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## Case Report

# Femoral insufficiency fracture related to bisphosphonate use <sup>☆</sup>

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## ABSTRACT

This case report details the symptoms, diagnostic results, and surgical treatment of a 66-year-old woman who presented to the emergency department complaining of excruciating pain in her right leg after being injured while doing Pilates. After an accident involving a ball during a Pilates exercise, the patient reported feeling pain. Upon physical examination, the right leg was found to be shortened and externally rotated, with the foot's sensation and mobility unaffected. A displaced proximal subtrochanteric femur fracture was detected via plain film radiography.

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## Introduction

The third most frequent type of traumatic fracture is a proximal femur fracture [1]. People over the age of 65 are most commonly affected by proximal femur fractures (PFFs). A PFF frequently represents a transformative experience for elderly patients, depriving them of their already potentially compromised capacity for self-sustainability [2]. As the population ages, the prevalence of osteoporosis has increased, which has led to a parallel rise in fragility fractures linked to weakened bone quality and density, such as those of the spine, proximal

femur, proximal humerus, and distal radius. The social burden to society of treating bone fractures is substantial. The effects on a particular patient can range widely, including pain, job loss, and loss of mobility, and temporary disability [3].

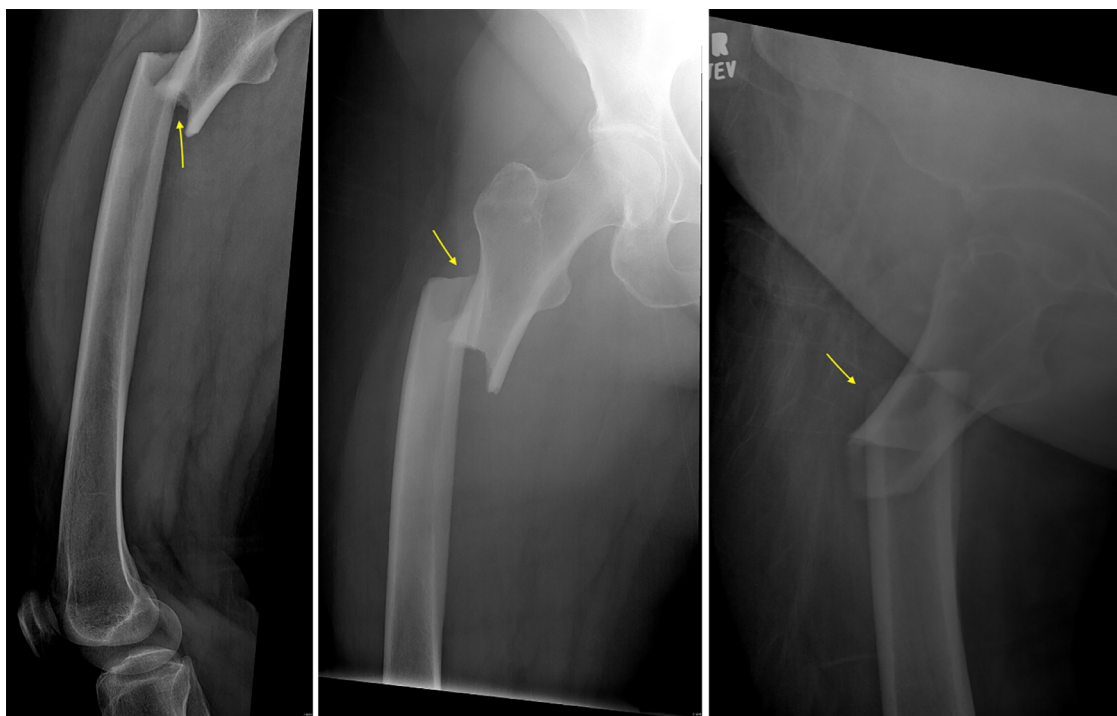
## Case

This is a 66-year-old lady who presented to the emergency department due to right leg pain. She was doing exercises

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E-mail address: [Latha\\_Ganti@Brown.edu](mailto:Latha_Ganti@Brown.edu) (L. Ganti).<https://doi.org/10.1016/j.radcr.2023.09.092>1930-0433/© 2023 The Authors. Published by Elsevier Inc. on behalf of University of Washington. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>)



**Fig. 1 – AP view radiograph of the pelvis demonstrates the right hip in neutral and external rotation with fracture of the proximal right femoral diaphysis with femoral dislocation and foreshortening of approximately 3.8 cm. No radiopaque foreign object identified. Bone density is within normal limits.**

prescribed to her by physiotherapy due to a prior back injury. She had her knee on a small ball and then leaned forward. The ball rolled forward and pulled her leg with it. She did not injure any other part of her body. She stated that besides this acute episode, she was otherwise in her usual state of good health. Her past medical history was significant for back injury, chronic right leg pain, hyperlipidemia, hypothyroidism, and osteoporosis, for which she was on alendronate 70 mg once weekly.

She denied any fevers, chills, chest pain, shortness of breath, nausea, vomiting, diarrhea, abdominal pain, headache or urinary symptoms. Physical examination revealed an externally rotated and shortened right leg. The patient was able to wiggle her toes. Dorsalis pedis and posterior tibial artery pulses were intact, as was sensation to her lower extremity. She reported the pain to be constant, improved with rest, and exacerbated by movement, radiating to her thigh. Vitals signs were temperature 36.7°C, pulse 78 beats per minute, blood pressure 131/68 mm Hg, respirations 16 breaths per minute, and pulse oximetry 100% on room air. Laboratory analysis including complete blood count, chemistry panel and coagulation studies were unremarkable.

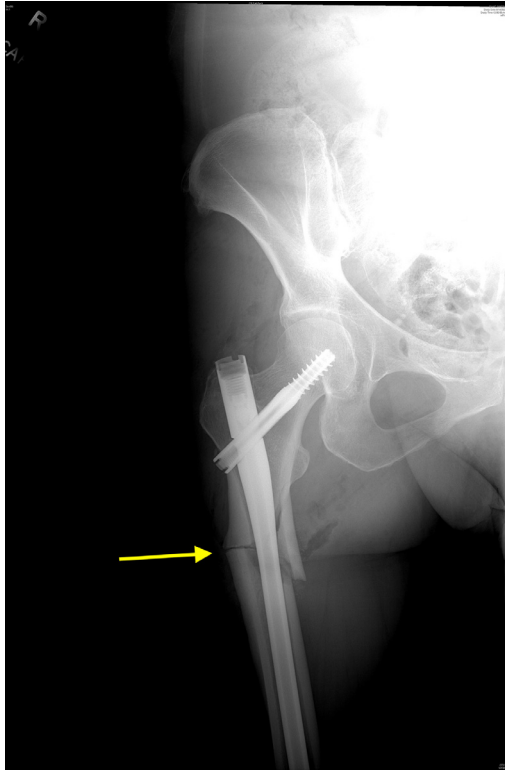
Radiographs of the knee, hip, pelvis, and chest were negative for any acute pathology. Radiograph of the femur revealed a subtrochanteric femur fracture with femoral dislocation and foreshortening of approximately 3.8 cm. There was no associated fracture or dislocation of the right hip or right knee (Fig. 1).

The patient was taken to the operating room and the fracture was reduced under fluoroscopy. Subsequently, an appro-



**Fig. 2 – Radiograph depicting placement of a lag screw within the femoral head and a distal locking screw.**

prate length and size gamma nail was selected and advanced over a ball-tipped guide-wire in a standard fashion. This was followed by placement of a lag screw within the femoral head and a distal locking screw (Fig. 2). The patient tolerated the procedure well and was discharged home on postopera-



**Fig. 3 – Radiograph status post-ORIF depicting intramedullary rod with proximal and distal fixation screws. Fracture fragments are in near anatomic alignment. Gas in the soft tissues reflects postsurgical changes.**

tive day 3, with a wheelchair, beside commode, and rolling walker. Postoperative radiographs demonstrated a right subtrochanteric comminuted femur with intramedullary rod with proximal and distal fixation screws. Fracture fragments were in near anatomic alignment (Fig. 3).

## Discussion

Lower extremity fractures are considered the most limiting in both function and quality of life. The time required for the bone to fully heal can take 6-8 weeks and determines the patient's period of immobility. Through the process of mechanotransduction, which involves signal transduction across the cell membrane, forces at the fracture site are influenced by mechanical loading. Cells respond to mechanical stimuli in the extracellular matrix. Depending on the size of the fracture gap, different responses are seen in relation to the strength and direction of these forces acting at the fracture site [4]. Factors like these allow the fracture to heal more efficiently with less strain on the body. Other types of force input do not affect fracture healing as effectively as axial loading, which is seen in activities like weight bearing. These transduced signals are reacted to by osteocytes, and osteoblasts are drawn in during higher loading. How to properly dose mechanical stimuli (for example, weight-bearing or high levels of mobility) in

the clinical setting to maximize recovery through the application of this molecular biology knowledge remains a gap in current knowledge [4].

Significant fractures may result in permanent disability. When bone union does not take place or a fracture fixation constructs malfunctions mechanically before bone union, this burden is made worse [3]. Only 40%-60% of elderly patients recover their prefracture level of mobility and ability to carry out daily activities within a year of a hip fracture. PFFs are associated with a significant risk of cardiovascular, pulmonary, thrombotic, infectious, or bleeding complications in frail patients, with additional surgical delay raising the mortality risk [4]. Risk factors for PFF include: poorer bone quality; female sex, which is frequently linked to bone brittleness; and certain ethnic origins, particularly Caucasians. With a direct effect on bone mineral density, the risk is higher in people who live further north, get less sun exposure, drink water with more fluoride and less calcium, and are poorer [1].

A retrospective study of 38 patients with complete subtrochanteric and diaphyseal femoral fractures found that among the candidate predictors of bisphosphonate-related fractures, focal lateral cortical thickening and transverse fracture had the highest odds ratios (76.4 and 10.1, respectively). Focal lateral cortical thickening and transverse fracture were also found to be the most accurate factors for detecting bisphosphonate-related fractures [5]. Our patient had osteoporosis and took bisphosphonate therapy. The transverse nature of her fracture is highly suggestive of an insufficiency fracture related to bisphosphonate use.

These fractures are highly treatable. The first step is to establish a suitable mechanical and biological environment for healing at the fracture site. The second goal is to minimize the fracture-associated disability mentioned above by offering sufficient stability to enable immediate functional use of the injured part. A situation of "absolute stability" is created if a fracture is minor and the major fragments can be perfectly reduced surgically with implant compression, in which case the bone will heal primarily without the development of a callus. The bone ends' immediate load-sharing will also protect the implant from stress. The fracture site will most frequently have a variable gap after surgery [3].

## Conclusion

Elderly patients frequently experience proximal femur fractures, which significantly impair their mobility and quality of life. Osteoporosis was clearly an underlying risk factor for the patient's condition based on the patient's presentation, imaging results, and medical history, and her use of bisphosphonates. Fractures to the proximal femur have a significant effect on long-term outcomes and functional recovery. For patients to achieve the best results and experience the least amount of disability, prompt and effective treatment in combination with thorough postoperative care is essential. A multidisciplinary approach involving orthopedic surgeons, physiotherapists, and geriatric specialists is necessary to treat fragility fractures. It's crucial to address underlying risk factors like osteoporosis. Innovative methods to improve fracture healing

and avoid complications in the elderly should be the focus of future research. This case emphasizes the difficulties posed by proximal femur fractures in the elderly. For these patients to have a successful recovery and an improved quality of life, early diagnosis, appropriate surgical intervention, and comprehensive care are essential.

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### Patient consent

Written informed consent was obtained from the patient for publication of this case report.

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