Avoiding Complications in Acetabular and Pelvic fractures

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Acetabular Fractures

- Epidemiology:
  - Bimodal distribution: high energy often in young patients
  - Low energy in elderly patients
  - Lower extremity injury most common associated injury- 36%
  - 80% hip survival with well treated acetabular fracture
  - Male >Female, ? anatomy
Acetabulum anatomy
The Judet and Letournel acetabular fracture classification system
CT differentiation
Acetabular Fractures

Risk factors for poor outcome:

- NON ANATOMICAL REDUCTION (2mm)
- Age >40yo. Risk for poor outcome increases directly with age
- Posterior fracture patterns and associated fracture patterns - transverse-posterior wall the worst outcomes of Letournel classifications
- Delayed hip reduction >12 hours
- Femoral head injury
Post Traumatic Arthritis

- Directly related to quality of reduction - 89% excellent to good with anatomic reduction
- 53% poor outcomes with poor reduction
- Highest risk with transverse posterior wall
- Elderly highest risk for loss of reduction
- Articular injury to femoral head-hip cannot be salvaged by anatomical reduction of acetabulum
Treatment Goals

1. Multiple studies confirm best predictor of successful treatment of acetabular fractures is obtaining and maintaining a quality reduction
   - <2mm = 13% post traumatic arthrosis
   - >2mm = 43% post traumatic arthrosis
Improving reduction

- Time to ORIF- sooner is better

- Better reductions with quicker time to OR. Decrease nosocomial contamination and infection rates

- Prone vs lateral- no difference proven, possible higher infection rate with prone but prone used on more complex cases

- Better results with more experience
20 yo male MVC ejected driver

Classification?
Combined

- **Dual approach chosen**

- Anterior approach with orif SI joint first
Combined

- Post op CT before second-posterior approach
Combined

9month follow up
Elderly

- 80yo low energy fall on hip at class reunion
- History of prostate cancer with open prostatectomy
- Beware elderly male with prostate issues/ASA
Elderly
Elderly- not difficult to obtain reduction, difficult to maintain reduction

Unable to perform medial Stoppa window secondary to previous surgery
Elderly

- Patient with late avn, and residual protrusio
Elderly

- Conversion to th
- Largest risk is acetabular component
- May need cement for osteopenia
Avascular Necrosis

- Letournel “Femoral head necrosis is nearly impossible to prevent”

- Proven reduction after 12 hours of hip dislocation is higher risk of avn

- Need concentric reduction
Avascular Necrosis

- Felt to be die cast at time of injury
- Surgical contributions to risk:
  - Incision of piriformis or conjoined tendon less than 1.5 cm from femoral insertion can injure blood supply
  - Avoid excessive stripping of blood supply to wall fragments
  - Complete tear of piriformis or obturator has high association with late AVN
- Can occur up to 2 yrs from injury
Avascular Necrosis

- Posterior fracture patterns: 18-20%
- Overall: 6-8%
- Higher risk with posterior wall exiting into subchondral arc
42 yo in mvc

- Pulmonary contusion, and transverse posterior wall acetabular fracture

- Post “reduction” ap pelvis
AVN

- Corresponding post "reduction" CT
- Now 14 hours post injury
AVN

- Reduction in OR 20 hours post injury
Anatomical reduction obtained of acetabular fracture
AVN

- Doing well, returned to work, until developed AVN 9 months post injury
Dislocation - AVN prevention

- One shot at reduction of native hip
- If irreducible needs to be taken straight to OR with preparations for orif
Dislocation - AVN prevention

30 yo injured playing soccer

Patient transferred with no reduction attempts for osh
Dislocation - AVN prevention

- Pt treated with ORIF after successful closed reduction
Nerve injury

- German pelvic registry:
  - 4.5% acetabular patients with nerve injury at presentation
  - 8% nerve injury at discharge
Nerve Injury

- Giannaudi: 13 pts with foot drop at presentation.
- Only 2/13 improved at 5 yr f/u
- 0% if emg showed concomitant slowing at knee
- Beware ICU palsy: prolonged positioning on peroneal nerve
Pt developed foot drop between staged surgery
Intra-articular hardware (Schutter)

- Archdeacon 2015:
- 2.5% of all post op CT “benefitted” from study
- 1% IA hardware, .7% fragment, .5% malreduction, .3% combined

- ? Risk/ benefit
- Moed: post op CT of posterior wall correlates with outcomes
Nonunion

- Rare in acetabular fracture: must r/o occult infection
- Highest risk with 4.5 mm plating
- Case: 21 yo female pedestrian struct treated with ORIF acetabulum in Kenya
Case - nonunion/IA hardware
Case - nonunion/IA hardware

- 5 year follow up with hip salvage
- Full activity
- Mild arthrosis
Heterotopic Ossification

- Brooker classification:
  - I: bone islands
  - II: 1 cm separation
  - III: less than 1 cm separation
  - IV: fused/bridged
Heterotopic Ossification

- Risk Factors:
  - Prolonged mechanical ventilation, Head injury, males, African American, extensile approach
  - Symptomatic HO 10% kocher
  - 42% extensile
  - 14% combined
Heterotopic Ossification

- Must debride all necrotic gluteus minimus

- CORR 2016 davis JA
  Decreased HO with irradiation only-preferred over Indocin

Sagi 2014 JOT
Higher incidence of posterior wall symptomatic nonunion with Indocin, no effect of HO
Heterotopic Ossification

- Karunakar et al: no diff Indocin vs placebo

- Indocin associated with higher risk long bone nonunion

- Radiation- 700cGy 72 hrs post or 4 hrs prior

- Low risk of late sarcoma conversion- case report 11 yrs out chondroblastic osteosarcoma. Felt to be higher risk with second dose
Heterotopic ossification (DPF WH)

- COX 2 inhibitor encouraging data in THA population/military

- Need more studies on acetabular fracture patients
Infection

- Deep infection rate is 5-8% in multiple studies

- Risk factors:
  - Longer OR times (3 hours)
  - Increase time from admission to surgery
  - Higher blood loss higher BMI
  - Prolonged ICU stay
  - Abdominal injury
  - Morel lesion
Infection

- Prone positioning?
- Nutritional contribution poorly studied
Infection

- 20 yo multiply injured patient in m.c.c. Hemodynamically unstable. Prolonged wait for surgery
- Prone approach
Infection

- Severe chondral injury
- Good reduction obtained
Infection

- Abx spacer placed
- Pseudomonas
- Removal of spacer and culturing prior to THA
Infection

- Successful conversion to THA
- 5 years out
Pelvic Fractures (new pt)

**Epidemiology:**

- **High Energy:** 50% mortality open fracture - minimal change over years
- **LC - head/chest injury association**
- **APC - Abdominal**
- **>80% hemodynamic instability pts associated with venous bleeding**
Pelvic Fractures

- High Energy:
  - 60% chest injury
  - 50% sexual dysfunction
  - 50% long bone fx

- Risk factors for poor outcome:
  - SI joint >1 cm
  - LL discrepancy >2 cm
  - Neurologic injury

- Initial resuscitation critical in high energy:
  - Binder or sheet for open book
  - Traction for vertical shear
  - TEG algorithm replacing 1:1:1!
Pelvic Fracture

- Beware CT in binder
- Avoid binder on LC injury - risk arterial injury in elderly
- Resuscitation SI screws replacing c clamp for posterior injury/instability
- Case - SI jt diastasis righ, left bicolumn acet fx, hit by forklift
Binder properly placed over greater trochanters NOT iliac wings

Effective for APC tamonade, not for LC injuries
Pelvic Fracture

- **Algorithm:**
  - ABC
  - Temporary stabilization
  - Resuscitation
  - If not response: angio
  - If negative: OR fix vs SI screws

- Recent case- unresponsive to angio, SI screws used with anterior column and left acetabular reduction/traction
Pelvic Fracture

- Surgical indications:
  - Complete/displaced dennis 2/3
  - Most U types
  - APC > 2.5 cm wide

- Indications expanding as percutaneous techniques have evolved, especially in elderly
CT scan critical for sacral evaluation. Vertical shear pelvis treated with traction followed by ORIF and transiliac screws (significantly stronger fixation).
Pediatric Pelvic Fractures

- Most commonly involve iliac wing and ramus
- Most non operative
- Need to treat similar to adults-unstable vertically/rotationally unstable may need surgical intervention
- 6 yo pedestrian struck with rotationally and vertically unstable APC injury
Pediatric Pelvic Fracture

- Grossly unstable left hemipelvis
- Poor outcomes untreated
Pediatric Pelvis
Hardware complications

- Most common percutaneous failure is retrograde ramus screw unicortical
- No benefit to neuro monitoring with screw placement
Hardware complications

- Complete unstable dennis 2 sacral fractures with bilateral displaced rami fractures- high risk of late deformity
- Severe sacral dysmorphism S1
- S2 corridor safest
Hardware complications

- Patient with significant neuropathic pain post op
- Motor intact
- CT obtained
- Concern for posterior screw placement
Hardware complications - S2 canal placement
Hardware complications

- Revision screws and anterior ring stabilization
- Symptoms immediately resolved
Urogenital

- 20% of all pelvic fractures with urogenital injury
- Higher in Male and APC injury
- Blood at meatus mandates retrograde urethrograph
Elderly Pelvic Fracture

- >60yo much more likely to have arterial injury

- Displaced LC injury binder can worsen or cause arterial injury

- Earlier angio

- Surgical indications expanding
Elderly Pelvic Fracture

- 7% of all fractures >65yo

- Much higher incidence of U/H type fracture

- All anterior ring injuries get CT pelvis- difficult to delineate on plain radiograph

- Hospital stays avg 9-43 days worldwide

- OTB c/s- forteo encouraging results in Europe
Elderly Pelvic Fracture

- Short term results of complete LC 1 pelvic fractures in elderly:
- Giannoudis: all pts with complete sacral fractures and sup/inferior ramus taken to or for stress testing
- >2cm considered positive and treated with si screws and anterior fixation. Those fixed showed significantly less pain meds, significantly decrease hosp stay and quicker pain free ambulation

? Role of fixation in stable patterns
Elderly Pelvic Fractures

**Protocol:**

- Patients with LC1 fracture pattern deemed stable radiographically should be able to mobilize within 3 days with protected wb.
- Patients unable to mobilize - consider surgical treatment/ EUA
U type

- Most commonly missed elderly pelvic fracture
- Can lead to severe disability/loss of ambulation/chronic pain
- Most common mechanism: fall on buttocks
- Paradoxical inlet/ct sagittal
- Bilateral sacral fractures - paradoxical inlet
U-type classification
Dennis classification
Utype - Case

- 70 yo female who fell at home after revision hemi hip
- Self referred to clinic with inability to walk for 2 weeks and bilateral foot drop
- No diagnosis made following multiple x-rays of hip
U-type case

- Transiliac S1 screws placed for insitu fixation
- Immediate wt bearing
- Full return of nerve function at 6 months