Turkish Neurosurgery 2006, Vol: 16, No: 3, 139-144

Planning of Surgical Management of Giant Spinal Schwannomas: Report of Four Cases

Feyza KARAGÖZ GÜZEY
N. Serdar BAŞ
Erhan EMEL
Nezih ÖZKAN
Deniz GÜZEY*
Barış SEL
İbrahim ALATAŞ

Departments of Neurosurgery, and II. General Surgery*, Vakıf Gureba Training and Research Hospital, Istanbul, Turkey

ABSTRACT

OBJECTIVE: Giant spinal schwannomas are rare tumors. Complete excision is recommended for these tumors because inadequate removal has a high risk of recurrence, which requires more definitive, difficult, and dangerous surgery. However, complete removal poses difficulties and combined multistage approaches may be necessary.

METHODS: Four cases with giant spinal schwannomas were reported. Two of them were giant dumbbell tumors, and two were invasive type schwannomas.

RESULTS: Two cases were operated by an anterolateral retroperitoneal approach, one by a lumbar posterior approach and instrumentation, and one with a thoracic tumor by costotransversectomy and laminectomy. In three cases, the tumors were totally removed. In the other case with a huge lumbar tumor treated by the anterolateral approach, the tumor could not be totally removed and a second stage was required but the patient refused the operation.

CONCLUSION: In selected cases with giant spinal schwannomas, one staged posterior or anterolateral operation may be sufficient for complete removal of the tumor. Therefore, a cautious evaluation of the preoperative radiological examination is essential to plan the surgery and to avoid unnecessary operations. In addition, spinal stability must be evaluated preoperatively. Stabilization may be required especially when a posterior approach is planned for treatment of invasive type schwannomas extending into the vertebral bodies, and the paravertebral region.

KEY WORDS: Schwannoma, giant schwannoma, surgical approach, spinal tumor

Received :18.07.2005
Accepted : 23.03.2006

The first three cases of the paper have been presented as a poster at the 18th Scientific Congress of the Turkish Neurosurgical Society, Antalya, 2004.

Correspondence address
Feyza KARAGÖZ GÜZEY
Fatma Sultan Mah. Kahal Bagi Sok. 31/6 Fatih, 34093, Istanbul, Turkey
Phone : +90 212-5346900
Fax : +90 212-6217580
E-mail : fkarag@yahoo.com

INTRODUCTION

Spinal schwannomas are benign tumors arising from spinal nerve root sheaths. These tumors may grow into the various anatomical spaces, and may rarely reach considerable size without prominent symptoms and signs. Giant spinal schwannomas usually occur in the lumbar and sacral regions because of the mobility of the roots and the wide intradural spaces (5).

Confusion exists regarding the term giant spinal schwannoma in the literature (14). The majority of giant spinal schwannomas are dumbbell-shaped lesions with extensive paravertebral extensions but some of them differ from these dumbbell tumors with huge sizes, extensions to all planes, and invasive characteristics (5,14). Sridhar et al (14) advocated a new classification system for spinal schwannomas to solve this problem and suggested two types of giant spinal schwannomas: Dumbbell-type intraspinal tumors with extraspinal

extension >2.5 cm, and invasive tumors with erosion of the vertebral bodies and lateral and posterior extensions into myofascial planes.

Complete excision is recommended for giant spinal schwannomas because inadequate removal has a risk of recurrence and more definitive and more dangerous operations may be necessary in recurrent tumors (5). However, complete removal of these tumors poses difficulties because of their intra- and extraspinal dumbbell shapes, or huge tumor masses engulfing the roots in the spinal canal (3-5). Usually, combined multistage approaches may be necessary and in some cases, complete excision **may not be** possible even by combined procedures (3,4,12).

Four cases with giant spinal schwannoma are reported, **and the surgical approach selection is discussed in these rare tumors.** Two of these were dumbbell tumors extending to the retroperitoneal region, and two were huge invasive intraspinal tumors.

CASE REPORTS

Case 1: A 31-year-old lady was admitted a 2-year history of low back pain and numbness and a feeling of weakness over both legs. There was no abnormality on neurological examination. On magnetic resonance imaging (MRI), a paravertebral mass extending to the widened right L2-3 neural foramen, 2x3 cm in size was seen (Figure 1 A and B). The mass was enhanced heterogeneously after intravenous gadolinium injection.

The tumor was removed totally by the right lateral retroperitoneal approach. The tumor was extradural and it was not difficult to remove its intraforaminal portion thanks to the widened foramen. The pathological examination showed characteristics of a schwannoma. There was no mitosis. There were no complaints or signs after 50 months, and no recurrence on control MRI 36 months after surgery.

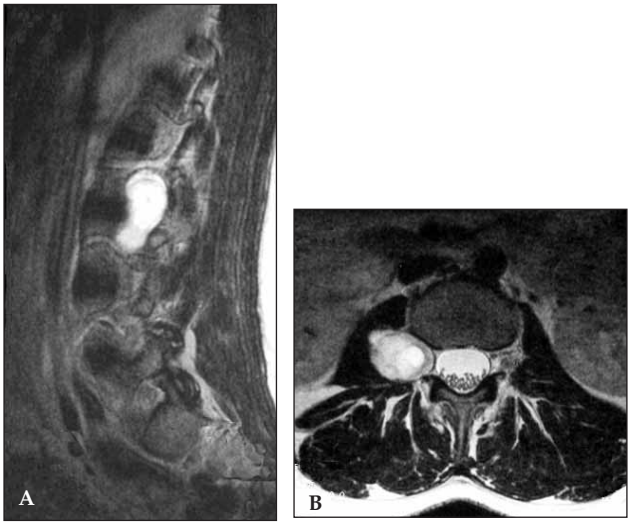


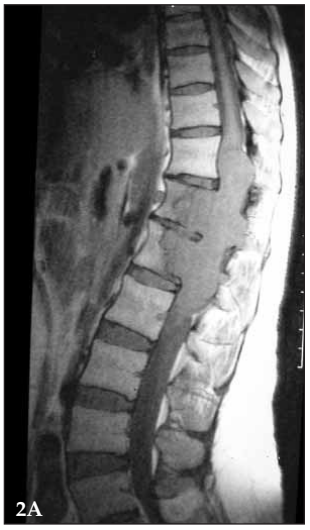
Figure 1- Case 1. Preoperative sagittal (**A**) and axial (**B**) lumbar MRI sections showing a retroperitoneal mass extending to the widened right neural foramen.

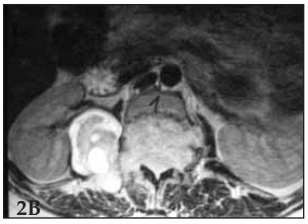
Case 2: A 22-year-old lady had a history of weakness and numbness on both her legs for 2 years, and urinary incontinence and anal sphincter disturbance for 6 months. On neurological examination, there were paraparesis especially of the proximal leg muscles, hypoesthesia of the left leg, and urinary and anal sphincter disturbances.

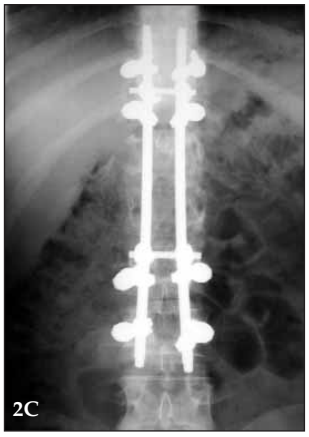
Lumbar radiographs revealed erosion of the pedicles and the posterior portion of the bodies of T12 and L1 vertebrae, and widening of the spinal canal at those levels. On MRI, there was a giant spinal tumor between T11 and L2 levels, 9x6x3.5 cm in size. The tumor eroded the T12 and L1 bodies, and extended to bilateral neural foramina and the retroperitoneal region on the right side (Figure 2 A and B). The dural sac was pushed to the left side of the spinal canal at the levels of the upper and lower pole of the tumor.

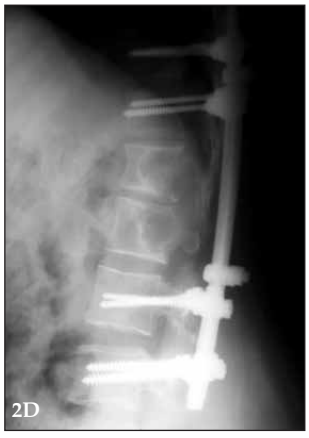
The posterior approach was chosen first because the tumor filled the whole spinal canal at the T12 and L1 levels, and extended to bilateral neural foramina. The tumor was totally removed by laminectomy and facetectomy. A posterolateral fusion and posterior instrumentation with T10, T11, L2 and L3 pedicle screws were added (Figure 2 C and D). There was no difficulty in dissecting the tumor from the nerve roots because it was wholly extradural in location. The tumor portions eroding the T12 and L1 vertebral bodies were dissected and removed easily. It was also not difficult to expose the retroperitoneal tumor portion through the widened right T12-L1 neural foramen after facetectomy. **The pathological examination revealed typical findings of a schwannoma with hematoxylin-eosin (HE) dye (Figure 2E) and a strong reaction to S-100 protein. There were 2 mitoses in 10 areas.**

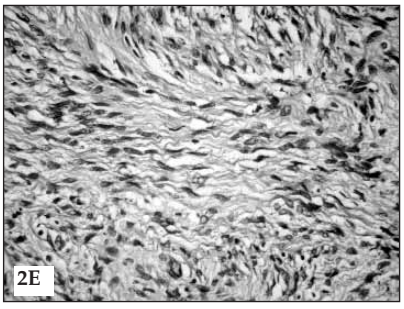
The patient's neurological condition quickly improved in a few days. There was no paraparesis when she was discharged after one week. Follow-up MRI after 13 months revealed no residue or recurrence, and showed reconstitution of T12 and L1 bodies (Figure 2F). There were no complaints or neurological findings 24 months after the surgery.











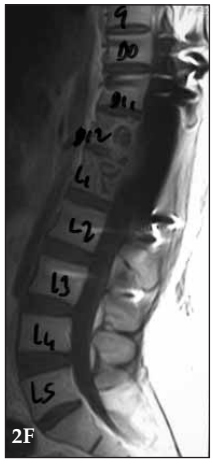
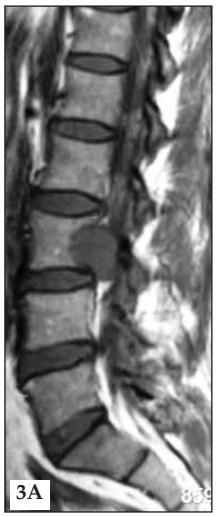
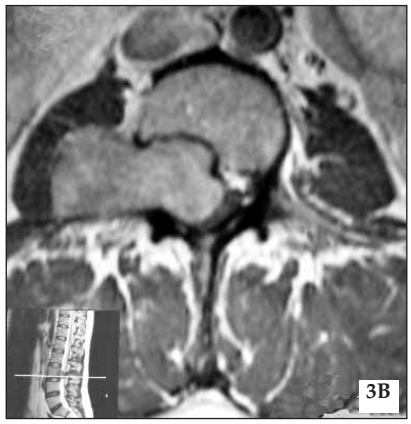
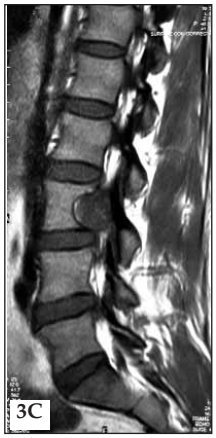


Figure 2- Case 2. Preoperative sagittal (**A**), and axial (**B**) MRI sections showing a giant spinal tumor between T11 and L2 levels. Note that the tumor eroded the T12 and L1 bodies, and extended the bilateral neural foramina and retroperitoneal region on right side. The tumor was totally extradural during the surgery. The instrumentation system was seen on the AP (**C**) and lateral (**D**) postoperative radiographs. The pathology slide showed a typical Antoni A-type schwannoma (HE, original magnification x275) (**E**). There was no residue or recurrence on follow-up MRI after 13 months (**F**).







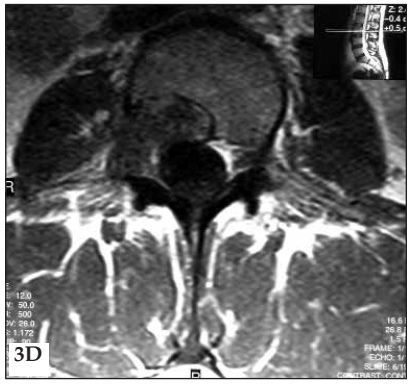


Figure 3- Case 3. Preoperative sagittal (**A**) and axial (**B**) MRI sections showing a giant spinal tumor, 54x33x30 mm in size, with extradural and paravertebral extension causing erosion at right pedicle and right hemibody of L3 vertebra. Postoperative sagittal (**C**) and axial (**D**) MRI sections showing the residual tumor in the right side of L3 body and right neural foramen.

Case 3: A 39-year-old lady was admitted with complaints of low back and right leg pain for 2 years. There was a diminished right patellar reflex, and hypoesthesia on right L2 and L3 dermatomes on neurological examination. MRI revealed a giant spinal tumor, 54x33x30 mm in size, with extradural and paravertebral extension causing erosion at the right pedicle and right hemibody of the L3 vertebra (Figure 3 A, B).

The tumor filled only the right side of the spinal canal at the L3 level. **A lateral retroperitoneal approach was chosen first not to damage the posterior vertebral arch and to protect spinal stability.** The tumor was removed mostly by the lateral retroperitoneal approach except the part in the

right side of the L3 body. This tumor was also wholly extradural in location, and it was highly calcified and hard. The right L3 root that the tumor had developed on was sacrificed with the tumor in the neural foramen. The hypoesthesia of the patient increased after the surgery. Histological examination revealed a schwannoma with 3 mitoses in 10 areas.

A second operation was recommended to the patient for residual tumor (Figure 3 C and D), but she refused. The residue was the same size after 12 months. She complained only of hypoesthesia on her right leg 20 months after the surgery.

Case 4: A 34-year-old lady was admitted with a 2-month history of back pain radiating to the left side. There was no abnormality on neurological examination. On MRI, a large tumor extending through the widened left T4-5 neural foramina from the left half of the spinal canal to the mediastinum, 3x4x5.5 cm in size, was seen (Figure 4 A and B).

The patient was operated on by costotransversectomy and laminectomy, and the purely extradural tumor was totally removed by excision of the root. The pathological examination revealed typical findings of a schwannoma. There was no mitosis.

There were no neurological deficits except a left T5 hypoesthesia after the surgery. There were no complaints after 6 months.

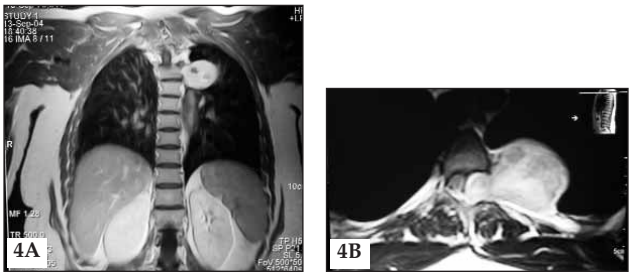


Figure 4- Case 4. Preoperative coronary (**A**) and axial (**B**) MRI sections showing a giant thoracic dumbbell tumor, 30x40x55 mm in size, with paravertebral extension.

DISCUSSION

Spinal schwannomas are most often single, small, benign tumors that are relatively easy to remove. Rarely, these tumors may reach giant size. Sridhar et al (14) classified the giant spinal schwannomas as dumbbell tumors and invasive type tumors. These two types are different in their patterns of behavior, of extension, and also for choice of surgical treatment.

Giant dumbbell schwannomas are more frequent than invasive ones (5,14). Large parts of these tumors are located in the paravertebral region and they have their own capsules. They pose difficulties mainly in the radical removal of the extraspinal part of the lesion. This problem may be solved by combined posterior and anterolateral approaches (2-4,8,9,11,12,14). In most cases, the classical posterior approach is necessary to remove the intraspinal tumor totally. In one of our cases with this type of giant schwannoma (Case 1), **the intraspinal part of the tumor was small, and the tumor was totally removed by only the anterolateral retroperitoneal approach thanks to the widened neural foramina.** In the other patient (Case 4), both intra- and extraspinal portions of the tumor were large, but it was located at the thoracic region, and it was totally removed by laminectomy and costotransversectomy in one stage.

Giant invasive schwannomas differ from the giant dumbbell ones in some aspects. They erode the posterior surface of the vertebral bodies, infiltrate through the posterior dura, and invade the myofascial planes (14). They make surgery much more difficult because of their growth in all directions. These tumors extend commonly over more than three vertebral levels, anterolaterally into the extraspinal space via the foramen, which they erode and widen; posteriorly, thinning and attenuating the dura and the posterior elements, and anteriorly eroding the vertebral bodies to varying extents (14). These extensions cause problems for the surgeon in terms of approach, resectability of the tumor, and stability of the spine. Combined anterolateral and posterior approaches are recommended to solve these problems as for giant dumbbell schwannomas (5,14).

Another important subject in surgery of giant spinal schwannomas is sacrificing the nerve root that the tumor developed on. Schwannomas are developed from the dorsal roots, and theoretically, sacrificing these roots only causes sensorial deficits (15). Kim et al (6) reported that the involved nerve roots were nonfunctional at the time of surgery, and risks of neurological deficit after sacrificing these roots are small. In Case 3 presented here, the root that the tumor developed from was sacrificed with the tumor. The preoperative sensorial neurological deficit was increased after surgery, and there was no motor deficit. In Case 4, the root was sacrificed and only sensorial deficit was seen after surgery.

Dissection of the tumor from the nerve roots may be more difficult in invasive type tumors than dumbbell ones, because these tumors often engulf the nerve roots of the cauda equina (5). Kagaya et al found 35 cases with giant invasive schwannoma of the cauda equina in the thoracolumbar, lumbar or sacral regions in literature (5). They reported a high percentage of neurological deficit when complete excision of the tumor was performed. However, Sridhar et al (3) reported that the relationship between the tumor and the neural structures is constant, and depending on the side of origin of the tumor, the cord/nerve roots are pushed and/or splayed to the opposite direction. It is therefore possible to perform a radical excision of the tumor without causing neurological damage. **In our Case 2, the huge tumor extending to all directions was extradural in location and could be removed without damage to nerve roots.**

Dissecting the invasive giant tumors from the surrounding soft tissue may be difficult because the tumors do not have a firm capsule and are vascular. The anatomy of the region is confusing when an essentially intradural tumor is seen at the muscle plane without the dural layer to delineate it (14). In our cases with invasive giant schwannomas (Cases 2 and 3), the tumors could be easily removed because they were wholly extradural in location. There were no new neurological deficits at the early postoperative period in Case 2, moreover existing deficits improved after surgery. In Case 3, the nerve root was sacrificed and the preoperative sensorial deficit increased after the surgery, but there was no motor deficit.

It is important to plan for stabilization after removal of invasive giant spinal schwannomas. These tumors may erode into the vertebral bodies (1,5,14). The tumor should be followed into the bone and removed. If the tumor causes extensive bone destruction, its complete or incomplete removal may require spinal reconstruction because of the unstable spine (5,14). Actually, the vertebral body may be slowly reconstitute itself (12). In Case 2 presented here, the follow-up MRI revealed reconstitution of T12 and L1 bodies 13 months after tumor removal (Figure 2f). However, early mobilization of these patients without stabilization may be hazardous, especially in those cases with tumors in thoracolumbar junction (14). Sridhar et al (14) recommended instrumentation in the presence of erosion of more than 25% of the vertebral bodies. Kagaya et al (5) reported that 11 of 33 cases whose tumors had been removed completely or incompletely required a stabilization procedure after tumor removal. In our Case 2, posterior instrumentation was performed after removal of the tumor by the posterior approach.

MRI is the gold standard for planning surgery in giant spinal schwannomas. The entire extent of the tumor is seen in all three planes, and the relationship of the tumor to the neural elements, vascular structures, and other organs is clearly defined. Plain radiographs and computerized tomography (CT) show the extent of bone destruction and are important to evaluate the need of stability of the spine.

In Case 1, the tumor is mostly in the paravertebral region, and in the widened foramen. Therefore, an anterolateral approach was chosen, and it was totally removed by this approach. In Case 2 with an invasive giant tumor, the tumor extended to the vertebral bodies, to the neural foramina and to the retroperitoneal region but the retroperitoneal part that was not too large was at the same level as the widened neural foramina. The tumor could therefore be easily removed with an extended posterior approach and facet removal. Already there was erosion of two vertebral bodies in addition to facet removal and it was thought that the spine was unstable, requiring posterior instrumentation with a pedicle screw system.

In the other case with an invasive tumor (Case 3), the larger part of the tumor was in extraspinal in location, and the intraspinal portion was only in right side of the spinal canal. **Therefore, a lateral retroperitoneal approach was chosen to avoid causing instability with a laminectomy.** However, a small tumor portion in the L3 body could not be removed, and a second posterior operation was required but the patient refused second operation. If a posterior approach had been chosen as the first approach in this patient as in Case 2, the tumor might have been removed by a one-stage approach with laminectomy thanks to the widened foramen and extradural location of the tumor.

In Case 4, the thoracic dumbbell tumor with a large intraspinal and a giant paravertebral portions could be totally removed by costotransversectomy and laminectomy. In the thoracic region, posterolateral approaches such as costotransversec-

tomy provide an advantage compared to lumbar region. Even huge tumors may be removed by these approaches, and anterior approaches are usually not necessary.

Another interesting finding in the presented cases was that all four tumors were purely extradural. In spinal schwannomas, 70-80% of all tumors are purely intradural, 10-20% are intra- and extradural tumors, and 10-20% are totally extradural (7,10).

In histological examination, all of the tumors were typical schwannoma. In dumbbell tumors (Cases 1 and 4), there were no mitoses, while in the infiltrating tumors of Case 2 and 3 there were 3 and 2 mitoses in 10 areas, respectively. However, mitoses are usually absent, or extremely scanty in schwannomas (13). There is no information on mitotic figures from the histological examinations of the cases with infiltrating type giant schwannomas in previous papers.

CONCLUSIONS

Spinal giant schwannomas are rare tumors. A combined anterolateral and posterior approach is generally recommended to totally remove both giant dumbbell and giant invasive type spinal schwannomas. However, in selected cases, only extended posterior or only anterolateral approaches may be sufficient to complete removal of the tumor thanks to the widened neural foramina due to the expansion of tumor. Therefore, a cautious evaluation of the preoperative radiological examination is essential for planning of the surgery and to avoid unnecessary operations. In addition, spinal stability must be evaluated preoperatively. Stabilization may be required especially when a posterior approach is planned for treatment of invasive type tumors.

REFERENCES

1. Bhatia S, Khosla A, Dhir R, Bhatia R, Banerji AK. Giant lumbosacral nerve sheath tumors. Surg Neurol 37:118-122, 1992.
2. Hakuba A, Komiyama M, Tsujimoto T, Ahn MS, Nishimura s, Ohta T, Kitano H. Transuncodiscal approach to dumbbell tumors of the cervical spinal canal. J Neurosurg 61: 1100-1106, 1984.
3. Ishibashi H, Akamatsu H, Sunamori M, Komori H, Shirasawa S, Nomoto S. [A case of giant dumbbell shaped schwannoma with massive pleural effusion]. Kyobu Geka 200 54:742-746, 2001 (abstract).
4. Kádár E, Kisfaludi N, Czirják S, Jakab F. Resection of giant schwannoma by combined surgical exposure. Acta Chir Hung 36:158-159, 1997.
5. Kagaya H, Abe E, Sato K, Shimada Y, Kimura A. Giant cauda equina schwannoma. A case report. Spine 25:268-272, 2000.
6. Kim P, Ebersold MJ, Onofrio BM, Quast LM. Surgery of spinal nerve schwannoma. Risk of neurological deficit after resection of involved nerve root. J Neurosurg 71:810-814, 1989.
7. Kono K, Inoue Y, Nakamura H, Shakudo M, Nakayama K: MR imaging of a case of a dumbbell spinal schwannom with intramedullary and intradural-extramedullary components. Neuroradiology 43:864-867, 2001.
8. Lot G, George B. Cervical neuromas with extradural components: surgical management in a series of 57 patients. Neurosurgery 41: 813-820, 1997.
9. McCormick PC. Surgical management of dumbbell tumors of the cervical spine. Neurosurgery 38:294-300, 1996.
10. McCormick PC, Stein BM: Spinal cord tumors in adults. Youmans JR (ed) Neurological Surgery, Volume 6, Fifth edition, WB Saunders, Philadelphia, 1996, pp3102-3122.
11. Oruckaptan HH, Gürcay O. Combined posterior and posterolateral one-stage removal of a giant cervical dumbbell schwannoma. Pediatr Neurosurg 30:102-107, 1999.
12. Piera JB, Durand J, Pannier S, Guiot G, Grossiord A. [10 cases of giant lumbo-sacral neurinoma]. Ann Med Interne (Paris) 126:316-30, 1975 (abstract).
13. Rosai J: Rosai and Ackerman's Surgical Pathology, Vol 2, 9th ed, China: Mosby, 2004: 2264-2266.
14. Sridhar K, Ramamurthi R, Vasudevan MC, Ramamurthi B. Giant invasive spinal schwannomas: definition and surgical management. J Neurosurg Spine 2: 210-215, 2001.
15. Stein BM, McCormick PC: Spinal intradural tumors, in Wilkins RH, Rengachary SS (eds) Neurosurgery, Volume 2, second edition, McGraw-Hill Companies, New York, 1996, pp1769-1781.