

Use of a Collagenous Patch Derived from Bovine Pericardium (Tutopatch) for Endoscopic Repair of Dural Tear in Percutaneous Endoscopic Lumbar Discectomy: A Technical Note

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ABSTRACT

An incidental dural tear is a well-known complication in both open and percutaneous lumbar spine surgery. Several techniques have been described for surgical repair of dural tears in open lumbar spine surgery. However, the treatment of iatrogenic dural tears in endoscopic spinal surgery remains challenging. The objective of this report is to describe a technique for endoscopic dural closure using a collagenous patch derived from bovine pericardium (Tutopatch) which is simple and effective.

Keywords: Dural tear, Percutaneous endoscopic lumbar discectomy, Tutopatch

Abbreviations

PELD: Percutaneous endoscopic lumbar discectomy; CSF: Cerebro-spinal fluid; MRI: Magnetic resonance imaging

INTRODUCTION

An incidental dural tear is a relatively common complication of spine surgery. Its prevalence ranges from 1% to 17% in open microsurgical techniques [1]. The incidence of a dural tear in percutaneous endoscopic techniques is considered to be relatively low. In a review of 816 consecutive patients who underwent Percutaneous Endoscopic Lumbar Discectomy (PELD), Ahn et al. reported an incidence of 1.1% [2]. In case of a dural tear in open lumbar spine surgery, several techniques have been described for surgical repair. However, the standard technique of suturing the tear is difficult, if not impossible, in PELD because of the limited working space and the difficulty in handling the surgical instruments within the narrow working channel of the endoscope. In these cases, the surgeon is usually obliged to terminate the endoscopic procedure and convert to open technique to be able to repair the dural tear and prevent its complications.

In this report, we describe a case of incidental dural tear during percutaneous endoscopic interlaminar discectomy that was treated successfully using a collagenous patch derived from bovine pericardium (Tutopatch).

CASE REPORT AND TECHNICAL NOTES

A 45 years old male patient presented with a large, left-sided, L5-S1 disc herniation associated with bilateral pars defect and low grade spondylolisthesis resulting in severe radical pain in the left leg that failed to respond to conservative treatment (**Figure 1**). Dynamic X-rays of the lumbar spine did not show significant movement of L5 over S1 (**Figure 2**).

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Figure 1. Preoperative MRI of the lumbar spine showing L5-S1 disc herniation on sagittal (left) and axial cuts (right).



Figure 2. Dynamic X-rays of the lumbar spine showing low-grade spondylolisthesis with no significant movement.

Surgical options were discussed fully with the patient including the possibility of fusion and instrumentation at L5-S1 level. Patient elected to undergo percutaneous endoscopic discectomy to relieve his sciatic pain and delay fusion at this level. The procedure was done in the prone position under

general anesthesia using the interlaminar approach from the left side. After removal of the herniated disc fragments, a dural tear affecting the S1 nerve root sleeve was noted in **Figure 3.**

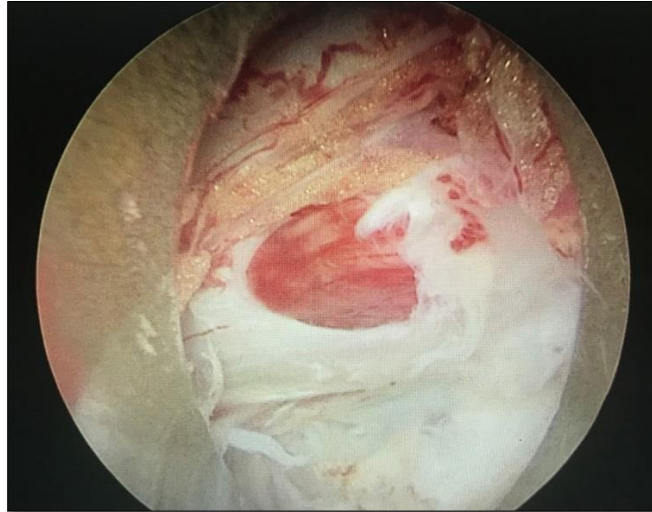


Figure 3. Dural tear affecting the S1 nerve root sleeve during endoscopic discectomy.

Because of the inability to suture the dura of the nerve root and in order to avoid conversion of the procedure to open surgery, a collagen patch derived from bovine pericardium, Tutopatch (Tutogen Medical GmbH, Industries traBe 6, 91077 Neunkirchen am Brand, Germany) was used to repair the dural tear. Using the regular endoscopic instruments,

mainly the endoscopic grasping forceps and a hook probe, a small piece of the patch was cut and inserted through the defect in the dura to seal the tear from within **Figure 4** (RTI Surgical, Inc. 11621 Research Circle Alachua, Florida 32615).



Figure 4. Tutopatch (top) piece used to seal the dural tear (bottom).

Another piece of the patch was used to cover the outer surface of the defect. The aim was to prevent rootlets herniation through the dural tear.

The patient was kept on flat bed rest for 24 h after which he was allowed to ambulate freely. He did not report any

symptoms related to CSF leakage like headache, nausea, vomiting or neck pain and stiffness. A two-week follow up MRI of the lumbar spine showed no signs related to CSF leakage (**Figure 5**).



Figure 5. Postoperative MRI of the lumbar spine showing no signs of CSF leakage.

Regular follow up of the patient at 2 weeks, 6 weeks and 3 months showed complete resolution of his symptoms except for mild numbness along the dermatomal distribution of the S1 nerve root.

DISCUSSION

An incidental dural tear is a well-known complication in any spine surgery. Its treatment in open techniques is well described in the literature. However, treatment of dural tears in percutaneous endoscopic lumbar discectomy is still considered a challenging problem, even for highly experienced endoscopic spine surgeons. As the use of this endoscopic technique increases, the risk of having incidental dural tears also increases.

The incidence of dural tears in PELD is relatively low.

Chumnanvej et al. [3] described 60 patients who had full endoscopic lumbar discectomy via interlaminar approach. There were no serious neurological complications or dural tears. Ahn et al. [2] reported on 816 consecutive patients who underwent PELD using the transforaminal approach for treatment of symptomatic lumbar disc herniation. Only nine patients (1.1%) experienced symptomatic dural tears.

Dural tears during PELD might be recognized either intraoperatively or might be missed and diagnosed postoperatively. The postoperative clinical manifestations of dural tears in PELD are different from those of open lumbar discectomy. In open techniques, patients with dural tears usually present with signs and symptoms related to cerebrospinal fluid leakage like postural headache, nausea, vomiting, dizziness and photophobia. In addition, these

patients might present with large fluid collection at the surgical site.

However, in PELD, there is no dead space for collection of CSF and as such fluid collection in the wound or CSF leakage through the wound is rare and most of these patients usually present with recurrence of the radicular pain, with or without neurological deficit. According to Ahn et al. [2], these signs and symptoms may be due either to nerve root irritation secondary to exposed nerve rootlets or to nerve root herniation through the dural defect. Patients with nerve root irritation usually present with intractable leg pain without neurological deficit while patients with nerve root herniation usually present with leg pain associated with neurological deficit.

The management protocol of dural tears in PELD has not been well described in the literature. Direct suture repair, like in open surgeries, is technically difficult, if not impossible due to the limited working space. When an iatrogenic dural tear is recognized intraoperatively, the surgeon is usually forced to convert to open technique and perform direct repair under microscopic visualization. Ahn et al. [2] stated that the intraoperative attempt to repair the defect by shielding materials is ineffective and the proper management option is immediate open conversion and direct repair of the dural tear.

However, surgical repair of the dural defect without direct suturing is also a well-known technique in open spine

surgery. Several studies in the literature reported good clinical results with dural repair using fat or muscle graft, fascia graft, various sealants materials like fibrin glue, or other closure adjuncts such as dural grafts and patches [4,5,6].

There have been also reports of dural tear treatment without primary dural suture in endoscopic lumbar spinal surgery [6,7,8,9] (**Table 1**). Choi et al [4] reported on 67 patients who underwent percutaneous endoscopic discectomy through the interlaminar approach. There were two cases of injury to the dural sac without significant neural deficit. These cases did not require open repair, and were managed with bed rest and increasing the patient’s hydration for a couple of days. Chen et al [5] reported on 123 patients who had received endoscopic excision of lumbar disc herniation at the L5-S1 level via an inter-laminar approach. There was one case of dural injury that did not require surgical repair without any sequelae. Sencer et al. [10] performed full endoscopic interlaminar and transforaminal lumbar discectomy in 163 patients with lumbar disc herniation. Dural tears occurred in 6 cases (3.6%). All patients who had dural tears underwent surgery with the interlaminar approach. There was no attempt at dural repair in 5 cases. These patients were followed in the clinic with 2 additional days of bed rest and thereafter were mobilized and discharged.

Table 1. Dural tear treatment without primary dural suture in endoscopic lumbar spinal surgery.

Ahn et al. [2]	816	9	Open repair
Choi et al. [4]	67	2	No repair
Chen et al. [5]	123	1	No repair
Sencer et al. [11]	163	6	No repair (5 cases) Open repair (1 case)

On the other hand, Shin et al. [11] described the Youn’s technique for primary endoscopic dural suture repair using basic endoscopic instruments including an endoscopic ring curette and a 6-0 prolene suture. Although this technique allows direct suturing and closure of the dural defect, it is a technically challenging procedure that needs surgical skills and wide experience with the use of endoscopic instruments. Furthermore, even if the suture needles are passed through both sides of the dural membrane, the procedure of pulling the suture thread outside the endoscope and then pushing the knot through the scope might cause more damage to the edges of the dural membrane and thus enlarge the dural defect leading to CSF leakage.

The technique described above is simple and does not require the use of any suturing materials. It entails the use of

intradural and epidural patch to repair the dural defect (double-layered duraplasty). Using only an epidural patch will not resist the pressure of a CSF leak. If an intradural patch is added, then the CSF pressure will push the patch against the dural wall defect and prevent any CSF leakage or rootlets herniation. Hence, this method will provide a more watertight dural repair than a one-layer dural patch. In addition, the collagen matrix initiates clot formation, resulting in a chemical seal. It also provides a chemical signal for fibroblasts infiltration which deposit new collagen, thereby reconstituting new dura.

The advantage of using the Tutopatch collagen is the small thickness of the patch which makes it easier to be inserted inside the dural defect without the fear of rootlets compression, especially for dural tears involving the nerve

root sleeves like in our case. Once applied, these patches usually conform to the shape of the anatomy structures, making it well suited for any type of dural defects.

It is well known that dural tears involving the nerve root sleeves are difficult to be repaired by primary suturing as this may theoretically result in stenosis of the affected root. As such, they are managed without suture repair. The technique described above avoids this complication by closing the dural defect without narrowing the nerve root sleeve. Our aim is not to prevent CSF leakage as this rarely occurs in percutaneous endoscopic procedures but to prevent nerve rootlets irritation or herniation.

CONCLUSION

Dural tears in percutaneous endoscopic lumbar discectomy is considered a challenging complication. There is no golden standard for treatment of dural tears in endoscopic spine surgery. We propose a simple surgical technique for repair of dural defects in PELD using a collagen patch (Tutopatch) and the regular endoscopic instruments.

CONFLICT OF INTERESTS

No potential conflict of interest relevant to this article is reported.

REFERENCES

1. Deyo RA, Cherkin DC, Loeser JD, Bigos SJ, Ciol MA (1992) Morbidity and mortality in association with operations on the lumbar spine. The influence of age, diagnosis, and procedure. *J Bone Joint Surg Am* 74: 536-543.
2. Ahn Y, Lee HY, Lee S-H, Lee JH (2011) Dural tears in percutaneous endoscopic lumbar discectomy. *Eur Spine J* 20: 58-64.
3. Chumnanvej S, Kesornsak W, Sarnvivad P, Paiboonsirijit S, Kuansongthum V (2011) Full endoscopic lumbar discectomy via interlaminar approach: 2-year results in Ramathibodi Hospital. *J Med Assoc Thai* 94: 1465-1470.
4. Gautschi OP, Stienen MN, Smoll NR, Corniola MV, Tessitore E, et al. (2014) Incidental durotomy in lumbar spine surgery - A three-nation survey to evaluate its management. *Acta Neurochir (Wien)* 156: 1813-1820.
5. Grannum S, Patel MS, Attar F, Newey M (2014) Dural tears in primary decompressive lumbar surgery. Is primary repair necessary for a good outcome? *Eur Spine J* 23: 904-908.
6. Shibayama M, Mizutani J, Takahashi I, Nagao S, Ohta H, et al. (2008) Patch technique for repair of a dural tear in micro endoscopic spinal surgery. *J Bone Joint Surg Br* 90: 1066-1067.
7. Choi G, Lee SH, Raiturker PP, Lee S, Chae YS (2006) Percutaneous endoscopic interlaminar discectomy for intracanalicular disc herniations at L5-S1 using a rigid working channel endoscope. *Neurosurgery* 58: ONS59-68.
8. Chen HT, Tsai CH, Chao SC (2011) Endoscopic discectomy of L5-S1 disc herniation via an interlaminar approach: Prospective controlled study under local and general anesthesia. *Surg Neurol Int* 2: 93.
9. Oertel JM, Burkhardt BW (2017) Full endoscopic treatment of dural tears in lumbar spine surgery. *Eur Spine J* 26: 2496-2503.
10. Sencer A, Yorukoglu AG, Akcakaya MO (2014) Fully endoscopic inter laminar and transforaminal lumbar discectomy: Short-term clinical results of 163 surgically treated patients. *World Neurosurg* 82: 884-890.
11. Shin JK, Youn MS, Seong YJ, Goh TS, Lee JS, et al. (2018) Iatrogenic dural tear in endoscopic lumbar spinal surgery: Full endoscopic dural suture repair (Youn's technique). *Eur Spine J* 27: 544-548.