Pelvic Ring Injury notes w/ Dr. Vemulapalli

Anatomy

- Composed of 3 bones: 2 innominate bones and the sacrum; Formed by the fusion at the triradiate cartilage
  Meets anteriorly at the pubic symphysis and posteriorly at the SI joint.
- Stability is conferred by its ligamentous connections (Mostly its posterior ligaments)
  - Posterior SI complex- strongest ligaments in the body
    - Interosseous SI Ligaments
    - A/P SI Ligaments
    - Ilio-lumbar ligaments (L5 Transverse process to Iliac Crest)

    *** Together resists Rotational vs Vertical Shear forces
  - Sacrospinous ligament (transverse band from lateral sacrum to ischial spine)
  - Sacrotuberous ligament (dorsal sacrum to ischial tuberosity)
    *** External and vertical shear forces

Biomechanics and Pelvic Stability

- Anterior structures contribute up to 40% of pelvic stiffness and stability (esp in two legged stance)

MOI

- The force vector dictates the fracture pattern
  - Lateral Compression forces (falls, side impact MVA)- apply internal rotation force on pelvis
    - >fx pubic rami anteriorly + anterior compression of anterior sacrum
  - Anterior to Posterior forces (head on MVA, falls, crush inj)- apply external rotation force on the pelvis
  - Shearing Forces (falls from height)- can cause vertical displacement if post and ant ligaments inj
    - Posteriorly- SI ligaments disrupted. Anteriorly- disruption of rami or symphysis

Classification

Tile's ; OTA; Young-Burgess

Tile- divided to post arch (post to acetabulum) and anterior arch (anterior to acetabulum) -

- A: stable (doesn't involve ring) - AIIS/ASIS avulsions, crest fx
- B: rotationally unstable/vertically stable
- C rotationally/vertically unstable

- APC I: <2.5cm diastasis, APC II: >2.5cm diastasis + SI widening, APC III: APC II + SI joint disruption
    - Associated w/ urethral / bladder injuries
    - MC cause of death- shock
- LC I: sacral (complete or incomplete) compression fx, LC II: LC1+ iliac wing fx, LC III: LC II+ contralateral external rotation injury (windswept pelvis)
    - Associated w/ brain injuries
- VS - most unstable
    - Vertical displacement of hemipelvis
    - Symphyseal diastasis or rami fxs anteriorly; iliac wing fx, sacral fx, si joint dislocations posteriorly

Physical Exam

- ATLS Protocol
- Look for signs of shortening or external rotation (VS or APC injury)
- Anterior pelvis may exhibit symphyseal gap
- Pelvic stability (single attempt)
- Rectal and Pelvic exam (blood in rectum or vagina; blood in urethral meatus, significant penile or scrotal swelling or ecchymosis, high riding prostate)
- Neurovasc exam (sciatic and sacral plexus)

Imaging

- AP pelvis
    - ant injuries (pubic rami, symphyseal displacement, SI joint and sacral fx, Iliac and L5 fxs
    - Inlet -
        - A/P displacement of si joint, sacrum, or iliac, internal rotation deformities as well
- Outlet - X Ray beam 45 degrees cephalad
    - vertical displacement of hemipelvis
- CT
    - SI complex
    - Look for 2 areas of disruption. Pelvis is a ring structure so a disruption in one area is accompanied by a disruption in another area
    - Sagittal recons- Eval for kyphosis, U shaped fx, spine/pelvic dissociation
    - Contrast extravasation - arterial bleed

Emergent stabilization in the hypotensive unstable pelvic fx

- Hemorrhage control
    - Hemorrhage usually venous injury with posterior venous plexus
    - Resuscitation blood:platelets:FFP (1:1:1 ratio)
        - Trend Lactate, base deficit, hemoglobin
    - Also may be arterial; Superior gluteal (MC), internal pudendal, Obturator

Angiography/Embolization

- Variable indications:(used in ~20% APC/VS cases)
- Complications can include gluteal necrosis/ impotence

Acute ED stabilization

- Wrapping a sheet/ Pelvic binder
    - Binder around greater troch levels
- Pelvic packing (provides tamponade)
- Skeletal traction (vertically unstable fx)

Ex fix placement

- Ex fix should be applied before an ex lap ideally
- Abdominal packing in an unstable pelvis will contribute to instability, inability to pack against a closed volume pelvis

Ex fix

- Supra-acetabular pins - obturator outlet for starting point, obturator inlet to ensure pin is within inner/outer tables, iliac oblique- pin above acetabulum
    - LFCN at risk
- Iliac crest pins

Other stabilization methods

- Subcutaneous anterior pelvic fixation (In-fix)
- Pelvic C clamp- helps w/ posterior ring injuries

Non-op tx?

- APC I (<2.5cm displacement)
- Most LC I
    - incomplete sacral fx w/ ipsilateral rami fx - WB trial + repeat images
- *Complete sacral fx w/ ipsilateral or bilateral rami fx- controversial- some stabilize to improve pain

Treatment

- Surgical Indications
  Symphysis diastasis > 2.5 cm
  SI joint displaement > 1cm
  Sacral fracture w/ displacement > 1cm
  Displacement or rotation of hemipelvis
  Open fracture
  Chronic pain

Sources:

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Sagi, H. C., Coniglione, F. M., & Stanford, J. H. (2011). Examination under anesthetic for occult pelvic ring instability. *Journal of orthopaedic trauma*, *25*(9), 529-536.

Kaiser, S. P., Gardner, M. J., Liu, J., Routt Jr, M. C., & Morshed, S. (2014). Anatomic determinants of sacral dysmorphism and implications for safe iliosacral screw placement. *JBJS*, *96*(14), e120.

Orthobullets

Rockwood and Green’s Fractures in Adults