UNSTABLE PELVIC FRACTURES
Case Presentation

- 13yo healthy girl
- BIB EMS s/p ped struck by truck
- Prolonged extrication
- Traumatic arrest on arrival to trauma bay
- GCS 3
Initial Resuscitation

- Intubated
- 1 round epi/atropine → BP 118/60, HR 150
- Left femoral cordis → 6 units PRBC via level 1
- Secondary survey:
  - abrasions anterior abdominal wall, distended
  - Bleeding Lac Rt groin & unstable pelvis → T-pod placed
  - Rt ankle lac & deformity
- CXR no PTX
- PXR: fx Rt pubic symphysis w/ SI dislocation
- FAST: + RUQ fluid
Management

- Taken emergently to OR for ex-lap.
- IR notified to prepare for intra-operative pelvic angiography
- Operative findings: dark blood around liver retroperitoneal hematoma intact liver & spleen
- BP labile despite additional 2 PRBC + 2 FFP via SC
- IR prepared for angio
- PEA, unable to revive after 20min ACLS protocol
Unstable Pelvic Fractures

Epidemiology
Anatomy & Classification
Associated Injuries
Treatment Algorithm
Initial Management
Pelvic Packing vs IR Embolization
Pelvic Fracture Epidemiology

- **Mechanism**
  - MVC 67%
  - Pedestrian struck 15%
  - Motorcycle 5%
  - Fall/Jump 5%
  - Crush 5%

- **Mortality**
  - High-energy 10-20% mortality
  - Open fractures 50% mortality
Pelvic Ring

2 inominate bones
Sacrum
2 sacroiliac joints
Pubic symphysis
Unstable = disrupted in 2 places (15% of pelvic fx)

Copyright © The McGraw-Hill Companies, Inc. All rights reserved.
Pelvic Stability

Additional stability provided by sacrospinous, and sacrotuberosus ligaments.
Pelvic Vascular Anatomy

Common Iliac branches over SI joint

MC injured vessels:
  superior gluteal
  Internal pudendal
  Obturator
  Lateral sacral

www.downstatesurgery.org
Pelvic Fracture Classification

Table 12–1. Burgess and Young Classification System of Pelvic Ring Injuries

Lateral Compression (LC)

LC I: Pubic rami fracture (transverse) and ipsilateral sacral compression
LC II: Pubic rami fracture (transverse) and iliac wing fracture
LC III: Pubic rami fracture (transverse) and contralateral open-book injury (i.e., pelvis is run over by an automobile wheel, resulting in the hemipelvis on the side of lateral impact to rotate internally and the contralateral hemipelvis to rotate externally)

Anteroposterior Compression (APC)

APC I: Symphyseal diastasis (1–2 cm) with normal posterior ligaments
APC II: Symphyseal diastasis or pubic rami fracture (vertical) with anterior SI joint disruption
APC III: Symphyseal diastasis or pubic rami fracture (vertical) with complete SI joint disruption

Vertical Shear (VS)

Symphyseal diastasis or pubic rami fracture with complete SI joint disruption, iliac wing, or sacrum (with vertical displacement)

Combined Mechanical (CM)

Combination of other injury patterns (LC/VS or LC/APC)
Lateral Compression Fractures

- 41% of all pelvic fractures
- Shortens diameter across pelvis
- Average 4 units prbc
- Blood loss from associated injuries rather than fracture
  - Abdominal solid organ
  - Thoracic: lungs, aorta
  - Cervical spine
- Mechanisms
  - T-bone MVC
  - Ped struck from side
  - Fall from height landing on side
Lateral Compression: LC 1

- Transverse pubic rami fracture & ipsilateral sacral compression
- Stable
- Few associated injuries
Lateral Compression: LC 2

- Transverse pubic rami fracture & iliac wing fracture
- Mildly unstable
- Treatment: bedrest → ORIF

www.downstatesurgery.org
Lateral Compression: LC 3

- Transverse pubic rami fracture & contralateral open-book injury
- Rollover injury
- Unstable fracture
- Hemodynamic instability and associated injuries common
- Treatment: emergent ex-fix
Anteroposterior Compression (APC)

- 26% of all pelvic fractures
- Widens pubic symphysis and SI joints
- Average 15 units prbc
- Blood loss from vascular disruption
- Associated with sacral plexus and urogenital injuries
- Mechanism
  - Head-on MVC
  - Straddle injuries: motorcycle collision
  - Crush injuries
Anteroposterior Compression: APC1

- Symphyseal diastasis 1-2cm with normal posterior ligaments
- Few associated injuries
- Treatment: bedrest in lateral position
Anteroposterior Compression: APC2

- Symphyseal diastasis or vertical pubic rami fracture with anterior SI joint disruption
- Rotationally unstable
- Associated with hemorrhage and nerve injury
- Treatment:
  - emergent ex-fix.
  - IR embolization (20%)
Anteroposterior Compression: APC3

- Symphyseal diastasis or vertical pubic rami fracture with complete SI joint disruption
- Internal hemipelvectomy
- Associated with internal iliac vessel disruption, lumbosacral plexus injury, and intra-abdominal organ injury

Treatment:
- Emergent ex-fix
- IR embolization (>20%)
Vertical Shear (VS)

- 5% of all pelvic fractures
- Associated with sacral nerve, abdominal organ, & additional fractures but less vascular injury than severe APC fractures
- Sympyseal diastasis or pubic rami fx with disruption of SI joint, iliac wing, or sacrum with vertical displacement
- Mechanism
  - Jump/fall from height landing on extended leg
  - Structural collapse (scaffolding)
  - Motorcycle abrupt stop
- Treatment
  - Emergent ex-fix
  - IR embolization (20%)
Combined Mechanism (CM)

- 10% of all pelvic fractures
- LC + VS or LC + APC
- Very unstable
- Associated with multiple organ injuries

Treatment:
- Emergent ex-fix
- IR embolization

Copyright © The McGraw-Hill Companies, Inc. All rights reserved.
Associated Injuries

- **Neurologic**
  - L5 & S1 nerve roots, sciatic, femoral, pudendal, and superior gluteal nerves
  - 10-15% of patients, 50% in VS fractures

- **Vascular**
  - 90% venous, 10% arterial
  - 60% hypotension from pelvic hemorrhage in LC & APC 2-3 fractures
Associated Injuries

- **Urogenital**
  - Bladder rupture 5-10%
  - Urethral injury 5-10%
  - MC in APC fractures
  - Vaginal – open fx

- **Rectal**
  - Open fx
  - Diverting colostomy
Primary survey—ABCs
Intravenous access proximal to the diaphragm
Early blood transfusion
AP radiograph of pelvis

Hemodynamically unstable
Circumferential pelvic wrapping
Remains in extremis despite aggressive resuscitation
Responds to fluid but requires ongoing transfusion to maintain blood pressure

Hemodynamically stable
Complete secondary survey
Inlet and outlet views
Pelvic CT scan
Definitive pelvic fracture management

Operating room for laparotomy*
Intraperitoneal hemorrhage control, pelvic packing, and external fixation, open reduction and internal fixation for all unstable fracture patterns

Hemodynamically unstable
Angiography
Hemodynamically stable
Definitive pelvic fracture management

Intraperitoneal bleeding
Laparotomy* Pelvic external fixation or open reduction and internal fixation
Ongoing transfusion requirement
Stable blood pressure
Angiography
External fixation or
Definitive pelvic fracture management

No intraperitoneal bleeding
Angiography

*Pelvic binder or external fixation to remain in place during laparotomy
Assessment of Pelvic Stability

Copyright © The McGraw-Hill Companies, Inc. All rights reserved.
Stabilization of pelvic fractures
Preperitoneal pelvic packing

- 6-8cm midline incision extending from pubic symphysis cephalad
- Midline fascia divided
- 3 laparotomy pads placed on each side of bladder
- Fascia closed with 0-PDS, skin closed with staples
- Return to OR in 24-48hrs for packing removal
Pelvic Packing vs Angiography

Osborn et al 2009
- 20 angio, 20 pack
- Angio 130 min
- Pack 45 min
- No difference in mortality
- Decrease # PRBC needed in packing group

Tai et al 2011
- 11 angio, 13 pack
- Angio 140 min
- Pack 79 min
- No difference in mortality
References

- Canale & Beaty. Campbell’s Operative Orthopedics, 11th ed. 2007
- Feliciano, et al. Trauma, 6th Ed. 2008
- Skinner, HB. Current Diagnosis and Treatment in Orthopedics, 4th Ed. 2006
- Tai DK, et al. Retroperitoneal pelvic packing in the management of hemodynamically unstable pelvic fractures: A level 1 trauma center experience