Case

• 25 y.o. male presents to E.D. as a Level I trauma by air evac after sustaining a severe crush injury to the pelvis run over by a tractor

• Pt was intubated in the field, airway was confirmed in the E.D., and equal, bilateral breath sounds were heard

• Pt was hypotensive due to blood loss from the pelvic injury
Case

- IV access was obtained including a Cordis catheter

- Exposure found the patient to have a massive laceration to the left pelvis, exposed pubic ramus, unstable pelvic fracture, exposed femoral vessels, near complete avulsion of the rectum from the pelvis, and gross contamination of the pelvic wound
Pelvic Trauma

- 3% of all fractures
- 60% from MVC, 30% from falls, 10% from crush injuries, athletic injuries, and penetrating trauma
- Third most commonly found injury in MVC fatalities
- 8-15% mortality with closed fractures
- 25-50% mortality with open fractures
Anatomy

- Comprised of three bones: sacrum and two innominates
- Innominates are subdivided into the ilium, ischium, and pubis
Anatomy

- Stability depends upon ligaments
- Pubic symphysis is a thick fibrocartilaginous disk joining the innominate bones
Tile Classification
Based on integrity of posterior sacroiliac (SI) complex

A: SI intact: stable fracture

B: SI partially intact: rotationally unstable, vertically stable

C: SI disrupted: rotationally and vertically unstable
Type A Fractures

• Stable Fractures
• Frequently Managed Non-Operatively
  • Avulsion fractures
  • Non-displaced pubic ring fractures
  • Stable iliac ring fractures
  • Transverse sacral fractures
    • Some suggest may need to be reclassified
• Bleeding less and usually venous
• Careful with binder
Type B Fractures

- Rotationally unstable but vertically stable


- Lateral force. Sacroiliac complex and pubic rami fractures can be unilaterilateral (B2) or bilaterlateral (B3)

- Can have significant usually venous bleeding
Type C Fractures

- Rotationally and vertically unstable
- C1 unilateral complete disruption of SI complex
- C2 unilateral complete disruption, contralateral partial disruption
- Venous and arterial bleeding
Anatomy - Vascular

Bleeding that presents usually occurs from branches of the iliac arteries.
Pelvic Injury - Hemorrhage

• Accounts for 60% of pelvic trauma related deaths

• Sources
  - osseous
  - venous
  - arterial

• Pelvic volume \((\frac{4}{3})\pi r^3\)

• Maintain volume by controlling radius to promote tamponade and clot formation

"Preserve clot [...] Punch anyone who tries to spring the pelvis"

Tim Coats
Royal London Hospital
External Fixation

• Associated with a reduction in mortality (from 26% to 6%)
• Historically trauma room bedsheets wrapped tightly around the pelvis

• Pelvic binder- Quick and easy, limits groin vascular access, greater trochanters

• Other devices can provide fixation and access to abdomen, but time expense in ED placement
Venous Hemorrhage

- 90% of pelvic fracture bleeding is venous
- Injury disrupts posterior pelvic veins
- Confines of the rigid pelvic space are disrupted allowing expansion of hematoma into the retroperitoneal space
- Associated with sacroiliac widening injuries (Type B or C injuries)
Venous Hemorrhage

- Pelvic venous hemorrhage can be significant
- Imaging (CT) may show only hematoma.

- Closing pelvic ring facilitates control
  - Binder
  - Operative fixation

- Uncontrolled venous bleeding/unstable patient:
  - OR for pelvic packing
  - Interventional radiology for embolization of bilateral internal iliac arteries
Arterial Hemorrhage

- < 20% of deaths
- Branches of the int. and ext. iliacs
- Delayed presentation due to arterial spasm with hypovolemia
- 2% of lateral compression injuries
- 20% of AP compression, vertical shear or combined injuries
Arteriography

- Diagnostic and therapeutic for pelvic arterial bleeding
- Controversies
  - Indications for use
  - Time expense (average 155±46 minutes from admission to angio suite)
  - Embolize stable patients with blush and risk possible bone ischemia
Arteriography
Clinical Indications

- Failure to respond to resuscitation after fixation when other sources ruled out

- Failure of initial resuscitation defined as failure of sustained (>2 hrs) SBP > 90mmHg after administration of ≤ 2 u PRBC

- Contrast Blush – not absolute
Arteriography
Radiological Indications

- Pelvic CT scan contrast blush indicates arterial extravasation
- Sensitivity 80%, Specificity 98%, PPV 80%, NPV 98%
- In patients who were not hypotensive sensitivity 60%, specificity 92%, PPV 75%, NPV 85%
Pelvic Fracture

A B C’s of primary survey
Consult Ortho

Stable
Secondary Survey
CT scan pelvis

No contrast blush
Ortho management of fracture

+ Contrast blush
Angiography

Unstable . . .
Unstable

- Resuscitate. Pelvic Binder
- Secondary Survey. R/O other sources of bleeding. CT scan, U/S, DPL
- Other source pos.
  - Laparotomy, ext-fix device
- Other source neg. or surgery not indicated . . .

Stable
- ICU

Unstable
- Angiography
- In-extremis
  - Laparotomy and packing
Other source negative or surgery not emergently indicated

Pelvic contrast blush on CT

Yes
- Stable resuscitation
  - Angiography

No
- Unstable resuscitation
  - Laparotomy, pack, angiography
- Stable resuscitation
  - Fixation
- Unstable resuscitation
  - Laparotomy & pack if retroperitoneal hematoma vs. angiography
Anatomy - Viscera

- Genitourinary
- Anorectal
- Gynecologic
Urological Injuries

- Incidence 16.5% (bladder 6.8%, urethra 7.7%, combined 2.0%)
- Microscopic hematuria alone is not an indication for further investigation (repeat U/A)
- Indications for investigation: inability to pass urine, blood at the urethral meatus, a scrotal or perineal hematoma, high riding prostate, large retroperitoneal hematoma
- Pelvic rim disruption seen on CT – if stable due CT cystogram on the table
Urological Injuries

Investigative studies include: retrograde urethrogram, cystogram & post drain x-ray, CT cystogram, intravenous urogram
Urological Injuries - Bladder

- Extraperitoneal ruptures (50%). Nonoperative. Urethral catheter, pelvic stabilization, compression or drainage of the space of Retzius.
- Intraperitoneal ruptures (40%). Operative repair.
- Combined ruptures (10%). Operative repair.
Urological Injuries - Urethra

- More common in males
- Partial disruption (42%) – blood at the meatus, scrotal and perineal hematoma.
- Complete disruption (58%) – high riding prostate. Requires suprapubic catheter.
- Delayed reconstruction of urethra preferred because risk of impotence and incontinence if surrounding tissues are damaged.
• Mortality 25-50%
• Those who survive to presentation are more likely to die from sepsis than hemorrhage
• Structures involved: urological, anorectal, gynecologic, skin and soft tissue
Anorectal Injury

- Usually need colostomy and mucous fistula
- Antibiotics
- Relative indication to defunctionalize bowel for open wound to perineum, groin, or sacrum
Gynecologic Injury

• Vaginal lacerations are associated with pelvic ring “tilt” fractures
• Vaginal exam
• Debridement and repair
• Antibiotics
Skin and Soft Tissue

- May present with a small skin laceration
- Debridement of devitalized tissue
- Suction drainage
- Delayed reconstruction
Conclusion

Pt was taken to the O.R.

External fixator was placed by ortho.

Ligation of common femoral vein, end colostomy APR was performed, extensive debridement, packing.
Conclusion

POD 2 and 4, debridement and re-packing. POD 4, IVC filter.

POD 7, debridement and pedicle myocutaneous flap to groin.

POD 11, bleeding from infected left common femoral artery, emergent debridement of CFA and interposition GSV graft.

POD 14, tracheostomy.

POD 28, D/C.
At OSH stented bleeding left groin pseudoaneurysm. POD 36, readmitted with infected groin hematoma. POD 38, I&D of infected left groin wound hematoma. POD 43, Left axillary to above knee popliteal bypass graft and removal of left femoral stent. POD 49, D/C. POD 126, removal of external fixator device.