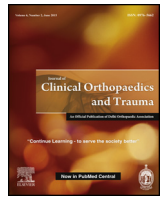




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# Journal of Clinical Orthopaedics and Trauma

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## Case report

# Progression of bisphosphonate-associated impending atypical femoral fracture despite prophylactic cephalomedullary nailing: A case report and review of literature

Aditya V. Maheshwari, Samantha J. Yarmis, Justin Tsai, Julio J. Jauregui\*

SUNY Downstate Medical Center, Department of Orthopaedic Surgery and Rehabilitation, Brooklyn, NY, United States

## ARTICLE INFO

### Article history:

Received 6 April 2016  
Received in revised form 1 May 2016  
Accepted 8 June 2016  
Available online xxx

### Keywords:

Bisphosphonates  
Atypical femur fractures  
Bisphosphonate associated fractures  
Pathologic fractures  
Stress fractures

## ABSTRACT

While bisphosphonates have been shown to be effective in reducing the incidence of typical osteoporotic fractures, long-term bisphosphonate may be associated with atypical femoral fractures. We report a case of a bisphosphonate-related impending atypical femoral fracture which progressed despite prophylactic cephalomedullary nailing. The fracture healed without further surgical intervention after correcting the patient's bone metabolic profile and stopping the possible offending factors. Although prophylactic fixation of these fractures is recommended, our case and relevant literature review demonstrate that a simple fixation without optimizing other possible predisposing factors may not prevent progression of these fractures.

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## 1. Introduction

Bisphosphonate-related atypical fractures of the femur (AFF) have distinct clinical and radiologic presentations, including prodromal pain, cortical hypertrophy, and unicortical “beaking”.<sup>1</sup> The recognition of these features provides opportunities for prophylactic fixation, which has been suggested as the treatment of choice for bisphosphonate-related AFF.<sup>2–4</sup> We present a case of AFF where the fracture progressed despite prophylactic fixation of the femur, and provide a review of literature on similar cases. The patient was informed that data concerning the case would be submitted for publication, and she consented.

## 2. Case report

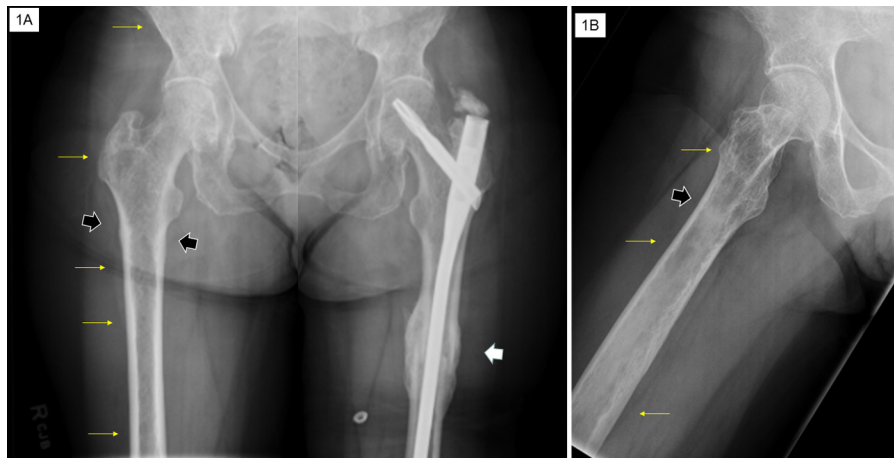
A 70-year-old African-American female (BMI 26.5) with a history of hypertension, hyperlipidemia, and multiple myeloma (MM) presented with worsening right hip/thigh pain for 3 months. Her MM was diagnosed one year previously after she had sustained a displaced pathologic fracture of her left femur. This had been

treated by a cephalomedullary nail followed by radiation (3000 cGy in 15 fractions) by a different surgeon (Fig. 1A). She was then placed on lenalidomide (25 mg, 21 days on/7 days off cycle) with dexamethasone 40 mg/week. She had been on alendronate 35 mg/week for 3 years, but was switched to monthly infusions of 4 mg zoledronic acid after the fracture and initiation of the myeloma treatment one year ago. A skeletal survey showed multiple lytic lesions in several long bones. In addition to the typical AFF related lateral cortical beaking in the subtrochanteric region on the right side, some cortical hypertrophy was also seen on the medial cortex (Fig. 1A and B). Although pathologic fractures are excluded from definition of AFF,<sup>5</sup> this appeared more like an AFF rather than a myeloma-related pathologic fracture because of its typical beaking, absence of a typical myeloma lytic lesion at the beaking site, and use of bisphosphonate. Because of her symptoms, multiple lytic lesions, increased risk for another pathologic fracture, and possible AFF, she was indicated for prophylactic cephalomedullary nailing (Gamma III, 12 mm × 400 mm × 125°, 2 distal locking screws, Stryker, Mahwah, NJ; Fig. 2A). Reamings sampled for MM were negative, but the tumor board recommendation was to radiate her femur/hemipelvis (3000 cGy × 15 fractions). Bisphosphonates were stopped, while her treatment for MM was continued.

Although she was asymptomatic, follow-up radiographs showed slight worsening of the subtrochanteric beaking with a

\* Corresponding author at: SUNY Downstate Medical Center, Department of Orthopaedics, 450 Clarkson Avenue, MSC 30, Brooklyn, NY 11203, United States. Tel.: +1 718 221 5270.

E-mail address: [juljau@gmail.com](mailto:juljau@gmail.com) (J.J. Jauregui).



**Fig. 1.** (A) AP radiograph of pelvis and proximal femur showed a healed fracture over a cephalomedullary nail on the left side (white arrow). On the right side, multiple permeative lesions are seen in the entire femur and pelvis (yellow arrows). A subtle beaking is also seen on the right side (black arrow). (B) A frog table lateral radiograph showed multiple permeative lesions in the entire femur and pelvis (yellow arrows). An area of sclerosis is also seen in the subtrochanteric region (black arrow).



**Fig. 2.** (A) AP radiograph of the proximal femur at one month postoperatively clearly showing the beaking and sclerosis on both sides (black arrow). (B) AP radiograph at 4 months postoperatively showing slight worsening of the beaking (black arrow). (C) The frog table lateral view showed a subtle radiolucent line, indicating a fracture line (black arrow).

radiolucent fracture line, more obvious on the oblique views (Fig. 2A–C). Blood work showed a low Vitamin D, 25-OH, total level of 16.4 µg/dl (normal: 30–95). Other results included a normal complete blood count, normal comprehensive metabolic profile, intact parathyroid hormone level (29.8 pg/ml, normal: 15–65), calcium (9.4 mg/dl, normal: 8.2–10), phosphate (3.5 mg/dl, normal: 2.5–4.5), alkaline phosphatase (35 U/L, normal: 34–104), C-reactive protein (<4 mg/L, normal: 0–8), and ESR (20 mm/h, normal: 0–30). A dual-energy X-ray absorptiometry (DEXA) scan of the lumbar spine showed mild osteopenia (T-score 1.2). The patient was then started on cholecalciferol 50,000 U/week for the next 12 weeks along with calcium supplements of 1000 mg/day. Because of history of skeletal malignancy, teriparatide was not

considered. She had no restriction in her activities and weight-bearing status.

Serial radiographs showed progression of her subtrochanteric fracture over a course of one year (Fig. 3A–C). Her vitamin D levels were 24.9 µg/dl after 4 months, and 28.9 µg/dl one year later after another 12 doses of 50,000 U/week. At 12 months postoperatively, her MM treatment was discontinued after a negative laboratory work-up and bone marrow biopsy. She was then maintained on 2000 U/day of cholecalciferol and 1000 mg/day of calcium. At 15 months postoperatively, the fracture began to heal (Fig. 3D), which consolidated at 18 months (Fig. 4A and B). At 55 months follow-up, radiographs showed further consolidation of the fracture and she remains myeloma-free and asymptomatic (Fig. 5A and B).

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