

# Fragility fractures of the pelvic ring

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## Abstract

Improved diagnostics and ageing population have led to increasing rates of pelvic ring fragility fractures. This is a patient group that presents with significant co-morbidities, requiring wide range of resources, prolonged care, and significant financial burden. However, the literature lacks clear guidance on their diagnosis and management. Fragility fractures of the pelvis behave differently to the classical high-energy injuries in young adults, and hence, their management principles are also different. The management goal is to control pain and restore pre-injury mobility. Multidisciplinary input and early social care planning are vital. Most patients can be managed conservatively, but a selected group may require surgical fixation owing to failure to progress with conservative treatment. Early identification of those patients and unstable fracture patterns is the key to prevent progression to complex non-unions. Surgical fixation requires special considerations compared to young adult fractures. Stabilization of both anterior and posterior parts of the pelvic ring provides adequate biomechanical construct to allow full weight-bearing in this age group. This review aims to provide guidance on the assessment and management of those injuries.

**Keywords** assessment; fragility fracture; pelvis; treatment

## Introduction

The UK Office for National Statistics reported a continuous increase in the percentage of elderly population in the UK. It predicted that by the year 2046 approximately 25% of the

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population would be 65 years or above. With an ageing population, we are seeing more and more fragility fractures.<sup>1</sup>

Furthermore, improved access to diagnostic imaging, and lower threshold for performing computed tomography (CT) scan or magnetic resonance imaging (MRI) for suspected hip fractures,<sup>2</sup> may have also contributed to the increasing rate of diagnosis of pelvic fractures including posterior ring injuries.

This review aims to provide an up-to-date understanding of pelvic fragility fractures (PFF) and guidance to orthopaedic and orthogeriatric doctors on the clinical assessment and management of these fractures.

## Definitions

Fragility fractures are defined as fractures that result from mechanical forces that would not ordinarily result in a fracture. The World Health Organization (WHO) has quantified this as forces equivalent to a fall from a standing height or less.<sup>3,4</sup>

Osteoporotic fractures are defined as fractures that are associated with a decreased bone mineral density (BMD).<sup>4</sup>

In 'insufficiency pelvic fractures' there is often no history of trauma and those fractures occur during normal activities of daily living. Patients usually present with symptoms averaging 4–6 weeks.<sup>5</sup>

## Demographics and impact

The incidence of PFF is increasing due to ageing populations.<sup>1,6–10</sup> In an epidemiological study on incidence of fragility fractures in Lothian, UK, Court-Brown et al demonstrated a PFF incidence of 47 and 115 in 100,000 over 65 years old, male and female, respectively, per year. Those rates increased with age and reached more than double in patients above 80 years old in both sexes. This represents 10–13% of the incidence of fractured proximal femur in the same population.<sup>5</sup> Similar incidences have been reported in Germany,<sup>11</sup> Spain,<sup>12</sup> Australia,<sup>1</sup> Finland,<sup>13</sup> Sweden,<sup>14</sup> and the USA.<sup>15</sup>

In an epidemiological 5-year survival study on Lothian population, UK, Hill et al demonstrated a mortality rate of 13% at 1 year, and 54% at 5 years, rising up to same rates for proximal femur fractures. A logistic regression analysis demonstrated increased mortality with increasing age and dementia. By the end of the study period 40% lost their pre-injury mobility level, and 19% dropped their accommodation level.<sup>10</sup> Other studies mirror these rates with inpatient mortality reported between 3% and 7%.<sup>1,16–18</sup>

## Classification and patterns

The two most commonly used classifications for pelvic fractures are Tile,<sup>19</sup> and Young and Burgess.<sup>20</sup> Both systems were aimed to guide the treatment of the classical high-energy pelvic trauma, which typically occurs in young adult bone. Those injuries can disrupt the bony or soft tissue components in the pelvic ring.

PFF do not behave similarly to young adult high-energy fractures, and thus, those two classification systems may not apply to this patient group. Owing to the osteoporotic bone, those injuries rarely involve soft tissue components, and are typically bony injuries and are usually minimally displaced with the aid of the intact ligaments.

Rommens et al<sup>5</sup> introduced a comprehensive classification of PFF which reflects the degrees of fracture instability (Table 1). The authors noted a fluent transition between the levels of instability and delayed presentations in types III and IV, suggesting the possibility of progression of instability in milder cases.

The most common mechanism of injury in PFF is simple fall from standing height.<sup>1,10,21</sup> This results in a lateral compression force to the pelvis, and typically presents with an anterior ring injury (uni- or bilateral rami fractures) with undisplaced sacral ala fracture (partial or complete, and uni- or bilateral).<sup>5,6,22</sup> This represents lateral compression (LC) 1 in the Young and Burgess classification, and types IIb and IIc in the Rommens classification.<sup>5</sup>

PFF of the sacral ala are usually incomplete (involving the anterior cortex only), and unilateral,<sup>5,23</sup> but bilateral and complete (involving the anterior and posterior cortices) variants can occur. Another described variety was the U-shaped fracture. The horizontal component of the 'U' or 'H' tends to occur at lower part of S1, or upper part of S2.<sup>5,24</sup> This allows for intrusion or anterolisthesis of the proximal part of the fracture, which is connected to the spine, as a result of the body's weight.<sup>5,24</sup>

### Clinical assessment

Acute osteoporotic pelvic fractures usually present with pelvic pain following an injury, most commonly a simple fall from standing height. Insufficiency fractures present with prolonged history of pelvic, or lower back, pain not related to any traumatic incident, and exacerbated by weight-bearing.

The clinical assessment and treatment of this patient group should address two aspects: geriatric and elderly care, and the pelvic fracture. Team work with the care of the elderly physician, general practitioner, or pre-admission care home is of vital importance. Information about the patient's pre-injury level of mobility, housing level, mental capability (including abbreviated mental score (AMT)), background medical history, active medications (especially anti-coagulants), falls and social history are keys to building a treatment and rehabilitation plan. Underlying

causes and risks to primary and secondary osteoporosis should be identified.

Clinical examination aims to detect associated injuries, new neurological deficit related to the injury, and the local soft tissue and skin condition around the pelvis. Local examination includes palpation of the anterior (pubic symphysis and rami, anterior superior iliac spine (ASIS)) and posterior (iliac wings, sacro-iliac joint and sacrum) components of the pelvic ring. Bilateral concentric compression on the iliac wings can produce anterior and/or posterior localizing pain. Posterior ring tenderness in the presence of anterior ring injury evident on plain radiographs may necessitate further assessment with CT and/or MRI, especially in patients with severe pain and difficulty in progression of rehabilitation. Associated injuries of the hip and spine are not uncommon<sup>10</sup> (see Figure 1).

### Radiological assessment

Baseline radiological assessment includes the three standard pelvic radiographs: anteroposterior (AP), inlet, and outlet views. Wedge sacral ala fractures, typically seen in Young and Burgess LC1 and Rommens IIb, can be seen on the inlet view (Figure 2).

Up to 60% of posterior ring injuries can be missed on plain radiographs.<sup>6</sup> Many authors recommend performing a CT scan for all evident anterior pelvic ring, or even suspected, fractures in this age group,<sup>6,22,25</sup> while others recommend it in patients failing to progress with conservative management of their pelvic injury after two weeks.<sup>26</sup> We recommend performing CT in any of the conditions listed in Table 1. The criteria listed in Table 1 present a selective approach identifying patients who it has been suggested may require consideration of surgical reconstruction (atypical patterns), or lack sufficient imaging to determine the management protocol.

Plain radiographs and CT may fail to detect insufficiency fractures, especially in the early stages of the fracture. These can be detected by MRI, which can be invaluable in patients with pelvic pain, no history of injury and negative CT.

### Management

In PFF the treatment strategy aims to restore pre-injury level of mobility and minimize risk of chronic pain.

Management of PFF should address two components. The essential component includes management of the patients' pain, co-morbidities, associated injuries, osteoporosis, and social discharge planning. Fracture management is the second component.

Management of PFF should involve a multidisciplinary approach similar to those in hip fractures. Pain relief should be commenced early including regular paracetamol and opioids if required. PFF patients are unlikely to have early surgery, which is a significant pain-relieving factor, therefore, a long-term plan for pain control is essential, and involvement of the pain team is advisable to facilitate early mobility.

Orthogeriatric input is essential. Patients usually present with other co-morbidities that can be disturbed by the pathophysiology of the pelvic injury. Prophylactic anticoagulants should be considered in all patients. Falls prevention, bone health assessment, and social care discharge planning should be part of the standard care pathway. Physiotherapy assistance with mobility

### Indications for CT in pelvic fragility fractures with radiographically proven anterior ring injury (authors' view)

#### Indication

- Failure to obtain good-quality pelvic radiographs (obesity, osteoporosis, pelvic implants, bowel gas)
- Posterior pelvic tenderness
- Persistent severe pain, at 10–14 days resulting in failure to mobilize
- Atypical mechanism, high-energy injury
- Atypical fracture pattern
- Classification other than Young and Burgess lateral compression (LC) 1 or Rommens IIb, on radiographs
- Bilateral posterior ring injury
- Displaced posterior ring injury
- Posterior ring injury involving sacrum Denis zones 2 or 3, or ilium

Table 1

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