Epidural Blood Patch on Cerebrospinal Fluid Leakage Caused by Iatrogenic Dural Injury After Transforaminal Lumbar Interbody Fusion

Gi Hun Kim and Tack Geun Cho

Department of Neurosurgery, Kangnam Sacred Heart Hospital, Hallym University College of Medicine, Seoul, Korea

ABSTRACT

A 65-year-old woman who underwent transforaminal lumbar interbody fusion at L4-5 for very severe spinal stenosis combined with a hard disc and instability presented with a headache on postoperative day (POD) 3 and cerebrospinal fluid (CSF) leakage on POD 5. Follow-up lumbar spine computed tomography (CT) was performed on POD 7, and fluid collection at the operation site was observed on CT images. Under the diagnosis of iatrogenic dural injury, absolute bed rest and lumbar drain catheter insertion at the L2-3 level were performed for three days, but the patient continued to complain of severe headache until POD 10. We reoperated on POD 10 and observed a dural defect with CSF leakage. The surgery was completed after ensuring that the CSF leakage was resolved by dural repair. However, 10 days after the reoperation, the amount of hemovac drainage still did not decrease and was measured to be more than 250 mL. There was no improvement in the patient’s symptoms. Twenty days after the first surgery, an epidural blood patch was applied to the epidural space at the site of dural injury, and the patient’s symptoms improved.

Keywords: Blood patch, epidural; Spine; Postoperative complications

INTRODUCTION

Due to the complexity of spine surgery, the prevalence of dural ruptures causing cerebrospinal fluid (CSF) leakage is high, which can lead to many complications, including incomplete surgeries, reoperation, meningitis, arachnoiditis, brain abscesses, CSF fistulas, headache, and even subarachnoid and subdural hemorrhage. Many studies have focused on suture repair to prevent CSF leakage when dural tear occurs, and absolute bed rest (ABR) and lumbar drain were performed. We report the case of a 65-year-old woman who was successfully treated with epidural blood patch (EBP) for uncontrolled CSF leakage after transforaminal lumbar interbody fusion (TLIF) at L4-5.
**CASE REPORT**

A 65-year-old woman presented with a 6-month history of back pain, radiating pain and tingling sensations from the left hip to the calf. Lumbar spine magnetic resonance imaging (MRI) T2-weighted images demonstrated very severe spinal stenosis at L4-5 with a ruptured intervertebral disc. A large hard disc at L4-5 was observed on lumbar spine computed tomography (CT) (FIGURE 1). Spinal instability at the L4-5 level was observed on simple lumbar spine radiographs (FIGURE 2). TLIF at L4-5 was performed. Surgery was completed after ensuring that the nerve was well decompressed (FIGURE 3). On postoperative day (POD) 3, the patient complained of a headache, and CSF oozing out of the skin occurred 2 days later. Lumbar spine CT performed on POD 5 and brain MRI performed on POD 6 demonstrated no specific findings. The patient was put on ABR for 2 days. However, the CSF oozing continued and worsened. Lumbar spine CT performed on POD 7 showed fluid collection at the surgical site (FIGURE 4). Under the diagnosis of iatrogenic dural injury, ABR and lumbar drain catheter insertion at the L2-3 level were performed for 3 days, but the patient continued to complain of severe headache until POD 10. We reoperated on POD 10, and a dural defect with CSF leakage was observed. The dura mater was sutured using Vicryl #4-0 and we covered it with Gelfoam and fibrin sealant (Tisseel®). After reinforcing the muscle and adipose tissue around the dura mater, the Valsalva maneuver was performed to check whether CSF leakage was resolved. There was some oozing at the surgical wound site after 2nd surgery. However, the amount of CSF oozing was significantly decreased. Hemovac was drained in natural pressure. However, 10 days after the reoperation, the amount of hemovac drainage still did not decrease and was measured at over 250 mL. There was also no improvement in the patient’s symptoms.

At that time, CSF leakage persisted after lumbar drainage, which was performed as the first treatment, and still persisted after dural repair as a second treatment. Considering that intracranial hypotension caused by CSF fistula was sometimes treated with an EBP, we decided to treat the uncontrolled CSF leakage with this method (FIGURE 5).

Twenty days after the first operation, the patient was transferred to the angiography room and positioned prone. The epidural space was found by simultaneously checking the anterior posterior/lateral radiography using biplane fluoroscopy. A small amount of contrast dye was injected to ensure proper needle placement. Then, 20 mL of autologous blood was slowly injected (30 seconds) through a spinal needle into the epidural space at the site of the dural injury. The day after the procedure, the patient’s severe headache was almost relieved, and

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**FIGURE 1.** Preoperative lumbar spine magnetic resonance imaging and computed tomography demonstrated very severe spinal stenosis with ruptured intervertebral hard disc.
FIGURE 2. Lumbar plain radiographs demonstrated spinal instability at L4-5 level.

FIGURE 3. Postoperative lumbar spine magnetic resonance imaging demonstrated that the nerve was well decompressed.

FIGURE 4. Lumbar spine computed tomography performed on post-operative day 7 demonstrated fluid collection at the operation site.
the daily hemovac drainage volume decreased from 250 mL to less than 10 mL. The patient’s condition was maintained during the discharge and outpatient follow-up period.

**DISCUSSION**

The prevalence of iatrogenic dural tears after spine surgery is generally known to be between 1%–17%, although this varies in literature. There was a tendency for the prevalence to increase with reoperation or more complicated surgery. In addition, the prevalence also showed a tendency to increase with age. Wang et al. showed no significant difference in the prevalence of iatrogenic dural tears according to whether instrumentation was used during spinal surgery. In this case, factors that increased the risk of dural rupture included severe adhesions and degenerative changes to the dura mater due to hard disc and old age of 69 years.

Many studies have focused on suture repair to prevent CSF leakage when dural tear occurs, and ABR, lumbar drainage, antibiotics, and hydration have been performed. Grannum et al. suggested that CSF leakage was treated after ABR for an average of 2.6 days without primary suture repair in dural tears after lumbar decompression surgery. In another study, approximately 90% of untreated intracranial hypotension was self-limiting and resolved spontaneously within 7 to 10 days. In this case, it was considered that CSF leakage was not treated with ABR because TLIF had more dead space than decompression without instruments such as laminectomy.

Generally, EBP has been commonly used over the last 6 decades to treat intracranial hypotension and has proven to be beneficial. The mechanism by which EBP improves intracranial hypotension is unknown. The “plug” theory for symptom alleviation suggests that blood injected during EBP forms a gelatinous epidural plug, sealing the dural tear site and preventing further CSF leakage into the epidural space. If there is no continued loss, CSF regeneration restores CSF pressure and relieves symptoms. The “pressure patch” hypothesis
EBP on CSF Leakage by Dural Injury After TLIF

focuses on the effect of injected blood on the pressure dynamics of the central nervous system. The injected blood increases the epidural pressure and compresses the dura mater, which increases the subarachnoid CSF pressure. A previous study reported that EBP was also effective in patients with intracranial hypotension who had CSF leakage or complications such as subdural hemorrhage. Therefore, we believe that EBP would be effective in the treatment of CSF leakage caused by iatrogenic dural tears.

Because of the complications of EBP, its application in the treatment of intracranial hypotension has been a subject of debate. A review by Boonmak et al. concluded that EBP is more beneficial than conservative treatment. Mild-to-moderate back pain is a commonly reported complication of EBP, but it usually improves in days and is generally reported to be more preferable to headache caused by intracranial hypotension. The risk of additional dural injury due to EBP is minimal, because this procedure is not technically difficult. Injected blood may cause an infection nidus. Despite being a rare complication, prompt action and management are required. According to the literature, it has been reported that signs of infection after EBP usually appear 3 to 5 days later. For this reason, the patient in this case was sufficiently informed about the complications before the procedure. After the procedure, the patient was under close surveillance and did not experience any of the aforementioned symptoms, except for mild back pain.

However, the ideal time for apply EBP remains unclear. In a study by Scavone et al., prophylactic EBP following incidental dural puncture in parturients for epidural catheter injection has not been shown to decrease the incidence of intracranial hypotension. On the other hand, in a study of Stein et al., prophylactic EBP reduced the incidence of intracranial hypotension. The authors speculated that if CSF had already leaked, a relatively high volume of CSF could dilute autologous blood and interfere with clot formation due to EBP. In this case, although it was 2 weeks since the CSF leakage occurred, clot formation due to EBP was considered successful as the amount of CSF in the surgical site was small because the hemovac drain was inserted during reoperation. The optimal blood infusion volume for CSF leakage has not been studied yet, but in the study by Paech et al., 20 mL of autologous blood was sufficient for intracranial hypotension, which was the volume used for this case as well.

There were literatures that EBP was performed on CSF leakage after open spine surgery. In a case report by Gilly et al., a patient who underwent minimally invasive L5-S1 fusion showed CSF leakage and EBP was applied at the dural tear site. As the number of minimally invasive spine surgery increases, noninvasive dural repair methods such as EBP may be used more frequently instead of converting to an open primary suture repair. In a case report by Kavishwar at al., a patient female who underwent L4-5 microdiscectomy was diagnosed a pseudomeningocele having a CSF collection in the paraspinal lesion and EBP was applied. It may be worth trying EBP to avoid second surgery as it may sometimes be unsuccessful. In this case, no dural tear was observed during the first operation. CSF leakage and headaches persisted even after the reoperation. The patients symptoms were alleviated only after the EBP.

CONCLUSION

EBP using autologous blood may be one way to treat CSF leakage after TLIF.
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