Femoral canal obliteration secondary to prolonged alendronate use: a case report

Chin Tat Lim, Tony Setiobudi, Shamal Das De
University Orthopaedic, Hand and Reconstructive Microsurgery Cluster, National University Hospital, Singapore

ABSTRACT
Insufficiency fractures secondary to prolonged alendronate use is due to inhibition of osteoclastic activity and suppressed bone turnover. Complications of fracture fixation include non-union, mal-union, and difficulty in intramedullary nail insertion. We report a technical challenge in intramedullary nailing of an obliterated femoral canal in a patient on long-term bisphosphonate treatment. The fracture site was explored. The medullary canal was re-created by drilling. Patience and caution during drilling and reaming are necessary to avoid iatrogenic fractures.

Key words: alendronate; femoral fractures; osteopetrosis

INTRODUCTION
Insufficiency fractures secondary to bisphosphonates are increasingly recognised. Their management has progressed from fracture fixation to identifying pre-existing abnormality and prophylactic fixation.1 Bisphosphonates suppress osteoclastic bone turnover and lead to increased mineralisation, rendering bones more brittle.2,3 Bisphosphonate-related fractures are associated with non-union and narrow femoral canals, posing difficulty in inserting an intramedullary nail. We report a technical challenge to intramedullary nailing of an obliterated femoral canal in a patient on long-term bisphosphonate therapy.

CASE REPORT
In March 2010, an 89-year-old Chinese woman presented with swelling and tenderness around the right proximal femur after a fall on the right side of the body. The fall was preceded by giving way of the right lower limb. She was then unable to bear weight. She had been taking alendronate for 5 years for her osteoporosis, and had prodromal bilateral thigh pain for one year. Her other medical problems included hypertension, paroxysmal atrial fibrillation, and degenerative scoliosis.

The range of movement of the right hip was
limited by pain. There were no bruises or open wounds around the right thigh. Right lower limb pulses were strong and there was no neurological deficit. The left lower limb did not reveal any tenderness or deformity. Radiographs showed a subtrochanteric fracture with short obliquity (Fig. 1). There was lateral cortical thickening and a medial cortical spike. Her blood count, renal function, and calcium level were within normal limits, but her 25-hydroxy vitamin D level was low.

The patient was subjected to traction with a knee piece. After optimisation of her medical condition, she underwent intramedullary nailing on day 3. To enable nail entry, a 3 cm incision was made proximal to the greater trochanter in line with the right femoral shaft. The greater trochanter was located using a guide wire under intra-operative fluoroscopy, and an open ream was performed. As there was resistance to insertion of the long guide wire despite adequate reduction, the fracture site was explored. A lateral longitudinal incision was made on the right lateral thigh at the level of the fracture. The fascia lata was incised in line with the skin and the vastus lateralis split. Obliteration of both the proximal and distal femoral medullary canal by dense sclerotic bone was noted (Fig. 2). The medullary canal was re-created by drilling until the reaming instrument could be passed into the distal fragment. The consistency of the obliteration was as hard as the cortical bone. Subsequently, canal preparation, bone grafting, and nail insertion were carried out as usual (Fig. 3a).

The patient was discharged one month after the operation. She was able to bear weight partially with a walking frame. At month 6, the patient was able to ambulate, but there was non-union (Fig. 3b). She was on teraparatide, vitamin D, and calcium supplements.

---

Figure 1  Radiographs showing a slight obliquity fracture of the proximal femoral shaft. There is lateral cortical thickening (white arrow) with medial cortical spike (black arrow).

Figure 2  Intra-operative photograph of the distal fragment fracture edge showing the obliterated femoral canal (arrow).

Figure 3  Radiographs showing (a) fracture reduction with an in situ intramedullary nail, and non-union at (b) month 6 and (c) year one.
At year one, the fracture remained non-united (Fig. 3c).

**DISCUSSION**

Prolonged alendronate use can lead to severely suppressed bone turnover, which is characterised by reduced osteoclastic surfaces with decreased or absent tetracycline staining. This condition is associated with non-traumatic fractures of bones that are rich in cortical bone, fractures at atypical sites such as the femoral shaft, pubic bone, and ischium. Its distinct radiological features include lateral femoral cortex thickening, slight obliquity fractures, medial cortical spikes, and fracture non-union.

In 2007, 13 cases of atypical subtrochanteric fractures in a Singaporean hospital were reported. In 2009, 15 such cases were reported in a US hospital. In 2010, 23 and 26 such cases were reported in the same Singaporean hospital by 2 studies. Widespread recognition of such fractures has led to increased reports of these complications and technical difficulties in treatment. Complications such as non-union and delayed union as well as difficulty in intramedullary nail insertion as a result of the thickened lateral cortex have been reported.

In our patient, the dense sclerotic bone in the femoral canal could be the result of inhibition of bone remodelling from prolonged alendronate use. The drill bit flutes were immediately filled with bone during reaming and rendered the reamer ineffective. This may lead to breakage of the reamer drill bit and excessive frictional heat, thus resulting in bone necrosis.

Difficulty in reaming of the medullary canal has also been reported in the treatment of osteopetrosis. In an osteopetrotic patient with a subtrochanteric fracture in 1957, there was a solid-white, grossly amorphous appearance in the bone end, and the medullary canal was completely obliterated by hard bone indistinguishable from the cortex. The medullary canal had to be drilled with an electrician’s drill. Such dense sclerotic (osteopetrosis) bones are brittle and easy to fracture, and commonly involve the femoral neck and the upper third of the femoral shaft. In a case of intramedullary fracture fixation, the canal could not be manually reamed beyond 7 mm and had to be fixed with a 7-mm Kuntscher nail. Power instruments were thus used to create a canal with a long drill bit before reaming through a guidewire. Two graduated drills should be used to reconstitute the canal, as one drill was used for drilling, while the second drill was allowed to cool and the bit was cleared of bone adherent to the flutes. After the canal was sufficiently enlarged, a similar technique of alternating intramedullary reamers was used for serial reaming of the canal. Patience and caution during drilling and reaming are necessary, as the hard, brittle, osteopetrotic bone and the obliterated marrow cavity are at risk of iatrogenic fracture.

**REFERENCES**