Long-term Bisphosphonate Therapy-induced Periprosthetic Femoral Stress Fracture in a Sliding Hip Screw Implant: A Unique Case Report

Mark R Adams[1], Conor Dunn[1], Michael S Sirkin[1], Mark C Reilly[1]

What to Learn from this Article?

This case report highlights to the clinician the importance of making their patients on long-term bisphosphonate therapy aware of the symptoms of potentially impending stress fracture to prevent further injury.

Abstract

Introduction: Long-term bisphosphonate therapy for osteoporosis is associated with an increased risk of low-to-no energy atypical subtrochanteric and femoral shaft fractures with characteristic radiologic findings. There are few reports of patients with long-term bisphosphonate-induced periprosthetic fractures, all of them had a hip arthroplasty prosthesis. In this report, we present a unique case of a 90-year-old Caucasian female on long-term bisphosphonate therapy with a sliding hip screw implant who sustained a periprosthetic fracture of the femoral shaft at the distal aspect of the plate.

Case Report: In April 2014, a 90-year-old female presented with left thigh pain after a fall from standing height. She had a previous fixation of a left intertrochanteric hip fracture with a sliding hip screw in 1999 and a 9-year history of bisphosphonate therapy. Radiographs obtained in the emergency department revealed a left-sided femoral shaft fracture at the distal aspect of the previously applied five-hole side plate. Of note, the periprosthetic fracture demonstrated cortical thickening at the fracture site of the lateral femoral cortex, lack of comminution as well as a transverse appearance. The patient was taken to the operating room the next day for retrograde placement of an intramedullary nail of the left femur with revision of left intertrochanteric femur fracture fixation. By 3 months postoperatively, she had obtained full radiographic union.

Conclusion: This case report highlights the possibility of an atypical fracture distal to the sliding hip screw implant after open reduction internal fixation of an intertrochanteric hip fracture in patients on long-term bisphosphonates.

Keywords: Periprosthetic fracture, bisphosphonates, sliding hip screw, stress fracture.

Access this article online
Website: www.jocr.co.in
DOI: 2250-0685.568

Author's Photo Gallery


Dr. Mark Adams


Dr. Conor Dunn


Dr. Michael Sirkin


Dr. Mark Reilly

[1]Department of Orthopaedics, Rutgers - New Jersey Medical School, Newark, NJ, USA.

Address of Correspondence
Dr. Conor Dunn,
2 Highfield Lane, Cedar Grove, NJ 07009, USA.
E-mail: conor.dunn13@gmail.com

Journal of Orthopaedic Case Reports | pISSN 2250-0685 | eISSN 2321-3817 | Available on www.jocr.co.in | doi:10.13107/jocr.2250-0685.568

Introduction

Bisphosphonates are increasingly used to prevent many typical osteoporotic fractures, including vertebral and hip fractures, by reducing the loss of bone mass with inhibition of osteoclastic bone resorption through apoptosis [1]. They are considered the first-line therapy for post-menopausal osteoporosis [1]. Short-term risks have been well described in the literature while the long-term risks have not been well documented. Low-to-no energy atypical femoral fractures have recently demonstrated to be associated with long-term use, potentially due to the altered bone repair and remodeling processes [2].

The definition of these atypical subtrochanteric stress fractures has undergone an evolution over the past several years. Recently, radiographic and clinical criteria were set by the Second Report of a Task Force of the American Society for Bone and Mineral Research; importance was placed on transverse orientation, minimal or non-comminution, and periosteal stress reaction at the fracture site [3]. Treatment of these atypical fractures involves intramedullary nailing of the femur followed by cessation of bisphosphonate use with alternate medical therapy replacement [4]. Alternate medical therapy has also shown the ability to heal insufficiency changes caught prior to induction of stress fracture [5].

Despite the abundance of cases in literature involving these atypical fracture patterns, the reports that involve periprosthetic fractures are sparse. All of the atypical periprosthetic fractures in literature have been distal to arthoplasty femoral stems [6, 7, 8]. Here, we report a unique case of periprosthetic long-term bisphosphonate therapy-induced stress fracture in a patient with a sliding hip screw implant.

Case Report

In April 2014, a 90-year-old female presented with left thigh pain after a fall from standing height. She had a previous fixation of a left intertrochanteric hip fracture with a sliding hip screw in 1999 and a 9-year history of bisphosphonate therapy. She noted intermittent left thigh pain over the previous few months. It was unclear whether she fell and then noted pain in the thigh or if the thigh gave way, leading to the fall. She was diagnosed with osteoporosis in 2004 using dual-energy X-ray absorptiometry scan and began treatment on alendronate therapy 70 mg tablet weekly. After 9 years of use, the alendronate therapy was discontinued to give her a drug holiday in 2013; vitamin D3 and calcium supplementation were continued. Her past medical history included a diagnosis of atrial fibrillation treated with rivaroxaban and hypertensive heart disease. Her past surgical history included fixation of a reverse obliquity intertrochanteric hip fracture with a sliding hip screw in 2008. She was asymptomatic on the right side.

Radiographs obtained in the emergency department revealed a left-sided femoral shaft fracture at the distal aspect of the five-hole lateral plate and screw fixation of the previously applied five-hole side plate. Of note, the periprosthetic fracture demonstrated cortical thickening at the fracture site of the lateral femoral cortex, lack of comminution as well as a transverse appearance (Figs. 1 and 2).

The patient was taken to the operating room the next day for retrograde placement of an intramedullary nail of the left femur with revision of left intertrochanteric femur fracture fixation. The five bicortical screws were removed from the sliding hip screw side plate so that the intramedullary nail could be inserted across the fracture site. The lag screw and side plate were maintained. The nail was interlocked with two screws distally and proximally. The two proximal interlock screws consisted of one anterior-to-posterior screw and another lateral screw through the side plate and the interlock hole in the nail (Fig. 3).

Figure 1: Pre-operative lateral view proximal femur; cortical thickening noted about the anterior cortex of the shaft at the fracture site. Relatively transverse fracture noted; fracture occurred through a screw hole in femur.

Figure 2: Pre-operative anteroposterior view distal femur; cortical thickening noted at the lateral aspect of the shaft at the fracture site.

Postoperatively, the patient was able to ambulate with a walker and was discharged home with regular follow-up. She used a cane at 6 weeks postoperatively, reaching her pre-operative functional level of

Figure 3: Post-operative anteroposterior view proximal femur fracture is well aligned; cortical thickening is evident distal to lateral plate. Intramedullary nail fixation is present.

ambulation in the community. Healing was noted on her radiographs at 6 weeks postoperatively, particularly at the medial cortex. By 3 months, she had obtained full radiographic union. The patient was also started on denosumab 60 mg single subcutaneous injection once for every 6 months beginning 6 weeks postoperatively in conjunction with her regular vitamin D3 and calcium supplements. No further adverse events were noted.

Discussion

Stress or insufficiency fractures of the femur typical of long-term bisphosphonate therapy (approximately 5 years or more) present with characteristic radiologic and clinical findings [1, 9]. They are also strongly linked to our understanding of the mechanism of action and pharmacology of this class of drugs. Osteoclastic activity, while correlated to osteoporotic changes, is also a critical function of bone homeostasis and remodeling [9]. And with a half-life in bone of 10 years, it is of no surprise that long-term suppression of this vital action of bone predisposes it to stress fracture [1].

These fractures have a characteristic pattern, demonstrating a transverse fracture line, non-comminution, with medial spiking and lateral cortical thickening at the subtrochanteric or femoral shaft region with or without local periosteal reaction and delayed healing [3, 6]. These fractures are rare, however, with an absolute risk from 3.2 to 50 per 100,000 person years, rising with increased years of exposure to as high as 100 per 100,000 person years [3, 9].

Atypical stress fractures evolve over time and have a distinct clinical presentation, which makes it possible to prevent a patient from completing a stress fracture. Patients taking bisphosphonates who present with constant groin or thigh pain should be examined with radiographs. Demonstration of cortical thickening of the subtrochanteric femur suggestive of prodromal changes calls for cessation of bisphosphonates with the addition of vitamin D, calcium, and either denosumab or teripartide to allow the insufficiency to heal while continuing protection from osteoporotic fracture as well [3, 5, 9]. This medical management is also indicated if the patient on bisphosphonates presents with a complete stress fracture with atypical characteristics [3, 9].

If an incomplete fracture coexists with moderate-to-severe pain, it is reasonable to consider prophylactic internal fixation [9]. In the management of all patients with atypical femur fracture, it is also reasonable to consider radiographs of the contralateral femur as 28-44.2% of cases will have bilateral involvement [3, 9]. Conservative medical management with partial weight bearing is appropriate in patients with contralateral involvement. In patients with moderate-to-severe pain, prophylactic open reduction and internal fixation (ORIF) can be considered as these patients will typically have impaired mobility [3, 9].

Our patient had a history of long-term bisphosphonate use and 3 months of thigh pain leading up to her fracture; this is consistent with our understanding of how a stress fracture can develop and complete over time. Certain radiologic findings were typical; the fracture line was transverse with spiking medially and cortical thickening laterally in the subtrochanteric region. Furthermore, these changes predominated anteriorly and laterally, corresponding with the tension side of the femur and likely the area that precipitated failure of the femur. Despite her cessation of the bisphosphonate 1 year before the fracture, these radiographic characteristics were still evident. As the half-life of bisphosphonates is approximately 10 years, it is not surprising that the femur had not reestablished its normal processes of bone homeostasis [1]. It was unique to this patient that this fracture occurred distal to the tip of a fracture fixation implant. It has been established in literature that these atypical fractures can occur at the distal tip of an arthroplasty implant but not with a fracture fixation implant [6, 7, 8].

To better understand this apparent absence of a bisphosphonate therapy-induced insufficiency periprosthetic fractures about fracture fixation implants, one needs to appreciate the recent history of bisphosphonate treatment and hip fracture surgical treatment. While insufficiency fractures themselves are a well-described complication of bisphosphonate therapy, the therapy only became approved and clinically popular in the late 1990s. This time period happened to coincide with the increased use of the cephalomedullary nail over the sliding hip screw [10]. There are no reports of periprosthetic insufficiency fractures in patients treated with cephalomedullary nails at this time in literature. There are several possible reasons for this, and with time this will likely be better understood. Perhaps, there is no difference between patients on bisphosphonates who have been treated with a cephalomedullary nail and those who have been treated with a sliding hip screw. Alternatively, in those patients who have been treated with short nails, perhaps the stress riser effect is less at the distal end of the nail than at the distal end of the sliding hip screw side plate in the diaphyseal femur in a patient using bisphosphonates. It is also possible that those patients with long nails have been prophylactically treated for future insufficiency femoral shaft fractures.

Conclusion

This case report highlights the possibility of an atypical fracture distal to the sliding hip screw implant after ORIF of an intertrochanteric hip fracture in patients on long-standing bisphosphonates. As the elderly population grows, we are likely to see this issue more often, and perhaps with the cephalomedullary nail as well.

Clinical Message

The authors suggest that the clinician should notify their patients on bisphosphonates with the signs and symptoms of a stress fracture so that they can present prior to completing the fracture.

References

1. Tonino RP, Meunier PJ, Emkey R, Rodriguez-Portales JA, Menkes CJ, Wasnich RD, *et al.* Skeletal benefits of alendronate: 7-year treatment of postmenopausal osteoporotic women. Phase III Osteoporosis Treatment Study Group. J Clin Endocrinol Metab 2000;85:3109-15.
2. Abrahamsen B, Eiken P, Eastell R. Cumulative alendronate dose and the long-term absolute risk of subtrochanteric and diaphyseal femur fractures: a register-based national cohort analysis. J Clin Endocrinol Metab 2010;95:5258-65.
3. Shane E, Burr D, Abrahamsen B, Adler RA, Brown TD, Cheung AM, *et al.* Atypical subtrochanteric and diaphyseal femoral fractures: second report of a task force of the American Society for Bone and Mineral Research. J Bone Miner Res 2014;29:1-23.
4. Weil YA, Rivkin G, Safran O, Liebergall M, Foldes AJ. The outcome of surgically treated femur fractures associated with long-term bisphosphonate use. J Trauma 2011;71:186-90.
5. Aspenberg P, Genant HK, Johansson T, Nino AJ, See K, Krohn K, *et al.* Teriparatide for acceleration of fracture repair in humans: a prospective, randomized, double-blind study of 102 postmenopausal women with distal radial fractures. J Bone Miner Res 2010;25:404-14.
6. Schaffer J, Attarian D, Wellman S. Periprosthetic femoral insufficiency fracture in a patient on long-term bisphosphonate therapy. Duke Orthop J 2011-2012;2(1):66-9.
7. Sayed-Noor AS, Sjödén GO. Case reports: two femoral insufficiency fractures after long-term alendronate therapy. Clin Orthop Relat Res 2009;467:1921-6.
8. Cross MB, Nam D, van der Meulen MC, Bostrom MP. A rare case of a bisphosphonate-induced peri-prosthetic femoral fracture. J Bone Joint Surg Br 2012;94:994-7.
9. Unnanuntana A, Saleh A, Mensah KA, Kleimeyer JP, Lane JM. Atypical femoral fractures: what do we know about them? AAOS exhibit selection. J Bone Joint Surg Am 2013;95:e8 1-13.
10. Anglen JO, Weinstein JN; American Board of Orthopaedic Surgery Research Committee. Nail or plate fixation of intertrochanteric hip fractures: changing pattern of practice. A review of the American Board of Orthopaedic Surgery Database. J Bone Joint Surg Am 2008;90:700-7.

Conflict of Interest: Nil
Source of Support: None

How to Cite this Article

Adams MR, Dunn C, Sirkin MS, Reilly MC. Long-term Bisphosphonate Therapy-induced Periprosthetic Femoral Stress Fracture in a Sliding Hip Screw Implant: A Unique Case Report. Journal of Orthopaedic Case Reports 2016 Sep-Oct;6(4):53-56.