SSH postoperatively, whereas existing reports have described patients with a known dural injury (7,9) or those who have undergone open microscopic surgery (4-7,9) (*Table 1*). Our case is unique because it occurred after full-endoscopic decompression. In particular, decompression was performed without dural injury during the operation, and the patient's symptoms improved immediately after surgery and then worsened. Therefore, the mechanism is questionable because the dura was intact in the operative field.

The mechanism underlying this complication is

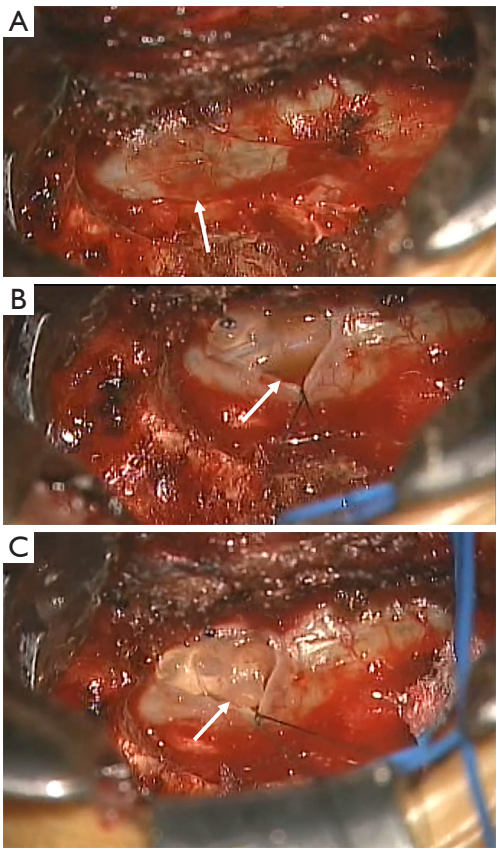

Figure 5 Microscopic view of open exploration surgery. Intact but discolored (arrow) dura matter is shown (A). After dural incision, xanthochromic fluid (arrow) is gushing out (B). The subarachnoid membrane (arrow) is intact (C).

unknown. There are only a few hypotheses. First, injury of the bridging vessels between the dura and arachnoid membrane could be the most likely explanation for SSH without dural injury (13). The bridging vessels between the outer and inner layers of the dura mater may be the source of the bleed, although rare (6). Because there was no evident dural injury in our patient, we assume that dural manipulation during the decompressive procedure may have caused the hematoma formation. However, more unusually, it occurred at the level below not the level at which the surgery was performed. Therefore, more in-depth consideration of the mechanism is needed.

Second, the subdural space exists as a potential space between the arachnoid and dura mater, which is connected though a layer of border cells with weak, easily sheared intracellular connections (14). The shearing of these layers with minor trauma disrupts these weak junctions and splits open the space we consider as the subdural space. The hemorrhage was caused by the rupture of small extra-arachnoidal vessels located on the inner face of the dura mater. Bleeding may have subsequently developed and created a hematoma between the dura and intact arachnoid (8,14). As a result, this hypothesis is somewhat consistent. In the field of microscopic surgery, we also identified a safe arachnoid membrane.

Third, an unexpected increase in pressure in the abdominal or thoracic cavities could have elevated the pressure in the spinal vessels, particularly the valveless

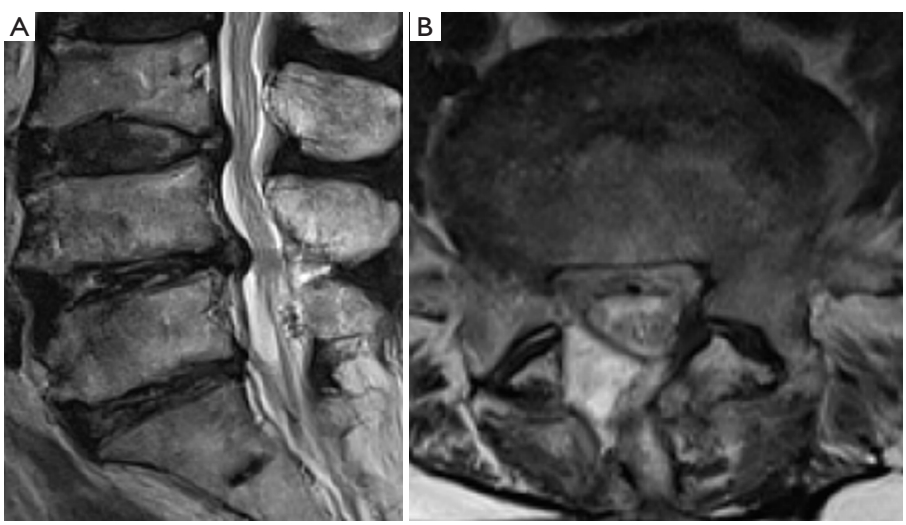

Figure 6 A month after surgery, the patient's sagittal (A) and axial (B) magnetic resonance images show total resolution of the previous hematoma.

Table 1 Previous literatures on SSH after lumbar surgery.

Study	Patient	Operative level	SSH level	Operation	Dura injury	Neurologic deficit	Management
Boe *et al.* (4), 2017	M/76	L34/45	T11–L5	Open decompression	N	Y	Exploration
Chang *et al.* (5), 2012	F/59	L3–S1	L2–L5	Open fusion	N	Y	Exploration
Gakhar *et al.* (6), 2013	M/76	L5S1	L45	Microscopic fusion	N	Y	Conservative
Gehri *et al.* (7), 2000	F/77	L5S1	L5–S2	Microscopic decompression	Y	Y	Exploration
Lykissas *et al.* (9), 2015	M/63	L34	L3–S1	Microscopic decompression	Y	Y	Exploration
Current *case,* 2020	F/68	L45	L5S1	Endoscopic decompression	N	Y	Exploration

SSH, Spinal subdural hematoma; M, Male patient; F, Female patient; L, Lumbar; S, Sacral; Y, Yes; N, None.

radiculomedullary veins because they cross the subdural and subarachnoid spaces (6).

These three hypotheses are theories that can arise spontaneously or after any surgery. Because this case of SSH developed after endoscopic decompression, there may be a unique mechanism caused by endoscopic surgery. A possible example is the pressure of the irrigation fluid. Persistent barotrauma may have caused these three mechanisms. Although there were no intraoperative complications and the patient's condition improved immediately postoperatively, we also suspect the possibility of unrecognized injury to the dura mater. For example, we placed an epidural drain on the dura to prevent epidural hematoma. The tip of the drain may have compressed the dorsal dura, or the negative pressure of the drain may have also caused pressure change under the dura. We searched for literature on epidural drains and SSH, as well as literature on the location of appropriate epidural drains. Unfortunately, however, no literature has been found directly related to these. Therefore, we could not identify the exact reason for the delayed SSH after endoscopic decompression.

Emergency surgical decompression with hematoma evacuation is undisputed in SSH patients with neurological deficits (4,5,7,9,15). In contrast, patients without neurological deficits can be treated by conservative management (6,9) (*Table 1*). Although there were no problems during the operation, immediate postoperative MRI is needed if the postoperative neurologic deficit is aggravated or progressing compared to before the operation. Our patient had complete resolution of neurologic deficits after immediate decompression surgery. We recommend that surgeons should be cautious of this rare complication, and care should be taken to prevent delay of examination and treatment in similar patients.

SSH is a very rare complication of full-endoscopic spine decompressive surgery. Immediate radiologic evaluation is necessary for patients with postoperative severe pain or neurologic deficit, and emergency open evacuation with durotomy is the treatment of choice for patients with SSH and neurologic deterioration.

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Footnote

Reporting Checklist: The authors have completed the CARE reporting checklist. Available at http://dx.doi.org/10.21037/jss-20-664

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Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at http://dx.doi.org/10.21037/jss-20-664). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee(s) and with the Helsinki Declaration (as revised in 2013). Written informed consent was obtained from the patient.

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