An atypical presentation of a femur fracture

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A 56-year-old woman with a past medical history significant for sarcoidosis, hypertension, and osteoporosis presented to the ED via emergency medical services after sustaining a right leg injury in a fall at home. She said she was carrying groceries into her house when she tripped over the threshold, landing on a flexed right knee. She had immediate pain to her right thigh and was unable to bear weight. She denied any symptoms of syncope before the fall, had no loss of consciousness or neck pain, and denied any other injuries. Her medications include lisinopril 20 mg once daily and prednisone 10 mg once daily for the past several years. She took alendronate 10 mg once daily for 5 years for osteoporosis, but discontinued this drug about 8 months ago after bone mineral density testing revealed an improvement in her bone mass. Actual data from the testing were unavailable to the ED staff at the time of her visit.

On physical examination, she was a well-developed, well-nourished woman in moderate distress secondary to right thigh pain. She was in a cervical collar and a right leg traction splint. Despite a potentially distracting injury, her cervical spine was cleared clinically based on the low mechanism of injury, and cervical spine radiographs were not obtained. Extremity examination demonstrated a shortened right leg, with an obvious deformity to the mid-thigh. Skin was intact. Dorsalis pedis and posterior tibial pulses were 2+ and bounding. Sensation was intact to all regions. The remaining extremities were noted to be atraumatic. The rest of the physical examination was unremarkable.

After administration of parenteral analgesics, anteroposterior (AP) and lateral right femur radiographs were obtained (**Figures 1** and **2**). What would be most appropriate to order next?

- AP pelvis radiograph
- CT scan of the right femur
- MRI of the right femur
- Left femur radiograph

The correct answer is a left femur radiograph. The on-call orthopedic surgery resident was paged for the patient's

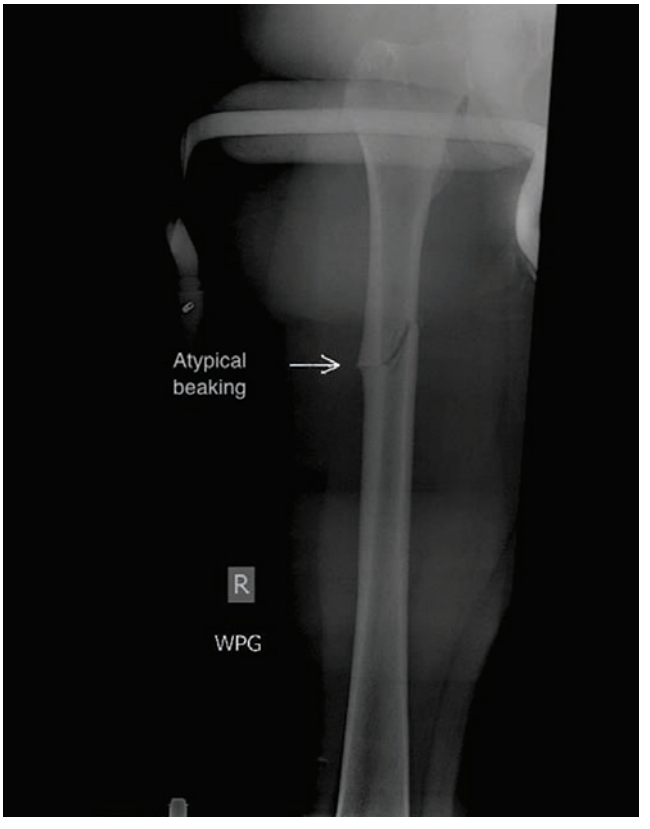

FIGURE 1. AP view of right femur showing atypical beaking

FIGURE 2. Lateral view of right femur

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right femoral shaft fracture. Before their arrival, the ED physician assistant (PA) was contacted by the radiologist, who noted some atypical beaking on the femoral cortex at the site of the fracture. As this finding can be a result of long-term bisphosphonate use, he recommended imaging of the contralateral femur. AP and lateral left femur radiographs were obtained, and demonstrated similar beaking at the junction of the proximal and mid-third of the femoral shaft, significant for impending fracture.

Initial radiographs of this patient's right femur demonstrated characteristics consistent with long-term bisphosphonate use.

The patient was admitted to the orthopedic surgery service and had successful intramedullary nail placement for her acute right femoral shaft fracture. Postoperatively, she was made weight-bearing as tolerated on her surgically repaired right leg and was partial weight-bearing on her left leg. She had an elective intramedullary nail placed in her left femur 6 weeks later as prophylaxis against the impending fracture at this site. She did well postoperatively with no further complications.

DISCUSSION

Initial radiographs of this patient's right femur demonstrated characteristics consistent with long-term bisphosphonate use. Before a fracture becomes complete, these findings can be subtle and easily overlooked.[1] The imaging findings are unique when compared to other types of insufficiency fracture, such as stress fractures or pathologic fractures. Bisphosphonate-induced insufficiency fractures initially show cortical thickening within the lateral cortex of the proximal femur where the majority of the tension occurs.[1] As the bisphosphonates continue to exert their action on the bony metabolism, the thickening can progress to the medial cortex, eventually leading to a transverse fracture. The other causes of insufficiency fracture will usually demonstrate changes at the medial cortex with areas of periosteal reaction, and in the case of pathologic fractures may show poorly defined lucent margins.[1]

Bisphosphonates are first-line therapy for patients with conditions characterized by increased osteoclast-mediated bone resorption, such as osteoporosis, Paget disease of the bone, osteogenesis imperfecta, and malignancy metastatic to bone.[2] The most common use by far is to reduce the risk of osteoporotic fractures and the associated increase in patient morbidity and mortality and increased healthcare costs that accompany such fractures.

Bisphosphonates act on the enzymes responsible for forming the cytoskeleton in osteoclasts, thereby strongly inhibiting bone resorption.[3] The drug has no significant effect on osteoblasts, which will continue to form new bone and fill in the pits associated with the weakened cortex. As bisphosphonate use continues, the existing bone matrix becomes packed more densely with little to no resorption, thereby reducing fracture risk.[3]

Initially, the main concern with bisphosphonate use was the common occurrence of adverse reactions, primarily gastrointestinal issues. As the prevalence of the class increased and the duration of therapy has increased, additional safety concerns have arisen. The medications remain active in bone for up to 10 years, and a growing concern is that of an oversuppression of bone turnover. This may impair the ability to repair skeletal microfractures, increasing skeletal fragility.[2] The incidence of atypical femur fractures, such as in the case patient, has continued to rise in patients on long-term bisphosphonates.

Numerous studies have shown that bisphosphonates offer broad-spectrum reduction of fracture risk not shown for other available agents.[4] Retrospective reviews evaluating atypical femur fractures have shown an apparent high prevalence of bisphosphonate use among patients with atypical femur fractures, but the absolute risk of an atypical fracture is small and the benefit-to-risk ratio is clearly in favor of treatment.[5] Various models are being evaluated to determine, if possible, an optimal duration of therapy. Most recommendations include a drug holiday after 5 years, and customizing the holiday and treatment regimen based on data evaluating the patient's risk of future fracture.

This patient presented with an unusual mechanism of injury for a femoral shaft fracture. Providers must investigate such discrepancies in patient history and diagnosis thoroughly. Through the combined efforts of the ED staff, radiology department, and orthopedic surgeons, additional imaging demonstrated an impending fracture, directly guiding our treatment, and avoiding a potentially catastrophic future injury. **JAAPA**

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