Chapter 55 – Pelvic Trauma

Episode Overview

1) Describe common pelvic fractures and their classification
   a. Young-Burgess classification
   b. Tile classification
   c. Denis classification

2) List 3 categories of complications of pelvic fractures

3) Describe the approach and management of hemodynamically unstable pelvic fracture.

4) List 5 radiographic cues to posterior arch fractures

5) What is the management of penetrating pelvic trauma?

Wisecracks:
1) How are open pelvic fractures diagnosed and managed?
2) What is the classification of acetabular fractures?
3) How are coccygeal fractures managed?

Rosen’s in Perspective:

- Key message: be scared! Patients can easily exsanguinate into their pelvis from pelvic ring fractures
  - Also requires large amount of force - look for other injuries
- Epidemiology:
  - Primarily result from MVCs and ped struck trauma.
  - Less commonly (5-10%) falls from height
  - Mortality is 9-22% - independent predictor of death
- Anatomy
○ Complex structure, but at the core is a ring protecting visceral components (GI tract, vasculature, nerves)
○ Major components of stability: posterior arch (weight bearing), symphysis pubis anteriorly.
○ Unstable ring fractures mostly due to disruption of ligaments of posterior arch.
○ Vascular
  ■ Lots of vascular structures! Internal and external iliac arteries.
  ■ Superior gluteal artery commonly injured in posterior arch fractures.
  ■ Obturator and internal pudendal arteries commonly injured in ramus fractures.
  ■ Veins form venous plexus and have no valves and adhere closely to pelvic walls - can hemorrhage easily and are not compressible.
○ Neurologic
  ■ Cauda equina in sacral spinal canal
  ■ Injury to posterior pelvis/sacrum can cause lower neurologic deficits & autonomic dysfunction
    ● Check rectal tone, post-void residual, etc.!

1) Describe common pelvic fractures and their classification
   • It can be useful to consider both types of classification (stability as well as mechanism)
   • Key is underlying principles of stability and co-injury over detailed specifics.
   • Broad classification: stable vs. unstable fractures

   a) Young-Burgess classification
- Based on mechanism of injury
- **Anterior-Posterior Compression (APC)**
  - APC I: symphysis < 2.5cm *(stable)*
  - APC II: symphysis > 2.5cm, SI disruption *(partially stable)*
  - APC III: symphysis > 2.5cm, SI shearing *(completely unstable)*
- **Lateral Compression (LC)**
  - LC I: ipsilateral sacral crush injury *(stable)*
  - LC II: ipsilateral sacral crush injury, disruption of posterior SI ligaments, possibly iliac wing fracture *(partially unstable)*
  - LC III: internal rotation of ipsilateral hemipelvis with external rotation of contralateral hemipelvis *(windswept pelvis)* *(partially unstable or completely unstable)*
- **Vertical Shear (VS)**
  - Vertical displacement of symphysis and JI joints
  - **ALWAYS UNSTABLE**
- **Combined Mechanism (CM)**
  - **ALWAYS UNSTABLE**

**b) Tile classification**

**Type A, B, and C (C is worse)**
- All about rotational (hinging pelvis) stability and vertical (shearing) stability
- **A - Stable Injuries**
  - Rotationally and vertically stable
  - Fracture of bones outside the pelvic ring itself.
    - Avulsion fractures
      - Athletic injury, sudden forceful muscular contraction
      - Common in older children/teens - physeal avulsion
      - Ischial tuberosity, iliac crest epiphysis, ASIS
      - Can avulse AIIS from kicking (rectus femoris contraction) but can also be normal *os acetabuli*.  

![Box 55-1 Tile's Classification of Pelvic Fractures](image-url)
- Conservative treatment, surgery rarely needed
  ■ Isolated iliac wing fracture
  ■ Inferior public ramus fracture
  ■ Transverse sacral or coccyx fracture
- Mechanism:
  ○ Forced flexion
  ○ Fall from height
- Below S4 unlikely to result in neurologic injury
  ○ Treated conservatively
- Above S4 common neurologic injury
  ○ Need careful neurologic exam and surgical referral
- Undisplaced fractures of the pelvic ring
  ■ Be careful and always search for second ring fracture
  ■ Commonly isolated fracture of inferior and superior public ramus
  - If displaced - look for another fracture!
  - Fracture of both rami on ipsilateral side can be associated with unrecognised impact fracture of posterior pelvis
  - Get a CT if clinically any posterior pelvic pain or instability
  - **In one study, 95% of elderly patients with isolated ramus fracture had sacral fractures on MRI!**
  - Lateral compression mechanism (Young-Burgess I) associated with 7% mortality
- Four-pillar fractures of both pubic rami on both sides (“butterfly segment”)
  - Straddle mechanism - direct blow to symphysis
  - High rate of concomitant injuries - **Computer Tomography**
  - High rate of injury to GU tract

**B - Partially Stable**
- Rotationally unstable, vertically stable
- High energy impacts - mechanism determines injury types
- B1: Open book fracture
  - Typically from AP force
  - Radiology:
    - Symphysis widening > 2.5cm
    - Widening of SI joints
  - Can have severe vascular & neurologic compromise
  - Complete separation of hemipelvis from shearing (vs. hinging of SI joint) is completely unstable (Tile C) - need CT to tell.
- B2: ‘Closed book fracture’
  - Typically from lateral compression
  - Overriding of pubic symphysis (internal rotation of hemipelvises)
  - Decreases volume of pelvis, typically associated with less blood loss than AP injuries

**C - Unstable**
- Rotation unstable, vertically unstable
- Result from vertical shearing force on the pelvis
  - E.g. fall from height, ‘submarining’ under dashboard
- SI joint has been disrupted from vertical shearing force
Look for avulsion of ischial spine, avulsion of lower lateral lip of the sacrum, and injury to L5 transverse process on radiology - all insertion sites of important ligaments
- Potential for large volume blood loss, significant hypovolemia, PEA arrest
- C1 - unilateral
- C2 - bilateral
- C3 - bilateral with involvement of acetabulum
- Remember - vertical fractures of the sacrum count as well - transverse do not (orientation to the pelvic ring is different)

b) Denis classification

![Denis Classification Diagram](image)

*Figure 55-10. The Denis classification of vertical sacral fracture. Zone I is lateral to the sacral foramina (known as the sacral ala). Zone II is transforaminal. Zone III is the central sacrum medial to the foramina.*

- Classification of vertical sacral fractures
- Higher numbers are worse in terms of potential for neurologic injury and pelvic instability
- Denis I - lateral to sacral foramina
- Denis II - through sacral foramina
- Denis III - medial to sacral foramina, involving spinal canal

2) List 3 categories of complications of pelvic fractures

- Associated injuries
  - Urologic
    - More common in men, anterior pelvic fractures
    - Check for blood at the meatus
    - Retrograde urethrogram to check for urethral injury
    - Don’t forget bladder can be injured as well.
  - Neurologic
    - Worse with worsening instability (Tile A < B < C)
    - Worse with more medial vertical sacral fractures (Denis I < II < III)
    - Cauda equina possible
  - Gynecologic
    - Can have open pelvic fracture into vagina
    - Look for blood at introitus
    - Careful manual examination
  - Gastrointestinal
**Open pelvic fracture into GI tract**
- High risk of infection
- Careful digital internal examination

**Hypovolemia/shock**
- Can easily lose 10-15 units of blood volume into pelvis
- Consider in trauma patients in PEA
- APC had highest average transfusion requirements (15 units), VS next (9 units), LC least (4 units)

**Infection**
- Open pelvic fractures can be occult and open into “dirty” areas such as GI tract of vaginal vault

### 3) Describe the approach and management of hemodynamically unstable pelvic fracture.

- Access -> stabilize -> control hemorrhage -> resuscitate with blood -> definitive treatment
- Ensure excellent IV or central access above the pelvis
- Consider early activation of massive transfusion protocol
  - Typical to require 10 - 20 units of pRBCs in first 24 hours
  - Do not delay definitive treatment in order to attain normotensive vitals
- Bind/stabilize pelvis with sheet or pelvis binder
  - Consider requesting orthopedic external fixation of pelvis
- Recently some articles published about REBOA (resuscitative endovascular balloon occlusion of the aorta)
  - Trained ED physicians only! Still experimental
  - Balloon catheter threaded into thoracic aorta and inflated to occlude lower body perfusion
  - Prevents further hemorrhage, increases afterload and brain perfusion
  - Also successfully performed prehospital by London HEMS!! What a bunch of bad asses (Sadek et al., Oct. 2016 - [http://www.resuscitationjournal.com/article/S0300-9572(16)30136-8](http://www.resuscitationjournal.com/article/S0300-9572(16)30136-8))
- Assess for associated injuries
  - Patients with both retroperitoneal hemorrhage from pelvic fracture and intrabdominal hemorrhage have a mortality rate of 40%
    - Make sure to involve ortho, general surgery, and interventional radiology in planning approach for whether to go to OR for pelvis or abdomen first, or combined setup.
    - Ortho may also place pelvic packing during laparotomy
  - Remember: pelvic injuries bleed into retroperitoneal space, but FAST exam looks at intraperitoneal space. False-negative FAST exam has an odds ratio of 3.5 in patients with pelvic trauma! Don’t rely on it!
  - Rosens talks about DPL... yeah no.
- Angiography and embolization for suspected arterial bleeds
- Orthopedic referral

### 4) List 5 radiographic cues to posterior arch fractures

- This is box 55-3 in Rosens
  - Avulsion of L5 transverse process
5) What is the management of penetrating pelvic trauma?
   - Complex anatomy, very high likelihood of visceral, vascular, and/or neurologic injury
   - Overall mortality is 6-12%
   - All cases of penetrating pelvic trauma should have emergent surgical consultation and should be covered with broad spectrum antibiotics
   - DRE is important to assess for injury to the rectum.

Wisecracks:

1) How are open pelvic fractures diagnosed and managed?
   - Important to look for occult open fractures
   - Can be intravaginal, intrarectal
   - Look for blood at introitus, injury to the perineum or gluteal region, and make sure to perform a DRE and vaginal examination
     - Be careful with internal exams in order to not lacerate finger on bone fragments
   - Active bleeding can be controlled with direct pressure
   - Cover early with broad spectrum antibiotics and anaerobic coverage

2) What is the classification of acetabular fractures?
   - Finally! A universal classification!
● Type A - anterior or posterior column fracture
  ○ Posterior more common
    ■ Forceful impact to flexed knee (dashboard injury)
  ○ Anterior less common
    ■ Extension of superior ramus fracture into acetabulum
● Type B - anterior and posterior column, segment of acetabulum still attached to ilium
  ○ Often T-shaped fracture
● Type C - anterior and posterior column, no segment of acetabulum still attached to ilium
● All of these need CT and orthopedic referral

3) How are coccygeal fractures managed?
● Conservatively!
  ● Rest
  ● Analgesia
  ● Sitz baths
  ● Stool softeners

  ● If ongoing intolerable pain, can consider non-emergent orthopedic referral for local steroid injection or coccygectomy