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Epidural Blood Patch for Early Postoperative Cerebrospinal Fluid Leak After Lumbar Intradural Tumor Resection

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Abstract

Epidural blood patching (EBP) is an established treatment for post-dural puncture headache, but evidence for its use after spinal surgery remains limited. A 36-year-old woman presented on postoperative day 8 with a 10/10 orthostatic headache, nausea, vomiting, neck stiffness, and surgical-site swelling after resection of an intradural left S1 schwannoma. Lumbar magnetic resonance imaging showed an extradural cerebrospinal fluid collection at L5-S1 communicating with the thecal sac. Because she still could not stand after two days of conservative management, a 20-mL interlaminar EBP was performed at L3-L4, above the operative field, after ultrasound-assisted level localization. The patient reported marked improvement immediately afterward. She first walked with assistance about 24 hours after the patch, on postoperative day 11. By that evening, she could walk and sit for meals without headache. She remained headache-free at one- and two-week follow-up. Spontaneous improvement cannot be excluded after this short trial of conservative management, and no repeat imaging was obtained to confirm closure of the leak. This case describes interlaminar EBP above the operative field as an alternative considered before re-exploration.

Categories: Neurosurgery, Anesthesiology
Keywords: epidural blood patch, intradural tumor, orthostatic headache, postoperative cerebrospinal fluid leak, spinal surgery

Introduction

Cerebrospinal fluid (CSF) leakage can occur after spinal surgery when the dura is intentionally opened to access an intradural lesion or is inadvertently breached during an extradural procedure [1,2]. In a retrospective cohort of 375 patients undergoing intradural spine surgery, 30 (8%) developed clinically or radiologically confirmed postoperative CSF leakage [3]. In a separate cohort undergoing intradural spinal tumor resection, severe headache occurred in 20 of 96 patients (20.8%) with postoperative CSF accumulation on magnetic resonance imaging (MRI) [4]. A CSF leak is the escape of CSF through a dural defect; the escaped fluid may collect outside the thecal sac. A contained extradural CSF collection communicating through a dural defect may be described as a pseudomeningocele, whereas a cutaneous CSF fistula allows drainage through the skin [1,2]. Patients may present with orthostatic headache, nausea, vomiting, or surgical-site swelling. Management depends on the presentation and may include conservative measures, CSF diversion, wound revision, or direct dural repair [1,2].

An epidural blood patch (EBP) involves injection of autologous blood into the epidural space and is an established treatment for post-dural puncture headache [5]. The injected blood may initially compress the thecal sac and transiently increase CSF pressure; subsequent clot formation may help limit further leakage [6,7]. After spinal surgery, the dural opening may be larger than a needle puncture and may already have been sutured or reinforced with a sealant. Removal of bone or ligament and the presence of postoperative fluid can also alter the anatomy near the repair [6,8]. The evidence for post-dural puncture headache therefore cannot be directly extrapolated to postoperative leaks, for which the evidence consists mainly of case reports, small series, and retrospective studies [6,8-12].

An interlaminar EBP accesses the epidural space between adjacent laminae, whereas the transforaminal approach accesses it through a neural foramen. Published postoperative reports describe ultrasound or fluoroscopy used to guide needle placement or treatment [6,8-12]. In this case, ultrasound was used before needle insertion to identify and mark the interspace. We describe an interlaminar EBP performed above a recent lumbar operative field for an early symptomatic CSF leak following intradural tumor resection.

Case Presentation

A 36-year-old woman presented with a one-year history of low back pain and left S1 radicular pain. Lumbar MRI showed an approximately 7-mm intradural lesion arising from the left S1 nerve root, with features suggestive of a nerve sheath tumor (Figure *1*). She underwent a left L5 hemilaminectomy and left L5-S1 ligamentum flavectomy, followed by gross total resection of the lesion through a dorsal durotomy.

Histopathology confirmed a schwannoma. The dura was closed with a continuous 5-0 VICRYL (polyglactin 910) suture (Ethicon, Inc., Somerville, NJ), and the operative note described the closure as watertight. The closure was reinforced with crushed muscle, an absorbable gelatin sponge, and a dural sealant. No surgical drain was placed. Her radicular symptoms initially improved, and she was discharged on postoperative day (POD) 7.

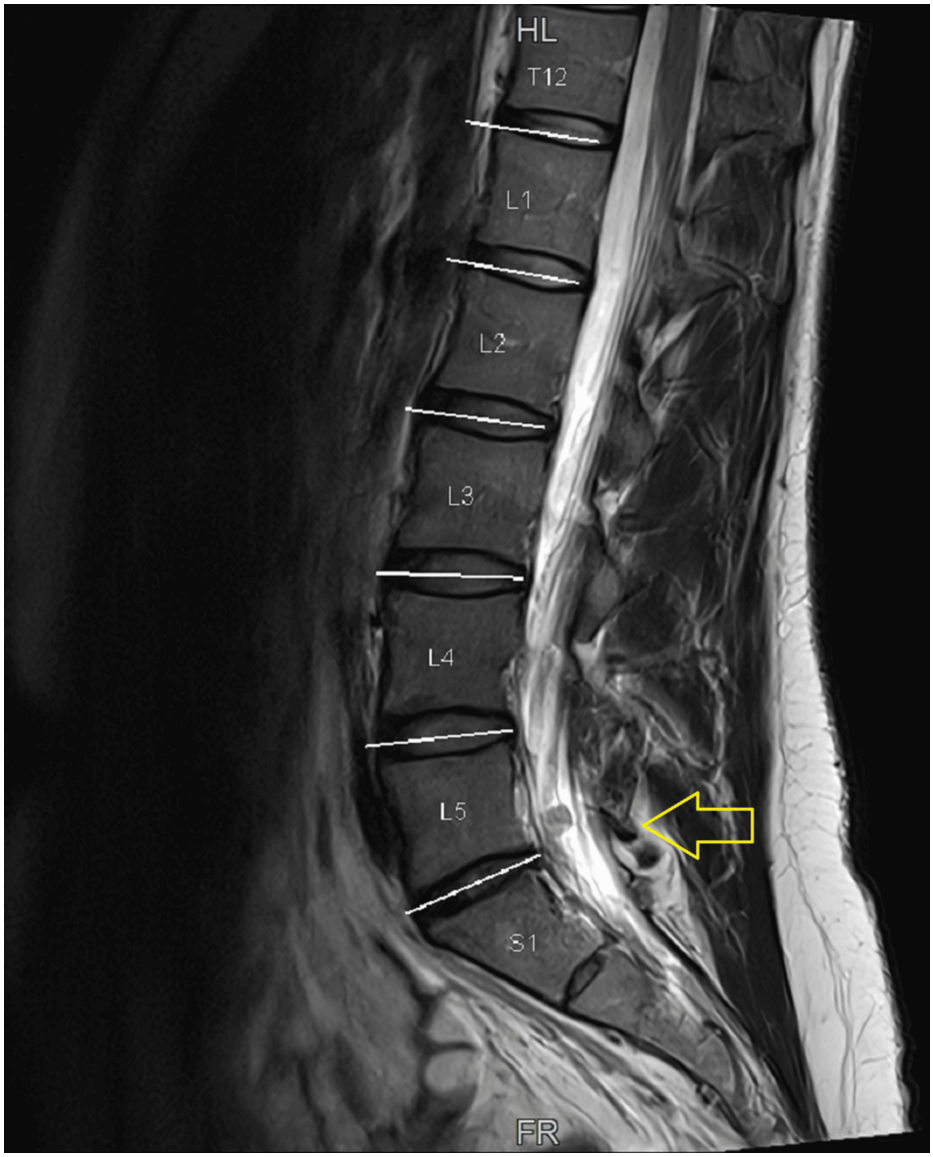


FIGURE 1: Preoperative sagittal lumbar spine MRI demonstrating the small intradural lesion (yellow arrow) at the lumbosacral level arising from the left S1 nerve root, with imaging features suggestive of a nerve sheath tumor.

MRI, magnetic resonance imaging

On POD 8, she returned to the emergency department with a 10/10 orthostatic headache, nausea, vomiting, neck stiffness, and swelling at the surgical site. Her headache improved when she lay down and prevented her from standing. Blood pressure was 120/65 mmHg, heart rate was 74 beats/min, respiratory rate was 20 breaths/min, oxygen saturation was 99%, and temperature was 36.6 °C. The incision was intact, with mild fluctuant swelling and a positive cough impulse. No external drainage or local signs of infection were observed, and there was no focal neurological deficit. The white blood cell count was 9.32 × 10^3/µL, and the platelet count was 281 × 10^3/µL. C-reactive protein (CRP) (19.2 mg/L) and erythrocyte sedimentation rate (ESR) (49 mm/h) were elevated; neither had been measured preoperatively. The neurosurgical team documented no clinical signs of infection. Blood cultures were not obtained.

Urgent lumbar MRI demonstrated a 3.7 × 2.0 cm extradural CSF-intensity collection at the L5-S1 operative site on sagittal (Figure 2) and axial (Figure 3) images. The study showed communication between the collection and the thecal sac, consistent with a postoperative CSF leak. Smaller anterior CSF-intensity collections extended from L2-L3 to L4-L5.



FIGURE 2: Postoperative sagittal lumbar spine magnetic resonance imaging (MRI) demonstrating the cerebrospinal fluid (CSF)-intensity collection (yellow arrow) at the L5-S1 operative site, consistent with postoperative CSF leakage.

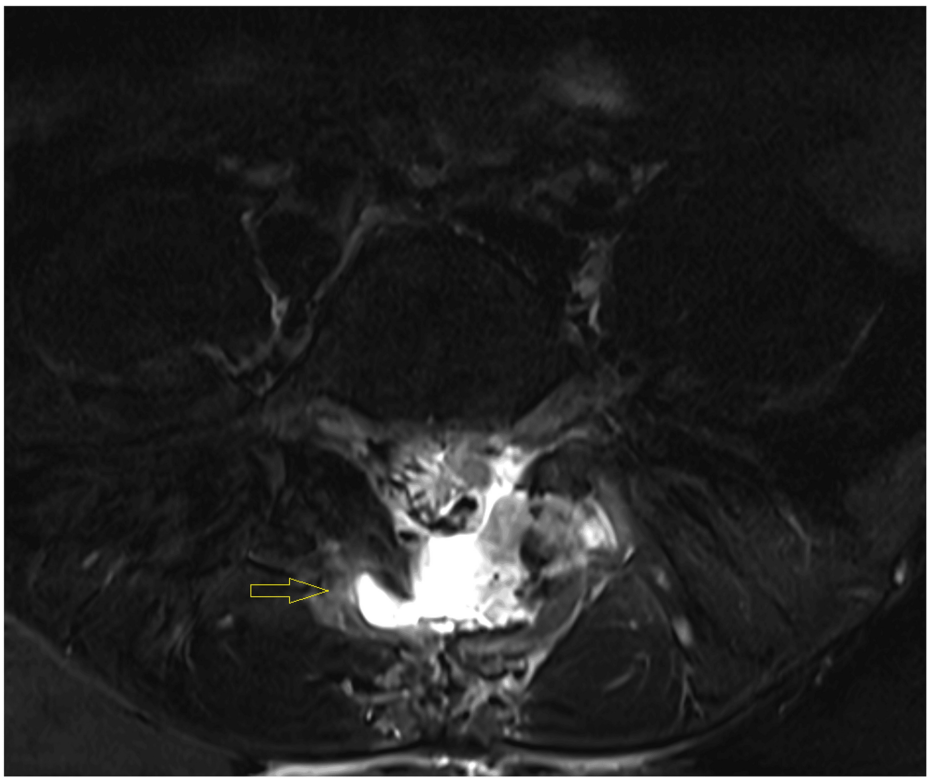


FIGURE 3: Axial lumbar magnetic resonance imaging (MRI) on postoperative day (POD) 8 showing the extradural cerebrospinal fluid (CSF)-intensity collection (yellow arrow) at the L5-S1 operative site before epidural blood patching.

Initial management included bed rest, intravenous lactated Ringer's solution, paracetamol (1 g), parecoxib (40 mg), and ondansetron (4 mg). Ibuprofen was given the following day, and the patient was advised to drink coffee. Because she still could not stand after two days of conservative management, the neurosurgical and anesthesia teams agreed to attempt an EBP before surgical re-exploration.

The patient was not taking anticoagulants or antiplatelet agents. Testing two days before surgery showed a prothrombin time of 10.3 seconds, an international normalized ratio of 0.89, and a partial thromboplastin time of 27.3 seconds; no more recent coagulation results were available. At 07:46 on POD 10, she received intravenous co-amoxiclav 1.2 g before EBP. With the patient seated, the operator used ultrasound to identify and mark the L3-L4 interspace before insertion of a 16-gauge Tuohy needle. The insertion site was infiltrated with 3 mL of 2% lidocaine (60 mg). The procedure was performed without sedation. The operator used their usual loss-of-resistance-to-air technique. The syringe was loaded with 2 mL of air, and air injection stopped at loss of resistance; the delivered volume was not measured. No fluid was obtained on aspiration. A second operator obtained venous blood through a hand cannula placed aseptically in a separate sterile field. The operator slowly injected the planned 20 mL of autologous blood. The patient tolerated the injection well. No injection duration or rate in mL/min was documented. No prophylactic antibiotic dose was given after the procedure.

EBP was performed at approximately noon on POD 10, and she reported marked improvement in headache afterward. She remained flat in bed for the remainder of that day and could turn in bed but did not sit up or walk. On POD 11, the head of the bed was gradually elevated before sitting and mobilization. She first walked with assistance at approximately noon, around 24 hours after EBP, reporting mild dizziness without significant headache. By the evening of POD 11, she was walking to the bathroom and sitting for meals without headache. She reported low back pain and intermittent left sciatica. The incision was clean and dry, with no significant swelling or visible external drainage. She was discharged on POD 12 without headache.

At follow-up one and two weeks after EBP, the patient remained headache-free and the wound was unremarkable. She reported mild left lumbar pain and was advised to pursue physiotherapy and pool-based exercises. Later outpatient notes, extending to approximately four and a half months after EBP, described residual back stiffness and surgical-site discomfort but did not mention recurrent headache. The treating neurosurgical team did not consider repeat MRI clinically indicated. The subsequent status of the extradural collection and closure of the dural defect were therefore not confirmed on imaging. No standardized

numerical headache scores after EBP or timed orthostatic challenge were available in the reviewed records. The cause of the residual back pain was not established.

Discussion

Management of postoperative CSF leakage depends on symptom severity, wound integrity, neurological findings, and concern for infection. Options include conservative measures, lumbar CSF diversion, wound oversewing, and surgical re-exploration with dural repair [1,2]. In this case, the incision was intact without external drainage, and there was no focal neurological deficit. The patient was afebrile, the white blood cell count was within the laboratory reference range, and the neurosurgical examination did not identify clinical signs of infection. The inflammatory markers were elevated, however, and blood cultures were not obtained. The decision to proceed after two days of conservative management reflected the severity of the orthostatic headache and the inability to mobilize.

Table *1* summarizes selected reports of EBP for postoperative spinal CSF leaks.

Study and sample	Postoperative setting	EBP technique	EBP timing	Injection level	Blood (mL)	Follow-up	Outcome and adverse events
Clendenen et al. [8] Case series, 6 patients	Symptomatic leak after lumbar surgery	Four-dimensional real-time ultrasound-guided EBP	-	Overexposed dura at operated level	-	-	Headache relief in all six patients
Fridley et al. [9] 2 case reports	Lumbar pseudo-meningoceles in adolescents	Ultrasound-guided aspiration and EBP	-	-	-	-	Immediate symptom resolution in both
West et al. [10] 48 patients, 49 episodes of care	Symptomatic postoperative pseudo-meningocele	Real-time ultrasound-guided aspiration and EBP; 61 EBPs	-	Targeted to operative dural defect	-	Median 4.3 months	51.0% resolution after first EBP; 20.4% additional success after multiple EBPs; 14.3% complications*
Kavishwar et al. [11] 1 case report	Lumbar pseudo-meningocele after microdiscectomy	Ultrasound-guided aspiration and blood patching	-	L4-L5 and L3-L4	10 mL at each site	1 year	Symptoms improved; collection resolved on MRI at one year
Kim and Cho [6] 1 case report	Persistent leak after TLIF	Fluoroscopy-guided EBP	POD 20	L4-L5, at injury	20 mL	Not specified	Headache and drainage improved; mild back pain reported
Goodman et al. [12] 2 case reports	Cervical and lumbar dural leaks	Transforaminal EBP	-	Cervical: repair levels; lumbar	-	-	Cervical leakage stopped; lumbar positional symptoms resolved after transforaminal EBPs
Present case 1 patient	Leak after intradural S1 schwannoma resection	Interlaminar EBP after ultrasound-assisted localization	POD 10	L3-L4, two interspaces cephalad to L5-S1	20 mL	1 and 2 weeks; later notes to ≈4.5 months	First assisted walk ≈24 h after EBP; walking and sitting without headache by evening of POD 11; no repeat MRI

TABLE 1: Selected published evidence on epidural blood patch for cerebrospinal fluid leaks after spinal surgery.

*West et al. [10] reported these percentages in the abstract. The abstract does not provide event counts or complication types; the denominators were not independently established from the full article.

A dash indicates a detail not established from the accessible original source. For Kavishwar et al. [11], presentation was one month after surgery; an exact EBP day was not stated.

CSF, cerebrospinal fluid; EBP, epidural blood patch; MRI, magnetic resonance imaging; POD, postoperative day; TLIF, transforaminal lumbar interbody fusion

Clendenen et al. reported headache relief in six patients treated with four-dimensional ultrasound-guided EBP after lumbar surgery [8]. Fridley et al. described immediate symptom resolution in two adolescents after ultrasound-guided aspiration and EBP for symptomatic postoperative lumbar pseudomeningoceles [9]. West et al. described 48 patients across 49 episodes of care, during which 61 ultrasound-guided EBPs were performed. The published abstract reports symptom resolution after the first EBP in 51.0%, additional success after multiple EBPs in 20.4%, and complications in 14.3%; it does not provide event counts or specify the types of complications [10]. Kavishwar et al. reported symptomatic improvement and subsequent MRI resolution of a lumbar pseudomeningocele after ultrasound-guided aspiration and blood patching [11].

Kim and Cho reported improvement after fluoroscopy-guided EBP at the site of a persistent leak following lumbar fusion, after lumbar drainage and dural repair had been attempted [6]. Goodman et al. described transforaminal EBP for two postoperative dural leaks, one cervical and one lumbar [12]. Differences in presentation, injection technique, and outcome assessment limit comparisons between approaches.

The L3-L4 interspace was selected two interspaces cephalad to the L5-S1 operative site to avoid accessing the epidural space through the recent surgical field. Ultrasound was used to mark the level before the procedure; needle advancement was not guided by real-time ultrasound. No fluid returned on aspiration; this observation alone does not establish the position of the needle relative to the anterior collections. Needle position and blood spread were not independently confirmed by imaging, so it is unknown whether blood reached the L5-S1 defect. The prompt symptomatic improvement is consistent with a transient pressure effect, while clot formation is another proposed mechanism; neither was demonstrated in this patient [6,7].

Infection is a potential complication of EBP [6]. Imaging after EBP has demonstrated compression of the thecal sac and nerve roots [7], raising concern about adding blood to an epidural space already containing a postoperative collection. Pneumocephalus, intrathecal hematoma, and arachnoiditis have been described after EBP in other settings [13,14]. Loss of resistance to air reflected operator familiarity rather than evidence of superiority over saline. In this case, the patch was placed above the operative field, and a second operator obtained autologous blood using a separate sterile field. An uneventful injection in one patient does not establish the safety of the technique after intradural surgery.

The main outcome was relief of orthostatic headache. Following flat bed rest on POD 10, head elevation and mobilization were introduced gradually on POD 11. The first assisted walk occurred approximately 24 hours after EBP and was accompanied by mild dizziness without significant headache. By the evening of POD 11, she was walking to the bathroom and sitting for meals without headache; wound inspection at that time showed no significant swelling or external drainage. She remained headache-free at one and two weeks. The later outpatient records did not mention recurrent headache but did not include a structured assessment of recurrence. Spontaneous improvement cannot be excluded given the brief trial of conservative management and the single-patient design. Without repeat MRI, the subsequent size of the collection and closure of the dural defect could not be assessed. Longer follow-up with systematic symptom assessment and follow-up imaging in prospective studies would help distinguish durable symptom relief from radiological resolution.

Conclusions

In this patient, an interlaminar EBP performed above the recent lumbar operative field after ultrasound-assisted level localization was followed by resolution of orthostatic headache, with no headache reported at the one- and two-week follow-up visits. The neurosurgical and anesthesia teams chose EBP because the headache prevented mobilization, the incision was intact, and no focal neurological deficit or clinical signs of infection were documented. Spontaneous improvement cannot be excluded, and dural closure was not confirmed on imaging. This case illustrates an option that was used before re-exploration and highlights the need for better evidence on patient selection, timing, and technique.

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

Concept and design: Thaer Abuamer, Mohammed Abdulkarim Alhashimy

Acquisition, analysis, or interpretation of data: Thaer Abuamer, El Fatih Bashir El Malik, Yehya Issa, Mohammed Abdulkarim Alhashimy

Drafting of the manuscript: Thaer Abuamer

Critical review of the manuscript for important intellectual content: El Fatih Bashir El Malik, Yehya Issa, Mohammed Abdulkarim Alhashimy

Supervision: Mohammed Abdulkarim Alhashimy

Disclosures

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