Pelvic Fractures

Pelvic fractures range in severity from low-energy, relatively benign injuries to life-threatening, unstable fractures.

The ring formed by the fused bones of the ischium, ilium and pubis attaches to the sacrum and contains vital structures including major blood vessels and nerves and digestive and reproductive organs. Major pelvic fractures can therefore be catastrophic, mainly due to blood loss. They result from very high-energy trauma such as those generated in road traffic accidents, crush injuries or falls from height. They require urgent hospital treatment.

Less severe, stable fractures which do not damage the structural integrity of the pelvic ring can result from lower-energy impact. They typically involve fractures of only one of the pelvic bones. Fractures of pubic rami with insignificant or minimal trauma can be a presentation of osteoporosis.

Avulsion fractures are generated by sudden muscle contractions. These do not affect the integrity of the pelvis, can be managed conservatively and often go undetected.

Epidemiology

- The most significant fractures result from major trauma.
- Less severe, stable fractures are most commonly seen in elderly persons, particularly those with osteoporosis. They typically occur following a fall from standing. Isolated pubic ramus fractures are common and often missed.
- Avulsion fractures can result from sporting activities. They are particularly common in sporty teenagers and typically involve the hamstrings and the ischium, resulting from a sudden muscle contraction. They can go undetected.

Presentation

Any history of significant trauma should raise the consideration of a pelvic fracture. Presenting features of all pelvic fractures may include:

- Tenderness, bruising, swelling and crepitus of pubis, iliac bones, hips and sacrum.
- Haematuria
- Rectal bleeding.
- Haematoma or palpable fracture line on rectal examination.
- Haematoma above the inguinal ligament, the proximal thigh or the perineum.
- Loin bruising due to retroperitoneal bleeding.
- Neurological and vascular abnormalities in either or both legs.
- Instability on hip adduction and pain on hip motion suggests an additional fracture of the acetabulum.
- In men: signs of urethral injury, including a high-riding or boggy prostate on rectal examination, scrotal haematoma or blood at the urethral meatus.
- In women: vaginal bleeding and/or a palpable fracture line on bimanual vaginal examination.

High-impact, unstable pelvic fractures

- Major pelvic fractures present rapidly due to the circumstances of the trauma and the patient’s clinical condition.
- Patients present with pain and shock. As pelvic fractures may be closed the degree of blood loss may not be initially clear.
- Pelvic instability is likely. Deformity may not be initially obvious.
- If attending road traffic accidents the ability of patients with unstable pelvic fractures, initially, to move around and attempt to walk after the injury is well known and should not mislead the clinician into thinking the pelvis is intact.

Low-impact, stable pelvic fractures

- In these fractures the effect on function can be considerably less obvious.
- Blood loss is less likely to be haemodynamically challenging.
- Pain on walking is usual but patients often walk unaided.
- Attempts to ‘spring the pelvis’ to assess stability should be avoided as this is unreliable and may cause additional bleeding or injury.

Classification of pelvic injuries

There are several classification systems used to develop classification-based treatment protocols. They are generally based on the fracture pattern and the stability of the pelvic ring. Those most commonly referenced are the Tile Classification and the Young-Burgess Classification, both given below. One review found the Young-Burgess system less prone to intra-observer variability.[1, 2, 3]

Tile classification
Type A
- Stable injuries: include avulsion fractures, isolated pubic ramus fractures, iliac wing fractures and single-bone stable fractures.
- Avulsion fractures occur at the point of attachment of muscles:
  - Anterior inferior iliac spine: rectus femoris; often resulting from a mis-kick into the ground.
  - Anterior superior iliac spine: sartorius.
  - Ischial tuberosity: hamstrings.

**Type B**
- Rotationally unstable but vertically stable.
- B1: 'open book fracture' - these are anteroposterior compression (APC) fractures, causing separation of the pubic symphysis and widening of one or both sacroiliac (SI) joints.
- B2: ipsilateral compression causing the pubic bones to fracture and override.
- B3: contralateral compression injury resulting in pubic rami fractures on one side and compression SI injury on the other side.

**Type C**
- Rotationally and vertically unstable.
- The pelvic ring is completely disrupted or is displaced at two or more points.
- Associated with massive blood loss and a very high mortality.
- Subdivided into:
  - C1: unilateral.
  - C2: bilateral.
  - C3: also involving acetabular fracture.

### Young-Burgess Classification

<table>
<thead>
<tr>
<th>Type</th>
<th>Anterior-posterior Compression (APC)</th>
<th>Lateral Compression (LC)</th>
<th>Vertical Shear (VS)</th>
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</thead>
<tbody>
<tr>
<td>I</td>
<td>APC I: symphysis widening &lt;2.5 cm.</td>
<td>LC I: pubic ramus and ipsilateral anterior sacral ala fracture.</td>
<td>VS: posterior and superior directed force.</td>
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<tr>
<td>II</td>
<td>APC II: symphysis widening &gt;2.5 cm.</td>
<td>LC II: ramus fracture and ipsilateral posterior ilium fracture.</td>
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<td></td>
<td>Disruption of sacrospinous and sacrotuberous ligaments.</td>
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<tr>
<td>III</td>
<td>SI dislocation with vascular injury.</td>
<td>LC III: ipsilateral compression and contralateral APC.</td>
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### Investigations
- Urinalysis: may show gross or microscopic haematuria.
- Pregnancy test in a female of childbearing age.
- Serial haemoglobin and haematocrit measurements to monitor ongoing blood loss; group and cross-match.
- X-rays:
  - Anteroposterior pelvic X-ray diagnoses the vast majority of pelvic injuries.
  - Destruction of normal pelvis contours (Shenton's lines), asymmetry and widening of the pubic symphysis or SI joints.
- CT scan:
  - To determine whether any other injury is present.
  - For evaluation of pelvic anatomy and degree of pelvic, retroperitoneal and intraperitoneal bleeding.
  - To assess for acetabular fracture and hip dislocation.
- Ultrasound:
  - To detect intrapelvic bleeding or fluid.
- Retrograde urethrography:
  - For males with a displaced or boggy prostate or blood at the urethral meatus.
  - For females in whom a urethral catheter cannot easily pass.
  - For females with a vaginal tear or palpable fracture fragments adjacent to the urethra.
- Arteriography:
  - If the patient is haemodynamically unstable and ultrasound, CT scan or peritoneal tap excludes significant intraperitoneal bleeding.
  - Allows for determination of the bleeding site and potentially embolisation as a means of control.
Cystography:
- For patients with haematuria and an intact urethra.

Management

Stable type A injuries
- Surgery is not usually needed.
- Refer to orthopaedics for analgesia, initial bed rest and then mobilisation.
- The patient will not be fully weight-bearing for several months. Crutches or a walker will be used to aid mobilisation.
- Avulsion fractures: usually only require rest and pain relief.
- Larger avulsions, especially of the ischial tuberosity, may require internal fixation to avoid complications such as non-union.
- Anticoagulation to reduce deep vein thrombosis (DVT) risk may be required.

Unstable type B and type C fractures
- Initial management should follow Advanced Trauma Life Support protocols.
- Avoid rolling the patient and instead perform a straight lift with a number of helpers.
- Assess for and treat hypovolaemia, anticipate coagulopathy and ensure blood is rapidly available, as a massive transfusion may be required.
- Massive fluid resuscitation is generally still recommended but there is some evidence that a restrained fluid volume therapy may improve outcomes. Fluid management in major trauma generally remains an area of controversy and researchers continue to debate it.[6]
- Following established protocols helps standardise care and achieve the best outcomes. There is still ongoing international debate about what these should be. There are no universally accepted guidelines.[7]
- Initial aim is reduction of blood loss by reducing pelvic volume, stabilising clot formation and reducing ongoing tissue damage. This can be achieved by binders, sheets and stabilisation by external fixation.
- External fixation involves long screws inserted into the bones from the sides and a large external frame. It allows the surgeon to address the potential internal neurovascular and soft tissue injuries.
- Minimise movement and support an obviously unstable pelvic fracture associated with severe haemorrhage using, for example, medical anti-shock trousers (MAST suit).
- Unstable patients may need selective arterial embolisation and/or pelvic packing.
- Open pelvic fractures involving the perineum or bowel may need colostomy.
- Do not catheterise if urethral injury is suspected.
- Diagnostic peritoneal lavage may be required and should be performed by a supra-umbilical approach, as a pelvic haematoma may track up the abdominal wall.
- Further management is case-specific. Some require traction; others may require internal fixation with plates or screws. In some cases external fixation will be sufficient.
- Early fixation is important for mobilisation and pain control and for the prevention of deformity and chronic instability.
- The need for a multidisciplinary approach in order to achieve the best outcomes is not disputed.[8]

Complications
- Increased incidence of thrombophlebitis.
- Intrapelvic compartment syndrome.
- Continued bleeding from fracture or injury to pelvic blood vessels.
- Associated bladder, urethral prostate or vaginal damage is common.
- Associated thoracic and abdominal injuries occur in 10-20%; massive internal haemorrhage may occur.
- Sexual dysfunction may be a long-term problem.[9]

Prognosis
- Prognosis varies depending on severity of fracture and associated injuries.
- Severe blood loss is the main threat to life. Pelvic fracture associated with haemodynamic instability has a mortality in excess of 40%. [7,10]
- Stable pelvic fractures heal very well.
- High-energy fractures may have significant complications including bleeding, organ damage, infection, venous thrombosis and embolism.
- Severe compound fractures of the pelvis lead to a mortality rate of over 40%.
- Patients who also have acetabular fractures do significantly worse than those without this added complication.
- Prolonged physiotherapy and rehabilitation will be needed for a return to full fitness.
- Subsequent problems may involve long-term effects on internal pelvic structures which may leave patients with symptoms such as persistent pain, impaired mobility or sexual dysfunction.
- Regardless of fracture type, neurological injury is a strong predictor of poor outcomes.[5]

Prevention
- Car safety - seat belts, speed restrictions, impact protection systems.
- Any safety procedure that reduces risk of falls from high levels, including site safety on construction sites.
- Treatments to improve bone density in selected patients.
- Active approach to the management of impaired mobility in the elderly, with physiotherapy and occupational therapy programmes to address home safety, core stability, balance, fitness, strength and aids to walking.
Further reading & references

- Pelvic Fractures; Wheeless' Textbook of Orthopaedics


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