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Video Article

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Full-Endoscopic Resection of a Lumbar Intradural Tumor (Schwannoma): Video Case Report and Description of the Surgical Technique

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Endoscopic spinal surgery has gained increasing popularity over the past 10 years. Its muscle-preserving nature, reduction in postoperative pain, and lower complication rates have contributed to the growing number of surgeons adopting this technique year after year. This same progression has led to the application of the technique in oncological pathology, primarily for separation surgeries and biopsies of extradural lesions. However, reports in the literature on the use of this technique to treat intradural spinal tumors remain scarce. To present a case report of a patient with an intradural lesion, compatible with schwannoma, successfully removed using a fully endoscopic technique. A 46-year-old female patient presented with a long-standing history of low back pain and bilateral leg pain. The pain worsened over the past few months before her initial presentation. She also reported experiencing weakness in her feet and intermittent hypesthesia in her legs. Magnetic resonance imaging (MRI) showed a small intradural extramedullary tumor at the L1 level. Given the patient's young age, the tumor location at the thoracolumbar junction, and the rather small tumor size, a full-endoscopic approach was selected and performed. A step-by-step video of the surgical technique is provided with the manuscript. The current follow-up period is 2.5 years, with the patient remaining asymptomatic. The most recent follow-up MRI, conducted 16 months after the surgery, indicated no signs of recurrence. To our knowledge, this is the first video report providing a step-by-step description of this procedure. More high-quality evidence is needed to properly evaluate the safety and outcomes of this technique.

Keywords: Full-endoscopic resection, Intradural tumor, Video, Step-by-step

INTRODUCTION

Endoscopic spinal surgery has gained increasing popularity over the past 10 years. Its muscle-preserving nature, reduction in postoperative pain, shorter hospitalization times, and lower complication rates have contributed to the growing number of surgeons adopting this technique year after year.[1]

Initially designed for the removal of soft lumbar disc herniations,[2] advancements in endoscopic instrumentation, along with the technical evolution of surgeons, have allowed the expansion of endoscopic surgery indications to include a wide range of stable degenerative pathologies of the lumbar,[3,4] thoracic,[5] and cervical spine.[6,7]

This same progression has led to the application of the technique in oncological pathology, primarily for separation surgeries and biopsies of extradural lesions.[8] However, reports in the literature on the use of this technique to treat intradural spinal tumors remain scarce.

We present a case report of a patient with an intradural lesion, compatible with schwannoma, successfully removed using a fully endoscopic technique.

MATERIALS AND METHODS

A 46-year-old female patient presented with a long-standing history of low back pain and bilateral leg pain. The pain worsened over the past few months before her initial presentation. She also reported experiencing weakness in her feet and intermittent hypesthesia in her legs. Conservative treatments have been ineffective in reducing her pain.

Preoperative magnetic resonance imaging (MRI) imaging revealed central canal stenosis from L2 to L5. Therefore, the patient underwent a decompression procedure. Unfortunately, the patient did not achieve adequate relief from pain or weakness following the surgery. Consequently, a follow-up MRI, which included contrast-enhanced sequences, was performed. This imaging confirmed a sufficient decompression of the central canal stenosis, but the contrast-enhanced sequences unexpectedly identified a previously undetected small intradural extramedullary tumor at the L1 level. The patient's persisting symptoms of leg pain and weakness, the possible tumor growth within a few months (retrospectively comparing the current with the initial MRI imaging), coupled with anxiety coming from negative family experiences related to tumors, have led to a strong desire of the patient for the removal of the intradural tumor. Lab results were unspecific.

Given the patient's young age, the tumor location at the thoracolumbar junction, and the rather small tumor size, a full-endoscopic approach was selected. The aim was to achieve complete tumor removal while preserving the stability and functionality of the spinal segment.

General anesthesia was used in this case. The patient was positioned prone, with supports under the iliac crests and thorax, as is customary for thoracolumbar endoscopic procedures.

Although we routinely perform these procedures under neuromonitoring, it was not available in this case due to technical and logistical difficulties. The patient was informed of the fact that the lack of neuromonitoring could increase the risk of postoperative neurological deficits.

Fluoroscopic marking of the operative level was performed, counting from the sacrum up to the L1 vertebra. Considering that the tumor was situated directly beneath the L1 lamina, the skin incision was made directly over this structure. To minimize resection of the facet joint and ligamentum flavum, a translaminar approach was employed.

After achieving dural exposure appropriate to the size of the lesion, a dural opening was made using an endoscopic blade. At this point, the irrigation pump pressure was reduced to the minimum necessary to prevent significant venous bleeding, and the endoscopic outflow was kept open to avoid increases in intradural and thereby potentially intracranial pressure.

Furthermore, the entire table was slightly elevated at the head to prevent any localized increase in intradural pressure from directly affecting the intracranial pressure.

Simultaneously, the radiofrequency device was reduced to the minimal effective intensity to allow safe coagulation of the tumor without affecting neural structures.

Bimanual endoscopic dissection techniques were utilized to remove the lesion, using the working sheath as a dissector. Scissors, blunt endoscopic dissectors, and hooks were employed to detach the tumor from the neural structures and remove it in a piecemeal fashion. An inlay gelfoam was used to protect the nerve rootlets, and an endoscopic dural closure was performed with separate stitches reinforced with an overlay dural patch.

The patient experienced full resolution of symptoms in the immediate postoperative period, with no additional neurological deficits. A follow-up MRI obtained 2 days later confirmed complete resection of the lesion. The patient was discharged 72 hours postoperatively. Histopathological examination confirmed the presumptive diagnosis of schwannoma. At the 16-month follow-up, there was no evidence of lesion recurrence.

Informed consent was obtained from the patient for the use of this material for scientific purposes.

RESULTS

In the presented case, we achieved the oncological objectives while maintaining all the advantages associated with endoscopic spinal surgery. Patient was discharged after 48 hours, with no registered neurological or wound-related complications. The current follow-up period is 2.5 years, with the patient remaining asymptomatic. The most recent follow-up MRI, conducted 16 months after the surgery, indicated no signs of recurrence.

DISCUSSION

The first reports of endoscopic spinal surgery date back to the 1990s.[9] Originally conceived as a minimally invasive alternative for the removal of soft lumbar disc herniations, 30 years of technical and technological improvements have elevated it

to the gold standard for various degenerative spinal pathologies.[3,10,11] Its advantages—such as minimal muscle disruption, excellent visualization, small surgical wounds, and a significant reduction in wound-related complication rates—make it particularly appealing for addressing spinal oncologic pathology.

There are several reports in the literature on the application of full-endoscopic spine surgery for oncological conditions.[12,13] Most of these involve extradural lesions, where biopsy, debulking, and in certain cases, total resection have been performed.[14,15]

Regarding intradural lesions, Şentürk and Ünsal[16] published in 2019 a case of a lumbar intradural meningioma treated using a full-endoscopic technique with a translaminar approach. In our case, a translaminar approach was used as well, specifically targeting the precise location of the lesion. For such cases, intraoperative navigation can be beneficial.[2,17,18] However, in this particular case, we were able to effectively locate the lesion using radiological landmarks and intraoperative fluoroscopy.

Once the lesion has been located, the surgeon must ensure that dural exposure is sufficient for a safe and comfortable resection. This may involve the unilateral or bilateral removal of bony structures and the ligamentum flavum. Therefore, before attempting such procedures, it is recommended that the surgeon be proficient in decompressive techniques like endoscopic unilateral laminotomy with bilateral decompression.

Controlled dural opening is a key step in these procedures. The size of the durotomy must allow for proper control of the neural structures while enabling comfortable dissection of the lesion. Small openings can make tumor manipulation difficult, while larger openings increase the challenge of managing intradural roots and the subsequent closure.

The single-handed nature of the full-endoscopic technique has been considered a limitation for tumor dissection maneuvers. However, with proper training, we have developed "bimanual" dissection techniques that utilize the working sheath bevel as an accessory dissector. This approach allows us to replicate microsurgical maneuvers of separation, coagulation, and cutting, all while maintaining the excellent visualization provided by the endoscope.

The dural closure performed follows the endoscopic variant of microsurgical approaches, originally described by Shin et al.[19] in 2018. In some cases, this type of dural suture may not be feasible due to tissue fragility or a lack of surgeon experience. In such instances, the placement of a synthetic dural substitute is also a valid option.

The gold standard for intradural tumor removal typically involves either an open or microsurgical approach. However, these approaches often result in substantial disruption of the paraspinal muscles and are usually combined with a (hemi-)laminectomy. This is especially valid for the thoracolumbar junction, an area subjected to considerable mechanical stress. As a consequence, patients may experience significantly greater postoperative pain and a potential long-term compromise of spinal stability. Therefore, surgical techniques such as uniportal endoscopy, which minimize bone resection and muscle destruction, can decrease the incidence of postoperative instability or kyphosis.

In this specific case, the advantages of the endoscopic approach were thought to outweigh its disadvantages such as restricted capabilities for tumor dissection/resection and dural closure, as well as a very limited amount of existing literature.

Despite the favorable outcome in this case, there is insufficient evidence to recommend this procedure over other techniques. Endoscopic resection of intradural lesions is a highly demanding procedure from a technical standpoint and should only be performed by surgeons with extensive experience in full-endoscopic techniques.[20]

Furthermore, evidence suggests that a dural tear may increase the risk of complications specific to endoscopic spine surgery such as severe headaches, seizures, and visual disturbances.[21] Until the underlying causes of these potentially serious complications are thoroughly explored, it is essential to exercise caution when considering an endoscopic intradural approach: Lowering pump pressure and keeping the endoscope outflow open helps prevent such complications.

Overall, it is important to emphasize that open microsurgical resection remains the gold standard for treating these types of lesions.[22]

CONCLUSION

The presented full-endoscopic technique allowed a safe and complete resection of the lesion. To our knowledge, this is the first video report providing a step-by-step description of the approach, intradural tumor (schwannoma) resection, and especially dural closure for this procedure. More high-quality evidence is needed to properly evaluate the safety and outcomes of this technique.

NOTES

Video File: The video file for this article is available at https://doi.org/10.14245/ns.2449080.540.

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