Pelvic injuries

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Abstract

Pelvic fractures are a complex set of injuries often relating to high energy trauma. Because of their mechanism, they often present with associated injuries and have a high morbidity and mortality rate. Description is mainly based on the direction of injury using the Young and Burgess classification. Anteroposterior compression (APC) injuries have the highest risk of significant blood loss and mortality. Assessment should always be undertaken using advanced trauma and life support (ATLS) protocols alongside an experienced trauma team and any patient with a high energy injury should have a pelvic binder fitted to reduce the pelvic volume and tamponade any potential bleeding. Imaging can be undertaken in the emergency department setting using portable pelvic radiographs. CT scans help classify the injury and decide on definitive management. Temporary external fixation may help control fracture related haemodynamic instability with or without pelvic packing or angioembolization as indicated. Definitive fracture fixation can be undertaken when the patient, and their other injuries, are stabilized.

Keywords High energy injury; pelvic fracture; road traffic accident

Introduction

Pelvic ring injuries represent a complex spectrum of injuries from low-energy osteoporotic fractures to highenergy disruptions of the pelvic ring, and can be associated with high mortality and morbidity.

A typical history is of a high energy injury in young patients from road traffic accidents or a fall from height. However, the incidence of pelvic and acetabular fragility fractures in the elderly is increasing due to an increasingly elderly population with an increasing rate of osteoporosis.

The mortality rate of pelvic ring injuries varies from 15–25% for closed fractures to 50% for open fractures with early death being caused by haemorrhage and associated brain injuries, while late death is the result of sepsis and multi-organ failure.

Morbidity associated with pelvic injury has long-term medical and socioeconomic implications (including mental health issues, chronic pain, pelvic obliquity, leg length or rotational discrepancy, gait abnormalities, sexual and urological dysfunction and long-term unemployment).

Associated injuries include significant head, chest and abdominal injuries and these should all be excluded during the primary and secondary survey as per ATLS protocols and with the trauma CT.

With all these in mind, everybody involved in major trauma management should have a basic understanding of diagnosis, pattern recognition, immediate and definitive management of pelvic fractures.

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Classification

Pelvic ring ligaments

The stability of the pelvis is maintained by ligaments, as well as the muscles and fascia that make up the pelvic floor (Figure 1).

Anteriorly, the symphysis pubis provides the major mechanical stability. Posteriorly, a complex of strong ligaments (the sacrospinous, sacrotuberous, iliolumbar, and anterior and posterior sacroiliac (SI) ligaments) maintains the integrity of the posterior arch. These posterior ligaments are the strongest ligaments in the body so injury to these indicates a very high energy injury.

It is important to appreciate that mechanically **unstable** pelvic fractures are unstable primarily because of the disruption of these **posterior** ligaments.

Young and Burgess describe the vector of disrupting force and the result of displacement:

1. A force applied from the front will cause an anteroposterior compression (APC) type injury.
2. A side-on impact will cause a lateral compression (LC) type injury.
3. An upwards movement of the pelvis in relation to the sacrum will cause a vertical shear (VS) type injury (Table 1 and Figure 2).

Tile describes the horizontal and vertical stability of the pelvic ring (Table 2).

Other specific fractures

Tilt fracture: a displaced fracture of the ramus impinges on the vaginal vault and may obstruct the birth canal.

Butterfly fracture: bilateral inferior and superior pubic rami fractures, arising from an antero-inferior force.

Management (Figure 3)

Diagnosis

History: understanding the mechanism of injury is vital. A high energy mechanism of injury (motor vehicle collision, fall from height) can be associated with major pelvic disruption and other potentially life-threatening injuries and the ATLS approach is essential in immediate management of this patients.

Each mechanism of injury causes a predictable spectrum of pelvic fracture patterns and associated injuries:

- Head-on collisions are associated with APC injuries, potentially generating life threatening haemorrhage from tears of pre-sacral venous plexus and internal iliac vessels.
- Side-impact collisions are associated with LC type injures causing injuries to the lower genitourinary system from internal rotation of the affected hemi pelvis.
- Falls from height are associated with VS injuries causing disruption of the iliac vessels with uncontrolled haemorrhage as well as severe pelvic instability.

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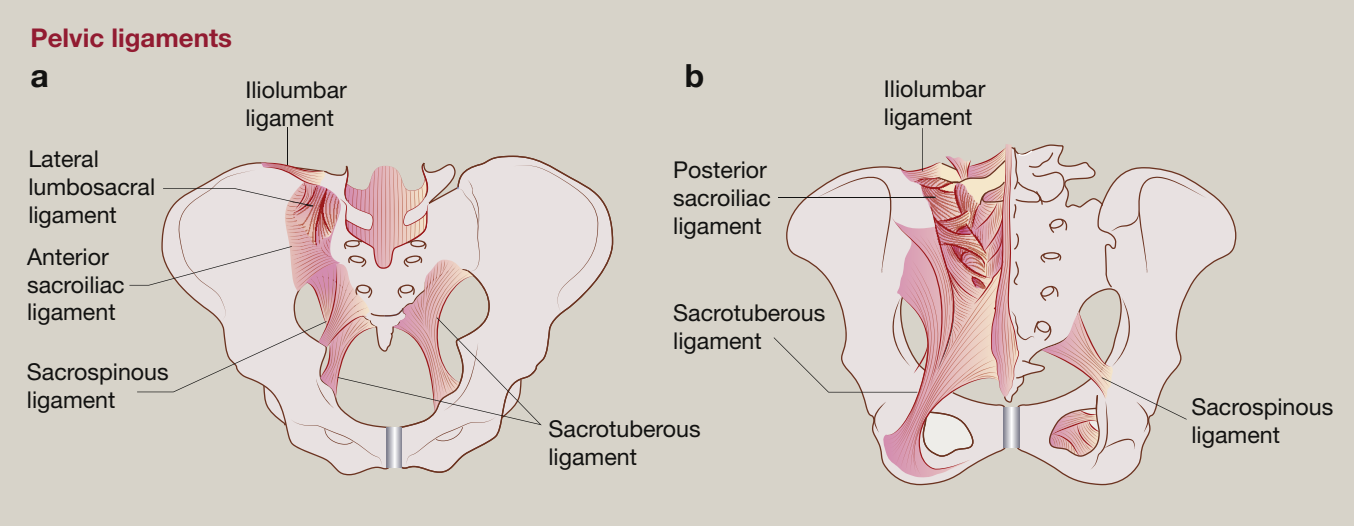

Figure 1

Young and Burgess classification of pelvic fractures

Anteroposterior compression (APC)	
APC 1	Disruption of the pubic symphysis (open book)
	Pubic diastasis <2.5 cm
	Posterior ligaments intact
APC2	Pubic diastasis >2.5 cm
	Sacrospinous, sacrotuberous and anterior SI ligaments disrupted
	Rotational instability
APC3	Pubic diastasis >2.5 cm
	Sacrospinous, sacrotuberous and anterior SI ligaments disrupted
	Posterior SI ligaments disrupted
	Rotational instability
	Complete rotational and vertical instability
Lateral compression (LC)	
LC1	Ipsilateral sacral crush injury
	Transverse/oblique pubic ramus fracture
LC2	Sacral crush injury
	Disruption of posterior SI ligaments
	Iliac wing fracture may be present (crescent fracture)
	Rotationally unstable
LC3	Ipsilateral LC injury
	Contralateral APC injury ("windswept" pelvis)
	Rotationally unstable
Vertical shear (VS)	
VS 1 unilateral	Complete loss of attachment between sacrum and the lower limb
VS2 bilateral	Complete rotational and vertical instability

Table 1

In reality, a combination of injuries is often present but trying to work out the main directional force of injury is useful to help predict injuries and likelihood of vascular injuries and other injuries present.

Examination: initial management of these patients is based on the ATLS protocol and starts with a primary survey to identify and treat life threatening injuries. The circulation ('C') component of ATLS management is particularly at risk with severe pelvic disruption, therefore resuscitation and haemorrhage control is the first step in dealing with these injuries.

A pathway in the management of pelvic trauma. includes radiographs, trauma CT scans along with activation of a major transfusion protocol and ealry pelvic binder application.

BOAST 3 guidelines provide a framework of pelvic and fracture management and should be used as a reference. Once the patient is stabilised, the secondary survey is performed.

The first clot formed within the pelvis to minimise bleeding is recognised as the most important and so repeated movement of the pelvis (i.e. "springing") during assessment of any potential pelvic injury should be avoided. If no pelvic binder is present, inspection should be undertaken to assess for any signs of pelvic injury. Bruising over the anterior superior iliac spine (ASIS) or any signs of bruising around the groin can indicate a pelvic injury. Palpation should include attempting to close the pelvic ring manually and if there is excessive mobility, the pelvic position should be maintained while a binder is applied in this 'closed' position. A trauma CT should show any fractures of the pelvis but a CT showing no fracture should not rule out a ligamentous pelvic injury. In this case a radiograph without the binder on or an MRI scan should be undertaken if the suspicion of fracture is high.

Associated injuries should now be identified and appropriately managed:

Abdominal injury. If signs of peritonism of intraperitoneal bleeding – FAST and trauma CT.

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