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GRAND ROUNDS

Paget's disease of the lumbar spine: decompressive surgery following 17 years of bisphosphonate treatment

Alexander Hofmann[1] · Sabine Opitz[2] · Christoph Eckhard Heyde[1] · Nicolas Heinz von der Höh[1]

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Abstract

Background We present a rare case of Paget's disease (PD) with involvement of the lumbar spine over a period of 19 years. We discuss the diagnostic process to rule out alternative diagnoses and medical and surgical treatment strategies.
Case description A 58-year-old man first diagnosed with PD in 1998 with solid involvement of the 4th lumbar vertebra has been undergoing periodic examinations over a period of 18 years. Since then, the patient has been treated conservatively with bisphosphonates. When conservative treatment options have been exhausted, surgery was indicated due to a progressively reduced ability to walk. Surgery with undercutting decompression via laminotomy was performed. PD was confirmed by biopsy. Bisphosphonate treatment was continued pre- and postoperatively. Follow-up examinations showed an improvement in clinical outcome measures.
Conclusions Conservative treatment remains the gold standard for PD with spinal involvement. This patient had been asymptomatic on bisphosphonate therapy for almost 17 years, but presented with new onset back pain. In such cases, fracture and rare conversion into sarcoma must be ruled out, and biopsy should be performed even in the absence of signs of malignancy. Currently, there are no clear treatment recommendations available in the literature regarding cases of PD with expansive growth and involvement of the spinal canal causing neurologic deficits. Furthermore, laminectomy has been shown to cause complications in up to 27% of cases with the risk of early postoperative death. In contrast, extended laminotomy and undercutting decompression should be considered.

Keywords Paget's disease · Bisphosphonates · Lumbar stenosis · Neurogenic claudication · Spinal decompression

✉ Nicolas Heinz von der Höh
Nicolas.vonderHoeh@medizin.uni-leipzig.de

Extended author information available on the last page of the article

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Case presentation

A 58-year-old man presented with a 6-month history of severe low back pain. He was diagnosed with PD involving the fourth lumbar vertebra in 1998, confirmed by biopsy. Since then, the patient has been managed using conservative treatment, including medical therapy with corticosteroids, bisphosphonates and methotrexate. He has been undergoing periodic clinical and radiological examinations over a period of 18 years.

The patient presented with symptoms of claudication with a walking distance of 60 m. Clinical examination showed unremarkable findings of the spine and normal neurologic status, without radicular pain or paralysis and no problems in bladder or bowel control in particular. The patient's medical history was significant for hypertension, atrial fibrillation treated with cardioversion, hyperthyroidism, hyperlipoproteinemia and obesity (BMI 31.5 kg/m^2). Physical examination was normal.

Bone-specific alkaline phosphatase (54.9; 3.7–20.9 µg/l), alkaline phosphatase (2.67 µkat/l) and C-reactive protein (5.01 mg/l) were increased on the day of admission.

X-rays of the lumbar spine in two planes and a CT scan showed increased vertebral body expansion of the fourth vertebra.

Diagnostic imaging section

Radiographs revealed a relatively lucent density of the fourth vertebral center, but increased density in the periphery. CT showed involvement of the entire vertebra, including the processus spinosus and the vertebral body, with enlargement of the vertebral body and abnormalities in the shape of the vertebra. The vertebral body appeared to have multiple sclerotic foci of compact bone with thorny edges and a bone-within-bone picture. The sagittal profile showed a biconcave deformity of the vertebral endplates with the same height at the anterior and posterior

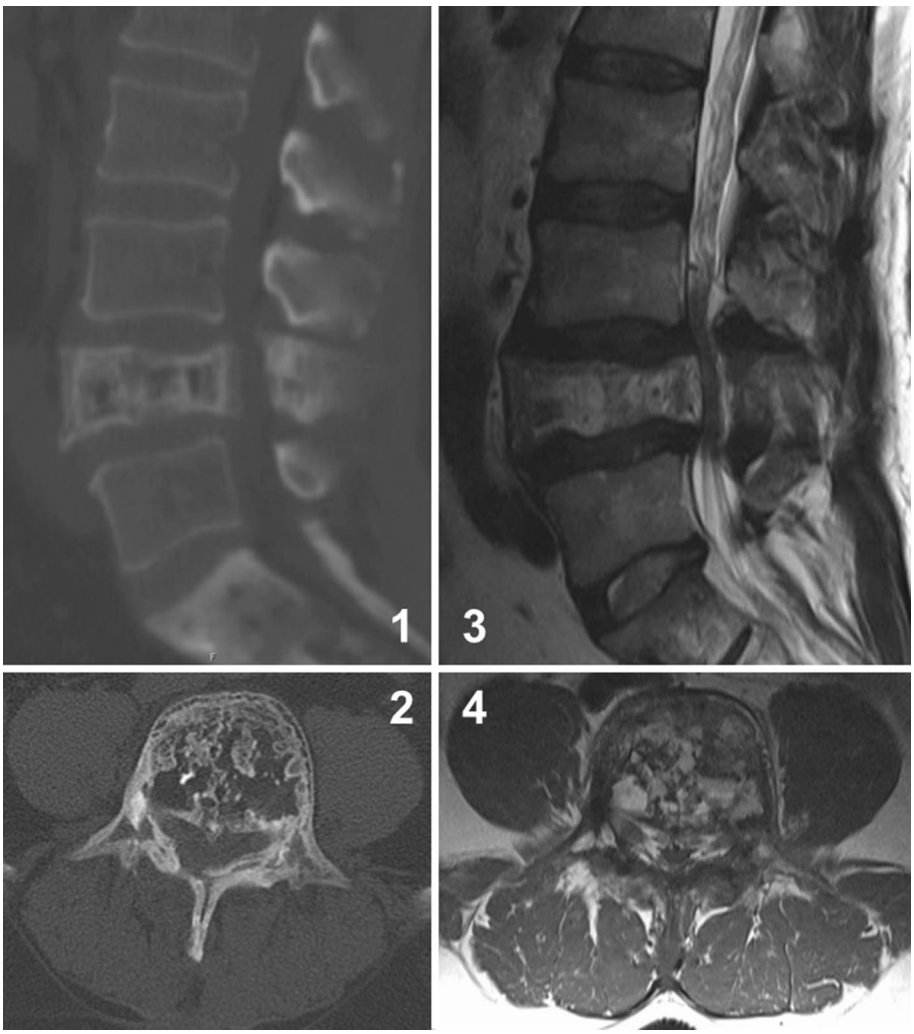

Fig. 1 CT scan images (1—sagittal; 2—transverse): biconcave deformity of the vertebral endplates; enlargement of the vertebral body with multiple sclerotic foci of compact bone; MRI (T2; 3—sagittal; 4—transverse): spinal canal stenosis with subtotal stenosis at L3/L4 and L4/L5 affecting both nerve roots of L3 and L4

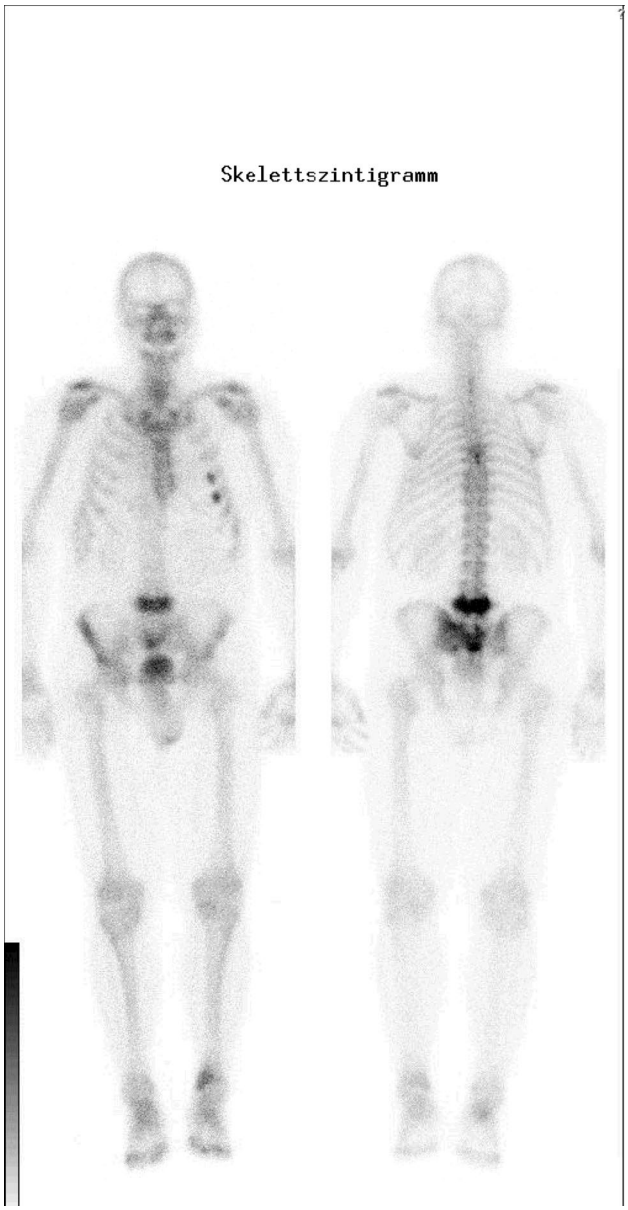

Fig. 2 Bone scintigraphy (SPECT) with involvement of the processus spinosi of T7 and S1

endplates (Fig. 1). MR images showed spinal canal stenosis with subtotal stenosis of 4 mm at L3/L4 and 6 mm at L4/L5 affecting both nerve roots of L3 and L4. The affected vertebral bodies had diffuse bone sclerosis, marrow edema, local fatty foci and sclerotic spots. Bone scintigraphy (SPECT) was performed to rule out further foci and showed solid involvement of the processus spinosi at T7 and S1 (Fig. 2). No pathological collapse was observed on CT or MR images.

Historical review, epidemiology, diagnosis, pathology and differential diagnosis

Paget's disease (PD) was first described in 1877 as "osteitis deformans" by Sir James Paget. In Europe, the prevalence of PD is 0.3%, but is decreasing in most regions. The prevalence of PD is higher in men and increases with age. PD also appears to have hereditary influences [7].

The spine is one of the most affected sites in PD [3], and most reported cases describe the involvement of only one vertebra.

Lumbar involvement is reported in 53% of cases [8]. PD of the spine is typically asymptomatic, but becomes symptomatic in one-third of patients [2]. The lumbar spine, especially L4 and L5, is most commonly involved. Overall, symptomatic spinal stenosis in PD remains rare. Pain and progressive spinal stenosis are the main symptoms of PD affecting the spine [4].

Pestka et al. [6] found 101 cases of PD involving the spine among a cohort of 754 patients, with polyostotic skeletal manifestation in 62 patients (61.4%) and monostotic involvement in only 39 patients (38.6%).

For differential diagnosis, the presence of hemangioma, metabolic processes such as renal osteodystrophy and primary hyperparathyroidism, fibrous dysplasia, lymphoma or metastatic neoplasm should be thoroughly investigated [5].

Malignant conversion to a rare sarcoma has a reported incidence varying from 0.3 to 10% [5]. Malignancy must be ruled out by biopsy when the diagnosis is unclear or in cases of pathologic fracture or rapid progression after a long period of disease control. Computed tomography-navigated percutaneous transpedicular biopsy is an effective and reliable method to confirm the diagnosis of PD [9].

Rationale for treatment

The present patient was first diagnosed with PD in 1998. He was asymptomatic for almost 17 years, but presented with a 6-month history of back pain. With conservative treatment remaining the gold standard of therapy for PD with spinal involvement, bisphosphonate therapy was initiated in 1998 without interruption.

The use of bisphosphonates can prevent the need for surgery; in this case, medical therapy with bisphosphonates remained successful for nearly 2 decades. The use of bisphosphonates is intended to prevent complications of PD such as deformity and spinal cord dysfunction. As a result, a Cochrane protocol was developed in 2014 to assess the benefits of bisphosphonates in improving

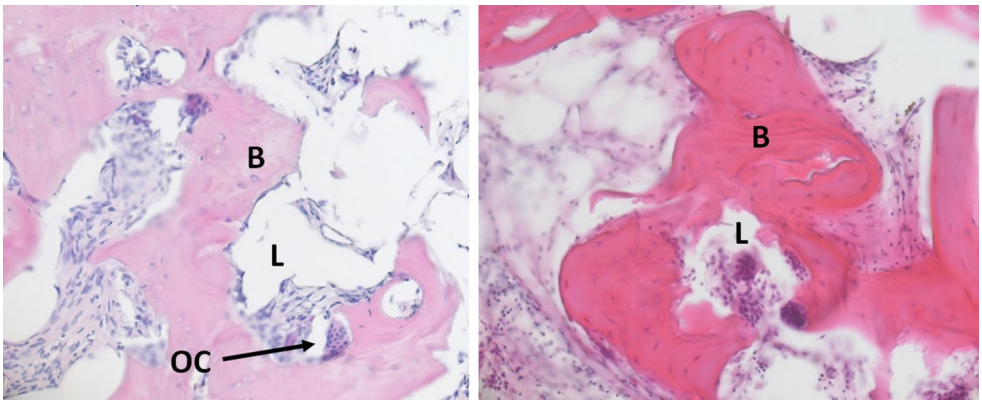

Fig. 3 An increased number of osteoclasts (OC) advancing at the interface of irregularly thickened bony trabeculae (B = bone; L = resorption lacuna) (HE, EwE, magnification 100×)

clinical outcomes and preventing complications of bisphosphonate therapy in adults with PD [1]. However, long-term studies over 10 years are very rare and symptomatic patients who undergo decompression surgery are at risk of major complications such as death [4].

The use of bisphosphonates preoperatively may reduce the rates of postoperative hematoma and complications, but the effects of bisphosphonate therapy on blood loss have not been studied in a controlled trial.

Complications of PD include spinal stenosis with clinical symptoms, neurologic deficits and vertebral collapse. In cases of PD causing neurologic deficits due to spinal stenosis, we found no clear surgical treatment recommendations in the literature. Cases of refractory pain and an intolerable decrease in walking distance should be considered for surgery.

On the day of admission, the patient showed symptoms of a progressive reduced ability to walk due to claudication and pain (VAS 6). Thus, treatment with biopsy and decompression surgery was determined to be the best course of action in our interdisciplinary tumor board session.

Laminectomy has been shown to cause complications in up to 27% of cases with the risk of early postoperative death and severe neurologic complications [4].

Due to the high complication rate in the literature, we performed an extended laminotomy and undercutting decompression of the lamina.

Operative procedure

Surgery was performed under general anesthesia with the patient in a prone position on a Wilson frame using an open dorsal midline approach from L3 to L5. The interlaminar window L3/L4 and L4/L5 was carefully exposed and dissected from soft tissue. We saw hypertrophic facet joints

Table 1 Follow-up: decreased ODI score, reduced pain and full recovery in his activities of daily living

FU	VAS	ODI	Walking distance (m)	Diagnostics
Pre-op	6		60	CT, MRI, X-ray
3 months	4	14	2000	X-ray
6 months	3	6	2000	X-ray
12 months	2	4	3000	CT, MRI, X-ray
24 months	2	4	5000	X-ray

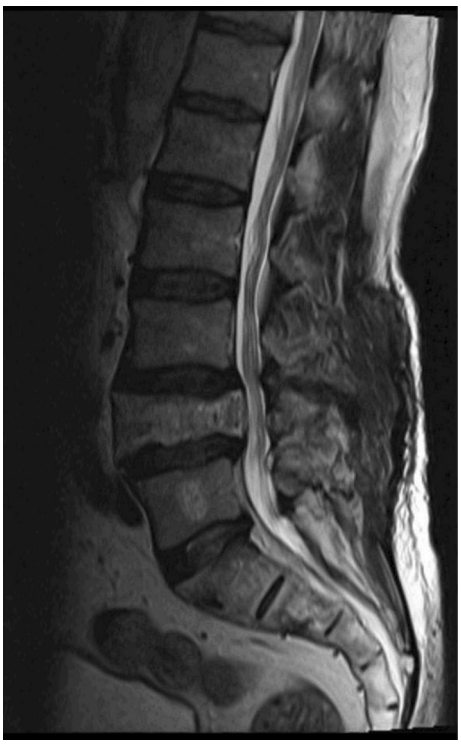

Fig. 4 Postoperative MRI after decompression

with cyst attached to the dura and a hypertrophic ligamentum flavum. The thickened ligamentum flavum was dissected near L4/L5 on the left-hand side. Subsequently, undercutting decompression was done toward cranial, caudal and lateral, whereby we had to substantially decompress toward lateral. We next carefully exposed the nerve root. The cyst lied down tight on the dura and was dissected using the dissector and the alligator forceps. The similar process was done at L3/L4 on the right-hand side and at L4/L5 on both sides. Subsequently, the lamina was dissected from cranial to achieve a sufficient sublaminary decompression. The total blood loss was 150 mm. We found no peri- and postoperative complications. The patient was allowed to walk the first day postsurgery; two drains were removed on day 2 after surgery.

Clinical outcome

Diagnosis was confirmed by histopathology without signs of malignant conversion. An increased number of osteoclasts advancing at the interface of normal bone were found, which is typical of Paget's disease of the bone (Fig. 3). The patient was discharged on the seventh postoperative day with moderate pain (VAS 4). Postoperative management included medical therapy with bisphosphonates, corticosteroids and leflunomide. Follow-up care included orthosis for 4 weeks and physical therapy for 3 months.

During postoperative follow-up, medical history, patient satisfaction, pain (VAS), walking distance and the Oswestry Low Back Pain Disability Questionnaire (ODI) were evaluated at 3, 6, 12 and 24 months after surgery.

At the final follow-up visit (Table 1), the patient had complete improvement in claudication, decreased ODI score (14–4), reduced pain (VAS 2–3) and full recovery in his activities of daily living. No disease progression was seen on MRI 12 months after decompression (Fig. 4). Walking distance increased to 5000 m 24 months after the operation.

Compliance with ethical standards

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

Informed consent All authors confirmed consent for publication.

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Affiliations

Alexander Hofmann[1] · Sabine Opitz[2] · Christoph Eckhard Heyde[1] · Nicolas Heinz von der Höh[1]

[1] Department of Orthopaedic, Trauma and Plastic Surgery, University Hospital Leipzig, Liebigstr. 20, 04103 Leipzig, Germany

[2] Department of Pathology, University Hospital Leipzig, Liebigstr. 26, 04103 Leipzig, Germany