PELVIC INJURY MODULE

Introduction

Pelvic injury is associated with significant morbidity and mortality through major haemorrhage, soft tissue infection and associated injury to intra-abdominal organs – particularly the bladder, bowel and genitalia. It is primarily due to blunt trauma with MVA and falls accounting for the majority of injuries.

Overall the mortality of pelvic fractures is 16%. A compound pelvic injury is particularly devastating with a mortality rate of 55%.1

Pelvic Anatomy

The pelvis has a rich collateral blood supply, especially across the sacrum and posterior ileum. The close proximity of major arteries, veins and highly vascularised cancellous bone increases the risk of severe haemorrhage.1 The pelvic peritoneum which theoretically should eventually limit and tamponade the bleeding pelvis, can actually accommodate more than 3 L.2

Figure 1   The proximity of the arteries in relation to the pelvis: IL iliolumbar artery; SG superior gluteal artery; LS lateral sacral artery; IP internal pudendal artery; O obturator artery1

Culprit arterial bleeding sites in pelvic fractures:

<table>
<thead>
<tr>
<th>Anteriorly (43% total)</th>
<th>Posteriorly (57% total)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal pudendal a 27%</td>
<td>Superior gluteal a 25%</td>
</tr>
<tr>
<td>Obturator a 16%</td>
<td>Lateral sacral aa 23%</td>
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<td></td>
<td>Inferior gluteal a 9%</td>
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## Classification of Pelvic Fractures

**Young – Burgess Classification**

<table>
<thead>
<tr>
<th>Anterior Posterior Compression</th>
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<tbody>
<tr>
<td>Characterised by pubic diastasis with or without SIJ disruption</td>
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</tr>
<tr>
<td><strong>Type I</strong></td>
<td>&lt; 2.5cm symphysis diastasis with no significant posterior injury</td>
</tr>
<tr>
<td><strong>Type II</strong></td>
<td>&gt; 2.5cm symphysis diastasis with anterior opening of SI joint</td>
</tr>
<tr>
<td><strong>Type III</strong></td>
<td>Disruption of the pubic symphysis and posterior ligaments with hemipelvis displacement</td>
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<table>
<thead>
<tr>
<th>Lateral Compression</th>
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<tbody>
<tr>
<td>Characterised by transverse pubic rami # with varying degrees of posterior injury</td>
<td></td>
</tr>
<tr>
<td><strong>Type I</strong></td>
<td>Posterior compression of the SIJ with oblique pubic ramus #</td>
</tr>
<tr>
<td><strong>Type II</strong></td>
<td>Rupture of the SI ligaments, crush # sacrum, internal rotation of the hemipelvis and oblique pubic ramus #</td>
</tr>
<tr>
<td><strong>Type III</strong></td>
<td>Type II features and AP compression injury to contralateral hemipelvis</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>Vertical Shear</th>
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<tbody>
<tr>
<td>Complete ligament or bony disruption of hemipelvis with vertical displacement</td>
<td></td>
</tr>
</tbody>
</table>

![Figure 2](image)  
Young-Burgess classification based on direction of force¹
Assessment

Goals of assessment in pelvic injuries:

i. Identify life threatening haemorrhage

ii. Identify associated injuries
   o Bladder
   o Bowel
   o Genitalia

History & Examination

• Mechanism of injury with focus on directional forces to pelvis
• Haemodynamic parameters to quantify extent of haemorrhage
• Inspection for bruising, deformity and compound wounds.
• Gently palpate the skeletal structures – springing pelvis is advised against as can exacerbate haemorrhage
• Examine lower limbs for length discrepancy, ischaemia or neurology
• Abdominal examination for signs of peritonism
• PR for evidence of bowel injury
• PV for evidence of genital injury

Investigations

Bedside:

VBG to quantify extent of haemodynamic compromise & baseline Hb

FAST to identify concurrent haemoperitoneum

DPL largely superseded by FAST

Bloods:

FBC baseline Hb & plts if DIC
ELFT, lipase associated renal, liver or pancreatic insult
Coags coagulopathy of trauma/DIC
G&H & CXM
βHCG

Imaging:

Pelvis XRay

CT & CT angiogram of pelvis is required to characterises the extent of pelvic injury, associated injuries as well as ongoing haemorrhage. Active bleeding – visualised by a contrast blush – can identify injuries amenable to angiographic intervention.

Retrograde urethrogram can be performed if there is any suggestion of a urethral injury
Management

Goals of management:

i. Address hypovolaemia and hypoperfusion
ii. Expedite definitive therapy for haemostasis
iii. Address associated bladder, bowel or genital injuries

Resuscitation

Major haemorrhage needs to be anticipated. Definitive control (via surgery or interventional radiology) is the major endpoint which needs to be expedited.

- Activate multi-disciplinary trauma system response
- If not already in place apply pelvic binder
  - definite role if evidence of pubic diastasis
  - can be deleterious in lateral compression injuries
- Activate massive transfusion protocol
- Commence warmed fluid resuscitation via large bore IV access to meet end points of palpable radial pulse or SBP > 85 or MAP > 60

  Use blood:plasma:platelets at 1:1:1
  Aim Hb >100, plt > 100, INR < 1.5, iCa$^{2+}$ > 1.0
  Administer cryoprecipitate if fibrinogen < 1.0
  Administer Tranexamic Acid 1g bolus followed by infusion

Specific therapy

A good algorithm created by the NSW Institute of Trauma and Injury Management for the management of the haemodynamically unstable patient with pelvic trauma is presented below.

In essence the haemodynamically unstable patient with isolated pelvic trauma (that is a negative FAST) and arterial bleeding amenable to interventional radiology needs urgent transfer to the IR lab to control haemorrhage.

The haemodynamically unstable patient with pelvic trauma and evidence of haemoperitoneum should proceed to OT urgently to address the intra-abdominal injury. The pelvis can be packed during the laparotomy. If this fails to control the haemorrhage iliac vessels can be ligated. Alternatively the patient could proceed to interventional radiology following laparotomy for haemorrhage control.
Management of the Haemodynamically Unstable Patient with a Pelvic Fracture with Angiography Services available

**Primary Survey (ABCDE)**
- Stop external blood loss
- Assess long bones
- Treat haemo / pneumothorax
- Chest and pelvic x-ray
- Assess abdomen with DPA* and/or FAST** if available

Pelvic fracture identified, haemodynamically unstable

Stabilise pelvis with non-invasive device*** in ED

Fluid resuscitation using small aliquots of fluid with early use of blood to maintain systolic BP 80-90 mmHg. Use caution in the elderly. Contraindicated in the unconscious patient without a palpable blood pressure. Maintain the systolic blood pressure >90mmHg for those with a traumatic brain injury. Treat any other serious injury identified in Primary Survey.

**ABDOMEN NEGATIVE**
- Immediate interventional angiography

**ABDOMEN POSITIVE**
- Immediate laparotomy
- Stabilise pelvis in OT using Single Pin V Shaped technique

Remains haemodynamically unstable?

NO
- Admit to ICU for stabilisation
- OT for fixation of pelvis

YES
- Repeat FAST**
- Immediate interventional angiography

**ABDOMEN NEGATIVE**
- Immediate interventional angiography

**ABDOMEN POSITIVE**
- Immediate Laparotomy
- Admit to ICU for stabilisation

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* Diagnostic Percutaneous Aspiration (DPA) - 15mls of frank blood = Positive DPA
** Focused Abdominal Sonography in Trauma (FAST) - Free fluid = Positive FAST
*** Non-invasive pelvic stabilisation with sheet or binder.
• Single gentle pass IDC is safe if potential urethral injury identified if this fails a SPC is required

• IV cephazolin if evidence of compound injury (broaden to triple ABs if evidence of bowel injury)

• Ensure adequate tetanus prophylaxis

**Supportive therapy**

- Keep NBM
- Ensure adequate analgesia
- Chart maintenance IV fluids
- Chart prn anti-emetics
- Keep patient warm
- Correct any coagulopathy
- Ensure comprehensive documentation

**Disposition**

Disposition will be largely dictated by patient stability and concurrent injuries. The haemodynamically stable patient with an isolated pelvic injury is usually admitted to the orthopaedic ward.

The unstable patient needs urgent transfer to OT or IR with subsequent admission to ICU or trauma HDU.

**Additional Information**

• Pelvic binders are thought to reduce fractures, provide stabilisation and reduce pelvic volume thereby limiting haemorrhage. There is no evidence to suggest one proprietary binder is superior to any other. A simple sheet can be used (Appendix 1). Ideally the pelvic binder device should allow access for laparotomy and femoral vessels for potential angiography.

• Urethral injury is suggested by the presence of perineal bruising, blood at the urethral meatus or high riding prostate. Less specifically haematuria or difficulty voiding may occur.

**Further reading**

• Heetveld M. 2007, *The Management of Haemodynamically Unstable Patients with a Pelvic Fracture*, NSW Institute of Trauma and Injury Management.

• Life in the Fastlane has a series of pages on pelvic trauma by Chris Nickson & a podcast by Scott Weingart which are worth having a look at

References


**APPENDIX A**

**Pelvic sheeting**

For rotationally unstable pelvic fractures: Open-book, Vertical Shear, Lateral Compression type III or Combined Mechanism fractures

1. Place folded bed sheet underneath the patient between iliac crests and greater trochanters.

2. With two trauma team members cross the sheet across the symphysis and pull the sheet firmly so it tightly fits around and stabilises the pelvis.

3. A third person should clamp the sheet at the four points shown (away from laparotomy / angiograph access points).