

4. Furlan A, Higashida R, Wechsler L, et al. Intra-arterial prourokinase for acute ischemic stroke. The PROACT II study: a randomized controlled trial: Prolyse in acute cerebral thromboembolism. *JAMA*. 1999; 282: 2003–11.
5. Smith WS, Sung G, Starkman S, et al. Safety and efficacy of mechanical embolectomy in acute ischemic stroke: results of the MERCI trial. *Stroke*. 2005; 36: 1432–40.

*Chad Thompson, MD, is a staff VIR at Mercy Hospital in Oklahoma City, OK.*

*Timothy Murphy, MD, is a Vascular Interventional Radiologist at Rhode Island Hospital, The Miriam Hospital, and Newport Hospital.*

*Christopher O. Hampson, MD, is a Vascular Interventional Radiologist at Rhode Island Hospital, The Miriam Hospital, and Newport Hospital.*

#### Disclosure of Financial Interests

The authors and/or significant others have no financial interests to disclose.

#### CORRESPONDENCE

Christopher O. Hampson MD  
Interventional Radiology  
Rhode Island Hospital  
phone: (401) 444 - 5184  
e-mail: champson@Lifespan.org

## Atypical Insufficiency Type Femoral Stress Fractures in Patient on Bisphosphonates

*Peter T. Evangelista, MD, and Scott M. Levine, MD*

**AN 86 YEAR-OLD WOMAN WITH HISTORY OF** inflammatory breast cancer and osteoporosis presented with progressive right leg weakness and discomfort. Her medication regimen included monthly Zometa (zoledronate) infusion. She was not on corticosteroids.

The patient underwent a right thigh MR imaging examination which demonstrated an incomplete mid femoral diaphyseal insufficiency-type stress fracture with lateral cortical thickening and triangular ridging (cortical beaking), incomplete transverse fracture line and

associated periosteal and endosteal marrow edema (Figure 1). Six days later on her way to her orthopedic appointment her leg gave out and she fell from standing. Radiographs at that time (Figure 2) demonstrated a complete transverse lateral to oblique medial

lateral to oblique medial femoral diaphyseal fracture at the site of the insufficiency-type stress fracture. This was treated with intramedullary nailing. Radiographs of the left femur (Figure 3) were obtained two weeks later and demonstrated a focal area of lateral cortical thickening in the proximal femoral diaphysis suspicious for stress reaction. The patient subsequently underwent prophylactic nailing of the left femur.



Figure 1. Coronal STIR image of the right thigh demonstrates incomplete right mid femoral diaphyseal insufficiency type stress fracture with lateral cortical thickening and triangular ridging (black arrow), incomplete transverse fracture line (white arrow) and periosteal and endosteal marrow edema (arrowheads).



Figure 2. Radiograph of the right proximal femur demonstrates a complete transverse lateral to oblique medial femoral diaphyseal fracture (arrow).

#### DISCUSSION

Osteoporotic fractures are typically low in energy and involve the wrist, proximal humerus or tibia, pelvis, and hip; they do not typically occur in the subtrochanteric or proximal femoral diaphyseal region as this area requires the application of considerable force to fracture.<sup>1</sup> There have been several case reports describing patients who develop fractures of the subtrochanteric or diaphyseal region



Figure 3. Radiograph of the left femur demonstrates focal area of lateral cortical thickening (arrow) in the proximal femoral diaphysis.

of the femur in the setting of long-term bisphosphonate therapy in the setting of minimal trauma. A recent population based, nested case control study found that among older woman treated for five or more years with bisphosphonates there was an increased risk of subtrochanteric or femoral shaft fractures, although the absolute risk of such fractures was low.<sup>2</sup> A proposed mechanism for these atypical

fractures is inadequate osteoclast activity which impairs bone remodeling and repair of normally occurring microdamage.<sup>1</sup>

It is important that physicians have a high level of awareness of this entity. New onset thigh or hip pain in patients on long-term bisphosphonate therapy should be investigated with radiographs of the femur. Typical imaging features include focal cortical thickening laterally and classically with a triangular ridge or beak configuration along the subtrochanteric or diaphyseal region.<sup>3</sup> Subsequently a discrete cortical break may develop. Some have advocated for routine radiographs of the contralateral femur to investigate for contralateral stress reaction.<sup>1</sup> In the setting of heightened clinical suspicion, more advanced imaging with magnetic resonance imaging or bone scintigraphy should

be considered. Prophylactic intramedullary nailing should be strongly considered as bone remodeling is impaired and patients have an increased risk of fracture completion with low energy trauma. More studies are necessary to determine whether discontinuing bisphosphonates and limited weight bearing is an acceptable alternative treatment option in the setting of stress reaction.

In summary, bisphosphonates have clearly been demonstrated to decrease the risk of osteoporotic fractures. There is now strong evidence that prolonged bisphosphonate therapy is associated with an increased risk of atypical subtrochanteric or femoral diaphyseal fracture although the absolute risk of these fractures is low. High clinical awareness of this entity in patients on long-term bisphosphonates presenting with new onset thigh or hip pain is warranted.

## REFERENCES

1. Neviaser AS, Lane JM, Lenart BA, Edobor-Osula F, Lorch DG. Low-energy femoral shaft fractures associated with alendronate use. *J Orthop Trauma.* 2008;22:346–50.
2. Park-Wyllie, LY, Mamdani MM, Juurlink DN, Et al. Bisphosphonate Use and the Risk of Subtrochanteric or Femoral Shaft Fractures in Older Women. *JAMA.* 2011; 305 (8): 783–9.
3. Capeci CM, Tejwani NC. Bilateral Low-Energy Simultaneous or Sequential Femoral Fractures in Patients on Long Term Alendronate Therapy. *J Bone Joint Surg Am.* 2009; 91: 2556–61.

*Peter T. Evangelista, MD, is Director of Musculoskeletal Radiology at Rhode Island Hospital, and Assistant Professor of Diagnostic Imaging at the Warren Alpert Medical School of Brown University.*

*Scott M. Levine, MD, is Assistant Professor of Diagnostic Imaging (Clinical) at the Warren Alpert Medical School of Brown University.*

## Disclosure of Financial Interests

Peter T. Evangelista, MD is a consultant for Biomimetic Therapeutics, Inc.

Scott M. Levine, MD, and/or his significant other have no financial interests to disclose.

## CORRESPONDENCE

Peter T. Evangelista, MD  
Rhode Island Hospital  
593 Eddy Street  
Providence, RI 02903  
phone: (401) 444 5184  
fax: (401) 444 5017  
e-mail: pevangelista@lifespan.org

