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Video Article

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Practical Guidance of Full-Endoscopic Technique for Incidental Durotomy Repair: A Surgical Video Demonstration

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This surgical video demonstrates the full-endoscopic repair of an incidental durotomy, offering practical guidance and insights into the technique. Incidental dural tears occur in up to 1% of lumbar endoscopic surgeries, with risk factors including interlaminar approaches, stenosis decompression, and power drill usage. Although many dural tears are managed with sealant or gel foam, no standard exists for when surgical repair is necessary. Complications such as cerebrospinal fluid leakage, radiculopathy, and neurological deficits can arise, prompting the need for effective repair techniques. A 50-year-old man presented with bilateral leg claudication due to lumbar stenosis (L4–S1). Full-endoscopic decompression was performed, during which an incidental 10-mm dural tear occurred at L5–S1. The nerve root was repositioned into the dural sac, and the tear was repaired using a 6-0 prolene suture with a knot pusher under endoscopic guidance. Gelfoam was applied to aid compression, and irrigation pressure was reduced to prevent increased intracranial pressure. The patient was mobilized after 48 hours and experienced significant symptom improvement without neurological deficits. We propose that dural tears should be repaired when possible to prevent complications. Surgeon experience, tear size, and location are critical factors. This case demonstrates a simple, effective endoscopic repair method, though further studies are needed to establish its long-term efficacy.

Keywords: Full-endoscopic spinal surgery, Uniportal endoscopy, Incidental durotomy, Endoscopic dural suture repair, Complication

INTRODUCTION

Incidental durotomy remains a challenging complication in endoscopic spinal surgery, particularly due to the technique's constraints on visualization and working space. While small tears can often be managed conservatively, larger defects frequently require surgical repair to prevent complications such as cerebrospinal fluid (CSF) leakage, pseudomeningocele formation, or persistent neurological deficits. Full-endoscopic techniques offer a minimally invasive approach to various spinal conditions, including dural repair, but demand precise handling due to the limitations of single-portal instrumentation. This article provides a comprehensive surgical video demonstration and technical guide for the full-endoscopic repair of incidental durotomy. By illustrating a step-by-step approach to achieving secure dural closure, we aim to contribute to the growing body of evidence supporting the feasibility and efficacy of endoscopic suture repair for managing this complication.

CASE REPORT

A 50-year-old man presented with a two-year history of bilateral leg claudication that had progressively worsened, rendering him unable to walk long distances in the 3 months prior to

his visit. Magnetic resonance imaging revealed lumbar spinal stenosis at the L4–5 and L5–S1 levels. After exhausting all conservative treatment options, the patient underwent a lumbar endoscopic unilateral laminotomy for bilateral decompression, following the AO Spine nomenclature,[1] at the affected levels via an interlaminar approach using a full-endoscopic technique.

Informed consent was obtained from the patient, with approval from our Institutional Review Board of Chulabhorn Royal Academy (EC087/2567).

1. Surgical Technique

During the procedure, an incidental dural tear occurred at the neural fold of L5–S1 while using a Kerrison punch. The tear, approximately 10 mm in size, was classified as a contained defect, allowing for repositioning of the nerve root back into the dural sac. To prepare the area around the tear, remnants of epidural fat, ligamentum flavum, and bone fragments were carefully removed, creating sufficient space for the trocar sheath near the thecal sac. This preparation was essential to enable the suture needle to twist contralaterally during the passage of the stitch. Gelfoam was applied to compress the nerve root back into the intradural space, and irrigation pressure was reduced to 30 mmHg (gravity pressure from 1 m above the operating table) to prevent an increase in intracranial pressure.

Using curved forceps, a 6-0 prolene suture was passed through the working channel of the endoscope. The needle was positioned tangentially to the dura, allowing for passage through both edges of the tear. Two simple knots were tied using a knot pusher. Following the repair, the water pump was stopped, and gelfoam was reapplied over the repair site. A hematoma patch formed within 2–3 minutes, indicating successful sealing of the dural tear.

2. Outcomes and Follow-up

The drain tube was removed the day after surgery, and the patient was mobilized after 48 hours of bed rest. He reported a marked improvement in leg pain and claudication, with no neurological deficits. At the 6-month follow-up, the patient remained symptom-free, with no recurrence of CSF leakage or pseudomeningocele formation. He reported no pain during daily activities, and no further complications were observed.

DISCUSSION

Incidental dural tears, or iatrogenic incidental durotomies, occur in up to 1% of lumbar endoscopic surgeries, with key risk factors including the interlaminar approach, stenosis decompression, and the use of power drills.[2] These injuries can result in CSF leakage in approximately one-third of patients, often leading to persistent radiculopathy, dysesthesia, and motor or sensory deficits.[3,4] Even with greater visualization compared with conventional open or microscopic surgery, incidental dural tears can still happen and cannot easily be detected during an endoscopic procedure due to the fluid irrigation that might obscure the leakage. However, the use of a dry scope by gently suctioning out all of the irrigation fluid and directly observing the suspicious tear site, with or without the use of the conventional Valsalva maneuver, is still beneficial. A recent systematic review highlighted that the management of incidental durotomy depends on the surgeon's ability to reposition neural contents into the dural sac and the size of the tear.[5] While small tears can often be managed with gelfoam patching (with or without sealant), larger tears (>10 mm) are better treated with sutured repair to ensure secure closure and prevent further complications.[5,6]

Traditionally, conversion to open surgery has been the go-to approach for dural repair during endoscopic procedures. However, there is a growing trend toward performing suture repairs endoscopically without conversion. The 2 primary endoscopic techniques are uniportal (full-endoscopic) and biportal (unilateral biportal endoscopic, or UBE) surgery.[7] UBE offers several advantages, including a shorter learning curve, more familiarity with conventional surgical instruments, and ease of repair due to the use of multiple working channels, making it more accessible for surgeons performing endoscopic dural repairs.[8]

Conversely, full-endoscopic suture repair presents greater challenges due to the limitation of working with a single portal. All steps, including lesion preparation, needle passage, and knot tightening, must be completed through the same working channel, which is typically less than 5 mm in diameter. Despite these limitations, Bergamaschi et al.[9] successfully demonstrated a dural repair using a full-endoscopic transforaminal approach. In their case, a sliding knot technique was used to manage the tension in the confined space. Furthermore, minimizing irrigation pressure and avoiding additives in irrigation fluid (such as anesthetics or adrenaline) are recommended to prevent intradural complications during the repair. In our case report, we demonstrated that full-endoscopic dural repair can be performed successfully without the need for conversion to open surgery. The outcomes were optimal, with the patient experiencing significant improvement without complications at the 6-month follow-up. Notably, we employed a simple knot technique rather than a sliding knot,[10] achieving secure closure using a knot push-

er, as demonstrated in the accompanying figures (Figs. 1–3) and surgical video.

There are several limitations to our report. It is based on a single case and serves as a technical note for full-endoscopic

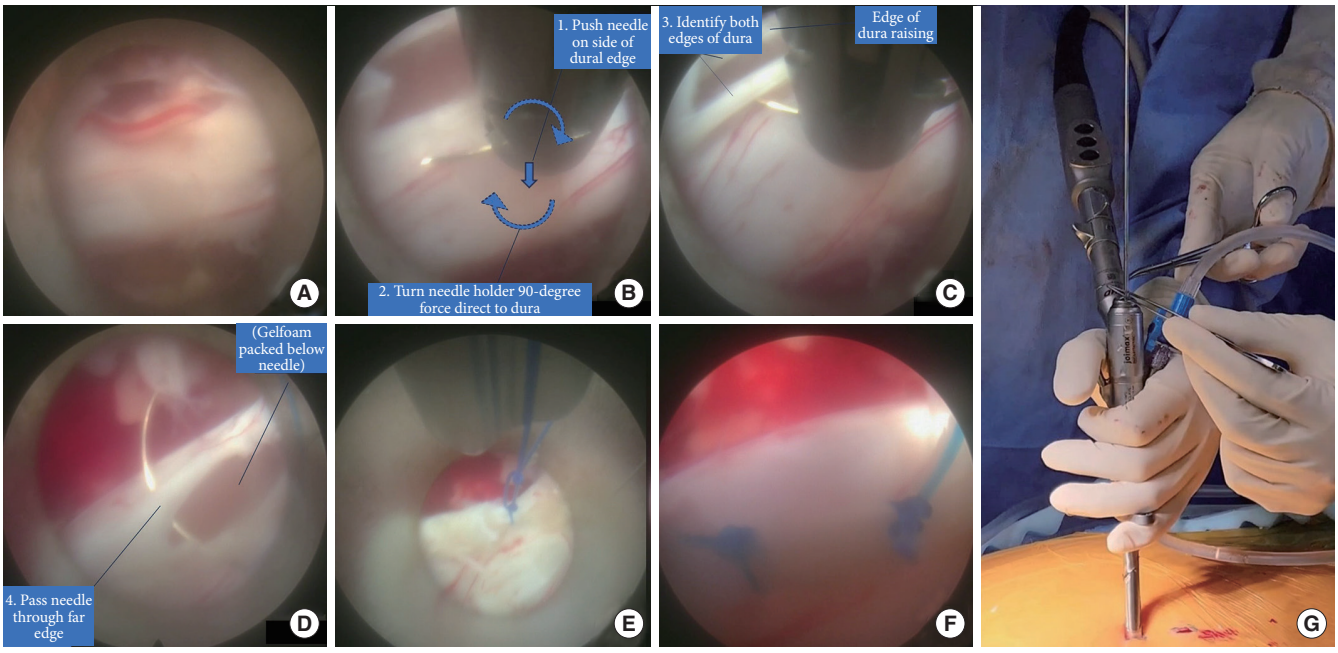

Fig. 1. To summarize, the intraoperative endoscopic view of dural repair can be categorized into 4 steps: push, turn, identify, and pass. (A) A dura tear with nerve root protrusion occurred. (B) The needle was pushed and turned 90° towards the dural edge. (C) As the edge of the dura raised, near and far edges were identified. (D) The suture was passed through both edges. (E) Two simple knots were made to secure the suture. (F) Two sutures were finished. (G) The knots were pushed through the working channel by the knot pusher.

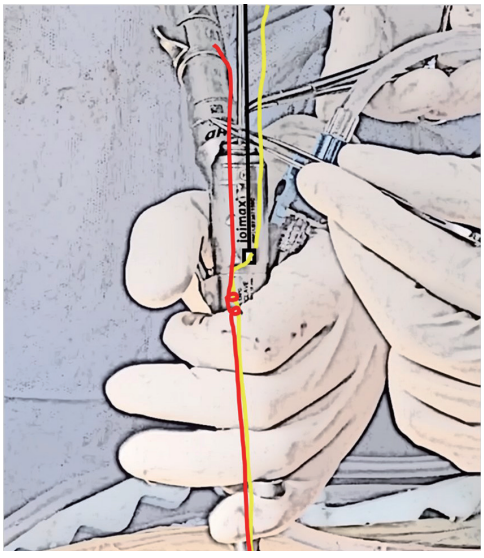

Fig. 2. The red and yellow lines represent the suture material in the main pole and the sliding pole, respectively. The knot pusher is shown as the black line with a loop. Two simple knots were made and pushed by the knot pusher. Then, another knot was made in the opposite direction to prevent the knot from slipping.

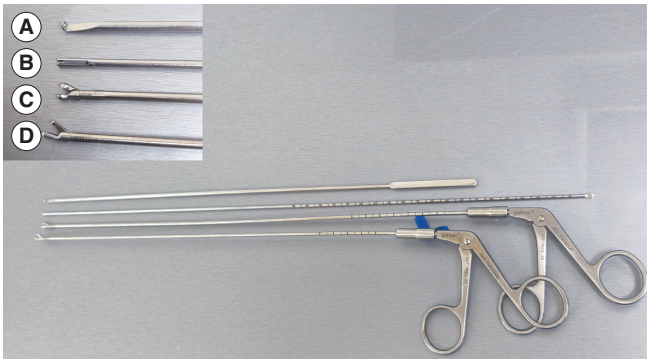

Fig. 3. Basic endoscopic instruments can be used universally, for example, slim straight forceps as needle holders, small punch forceps as scissors, and any long slim straight stick with a loop as a knot pusher. The picture demonstrates instruments used in dural repair. (A) Laparoscopic knot pusher closed head stainless steel length 403 mm, GREATLH DENTAL Store is an example of an available commercial instrument. In our operation, a suture passer for anterior cruciate ligament repair was used as a knot pusher (B). The iLESSYS Pro (Joimax GmbH, Karlsruhe, Germany) instruments of biopsy forceps, spoon, Joimax could be used as a needle holder (C), and its punch forceps as scissors (D).

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dural repair following iatrogenic incidental durotomy. Such occurrences are rare, and there is limited literature on the technique. Additionally, the retrospective nature of this case and the lack of long-term follow-up data restrict our ability to fully evaluate the long-term outcomes of this method. Nonetheless, we believe this case provides heuristic guidance, showcasing the feasibility and efficacy of full-endoscopic dural repair with excellent short-term results and minimal complications. Further studies are necessary to establish the long-term outcomes and standardize the use of this repair technique in similar cases.

NOTES

Video File: The video file for this article is available at https://doi.org/10.14245/ns.2449054.527.

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