Hip fractures in young adults

E B Goudie

A D Duckworth

T O White

Abstract

Hip fractures in young adults comprise a small proportion of the total hip fracture population. However they form a distinct and important sub-group, often presenting as a result of high-energy trauma, with other associated injuries. This article describes the specific challenges and pitfalls encountered in the management of these patients. The goals of treatment are discussed, as well as detailing the key factors needed to achieve a good outcome following this significant injury.

Keywords fracture; hip fracture; neck of femur; proximal femur; young adult

Introduction

Although hip fractures in young adults only account about 3% of the total hip fracture population, the consequences of nonunion, malunion and avascular necrosis (AVN) in this age group can be profound.

Femoral neck fractures in young adults differ from those in the elderly. They are often the result of high-energy trauma leading to fracture comminution and a greater disruption of blood supply to the femoral head. There is also a high incidence of associated skeletal and visceral injuries. Understanding the differences in treatment principles between elderly, frail patients and their physiologically young and active counterparts is essential to achieve good outcomes.

The rate of nonunion is almost 10% and that of AVN is 23% in young patients with displaced intracapsular hip fractures.[1] Salvage procedures such as osteotomy are not without risk and have high failure rates and arthroplasty in the young has implications for prosthesis survival and revision surgery. Whilst it is widely agreed that anatomical reduction and stable fixation are critical for a good outcome, the role of ancillary techniques such as capsulotomy, and other factors such as the timing of surgery and implant choice and configuration remain controversial.

E B Goudie ***MRCSEd*** *Specialty Trainee Trauma and Orthopaedic Surgery, The Department of Orthopaedics and Trauma, The Royal Infirmary of Edinburgh, United Kingdom. Conflicts of interest: none.*

A D Duckworth ***FRCSEd(Tr&Orth) PhD*** *Speciality Trainee Trauma and Orthopaedic Surgery, The Department of Orthopaedics and Trauma, The Royal Infirmary of Edinburgh, United Kingdom. Conflicts of interest: none.*

T O White ***FRCSEd(Tr&Orth) MD*** *Consultant Trauma and Orthopaedic Surgeon, The Department of Orthopaedics and Trauma, The Royal Infirmary of Edinburgh, United Kingdom. Conflicts of interest: none.*

This review aims to summarize the main management principles, outcomes of treatment and potential complications in young adults with hip fractures.

Classification, anatomy and vascular supply

Classification is based on the vascular anatomy of the proximal femur and this dictates management. The vascular anatomy to the femoral head arises from three sources.[2] The major supply arises from the lateral and medial circumflex femoral arteries (**a** and **b** on Figure 1), which are branches of the profunda femoris artery. Together they form an extracapsular anastomotic ring (**c** on Figure 1) at the base of the femoral neck. From this, retinacular vessels arise, pierce the hip capsule, run onto the neck under the synovium and ascend in a medial direction to penetrate the head (**d** on Figure 1).[3,4] The principal retinacular vessel lies on the posterosuperior aspect of the neck. Secondly there is a small contribution from the medullary canal, and, thirdly a negligible contribution from the ligamentum teres (**e** on Figure 1) in adults.[5]

The hip joint capsule inserts into the intertrochanteric line (anteriorly) and the intertrochanteric crest (posteriorly) in the region of the vascular ring.[6] Intracapsular fractures disrupt the retinacular vessels and place the blood supply to the femoral head at risk. This can result in AVN of the femoral head.[7] Extracapsular fractures rarely affect the blood supply to the femoral head and therefore the principles of treatment are different.

Classification of intracapsular fractures

The popular Garden classification is based on the degree of displacement, with four patterns of fracture described, based on the AP radiograph (Figure 2).[8] Although the Garden classification is widely used, there are poor levels of inter- and intra-observer agreement between the four subgroups.[9,10] In practice it is the identification of displacement (and therefore the risk of retinacular vessel disruption) that is essential and therefore for practical purposes fractures should be viewed as 'undisplaced' (Garden 1 and 2 fractures), or 'displaced' (Garden 3 and 4 fractures).[11,12] The Garden classification does not take into account displacement seen on the lateral view, although this is also crucial. Although there is no clear consensus, angulation (usually posterior tilt) of more than 10 degrees is usually considered displaced.

Pauwels classification indicates the vertical orientation of the fracture, with reference to the horizontal on an anteroposterior radiograph of the hip (Figure 3).[13] Most fragility fractures are of type 2, but young patients, suffering high-energy trauma often have a more vertical, Pauwels type 3 orientation.[14]

Classification of extracapsular fractures

These fractures are best described by their morphology and whilst there is no single useful classification, the Modified Evans classification serves as a guide to operative management (Figure 4).[15]

Mechanism of injury

In contrast to the elderly population, where fractures usually result from a fall from a standing height,[16] femoral neck fractures

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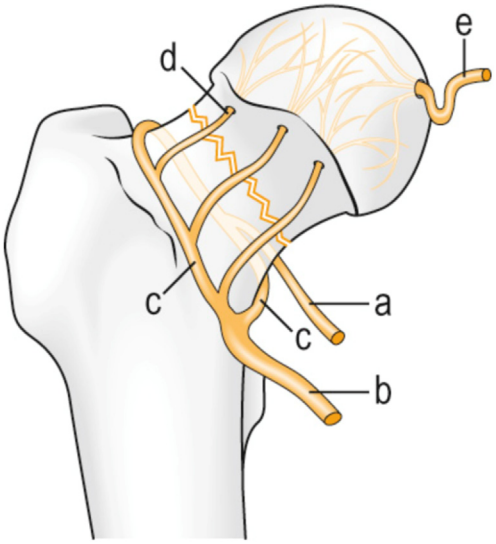

Figure 1 Vascular anatomy of the femoral head. Reproduced from McRae's Orthopaedic Trauma 3rd ed. by White TO et al, with permission.

in physiologically young adults typically occur with significant force, often from road traffic accidents, sporting injuries or falls from height. A substantial axial load, often with external rotation of the hip in an abducted position, is required for the femoral neck to fracture in young individuals.[17,18] The femoral head is held fixed by the anterior capsule while the hip rotates externally and the posterior cortex of the neck impinges on the lip of the acetabulum. Whilst the anterior cortex fails in tension, the posterior cortex is compressed, often resulting in marked comminution which can cause difficulty with reduction and achieving stable fixation.[16]

Diagnosis and initial management

Following major trauma, patients are assessed and managed according to standardized protocols, such as the Advanced Trauma and Life Support (ATLS) system. Fractures in young adults may be accompanied by other significant injuries, which must be excluded by an initial primary and secondary survey. Treatment of hip fractures in young adults should be performed only after other life and limb-threatening injuries have been addressed.

Clinical features

Whilst most young patients will have no medical comorbidities, risk factors such as chronic disease predisposing to osteoporosis (e.g. steroid use) or osteomalacia (e.g. alcohol abuse and renal failure) should be sought, particularly if the fracture has occurred following a low energy injury or if patient is older than 40 years,[19] as these tend to mitigate against successful stable fixation. Physical findings may be limited in an undisplaced fracture. There may be no obvious deformity with the only finding a painful range of motion of the hip. In displaced fractures, the affected leg is typically shortened and externally rotated. Associated fractures of the femoral shaft and acetabulum should be sought and specifically excluded. Open fractures and neurovascular injuries are rare but should be excluded.

Imaging

Most hip fractures can be readily diagnosed using plain radiographs, consisting of an anteroposterior (AP) and lateral projections of the hip. In 2% of cases the fracture may be difficult or impossible to visualize on plain radiographs. A trauma CT scan is commonly performed in multiply injured patients and may provide further information. In cases where the diagnosis is doubtful, and a 'trauma scan' has not been performed, a later CT or magnetic resonance imaging (MRI) scan may be

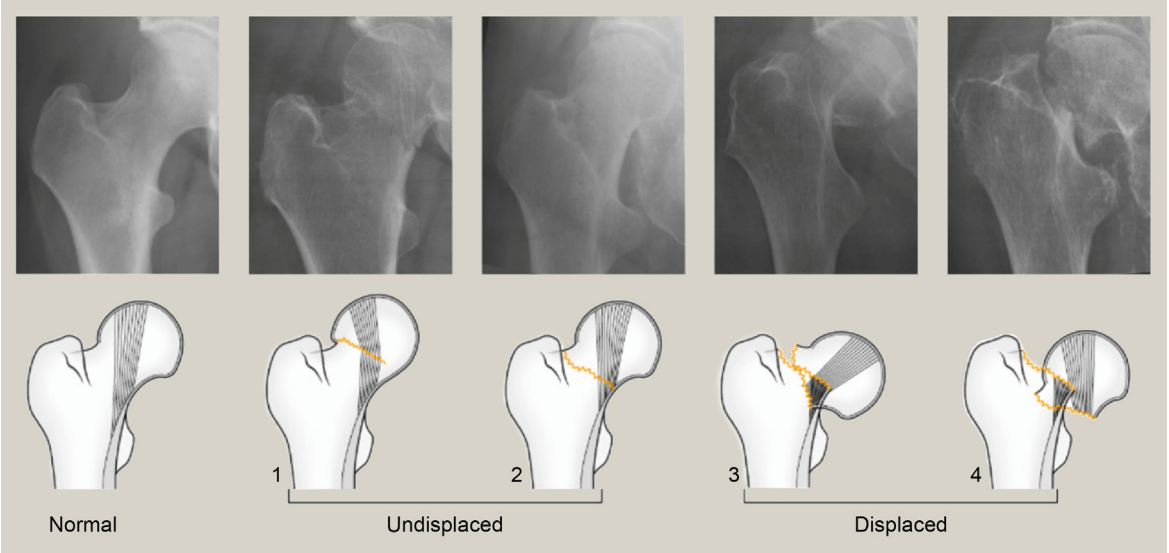

Figure 2 Garden classification of intracapsular factures. Garden 1: The fracture is *valgus* impacted (i.e. the apex of the fracture points medially). Classically, the medial cortical fracture is not seen on the radiograph. Garden 2: The fracture is complete but *undisplaced*, but the trabeculae remain aligned. Garden 3: The fracture is moderately displaced with disturbance of the trabecular pattern. Garden 4: The fracture is displaced but the trabeculae line up to indicate the head is in a neutral position. Reproduced from McRae's Orthopaedic Trauma 3rd ed. by White TO et al, with permission.

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