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## RESEARCH ARTICLE

### HEMILAMINECTOMY APPROACH FOR INTRADURAL EXTRAMEDULLARY SPINAL TUMORS

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#### ABSTRACT

**Introduction:** Spinal tumors rarely occur with an incidence of 10 per 100,000 people. Neurinoma (schwannoma) and meningioma are the most common types of intradural-extramedullary tumors (IDEM). In recent years there have been a number of studies investigating the excision of IDEM tumors with hemilaminectomy. Compared with the traditional surgical approach, hemilaminectomy is relatively safer with less trauma, and helps maintain spine stability. In this study, we describe our experience of 8 cases with hemilaminectomy for IDEM tumors, along with a review of the literature. **Case Report :** We performed eight cases of hemilaminectomy for IDEM tumors from January 2017 to December 2019. In the case of cervical IDEM (**Case-1**) 60-year-old male with weakness of all four limbs for 1 year, with 3/3 right and 4/4 left motoric strength, pain and numbness on both hands, neck and urination disorders, MRI examination of cervical spine with contrast showed visible extramedullary-intradural mass as high as C3-C5 in right dorsolateral, histopathological report is meningioma, we performed right-sided hemilaminectomy on the level of C3-C5. Two weeks post operative, normal motor function was achieved and pain disappears, one year follow up after surgery, no signs of spine instability both clinical and imaging. Case of IDEM in the thoracic (**Case-2**) 53-year-old woman with complaints of weakness on both lower limbs since 6 months, right left motoric power 5/3, history of back pain radiating to both limbs since 1 year ago, dysesthesia on both limbs, MRI examination of thoracic spine contrast showed intradural-extramedullary mass on the right ventrolateral as high as thoracic 8, we performed right hemilaminectomy on Th 8. The histopathological report is schwannoma. Two weeks post operation, normal motor function was achieved and pain disappeared, follow-up 1.5 years postoperatively did shows signs of instability in spine both clinical and imaging. 30-year-old woman (**Case-3**) came with complaints of weakness on both lower limbs for 6 months, motoric strength of 5/2 retention of urine was found, a history of back pain radiating to the lower limbs, a thoraco-lumbar MRI was performed, with results of anterior located mass on the Th-9, suspicious of a meningioma which stick to the anterior dura mater. In this case bilateral laminectomy was. After surgery maximum motor function improvement occurs after 8 months and the urinary catheter can be removed after 2 months. **Discussion:** 90% of complete resection can be performed, with a 10% surgical complication rate and 1.5% surgical fatality rate. Levi et al. also reported similar results for 66 patients with a 9% surgical complication rate and 1.5% mortality rate. Various studies have investigated IDEM tumors excision with hemilaminectomy, which is relatively safe with minimal trauma, and can maintain spinal stability. The advantage of hemilaminectomy is that reducing postoperative pain, prevents instability, avoids the use of postoperative external bracing and allows early mobilization of patients, less blood loss during surgery, better wound healing and reduced postoperative infections and shorter hospital stays than traditional total laminectomy. In our cases of eight operations, no tumor was found extending to the foramen. no unilateral facetectomy was needed. Two years of follow-up no spinal instability was found, all cases have motor improvement postoperative. Only one case was carried out by bilateral laminectomy. Our study group is too small and the follow-up period is too short to make a definite statement with respect to the applicability of the hemilaminectomy approach to intradural-extramedullary spinal cord tumors. **Conclusion:** Intradural-extramedullary spinal cord tumors that are not extended to the vertebral foramen can be resected safely and completely by hemilaminectomy approach. Hemilaminectomy approach is an optimal approach for providing sufficient exposure of spinal cord tumors. We have demonstrated the possibility of completely resecting intradural-extramedullary spinal cord tumors safely with the reductions of postoperative back pain, instability, degenerative changes and operative blood loss.

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## INTRODUCTION

Spinal tumors rarely occur with an incidence of 10 per 100,000 people (Masaryk, 1991), spinal tumors most often are derived from nerve sheath tumors, such as schwannomas and neurofibromas (30%), followed by meningiomas (25%) and others such as astrocytoma and angioblastoma (Stein, 1992). Neurinoma (schwannoma) and meningioma are the most common types of intraduralextramedullary tumors (IDEM). The most effective therapy for IDEM tumors can be achieved through early excision. The traditional laminectomy approach was used to excise IDEM tumors; although spine stability is often affected, due to interference with the posterior column. In recent years there have been a number of studies investigating the excision of IDEM tumors with hemilaminectomy. Compared with the traditional surgical approach, hemilaminectomy is relatively safer with less trauma, and helps maintain spine stability (Naganawa, 2011; Mannion, 2011). To prevent complications of instability, bilateral laminectomy with instrumentation or hemilaminectomy has been reported by Yasargil et al. in 1991 (Yasargil, 1991). In this study, we describe our experience of 8 cases with hemilaminectomy for IDEM tumors, along with a review of the literature.

## CASE REPORT

We performed eight cases of hemilaminectomy for IDEM tumors from January 2017 to December 2019 (table 1). In the case of cervical IDEM (Case-1) 60-year-old male with weakness of all four limbs for 1 year, with 3/3 right and 4/4 left motoric strength, pain and numbness on both hands, neck and urination disorders, MRI examination of cervical spine with contrast showed visible extramedullary intradural mass as high as C3-C5 in right dorsolateral, operation we has performed in general anesthesia, with prone position, midline incision at the level of C2-C6, with the aid of microscope, we performed right-sided hemilaminectomy on the level of C3-C5 with high speed drill and Kerrison punch, duramater opened paramedian, sticky tumor on the lateral right of the duramater is released and involved duramater was burned and gross tumor removal was achieved with the size of 17x10x39 mm, duramater sutured with prolene 8.0 to obtain a waterproof closure, fibrin glue was then instilled to cover the closed dura surface, histopathological report is meningioma, two weeks post operative, normal motor function was achieved and pain disappears, one year follow up after surgery, no signs of spine instability both clinical and imaging.

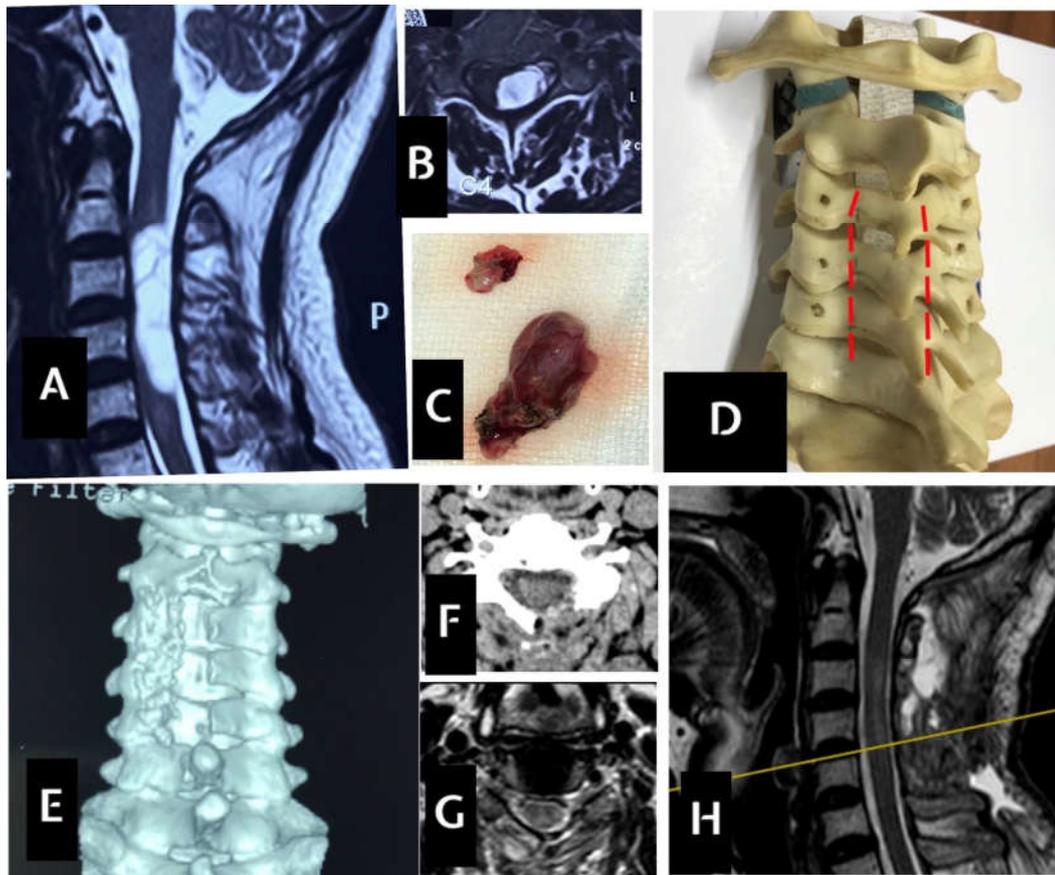
Case of IDEM in the thoracic (Case-2) 53-year-old woman with complaints of weakness on both lower limbs since 6 months, right left motoric power 5/3, history of back pain radiating to both limbs since 1 year ago, dyesthesia on both limbs, MRI examination of thoracic spine contrast showed intraduralextramedullary mass on the right ventrolateral as high as thoracic 8, surgery was performed in general anesthesia, prone position, midline incision, with the help of a microscope we performed right hemilaminectomy on Th 8 with high speed drill and Kerrison punch, duramater was opened paramedian, tumor luxated outward, radix appear to be involved in tumors, radix was sacrifice, then gross tumor removal was achieved with the size of 11x10x22, duramater sutured with prolene 8.0 to obtain a waterproof closure. Fibrin glue was then instilled to cover the closed dura surface, the histopathological report is schwannoma.

Two weeks post operation, normal motor function was achieved and pain disappeared, follow-up 1.5 years postoperatively did shows signs of instability in spine both clinical and imaging. In another case (Case-3), a 30-year-old woman with complaints of weakness on both lower limbs for 6 months, motoric strength of 5/2, the patient entered through the ER because she could not urinate, a history of back pain radiating to the lower limbs, a thoraco-lumbar MRI was performed, it showed anterior located mass on the Th-9, suspicion of a meningioma which stick to the anterior dura mater, before the operation was decided not to do a hemilaminectomy approach. In this case bilateral laminectomy was done so as to provide sufficient space to free the tumor which stuck to the anterior duramater and to prevent spinal cord injury during surgery, during the operation tumor was very sticky to the dura mater and very bloody, the tumor is removed peacefully, the duramater involved is burned, after the tumor is completely removed, the dura mater is sewn in the same manner as other cases. after surgery maximum motor function improvement occurs after 8 months and the urinary catheter can be removed after 2 months.

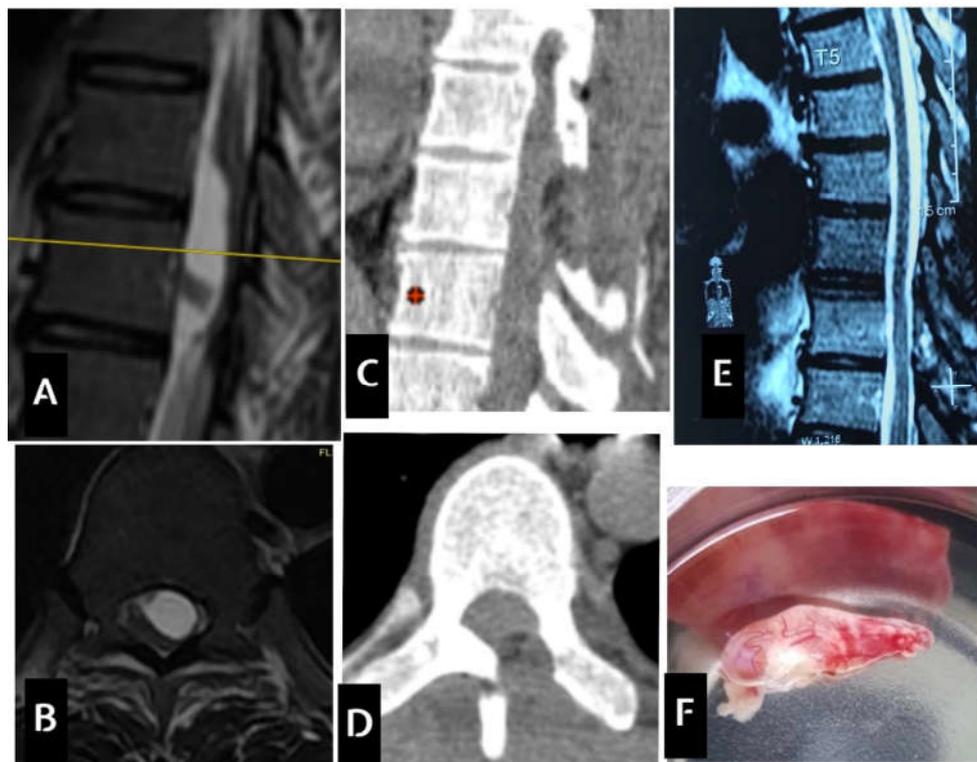
## DISCUSSION

Traditionally IDEM tumors operations have been carried out with a total laminectomy (bilateral laminectomy) method, which facilitates good access and visualization. Seppala et al. reported a case series of 187 patients who underwent spinal schwannoma resection surgery (Cervoni, 1995; Seppala, 1995). In this series, 90% of complete resection can be performed, with a 10% surgical complication rate and 1.5% surgical fatality rate. Levi et al. also reported similar results for 66 patients with a 9% surgical complication rate and 1.5% mortality rate (Levy, 1986). Because the traditional total laminectomy approach often influences the spinal stability on the postoperative period, due to posterior column disruption, with the development of microsurgery techniques to maintain the stability of spinal biodynamics, lately various studies have investigated IDEM tumors excision with hemilaminectomy techniques compared to the traditional surgical approach, hemilaminectomy is relatively safe with minimal trauma, and can maintain spinal stability (Mannion, 2011; Naganawa, 2011).

Hemilaminectomy has been reported at the beginning of spinal surgery and has been popularized by Egger et al. in the 1980's by using a microscope (Chiou, 1989; Eggert, 1983). In 1991, Yasargil et al. (1991) proposed hemilaminectomy for intradural tumors, and Oktem et al. (2000) described their experiences with 20 patients undergoing hemilaminectomy for intradural tumor resection. These patients did not show spinal instability after two years of follow-up. The advantage of hemilaminectomy is that it reduces postoperative pain, prevents instability, avoids the use of postoperative external bracing and allows early mobilization of patients (Pompili, 2004). Besides hemilaminectomy associated with less blood loss during surgery, better wound healing and reduced postoperative infections and shorter hospital stays than traditional total laminectomy (Bertalanffy, 1992; Tredway, 2006). Some surgeons may be concerned about incomplete removal of the tumor in hemilaminectomy approach, or inadvertent spinal cord damage with the relatively narrow surgical corridor compared with total conventional laminectomy during the surgery for spinal cord tumors.



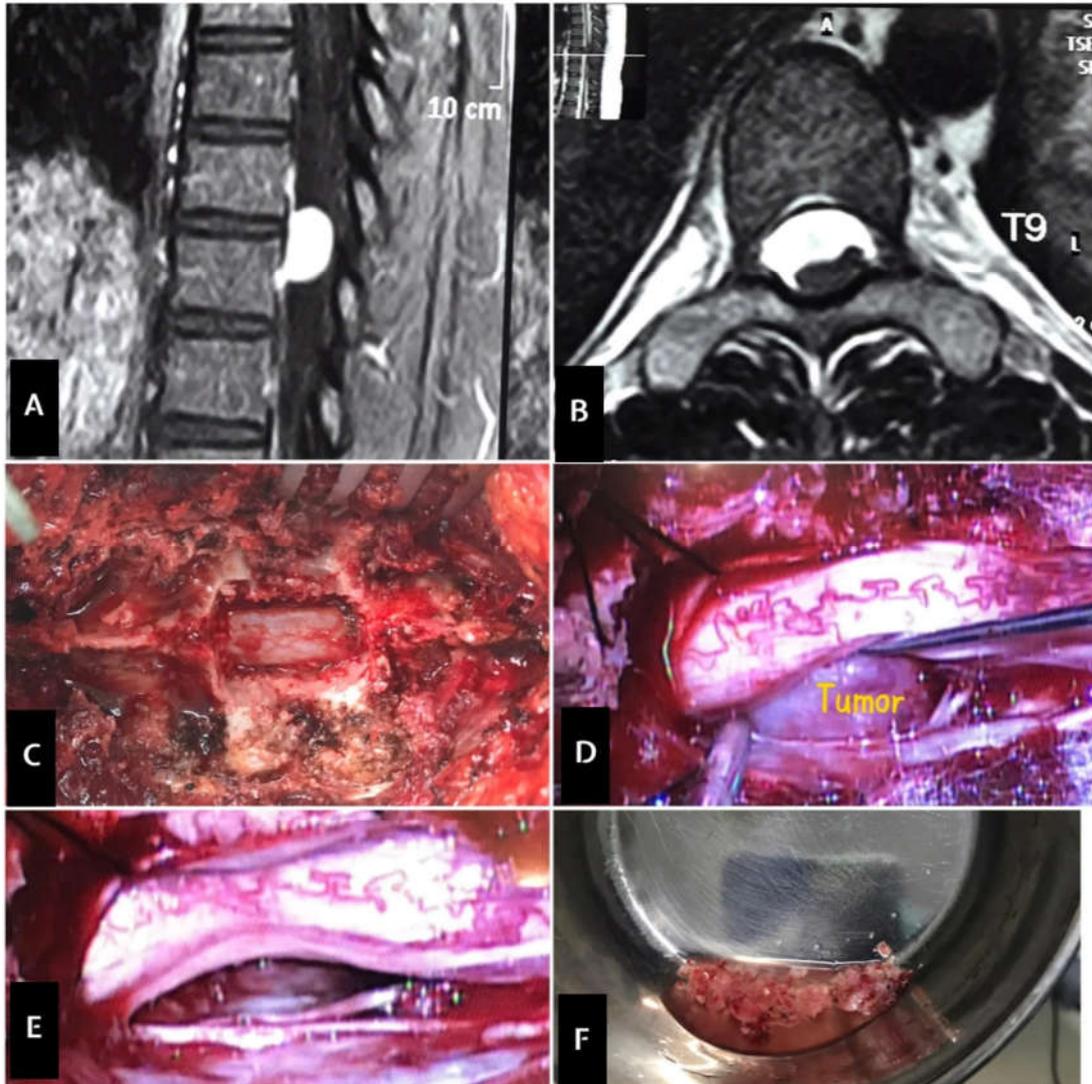
**Image 1.** (A) Cervical MRI coronal view, T2, mass on the level of C3-C5, (B) Axial view shows tumor on the right dorsolateral, (C) Tumor mass after removal, greyish red color, hypervascular with the size of 17x10x39 mm, (D) Schematic area of hemilaminectomy, (E) Cervical 3D CT Scan post operatively, area of hemilaminectomy in C3-C5, (F) Axial view CT scan post operatively, defect on right lamina, (G) Contrast cervical MRI with axial view post operatively, no tumor residue, (H) Sagittal view cervical MRI, no tumor residue



**Image-2;** (A) Contrast MRI of the thoracic spine, T2, sagittal view, tumor mass was visible as high as Th8, (B) MRI of the thoracic spine with contrast, T2, axial view, right ventrolateral tumor, suspected IDEM, (C) CT scan of thoracic spine postoperatively, sagittal view show unilateral lamina defect as high as Th8, (D) CT scan of the thoracic vertebrae axial view, visible lamina defect as high as Th8 on the right side, (E) MRI of thoracic spine with contrast postoperatively, sagittal view T2, no tumor residues was found, (F) Tumor mass after being removed into, gray red color, hypovascular, size 11x10x22mm

Table 1. Details of patients who underwent the hemilaminectomy for IDEM tumors

Patient no	Age / sex	Location	Size (mm)	Side	Histopatology
1	60/ Male	Cervical 3-5	17x10x39	Left, Dorsal	Menigioma
2	53/ Female	Thoracal 8	11x10x22	Right, Ventral	Schwannoma
3	30/ Female	Thoracal 9	13x12x15	True Ventral	Meningioma
4	51/ Male	Cervical 4-5	15x12x 29	Left, Dorsal	Schwannoma
5	41 / Male	JunctionT12-L1	17X16X18	Right, Dorsal	Schwannoma
6	56 / Female	Lumbal 2	13x12x22	Left, Dorsal	Schwannoma
7	52 / Female	Lumbal 1-2	13x12x28	Right, dorsal	Schwannoma
8	48/ Male	Thoracal 11	11x10x21	Left, Dorsal	Schwannoma



**Image-3. (A) Thoracal spine MRI, sagittal view, T1 contrast, showed tumor mass on the level of Th9, (B) MRI of thoracal spine, T1 contrast, axial view, tumor mass on the level of Th 9 and located anteriorly, (C) image of surgery after bilateral laminectomy on the Th9 level, (D) Tumors appear after minimal spinal cord retraction, hypervascular tumors, stick to the anterior duramater, cannot be luxated due to strong fixation on duramater, size 13x12x15 mm, (E) Photograph after piecemeal tumor removal, (F) Tumor mass which was removed in a peacemeal manner**

However, the narrow surgical field in hemilaminectomy approach is not an obstacle to removing IDEM tumors. Under the microscope, we secured working space for the operation via drilling of the base of the spinous process. We then could gross totally remove the tumor mass in the majority of cases. The exposure of the dorsal parts of the spinal cord after creating the working space for the operation is sufficient in comparison to total laminectomy. The dissection of the arachnoidal compartments and the release of cerebrospinal fluid provided a larger field for surgical manipulation. When gross total removal of the tumor without cord damage is not

feasible through the hemilaminectomy approach procedure, the surgeon can convert to bilateral laminectomy during the operation (Lee, 2012). In our cases of eight operations, no tumor was found extending to the foramen, so no unilateral facetectomy was needed, with an average of two years of follow-up there was no spinal instability even in the thoracolumbar junction, all cases of postoperative motor improvement occurred, of all the eight cases, only one case was carried out by bilateral laminectomy (case-3), Our study group is too small and the follow-up period is too short to make a definite statement with respect to the applicability of the

hemilaminectomy approach to intradural-extramedullary spinal cord tumors.

## Conclusion

Intradural-extramedullary spinal cord tumors that are not extended to the vertebral foramen can be resected safely and completely by hemilaminectomy approach. Hemilaminectomy approach is an optimal approach for providing sufficient exposure of spinal cord tumors. Although this small series of consecutive patients with a short follow-up, we have demonstrated that it is possible to completely resect intradural-extramedullary spinal cord tumors safely with the reductions in postoperative back pain, instability, degenerative changes and operative blood loss.

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