

Case report

Metastasis in vertebra mimicking acute compression fractures in a patient with osteoporosis MRI findings

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Abstract

Elderly patients who have osteoporosis and a cancer history with backache and vertebral fractures are diagnostic challenges. We present a case of an 87-year-old man who complained of severe low-back pain with radiation to the lower limbs and weakness of the lower limbs. The patient had had a fall on a bus 1 month before admission. The patient also had a history of colon cancer and had received a colostomy 9 years before. In this admission, lumbar spine radiographs showed compressive fractures of vertebral bodies at L1 and L3. Magnetic resonance imaging (MRI) showed hyperemic change of the L3 marrow with osteonecrosis (fluid sign). The ventral thecal sac was slightly compressed due to retropulsion of L3. The L1 marrow was normal. Bone densitometry of the calcaneus revealed osteoporosis. The patient was then treated by vertebroplasty and bilateral foraminotomy of L3 after a diagnosis of acute compressive fracture. On histology, there was a metastatic adenocarcinoma arranged in glands and nests in the bone and paraspinal soft tissue. On retrospective viewing, an axial gadolinium-enhanced MRI revealed paraspinal extension of soft tissue at L3, which is highly suggestive of metastasis in a vertebra. © 2005 Elsevier Inc. All rights reserved.

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1. Introduction

Elderly patients who have osteoporosis and a cancer history with backache and vertebral fractures are diagnostic challenges. Magnetic resonance imaging (MRI) can be helpful to determine the cause of vertebral collapse. Although several recent studies [1–4] have applied new MRI techniques in assessing vertebral collapse, routine evaluation of vertebral collapse commonly uses conventional spin-echo MRI. Patients with benign and malignant vertebral collapses can be distinguished by morphologic and signal-intensity criteria on conventional MRI [5–7]. However, diagnostic difficulty may exist when there is metastasis in

an osteoporotic vertebra. We present such a case of a vertebral collapse due to metastasis mimicking osteoporotic acute fracture.

2. Case report

An 87-year-old man complained of severe low-back pain with radiation to the lower limbs and weakness of the lower limbs. The patient had had a fall on the bus 1 month before admission. The patient also had a history of colon cancer (stage unknown) and had received a colostomy 9 years before. In this admission, neurological examination showed limitation of back motion and claudication. Lumbar spine radiographs showed compressive fractures of vertebral bodies at L1 and L3. MRI (1.5-T, Horizon LX, General Electric) of the lumbar spine showed hyperemic change of the vertebral bone marrow at L3 with central osteonecrosis (fluid sign) (Fig. 1A–D). The ventral thecal

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Fig. 1 (A) Sagittal T1-weighted (TR/TE=700/11.8 ms) image shows diffuse low signal intensity within the vertebral body of L3 and preservation of normal signal intensity of L1. Both vertebrae are collapsed. Note retropulsion of the posterior vertebral margin at L3. (B) Sagittal T2-weighted (TF/TE=3000/119 ms) image shows presence of fluid sign (arrow) in the anterior portion of the vertebral body of L3, suggesting a necrotic zone, and L1 with isointense signal. (C) Sagittal T1-weighted (TR/TE=566/11.8 ms) image with fat saturation after gadolinium administration shows high signal intensity of L3 and L1 with areas of necrosis (arrow). (D) Axial T1-weighted (TR/TE=616/10.3 ms) image with fat saturation after gadolinium administration shows enhancing soft-tissue mass (arrow) in the left side of the vertebra of L3. (E) Metastatic adenocarcinoma arranged in a glandular structure (arrow) in the bone tissue (H&E, $\times 200$). (F) Metastatic adenocarcinoma composed of markedly pleomorphic tumor cells (H&E, $\times 400$) (G) Metastatic adenocarcinoma (arrow) in the fibrotic stroma of the marrow spaces (H&E, $\times 100$).

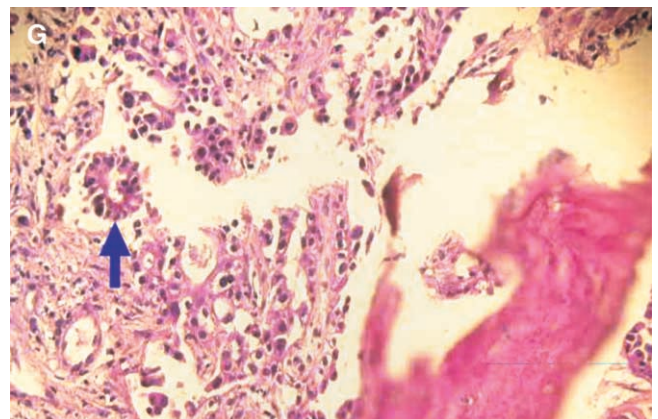
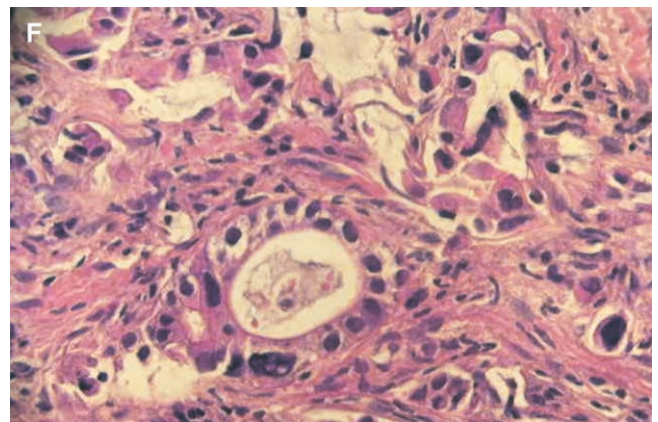
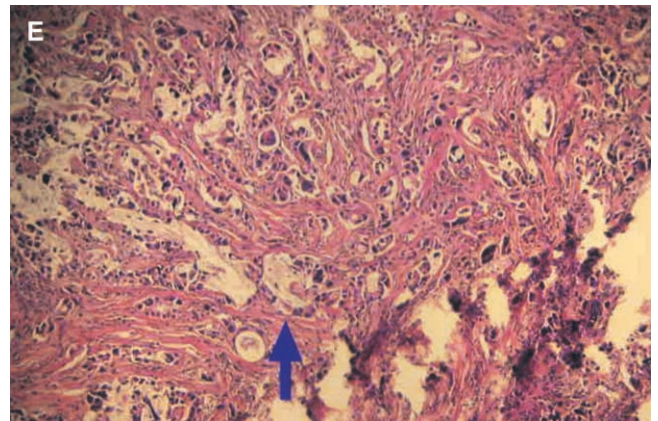
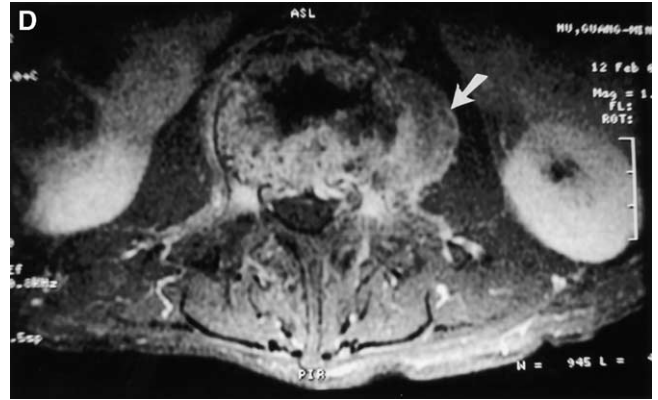


Fig. 1 (continued).

sac was slightly compressed due to retropulsion of L3. The vertebral marrow of L1 was normal. Bone densitometry of the calcaneus revealed osteoporosis (219 mg/cm²; T score, -3.44). Chest radiography and ultrasound of the abdomen revealed normal.

The patient was then treated with vertebroplasty and bilateral foraminotomy at the L3 level after a diagnosis of benign acute compressive fracture. On histology, there was a metastatic adenocarcinoma arranged in glands and nests in the bone and paraspinal soft tissue (Fig. 1E–G). The patient's symptoms had improved well except for local tenderness and poor wound healing after the operation.

Follow-up computed tomography 6 months after surgery showed collapse of the vertebral bodies at L1 and L3. Bony destruction of the left-sided pedicle and vertebral body at L3 was noted.

3. Discussion

Distinguishing collapsed vertebrae of benign cause from metastasis is critical in management of patients. The common benign causes of vertebral collapse include osteoporosis, trauma, and infection. In patients with benign vertebral collapse with minimal or no trauma and without clinical and radiological features of infection, osteoporosis is considered the most likely cause.

Osteoporotic fracture is a common disease in elderly patients. Conventional spin-echo MRI findings suggestive of osteoporotic vertebral fractures include retropulsion of bone fragments, preservation of normal signal intensity on T1-weighted images, return to normal signal intensity after gadolinium administration, with horizontal bandlike patterns, and isointense signal vertebrae on T2-weighted images [7]. In fractured vertebral bodies, the fluid sign is adjacent to the fractured end plates and the signal is isointense with that of cerebrospinal fluid. The fluid sign can help to suggest an acute compressive fracture and rarely occurs in metastasis [5].

Infectious spondylitis is characterized by the involvement of two adjacent vertebrae of having severe bone marrow edema and early destruction of the end plates. The disk space is narrowed and typically exhibits water-equivalent signal intensity on T2-weighted or short-tau inversion recovery (STIR) images. Paravertebral and epidural extensions, abscess formation, enhancement of bone marrow, the disk space, and the surrounding granulation tissue are well demonstrated by gadolinium-enhanced images [8].

Vertebrae with metastasis have low-signal-intensity marrow on T1-weighted images in 77% of cases, and exhibit rough, round areas of low signal intensity in adjacent noncollapsed vertebrae (63%) [7]. At least 50% or complete marrow involvement has been seen in 82% of the malignant vertebral collapses [6]. The demonstration of unsuspected metastases at other sites makes it more likely to be the cause of the fracture. The presence of an epidural soft-tissue mass

is specific for malignant vertebral collapse, with a relatively high sensitivity (80%) [7]. An expansile convex posterior cortex and the variable of low-signal-intensity pedicles on T1-weighted images have additional high predictive value for metastasis in vertebrae [7].

In our case, some clinical and MRI data may have misled us to the diagnosis of benign acute compressive fracture at L3. These data included the clinical history of trauma, osteoporosis determined by bone densitometry, and two collapsed vertebrae: the L3 with fluid sign, the L1 with intact fatty marrow. In retrospect, the paraspinal enhancing soft-tissue mass at L3 is highly suggestive of malignancy.

Recent researchers have reported that new MRI techniques have potential value in differentiating benign from malignant acute vertebral compressive fractures. These techniques include apparent diffusion coefficients (ADCs) [1,2], gadolinium-enhanced dynamic MRI studies [3], and opposed-phase gradient-echo sequences [4]. Further proper studies of these techniques to fully understand the diagnostic accuracy and underlying mechanism are needed before adding them to the routine protocol of MRI of the spine.

In summary, a case such as ours with cancer history, minor trauma, and osteoporotic compressive fractures of two vertebrae may be shown on conventional MRI. However, when one malignant sign occurs (such as paraspinal soft-tissue extension or mass), vertebral collapse due to metastasis should be considered, and a biopsy or short-term MRI follow-up is needed.

References

- [1] Chan JHM, Peh WCG, Tsui EYK, Chau LF, Cheung KK, Chan KB, Yuen MK, Wong ETH, Wong KPC. Acute vertebral body compression fractures: discrimination between benign and malignant causes using apparent diffusion coefficients. *Br J Radiol* 2002;75:207–14.
- [2] Spuentrup E, Buecker A, Adam G, Vaals JJ, Guenther RW. Diffusion-weighted MR imaging for differentiation of benign fracture edema and tumor infiltration of the vertebral body. *AJR Am J Roentgenol* 2001;176:351–8.
- [3] Chen WT, Shih T, Chen RC, et al. Blood perfusion of vertebral lesions evaluated with gadolinium-enhanced dynamic MRI: in comparison with compression fracture and metastasis. *J Magn Reson Imaging* 2002;15:308–14.
- [4] Zampa V, Cosottini M, Michelassi MC, Ortori S, Bruschini L, Bartolozzi C. Value of opposed-phase gradient-echo technique in distinguishing between benign and malignant vertebral lesions. *Eur Radiol* 2002;12:181–8.
- [5] Baur A, Stabler A, Arbogast S, Duerr HR, Bartl R, Reiser M. Acute osteoporotic and neoplastic vertebral compression fractures: fluid sign at MR imaging. *Radiology* 2002;225:730–5.
- [6] Tan DYL, Tsou IYY, Chee TSG. Differentiation of malignant vertebral collapse from osteoporotic and other benign causes using magnetic resonance imaging. *Ann Acad Med Singapore* 2002;31:8–14.
- [7] Cuenod CA, Laredo JD, Chevret S, et al. Acute vertebral collapse due to osteoporosis or malignancy: appearance on unenhanced and gadolinium-enhanced MR images. *Radiology* 1996;199:541–9.
- [8] Stabler A, Reiser MF. Imaging of spinal infection. *Radiol Clin North Am* 2001;39:115–35.