Subtrochanteric fractures of the hip

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Abstract

Fractures within the subtrochanteric region of the hip are notoriously challenging due to their intrinsic instability, fracture displacement and the large forces acting across this region. This review article considers the anatomy, biomechanics, presentation and detailed management of subtrochanteric fractures.

Keywords Hip fractures; intramedullary nailing; proximal femur; reduction; subtrochanteric fracture

Introduction

More than 1.5 million people suffer hip fractures worldwide each year.[1] Of these, subtrochanteric fractures are less common than femoral neck and intertrochanteric fractures, contributing somewhere in the region of 4–18% of all proximal-third femur fractures. The muscular attachments on the proximal femur create distracting forces which, when coupled with potentially differing fracture configurations, can provide a challenge for the operating surgeon. For the same reasons they tend to carry a worse prognosis than other fractures around the hip.[2–4]

Presentation

Subtrochanteric fractures have a bimodal age and sex distribution. The first group is young men who sustain high-energy trauma and the second is older osteoporotic women who sustain lower energy injuries, typically a fall from standing height. Subtrochanteric fractures in the skeletally immature are thankfully rare. They are usually due to high-energy trauma and are more commonly seen in male patients.

Risk factors

Although bisphosphonates are a recognized treatment for osteoporosis, elderly women who have had bisphosphonate treatment for more than 5 years are at increased risk of subtrochanteric fractures.[5] Bisphosphonate related fractures in this region tend to occur following minimal trauma. Patients can complain of predisposing pain and tend to have an atypical radiological appearance; transverse fracture, lateral cortex beaking and bicortical diaphyseal cortical thickening. This particular subtype of subtrochanteric fracture is particularly difficult to treat, with research showing slower rates of union and higher rates of surgical revision.[6,7] A full discussion of this subtype of fracture is outside the scope of this review.

Classification

Defining the subtrochanteric region remains controversial and considerable variation exists within the literature. Most commonly, it is defined as being from the inferior border of the lesser trochanter, extending to 5 cm below this point. It has however, been proposed to extend down as far as the level of the femoral isthmus.[8] Similarly, much variation exists in the classification of subtrochanteric fractures, with a review by Loizou et al. identifying 15 different classification systems.[9] Of these 15, the systems by Seinsheimer and AO were found to be the most commonly reported.[10,11] The most important difference between the two classifications is that the AO Classification deems subtrochanteric fractures with an intertrochanteric extension to be classified as trochanteric fractures. Seinsheimer's classification is shown in Figure 1.

Fracture displacement

Subtrochanteric fractures are subject to displacement of the fracture fragments due to the associated attachment of powerful muscle groups. The gluteal muscles and short external rotators tend to cause abduction and external rotation of the proximal femur, with iliopsoas causing flexion. The action of the adductor muscles usually causes adduction, medialization and shortening of the distal femur.

The classic deformity therefore seen with subtrochanteric fractures is for the proximal fragment to be flexed, abducted and externally rotated. The distal fragment is disconnected from the bony and soft tissue attachments of the hip joint. It therefore tends to be adducted and shortened due to the influences of the previously mentioned dominant adductors and hamstring muscle groups. This classical displacement is shown in Figures 2 and 3. These deforming forces lead to fracture displacement and importantly must be recognized and neutralized in order to achieve anatomical reduction prior to definitive fixation.

Management

Surgical intervention is the mainstay of treatment for subtrochanteric fractures. Non-operative management is seldom chosen due to issues with limb shortening, mal-rotation, as well as the high morbidity and mortality rates secondary to the prolonged recumbency associated with skeletal traction, especially in the elderly. It is therefore reserved for extreme circumstances, such as the patient being unfit to undergo an anaesthetic. The key principles of surgical management are to achieve anatomical reduction and stable fixation, which in turn facilitates early mobilization.

Delayed or non-union is more common in subtrochanteric fractures than in intertrochanteric or diaphyseal femur fractures, with loss of fixation or implant failure increasing morbidity and mortality in this patient group.[12] This is in part due to this region experiencing the highest tensile and compressive forces in the skeleton, with up to 1200 psi of compressive forces on the medical cortex during daily activity.[13–15] Furthermore, the subtrochanteric region consists of primarily cortical bone, and so bony union in this region tends to be slower than the better

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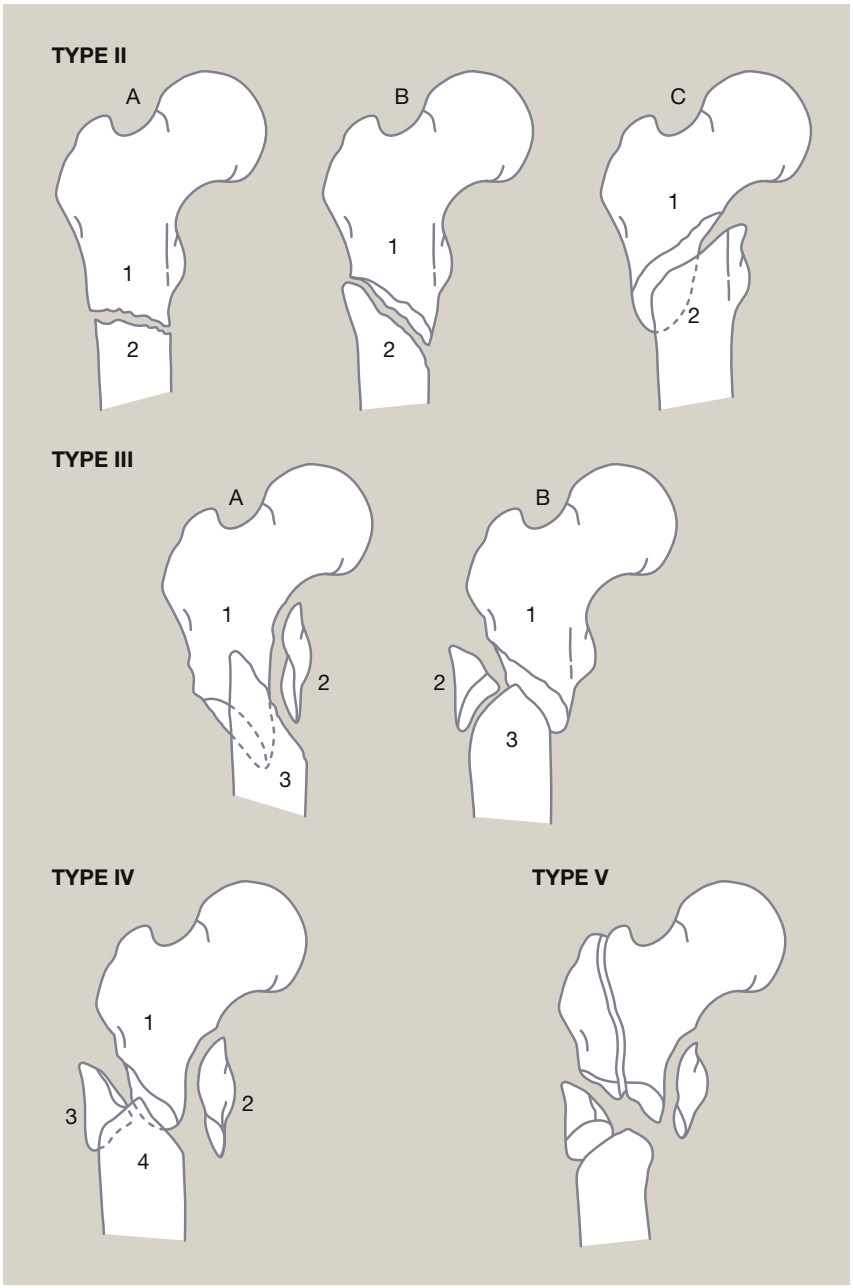

Figure 1 The Seinsheimer classification has 5 types; I-undisplaced, II-2 part fracture, III-3 part fracture, IV-comminuted, & V-Inter-trochanteric extension.[10]

vascularized metaphyseal bone of the intertrochanteric region. Patient factors including body habitus, bone quality, fracture pattern and fracture comminution have been shown to have a significant influence on outcomes.

Operative technique

Patient positioning: a number of different positioning techniques have been described in the literature. Careful positioning should assist in fracture reduction and surgical exposure, whilst not impeding vital intra-operative imaging. For the majority of these fractures, the authors favour the supine position on the fracture table, with the use of traction under image intensifier guidance to assist with achieving anatomical reduction. In the supine position, some institutions would routinely use a standard screen hip fracture drape, such as would be used for inserting a compression hip screw. However, prepping the leg free with split drapes at either end may allow for easier manipulation and fracture reduction, whilst maintaining sterility.

The lateral decubitus position does have its role, particularly for obese patients. Lateral positioning of the patient with the hip in slight flexion assists with neutralizing the deforming forces on the proximal fragment, but can pose a challenge in achieving suitable intra-operative imaging. This can be overcome by utilizing the detailed technique described by Carr et al.[16]

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