Clues for Identifying Unstable Pelvis Fractures

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Conflict of Interest

- Consultant- Stryker Orthopedics, Smith & Nephew
- Stock- Stryker, Wright Medical
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Clue #1: HISTORY OF INJURY

High vs low energy

- Mechanism
  - MVC
  - MCC
  - Fall from height

- Signs of Shock
  - Best predictor of mortality
ASSESSMENT

- ABC’S of ATLS
- Soft tissue exam- look for open fractures
- Neuro exam
  - most correlated with long term outcome
  - Highest % with medial sacral fractures (#2 zone 2)
- Vascular exam
- Urogenital exam
  - Blood at meatus- retrograde cystourethrogram
  - Hematuria- bladder injury
- Deformity, asymmetry or instability
- Documentation
High energy injuries

- 75% Hemorrhage
- 12% Urogenital
- 8% Lumbosacral plexus
- 60-80% Other musculoskeletal
- 15-25% Mortality
RADIOGRAPHY

- 3 trauma X-rays
  - Lateral C-spine
  - AP Chest
  - AP Pelvis
    - Inlet/Outlet
If evidence of pelvic ring fracture...
ANATOMY

Ligamentous

ASI
ST
SS
PSI
ST
ANATOMY

Relationships
Burgess-Young Classification

- Mechanism and direction of injury
LATERAL COMPRESSION

- Three types, increasing in severity
- Common anterior fracture pattern
- Ligament disruption rare
LATERAL COMPRESSION

LC 1: Sacral compression
LATERAL COMPRESSION

LC I: Sacral compression
LATERAL COMPRESSION

LC 2: “Crescent fracture”
LATERAL COMPRESSION

LC 2: Iliac wing fracture

- Fracture/dislocation of the SI joint
- Internal rotation deformity
LATERAL COMPRESSION

LC 3: Windswept pelvis
LC3
ANTEROPOSTERIOR COMPRESSION

APC

The classic “open book” type of pelvic fractures

- 3 types, increasing in severity
- Diameter acutely increased
- Contents subjected to tensile force
- Ligament disruption common
- Anterior injury through symphysis or rami
- Posterior injury through SI joint or sacrum
ANTEROPOSTERIOR COMPRESSION

- APC 1  Symphysis open, SI normal
- APC 2  Anterior SI ligaments violated
- APC 3  Complete iliosacral dissociation
Note that the ligaments are stretched, and not torn.
• Note: pelvic floor ligaments are violated, as well as anterior SI ligaments and symphysis
These anterior SI ligaments are disrupted...

But these **posterior** SI ligaments remain intact.
APC 3

Complete iliosacral dissociation
VERTICAL SHEAR
VERTICAL SHEAR
ASSOCIATED INJURIES

**Lateral Compression:**
- Abdominal visceral injury
- Head injury
- Few pelvic vascular injuries

**AP Compression:**
- Urologic injury
- Hemorrhage/pelvic vascular injury:
  APCII-10%, APCIII-22%
ASSOCIATED INJURIES

NEUROLOGIC

- Lumbo-sacral plexus
- L5, S1 most common
- Exploration not indicated
- Incomplete lesions may improve
- Often most important factor in long-term outcome
ASSOCIATED INJURIES

UROLOGIC

- Urethra - retrograde urethrogram
- Bladder - cystogram
  - Extraperitoneal - Foley vs. SP tube
  - Intraperitoneal - Repair, SP tube
- Suprapubic tube may complicate surgical treatment
Subtle Markers of High Energy

- Lumbar transverse process fractures
  - Iliac wing attached to lumber spine by stout iliolumbar ligament
  - Sign of vertical instability
Dynamic Instability

- Soft tissue attachments allow pelvis to recoil after initial displacement
- Curved CT table can help reduce pelvis
- Result can be imaging that looks “non displaced”
EUA

- Fluoroscopic exam of pelvis under general anesthesia
- Can demonstrate displacement
- Testing
  - Internal rotation/compression
  - External rotation
  - Push/pull
EUA

- 50% AP1 $\rightarrow$ AP2 (fixation)
- 39% AP2 $\rightarrow$ AP2b (posterior fixation)
- 35% LC1 $\rightarrow$ LC1b (fixation)

- Sagi et al, JOT, 2011
Management

• ATLS
  – Airway
  – Breathing
  – Circulation

• Early Orthopaedic Involvement
  – Examine Pelvis Once ?
  – Examine and Pack Open Wounds
  – Neuro Exam
Early Management

- Radiographs
- ‘Unstable’ Pelvic Ring
- Provisional Stabilization
  - Sheet
  - Binder
  - Caution w LC Injuries
Hemodynamically Stable

- Complete Trauma Workup/Resuscitation
- Completion Pelvis Imaging
- Watch Vitals Closely
- Consider Removing Binder
- *Elective Stabilization*
Hemodynamic Instability

• Source of Instability Blunt Trauma
  – Hemorrhage 95%
  – Cardiac, Hypothermia, Mediastinal, Brain, Neural,

• Hemorrhage
  – Thorax
  – Abdomen
  – Retroperitoneum
  – Extremity
  – Environment
Hemodynamic Instability

• Rapid Assessment of Chest/ Abdomen
  – Chest Radiograph
  – FAST
  – CT
  – DPL
Instability & CT/Fast Negative

- Continues Resuscitation 1+1+1
  - Hypothermia, Coagulopathy, Acidosis
- Provisional Stabilization w Binder
- Continued Instability >>> Angio
- Definitive Pelvic Ring Stabilization
Instability & CT/Fast Positive

- Laparotomy
- Ex Fix prior to Lap
- Maintain Binder & Fix After Lap
- Be Flexible Depending on Patient Status and Surgeon Comfort Level
- Continued Blood Loss >> Angio
EXTERNAL FIXATION/BINDER

• Immediate application to pt. in extremis
• Controls volume & therefore tamponade
• Stabilizes clots prior to pt. movement
Stabilization Options

- Sheet/Binder/ Ex Fix
- ORIF
- Percutaneous Fixation
What does a Ex Fix/Binder/Sheet do?

- Reduces Pelvic Volume
- Tamponade Effect to Limit Hematoma Expansion
- Limits Motion
  - Comfort
  - Clot Stabilization
- Useful w APC Injuries
Sheet / Binder

- Apply at Greater Trochanter Level
- Allows Access to Abdomen
- Temporary
  - Access Issues
  - Soft Tissue Breakdown
- May Modify For Angio Access
Pelvic Binder
INTERVENTIONAL ANGIOGRAPHY

• Much hemorrhage is venous
• Timeliness & availability of intervention
• May be useful adjunct to other methods
• Angiography suite often not optimal for patient resuscitation
• Institution dependent
Angiography

- Allows eval of other organ systems
- Embolization
  - Selective gelfoam
  - Multiple Embolization
  - Proximal Occlusion
Immediate Symphyseal ORIF

- APC, CMI
- Laparotomy
- Pfannensteil
- Avoid Lengthy Surgery
Definitive Treatment Summary

• Rotational and vertically stable injuries – Protected weightbearing

• Rotationally unstable but vertically stable injuries – Protected weightbearing with or without anterior stabilization

• Rotationally and vertically unstable injuries – Posterior stabilization with or without anterior stabilization
Treatment

- LC1 – Protected weightbearing 6 weeks
- LC2 – ORIF posterior fracture/dislocation +/- anterior stabilization
- LC3 – Bilateral posterior stabilization with anterior stabilization
Treatment

• AP1 – Protected weightbearing
• AP2 – Controversial – standard treatment is anterior stabilization, but may not be necessary
• AP3 – Posterior stabilization +/- anterior stabilization
Treatment

- Vertical shear – Posterior stabilization, usually with anterior stabilization
- CMI - Treatment directed towards individual injury components
Posterior Fixation

- Open vs. closed reduction
- Percutaneous SI screws
- Anterior SI joint plating
- Sacral bars
- Posterior sacral plating
Thank You