

Radiographic Evaluation and Classification of Pelvic Ring Disruptions

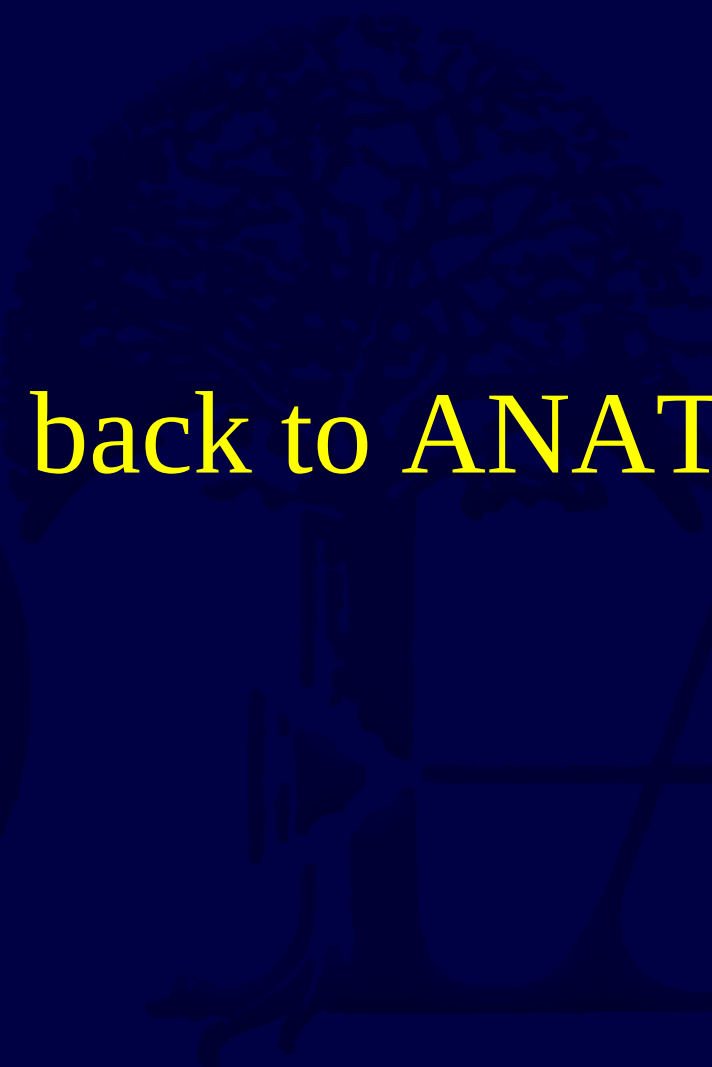
Joshua L. Gary, MD

February 2016

How do we classify this?

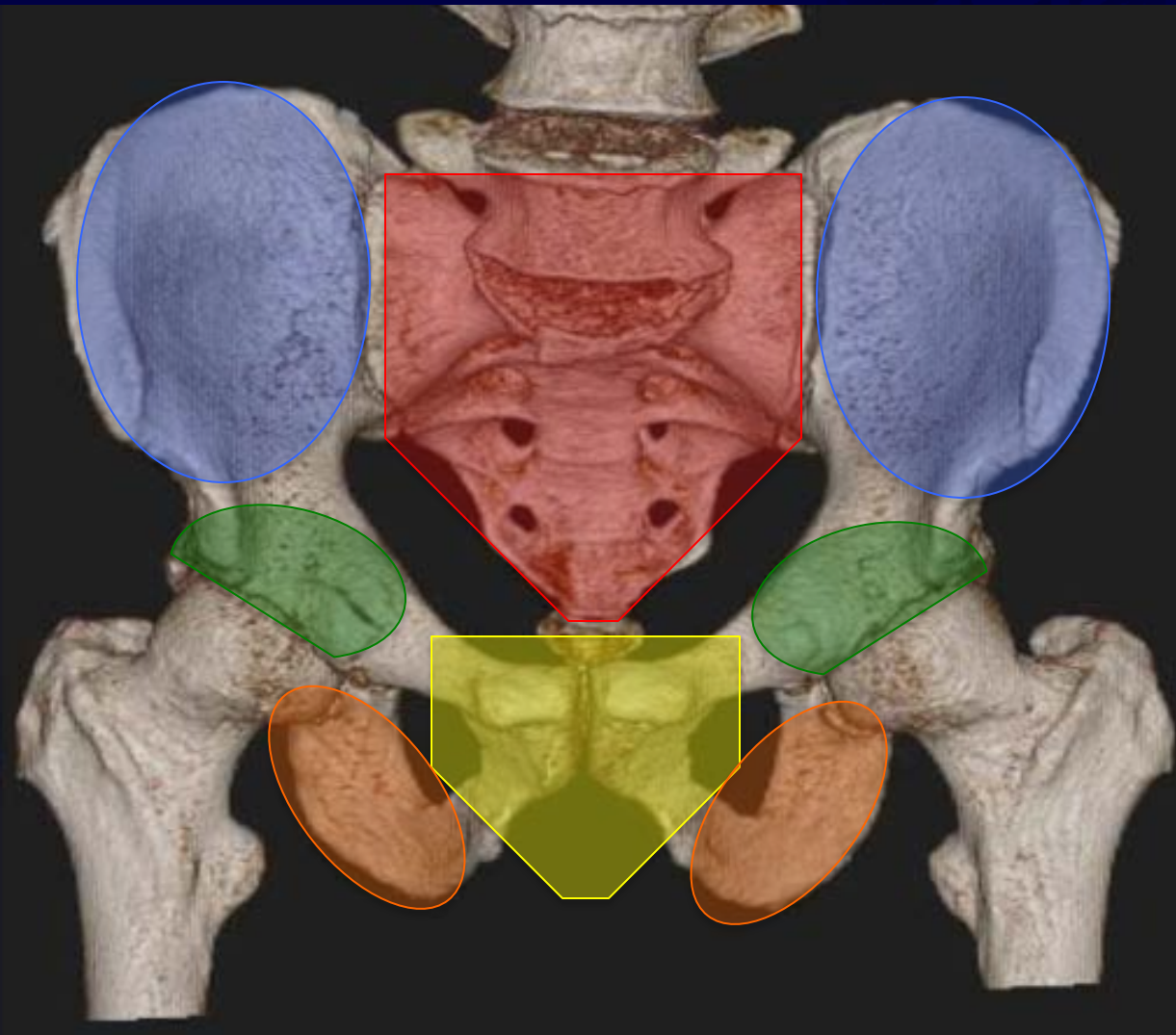
- Open?
- Closed?
- Tile?
- Young-Burgess?
- AO/OTA?
- Letournel?





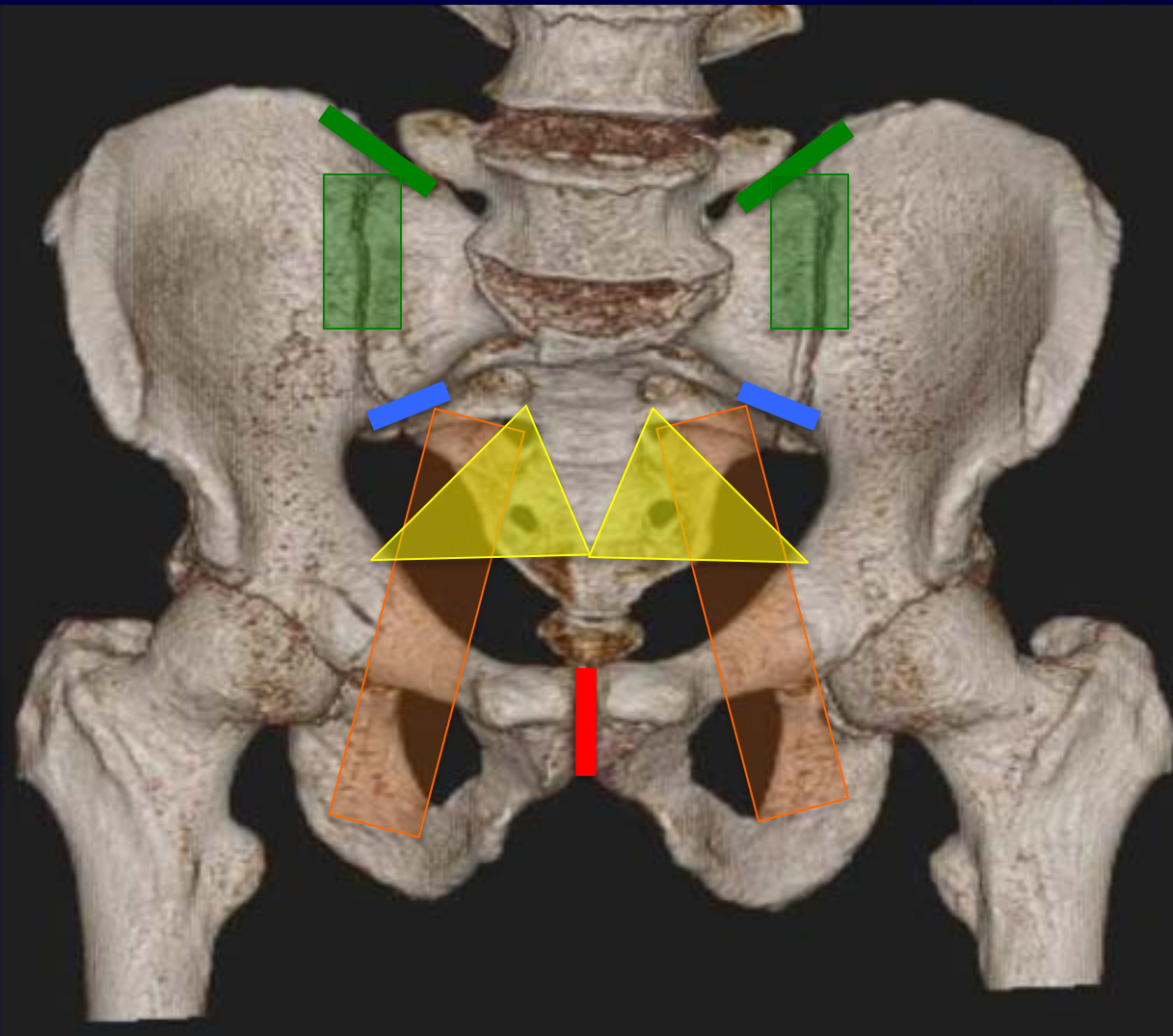
It all goes back to ANATOMY!

Osteology



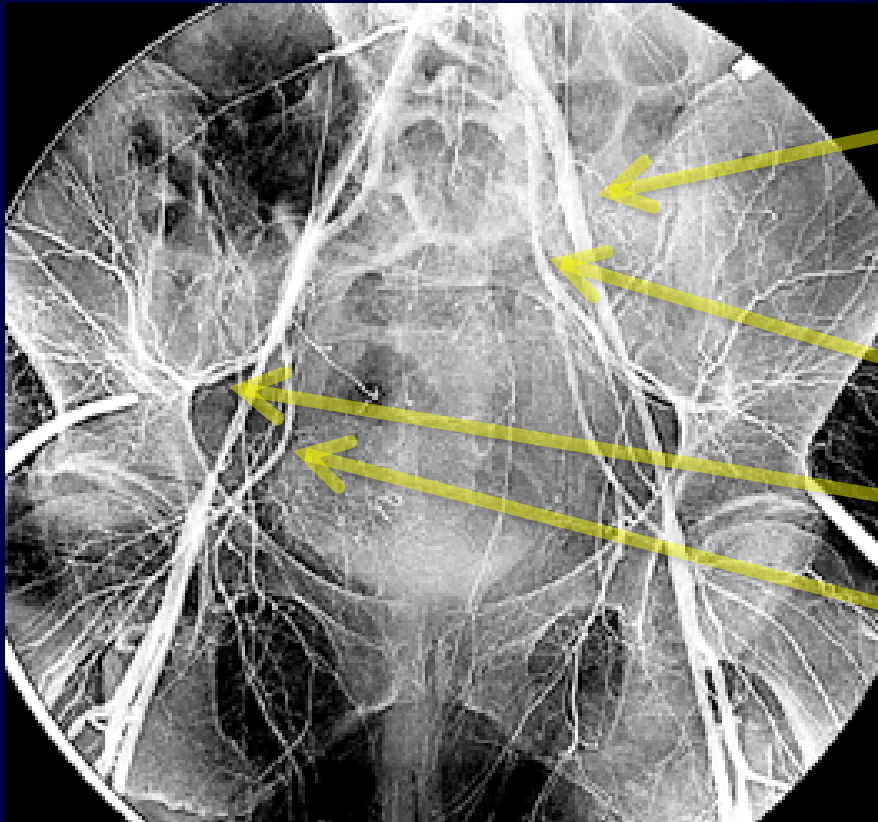
- Sacrum
- Iliac WIng
- Acetabulum
- Pubis
- Ischium

Ligamentous Anatomy



- Pubic Symphysis
- Anterior Sacroiliac Ligaments
- Posterior Sacroiliac Ligaments
- Sacrospinous Ligaments
- Sacrotuberous Ligaments

Vascular Anatomy

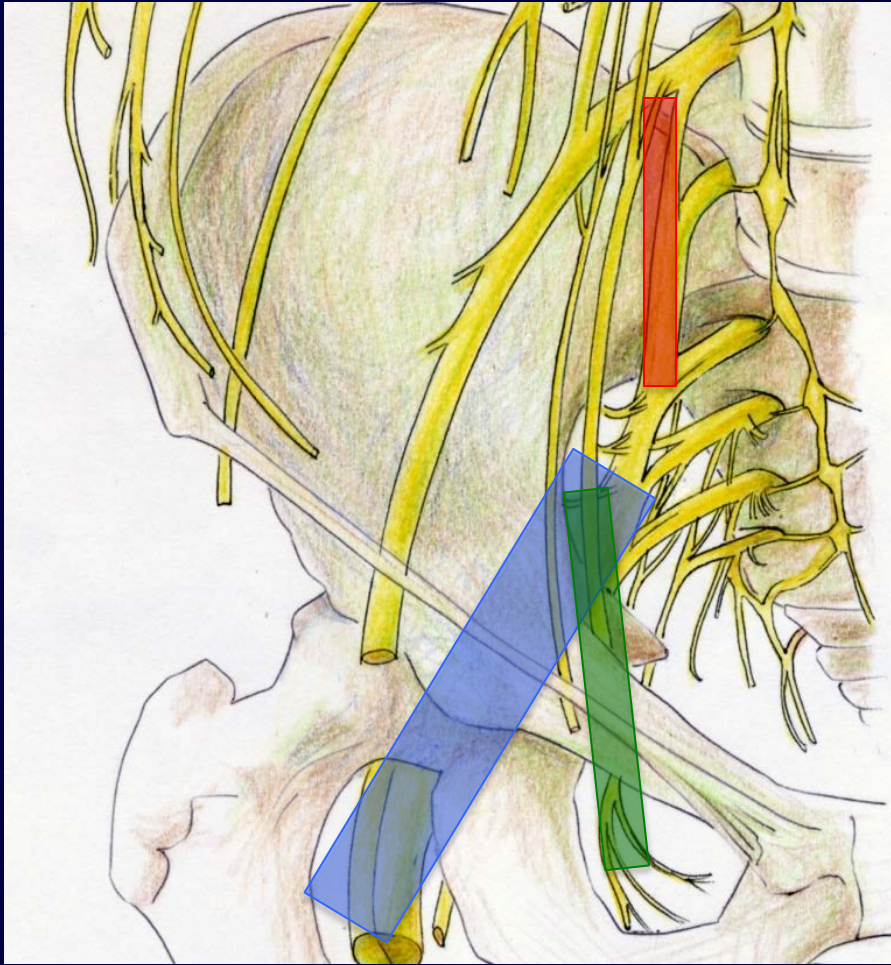


External Iliac System

Internal Iliac System

- Posterior Division
- Anterior Division

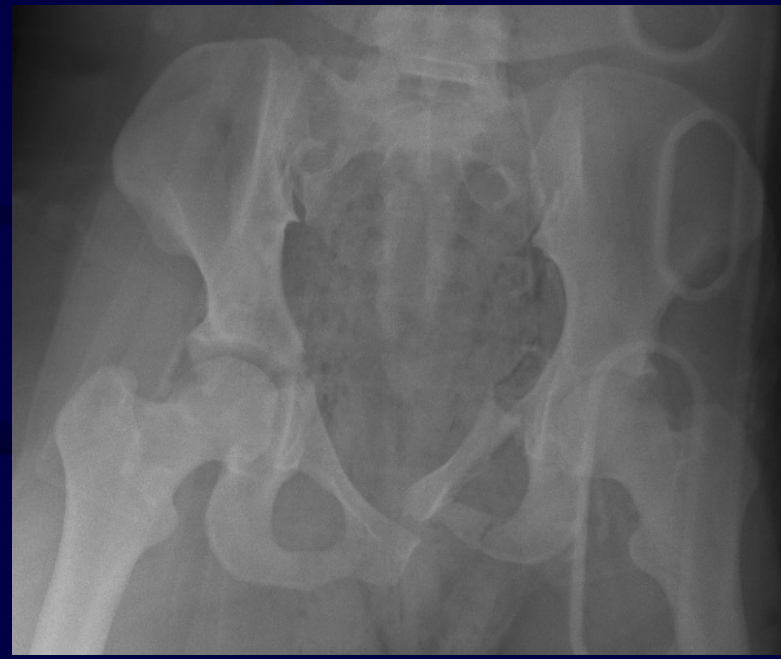
Nervous Anatomy



- L4/L5 nerve roots
 - Anterior sacrum
- Sciatic nerve
 - Greater sciatic notch
- Obturator nerve
 - Lateral obturator foramen

Imaging

- Screening AP Pelvis
- Circumferential compression changes appearance



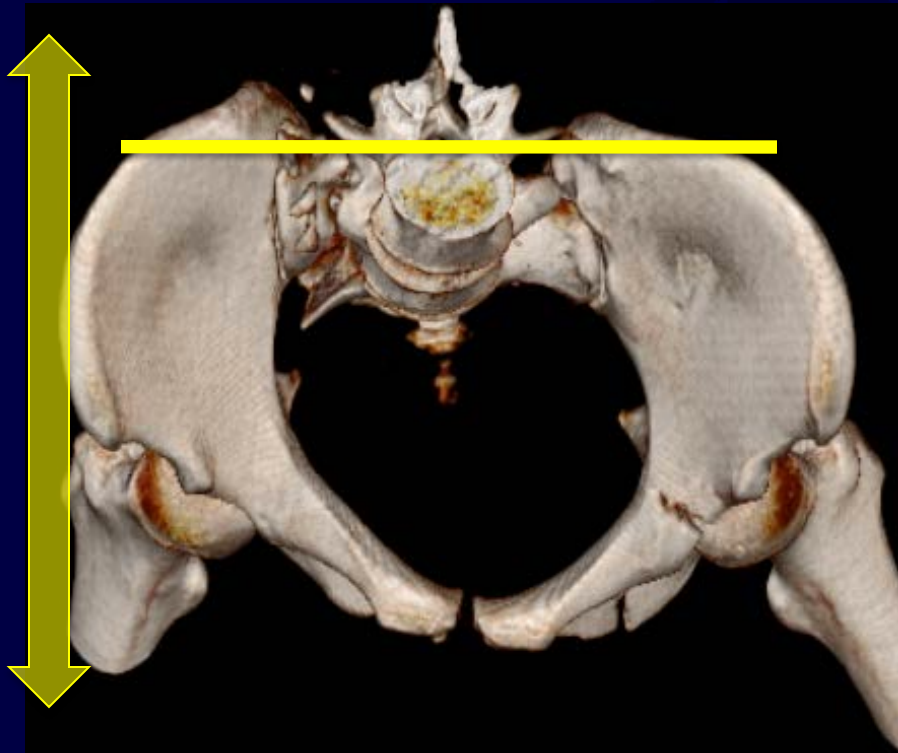
AP Pelvis



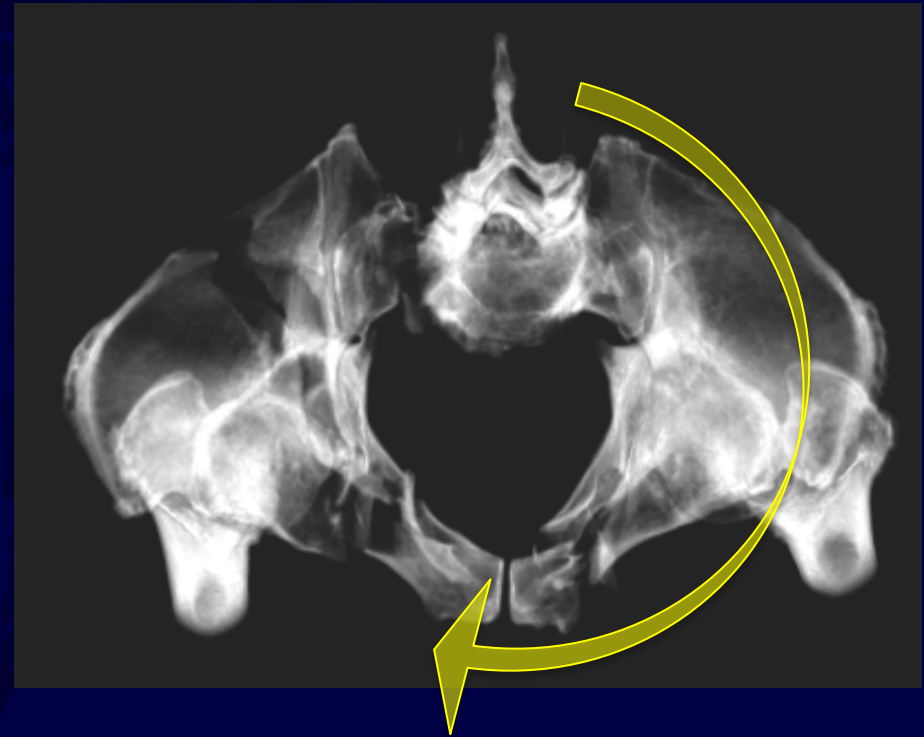
- General idea
 - Stable
 - Unstable
- Immediate interventions if needed
 - Circumferential compression
 - Reduction of hip dislocation

Inlet

**Anterior / Posterior
Displacement**

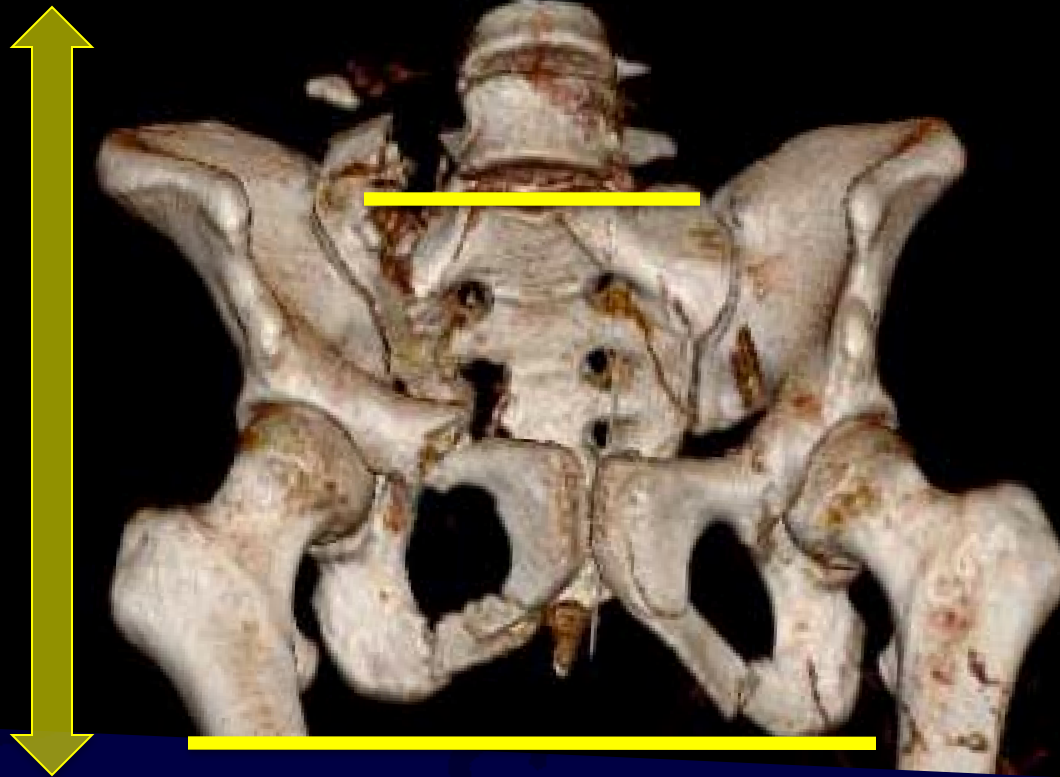


Internal / External Rotation



Outlet

**Cranial / Caudal
Displacement**



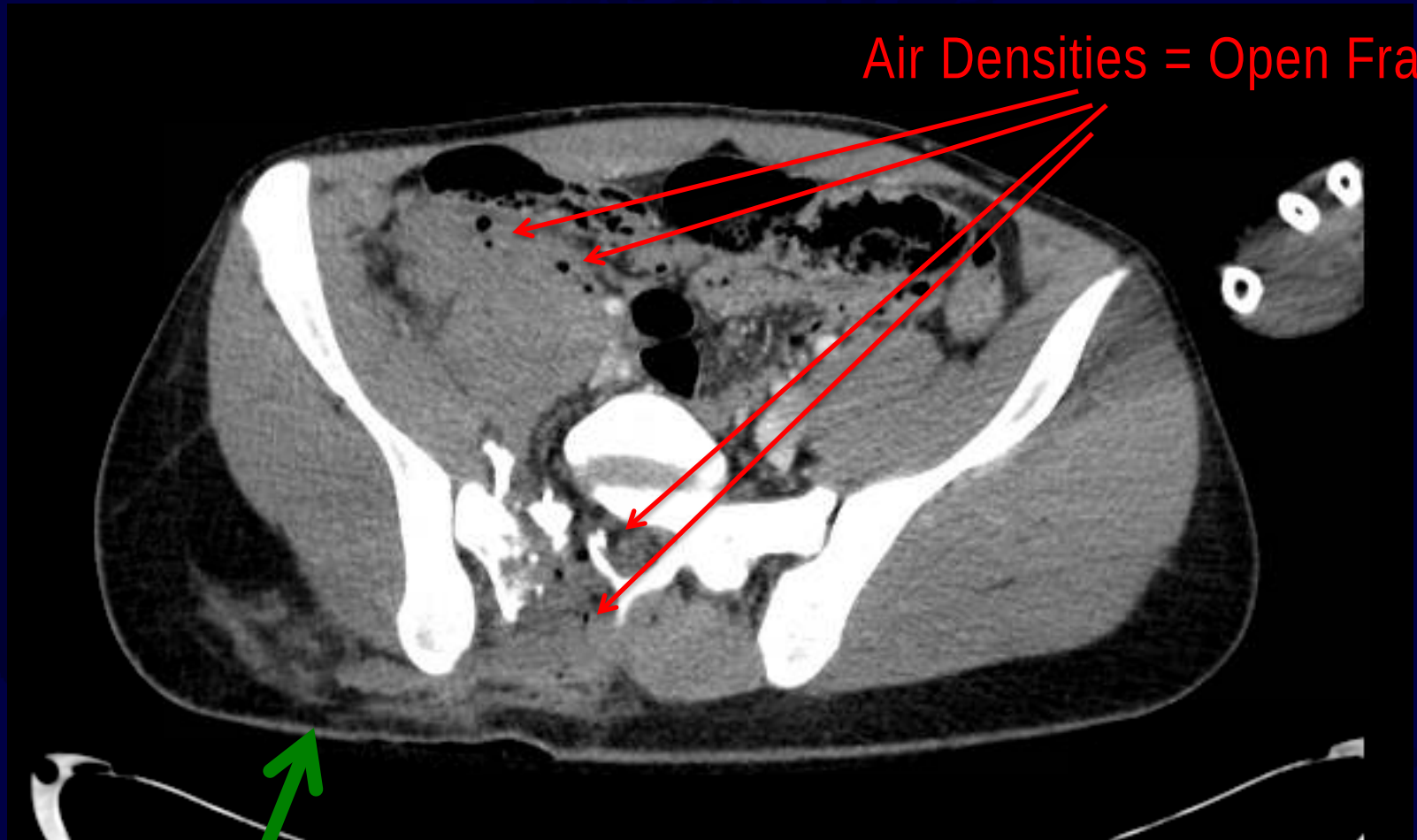
CT Scan



Study SOFT
TISSUE
WINDOWS
1st!!!!

Look at bony injury last.

CT Scan – Soft Tissue Windows



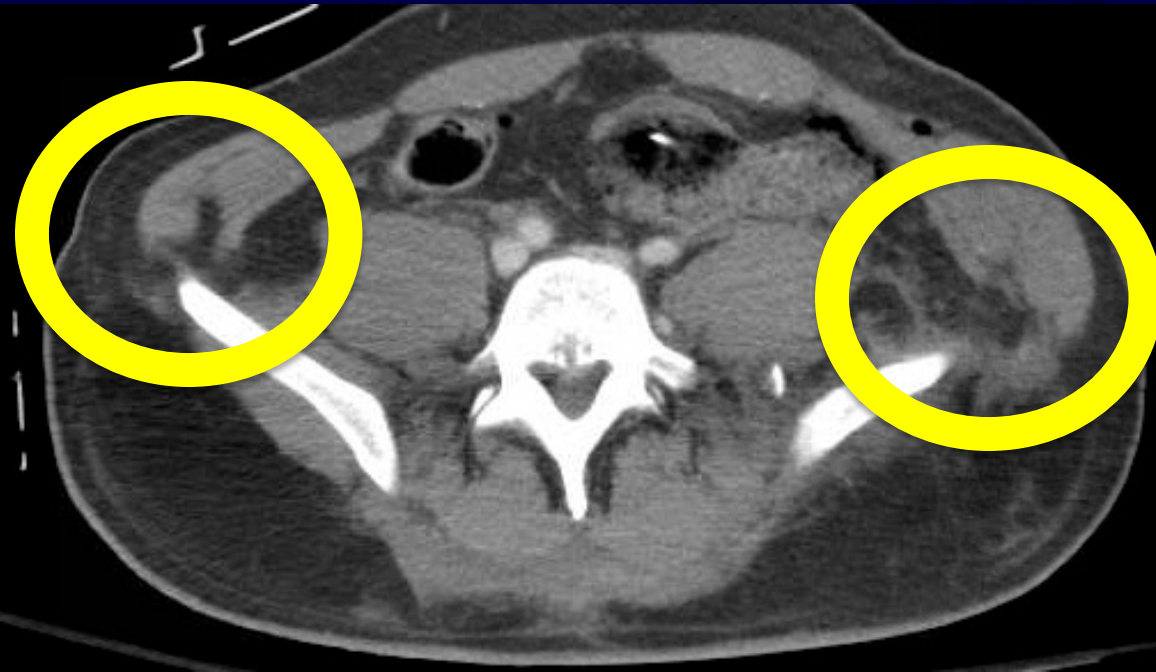
Hematoma=Morel-Lavallee

CT Scan – Inguinal Hernia



- Impacts open approaches
- May preclude percutaneous implant placement

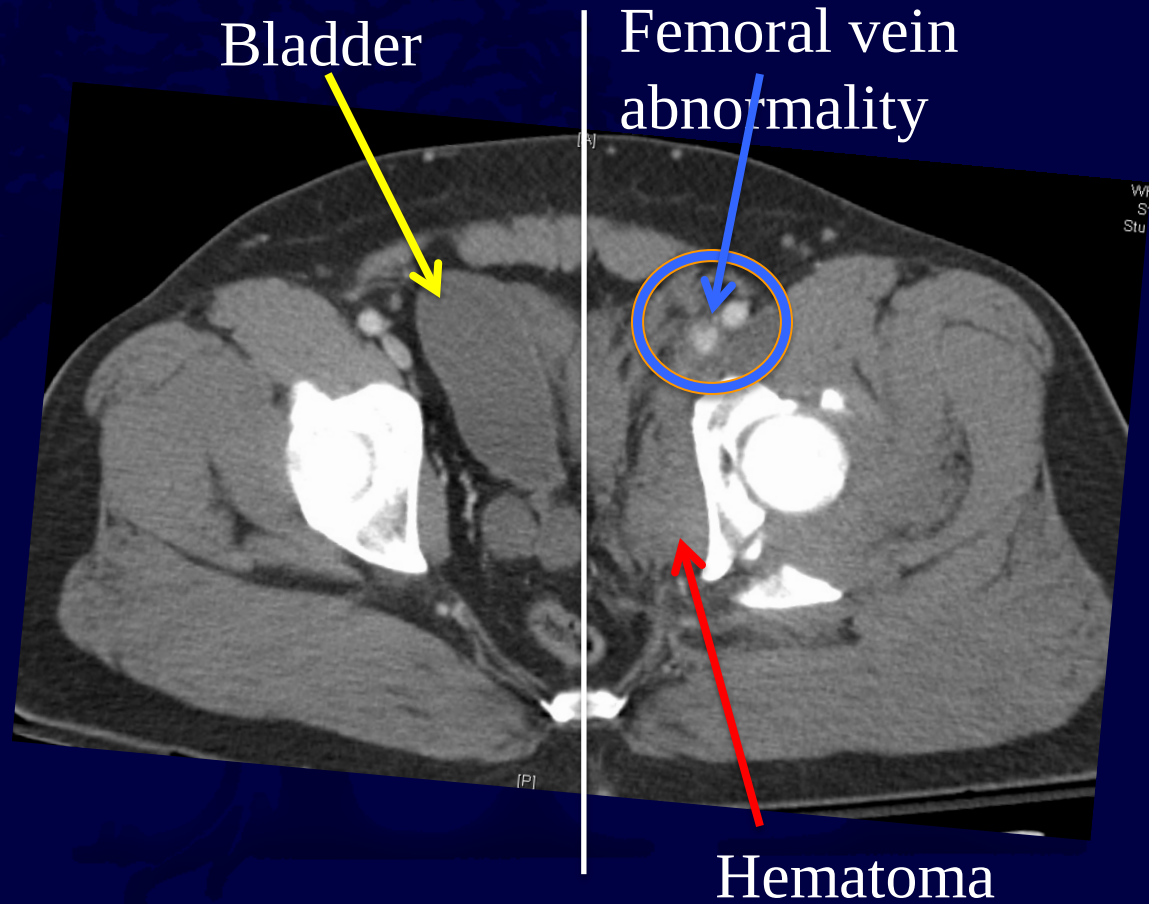
CT Scan – Lumbar Hernia



- Detachment of abdominal wall from iliac wing
- Repair with iliac window approach

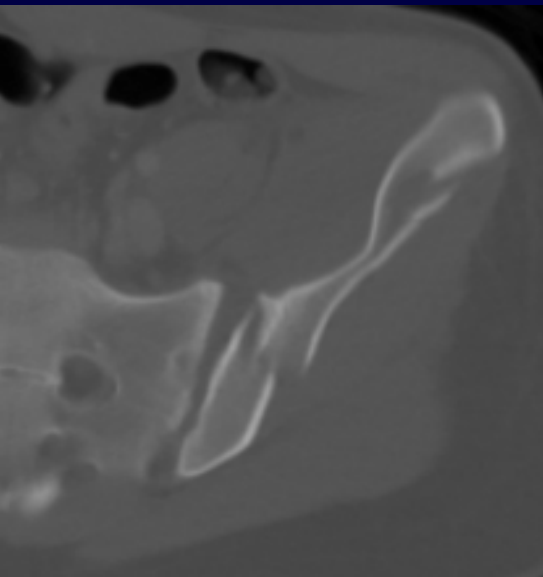
CT Scan – Hematoma

- Look for “midline shift”
- Associated vascular injury?

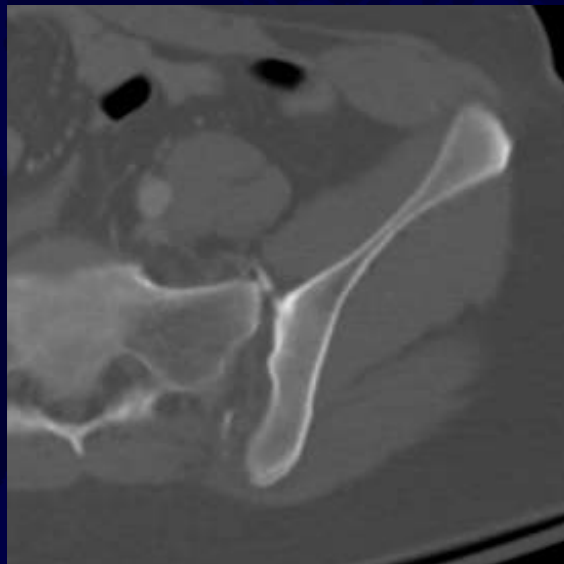


CT Scan – Posterior Ring

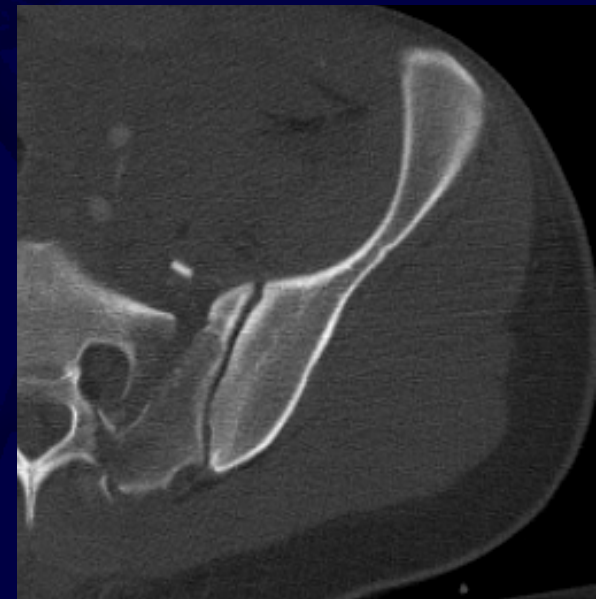
Iliac Fracture



SI joint Disruption



Sacral Fracture



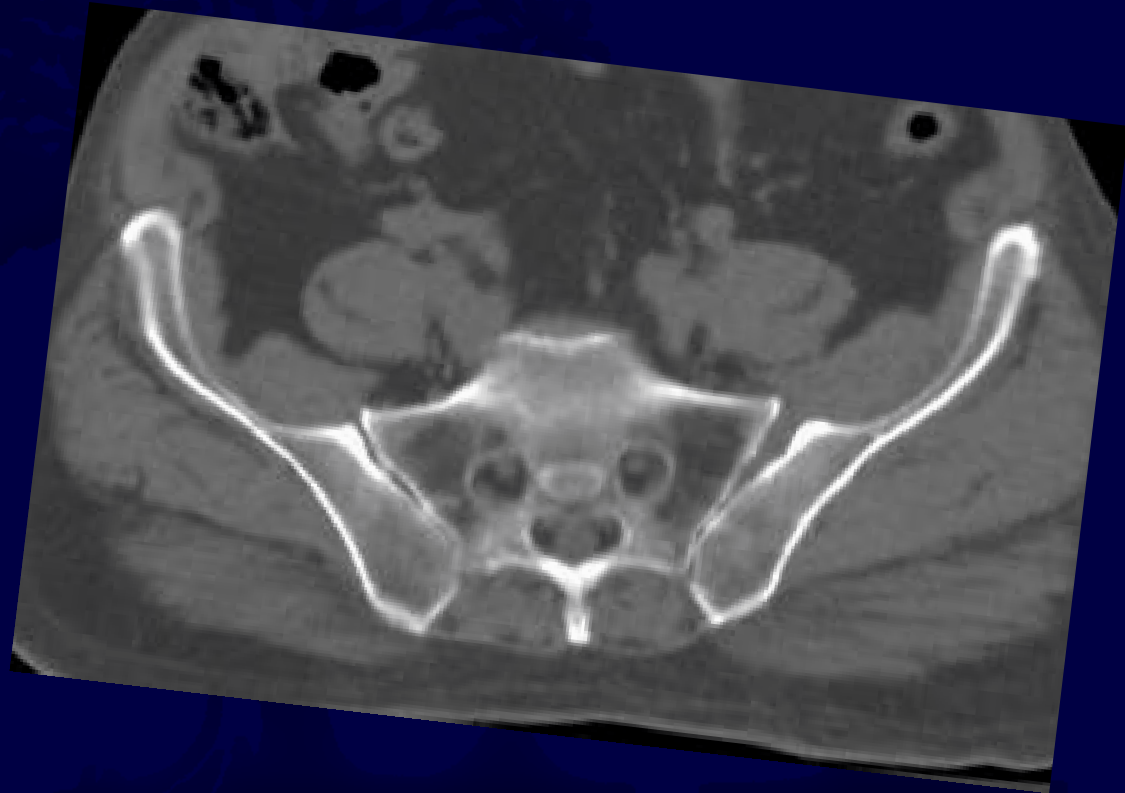
Posterior Ring – Iliac Fracture

- Displaced or nondisplaced?
- Internal or external rotation mechanism?



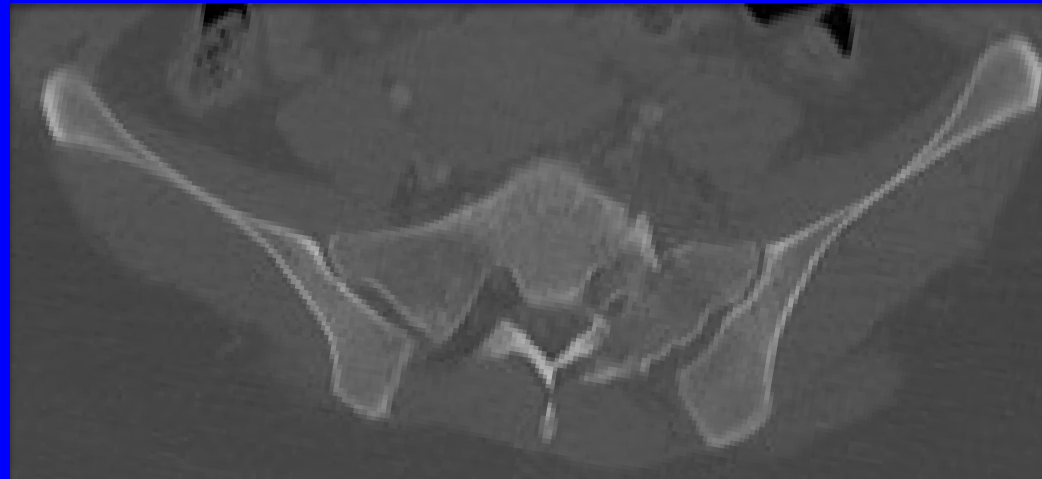
Posterior Ring – SI Joint Disruption

- Complete or Incomplete?
- Anterior sacral crush?



Posterior Ring – Sacral Fractures

- Complete or Incomplete?
- Extraforaminal, transforaminal, or median?
- Intraforaminal debris?

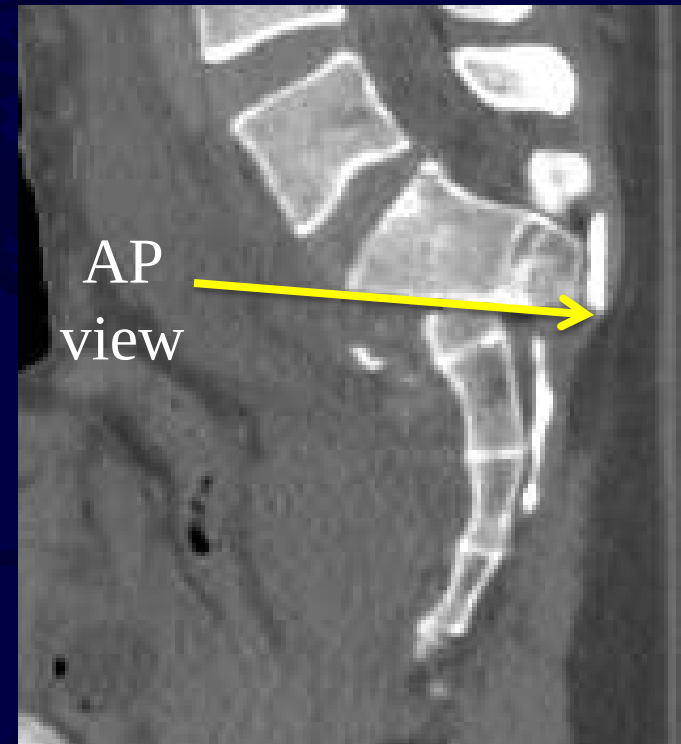


Posterior Ring – Bilateral Sacral Fractures

- Lumbosacral dissociation – “U”, “Y”, and “H” patterns
- Sagittal Images to look for transverse component of fracture
- Spinal canal compromise



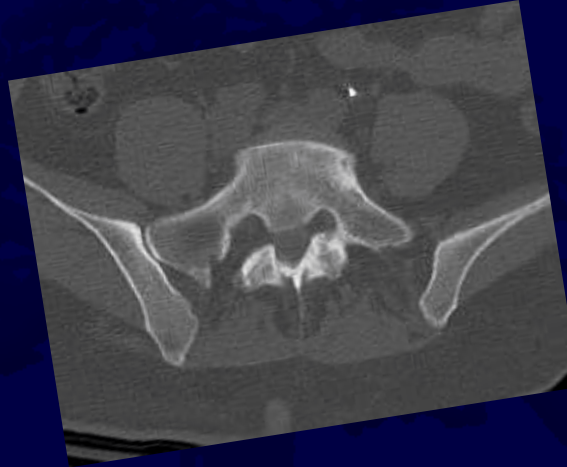
Paradoxical Inlet



Lumbosacral kyphosis leads to an “inlet” appearance on AP View

Posterior Ring – Sacral Dysmorphism

- Residual upper sacral disk
- Acute alar slope
- Mammillary processes
- “Tongue-in-groove” articulation
- Noncircular upper sacral foramina
- Fixation implications for SI screws

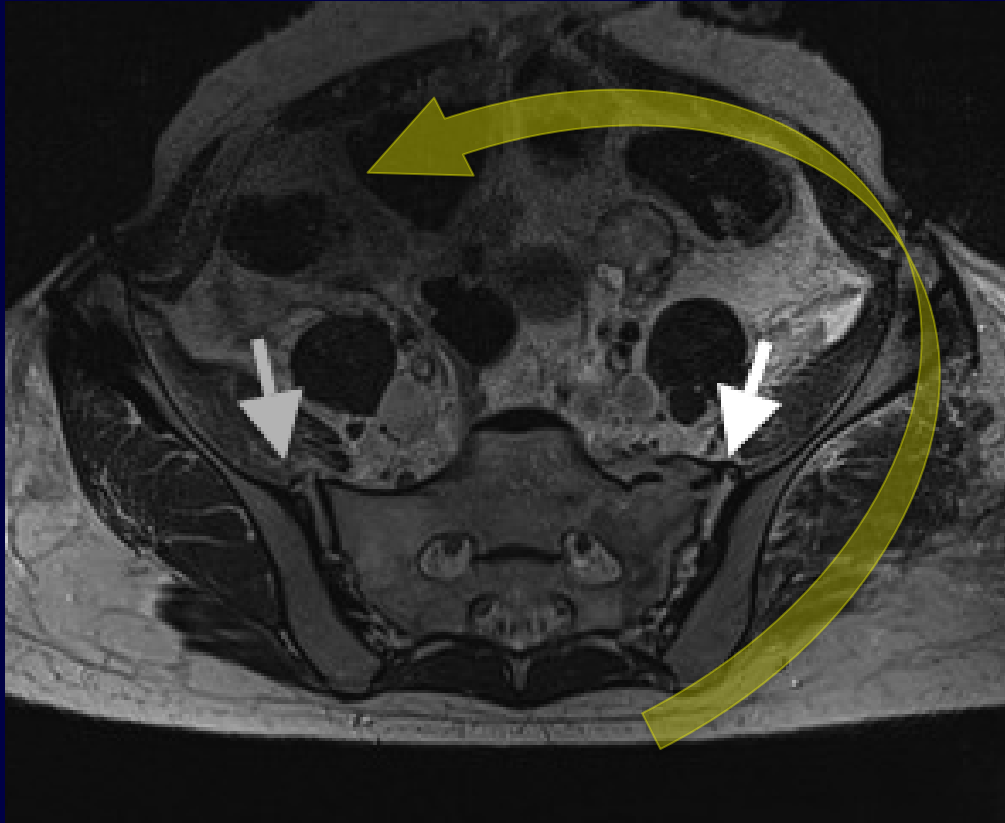


CT Scan – Anterior Ring



- Symphyseal disruption and/or rami fractures?
- Unilateral or bilateral?
- Horizontal or vertical pattern?
- Isthmic diameter of superior ramus for fixation
- Associated acetabular injury?

Magnetic Resonance Imaging



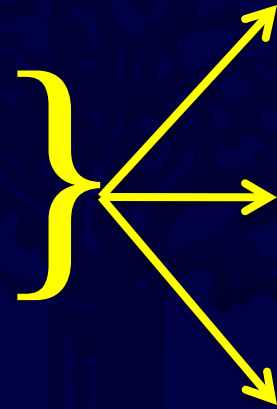
- Shows ligamentous injury
- Role undefined



Classification

Tile Classification

- Based on cadaveric sectioning
- Posterior ring only!



A: Stable

B: Partially stable

C: Completely unstable



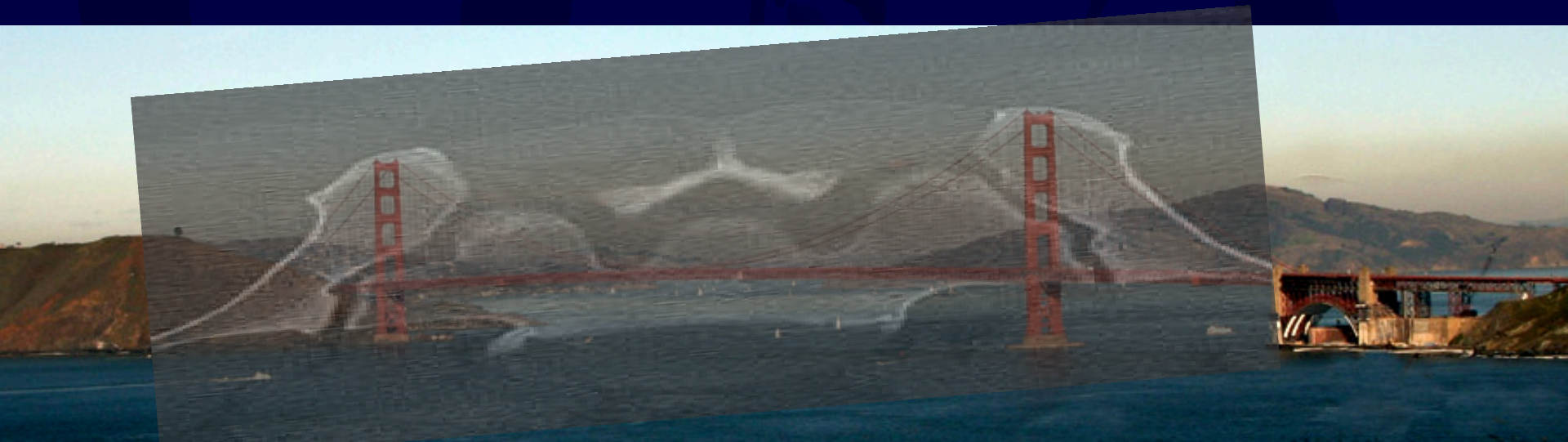
Tile Classification

- A: Stable
- B: Rotationally unstable, vertically stable
- C: Rotationally and vertically unstable

A1: Avulsion injury

A2: Iliac wing or anterior ring from direct blow

A3: Transverse sacrococcygeal fracture

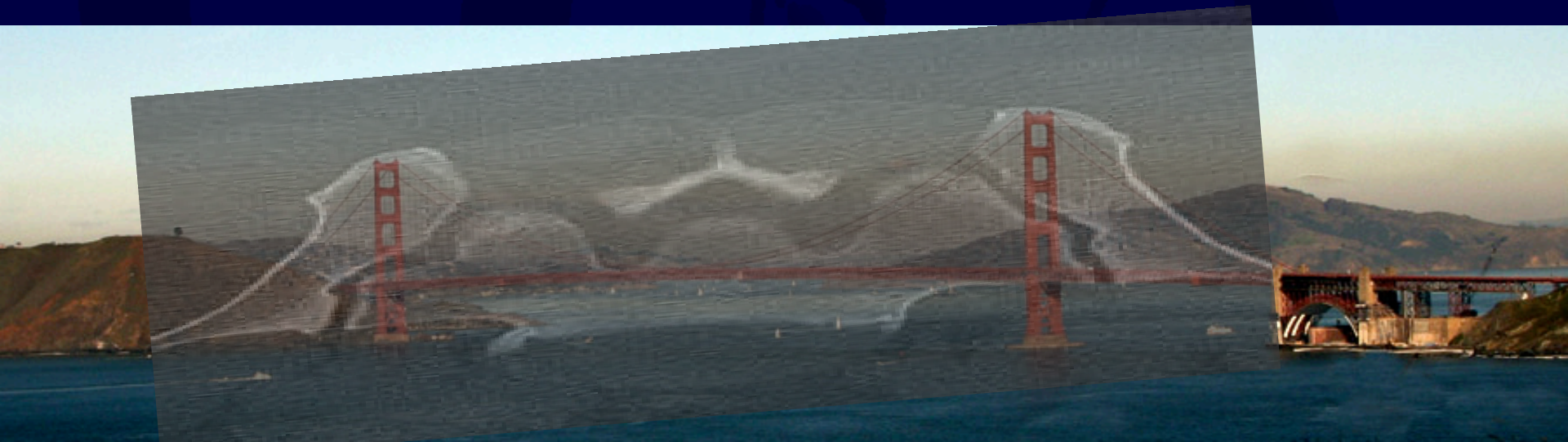


Tile Classification

- A: Stable
- B: Rotationally unstable, vertically stable
- C: Rotationally and vertically unstable



B1: Open book (external rotation)
B2: Lateral compression injury (internal rotation)
B2-1: Ipsilateral anterior and posterior injuries
B2-2: Contralateral (bucket-handle) injuries
B3: Bilateral



Tile Classification

- A: Stable
- B: Rotationally unstable, vertically stable
- C: Rotationally and vertically unstable



C1: Unilateral

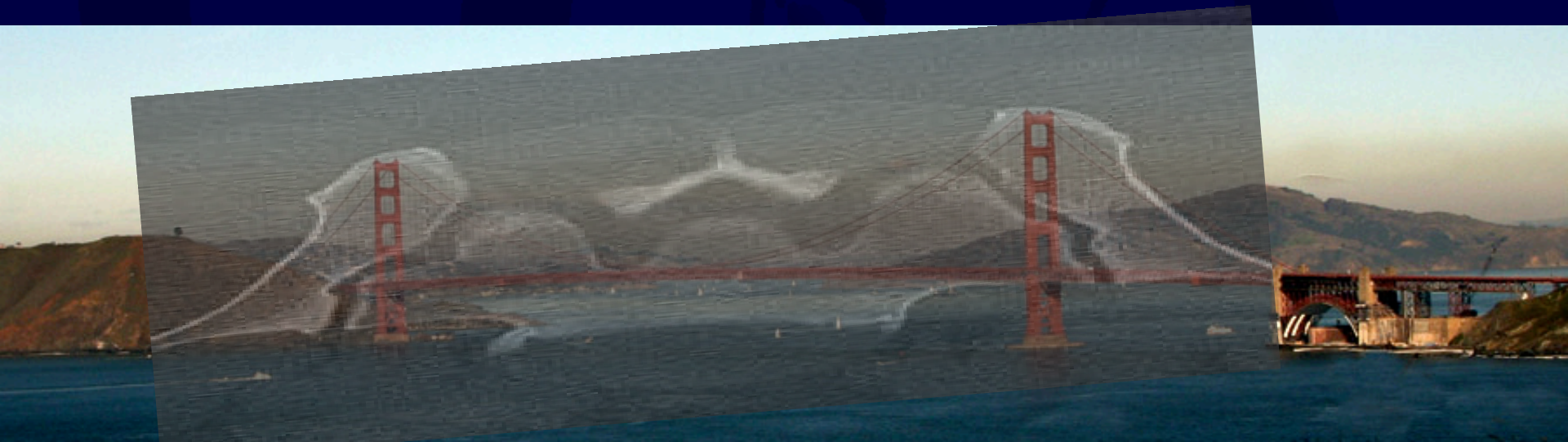
C1-1: Iliac fracture

C1-2: Sacroiliac fracture-dislocation

C1-3: Sacral fracture

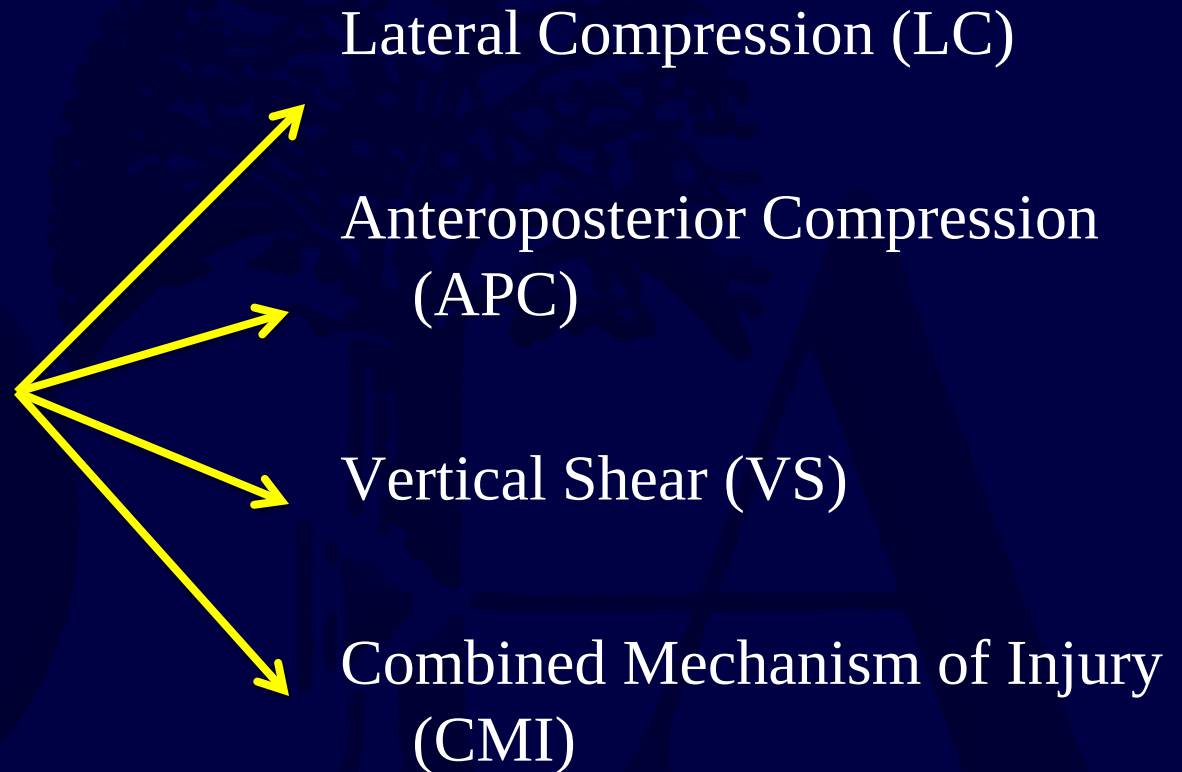
C2: Bilateral, with one side type B, one side type C

C3: Bilateral



Young and Burgess Classification

- Grouped by mechanism of injury

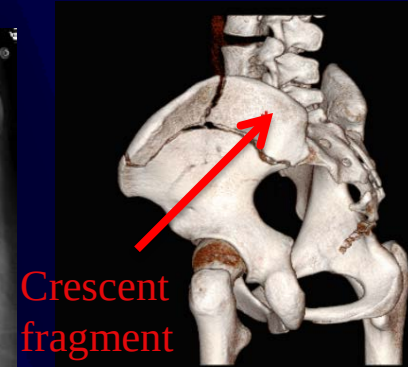


Young-Burgess Lateral Compression

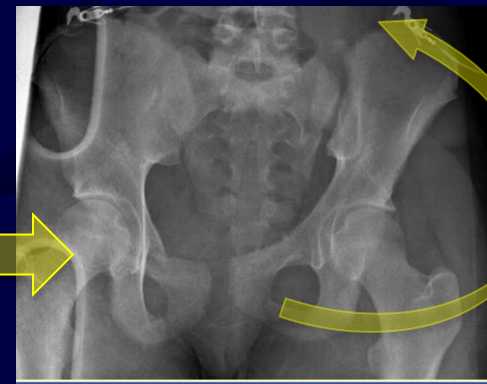
1: Sacral +
superior/inferior pubic
rami fractures
(unilateral or bilateral)



2: Crescent ($\pm$ sacral) +
superior/inferior rami
fractures



3: LC1 or 2 with
contralateral SI joint
injury (windswept
pelvis)



• LC

Young-Burgess Anteroposterior Compression

- APC

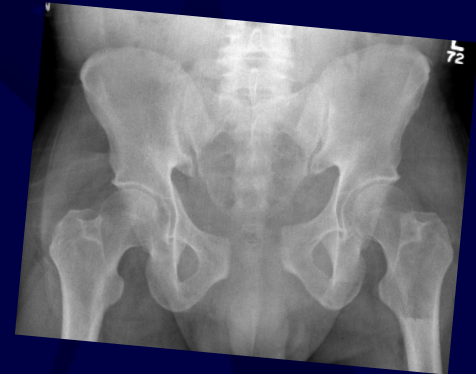
1: Pubic symphysis rupture



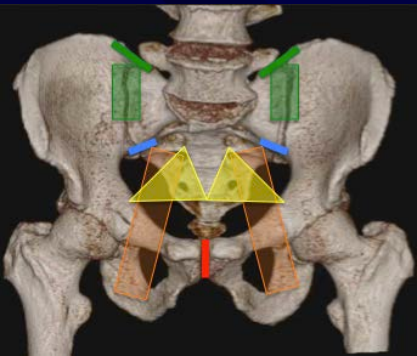
2: PS + Anterior SI ligament rupture

a: SS and ST intact

b: SS or ST disrupted

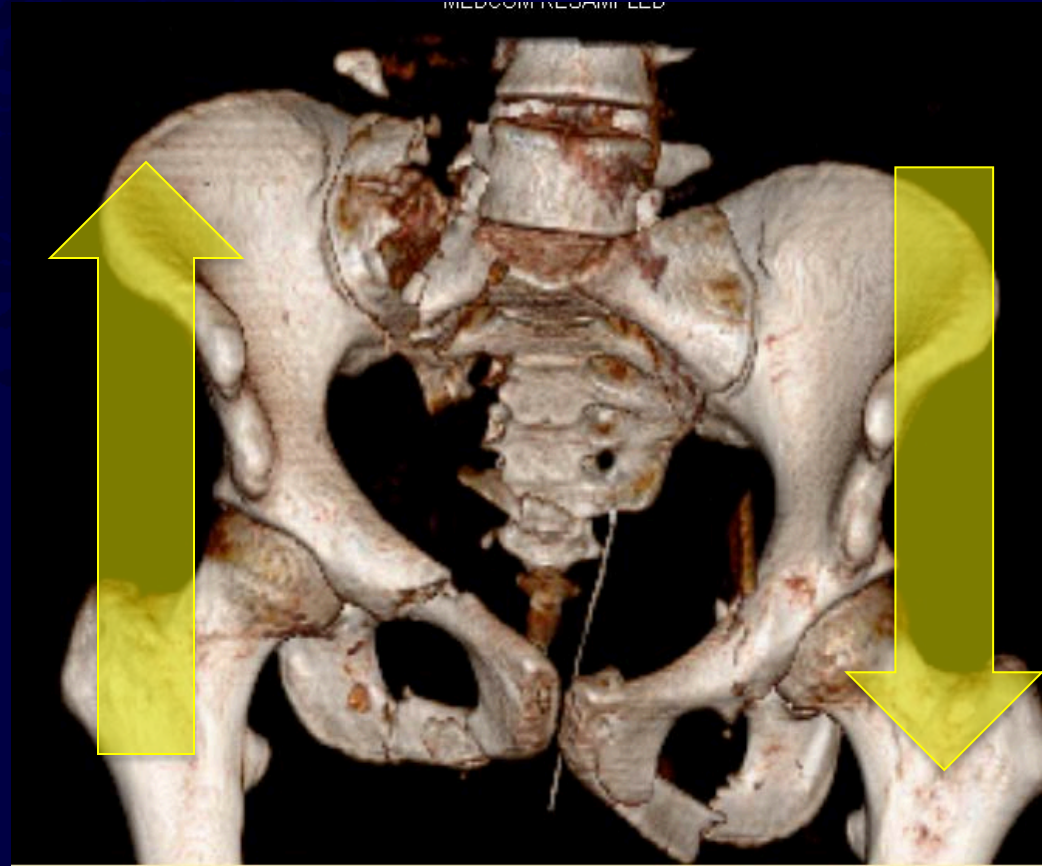


3: PS + ASI + Posterior SI ligament rupture



Young-Burgess Vertical Shear

- Shearing mechanism rather than external rotation



Young-Burgess Combined Mechanism of Injury



- Doesn't fit other classifications

LeTournel Classification

- Left complete SI dislocation
- Pubic symphysis disruption
- Displaced right transverse acetabular fracture
- Right complete SI dislocation

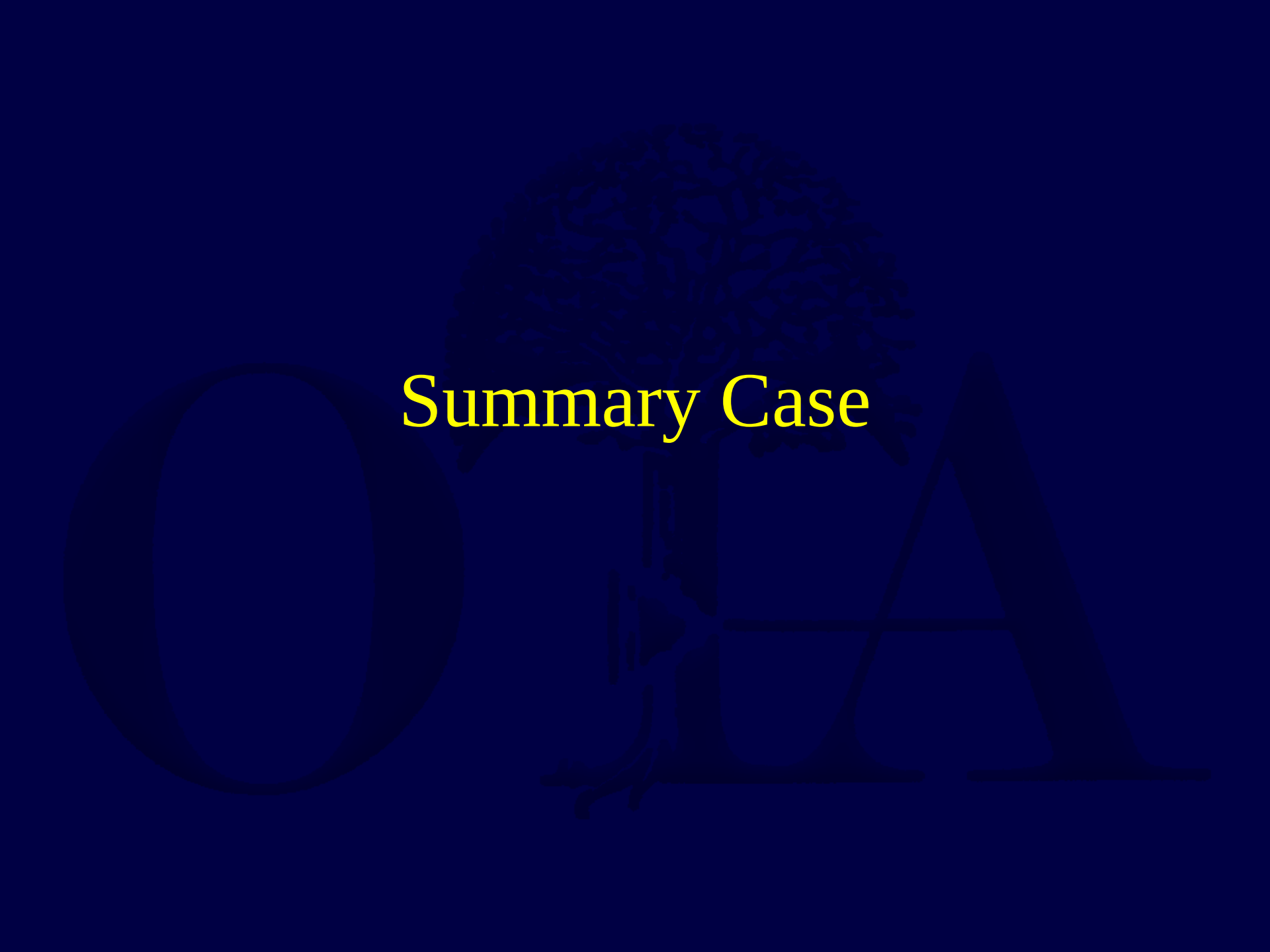


Describe injuries → Simple!!

Open Pelvic Fractures



- Jones Classification
 - I: Stable pelvic ring
 - II: Rotationally or vertically unstable pelvis without rectal or perineal wound
 - III: Rotationally or vertically unstable pelvis with rectal or perineal wound
- Gustilo-Anderson doesn't apply
 - Originally devised for tibia fractures

The background features a stylized, dark green tree with a dense, rounded canopy. The letters 'O', 'R', and 'A' are integrated into the tree's structure. The 'O' is on the left, the 'R' is in the center, and the 'A' is on the right. The letters are a light green color, matching the tree's foliage. The text 'Summary Case' is written in a yellow, serif font across the middle of the image, positioned over the 'R' and 'A' letters.

Summary Case

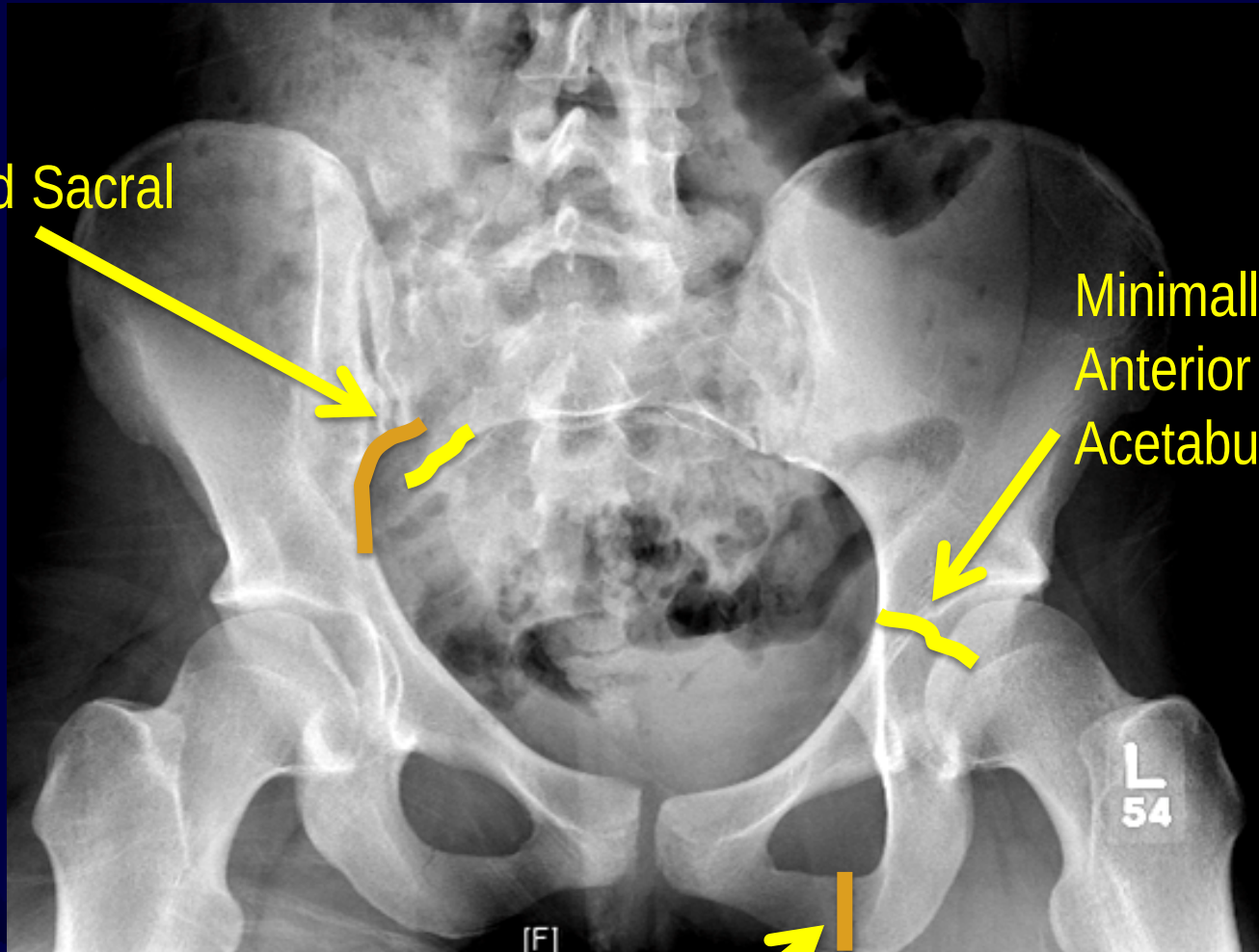
19 yo female thrown from horse



19 yo female thrown from horse

Displaced Sacral
Fracture

Minimally Displaced
Anterior Column
Acetabular Fracture

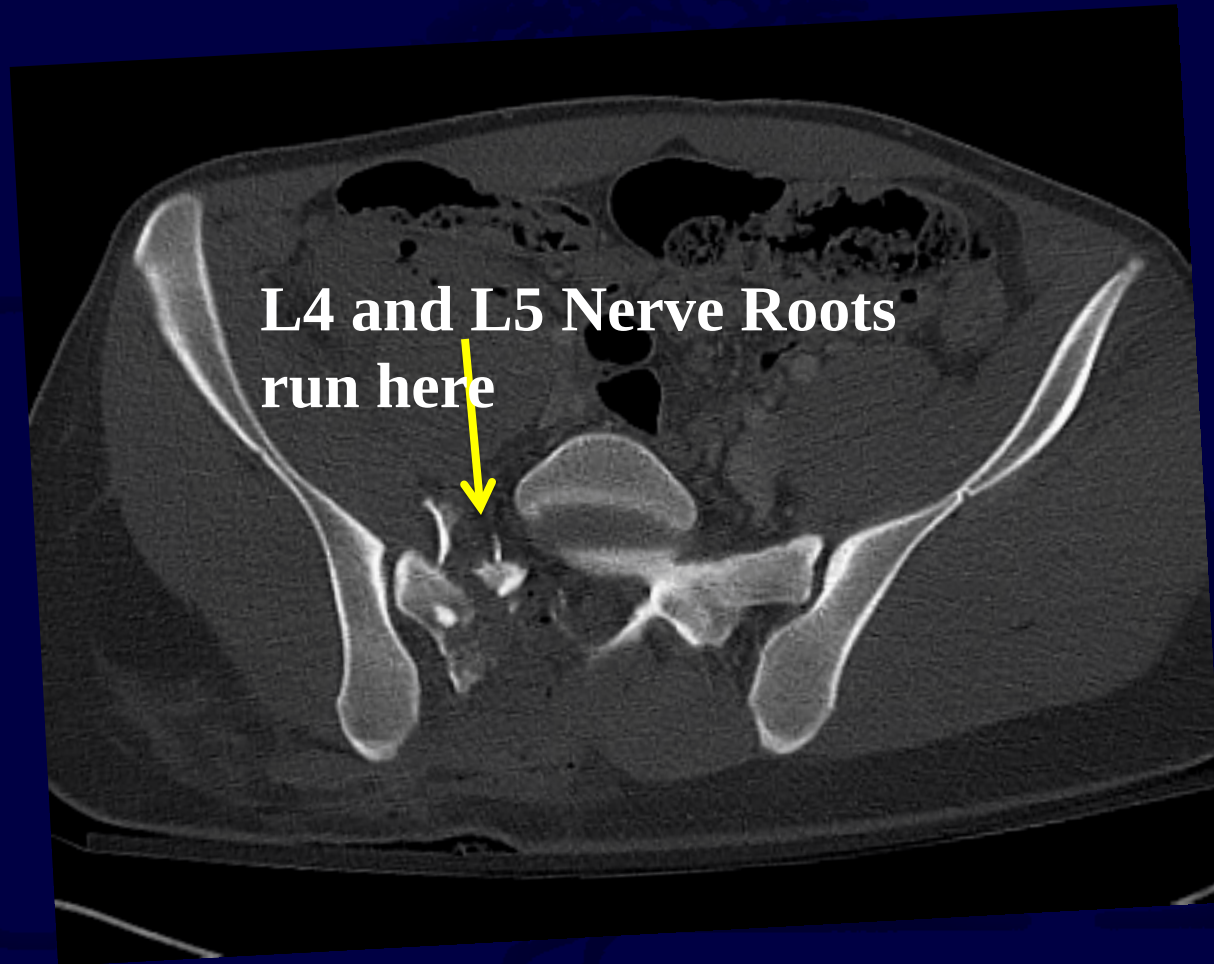


Inferior Ramus
Fracture

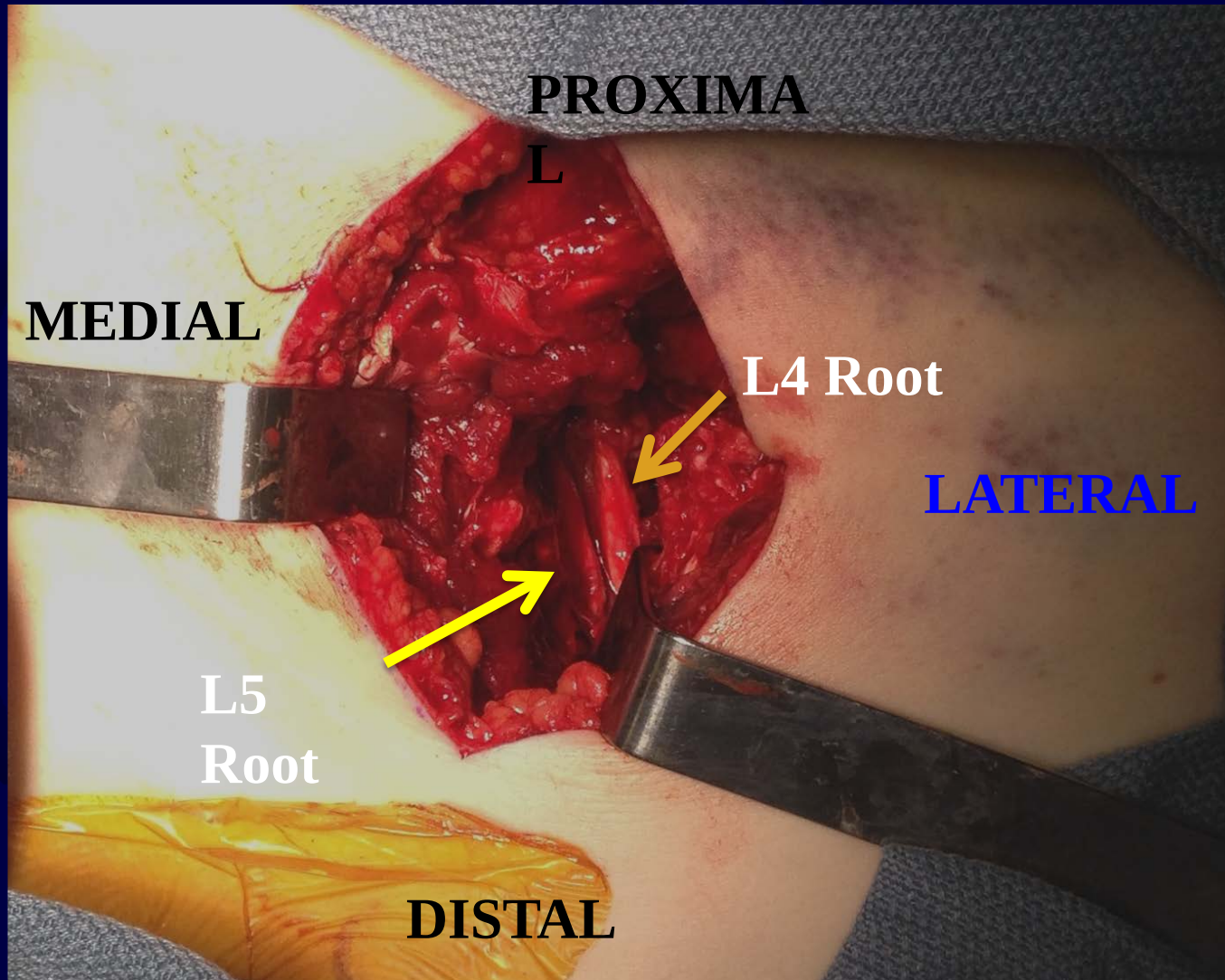
Computed Tomography



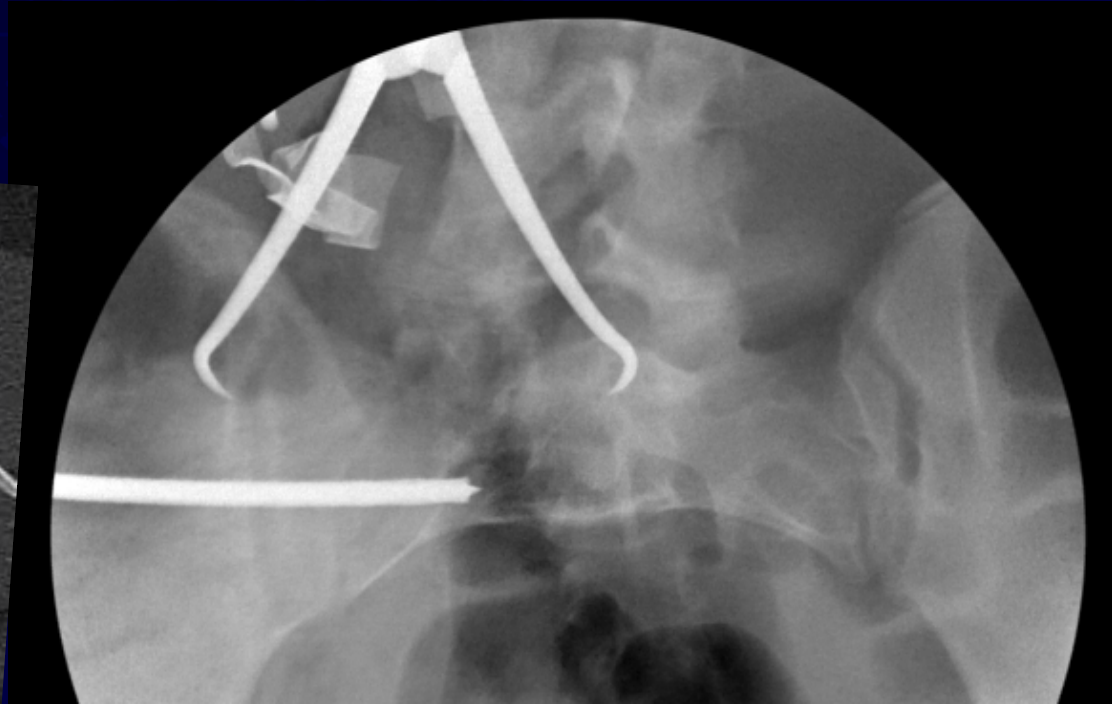
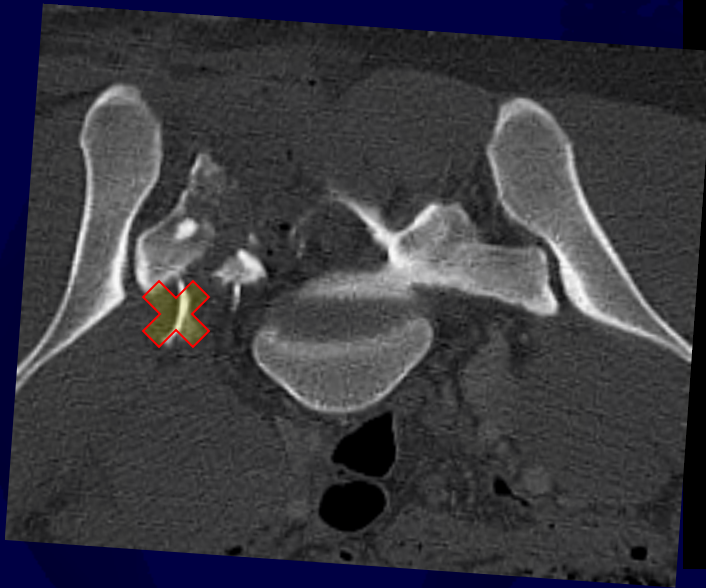
Computed Tomography



Visualize and protect nerve roots prior to reduction!

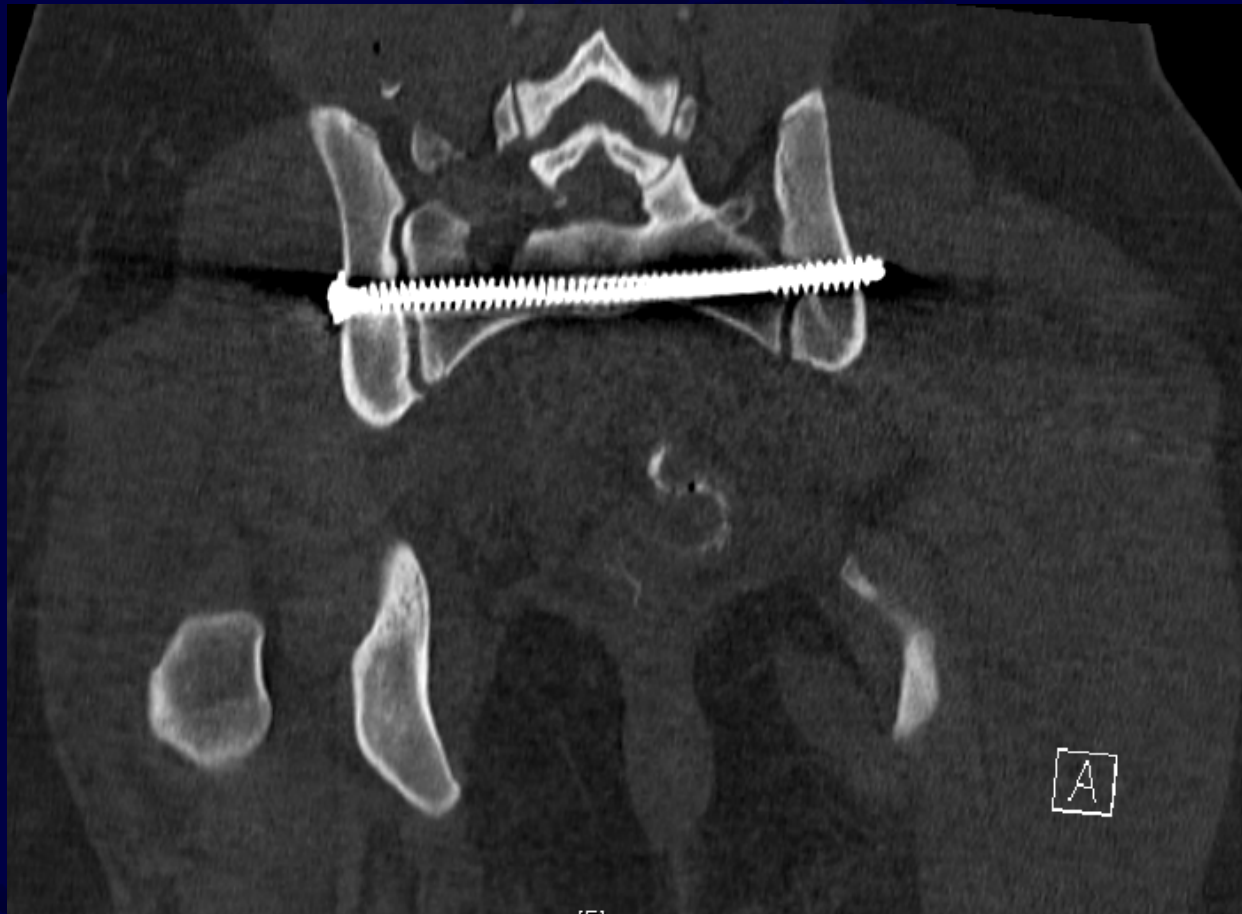


Remove anterior fragment prior to reduction!



DISTAL

Postoperative Result



DISTAL

Summary

- Anatomic knowledge = POWER!
- Proper Imaging = PLANNING!
- Classification = UNDERSTANDING!

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- For questions or comments, please send to ota@ota.org