Case Report

Cauda Equina Syndrome Associated With an Interspinous Device

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Abstract

Background Although postoperative spinal epidural hematoma (SEH) is not uncommon, hematomas that require surgery are rare. Cauda equina syndrome (CES) may be associated with postoperative SEH. In these cases, early recognition and emergency decompression can prevent further damage and better neurologic recovery.

Case Description A 41-year-old man underwent two-level discectomy with insertion of an interspinous spacer at L3-4 and L4-5 because of low back pain and radiculopathy. Eight hours after the operation, the patient developed CES. MRI revealed SEH compressing posteriorly at the L3-4 level. On emergency decompression and hematoma evacuation, the interspinous spacer had obstructed the laminotomy site at L3-4 completely, blocking drainage to the drain. The patient experienced complete neurologic recovery by 2 months followup.

Literature Review Many studies report risk factors for SEH. However, postoperative SEH can also be encountered

in patients without these risks. One study reported a critical ratio (preoperative versus postoperative cross-sectional area) correlated with postoperative symptoms, especially in those with CES. The propensity to develop CES is likely dependent on a number of patient-specific factors.

Clinical Relevance Surgeons should be aware that patients without risk factors may develop acute CES. Wider laminotomy (larger than half of the device size) may help to prevent this complication when one uses the compressible type of device, especially in patients with relatively small lamina.

Introduction

Postoperative spinal epidural hematoma (SEH) is not an uncommon condition; in asymptomatic patients, postoperative MRI and CT studies have identified postoperative SEH in 33% to 100% after lumbar disc or decompression surgery [6, 15, 17, 20]. In contrast, the incidence of postoperative SEH that necessitates surgical decompression ranges from 0.1% to 3% [1, 2, 7, 8]. Although rare, these postoperative hematomas can have devastating neurologic consequences and substantial morbidity.

In recent decades, a number of lumbar nonfusion posterior stabilization devices have been introduced as an alternative surgery to help treat patients with degenerative spinal stenosis, discogenic low back pain, disc herniation, facet syndrome, and spinal instability. The interspinous spacers (ISPs) have been designed with the concept of distracting adjacent spinous processes, unloading the intervertebral disc, blocking spinal extension, and improving central canal and neuroforaminal stenosis. Although improvement in visual analog scale score and functional scores have been reported in many studies [5, 10, 19], complications such as

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Each author certifies that his or her institution approved the human protocol for this investigation, that all investigations were conducted in conformity with ethical principles of research, and that informed consent for participation in the study was obtained.

The device reported in this case report is not FDA-approved.

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infection and spinous process fractures, some of which necessitated removal and fusion, were also found [5, 19].

We report an unusual cause of acute postoperative cauda equina syndrome (CES) resulting from an SEH caused by a silicone interspinous device that completely blocked drainage at the laminotomy site.

Case Report

A 41-year-old male patient was admitted with low back pain and sciatica in both legs. His preoperative neurologic examination showed left positive Lasègue test at 30°, a positive right Lasègue test at 45°, and ankle and big toe dorsiflexion strength of $\frac{4}{5}$ in both sides. MRI showed left paramedian disc herniation at the L3-4 level and right foraminal disc herniation at the L4-5 level (Fig. 1). Over a 6-month period, the patient did not respond to nonoperative treatment including medication and physical therapy. Hemilaminotomy and discectomy were therefore performed using a standard posterior midline approach at L3-4 and L4-5. After discectomy, epidural venous bleeding was controlled using a Gelfoam-soaked sponge (Pfizer Inc, New York, NY). Two interspinous devices (Device for Intervertebral Assisted Motion Spinal Stabilization System [DIAM]; Medtronic Sofamor Danek, Memphis, TN) were inserted between L3-4 and L4-5 spinous processes. A Redivac drain (B. Braun, Melsungen AG, Germany) was inserted under the spinal fascia before skin closure.

At 8 hours postoperatively, the patient developed urinary incontinence and neurologic deficits. On neurologic examination, hypoesthesia at L4 and L5 nerve root distribution, saddle numbness, and left ankle and big toe dorsiflexion strength were $\frac{1}{5}$ and right ankle and big toe dorsiflexion strength was $\frac{3}{5}$. MRI showed SEH compressing on the posterior dural sac at the L3-4 level (Fig. 2). The patient underwent emergency decompression and evacuation of hematoma. The silicone interspinous device completely obstructed the laminectomy site at L3-4 lamina causing a closed space with the epidural hematoma expanding underneath the device. We removed the DIAM spacer and extended the laminectomy at the L3-4 level to enhance visualization and evacuated the hematoma. Epidural venous plexus was identified as a bleeding source and stopped by cauterization and Gelfoam packing.

Ten hours postoperatively the patient was showing improvement of motor, sensory, and urinary function. Postoperative radiographs were checked (Fig. 3). At followup 2 months postoperatively, the patient had a complete neurologic recovery without signs of vascular complications or symptoms related to the bleeding or herniated nucleus pulposus.

Discussion

We report an unusual expanding SEH that was blocked from drainage by a silicone interspinous device after two

Fig. 1A–C Sagittal MRI showing L3-4 and L4-5 disc herniation (A). Axial MRI of L3-4 showing left paramedian disc herniation (B). Axial MRI of L4-5 showing small right foraminal disc herniation (C).

Fig. 2A–C Sagittal MRI showing epidural hematoma (black dotted line) compressing on the spinal canal markedly at the L3–4 level. DIAM (white dotted line) slipped into the laminectomy site above the hematoma (A). Axial MRI of L3–4 showing a large epidural hematoma (black dotted line) compressing on spinal canal with the DIAM (white dotted line) covered the laminectomy site completely and blocking the hematoma drainage (white arrow) (B). Axial MRI of L4–5 showing the DIAM (white dotted line) covered the laminectomy site completely (C).

Fig. 3A–B First postoperative posteroanterior (PA) lumbar spine radiograph showing DIAM devices were inserted in both L3–4 and L4–5. Smaller laminectomy site of L3–4 and L4–5 were noticed (A). Second postoperative PA lumbar spine radiograph showing DIAM at the L3–4 level was removed. Decrease interspinous space of L3–4 was seen (B).

levels of laminotomy and discectomy causing acute postoperative CES.

Since Jackson described the first case of SEH in 1869 [3], several hundred cases with various etiologies and risk factors such as an age of older than 60 years, Rh-positive blood type, and multilevel procedures (more than five levels) have been reported [1, 7, 17]. Preoperative non-steroidal anti-inflammatories use, hemoglobin less than

10 g/dL, and preoperative and postoperative coagulopathy were also identified as predisposing factors that can be prevented or corrected [1, 7, 17]. Although our patient had none of these risk factors, coagulopathy is a risk even in those without a history. One important factor for postoperative SEH is meticulous hemostasis during the procedure in patients with or without risk [7, 22]. In the present case, although hemostasis was considered adequate during the

initial surgery, rebleeding may have been caused by sudden elevation of the pressure while straining to ambulate. Care should be taken to prevent coughing during wake-up from anesthesia, sneezing, and lifting because those may cause rebleeding [9, 13]. Although a subfascial drain has been reported to reduce the rate of postoperative epidural hematoma [12], our case demonstrates that completeness of hemostasis is still crucial. CES after lumbar spine surgery is extremely rare. The incidence is reportedly 0.08% to 0.2% [11, 14, 18]. In a recent study, Sokolowski et al. compared the size of the hematoma and postoperative pain or CES and found the hematoma volume did not relate to risk. A critical ratio (the smallest ratio of postoperative to preoperative cross-sectional area within the lumbar spine) less than 0.25 was the only measurement correlating with the postoperative CES [16]. Jensen reported two patients with CES after lumbar disc surgery [4]. One of his patients had a fat graft patch to cover the durotomy at the foraminotomy site. Similar to the close space effect of the fat graft, our interspinous device fits perfectly over the laminotomy site creating a close space and reducing the cross-sectional area.

The idea of ISPs was first advocated in the 1950s by Knowle as a “plug” that could be inserted between the spinous process of the lumbar spine to distract the spinous processes and unload the facet joints [21]. However, the plugs often dislodged, necessitating removal. While using a similar rationale, modern ISP devices have been designed to minimize dislodging with implant wings (X-Stop; Kyphon, Sunnyvale, CA), flanges (Coflex; Paradigm Spine, NY), straps (Wallis; Abbott Spine, Austin, TX), or sutures (DIAM). The DIAM Spinal Stabilization System, an “H”-shaped dynamic-type interspinous spacer, is a polyester-covered, compressible silicone bumper that is placed between spinous processes with a mesh band and suture to hold it in place. It is currently not FDA-approved; however, the US FDA-regulated clinical trial was already initiated in late 2006. Despite rates of postoperative patient satisfaction ranging from 87.5% to 97% at 12 to 17.7 months [5, 10, 19], complications such as spinous process fracture, infection, recurrent or residual disc protrusion, and new-onset radiculopathy have been reported [5, 10, 19].

Because the device is made from silicone, the shape of the device can be changed and accidentally slipped into an open space such as the laminotomy site like in our study. We believe that limited excision of interspinous ligament, which separated the DIAM from the spinal canal, may prevent this complication.

Surgeons should be aware that patients without obvious risk factors may develop acute CES. Wider laminotomy (larger than half of the device size) and preservation of interspinous ligament may help to prevent this complication

when one uses the compressible type of device, especially in a patient with relatively small lamina.

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