



Posterior resection of fifth lumbar giant schwannoma combined with a recapping transiliac approach: case report and technical note

Hitoshi Tonomura¹ · Yoichiro Hatta² · Masateru Nagae¹ · Ryota Takatori¹ · Toshikazu Kubo¹

Received: 19 December 2017 / Accepted: 8 March 2018 / Published online: 13 March 2018
© Springer-Verlag France SAS, part of Springer Nature 2018

Abstract

A two-stage combined anterior and posterior approach is commonly used for total resection of giant spinal tumors. However, an anterior approach at the lower lumbar level is technically challenging because of the anatomy of the iliac wing, major vessels and nerves of the lumbosacral plexus. We report a case of fifth vertebral tumor treated posteriorly with a newly devised surgical procedure combined with a recapping transiliac approach. A 45-year-old female diagnosed with giant schwannoma of the fifth lumbar vertebra underwent single-stage posterior tumor resection combined with osteotomy of the lateral part of the iliac crest. Without an anterior approach, tumor excision was completed with a wide view into the fifth lumbar vertebral body. Autogenous bone graft was harvested and used to treat the bone defect. The resected iliac bone was recapped and fixed with screws. The patient was monitored for 8 years without recurrence, and postoperative lumbar alignment remained unchanged. This surgical procedure is safe and a useful adjunct approach for posterior total resection of giant spinal tumors at the lower lumbar level.

Keywords Fifth lumbar spine tumor · Giant schwannoma · Transiliac approach · Ilium osteotomy

Introduction

Total resection of giant spinal tumors extending from within the spinal canal to the anterior edge of a vertebral body is commonly performed using a combined anterior and posterior approach. However, the presence of iliac wing, major vessels and the lumbosacral nerve plexus at the lower lumbar level makes operative procedures with an anterior approach difficult. To enable safe surgical procedure in a satisfactory operative field, we devised a recapping transiliac approach. We describe a case of resection of a fifth lumbar giant schwannoma using this new procedure combined with a posterior approach.

Case report

Case history and examination

A female aged 45 years presented with low back pain and right drop foot. There was numbness in the right L5 nerve root territory and muscle weakness of the anterior tibialis muscle and the extensor hallucis longus. A scalloping lesion centered on the right side of the L5 vertebral body was observed in lumbar computed tomography (CT) images (Fig. 1). With magnetic resonance imaging, a mass lesion occupying over two-thirds of the L5 vertebral body was observed and extended from L4 to S2 within the spinal canal (Fig. 1). A CT-guided needle biopsy was performed, and the pathological diagnosis was schwannoma.

Surgical procedure

Position and skin incision

Patient was placed in the right lateral decubitus position using body support pad and vacuum bean bag. We confirmed that tilting surgical table enabled us to perform the following surgical procedure with one skin incision in both posterior

✉ Hitoshi Tonomura
tono@koto.kpu-m.ac.jp

¹ Department of Orthopaedics, Graduate School of Medical Science, Kyoto Prefectural University of Medicine, Kawaramachi-Hirokoji, Kamigyo-ku, Kyoto 602-8566, Japan

² Department of Orthopaedics, Japanese Red Cross Kyoto Daini Hospital, 355-5 Haruobi-cho, Kamigyo-ku, Kyoto 602-8026, Japan

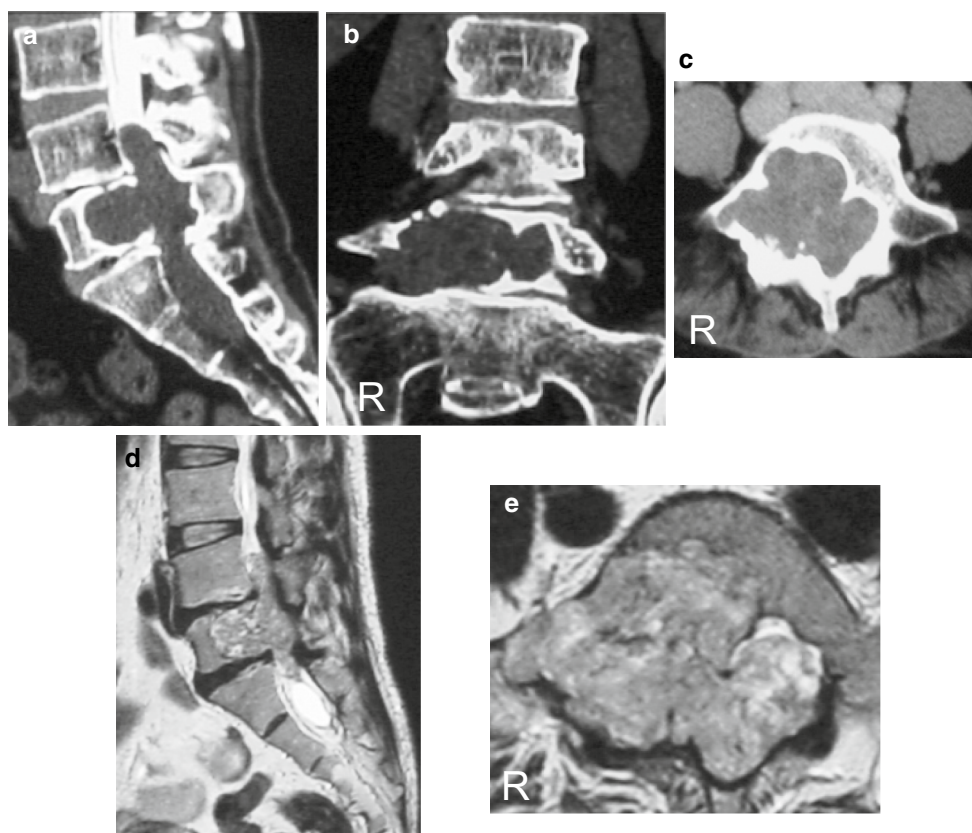


Fig. 1 Preoperative images. Sagittal (a), coronal (b) and axial (c) views of computed tomography after myelography. T2-weighted magnetic resonance imaging with sagittal (d) and axial (e) views

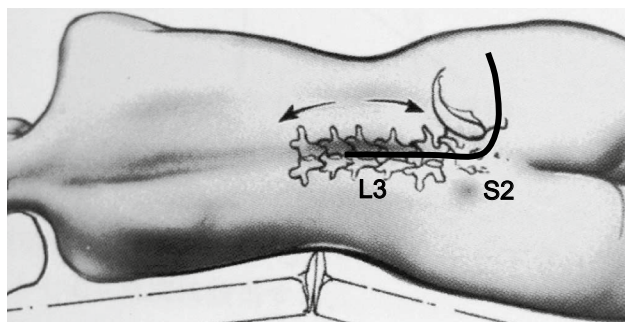


Fig. 2 Operative position and skin incision

and posterolateral approach. A curved skin incision was made from the midline to the right side (Fig. 2).

Posterior approach

The laminectomy was performed from L4 to S2. On the right side of L4/5 and L5/S1, facetectomy was performed. The tumor was seen to be protruding toward the dorsal side

of the spinal canal at the right side of L5. Tumor extension in an anterior direction from the transverse process was verified.

Posterolateral approach

These procedures were performed using the same skin incision as posterior approach. The gluteus maximus muscle and multifidus muscle were partially detached from the attachment exposing the right iliac crest under the periosteum. A hole was drilled at a distance of 40 mm caudally from the top of the right iliac crest and 50 mm from the external side of the right anterior inferior iliac spine at a position estimated before surgery (Fig. 3). A threadwire saw (T-saw) was passed through the hole in the bone, and an L-shaped osteotomy of the right iliac crest was performed (Fig. 4a). Following the osteotomy, the bone fragment with quadratus lumborum muscle still attached was flipped over to the cranial side, and in the anterior of paravertebral muscles, the tumor was exposed from the transverse process on the right side of L5 to the anterior edge of the vertebral body.

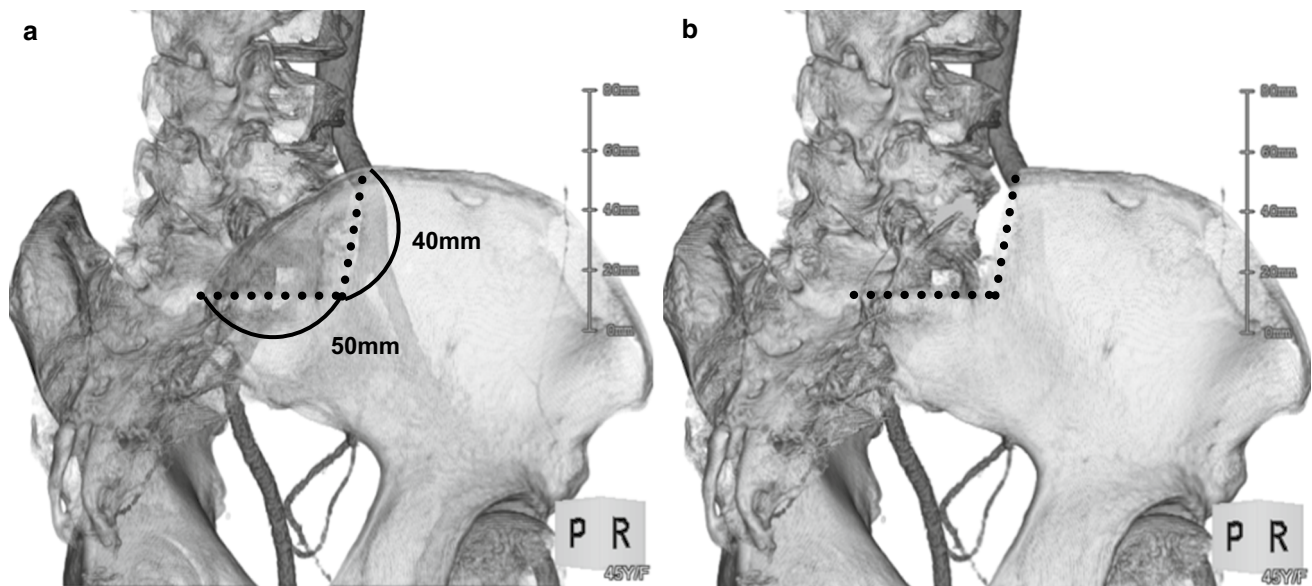


Fig. 3 Preoperative iliac crest osteotomy planning using 3-dimensional computed tomography images. Posterolateral views of iliac bone and lower lumbar spine (a) and simulated operative field after iliac crest osteotomy (b)

Tumor resection

Total removal of the tumor was accomplished under microscope through both posterior and posterolateral approach. Using a posterior approach, as much of the tumor in spinal canal and vertebral body as possible was resected. The tumor originated intradurally and progressed toward both inside and outside of the vertebral body. The dura mater in the protruding part of the tumor had defects. Remaining dura mater was resected, and the encapsulated tumor was exposed and resected using an ultrasonic surgical aspirator (Sonopet, Stryker Corporation, USA). The path of the L5 nerve root could not be verified. Next, tumor resection was performed using a posterolateral approach. The posterolateral lesion of the vertebral body had resulted in loss of bone cortex, and using this approach, it was possible to see the tumor under direct vision extending laterally from the right pedicle of the L5 vertebral body. The tumor reached as far as the contralateral anterior edge of the L5 vertebral body, and as much of it as possible was resected. We verified that no tumor remained inside the vertebral body. The above procedure enabled total excision of the tumor without using an anterior approach. Histopathological analysis of the excised tumor gave a definite diagnosis of schwannoma.

Dura mater repair, bone graft and reconstruction of the iliac crest

After tumor resection, there was near-circumferential loss of dura mater from L4 to S1. Dura mater repair was performed using thracolumbar fascia and cylindrically shaped

artificial surgical membrane. The bone defect size of L5 vertebral body was measured, and decortication was performed. Two fibular cortical bone grafts (each 2.5 cm long) were harvested and fitted into the bone defect. Cancellous bones from the iliac crest were also transplanted around the fibular grafts. The both cranial and caudal end plates of the L5 vertebral body were intact, and interbody fusion was not necessary. Osteotomized iliac bone was recapped and fixed from the iliac crest toward the periphery with three 6.5×60 mm cancellous screws. Sufficient fixation was obtained.

Postoperative course

The L5 deficit was stable, and there was no worsening of neurological symptoms after surgery, and bone union of the grafted bone and iliac bone at the osteotomy site was verified at postoperative year 1. Currently, at postoperative year 8, no clear tumor recurrence or lumbar instability has been observed during routine follow-up (Fig. 5).

Discussion

A two-stage combined anterior and posterior approach is commonly used for total resection of giant spinal tumors. However, oncologically, total resection is difficult using an anterior approach, particularly at the fifth lumbar level [1, 2]. There are the large degree of lumbosacral spine lordosis and the iliac wing, the major vessels such as descending aorta and vena cava, and the bilateral common iliac artery and vein; the vertebral vein plexus and the lumbosacral nerve

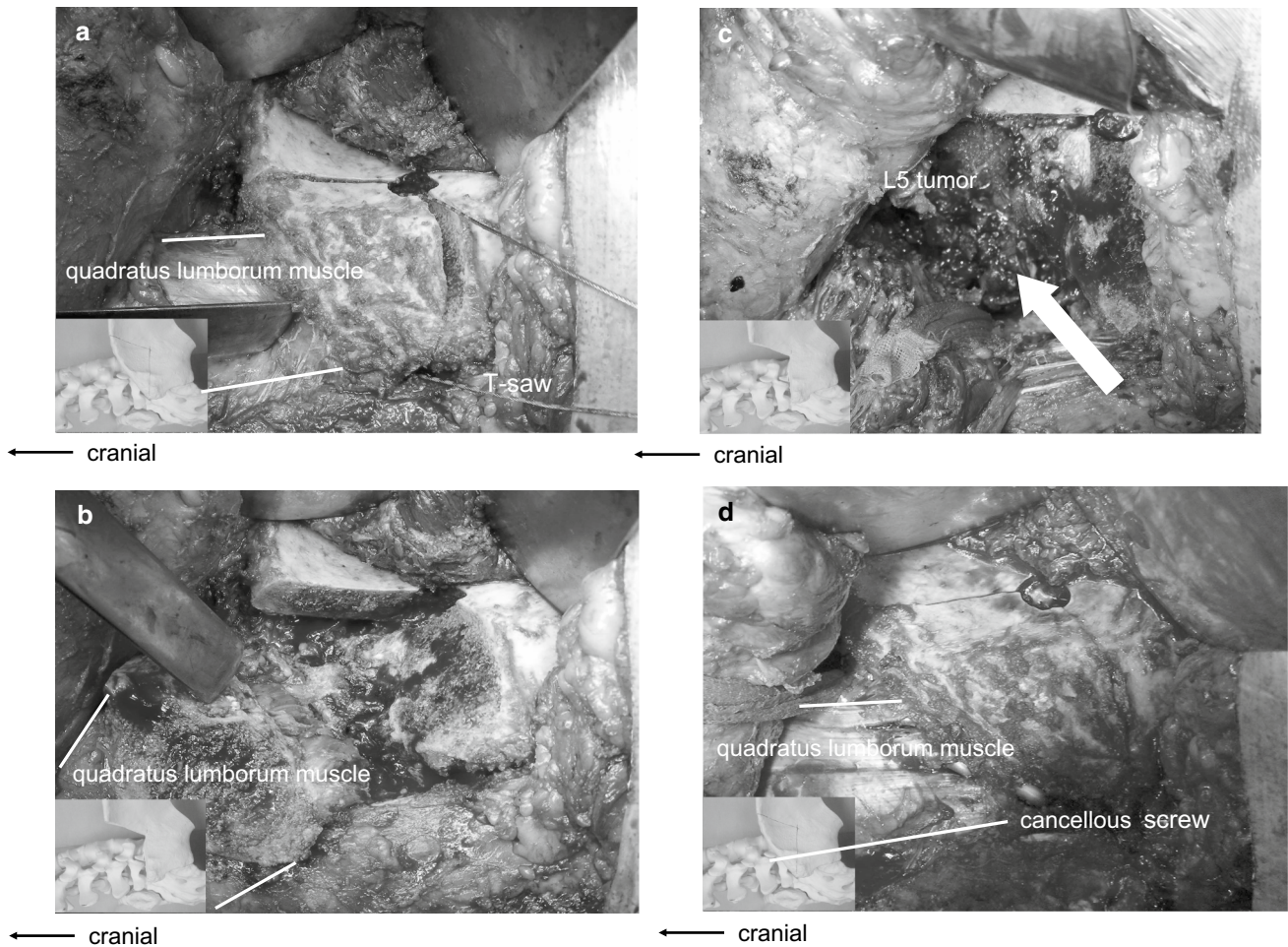


Fig. 4 Intraoperative findings of recapping transiliac approach. Posterolateral views of iliac bone and lower lumbar spine before (a) and after (b, c) iliac crest osteotomy. Iliac bone recapping after tumor resection (c)

plexus are located in the periphery of the fifth lumbar body. Therefore, an anterior surgical approach for the fifth lumbar level entails many difficulties. The rate of vascular injury using an anterior approach may be as high as 1.2–15.6% [3, 4], and there have been reports of severe bleeding due to damage to the iliolumbar vein [1] and/or common iliac vein [5].

Spinal schwannomas are slow-growing benign tumors with a capsule that originates in the myelin sheath. Many of them form intradural lesions, but approximately 30% spread extradurally from the root sleeve to form both intra- and extradural lesions [6–8]. There are reports of some cases of giant tumor masses that spread to outside vertebral bodies or form intraosseous schwannoma in vertebral bodies [6, 9–11]. Sridhar et al. [12] defined giant invasive spinal schwannomas (GISSs) as follows: they extend over two vertebral levels, erode vertebral bodies, and extend posteriorly and laterally into the myofascial planes. This definition of GISS was judged to apply to the case in this report. As with

general spinal schwannoma, GISS total resection is the recommended surgical procedure [8, 11, 13], but the invasive nature and compressive effect of GISSs, and the adjacent neurovascular bundle, mean this treatment is not always successful.

The GISS in this case originated in the fifth lumbar vertebra. Due to the tumor location and the extent of the invasion, total resection was expected to be difficult. However, a recapping transiliac approach combined with posterior tumor resection enabled total resection without using an anterior approach. With the newly devised approach, reduction of iliac bone with osteotomy provided a satisfactory operative field, enabling the performance of a safe surgical procedure inside the fifth lumbar vertebra. A recapping transiliac approach as an adjunct use of a posterior surgery avoided the need for two-staged surgery using an anterior surgical procedure. There are reports of using an endoscopic transiliac approach to the L5-S1 disk by drilling a hole in iliac bone, since a lateral approach to the fifth lumbar

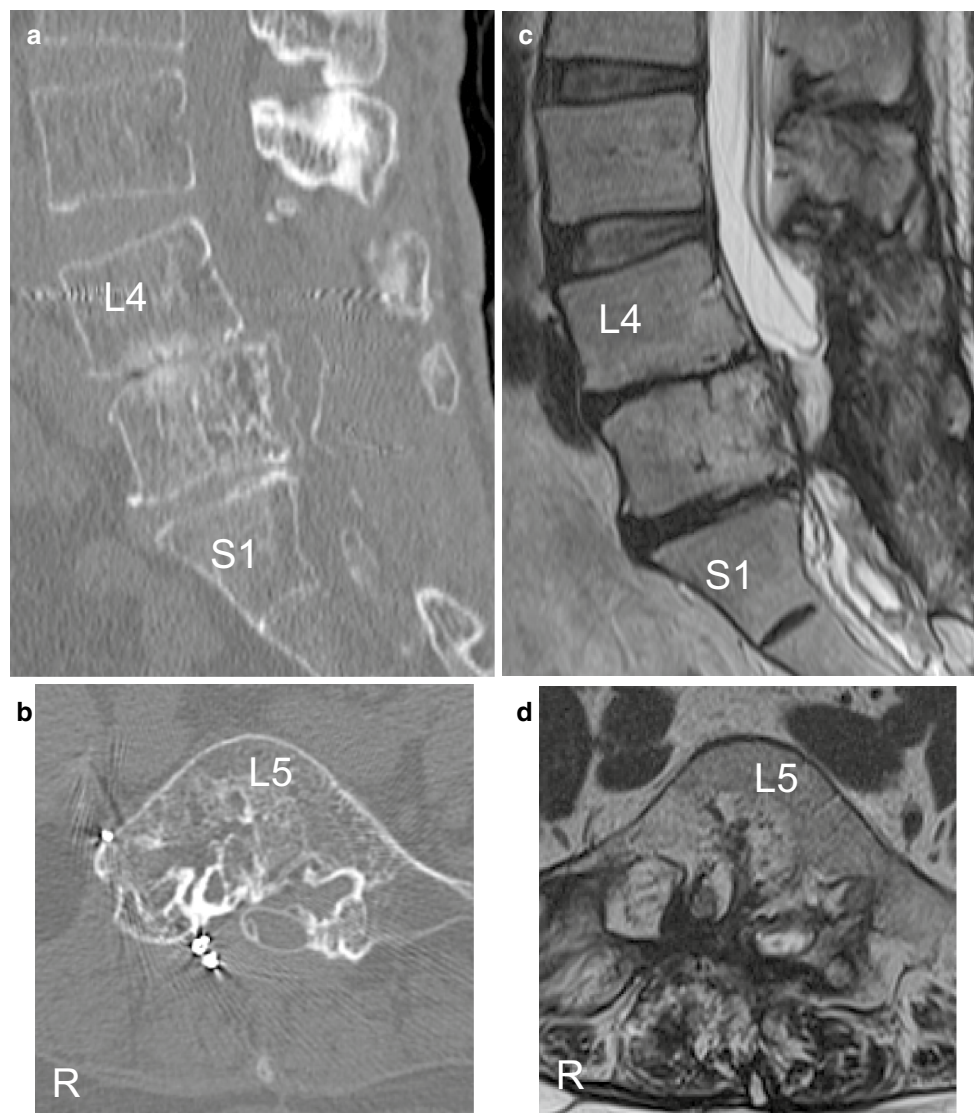


Fig. 5 Images at postoperative year 8. Sagittal (a) and axial (b) views of computed tomography. Sagittal (c) and axial (d) views of T2-weighted magnetic resonance images

vertebra is interrupted by the iliac wing [14, 15]. Using a recapping transiliac approach, with the aim of tumor resection, an L-shaped osteotomy of iliac bone is performed to enable extensive lateral incision into the fifth lumbar vertebra. The osteotomy line is planned so that it avoids the superior gluteal vessel, the superior nerves and other neurovascular bundles, and the sacroiliac joint [15]. There are individual differences in the distribution of the blood vessels and nerves, and the relationship between the position of the fifth lumbar vertebra and the iliac wing [16]. Therefore, the size of the osteotomy must be planned using 3-dimensional enhanced CT before surgery. After performing osteotomy of the iliac bone, it is flipped over with the quadratus lumborum muscle attached and the fifth lumbar vertebral body is reached by separating the paraventral muscles and psoas

major muscles. The advantages of this approach over a posterior-only approach are less muscle injury and the possibility of a surgical procedure with a lateral approach to the inside of an anterior vertebral body without placing excessive traction on dura mater or nerve roots. Tilting surgical table enabled us to perform surgical procedure simultaneously through both posterior and posterolateral approach. After performing the surgical procedure, the osteotomized bone fragment with muscle still attached is recapped. Therefore, blood flow to the distal bone fragment is maintained and it is effective for bone union.

Tumor resection with a posterior approach combined with a recapping transiliac approach was performed for a fifth lumbar giant schwannoma. Total removal of the tumor was possible without using an anterior approach. It is concluded

that this approach is a useful adjunctive approach for tumor resection surgery of the fifth lumbar vertebra since it provides a satisfactory operative field undamaged by major vessels or the lumbosacral nerve plexus.

Compliance with ethical standards

Conflict of interest All authors declare that they have no conflict of interest.

References

1. Shimada Y, Hongo M, Miyakoshi N, Kasukawa Y, Ando S, Itoi E, Abe E (2007) Giant cell tumor of fifth lumbar vertebrae: two case reports and review of the literature. *Spine J.* 7(4):499–505
2. Shousha M, El-Saghir H, Boehm H (2014) Corpectomy of the fifth lumbar vertebra, a challenging procedure. *J Spinal Disord Tech* 27(6):347–351
3. Tribus CB, Belanger T (2001) The vascular anatomy anterior to the L5-S1 disk space. *Spine* 26(11):1205–1208
4. Brau SA, Delamarter RB, Schiffman ML, Williams LA, Watkins RG (2004) Vascular injury during anterior lumbar surgery. *Spine J.* 4(4):409–412
5. Chiang ER, Chang MC, Chen TH (2009) Giant retroperitoneal schwannoma from the fifth lumbar nerve root with vertebral body osteolysis: a case report and literature review. *Arch Orthop Trauma Surg* 129(4):495–499
6. Kagaya H, Abe E, Sato K, Shimada Y, Kimura A (2000) Giant cauda equina schwannoma. A case report. *Spine* 25(2):268–272
7. Conti P, Pansini G, Mouchaty H, Capuano C, Conti R (2004) Spinal neurinomas: retrospective analysis and long-term outcome of 179 consecutively operated cases and review of the literature. *Surg Neurol* 61(1):34–43 (**discussion 44**)
8. Ghani AR, Ariff AR, Romzi AR, Sayuthi S, Hasnan J, Kaur G, Awang S, Zamzuri I, Ghazali MM, Abdullah J (2005) Giant nerve sheath tumour: report of six cases. *Clin Neurol Neurosurg* 107(4):318–324
9. Choudry Q, Younis F, Smith RB (2007) Intraosseous schwannoma of D12 thoracic vertebra: diagnosis and surgical management with 5-year follow-up. *Eur Spine J* 16(Suppl 3):283–286
10. Inaoka T, Takahashi K, Hanaoka H, Aburano R, Tokusashi Y, Matsuno T, Sugimoto H, Furuse M (2001) Paravertebral neurinoma associated with aggressive intravertebral extension. *Skelet Radiol.* 30(5):286–289
11. Vecil GG, McCutcheon IE, Mendel E (2008) Extended lateral parascapular approach for resection of a giant multi-compartment thoracic schwannoma. *Acta Neurochir* 150(12):1295–1300
12. Sridhar K, Ramamurthi R, Vasudevan MC, Ramamurthi B (2001) Giant invasive spinal schwannomas: definition and surgical management. *J Neurosurg* 94(2 Suppl):210–215
13. Yu NH, Lee SE, Jahng TA, Chung CK (2012) Giant invasive spinal schwannoma: its clinical features and surgical management. *Neurosurgery* 71(1):58–67
14. Osman SG, Marsolais EB (1997) Endoscopic transiliac approach to L5-S1 disc and foramen. A cadaver study. *Spine* 22(11):1259–1263
15. Choi G, Kim JS, Lokhande P, Lee SH (2009) Percutaneous endoscopic lumbar discectomy by transiliac approach: a case report. *Spine* 34(12):E443–E446
16. Zahiri H, Zahiri CA, Pourmand K, Afzali R (2002) Percutaneous approach to the fifth lumbar and first sacral disc. *Clin Orthop Relat Res* 395:148–153