

Combined Surgical and Radiosurgical Treatment of Symptomatic Aggressive Vertebral Osteomyelitis

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Key words

- spondylodiscitis
- vertebral osteomyelitis
- spinal radiosurgery
- combination treatment

Abstract

Introduction: The surgical treatment of vertebral osteomyelitis can be complicated by severe additional diseases or the need for extensive debridement with concomitant risks. We report a case of combined surgical and radiosurgical treatment of idiopathic vertebral osteomyelitis of L4.

Case Report: The patient presented with progressive enlargement of the right side of the vertebral body L4 due to chronic fibrous osteomyelitis without evidence of infection, leading to compression of nerve roots L4, L5 and the dural sac with resulting radicular paresis. During decompression of the nerve roots via a dorsal approach, massive bleeding from the inflammatory vertebral body occurred, making abortion of surgery necessary. Remnant inflammatory

masses of vertebral body L4 were treated by spinal robotic radiosurgery with a high tumoricidal dose of 20Gy without clinical and radiological signs of relapse of disease in the following three years.

Conclusion: We describe a case of the combined surgical and radiosurgical treatment of lumbar osteomyelitis with symptomatic nerve root compression. Dorsal decompression followed by spinal radiosurgery for the anterior vertebral parts with avoidance of potentially dangerous anterior spondylectomy led to a rapid improvement of paresis and pain with persistent control of vertebral inflammation and enlargement. The described case of close cooperation of surgeons and radiosurgeons offered an effective and functionality preserving treatment in this challenging case.

Introduction

Vertebral osteomyelitis responds well to conservative treatment at an early stage, but more complicated and advanced conditions, including mechanical spinal instability, epidural abscess formation, neurological deficits, and refractoriness to antibiotic therapy, usually require surgical intervention. However, surgical interventions can be complicated by often existing severe additional or even underlying diseases such as an impaired immune system secondary to diabetes mellitus, the use of corticosteroids, chemotherapy, renal or hepatic failure, or malnutrition [1,2]. Furthermore, often wide resections with prolonged duration of the operation are necessary with the danger of a concomitant hemostasiological disorder.

We report a case of surgical treatment of idiopathic progressive chronic fibrous vertebral osteomyelitis of L4 with symptomatic nerve root

compression. After surgical nerve root decompression further debridement was complicated by massive bleeding from the inflammatory vertebral body making abortion of surgery necessary. Remnant inflammatory masses of vertebral body L4 were successfully treated by spinal robotic radiosurgery without clinical and radiological signs of relapse of disease in the following three years.

Case Report

The 58-year old woman initially presented in 1998 in another hospital due to lower back pain. Lumbar MRI revealed hypointense signal in T₁ and hyperintense signal in T₂ within the right vertebral body and pedicle of L4 without enlargement or involvement of the spinal canal (• Fig. 1). Since the clinical symptoms were not

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specific and transitory and laboratory investigations were normal, clinical control examinations were made.

In September 2006 the patient presented with increasing severe lower back pain since April 2006 and with right-sided radiculopathy L4 and L5 including foot flexor weakness, right-sided loss of patellar reflex and disturbance of sensitivity. The patient was otherwise healthy without internal diseases or medication. MRI and CT (09/06) (• Fig. 1) showed massive enlargement of the right pedicular region, lamina and right side of the vertebral body L4 with osseous destruction, a heterogenous enhancement and a diffuse lateral border with contrast-enhancing soft tissue within the right recessus and neuroforamen L4/L5, leading to compression of nerve roots L4 and L5 and the dural sac.

The patient was initially considered to have a bone tumour. Therefore, a CT-guided needle biopsy was performed which revealed bony tissue with fibrous bone marrow without signs of malignancy. The bacteriological examinations showed no infection, there was no elevation of tumour markers. Staging examinations including CT scan of the thorax and abdomen as well as bone scintigraphy were inconspicuous. Since the clinical symptoms further worsened the indication for surgical decompression and debridement was given. The patient underwent an extended right-sided interlaminar fenestration L4/5 via a dorsal approach with decompression of nerve roots L4 and L5 and of the dural sac. With prolonged duration of surgery massive bleed-

ing from the inflammatory vertebral body evolved so that further debridement had to be stopped and the operation had to be aborted. The neuropathological examination showed residual small hematomas, granulation tissue with dense infiltration areas with lymphocytes, plasma cells and sporadic multinucleated giant cells without immunohistochemical stain of S-100. The diagnosis, confirmed by the Neuropathological and the Pathological Institute of the University of Munich and finally by the Bone Tumour Reference Center (University of Basel) was chronic fibrous osteomyelitis without evidence of a bone tumour or malignancy, again without evidence of infection.

Since remnant inflammatory changes within the vertebral body demanded further treatment we decided to perform highly focussed irradiation of L4 due to the danger of renewed intraoperative bleeding in case of anterior resection surgery. The tumour volume defined on the pre-treatment MRI and planning CT investigation comprised 24 mL. Single session fiducial free spinal radiosurgery (CyberKnife, Accuray, Inc., Sunnyvale, CA) was performed using 18 Gy to the 70% isodose line.

Follow-up examinations revealed a satisfying clinical improvement with resolvment of lumbar and radicular pain and of foot flexor paresis. Imaging studies obtained one and 24 months (• Fig. 2) after the procedure documented a considerable reduction in the size of the enlarged parts of the vertebral body with minimal loss of vertebral height. On repeated imaging studies

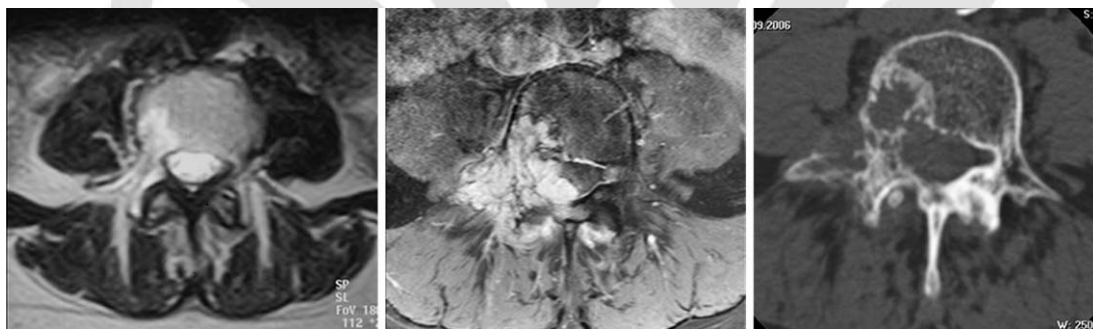


Fig. 1 Preoperative axial MRI images of L4. Left image: hyperintense signal in T₂ within the right vertebral body and pedicle of L4 (1998). Middle image: massive enlargement of the right pedicular region, lamina and right side of the vertebral body L4 with enhancement in T₁ and compression of nerve roots L4 and L5 and the dural sac (2006). Right image: osseous destruction of right-sided marrow and corticalis of L4 with sclerosis of the adjacent bone tissue, indicating slow growth of the lesion (2006).

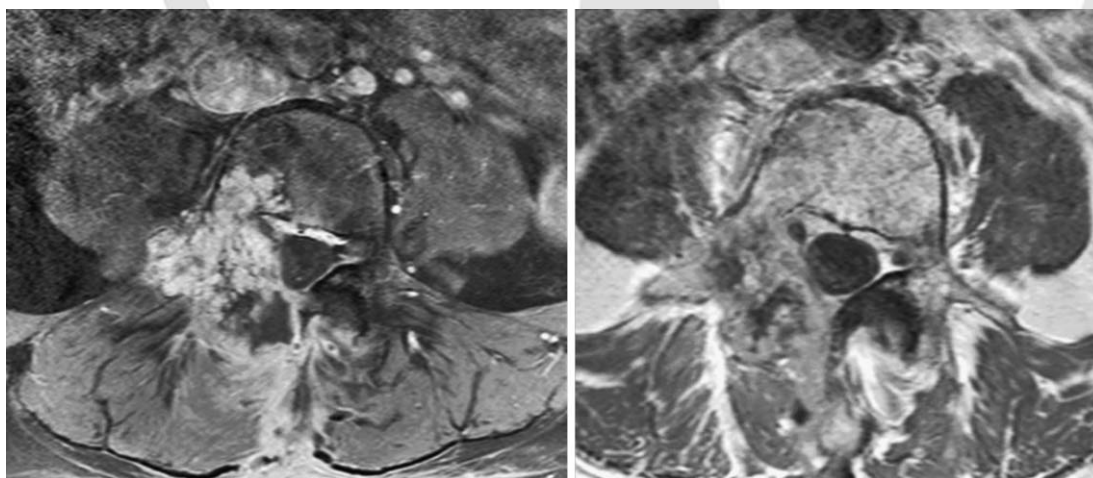


Fig. 2 Postoperative axial MRI images (both T₁ with contrast) of L4. Left image shows status one month after operation with decompression of nerve roots and the dural sac but still considerable enlargement and enhancement of the right side of the vertebral body L4 and intraspinal and paravertebral region. Right image shows status 24 months after local radiosurgery: stable decompression of the nerves and the dural sac without radiological signs of persistent inflammation.

obtained postoperatively, the size of the vertebral body and the degree of vertebral body compression were stable.

Discussion

Vertebral osteomyelitis is most commonly due to pyogenic or granulomatous infection and typically results in the combined involvement of the intervertebral disc and adjacent vertebral bodies. In our case the radiographic findings initially led to the assumption of a tumorous infiltration of the vertebral body with focal osseous enlargement and intra- and paravertebral contrast enhancement. However, the documented change of structure of the vertebral body over eight years argued against a malignant tumour. The heterogenous enhancement with a diffuse border was not typical for pyogenic osteomyelitis the changes of which usually go along the upward subligamentous spread, then the upper disc involvement and downward subligamentous spread [3]. Furthermore, the patient did not suffer from other severe diseases or failure of general condition, usually associated with pyogenic osteomyelitis [2]. Accordingly, repetitive histological and microbiological examinations did not show a neoplastic lesion or infection, but concordantly revealed signs of chronic fibrous osteomyelitis without radiological, laboratory, clinical or scintigraphic evidence of concomitant inflammatory lesions or infection.

Although surgical decompression resulted in rapid improvement of neurological deficits, the persisting presence of inflammatory changes within the remnant vertebral body demanded further treatment. Since complete spondylectomy even following embolization could not be expected to be safely accomplishable due to danger of renewed massive intraoperative bleeding, we decided against a further invasive surgical treatment. According to previous excellent experience [4] of patients with small spinal malignant tumours, spinal radiosurgery was thought to be a potentially safe and non-invasive modality to treat the remnant intra- and paravertebral inflammatory masses although inflammatory reactions are typically not an indication for spinal radiosurgery. No other report in the literature is currently available documenting the effects of highly focussed irradiation using tumour ablative dose levels. Frameless robotic radiosurgery uses real-time image guidance that allows for tracking of the target despite patient movement during the procedure. In the current system configuration there is no more need to implant additional fiducials for spinal tracking. Spinal tracking can be achieved only by the bony information of the affected vertebral body, making the treatment a true non-invasive and accurate procedure [5,6]. The current patient was treated with a high

tumoricidal dose of 20Gy in a single fraction as described for malignant spinal tumours recently [4,6,7]. By using highly conformal treatment planning with a sharp dose fall off, the dose to the neural structures in the spinal canal can be limited to under 8Gy which is regarded as safe for single fraction treatments [7,8]. Recently we could demonstrate that single session spinal radiosurgery is effective for fast pain reduction after treatment of spinal malignant tumours [4]. A similar analgesic effect could be documented in the here described case suggesting an additional anti-inflammatory effect of the focal irradiation.

Conclusion

The here described case is a good example for the need of close cooperation between surgeons and radiosurgeons to offer a maximum effective and functionality preserving treatment approach in this challenging case of lumbar osteomyelitis. Instead of anterior transabdominal vertebrectomy, it seems to be a much less invasive and equally effective treatment concept to do a relatively straightforward dorsal decompression and spinal radiosurgery for the anterior vertebral parts. This concept has so far not been adequately acknowledged in the neurosurgical literature and deserves further prospective evaluation.

Conflict of Interest: None

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