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Video Article

Exoscopic Minimally Invasive Excision of Intradural Extramedullary Tumor

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Abstract

Spinal tumors extending up to two levels can be removed using minimally invasive techniques. A microscope is traditionally used as a visualization tool with the tubular-retractor system. An exoscope is a newer optical tool with improved digital resolution, panoramic view, and better ergonomics for surgery. A 36-year-old who presented with paraparesis was diagnosed with intradural extramedullary tumor in the T7-T8 region. A complete tumor resection was possible using tubular retractors and exoscope. The patient recovered clinically. We document our surgical experience and present an edited video of the surgery. The key steps and nuances are described in the audio timeline. The authors acknowledge the feasibility of performing this surgery via a minimally invasive method using an exoscope.

Keywords

- intradural extramedullary tumor
- exoscope
- minimally invasive

Introduction

Spinal tumors have an incidence of approximately 0.74 per 100,000 person-years, with a slight female preponderance. A majority (69%) of cases are benign. The most common of these are meningiomas (29%), followed by nerve sheath tumors (24%), and ependymomas (23%). They produce symptoms of mass effect and management comprises of surgical excision.[1] Spinal tumors extending up to two levels can be removed using minimally invasive techniques. An endoscope or microscope is traditionally used as a visualization tool with the tubular-retractor system. An exoscope is a newer optical tool with improved digital resolution and panoramic view. This video demonstrates the combined use of a tubular-retractor system and exoscope to excise a thoracic intradural extramedullary spinal tumor in a 36-year-old who presented with paraparesis.

Clinical Features

The patient was a 36-year-old male presented with insidious onset, gradually progressive paraparesis for 6 months, with hypertonia and hyper-reflexia of lower limbs. Sensations were decreased below the xiphoid sternum. Magnetic resonance imaging (MRI) thoracic spine revealed an intradural extramedullary lesion, likely a schwannoma in the T7-T8 region. Surgical excision to remove the mass effect and obtain tissue for histopathological examination was planned. The options of open versus minimally invasive and exoscope versus microscope were assessed and discussed with the relatives and patient. Exoscopic minimally invasive surgical excision of the tumor using tubular retractors was done. The surgical steps are described in the ►**Video 1**. Postoperative MRI showed complete tumor removal. He has showed clinical improvement and is on regular physiotherapy.

Video 1 Video showing exoscopic excision of IDEM.

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Written Transcript

0:00—This video demonstrates exoscopic minimally invasive excision of an intradural extramedullary tumor in the thoracic region using tubular retractors.

0:10—The patient was a 36-year-old male complaining of insidious onset, gradually progressive weakness of both lower limbs for 6 months. On examination, the tone was increased in the lower limbs. Power in both lower limbs was ⅖, and knee jerks were exaggerated. Sensations were decreased below the xiphoid sternum.

0:31—MRI thoracic spine showed an eccentrically located T2 hypointense, contrast-enhancing mass on the left side of the cord in the T7–8 region. The mass was pushing the cord to the right. It is seen abutting the foramen but not entering it, suggesting an intradural extramedullary lesion, likely a schwannoma.

0:52—The patient was planned for surgical excision to remove the mass effect over the cord and obtain tissue for histopathological examination. The risks and benefits of open vs minimally invasive procedures were assessed. The lesion was extending over less than 2 vertebral levels making it amenable to minimally invasive surgical excision.[2] Similarly, the advantages and disadvantages of using an exoscope over a microscope were assessed.[3,4] The patient was planned for an exoscopic minimally invasive surgical excision of the tumor using tubular retractors.

1:29—The picture shows the planned trajectory of the tubular retractor placement and the expected surgical view.[5]

1:36—The patient was positioned prone. For marking the incision, first midline was marked, and T8 level was localized under fluoroscopic guidance. About 2 cm left of the midline, a parallel incision was marked to allow docking of the retractor on the transverse process of T8.[6]

1:54—Under fluoroscopy, a guide wire was placed on the left transverse process of T8. Sequential tubular dilators were used to enlarge the tract, and finally, an appropriate-sized quadrant system tubular retractor was placed and fixed to the table using holders.

2:10—This picture demonstrates our usual setup for such cases. An exoscope with two-dimensional high-definition (HD) vision mode placed on its holder and fixed to the operating table is seen. A wide-screen HD display is positioned opposite the surgeon. The tubular retractor is also seen fixed to the table after its placement.

2:31—T7 and T8 lamina were exposed, and the overlying soft tissue was cleared off.

2:46—Using a diamond drill bone was thinned out. Kerrison rongeur was used to remove the remaining portions of the lower part of the T7 lamina and the upper part of the T8 lamina. The spinous process base was undermined to expose the contralateral side. After adequate exposure, saline irrigation was done to clear the field and achieve hemostasis at the margins of exposure.

3:31—A paramedian dural incision was made with a number 11 surgical blade. The dural opening was extended with a right-angled hook dissector. After dural opening, yellowish gray tumor is seen protruding.

3:49—Tumor was removed in a piecemeal fashion initially. After adequate decompression, it was possible to dissect the tumor off the compressed cord. Now we start seeing one of the roots, and the tumor was separated from that. Tumor decompression is continued.

4:52—The final pieces of the tumor were dissected and removed. The cavity is inspected for any residual tumor, and the cord can be seen with its arachnoid preserved. The cavity is irrigated with saline, and hemostasis is secured.

5:20—Watertight dural closure is done, followed by a layered skin closure.

5:25—On postoperative MRI, no residual tumor is seen.

5:30—A reconstructed computed tomography scan of spine shows the minimal amount of bone loss the patient endured, which is the primary advantage of such a procedure; the patient was discharged on the third postoperative day. At 4 weeks follow-up, his lower limb power improved to ⅘. He is on regular physiotherapy.

Discussion

Symptomatic intradural extramedullary tumors are treated by surgical excision to remove the mass effect and obtain tissue for histopathological diagnosis. Small tumors that extend up to two vertebra levels may be managed by minimally invasive techniques. This involves the use of tubular retractors. Minimally invasive techniques have the advantage of reduced incision size, less muscle dissection, minimal bone drilling, and blood loss. Postoperative pain, hospital stay, and cost are less. There is a learning curve associated with it. The surgery proceeds using a microscope with basic surgical principles remaining the same. Recently, the use of exoscope for performing various surgeries has come into practice. The exoscope offers certain advantages over a microscope. In contrast to the face to machine orientation of the microscope, an exoscope provides a panoramic view via a large overhead display, through which the other staff may also have a more immersive experience. This orientation also leads to less surgeon fatigue, as the surgeon's position is not affected by the position of the ocular system. In contrast, the microscope has limited range of working distance, but has the advantage

of providing a three-dimensional image. The newer exoscope system has the option of three-dimensional viewing and mechanized holder movement, but some surgeons still consider the image quality of a microscope as superior.

During the surgery problems encountered were the coaxiality of the trajectory of vision and the instruments. The instruments used by the authors were regular microscopic instruments. It would be preferable to use angled instruments so that the hand grip area of the instruments falls away from the line of sight. During regular microscopic surgery after durotomy, the dural edges are kept away from the lesion using sutures. This was not possible in the present case as after placement of dural sutures, the other end of the suture would have to travel up and out from the upper edges of the tubular retractors, which would be less effective in spreading the edges of dura due to steeper angulation. The sutures would continuously come in the way of the instruments in the narrow space.

Conclusion

The successful outcome of this case suggests that minimally invasive techniques in combination with an exoscope provide good exposure and excellent visualization of the lesion and surrounding structures, in a select group of patients with intradural extramedullary tumors.

Patient Consent

A written informed consent has been obtained from the parents. The hand-drawn picture, photos, and video are original work of the authors.

Conflict of Interest

Node declared.

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