CASE REPORT

Obliteration of the medullary canal in an atypical bisphosphonate-related femoral fracture

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SUMMARY

We present a case of a patient with a bisphosphonate-related atypical femoral fracture. Her surgical management was complicated by obliteration of the medullary canal, which prohibited the passage of an intramedullary nail. The relevant literature is discussed.

BACKGROUND

This case has relevance to perioperative management of atypical bisphosphonate fractures in patients as reduced resorption at the fracture site can obstruct passage of an intramedullary nail, the standard operative treatment.

CASE PRESENTATION

A 68-year-old woman, presented with an atraumatic fracture of the right proximal femur. She reported that her right leg 'gave way' when she was in the act of sitting down. She had been aware of a poorly localised ache in the thigh during the month prior to her presentation. Eighteen months previously she had sustained a similar fracture of the proximal third of the left femur after a fall, which was successfully treated with a cephalomedullary nail. She had been on oral hormone replacement therapy for 12 years and oral bisphosphonates (alendronate) for 6 years.

INVESTIGATIONS

Femur radiographs at the time of the previous contralateral atypical femoral fracture (AFF) demonstrated a lateral-based flare on the side discussed above, indicating an imminent fracture (figure 1).

TREATMENT

Operative fixation using a cephalomedullary nail was performed. Fixation of the proximal fragment mandated an open reduction. Despite exposing the fracture site, it was not possible to pass a guide wire across the fracture due to obliteration of the intramedullary canal (figure 2). Hand reaming of each fragment was required. Satisfactory fixation was achieved with a cephalomedullary nail. Because an open reduction was necessary, the fracture site was augmented with demineralised bone matrix.

OUTCOME AND FOLLOW-UP

Clinical and radiological union was noted at 3 months.

Figure 1 Check-up radiograph post left side atypical femoral fracture (AFF), radiograph with evidence of right impending AFF.

DISCUSSION

The fracture suffered by the patient in this case displayed all major features of an AFF as recently defined by the task force of the American Society for Bone and Mineral Research: subtrochanteric, transverse orientation, no trauma, a medial spike and without comminution. Further features were also present including cortical hypertrophy, prodromal pain, bilaterality and prolonged bisphosphonate therapy.¹ Recently, and with great relevance to this case, newer evidence suggests that AFF are a form of stress fracture. Furthermore, periosteal reaction at the lateral cortex was upgraded from a minor to a major feature of an AFF.² Lateral cortex hypertrophy has been demonstrated in the unaffected contralateral femur of patients who have sustained an atypical bisphosphonate-associated subtrochanteric fracture,^{3 4} as was evident on a radiograph at the time of the contralateral fracture.

Several studies have shown that while alendronate increases bone mineral density,^{5–7} histological iliac crest bone analysis has demonstrated severe suppression of bone turnover with diminished bone matrix^{3 8} with impaired repair of microdamage.⁹ These findings of sclerotic bone were replicated in our histological analysis of specimens retrieved from the fracture site (figure 3).

Fracture site sclerosis has been noted previously.³ Das De *et al* suggested intramedullary nailing as the treatment of choice over extramedullary plating despite findings of non-unions with both modalities, except where a narrow medullary canal prohibits passing an intramedullary nail. Despite the introduction of newer antiresorptive medication for

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Figure 2 Complete occlusion of the medullary canal at the fracture site required 'open reaming'.

Figure 3 Histological specimen from the fracture site with evidence of a deeply embedded osteoclast displaying reduced potential for bone resorption.

osteoporosis, AFF have been noted with denosumab¹⁰ and involving a cathepsin K inhibitor in a patient with pycnodysostosis.¹¹

The conventional standard for treatment of subtrochanteric fractures is closed intramedullary nailing. The brittle thickened cortex can predispose to a higher risk of intraoperative

comminution than non-bisphosphonate-related fractures.¹² Opening a fracture for reduction is associated with a higher infection rate and delayed union.^{13 14}

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Contributors DTC was involved in primary investigator. HLB was responsible for pathology input. PH was involved as an editor and lead investigator.

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Learning points

- Osteoclastic inactivity in this case prevented cutting cone activity as part of the healing process at the fracture site, promoting fibrosis of the thick cellular mass and sclerotic non-functional calus.
- This case reinforces the indication for prophylactic treatment of impending atypical bisphosphonate subtrochanteric fractures.
- The possibility that the medullary canal may be obliterated in bisphosphonate fractures should be borne in mind during preoperative planning.

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