DOI: 10.5137/1019-5149.JTN.14780-15.2
Received: 06.04.2015 / Accepted: 09.10.2015
Published Online: 15.04.2016

Case Report

Cervical Hemilaminoplasty with Miniplates in Long Segment Intradural Extramedullary Ependymoma: Case Report and Technical Note

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ABSTRACT

The surgical approaches for spinal tumors, to a great extent, have been developed in accordance with the developments in medical technology. Today, many surgical techniques are implemented as anterior, anterolateral, posterior, posterolateral and combined approach. Due to its low morbidity, the posterior approach is the more preferred one. Laminectomy is a widely used technique, especially in neoplastic lesions. However, following laminectomy, there are numerous complications such as instability, kyphotic deformity and scar formation. In this paper, the excision of a tumor that was located intradural-extramedullary at the C3-C7 level with the cervical hemilaminoplasty technique is described. A 47-year-old female patient presented to our clinic with increasing complaints of neck and left arm pain, left arm numbness and searing pain for the last 10 years. On examination, hypoesthesia at the C4-7 dermatomes in the left upper extremity, an increase in deep tendon reflexes, and bilateral positive Hoffmann reflexes were observed. C3-C7 laminae were opened unilaterally on the right side with a midline skin incision. The laminae were drilled with a high-speed drill to provide a wide opening, both on the midline obliquely and from the border of the lamina-facet joint. After the tumor was totally excised, hemilaminae were placed into the previous position and reconstructed with mini-plates and screws. Cervical hemilaminoplasty provides a wide field of vision in tumor surgery of this region. Besides, the reconstruction of hemilaminae is important for stability. As the integrity of the spinal canal is preserved during reoperations of this region, the risk of complications is decreased.

KEYWORDS: Cervical hemilaminoplasty, Miniplate, Ependymoma, Intradural extramedullary tumor

INTRODUCTION

Spinal cord tumors account for about 15% of central nervous system neoplasms. Spinal tumors are divided into three major groups according to location: intramedullary, intradural extramedullary, and extradural. Intrinsic intramedullary tumors are uncommon and less frequent than extradural or intradural extramedullary tumors. Therefore, intramedullary tumors are rare, accounting for only 5 to 10% of all spinal tumors (3). The two most common intramedullary tumors of the spinal cord are ependymoma and astrocytoma. Specific clinical signs and symptoms are variable and largely determined by tumor location. Ependymomas are the most common tumors of the spinal cord in adults. Furthermore, intradural extramedullary (IDEM) ependymomas are very rare (10). Pain is the most common symptom among patients with IDEM ependymomas. Other symptoms are motor disorders, sensual disorders and sphincter disorders. Neurological symptoms gradually arise in these patients. The most valuable diagnostic technique is magnetic resonance imaging (MRI). An ependymoma may cause expansion of the spinal cord, which may enhance following intravenous injection of gadolinium. The role of surgery in the management of intramedullary tumors has

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evolved significantly in recent years. The surgical approach to spinal tumors has therefore also significantly improved due to the developments in technology. Anterior, anterolateral, posterior, posterolateral and combined surgical techniques are currently used. The posterior approach is mostly preferred because of the lower morbidity.

Laminectomy is a widely used method in spinal neoplastic lesions. The load in the cervical region is carried on the anterior column at a rate of 36% while 64% is on the posterior column on the facets (15). Thus, damage to the posterior tension band (interspinous ligaments, supraspinous ligament and ligamentum flavum) affects stability negatively. Similarly, the risk of kyphotic deformity and formation of a postlaminectomy membrane is increased after laminectomy. The rate of kyphotic deformation is very high, especially in the pediatric age group.

In this article, we present a case of intradural extramedullary ependymoma that was treated with a different surgical technique

■ CASE REPORT

A 47-year-old female patient who had been experiencing increasing neck and left arm pain, numbness in the left arm and searing pain complaints for the last 10 years presented to our clinic. The physical and neurological examination revealed hypoesthesia in the left upper extremity at C4-7 dermatomes, an increase in bilateral deep tendon reflexes, and bilateral positive Hoffmann reflexes. On cervical MRI, an intradural-extramedullary tumor at the C3-C7 level was detected and the patient was operated on (Figure 1A-C).

The case underwent surgery in the prone position under general anesthesia. The head was fixed with a Mayfield skull-pin head holder (Mayfield head-holder; OMI surgical products, Cincinnati, OH, USA). The level was determined with fluoroscopy. A posterior longitudinal incision was made in the midline. Unilateral subperiosteal dissection of paravertebral muscles was conducted to display facet joints of hemilaminae. Using the microscope, C3-C7 hemilaminae were cut from the base of the spinous process obliquely on the midline and from the border of laminae-facet joints with a high-speed drill (Figure 2). Then, five hemilaminae were removed totally by releasing the ligamentum flavum (Figure 3A, B). Afterward, the dura was opened by linear excision and the tumor was totally removed (Figure 4A, B). After closure of the dura mater, the mini-plates were placed out of the surgical area on C3-C7 hemilaminae (Figure 5). Subsequently, these hemilaminae were reconstructed in their original positions with mini screws (Figure 6). Then, the surgical site was closed properly.

The duration of the surgery was 170 minutes and the total blood loss was 150 cc. The tumor was totally removed. The histopathological diagnosis of the tumor was reported as ependymoma, World Health Organization (WHO) Grade II. Histologically, the tumor cells were characterized by round, oval nuclei, moderate hyperchromasia and a wide eosinophilic cytoplasm. There was no nuclear pleomorphism, and mitotic activity was absent. Perivascular pseudorosettes and rosettes were seen. The cells were immunoreactive for glial fibrillary acidic protein and epithelial membrane antigen. Ki-67 indicated a mitotic index of nearly 1%. These findings confirmed the diagnosis of ependymoma, WHO grade II (Figure 7A, B). On the postoperative 12th month MRI, no recurrence or residual tumor was detected (Figure 8A, B). No instability was detected on dynamic x-ray films (hyperflexion-hyperextension) taken at the postoperative 12th month (Figure 9). The patient had no complaints in the postoperative period except for numbness in the upper left extremity.

■ DISCUSSION

Total laminectomy is a widely used technique in posterior cervical surgery. Chronic neck pain, instability and kyphosis are the most prominent problems after laminectomy. Besides, the serious complications of laminectomy are the formation of scar tissue due to post-laminectomy membrane and neurological impairment (4,6,11,13,14,16). Katsumi et al. reported cervical instability in 20% of the patients who underwent wide laminectomy for resection of spinal cord tumors and blamed

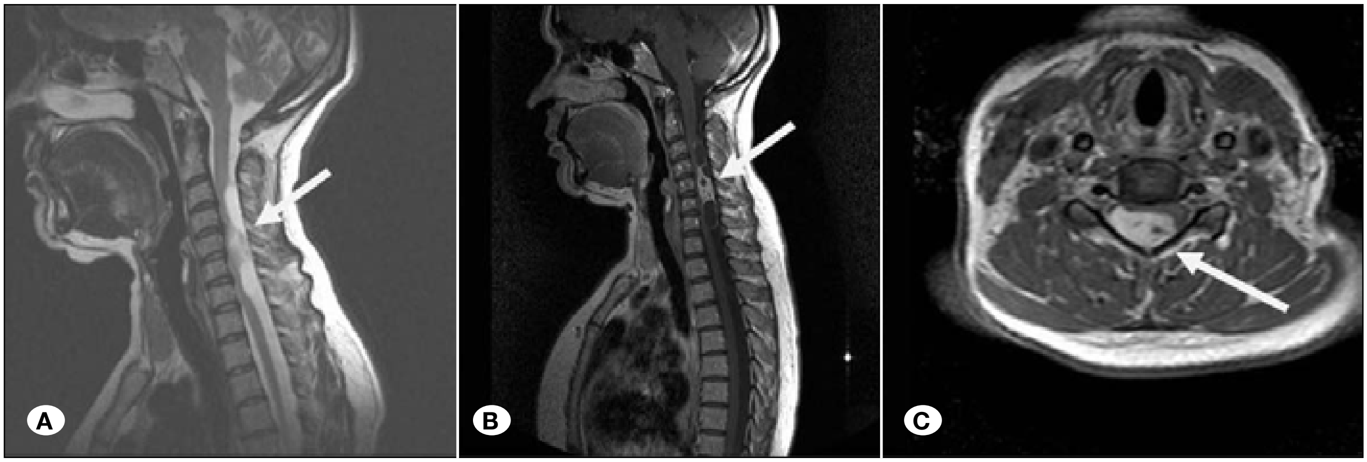

Figure 1: Preoperative Magnetic Resonance Imaging scans. **A)** T2 Sagittal image, **B)** T1 Sagittal image with contrast, **C)** T1 Axial image with contrast.

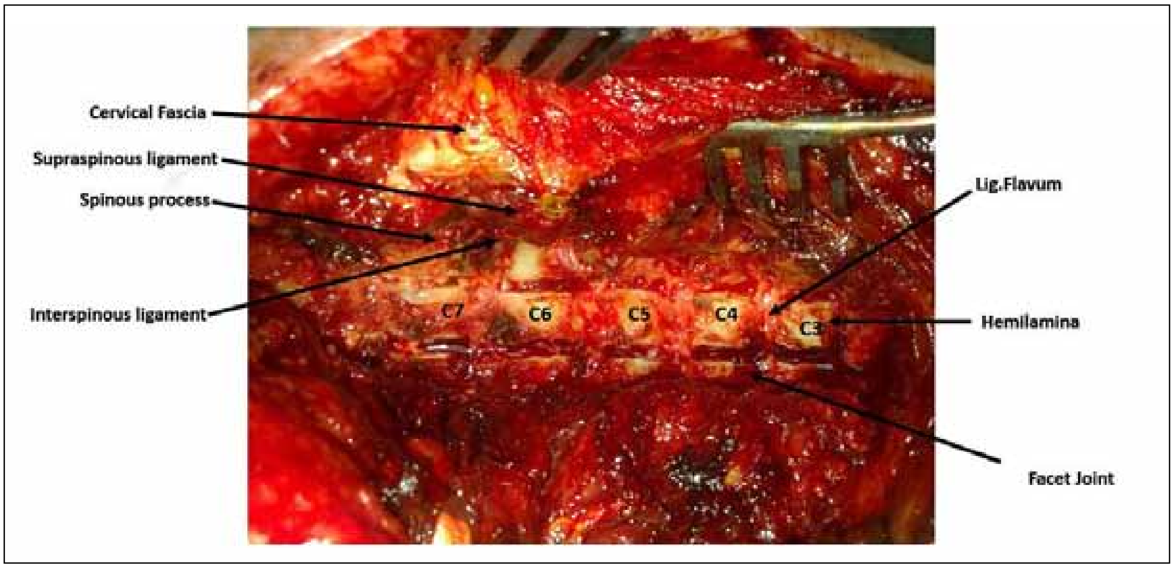

Figure 2: Cutting hemilaminae with high speed drill and the view of the surgical area.

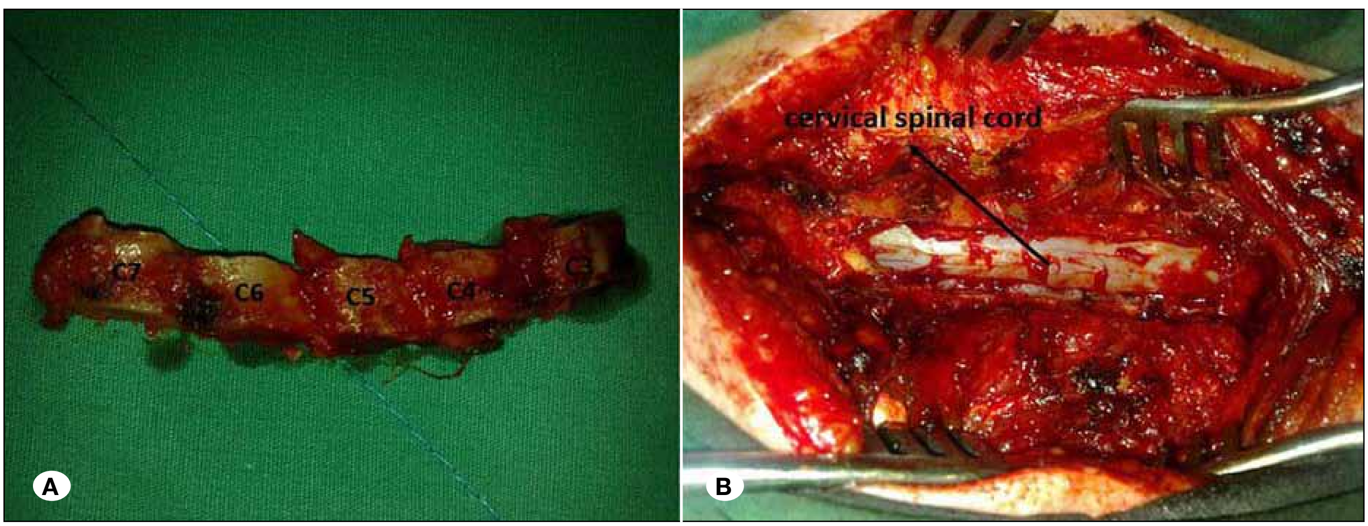

Figure 3: A) Appearance of the removed hemilaminae, **B)** Cervical spinal cord.

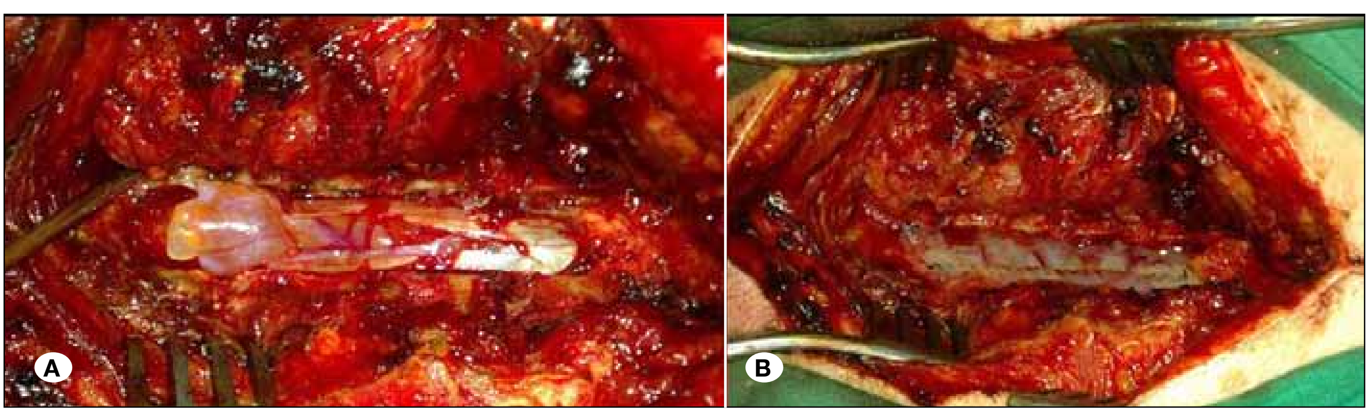

Figure 4: A) Appearance of the intradural-extramedullary spinal tumor, **B)** Closure of the dura mater.

Figure 5: Miniplates placed outside the surgical area on the hemilaminae.

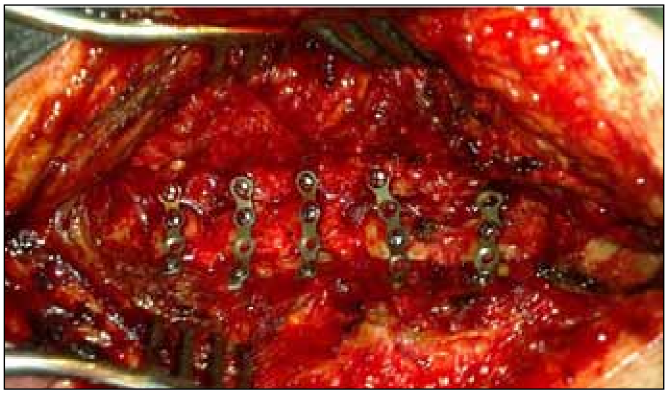

Figure 6: The reconstruction of the hemilaminae to the original position.

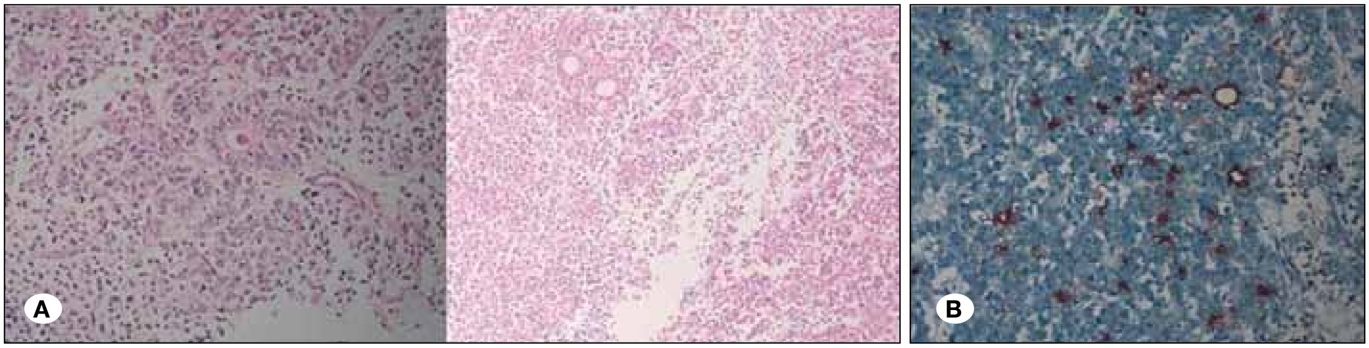

Figure 7: A) Perivascular pseudo-rosettes and rosettes are shown around a central lumen. **B)** Immunohistochemistry of epithelial membrane antigen (EMA) in ependymoma.

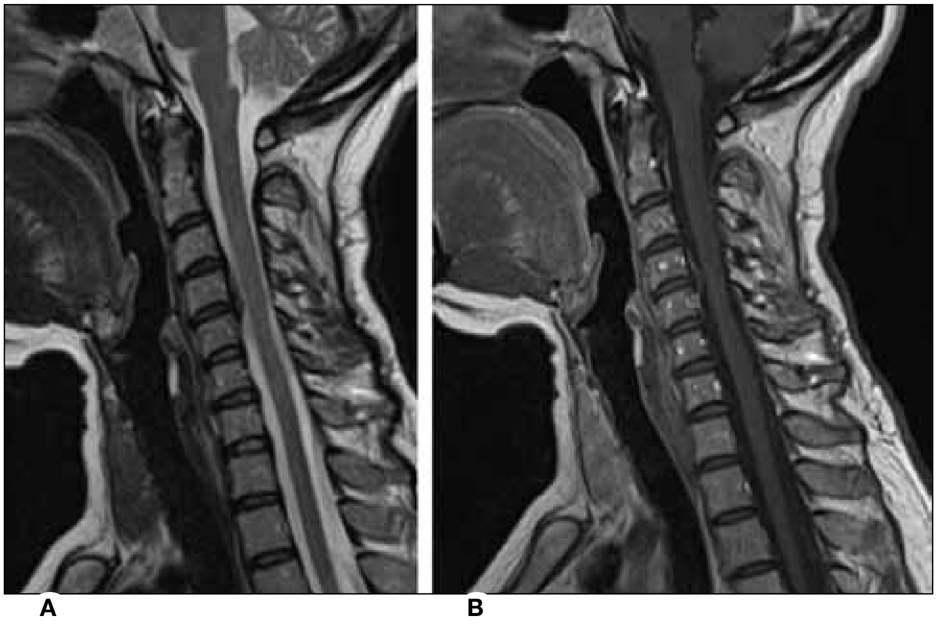

Figure 8: Postoperative 12th month MRI. **A)** T2 Sagittal image, **B)** T1 Sagittal image with contrast.

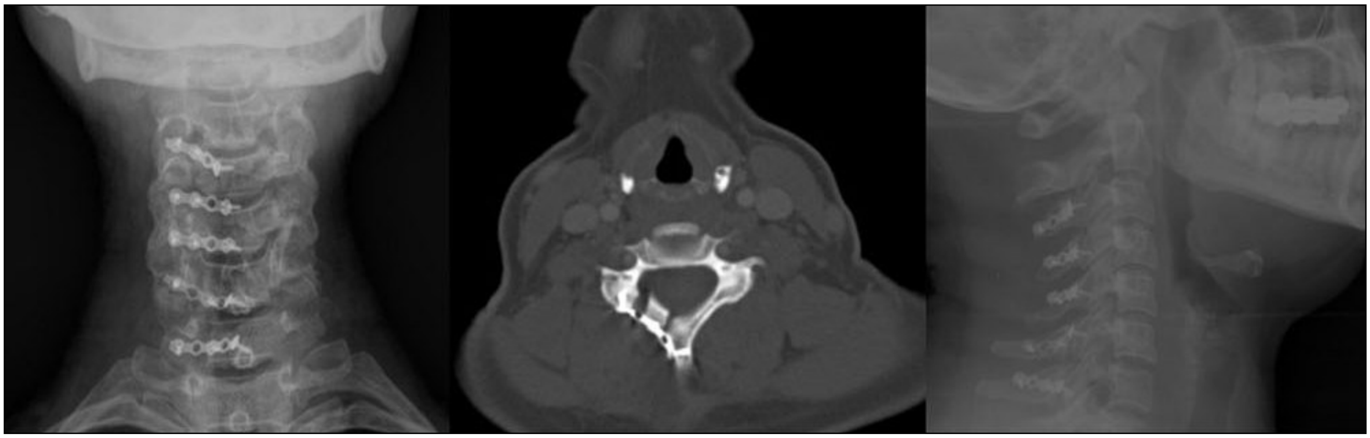

Figure 9: Postoperative 12th month roentgenogram and computed tomography.

the inclusion of C2 in the laminectomy and facet joint destruction for the development of cervical instability (9). Total laminectomy operations are contraindicated in children due to risk of kyphosis in the long-term and instability and also for adults with a kyphotic neck (1,17). The prevalence of postoperative spinal deformities after laminectomy is reported to be 42%, 24% of which are reported to be kyphotic deformities and 18% of which are reported to be plain deformities. Postoperative spinal deformities may be either symptom-free or progressive. Postoperative spinal deformities are progressive, especially in patients with an ossified posterior longitudinal ligament (OPLL). Due to a lack of OPLL, there is an increase in lordosis. On the contrary, when lordosis decreases, the spine stretches and moves to the front side. Upper cervical kyphosis is not seen in lower laminectomies under the C3 level. However, kyphotic angulation is seen at lower cervical levels, and leads to S-type deformity (7).

To eliminate hese disadvantages, the cervical hemilaminectomy technique is implemented and the preservation of stability with sagittal reconstruction is aimed (5,12). In the hemilaminectomy technique, the paravertebral muscles are dissected unilaterally and the contralateral muscles are preserved. This technique contributes to the stability by preserving interspinous and supraspinous ligaments (5). Besides, the shorter duration of operation and preservation of contralateral muscles decrease the perioperative blood loss (5,12). In our case, with this surgical technique, the contralateral muscles were preserved and our perioperative blood loss was measured as 150 cc.

Kato and Kaneko, in their cervical hemilaminoplasty technique for spinal tumor surgery, reported preservation against scar tissue formation after post-laminectomy (8). In case of recurrence, new surgical techniques will be safe compared to laminectomy. They reported the average duration of operation as 286 minutes. We measured the duration of operation as 170 minutes for the present case (8). In the surgical technique that was defined by Kato and Kaneko, primarily the T-Saw with intravenous catheter inside is passed under the lamina. Later, the spinous process and the capsule of the facet joint are cut (8). There is therefore a risk of damage to neural tissues during the cutting process. In this study, worsening of radicular motor function was observed in two cases. There is no risk for neural tissue in our technique. The cutting of laminae is performed on the laminae and the ligamentum flavum. Otherwise, the lamina is cut obliquely at pars interarticularis using the T-saw and the spatula in Kato's Technique (8). In our opinion, this method damages the facet joints. Our method is therefore more stable and less invasive than the Kato's Technique. In our technique, the volume of the removed bone during the surgery was low. Furthermore, multi-level cervical hemilaminectomy surgery cannot be performed at the same time in Kato's Technique. By this technique, one can not cut more than one hemilamina in the same surgery. Yet, we cut five hemilaminae in the same session using a high-speed surgical drill in our surgery. Therefore, our technique can also be applied easily in a shorter time.

Although ependymoma has been reported as a frequent intramedullary tumor or as a tumor arising from the conus medullaris or filum terminale, the intradural extramedullary location of this glial lesion is exceptional (2,3,10). Our case is therefore important for the literature.

CONCLUSION

We report a rare case of IDEM ependymoma of the cervical spine. The application of cervical hemilaminoplasty technique with mini-plates and screws provides a wide area of vision in intradural tumor surgery of the cervical region. Spinal stability is also preserved with this technique by preserving the integrity of the spinal canal. Furthermore, the complication risk of re-operations will be decreased. Compared to other techniques, the firstly implemented technique by our surgical team is easier to use for reconstruction of hemilaminae, needs a shorter duration and has the advantages of being a stable and minimal invasive approach.

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