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# Iatrogenic dural tear with giant pseudomeningocele. Technical note

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## ABSTRACT

Incidental durotomy during spine surgery carries a risk of cerebrospinal fluid (CSF) leakage, pseudomeningocele formation, and reoperation, and incomplete dural closure remains a frequent and troublesome problem. We report the management of a giant lumbar pseudomeningocele with a CSF fistula occurring after previous disc surgery, treated with a combined multilayer repair.

A 40-year-old woman, previously operated on twice for an L4-L5 disc herniation, presented with persistent lumbar pain, tinnitus, and a large subcutaneous CSF collection that enlarged on the Valsalva maneuver. MRI demonstrated a giant pseudomeningocele with a laterally located CSF fistula. Because the fistula was too lateral for safe direct suturing, it was repaired in a sandwich fashion using an autologous blood patch, TachoSil, an autograft fascia lata sutured circumferentially, and a vascularized muscular flap sutured tightly over the fascia lata, under loupe magnification. Neither fibrin sealant nor a subarachnoid drain was used, in order to avoid their associated risks.

The aspirated CSF was hyperproteic and bacteria-free. The postoperative course was uneventful and the patient was discharged in good health, with no recurrence at one-month follow-up. This combined technique — blood patch, TachoSil, autologous fascia lata, and a vascularized muscular flap — proved effective for treating the giant pseudomeningocele and preventing further complications such as CSF fistula and meningitis.

## INTRODUCTION

Incidental durotomy in spine surgery is associated with a risk of cerebrospinal fluid (CSF) leakage and reoperation. Rates of incidental durotomy have been reported in the literature to occur from 0.5% in lumbar discectomy to 35% in a single retrospective study<sup>19,20</sup>. Several strategies have been introduced, but incomplete closure is still relatively frequent and troublesome.

In the patient described in this case, effective management of the CSF leak prevented catastrophic infectious complications.

## Keywords

Dural repair,  
Neurosurgery,  
Spine surgery



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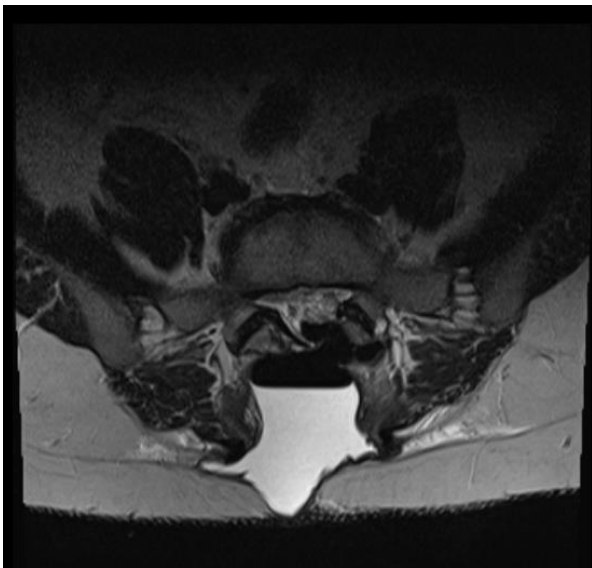
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## CASE REPORT

A 40-year-old female, operated on twice for L4-L5 lumbar disc herniation in other departments, was admitted to our department for continuous lumbar pain of medium intensity (VAS 6/10), tinnitus, and a large collection of CSF in the lumbar soft tissues that increased on the Valsalva maneuver.



**Fig. 1.** Preoperative aspect. CSF fistula diameter 23/6 cm. Volume: 200 mL of CSF.



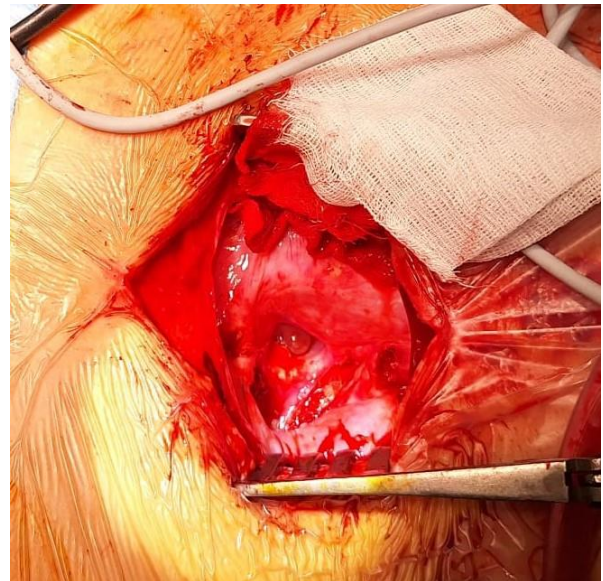
**Figure 2.** MRI, axial T2 with contrast. Hydroaeric level. Aeric level (blue arrow). Contrast fluid level (red arrow).



**Figure 3.** MRI, sagittal STIR with contrast. Pseudomeningocele. Aeric level (blue arrow). Contrast fluid level (red arrow).

Surgical intervention was performed: we repaired the lumbar dural fistula in a sandwich manner with the patient's own blood patch, TachoSil, then an autograft fascia lata sutured in a circular manner with separate threads, and an autograft muscular flap with its own vascularization sutured tightly over the fascia lata flap. We used Zeiss operating loupes with 3.5× magnification and our own halogen light.

CSF aspect: hyperproteic (111 mg/dL protein), bacteria-free.



**Fig. 4.** Intraoperative aspect. The location of the fistula was predominantly on the left side, under the superior articular process of L5 (yellow arrow). Typical silvery fibrous aspect of the muscular subcutaneous fistula plane forming the pseudomeningocele (green arrow).



**Figure 5.** Postoperative aspect.

The postoperative evolution was uneventful and the patient was discharged in good health.

Follow-up: 1 month.

## DISCUSSION

Dural tears are common complications encountered by spine surgeons. The prevalence of a CSF leak following traditional open laminectomy for degenerative spine conditions, especially spinal stenosis, has been widely reported; in one systematic review spanning 10 years, the pooled incidence was reported as 8%<sup>34</sup>.

Extending the laminectomy may be necessary to gain better exposure to repair the dura, while using magnification via loupes or a microscope. For durotomies that occur in inaccessible areas, such as far-lateral durotomies, a small plug of muscle or fat may be placed through a more medial, intentional durotomy and pulled into the defect<sup>31</sup>. If a dural violation occurs, the primary goal should be achieving a watertight closure. This can be done using patches, grafts, and sealants to reinforce the primary repair.

In cases where a watertight closure is not achieved, or if a durotomy goes unnoticed and the patient develops symptoms, immediate management of the CSF leak is mandatory.

Management of a CSF leak should begin conservatively, with bed rest and local pressure dressings. If these measures fail, care should be escalated promptly to include interventions such as an epidural blood patch or lumbar subarachnoid drain placement.

The following intraoperative closure techniques were considered: (1) primary suture with epidural fibrin glue; (2) autologous patch (pericranium or muscle fascia) with or without glue; (3) positioning of a heterologous dural patch (DuraGen [Integra LifeSciences], DuraMatrix [Stryker], or bovine pericardium) with or without fibrin glue; and (4) TachoSil (Corza Medical) with or without fibrin glue. TachoSil was considered a different patch compared with the common dural sealant because of its multiple functions as a dural sealant, hemostatic material, and bony sealant<sup>32</sup>.

Primary dural repair remains the treatment of choice<sup>1</sup>. Traditionally, sutures have been considered the gold standard for dural tear repair: braided nylon suture, monofilament polypropylene suture, and GoreTex suture<sup>1</sup>. Two different repair techniques, including interrupted and running locked suture techniques, have been commonly used<sup>6,7</sup>. The repair techniques have been described from simple sutures and sealants to different types of patches and grafts<sup>1</sup>; muscle, fascia, fat, and synthetic materials have long been used to repair moderate-sized dural tears<sup>2,3</sup>.

A combination of primary closure and patch or graft resulted in the lowest rate of CSF leakage (5.5%, 7/128)<sup>1</sup>, followed by a combination of primary closure, patch or graft, and sealant (13.6%, 24/176)<sup>1</sup>; a combination of primary closure and sealant (13.7%, 18/131)<sup>1</sup>; primary closure (17.6%, 18/102)<sup>1</sup>; sealant (22.1%, 17/77)<sup>1</sup>; a combination of patch or graft and sealant (31.9%, 15/47)<sup>1</sup>; and patch or graft (55.7%, 64/115)<sup>1</sup>.

While fibrin sealant for dural repair may offer advantages as an adjunct to traditional suturing, including reduced CSF leakage, these biological adhesives can carry a risk of viral and prion infection, as well as allergic responses<sup>8,9</sup>. We did not use fibrin sealant in this case for these two reasons.

As an alternative technique, nonpenetrating titanium clips have been used to achieve primary closure. The advantages of this technique include ease and speed of use, tighter closure, and less need for extended dissection in confined spaces<sup>10,11</sup>.

Closure of dural tears with grafts or patches has been another option. Autologous fat, muscle, and fascia have been available options for the repair of dural tears. More recently, synthetic and absorbable patches, including collagen matrix, gelatin sponge, polyglycolic acid sheet, and collagen patch coated with fibrin, have received U.S. Food and Drug Administration approval<sup>12</sup>. The use of grafts or patches is advantageous when dural tears are relatively large<sup>12</sup>. Basic fibroblast growth factor, epidermal growth factor, or transforming growth factor beta promote the proliferation of dural fibroblasts, deposition of collagen, and sutural fusion<sup>13,14</sup>. Complications include wound infections and intracranial hypotension syndrome, which often require revision surgery<sup>15</sup>. Other grafts include autologous dural substitutes such as fascia lata, fat, muscle, skin, and pericranium<sup>16</sup>.

CSF leaks also have varying degrees of severity. When the extravasated CSF forms a fibrous capsule beneath the skin, it is classified as a pseudomeningocele<sup>17,18</sup>.

It is helpful to organize primary repair strategies into three categories: sutures, sealants, and patches/grafts<sup>22,23</sup>.

A primary patch/graft is justified if primary closure of an intraoperative durotomy is not feasible, because the location is too lateral or neural elements would become compressed; then dural patches/grafts can be employed. In the case of our patient, the CSF fistula was situated laterally and was risky to suture directly (risk of radicular lesion).

Ideally, the patch/graft material should restore the continuity of the dura mater, minimize CSF leak, mimic the compliance of dura, and be biologically inert. Currently, the options fall into four categories: autograft, allograft (i.e., cadaveric dura), xenograft (animal-derived), and synthetic materials. In the autologous category, the options typically used in spinal surgery include fascia lata and muscle<sup>24</sup>.

Both mechanisms — CSF extravasation into a pseudomeningocele and inadequate fascial closure — may contribute to the formation of pseudomeningoceles and CSF fistulas.

Pseudomeningoceles typically appear as fluctuant masses that may become more pronounced with Valsalva maneuvers. Patients may also present with intracranial hypotension symptoms that include photophobia, cranial nerve palsies, and tinnitus<sup>25</sup>. Trendelenburg positioning is traditionally prescribed after lumbar dural tears because the upright position increases the hydrostatic pressure of the CSF and may worsen leakage<sup>26,27</sup>.

An epidural blood patch (EBP) is a procedure in which the patient's own blood is injected into the epidural space. It is thought that the blood forms a clot over the dural tear, allowing healing of the dura. The EBP also raises extradural pressure relative to the subarachnoid pressure to decrease the efflux of CSF<sup>28</sup>.

A large pseudomeningocele is best treated by a combination of primary closure and implantation of a subarachnoid drain. These drains are efficacious at an output rate of 5-10 mL/hr for 3-5 days, as a primary tool or supplement to other measures<sup>28</sup>. However, lumbar subarachnoid drainage has been reported to have a complication rate of up to 44%, with symptoms ranging from headache and nerve root pain to subdural hematoma, pneumocephalus, and meningitis<sup>30</sup>. In our case, we did not use a subarachnoid drain, to prevent the complications above.

Although the use of sealants has become prevalent, available sealants as an adjunct to primary closure did not reduce the rate of CSF leakage compared with primary closure. The combination of primary closure and patches or grafts could be effective in decreasing postoperative CSF leakage<sup>1</sup>.

## CONCLUSION

- The combination of techniques we used (blood patch, TachoSil, autologous fascia lata, and a muscular flap with vascular pedicle) proved effective in this case.
- The technique we used was very useful for the treatment of the pseudomeningocele and the prevention of other important complications (CSF fistula, meningitis).

## ABBREVIATIONS

CSF: cerebrospinal fluid.

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