Abstract: We report the case of a 70-year-old man, with increased anesthetic risk, who benefited from a lumbar laminarthrectomy from lumbar vertebra 4 (L4) to sacral 1 (S1). A dural tear facing L5-S1 levels occurred during surgery and was repaired intra-operatively. Postoperatively, back and radicular pain symptoms appeared along with a pseudo-meningocele. Successful treatment was only achieved after performing an epidural blood patch and closed subarachnoid drainage. This well-known but infrequent management was undertaken after a first epidural blood patch attempt, and after two unsuccessful surgical choking procedures. Management is here described, and discussed at the light of existing literature.

Key words: Spinal surgery; dural tears; epidural blood patch; subarachnoid drain.

Introduction

Accidental dural tear (ADT) is a frequent complication of spinal surgery. Its prevalence ranges between 1 and 17 %, depending on reported series and type of surgical procedure. (1-4) Risk factors of surgical ADTs include secondary scar or irradiation-healed tissues, hypertrophy and secondary yellow ligament ossification, or synovial cysts within the surgical field. (5,6)

Outcomes of ADTs encompass pseudo-meningocele, with possible nerve root entrapment, arachnoiditis, poor wound healing, or wound infection. ADTs may express variably, with signs and symptoms such as nausea-vomiting, photophobia, headache, wound watery discharge, and back or radicular pain.

Treatments of dural tears include primary surgical repair, closed subarachnoid drainage, epidural blood patch (EBP), laser tissue-welding, muscle, fat, or fascia grafts, fibrin-adhesive, cyanoacrylate polymer sealant, or Gelfoam® application, bed rest, and avoidance of wound drains. (4,7-12) Most authors advocate the use of a combination of these measures.

We here describe an unusual course of ADT in a patient whose co-morbidities limited recourse to surgical interventions. After several attempts using different treatment modalities, non-surgical treatment was, at the end, successful.

The patient gave permission to the authors for publishing the report.

Case report

A 71 year's old man (80 Kg, 167 cm; 28.68 BMI) underwent an elective lumbar vertebra 4 (L4) to sacral 1 (S1) decompressive laminectomy for a symptomatic spinal canal stenosis. His past medical history consisted of a Gold III chronic obstructive pulmonary disease (COPD), stable ischemic cardiopathy, resolved atrial fibrillation, and deep venous thrombosis.

For anesthesia, the procedure was uneventful. However, an immediately identified dural breach accidentally occurred and was closed by a 5/0 non-resorbable dura suture. This closure was completed by an autologous fat graft, withdrawn from the...
subcutaneous layer, fixed with fibrin glue, and, finally, covered with oxidized regenerated cellulose knitted fabric (Surgicel®).

The immediate post-operative course was uneventful. After 2 days, on righting, the patient complained of back pain and orthostatic headache. Upon symptoms breakout, the decision to perform a computed tomography (CT)-guided EBP was made. With patient in ventral decubitus, and after CT location of L2–L3, skin preparation, and local anesthesia, the Tuohy needle was inserted and position confirmed with contrast agent. Twenty milliliters of autologous blood were slowly injected into the epidural space. Due to lack of clinical improvement, and apparition of a significant subcutaneous fluid collection, the patient was transferred to our hospital for care handover, magnetic resonance imaging (MRI) and, eventual surgical second look. MRI showed a large tubular cerebrospinal fluid (CSF) collection, spreading from the spine to the subcutaneous layer, and compressing the dural sac (Figure 1a, b). In light of this, surgery was planned and consisted in plugging the breach using Tachosil® covered with fibrin glue. Except for flat bed rest during 24 hours, no other special measures were taken, and, after a few days, the subcutaneous collection and associated symptoms reappeared. A third surgical look was scheduled, and consisted of the same treatment. Indeed, direct dural suture became impossible due to lateral extension of the breach in the vicinity of nerve roots. Hope of success was glimpsed after five symptom-free days, and the patient was discharged home. He came back fourteen days later, with leak recurrence, but still no sign of cutaneous fistula.

Before embarking on a fourth surgical procedure, and given the risks associated with general anesthesia in this patient with multiple co-morbidities, a multidisciplinary open debate took place between anesthesiologists and surgeons. Consensus was obtained for a second EBP, this time associated with closed subarachnoid drainage. EBP was performed on a sitting patient and after skin preparation and local anesthesia. The Tuohy needle was inserted at the first palpable inter-spinous space above the laminectomy scar. Once the epidural space was spotted using the loss of resistance technique with a liquid mandrin, thirty milliliters of autologous blood were slowly injected. The patient did not report any pain upon blood injection. The Tuohy needle was then pushed a few millimeters forward, until frank CSF reflux occurred through the needle. An epidural catheter (B-Braun - Perifix® 20G) was inserted 5 cm into

![Image](image1.png)

**Fig. 1** — Sagittal (A) and axial (B) T2-weighed lumbosacral spine MRI showing a large 7 (antero-posterior) by 10 (rostro-caudal) cm tubular cerebrospinal fluid (CSF) collection (red arrows), spreading from the spine to the subcutaneous layer, and compressing the dural sac.
During that period, the patient did not complain of enhanced headache. Admission symptoms rapidly resolved, the patient was progressively allowed to stay upright, and was discharged fifteen days after the EBP. Five months later, a control MRI showed complete resolution of the fistula and pseudo-meningocele (Figure 2a, b).

**Discussion**

Several treatment modalities of surgical ADT are described. Therapeutic recommendations are mainly based on few descriptive non-randomized studies, with small sample sizes. Hence, comparing efficiencies is not easy. In addition, there is general consensus on the necessity to combine therapeutic modalities for better chances of success when surgical repair has failed or is impossible due to the localization of the breach. (9) First line treatment of ADT remains the meticulous repair of the breach, during the incriminated procedure itself, provided that the breach is recognized. (1,4) Despite the fact that most authors do not recommend sub-fascial closed suction wound drains in case of repaired ADT, some cases of safe use have been reported. (13)

When identified postoperatively, ADT can be managed according to varying schemes. Flat lying bed rest is the first step of conservative management, but it is not very efficient when used alone. (4,7) In addition, duration of bed rest varies a lot between reports, but does usually not exceed three days. Nevertheless, surgery should remain the first line treatment in patients with profuse CSF leakage, or symptomatic pseudo-meningocele, and after failure of conservative measures. Leak closure is usually achieved using a running non-resorbable suture. However, large dural defects require free muscle or fat graft, fixed with suture or fibrin glue. (1,4)

To avoid reoperation-linked morbidity, less invasive procedures have been proposed. EBP is a well-known treatment modality of post-dural puncture headaches, or idiopathic low intracranial pressure. It has also been used successfully to treat postoperative CSF fistulas and pseudo-meningocele. Noteworthy, cloth formation within the injected epidural blood has been found to be accelerated and strengthened in the presence of CSF. (14,15)

Classical reports of EBP-treated ADT describe Tuohy needle insertion at the first palpable inter-spinous space above the surgical scar, relying on blood gravitational spread to cover the dural defect. Case reports or small series of fluoroscopy, CT, or ultrasound-guided EBP’s have been published. (9,16-20) Caudal route has also been described in children. (21) The imagery-guided techniques enable real-time control of Tuohy needle progression, and efficient drainage of CSF collection before precise blood injection in front of the defect. However,
fluoroscopy and CT expose patients to a substantial amount of radiation.

Another alternative is CSF derivation through a closed subarachnoid drainage. The rationale of CSF diversion is a decrease in sub-dural-epidural differential pressure, allowing reduction of CSF leak, and healing of the dural breach. According to Shapiro (12), a 120 to 360 mL day⁻¹ drainage for seven days has a 90 to 92 % success rate in the treatment of CSF fistulas. However, wound infection, meningitis, or discitis can occur as frequently as 10 %. Other complications include headaches, transient nerve root irritation, catheter occlusion, and recurrence. Kitchel ¹¹ has successfully used drainage for shorter periods of four days, with lower infection rates, but higher incidence of recurrence (18 %). Combined techniques may be more advantageous than prolonged CSF diversion or EBP alone. In that case, CSF diversion and EBP concur at lowering CSF pressure gradients across the breach, and optimizing dural healing.

To our knowledge, medications such as synthetic ACTH, aminophylline, gabapentin, and caffeine have only been studied after dural puncture with a needle, to treat post-dural puncture headache, and not after surgical dural tears. Their efficacy remains unsure. Hakim et al. (22) have shown that the administration of a single intravenous dose of co-syntropin after an accidental dural puncture is associated with a significant reduction in the incidence of post-dural puncture headache and the need for EBP.

In our case, surgery seemed to be the best initial therapeutic option. Unfortunately, after an immediate repair, EBP and two meticulous re-interventions, a CSF fistula persisted.

Careful anesthetic management was sought during surgery, including depth of anesthesia monitoring, muscle relaxation monitoring, opiate-sparing multimodal analgesia, and bronchial aspiration at the end of surgery. Postoperatively, daily respiratory physiotherapy, and aerosol therapy were used. These measures probably contributed to avoid respiratory and cardio-vascular complications in this ASA III patient. However, each procedure was at risk of such complications. Indeed, Gold III COPD patients have 1.8 odds of developing postoperative respiratory complications as compared to non-COPD patients. (23,24) The risk of cardiac ischemia was less pronounced, insofar as his myocardial infarction happened twenty years ago, without any reoccurrence. In light of this, a multidisciplinary approach was planned to avoid supplementary surgery, general anesth

related potential complications. We came to the conclusion that it was worth trying a second EBP, this time combined with a 4 day closed subarachnoid drainage and ventral bed rest. Although previous re-interventions did not allow complete closure of the breach, they probably diminished its size, and favored the efficiency of our EBP-CSF drainage. The patient evolution has demonstrated that we were right.

Our team does not have strong experience of ultrasound-guided epidural approach, and we decided to use the traditional ‘loss of resistance’ technique. However, we must acknowledge that ultrasound-guided EBP would have been an elegant, non-irradiating technique, allowing control of the pseudo-meningocele drainage before blood injection directly in front of the dural defect.

**Conclusion**

Pseudomeningoceles and CSF fistulas are one of the most frequent iatrogenic complications of lumbar surgery. The key of treatment is a meticulous technique during the original surgery, and a watertight closure in the event of durotomy. Epidural blood patch associated with CSF diversion is often considered an intermediate step between conservative initial measures and openly invasive surgical procedures. Although a direct surgical repair is usually the definitive treatment, we have shown in this case report that these intermediate measures can be considered an option after failure of surgery, and may be successful at curing the problem. Our combined protocol maximizes the chances for dural healing and minimizes the risk of infection. It should be kept in mind when taking care of this kind of patients.

**References**


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