

Bisphosphonate-associated atypical femoral fracture with preceding cortical reaction

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Section: Musculoskeletal system

Area of Interest: Musculoskeletal bone Bones

Procedure: Diagnostic procedure

Procedure: Decision analysis

Special Focus: Metabolic disorders Case Type: Clinical Cases

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Patient: 62 years, female

Clinical History:

This patient presented subacutely with left thigh pain for two months, and had an outpatient plain pelvic radiograph (Fig. 1).

She later presented acutely to the hospital after a short interval of having "heard a loud crack" in the left leg, then fallen, with no preceding trauma. At this point repeat radiography was performed (Fig. 2).

Imaging Findings:

The outpatient radiograph was initially assessed as normal. Although indeed not demonstrating any femoral or pelvic fracture, it did in fact show focal cortical thickening of the left lateral proximal femur (Fig. 1).

At this site, one week later, a complete transverse fracture of the proximal femur was seen with some displacement (Fig. 2), with features consistent with atypical femoral fracture.

Fig. 3 shows the American Society of Bone and Mineral Research criteria for this classification of fracture.

Discussion:

A. Background

The concept of atypical femoral fracture in those receiving bisphosphonate therapy is well-known. Focal cortical reaction at the fracture site may represent an early stage of disease that is radiologically detectable and hence present the opportunity for prompt treatment. In a cohort of 33 morphologically similar fractures, a majority had prior bisphosphonate therapy and around half demonstrated a lateral cortical thickening reaction on pre-fracture imaging [1].

B. Clinical Perspective

Bisphosphonates remain clinically useful in the treatment of osteoporosis and other conditions reducing bone density, and although the overall total rate of fracture is markedly reduced with their use [2], there is a concurrent increased risk of the atypical-type fracture described here [3]. Judicious use of imaging and a high index of suspicion are warranted when these patients present with thigh pain [1].

This particular patient was prescribed bisphosphonates (alendronic acid 70mg PO weekly) for over 10 years, to reduce fracture risk from long-term oral corticosteroid therapy for a connective tissue disorder. Alertness to fracture risk in this context may have allowed for early diagnosis/prophylactic fixation.

C. Imaging Perspective

The diagnosis of bisphosphonate-associated atypical fracture is made when a patient with a history of bisphosphonate use presents with a transverse fracture at the metaphyseal-diaphyseal junction, in the subtrochanteric region of the femur. This occurs commonly in post-menopausal women, but has also been reported in men [11, 13].

The preceding lateral cortical stress reaction has an uncertain pathophysiological correlate but probably represents chronic microfractures in the context of oversuppressed bone remodelling [4, 5].

Similar appearances may be seen on CT, and there are also diagnostic features on radionuclide imaging [6] and MRI [7].

D. Outcome

Patients with bisphosphonate-associated atypical femoral fractures are treated per the standard for subtrochanteric fractures in general; that is internal fixation, usually intramedullary nail [8]. Operative intervention improves outcomes [9], but does not always prevent progression [10] and there is a higher failure and revision rate compared to typical fractures [11], presumably due to the underlying disordered bone metabolism.

E. Take Home Message, Teaching Points

Clinicians should be aware of the association between bisphosphonate use and atypical femoral fracture, and suspect this pathology in patients who report insidious groin or hip pain. Mean duration of preceding bisphosphonate therapy is circa 5-9 years [9, 12].

Radiologists should be alert to the possibility of detecting a pre-fracture lesion, usually a cortical reaction of the lateral cortex, before progression to full fracture.

Written informed patient consent for publication has been obtained.

Differential Diagnosis List: Bisphosphonate-associated atypical femoral fracture with preceding cortical reaction, Insufficiency fracture, Pathological fracture

Final Diagnosis: Bisphosphonate-associated atypical femoral fracture with preceding cortical reaction

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Figure 1

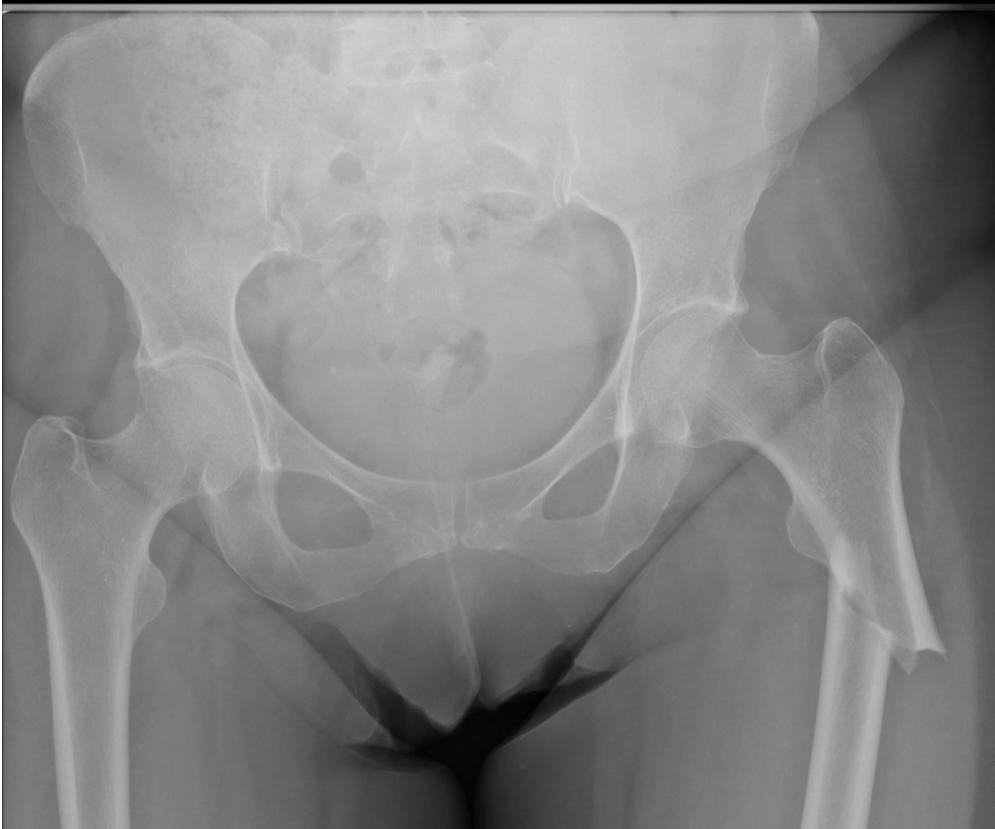
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Description: Outpatient frontal pelvic radiograph of a 62-year-old female, performed due to left thigh pain. **Origin:** Department of Radiology, Broomfield Hospital, Chelmsford UK

Figure 2

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Description: Frontal pelvic radiograph of the same patient, presenting with severe pain and a fall, performed one week later. **Origin:** Department of Radiology, Broomfield Hospital, Chelmsford, UK

Figure 3

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Table 3. ASBMR Task Force 2013 Revised Case Definition of AFFs

To satisfy the case definition of AFF, the fracture must be located along the femoral diaphysis from just distal to the lesser trochanter to just proximal to the supracondylar flare.

In addition, at least four of five Major Features must be present. None of the Minor Features is required but have sometimes been associated with these fractures.

Major features^a

The fracture is associated with minimal or no trauma, as in a fall from a standing height or less

The fracture line originates at the lateral cortex and is substantially transverse in its orientation, although it may become oblique as it progresses medially across the femur

Complete fractures extend through both cortices and may be associated with a medial spike; incomplete fractures involve only the lateral cortex

The fracture is noncomminuted **or minimally comminuted**

Localized periosteal or endosteal thickening of the lateral cortex is present at the fracture site (“beaking” or “flaring”)

Minor features

Generalized increase in cortical thickness of the **femoral diaphyses**

Unilateral or bilateral prodromal symptoms such as dull or aching pain in the groin or thigh

Bilateral **incomplete or complete femoral diaphysis fractures**

Delayed **fracture** healing

Changes are in bold.

ASBMR = American Society for Bone and Mineral Research; AFF = atypical femur fracture.

^a**Excludes** fractures of the femoral neck, intertrochanteric fractures with spiral subtrochanteric extension, periprosthetic fractures, and pathological fractures associated with primary or metastatic bone tumors and miscellaneous bone diseases (eg, Paget’s disease, fibrous dysplasia).

Description: American Society of Bone and Mineral Research criteria for the diagnosis of atypical femoral fracture [13] **Origin:** See reference #13