Pelvic and acetabular trauma

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Abstract

Pelvic and acetabular trauma often presents in the context of polytrauma and may cause life threatening haemodynamic instability. An understanding of anatomy, physiology and classification systems will help in the assessment of the stability of the fracture pattern and the patient. Patients should be managed according to agreed clinical guidelines within the trauma network. Early specialist input is required into decision making concerning the operative and non-operative management options.

Keywords acetabulum; pelvis; trauma

Introduction

Pelvic and acetabular fractures, and their management, have been described in ancient Egyptian and Chinese writings. In the 19th century, Malgaigne and Moore wrote seminal papers.[1] The more recent history of pelvic and acetabular trauma management includes the names of Judet, Letournel, Young as well as Burgess and Tile.[2] It is an increasingly important area of trauma and orthopaedics that anyone dealing with injured patients should be familiar with.

Epidemiology

The distribution of pelvic and acetabular fractures is bimodal: younger patients tend to sustain high energy pelvic ring disruptions and hip fracture dislocations whereas older patients more commonly suffer lower energy insufficiency fractures in osteoporotic bone. The incidence of pelvic fractures is estimated at 23 per 100 000[3,4] whilst the incidence of isolated acetabular fractures is estimated at 3 per 100 000.[5]

There is a male preponderance to pelvic and acetabular fractures.[6,7] The mechanism of injury in the under 60 age group is most often a road traffic collision; in the over 60 group, falls are the most common mechanism of injury.[5–7] It is worth noting that the incidence of diagnosis of acetabular fractures in older patients has increased significantly in the last two decades[5,7] and this will have significant implications for healthcare resource allocation.[8]

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Anatomy of the pelvic ring and acetabular columns

The pelvic ring

The pelvic ring consists of left and right innominate bones and the sacrum. The bony ring has two posterior joints (the left and right sacroiliac joints) and an anterior joint (the symphysis pubis). The following ligamentous structures provide stability: sacroiliac ligaments (anterior and posterior), the iliolumbar ligament posteriorly and the sacrospinous and sacrotuberous ligaments anteriorly. Disruption of the ring in one place causing displacement is necessarily associated with disruption elsewhere in the ring.

Acetabular columns and walls

The acetabulum found centrally in the innominate bone, which is itself formed from the ossification centres of the ilium, ischium and pubis. It provides a socket for the femoral head and is integral to the structure and function of the pelvic ring and hip joint. The innominate bone may be described has having an anterior and a posterior column, which act as struts to provide stability. On a lateral view, the innominate bone has the appearance of an inverted "Y" – with the longer vertical limb being the anterior column and the shorter limb the posterior column.

The anterior column consists of the pubis and ilium and runs from iliac crest to iliac wing and through the superior pubic ramus. It includes the lateral superior pubic ramus. The posterior column is composed of the ischium and ilium and runs from posterior ilium (just below the sciatic notch) down the ischial body and to the inferior pubic ramus. It includes the quadrilateral plate/surface and the posterior wall and dome. The anterior and posterior acetabular walls project from their columns (Figure 1).

Imaging of the pelvis and acetabulum

Plain radiography and CT are baseline imaging investigations for pelvic and acetabular fractures. Radiographic imaging is helpful in the rapid diagnosis of pelvic fractures and hip fracture dislocations, particularly in unstable patients.[9]

Baseline imaging for pelvic fractures includes an anteroposterior (AP) pelvis and inlet and outlet views.

The recommended views for acetabular fractures are AP pelvis and Judet views. Plain radiographs should be reviewed for the following acetabular landmarks: iliopectineal line (anterior column), ilioischial line (posterior column), anterior rim, posterior rim and the teardrop. Judet views include the obturator oblique (which shows the profile of the obturator foramen with the anterior column and posterior wall) and iliac oblique (which shows the profile of the iliac wing with the posterior column and anterior wall). Figure 2a,b and c illustrates these acetabular lines and radiographic views.

In the context of the polytrauma patient, a trauma CT will ordinarily be the baseline imaging of choice. The NICE guidelines (in England) for complex fracture management recommend CT as first line for all patients aged 16 and over.[10] In acetabular fractures this imaging helps assess marginal impaction and loose bodies in the hip joint, as well as articular gaps and step offs.

Pelvic and acetabular fracture classification

Pelvic ring fracture classification

The Tile classification and the Young & Burgess classification system are both commonly used to describe fractures of the

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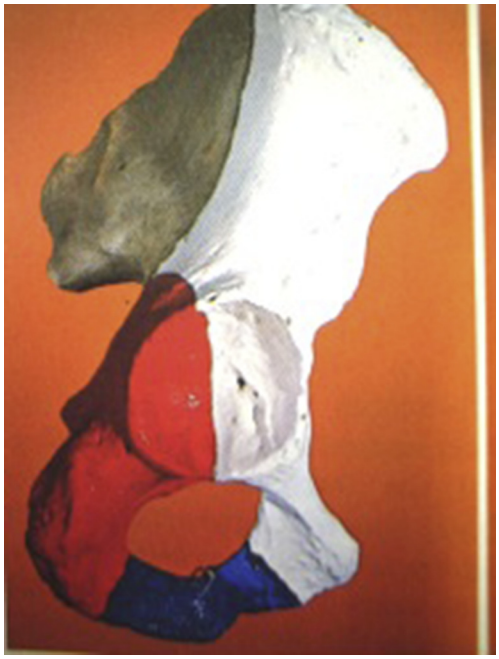

Figure 1 Illustration of acetabular columns. Area in white represents anterior column. Area in red represents posterior column.

pelvic ring. Both systems show reliable intra and inter observer correlation.[11] They do not always, however, correlate well with fracture stability or long-term patient outcomes.

Tile and Pennal subdivided pelvic fractures in 1980 based upon the implied direction of causative force and proposed management strategies based on this classification system.[12,13] This system was modified by Tile to create three main fracture patterns: Type A (stable injuries), Type B (rotationally unstable, vertically stable) and Type C (rotationally and vertically unstable). These three groups may be further subdivided as described in Table 1.

The Young & Burgess classification of pelvic ring fractures has been proposed more recently[14] and is based on the mechanism of injury. The three groups are: anterior posterior compression (APC), lateral compression (LC) and vertical shear (VS). Table 2 shows the further divisions within the three primary groups and Figure 3 illustrates the fracture patterns.

Tile classification of pelvic ring fractures

Tile classification	Tile classification subdivision
Type A	
• Stable	• **A1** no ring involvement
	• **A2** stable or minimally displaced fracture
	• **A3** transverse sacral fracture
Type B	• **B1** open book
• Rotationally unstable	• **B2** lateral compression
• Vertically stable	• **B2.1** with displacement through ipsilateral rami
	• **B2.2** with displacement through contralateral rami (bucket handle injury)
	• **B3** bilateral
Type C	• **C1** unilateral
• Rotationally unstable	• **C1.1** iliac fracture
• Vertically unstable	• **C1.2** sacroiliac fracture—dislocation
	• **C1.3** sacral fracture
	• **C2** bilateral; one side Type B, one side Type C
	• **C3** bilateral; both sides Type C

Table 1

Acetabular fracture classification

The Judet and Letournel[15] classification system for acetabular fractures is the most widely used. It describes 10 fracture patterns related to fracture lines running through the acetabular columns and walls, as illustrated in Figure 4.

In elderly patients, anterior column fractures are most common.[7] Other features particular to elderly acetabular fractures include: a separate quadrilateral-plate component, dome impaction in anterior fractures and comminution and marginal impaction in posterior wall fractures.[7]

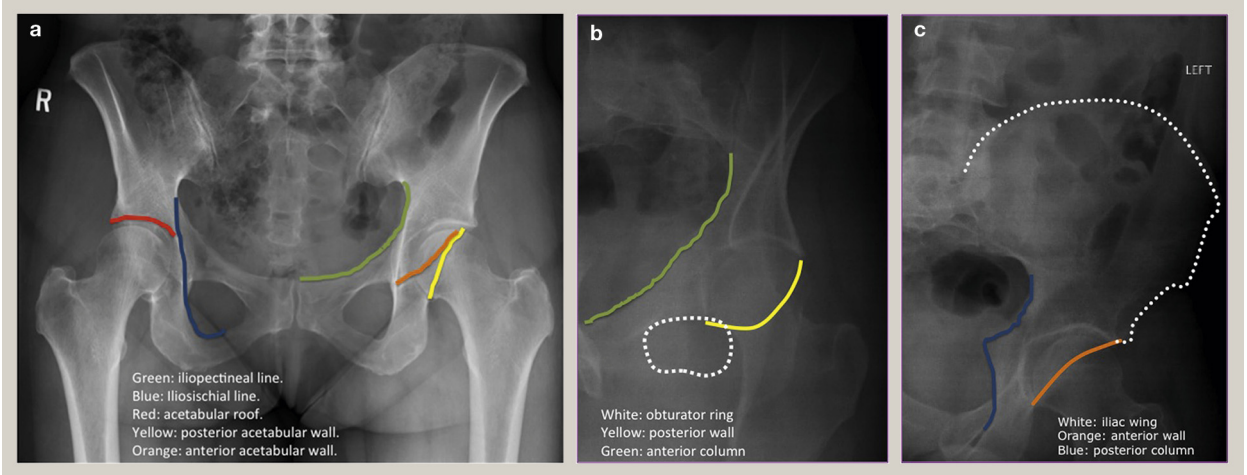

Figure 2 (**a**) Pelvic AP with iliopectineal and ilioischial lines. (**b**) Obturator oblique view. (**c**) Iliac oblique view.

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