Morphology and fixation pitfalls of a highly unstable intertrochanteric fracture variant

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ABSTRACT

Purpose. To describe a variant of intertrochanteric fracture not well-characterised in the existing classification systems.

Methods. 10 women and 2 men aged 59 to 98 (median, 80) years with intertrochanteric fractures characterised by a low intertrochanteric fracture, a basicervical fracture fragment, and a thin or fractured lateral wall with greater trochanteric comminution were reviewed.

Results. The 12 fractures were classified as A2.1 (n=1), A2.2 (n=7), A2.3 (n=1), and A3 (n=3) according to the AO/OTA classification, and as type 3 (n=2), type 5 (n=7), and type 6 (n=3) according to the Evans classification. The fractures were characterised by greater trochanter comminution and a coronal plane fracture extending into the greater trochanter resulting in a loss of superolateral support. Patients were treated with the Proximal Femoral Nail Antirotation (n=5), the Proximal Femur Locking Plate (n=6), or the reversed Less Invasive Stabilization System for distal femur (n=1). Within the mean follow-up period of 6 months, 3 patients with plating and one patient with nailing had mechanical failure defined as loss of alignment of >10º or screw cutout.

Conclusion. This intertrochanteric fracture variant is highly unstable with a high failure rate. Loss of superolateral support rather than the medial calcar buttress is the main contributing factor to mechanical failure. Computed tomography is important in preoperative planning. Intramedullary nailing is more appropriate than extramedullary plating for such unstable fractures.

Key words: classification; hip fractures

INTRODUCTION

There are several classification systems for intertrochanteric fractures including the Evans system,1 the AO/OTA system,2 and the Boyd and Griffith system.3 This study describes the radiological morphology and potential fixation pitfalls of a variant of intertrochanteric fracture not well-characterised in
the existing classification systems.

MATERIALS AND METHODS

Records of 200 patients with intertrochanteric fractures treated between April 2011 and March 2012 were reviewed. Of these, fractures in 10 women and 2 men aged 59 to 98 (median, 80) years were characterised by (1) a low intertrochanteric fracture, (2) a basicervical fracture fragment, and (3) a thin or fractured lateral wall with greater trochanteric comminution (Fig. 1).

RESULTS

The 12 fractures were classified as A2.1 (n=1), A2.2 (n=7), A2.3 (n=1), and A3 (n=3) according to the AO/OTA classification, and as type 3 (n=2), type 5 (n=7), and type 6 (n=3) according to the Evans classification. Computed tomography was performed for 9 out of 12 patients and revealed greater trochanter comminution and a coronal plane fracture extending into the greater trochanter resulting in a loss of superolateral support (Fig. 2).

The 12 patients were treated with the Proximal Femoral Nail Antitrotation (PFNA, n=5), the Proximal Femur Locking Plate (PFLP, n=6), or the reversed Less Invasive Stabilization System for distal femur (LISS, n=1). All implants were manufactured by Synthes. The LISS was initially designed for distal femoral and proximal tibial fractures, but it has been used for periprosthetic proximal femoral fractures and unstable intertrochanteric fractures.4

Mechanical failure was defined as loss of alignment of >10° or screw cutout. Within the mean follow-up period of 6 months, 3 patients who

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Figure 1  Radiographs showing a low intertrochanteric fracture (arrows, black lines), a basicervical fracture fragment (dotted arrows, dotted lines), and a thin lateral wall with greater trochanteric comminution (arrowheads, grey lines).

Figure 2  Computed tomography with 3D reconstruction showing the greater trochanter comminution (arrowhead) and coronal split (arrows).
underwent plating and one patient who underwent nailing had mechanical failure. The latter also had a concurrent peri-prosthetic fracture after a fall (Fig. 3). Another patient who underwent nailing developed avascular necrosis of the femoral head at 7 months. One patient died at 2 weeks from an unrelated cause. One patient died at 2 months from implant infection.

**DISCUSSION**

Surgical treatment for intertrochanteric fractures in the elderly provides mechanical stability and enables early mobilisation to prevent complications from prolonged recumbence. Although the dynamic hip screw is the gold standard for stable fractures, the implant of choice for unstable fractures remains controversial. In the 12 patients of our series, all fractures were deemed too unstable to be fixed with a dynamic hip screw.

Inter-observer agreement for the AO/OTA classification has been reported to be higher than that for the Evans classification, but neither system reaches acceptable reliability. Other studies also report acceptable reproducibility of the AO/OTA classification within groups but increased variability when fractures are further classified into subgroups. Both the AO/OTA classification and the Evans classification do not describe coronal plane involvement. Computed tomography for 9 of our patients showed a coronal plane fracture, with loss of superolateral support. Rather than the integrity of the medial calcar buttress, the main contributing factors to mechanical failure were considered to be loss of superolateral support, a thin or fractured lateral wall, and greater trochanteric comminution, particularly in those treated with the PFLP or reversed LISS for distal femur, as the locking plate was unable to prevent varus failure of these unstable fractures. The failure rate after locking plate fixation for unstable proximal femoral fractures has been reported to be 37% and 36.8%. The locking plate construct is considered to be too stiff to enable micromotion and this may lead to mechanical failure.

Intramedullary nailing is more appropriate than extramedullary plating for unstable fractures, because nails preserve femoral anatomy and resist distal fragment medialisation. In our 5 patients with PFNA fixation, one had mechanical failure probably because the greater trochanter comminution and displacement impeded insertion of the nail from the correct entry point, which is imperative for the success of PFNA fixation. When the entry point is incorrect or lateral, there is a tendency for over-lateralisation of the nail, which leads to a loss of the lateral wall buttress and subsequent failure. In addition, using an incorrect entry point may result in malreduction and further displacement of the fracture during nail insertion and implant failure. To overcome this, proper reduction, medialisation of the entry point, and careful reaming of the lateral wall are recommended. The shaft should be used as a reference point for the entry point rather than the tip of the greater trochanter, especially when there is a displaced coronal split fragment. Care should be taken to ensure reduction is maintained during the nail insertion.

Limitations of this study included the small sample size and the short follow-up period.

**CONCLUSION**

This intertrochanteric fracture variant is highly unstable with a high failure rate. Loss of superolateral support rather than the medial calcar buttress is the main contributing factor to mechanical failure. Computed tomography is important in preoperative planning. Intramedullary nailing is more appropriate than extramedullary plating for such unstable fractures.

**DISCLOSURE**

No conflicts of interest were declared by the authors.
REFERENCES