Radiographic Evaluation & Classification of Acetabular Fractures

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Objectives

- **Intact Acetabulum: Standard radiographic evaluation**
  - Obtaining and understanding standard views
  - Identifying and understanding Letournel's six radiographic landmarks
- **Acetabular Fractures: Plain Radiographs**
  - Classification of acetabular fractures
    - Elementary and associated patterns
    - Recognizing fracture patterns
  - Classification algorithm
- **Acetabular Fractures: CT evaluation**
  - Associated injuries
  - Recognizing patterns on CT
  - Further characterization of fractures

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Standard Radiographic Evaluation

Standard Pelvic Radiographs

Three views should be routinely obtained[1]:

- **AP**
- **Judets (oblique)**
  - Obturator oblique
  - Iliac oblique

Image courtesy of Dr. Raymond Wright, MD

AP Radiograph

- Centered on symphysis[1]
- Neutral rotation[1,2]
  - Symmetric obturator foramen
  - Spinous process in line with pubic symphysis
- Neutral pelvic tilt[3]
  - Coccyx ~1-3cm above symphysis

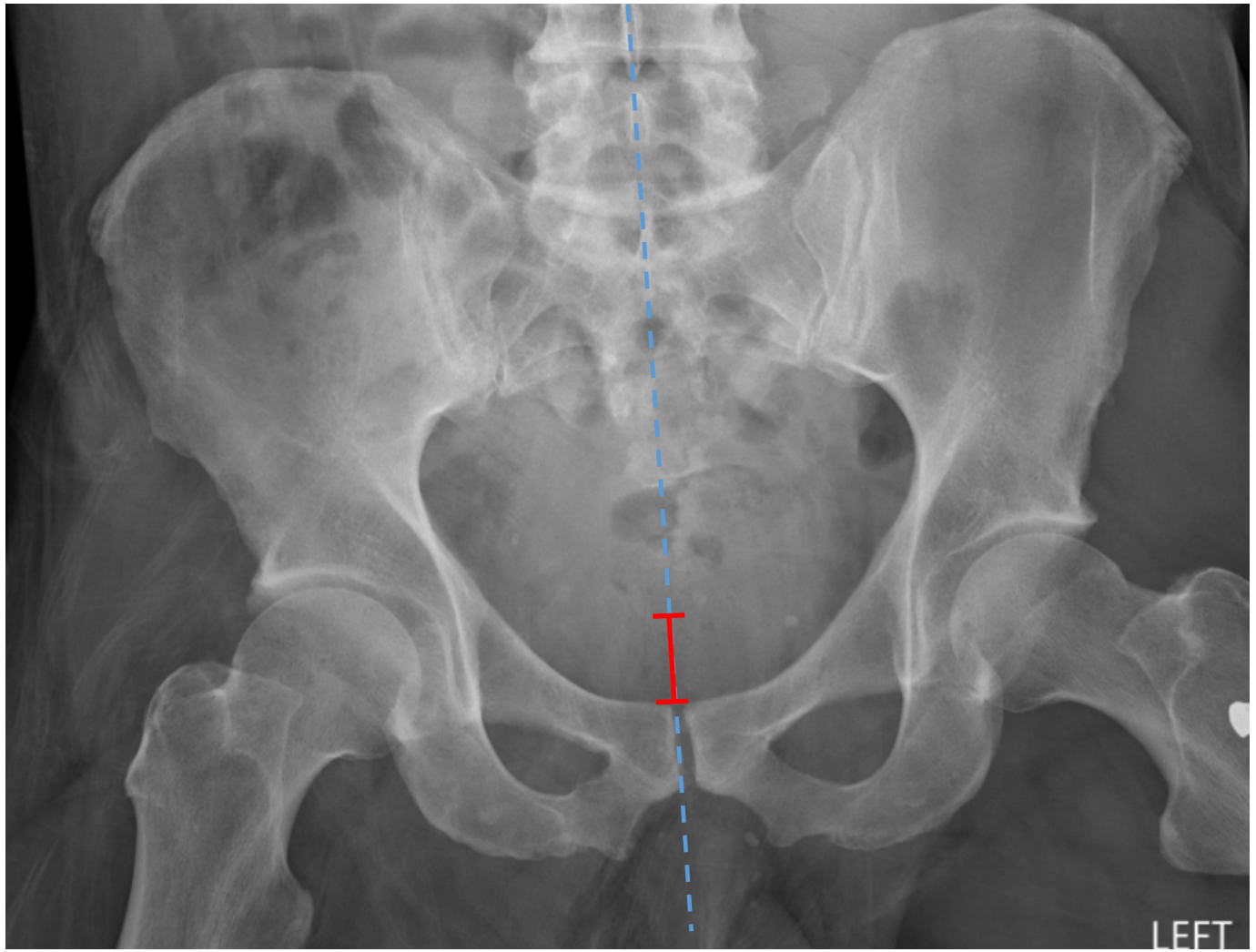


Image courtesy of Dr. Raymond Wright, MD

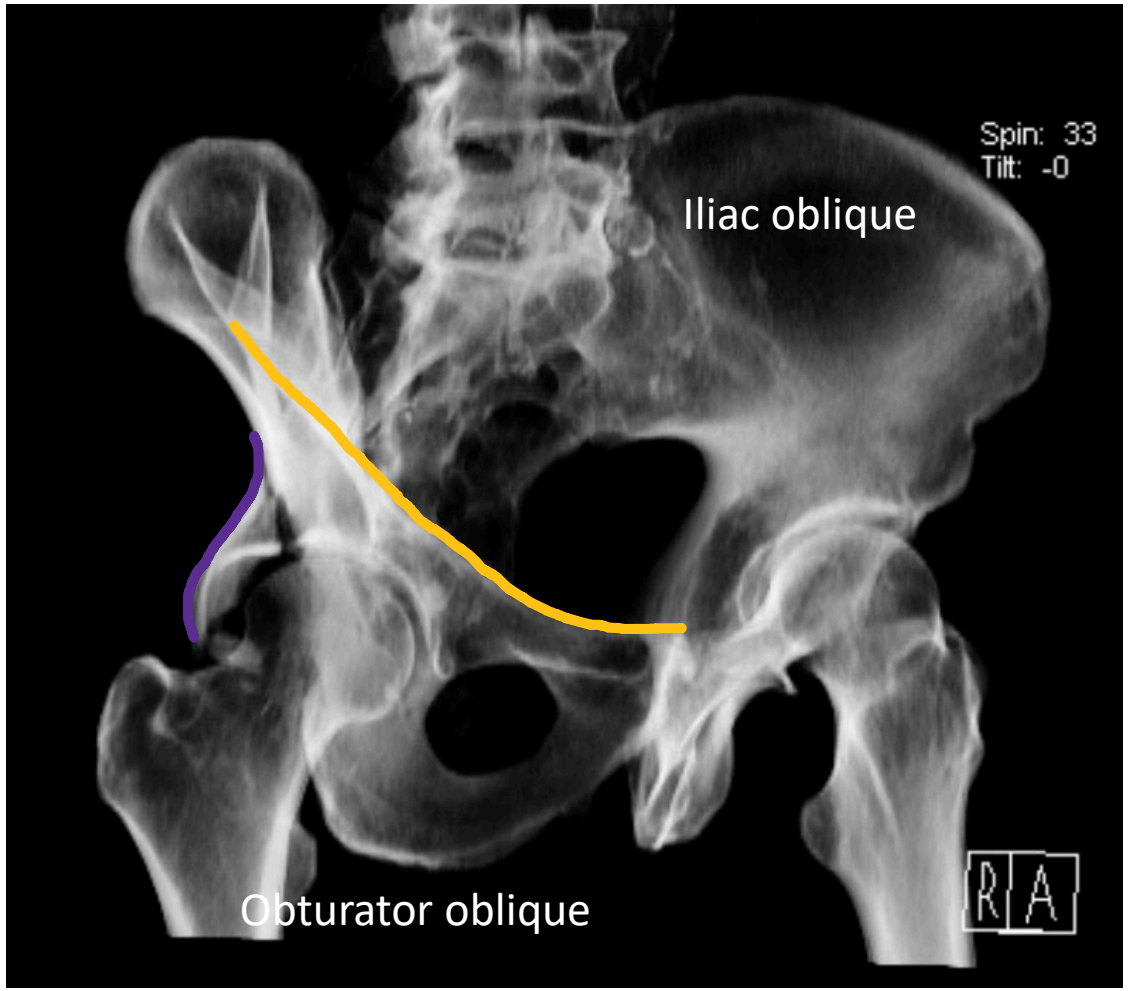
Judet Views

- Oriented 45 degrees to coronal plane[1]
- Obturator ring is perpendicular (orthogonal) to iliac wing[1,4]
  - Iliac oblique of one hip is obturator oblique of contralateral hip[4]
- Coccyx should be centered over cotyloid fossa

Images courtesy of Dr. Raymond Wright, MD

Obturator Oblique

- Injured hemipelvis bumped up, toward XR beam[1,2]
- Iliac cross section small as possible[1]
- Perfectly displays outline of the obturator ring[1]
- Best demonstrates
  - Anterior column
  - Posterior wall



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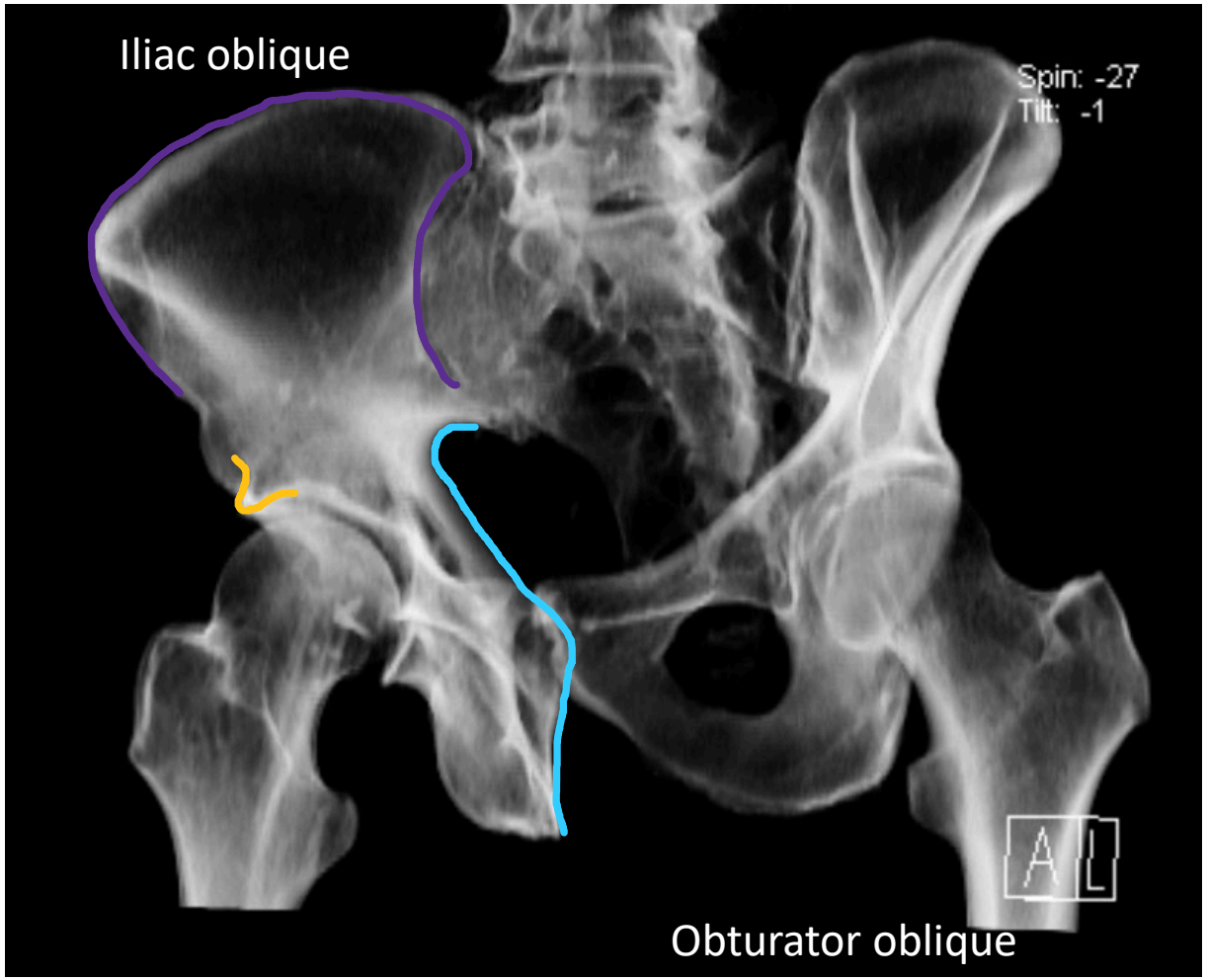
Iliac Oblique

- Contralateral (uninjured) hemipelvis bumped up, toward XR beam[1,2]
- Exposes surface of the iliac wing[1]
- Obturator foramen not visible, obturator ring as thin as possible[1]
- Best demonstrates[1]
  - Posterior column
  - Anterior wall
  - Iliac wing in profile



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Letournel's Radiographic Landmarks

Letournel's 6 Radiographic Landmarks

1. ***Iliopectineal line***
2. ***Ilio-ischial line***
3. ***Teardrop***
4. ***Acetabular roof***
5. ***Anterior wall***
6. ***Posterior wall***

All identified on AP pelvis radiograph

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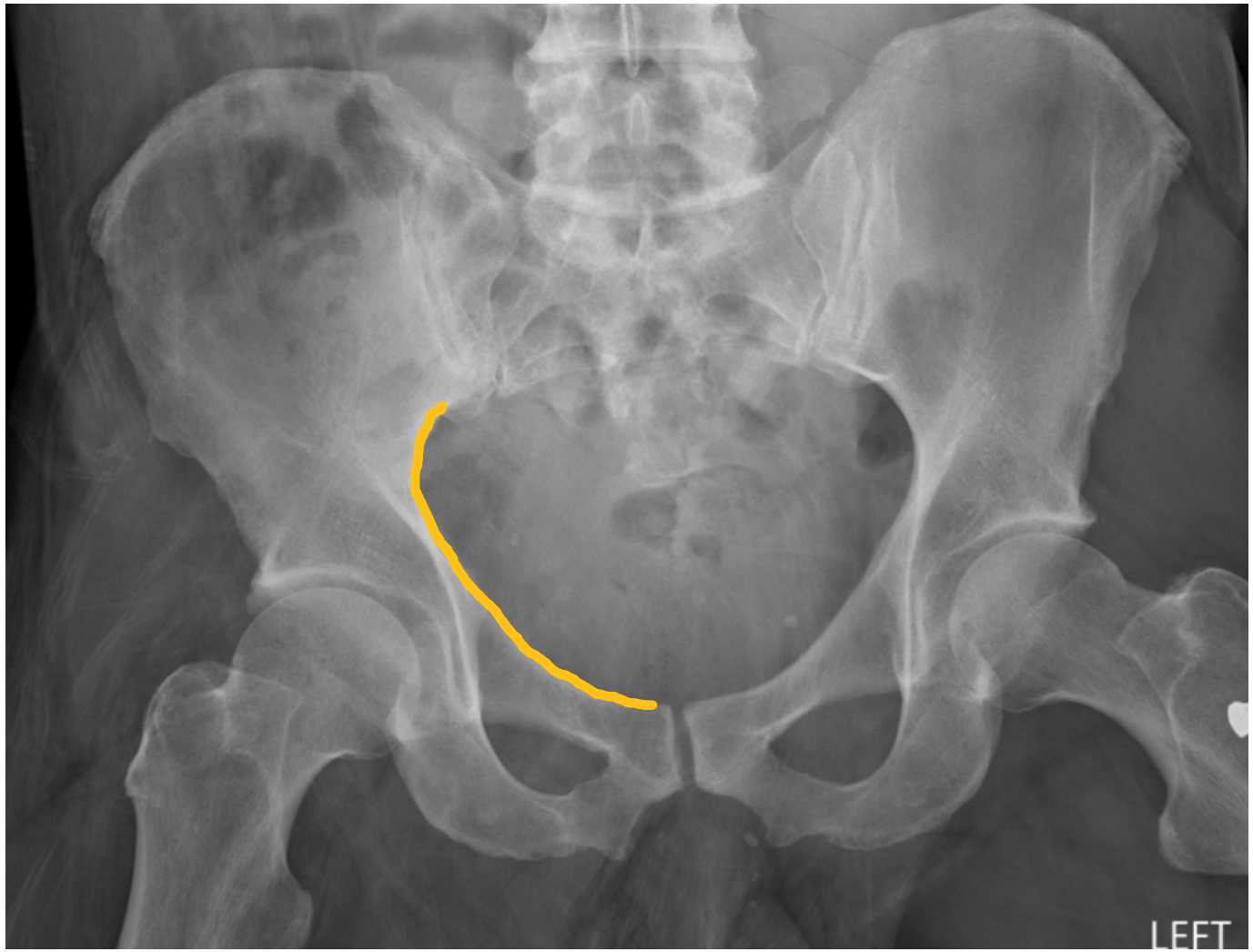
Iliopectineal line

- Landmark for anterior column[1]
  - Anterior ¾: pelvic brim
  - Posterior ¼: sciatic buttress and roof of sciatic notch



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Ilioischial line

- Landmark for posterior column[1]
  - Created by beam tangent to posterior portion of quadrilateral surface

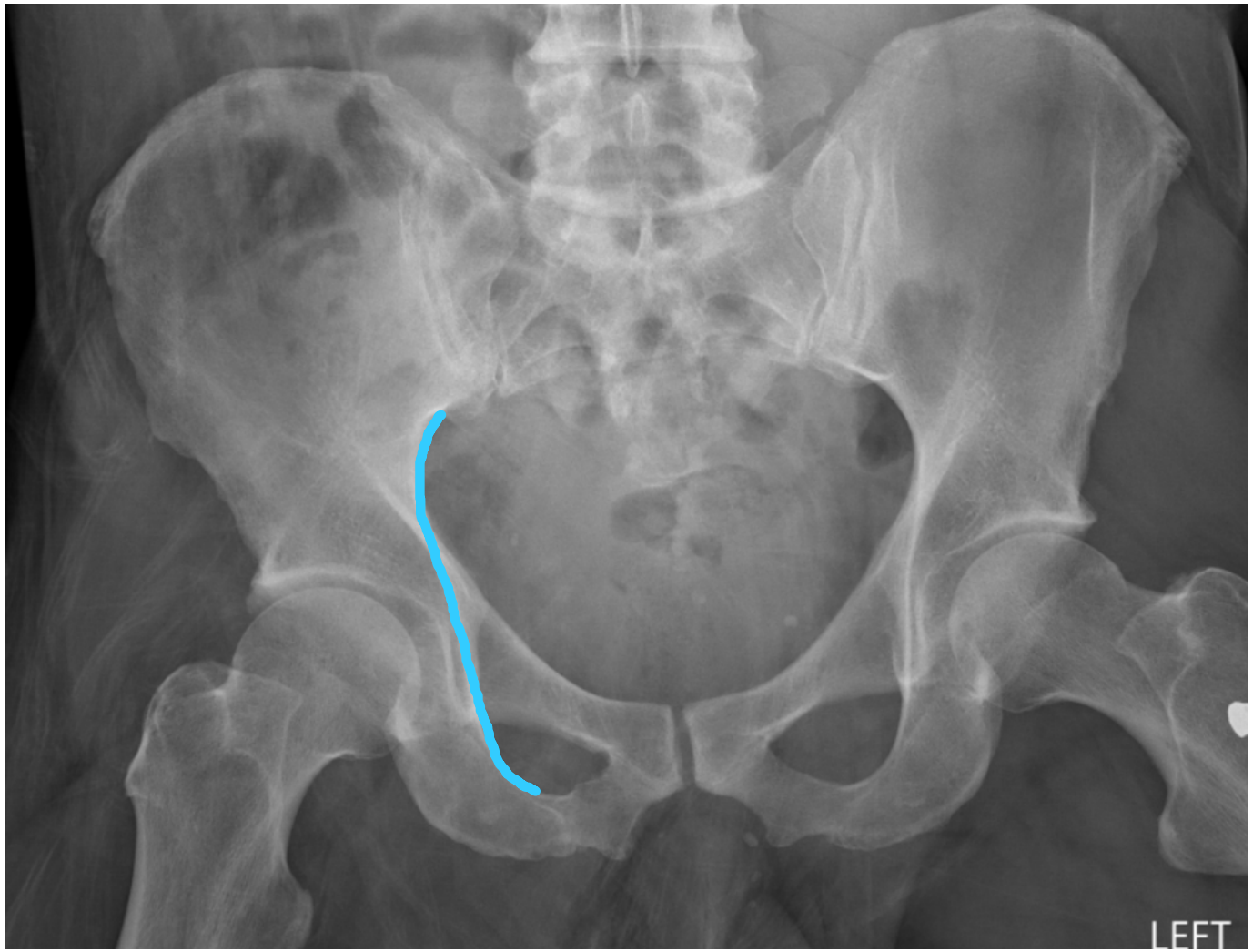
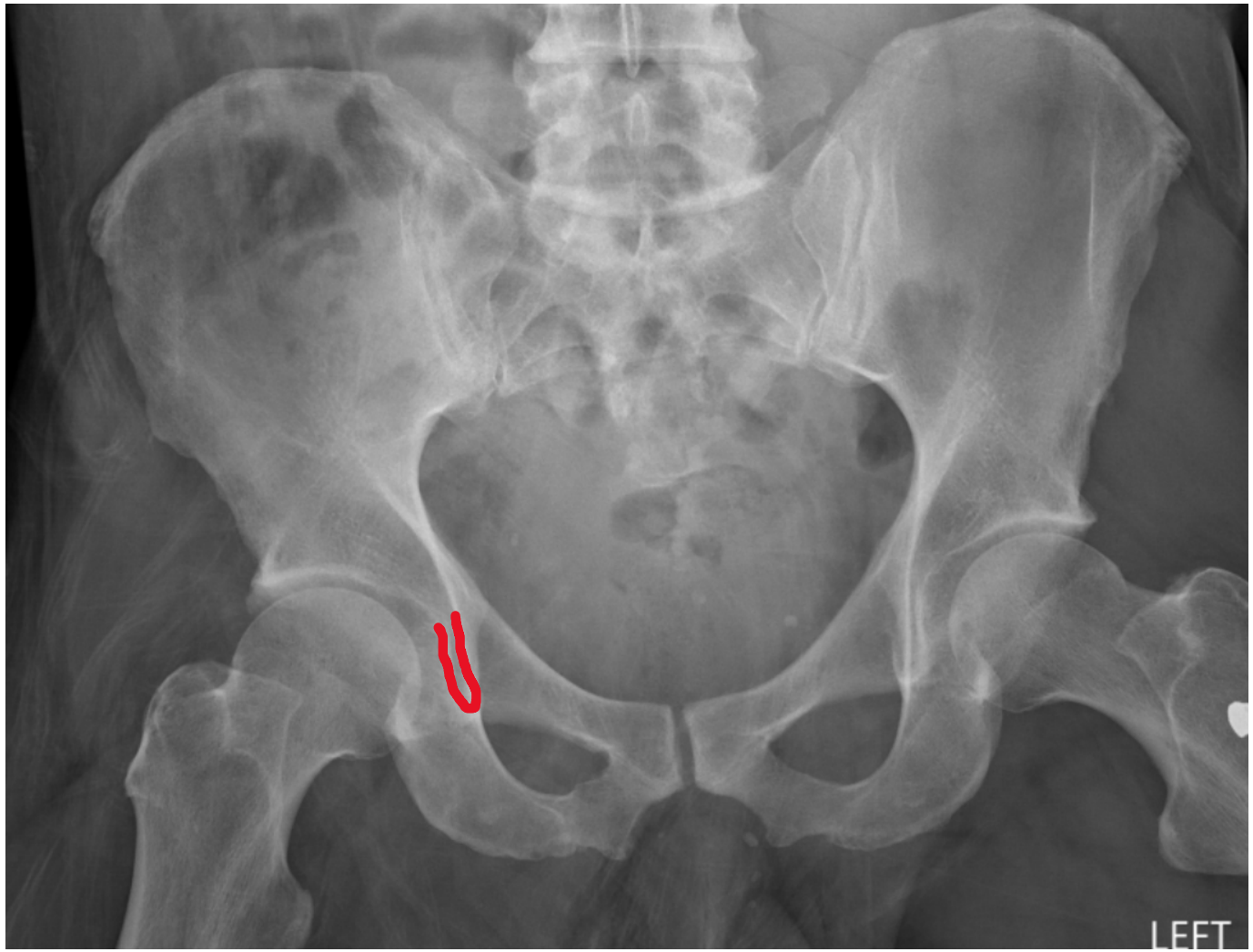


Image courtesy of Dr. Raymond Wright, MD

Teardrop

- Not a true anatomic structure[1]
  - Medial limb
    - obturator canal and anteroinferior portion of quadrilateral surface[1]
  - Lateral limb
    - Inferior aspect of anterior wall[1]
- Represents maintained relationship between columns[2]



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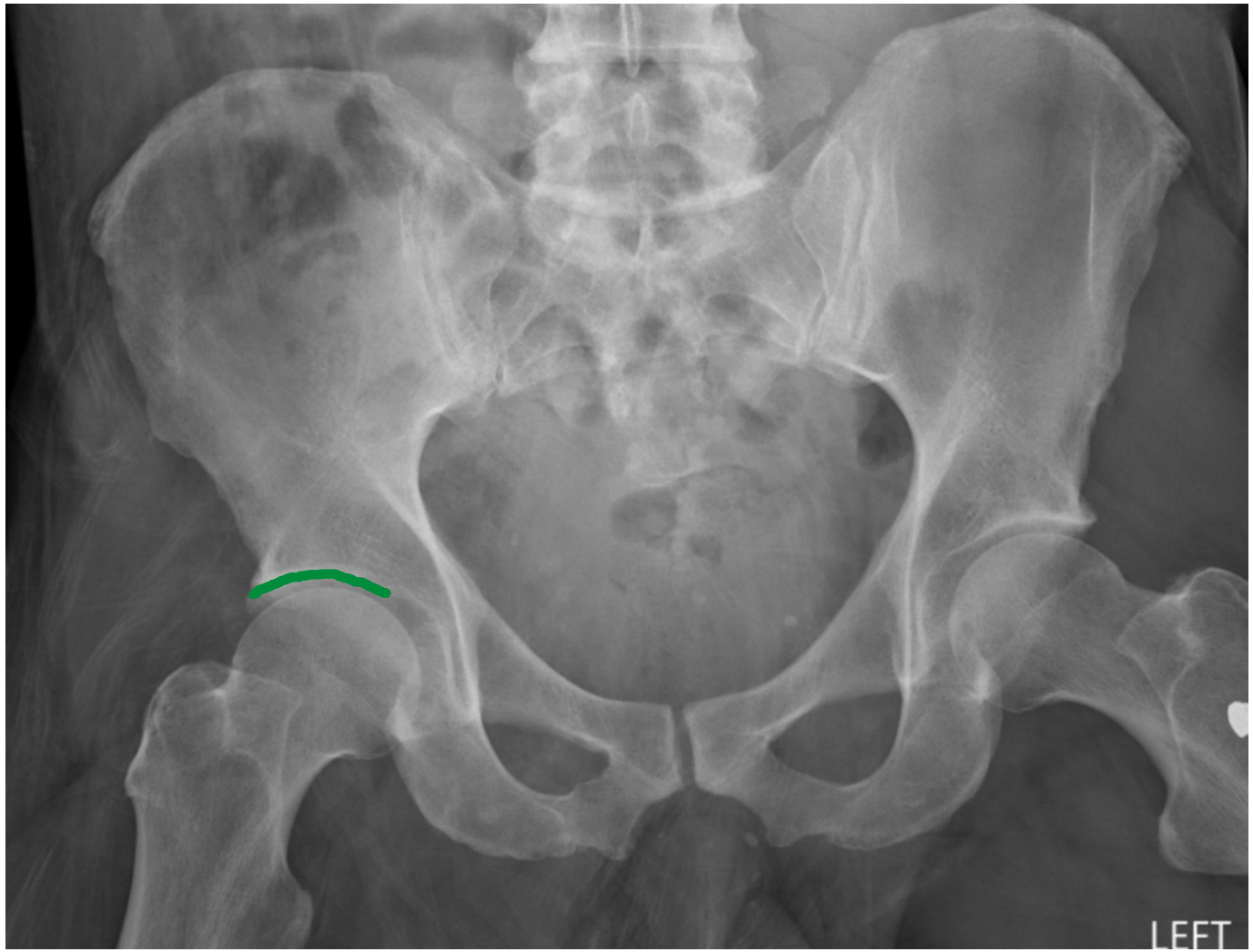
Acetabular Roof

- "Sourcil" = eyebrow[1]
- Created by beam tangent to subchondral bone of superior portion of acetabulum[1]
- Represents superior articular surface of the acetabulum[2]



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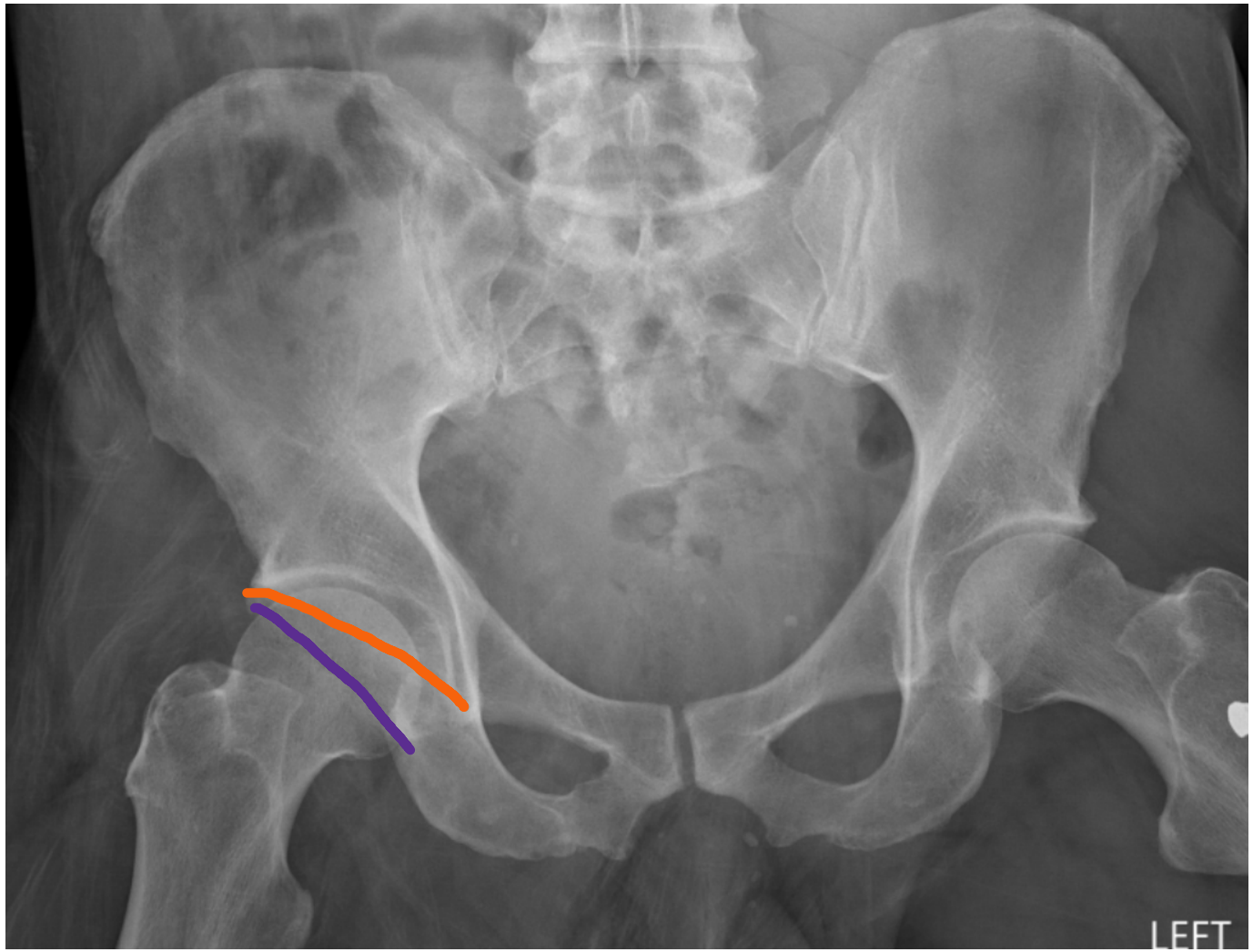
Border of Anterior & Posterior Wall

- Acetabulum slightly anteverted
  - Anterior wall appears medial to posterior wall[1]
  - Anterior wall is more horizontal than posterior wall[2]
- Radiographic landmark for anterior wall is contiguous w superior border of obturator foramen[1,2]



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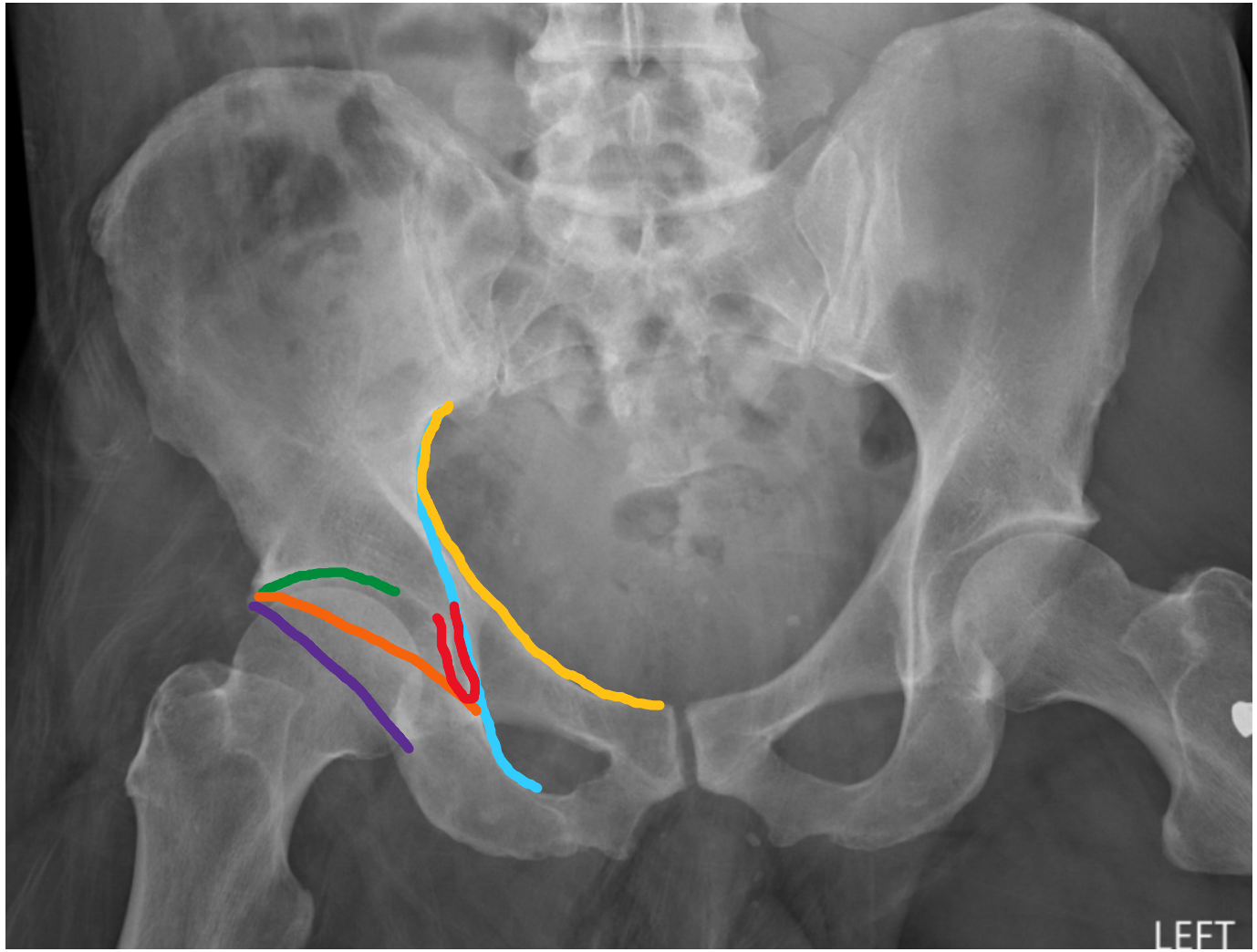
Letournel's 6 Radiographic Landmarks

1. ***Iliopectineal line***
   - Anterior Column
2. ***Ilio-ischial line***
   - Posterior column
3. ***Teardrop***
   - Relationship between columns
4. ***Acetabular roof***
   - Superior articular surface
5. ***Anterior wall***
6. ***Posterior wall***



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Fracture Classification

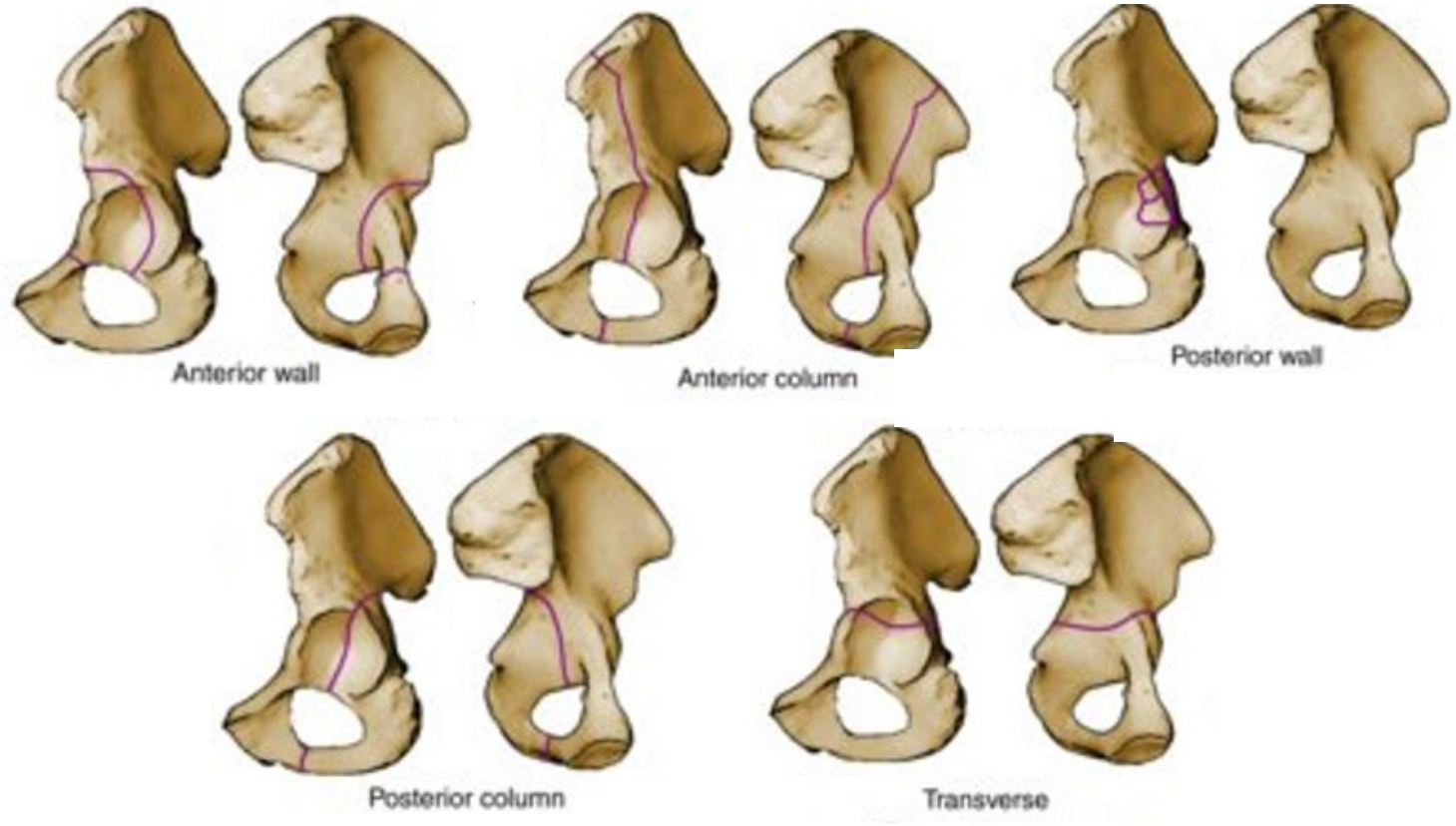
Classification of Acetabular Fractures

- Letournel's Classification
  - Five **elementary** patterns & five **associated** patterns
  - Based on anatomic pattern
    - Determined by analyzing six radiographic landmarks
    - Determine which are disrupted
- Variations from these patterns are common and well-recognized[1,2]

Letournel's Classification of Acetabular Fractures
Elementary Patterns
• Anterior wall fracture • Posterior wall fracture • Anterior column fracture • Posterior column fracture • Transverse fracture
Associated Patterns
• Transverse + posterior wall fracture • Posterior column + posterior wall • Anterior column + posterior hemitransverse fracture • T-type fracture • Both column fracture

Classification of Acetabular Fractures

- Elementary patterns
  - Separates part or entirety of single column from acetabulum[1]
  - Transverse fractures are an exception[1]
    - Both columns involved
    - Included in elementary family due to fundamental nature of fracture line[1]



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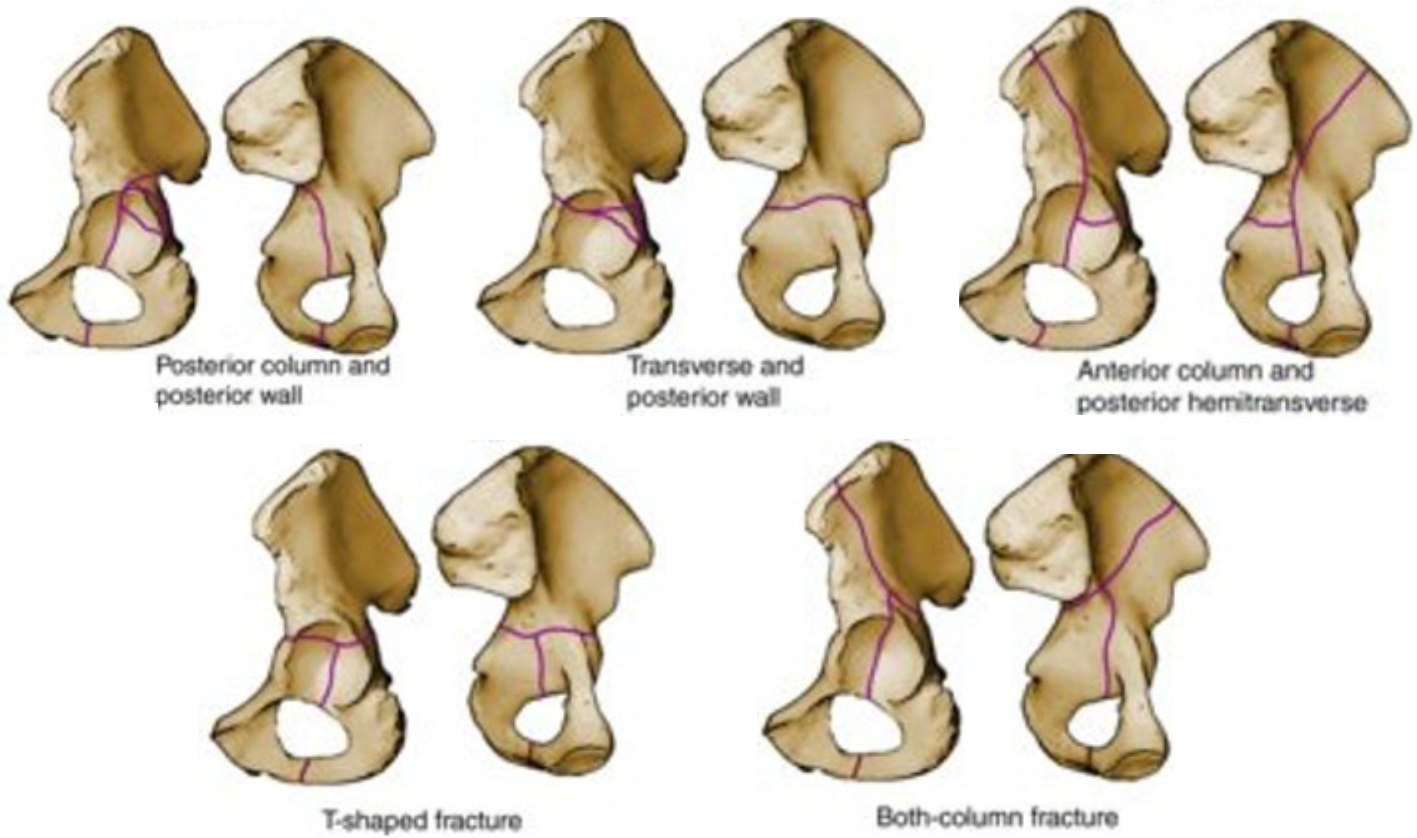
Classification of Acetabular Fractures

- Associated patterns
  - Combination of elementary patterns[1]
  - Elementary pattern + additional fracture component[1]



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Elementary Fracture Patterns

Anterior Wall Fractures

- Uncommon as isolated fractures[1]

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Anterior Wall Fractures

- AP
  - AIIS & pubis are not involved[1]
  - Typically occurs along upper 1/3[1]

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Anterior Wall Fractures

- Obturator Oblique
  - Trapezoidal shaped fragment[1]
    - Middle portion of anterior column
    - Driven medially by femoral head
  - Assess extent of articular surface involvement
    - How much is attached to the wall fragment[1]

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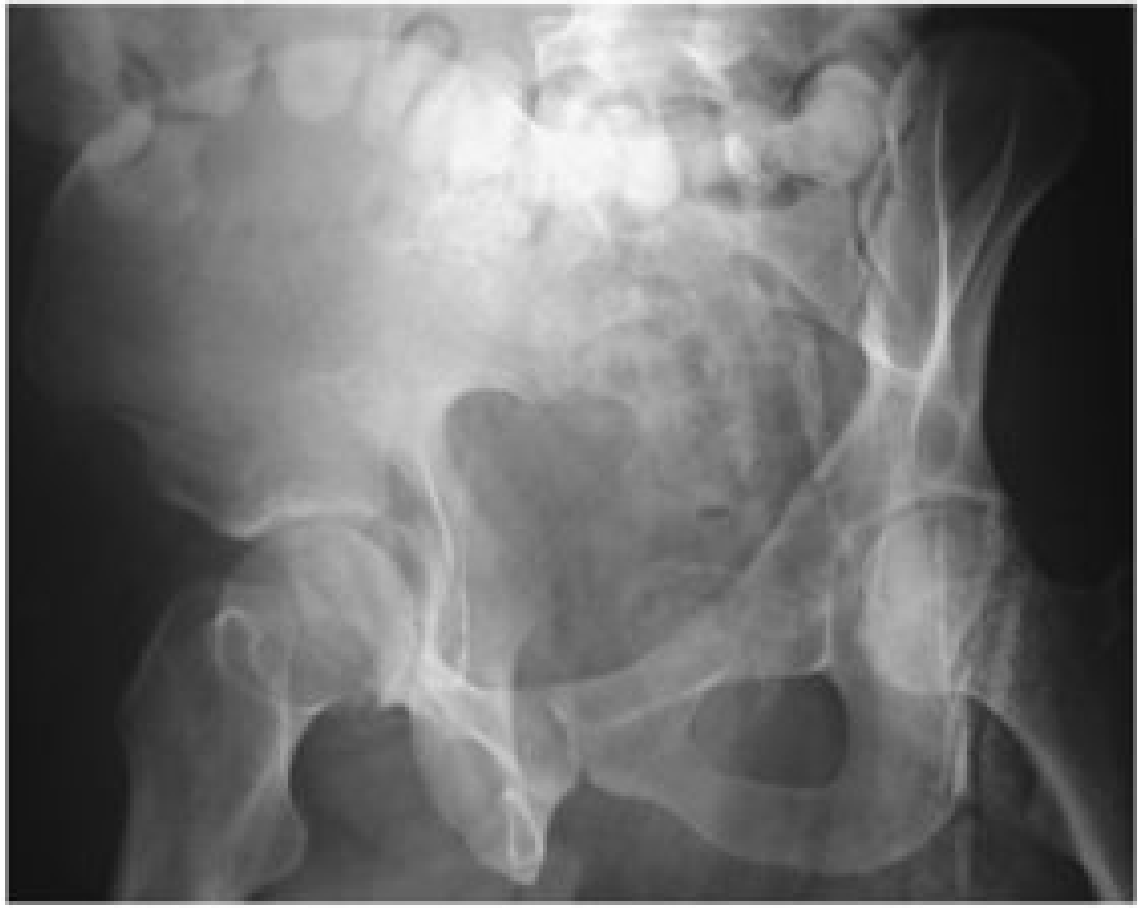
Anterior Wall Fractures

- Iliac Oblique
  - Posterior column intact[1]
  - Establish point of rupture of anterior wall[1]



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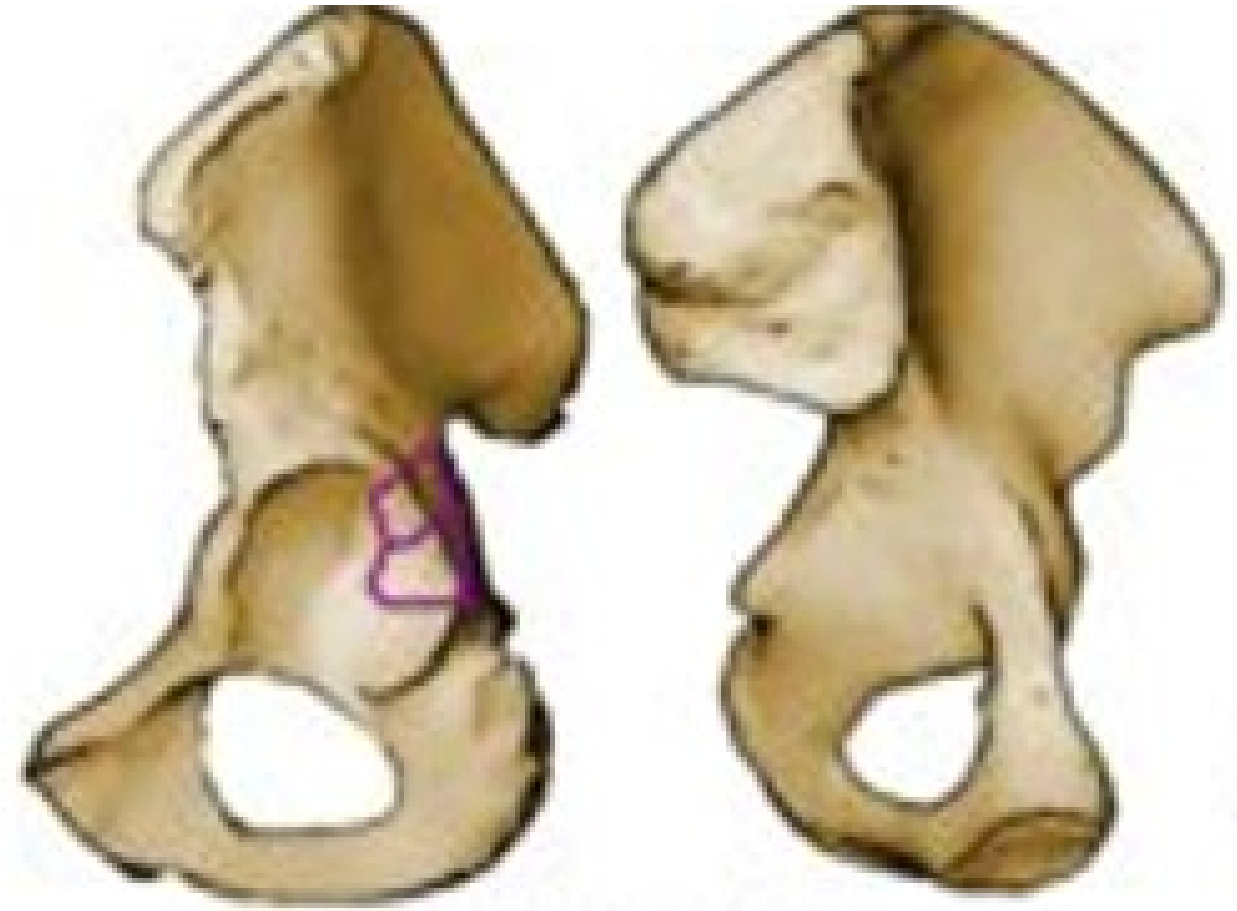
Posterior Wall Fractures

- Common pattern
- Commonly associated with
  - Posterior dislocation of femoral head[1]
  - Significant **marginal impaction**[1]



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Posterior Wall Fractures

- AP
  - Often associated with posterior dislocation of the femoral head[1]
    - PW fragment appears as cap on dislocated head[1]
    - Once reduced, fracture may be difficult to identify[1]

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Posterior Wall Fractures

- Obturator oblique
  - Provides most information regarding posterior wall fracture[1]
    - Depicts fragment size & displacement[1]
    - Any residual subluxation of the femoral head[1]

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Posterior Wall Fractures

- Iliac oblique
  - Typically not particularly useful in characterizing posterior wall fractures
  - Fracture may not be visualized at all

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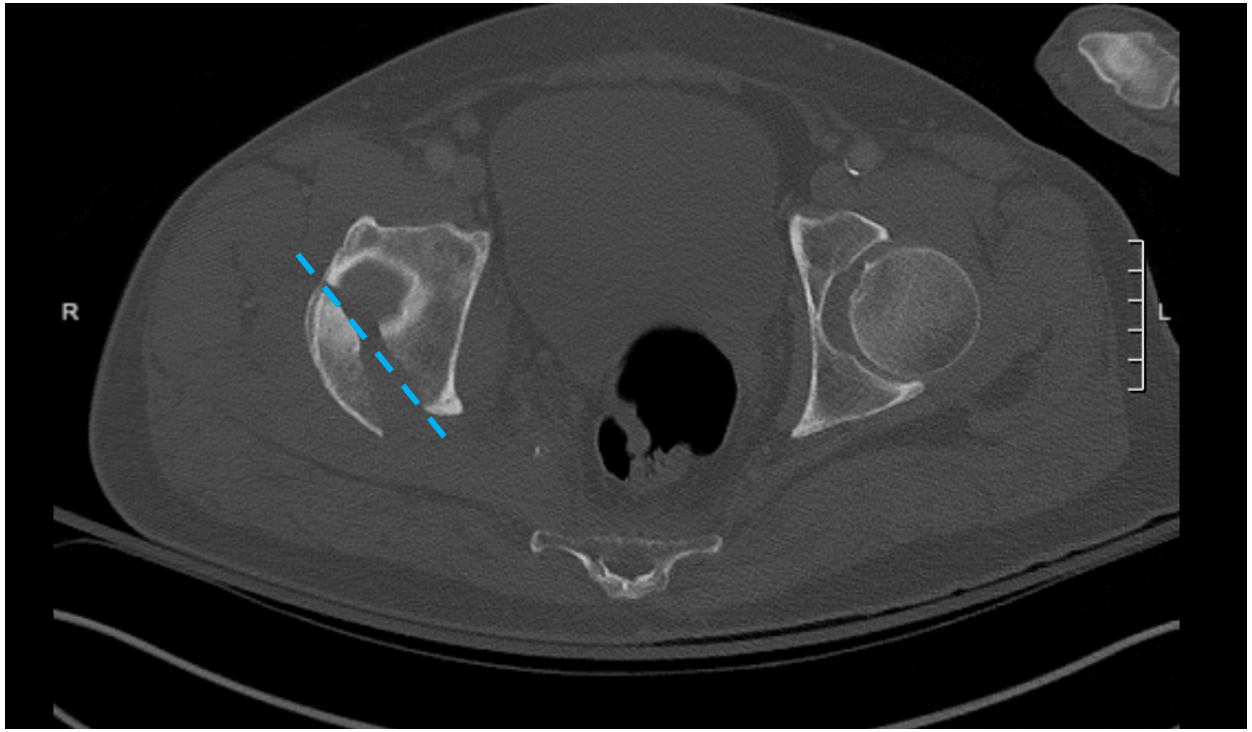
Posterior Wall Fractures

- CT
  - Fracture line oblique, anteriorly and peripherally, at ~45 degrees[1]
  - Characterizes marginal impaction[1]
  - Rule out associated, minimally displaced transverse fractures not visible on plain radiographs[1]



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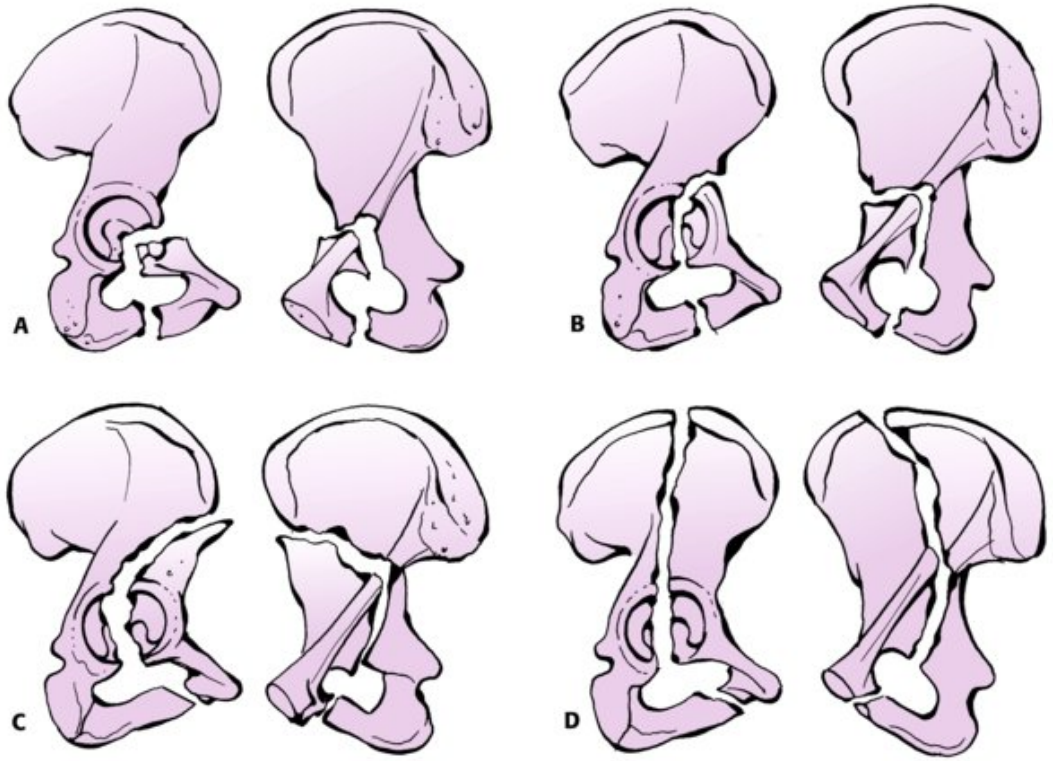
Anterior Column Fractures

- Subclassified based on where cranial extent of fracture line exits [1,2]
  - A.) Very low: anteroinferior acetabulum
    - Large portion of acetabular roof usually left intact
    - Often reduces spontaneously, remains stable
  - B.) Low: Psoas gutter
    - Inferior to AIIS
  - C.) Intermediate: Anterior interspinous notch
    - Between AIIS and ASIS
  - D.) High: Iliac crest
    - Posterior to ASIS



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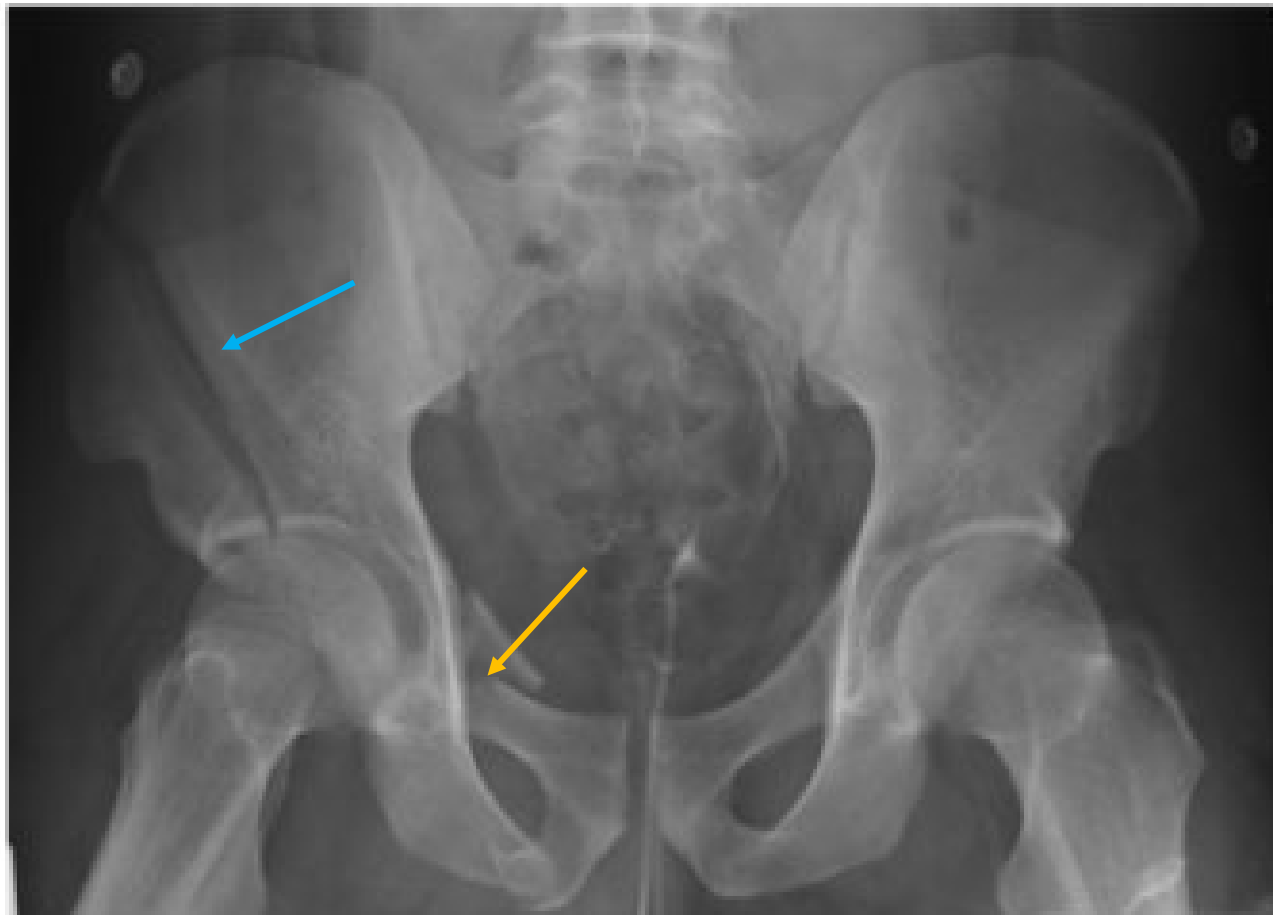
Anterior Column Fractures

- AP
  - Disrupted iliopectineal line[1]
  - Any involvement of iliac wing often visible[1]



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Anterior Column Fractures

- Obturator Oblique
  - Clearly shows location of disruption of iliopectineal line[1]
  - Best demonstrates extent of medial displacement of anterior column by femoral head[1]

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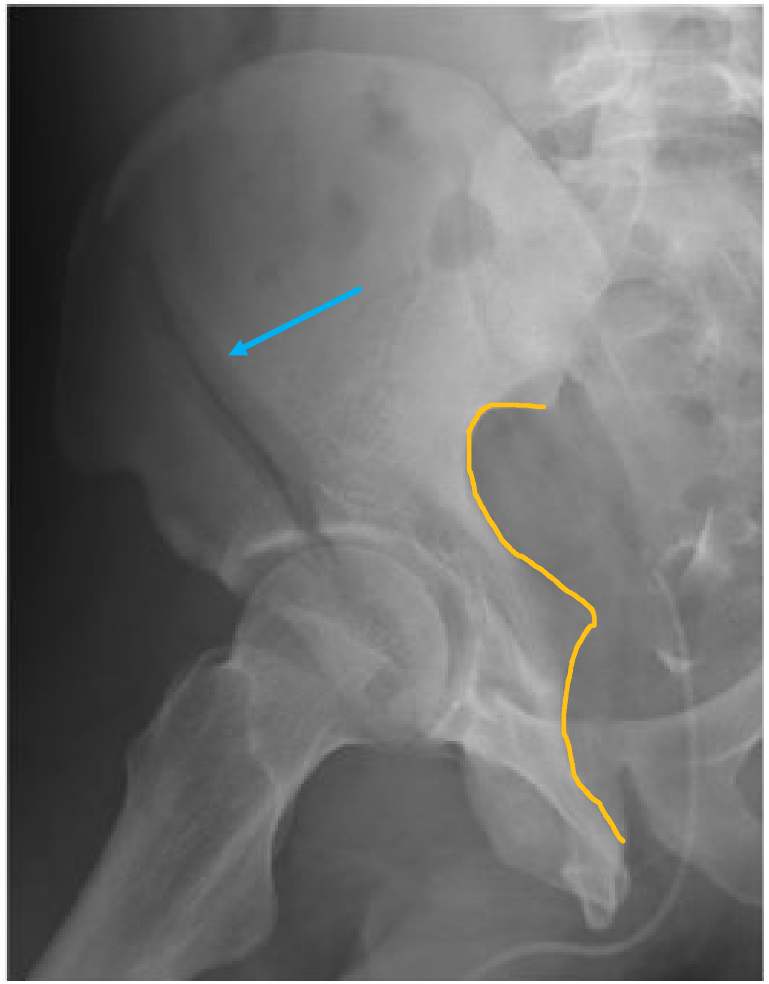
Anterior Column Fractures

- Iliac oblique
  - Confirms integrity of posterior column[1]
  - Best depicts any involvement of iliac wing[1]



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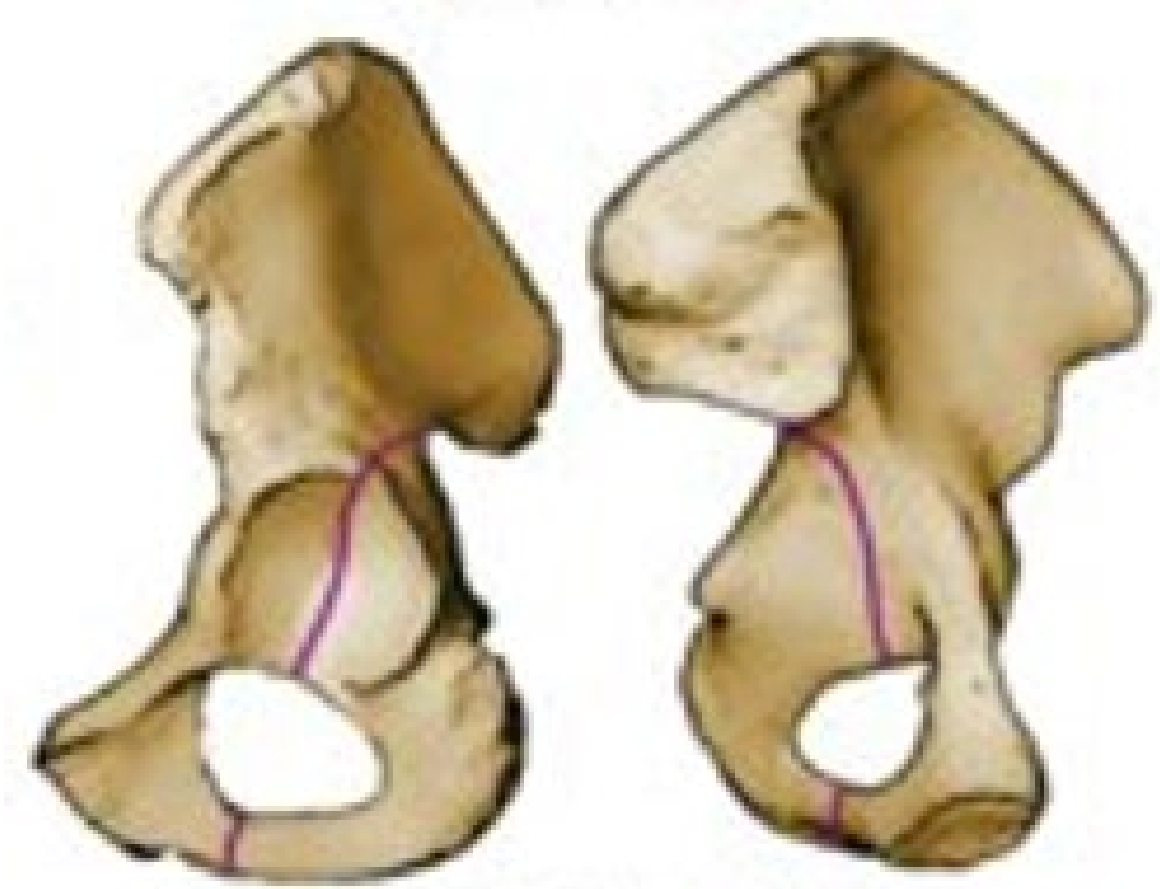
Posterior Column Fractures

- Fracture extends from posterior column near apex of greater sciatic notch[2]
- Continues caudally through inferior ramus[2]
- Separates entire ischioacetabular segment from innominate bone[2]



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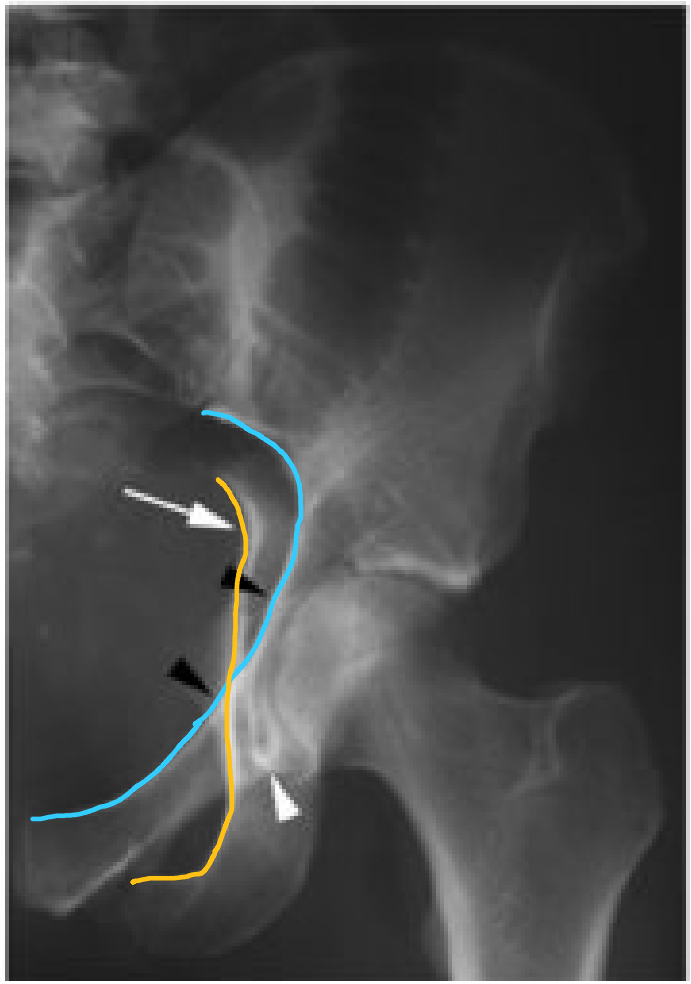
Posterior Column Fractures

- AP:
  - Loss of relationship of teardrop with iliopectineal line[1]
    - Ilioischial line displaced medially by femoral head[1]
    - Iliopectineal line intact[1]



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Posterior Column Fractures

- Obturator Oblique
  - Confirms integrity of iliopectineal line (Black arrow)[1,2]
  - Ischiopubic segment disrupted (White arrow)[1,2]

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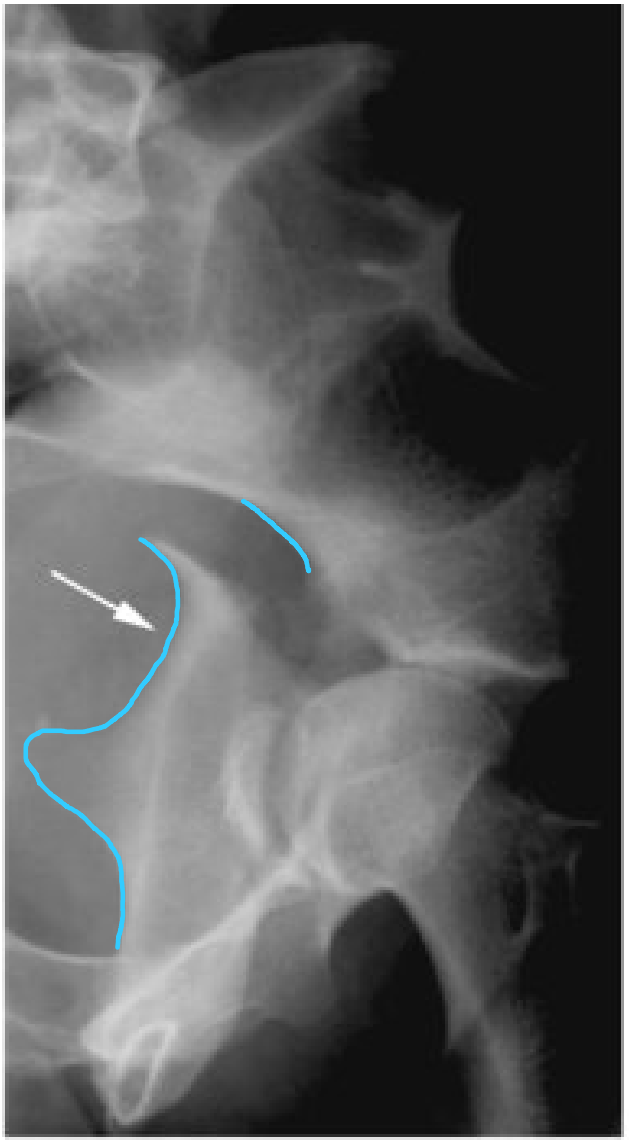
Posterior Column Fractures

- Iliac Oblique
  - Confirms disrupted ilioischial line, and extent of superior involvement[1]
    - Typically angle of greater sciatic notch[1]



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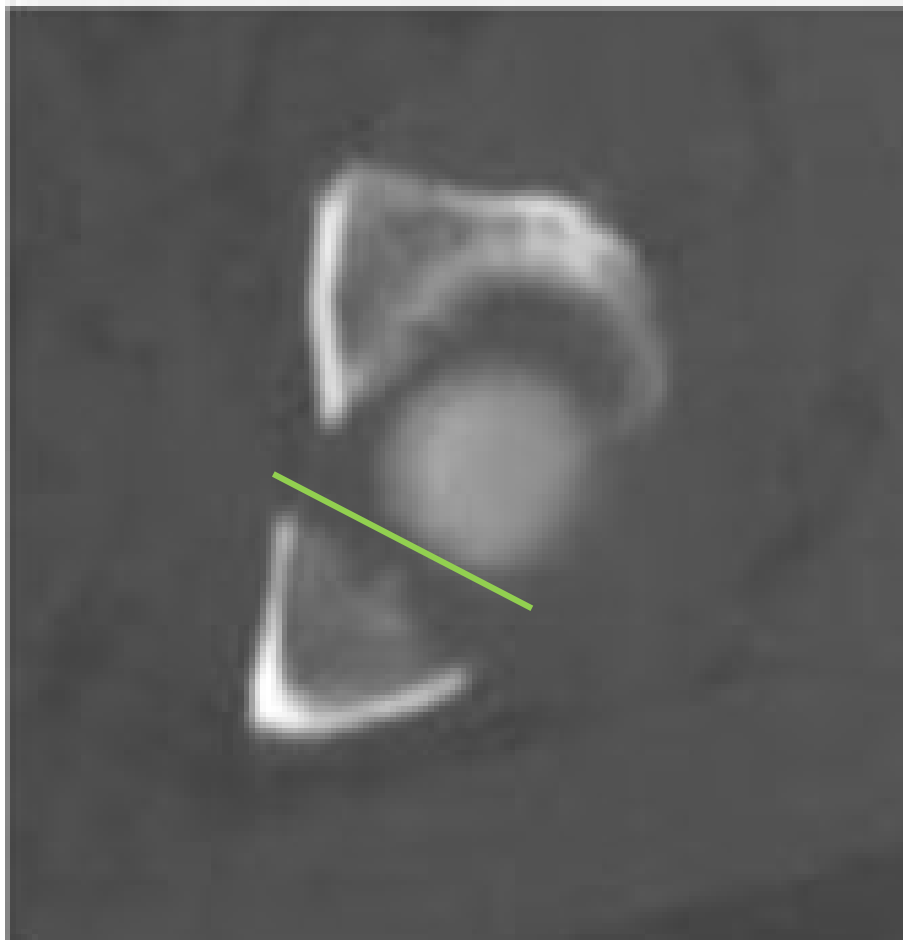
Posterior Column Fractures

- CT
  - Fracture line has **transverse (coronal)** orientation on axial CT[1]



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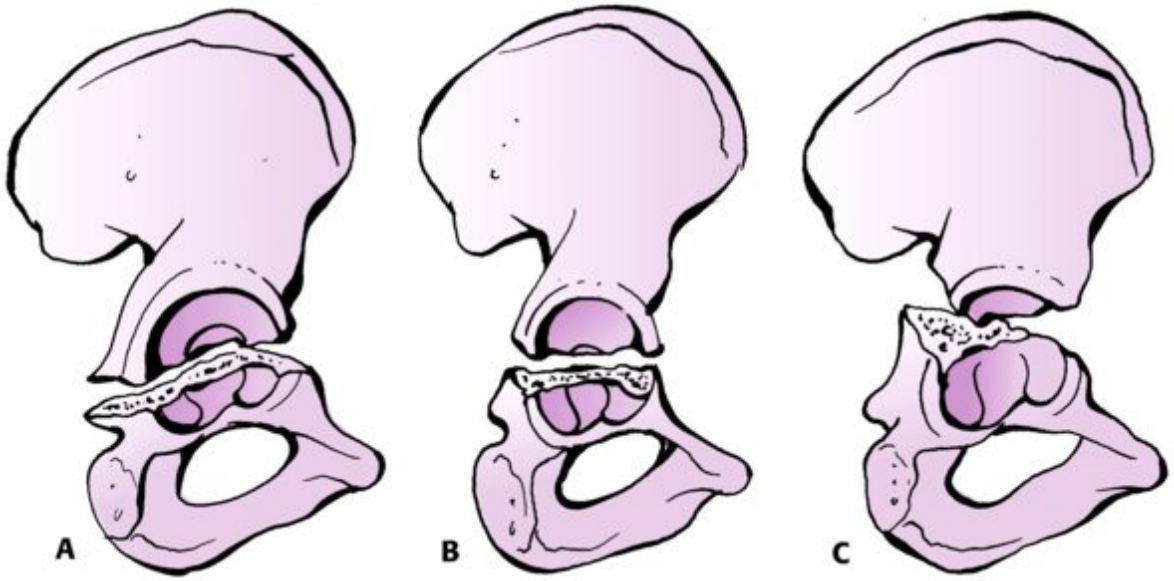
Transverse Fractures

- Subclassified based on level of fracture relative to acetabular roof[1,2]
  - A.) Infratectal
    - Inferior part of anterior and posterior walls
  - B.) Juxtatectal
    - Passes through highest point of cotyloid fossa
  - C.) Transtectal
    - At the level of the roof
- Divides innominate bone into ilium and ischiopubic segments[1]



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Transverse Fractures

- AP
  - Both ilioischial and iliopectineal lines disrupted[1]
  - Obturator ring intact[1]
  - Scrutinize for associated SI joint injury[1]

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Transverse Fractures

- Obturator oblique
  - Confirms integrity of obturator ring[1]
  - Aids in evaluation of relative displacement of the fragments[1]
    - Helpful for decision making for choice of approach

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Transverse Fractures

- Iliac oblique
  - Depicts point of rupture of greater sciatic notch (black arrow)[1]

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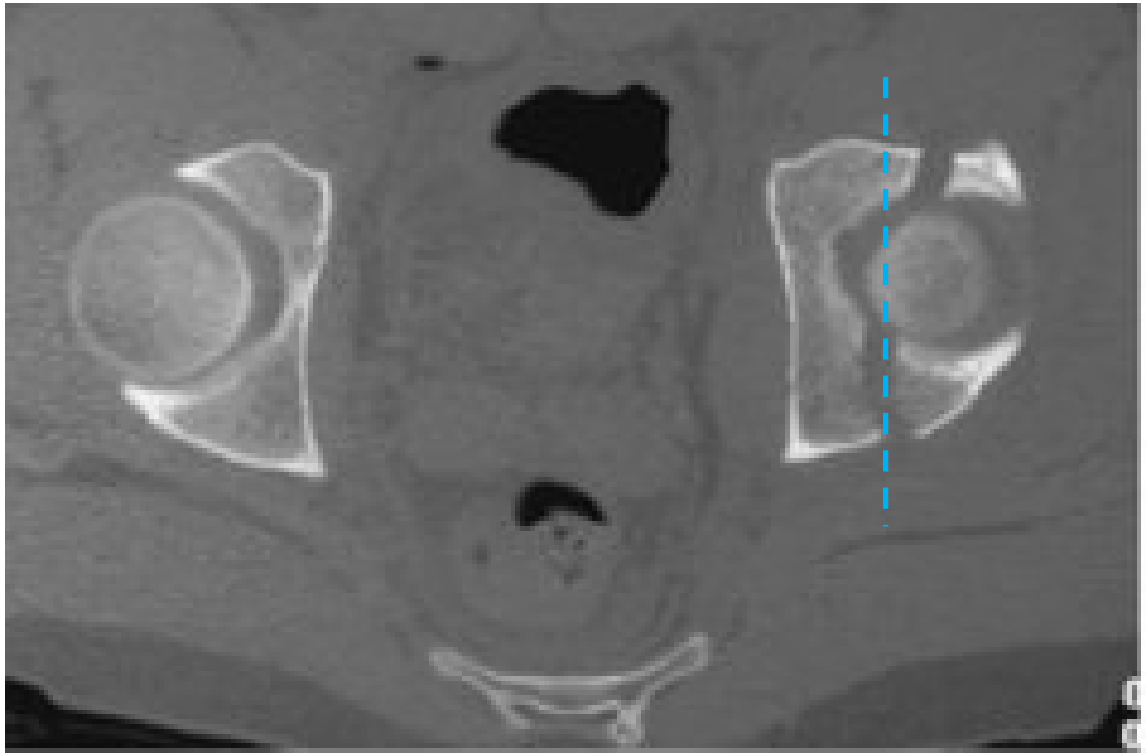
Transverse Fractures

- CT
  - Axial view
    - Fracture line has vertical (sagittal) orientation[1]
    - Evaluate for concomitant SI joint widening[1]
  - Coronal view
    - Useful for characterizing level of fracture[4]
      - ie. Trans/juxta/infra-tectal
    - Assess for associated marginal impaction[4]



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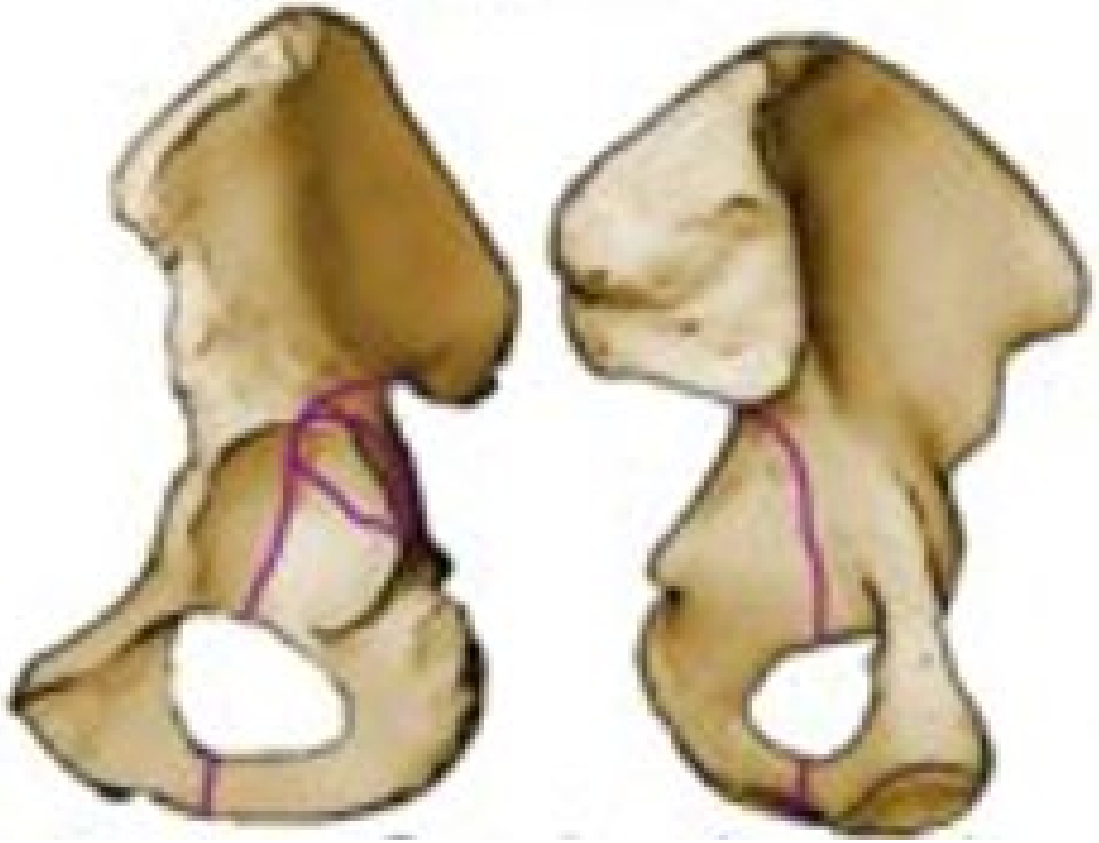
Associated Fracture Patterns

Posterior Column + Posterior Wall Fractures

- Combination of two elementary patterns[2]
  - Posterior wall portion can be thought of as comminution of posterior rim where posterior column fracture traverses it[2]
- Frequently associated with femoral head dislocation[2]



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Posterior Column + Posterior Wall Fractures

- AP
  - Ilioischial line disrupted[1]
    - "double" ilioischial line (black arrow)[1,2]
    - Sometimes posterior column component is minimally displaced and not readily visible on AP view[1]
  - Posterior wall fragment
    - Typically remains concentric with femoral head in setting of dislocation[1]
  - Ischiopubic ramus typically fractured[1] (white arrowhead)
  - Iliopectineal line intact[1] (black arrowheads)

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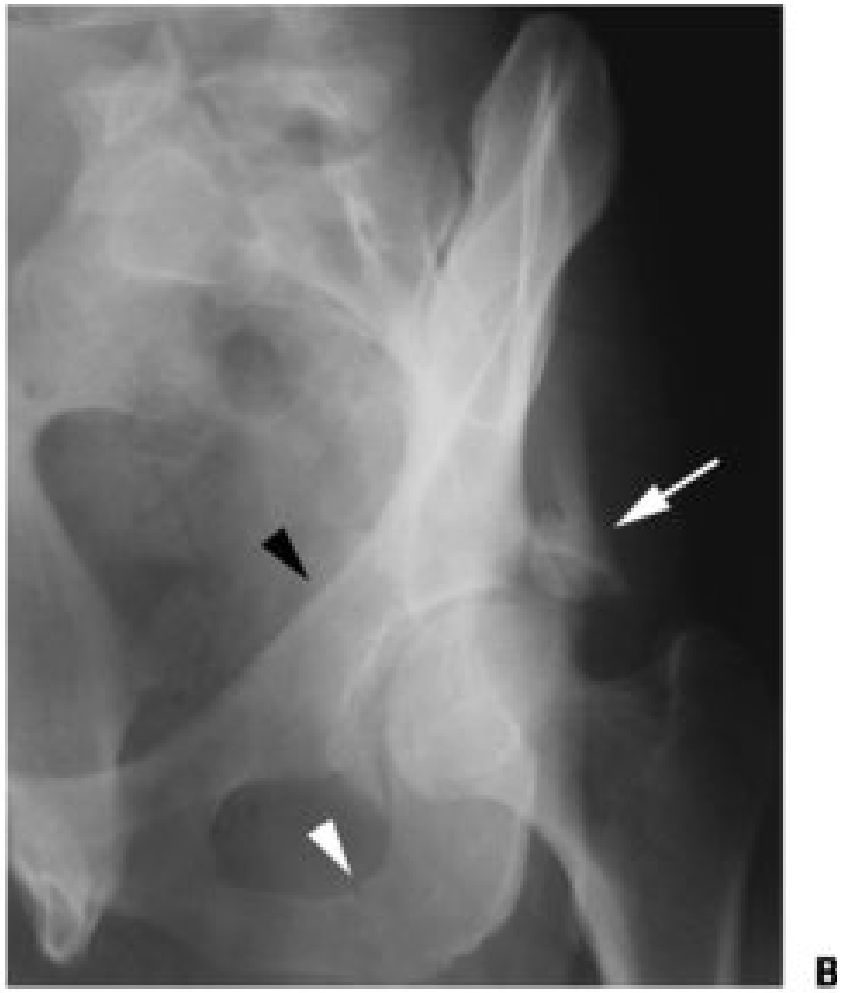
Posterior Column + Posterior Wall Fractures

- Obturator oblique view
  - Best demonstrates size and displacement posterior wall fragment[1] (white arrow)
  - Best delineates nature of inferior exit point of posterior column fracture[1] (white arrowhead)
    - Sometimes does not involve obturator foramen[1]
    - Instead splits the ischium[1]
  - Intact iliopectineal line[1] (black arrowhead)



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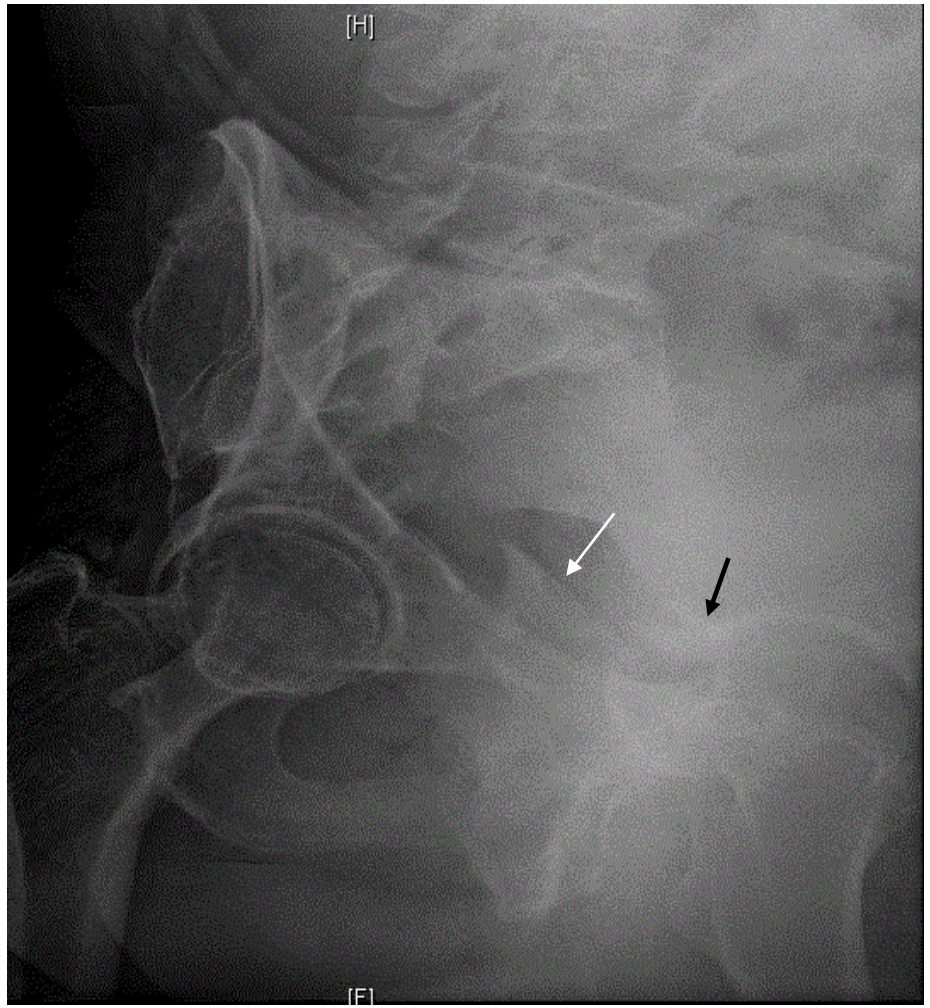
Posterior Column + Posterior Wall Fractures

- Iliac oblique view
  - Best depicts displacement of posterior column fragment[1] (white arrow)
  - Disruption of greater sciatic notch[1]
  - Posterior wall fragment appears superimposed on roof of acetabulum[1] (black arrow)



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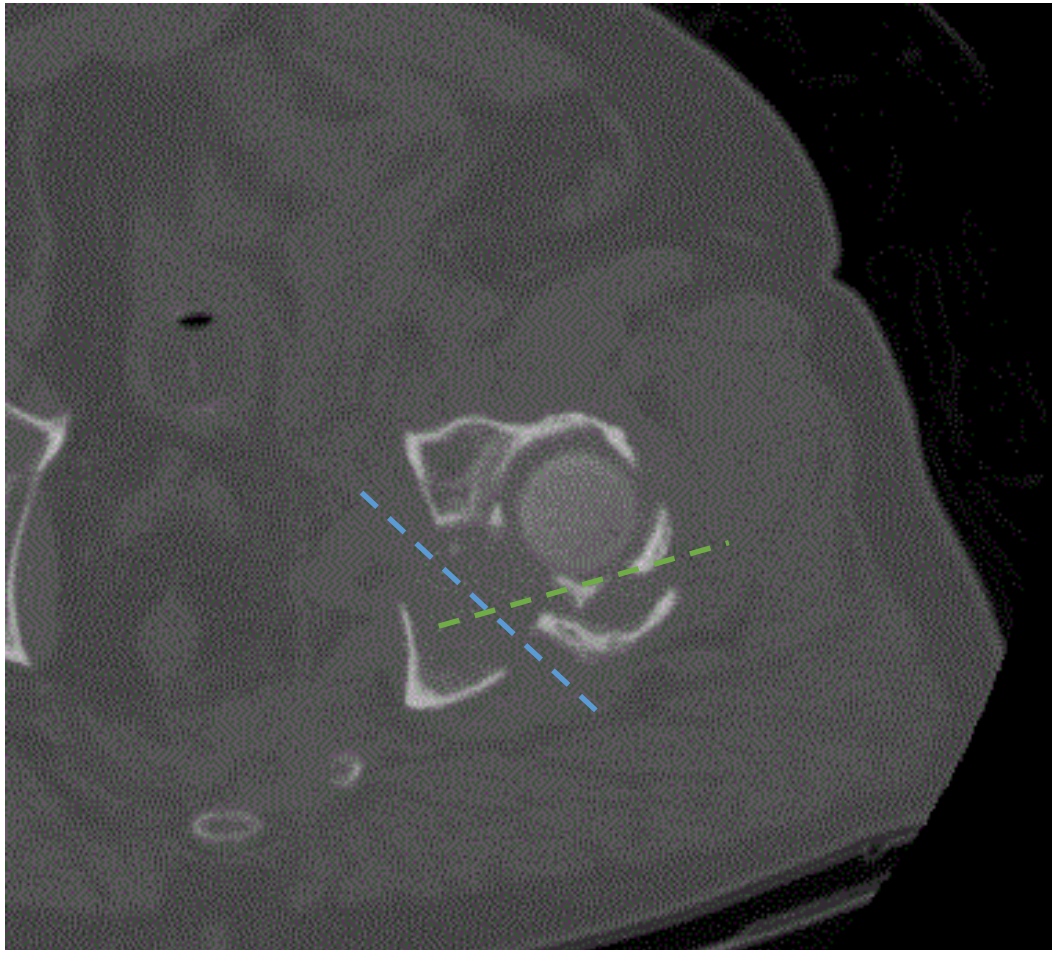
Posterior Column + Posterior Wall Fractures

- Axial CT
  - Posterior column fracture (black arrowheads)
    - Can have coronal or oblique (anterior and central) orientation[1]
  - Posterior wall fracture (white arrow)
    - Orientation is typically oblique (anterior and peripheral) at approximately 45-60 degrees[1]



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Transverse + Posterior wall

- Transverse component
  - Transtectal
  - Juxtatectal
  - Infratectal

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Transverse + Posterior wall

- AP
  - Teardrop is only remaining intact radiographic landmark[1]
  - Obturator ring intact[1]
  - Ischiopubic segment driven medially by femoral head[1]

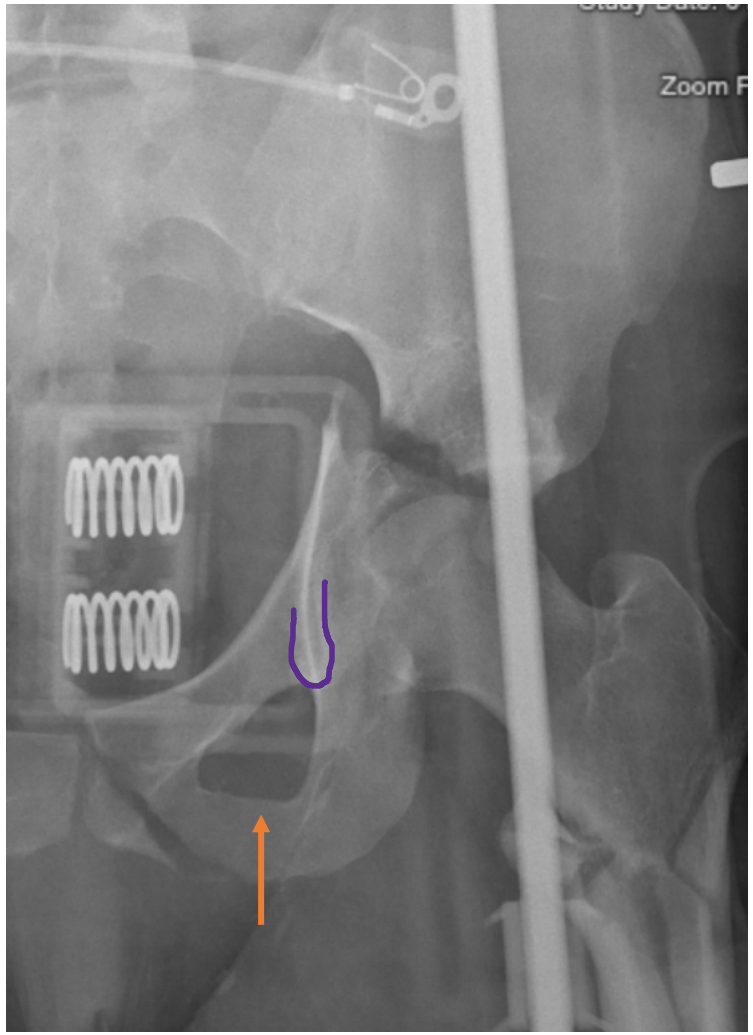


Image courtesy of Dr. Raymond Wright, MD

Transverse + Posterior wall

- Obturator oblique
  - Best demonstrates posterior wall fragment size and displacement[1]
  - Best way to evaluate for any persistent femoral head subluxation[1]
  - Obturator ring intact[1]

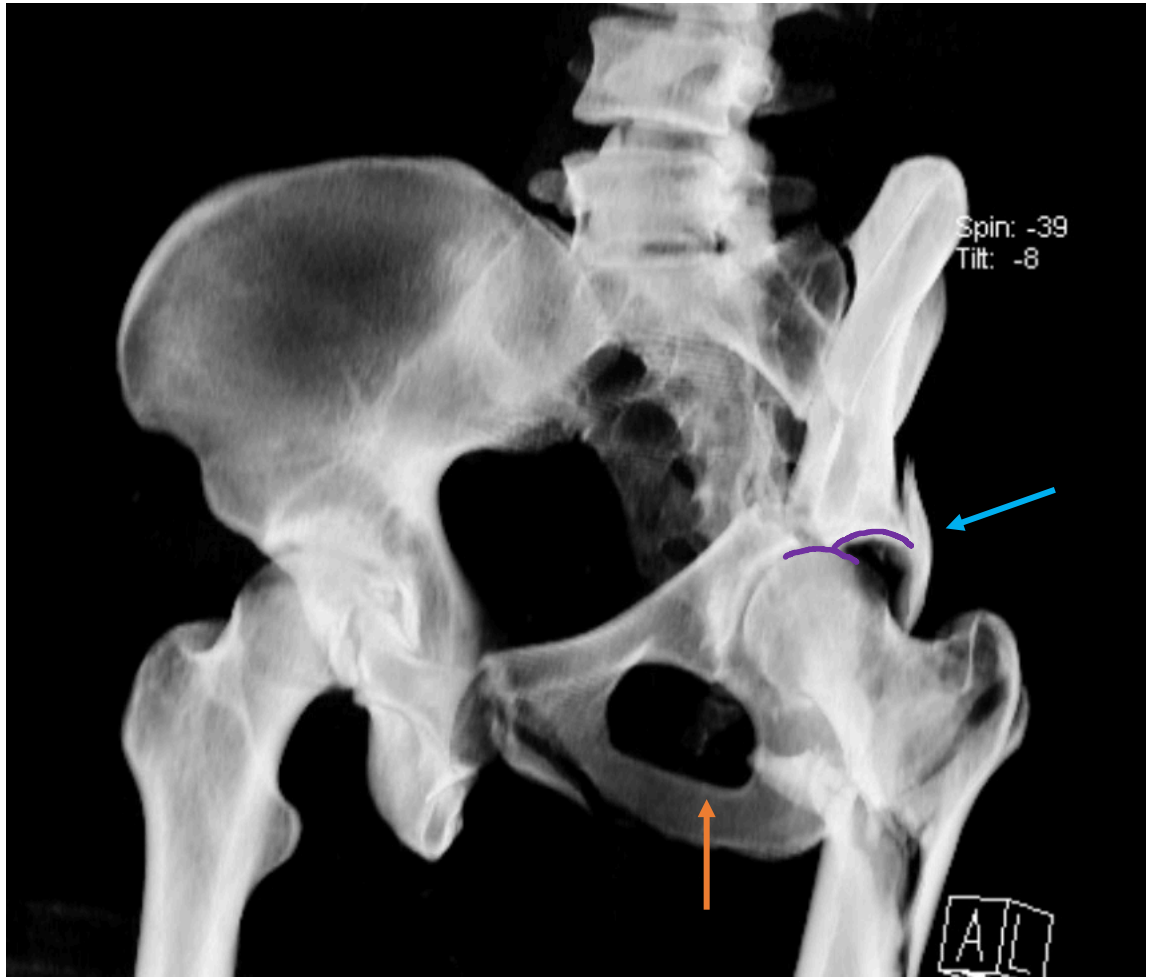


Image courtesy of Dr. Raymond Wright, MD

Transverse + Posterior wall

- Iliac oblique
  - Fracture line exiting greater sciatic notch[1]
  - Posterior wall fragment superimposed on roof of acetabulum[1]

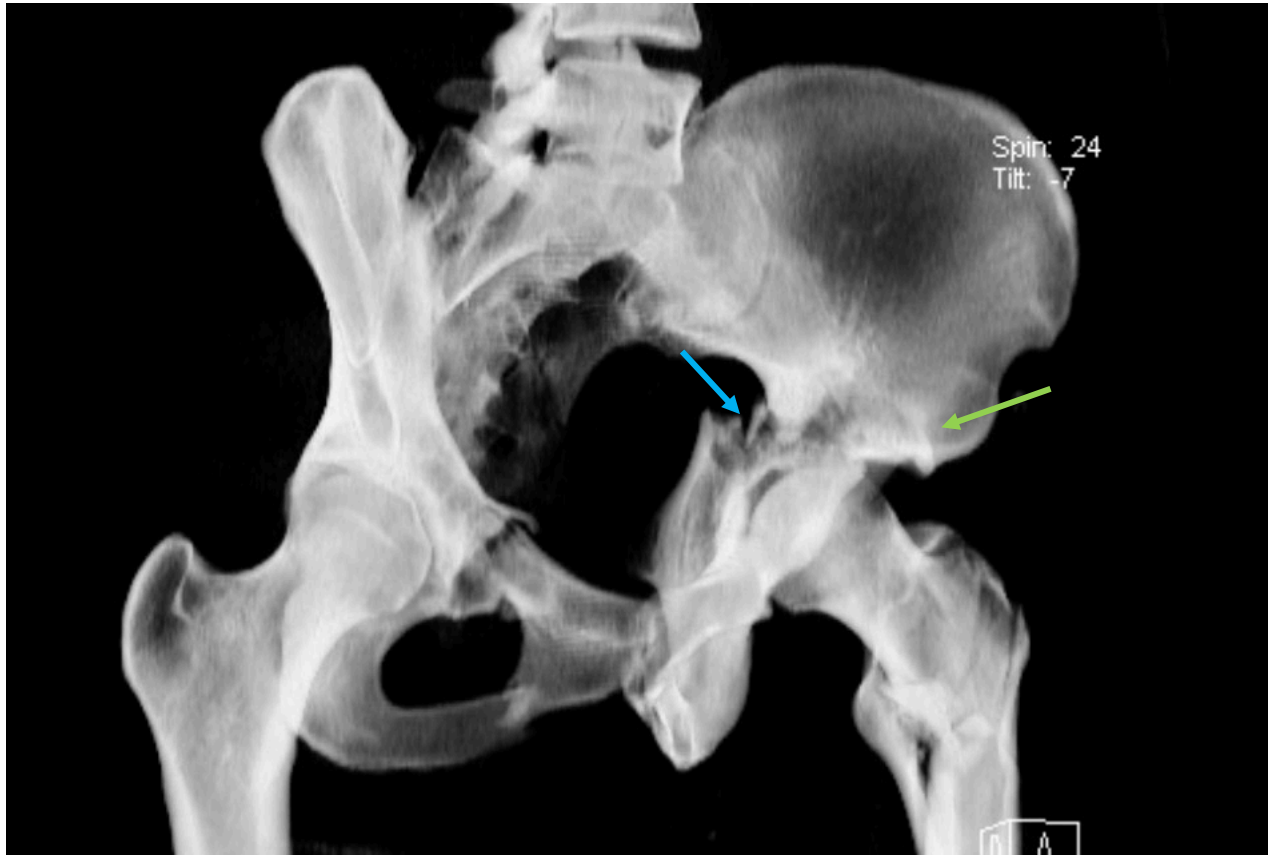
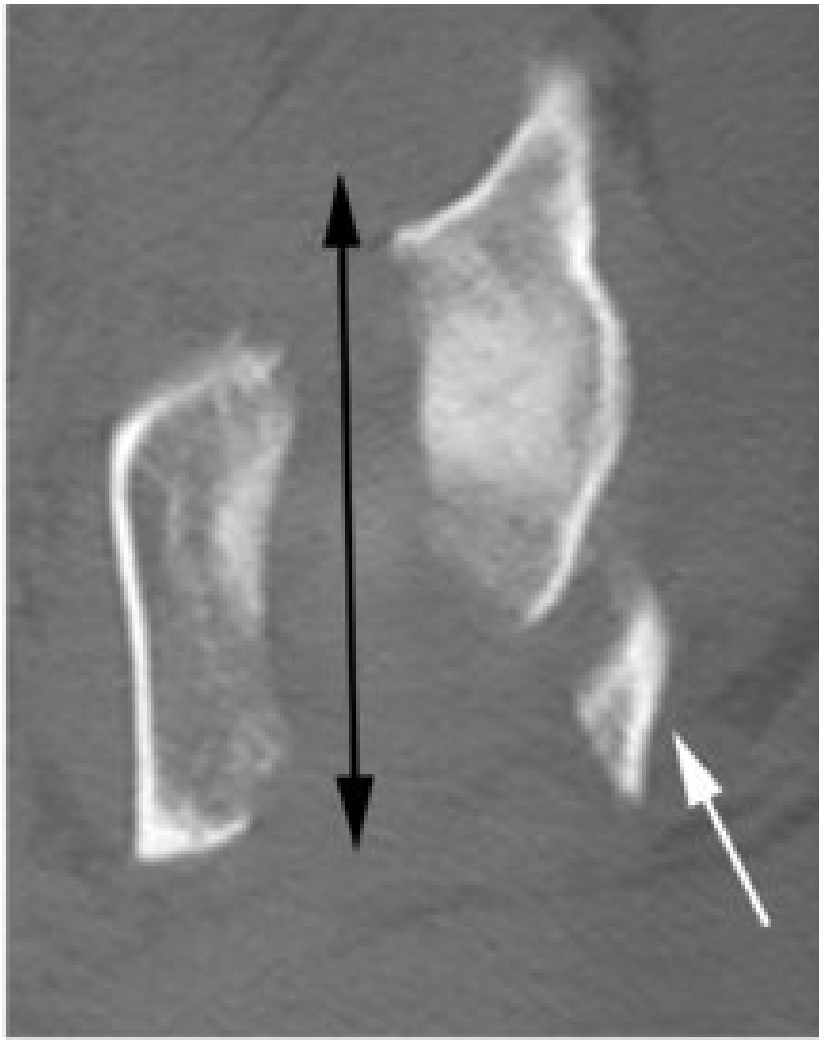


Image courtesy of Dr. Raymond Wright, MD

Transverse + Posterior wall

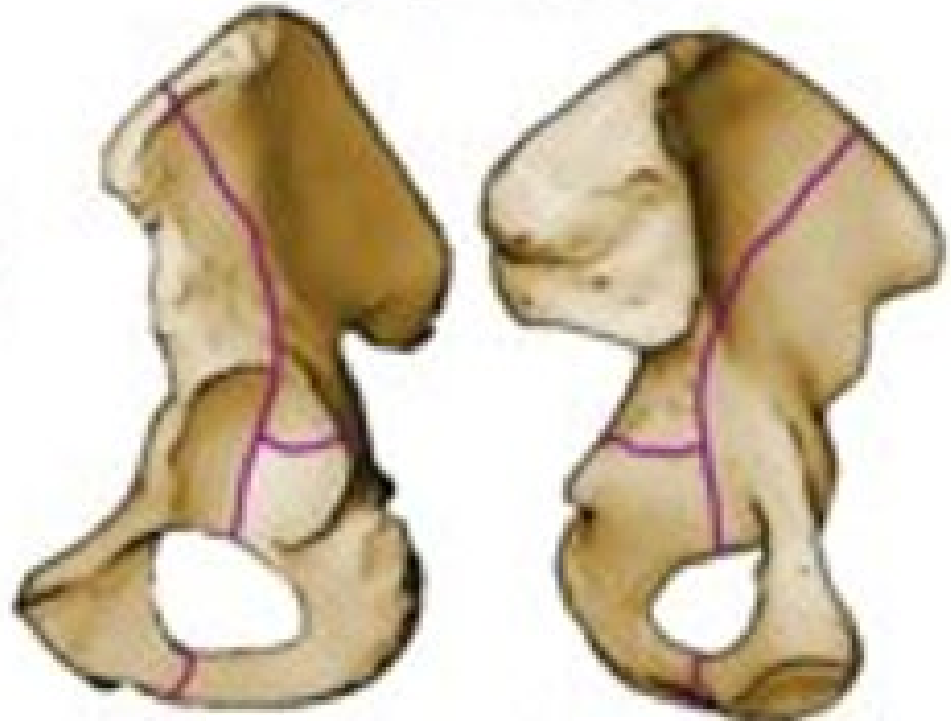
- Axial CT
  - Transverse component
    - vertical (sagittal) fracture orientation[1] (black arrow)
  - Posterior wall component (white arrow)
    - typical oblique (anterior and peripheral) fracture orientation[1]
  - Assess for associated pelvic ring injury[1]



Tornetta III, P et al. Rockwood & Greens Fractures in Adults. Philadelphia: Lippincott Williams & Wilkins, 2019

Anterior Column (or wall) + Posterior Hemitransverse Fractures

- Common in elderly patients[2,6]
  - Osteopenia
  - Low energy mechanism
- Often have associated impaction of the medial acetabular roof, or "gull sign"[2]
- Majority involve anterior column rather than anterior wall[2]



Tornetta III, P et al. Rockwood & Greens Fractures in Adults. Philadelphia: Lippincott Williams & Wilkins, 2019

Anterior Column (or wall) + Posterior Hemitransverse Fractures

- AP
  - Iliopectineal line disrupted
  - Medial subluxation of femoral head with segmental displacement of iliopectineal line[1]
  - Ilioischial line preserved[1]

Tornetta III, P et al. Rockwood & Greens Fractures in Adults. Philadelphia: Lippincott Williams & Wilkins, 2019

Anterior Column (or wall) + Posterior Hemitransverse Fractures

- Obturator oblique
  - Iliopectineal line disrupted
  - Femoral head follows anterior column lesion[1]
  - Fracture often multifragmentary with impaction[1]

Tornetta III, P et al. Rockwood & Greens Fractures in Adults. Philadelphia: Lippincott Williams & Wilkins, 2019

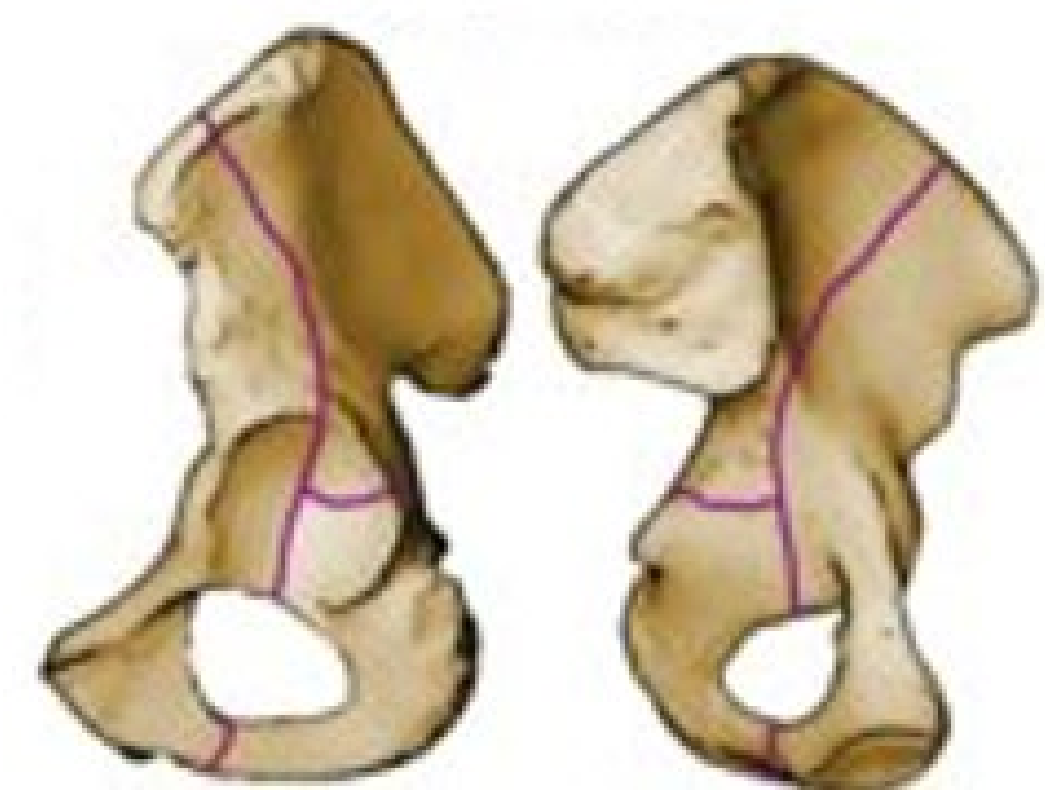
Anterior Column (or wall) + Posterior Hemitransverse Fractures

- Iliac oblique
  - Best demonstrates direction of posterior part of fracture[1]
    - Disrupted posterior column
    - Typically exits through greater sciatic notch
  - Demontrates involvement of ilium when anterior column portion extends into it[1]

Tornetta III, P et al. Rockwood & Greens Fractures in Adults. Philadelphia: Lippincott Williams & Wilkins, 2019

Anterior Column (or wall) + Posterior Hemitransverse Fractures

- CT
  - Anterior column component has typical **coronal orientation**[1]
  - Anterior fracture fragment often highly comminuted[1]
  - Posterior hemitransverse fracture component typically has vertical (anterior-posterior) direction, reminiscent of transverse pattern[1]
    - On axials, extends posteriorly from the coronal anterior column fracture



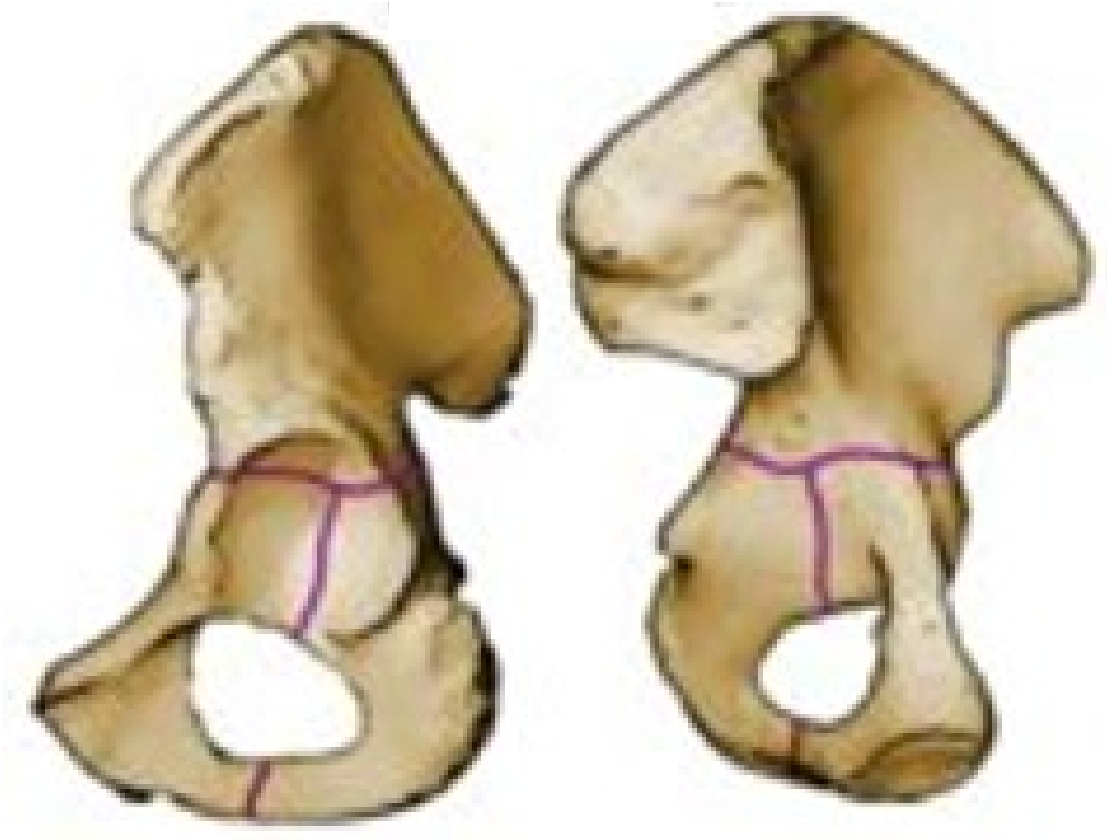
Tornetta III, P et al. Rockwood & Greens Fractures in Adults. Philadelphia: Lippincott Williams & Wilkins, 2019

T-Type Fractures

- Transverse fracture with vertical fracture line through ischiopubic segment
- On plain films, describe each component sequentially:

1. Transverse component[1]:
   - Transtectal
   - Juxtatectal
   - Infratectal
2. Vertical fracture line variants[1]
   - Vertical: splits obturator ring down center
   - Anterior: splits ring anteriorly
   - Posterior: splits ring posteriorly

   *Obturator ring may maintain its integrity in anterior and posterior variants[1]



Tornetta III, P et al. Rockwood & Greens Fractures in Adults. Philadelphia: Lippincott Williams & Wilkins, 2019

T-Type Fractures

- AP
  - Transverse component almost always has significant displacement[1]
  - Ilioischial line may appear duplicated[1,2] (black arrowheads)
    - Displacement of vertical component
  - Obturator ring disrupted[1,2] (white arrow)

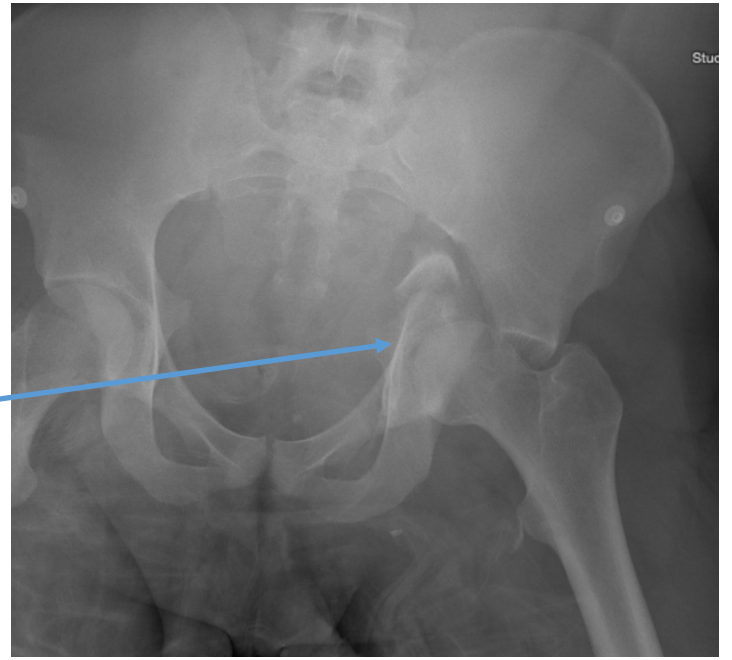
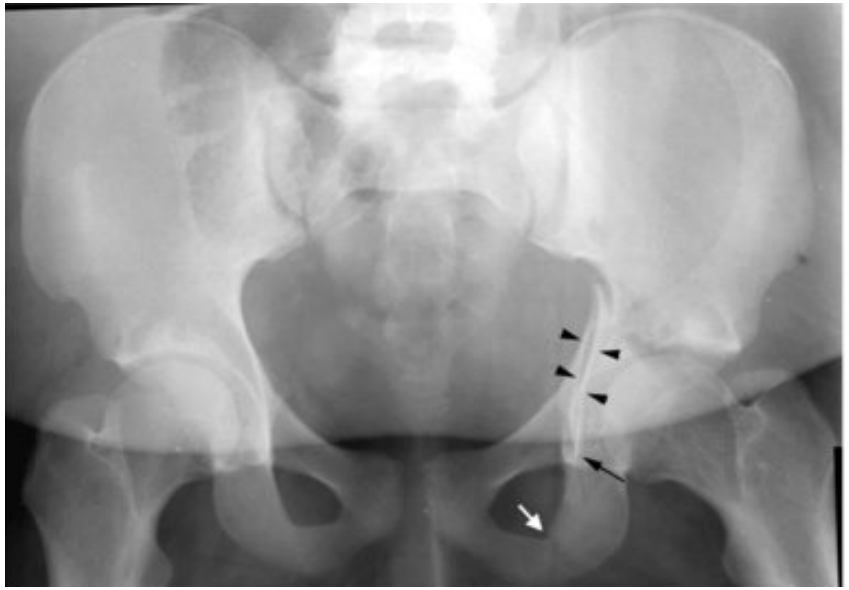


Image courtesy of Dr. Raymond Wright, MD



Tornetta III, P et al. Rockwood & Greens Fractures in Adults. Philadelphia: Lippincott Williams & Wilkins, 2019

T-Type Fractures

- Obturator oblique
  - Disruption of the anterior column
  - Best characterizes pattern of vertical (stem) component of the fracture [1]
    - Vertical
    - Anterior
    - Posterior
  - Best view to evaluate disruption of obturator ring when present[1]

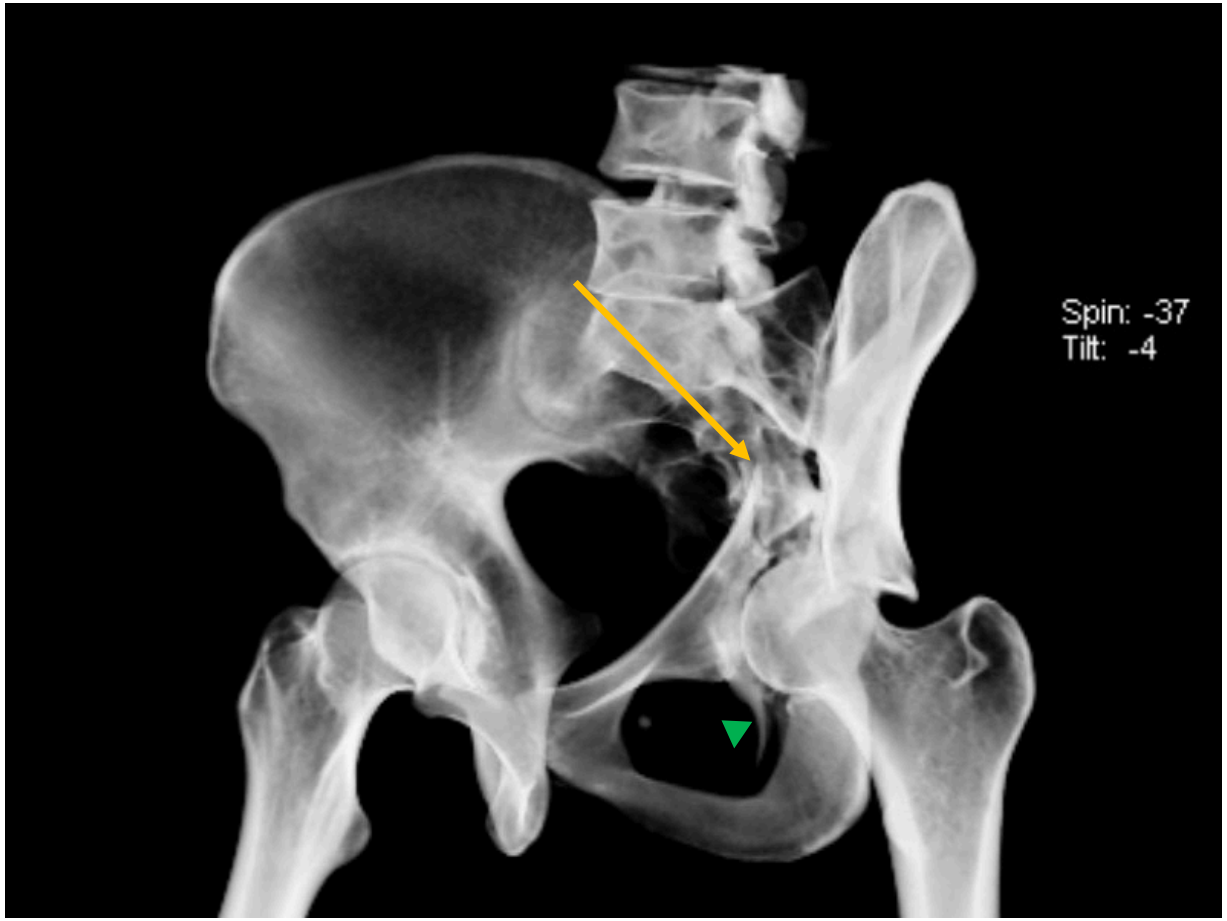
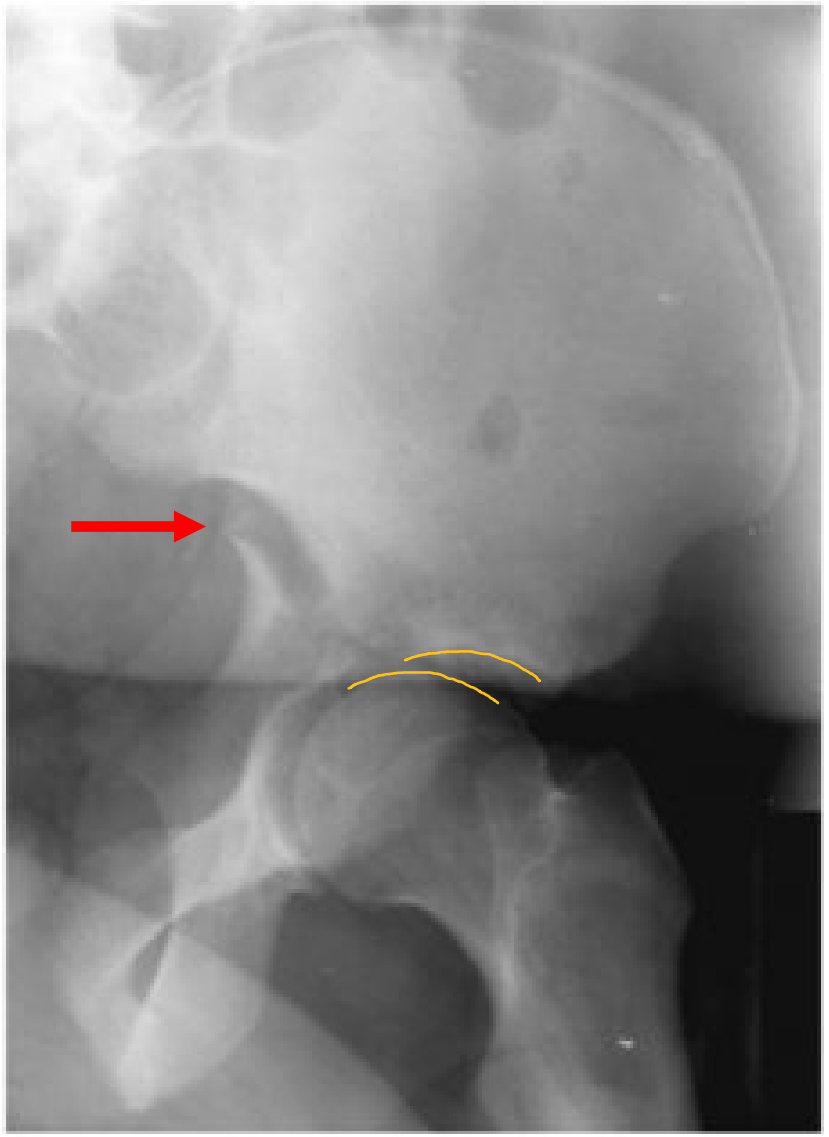


Image courtesy of Dr. Raymond Wright, MD

T-Type Fractures

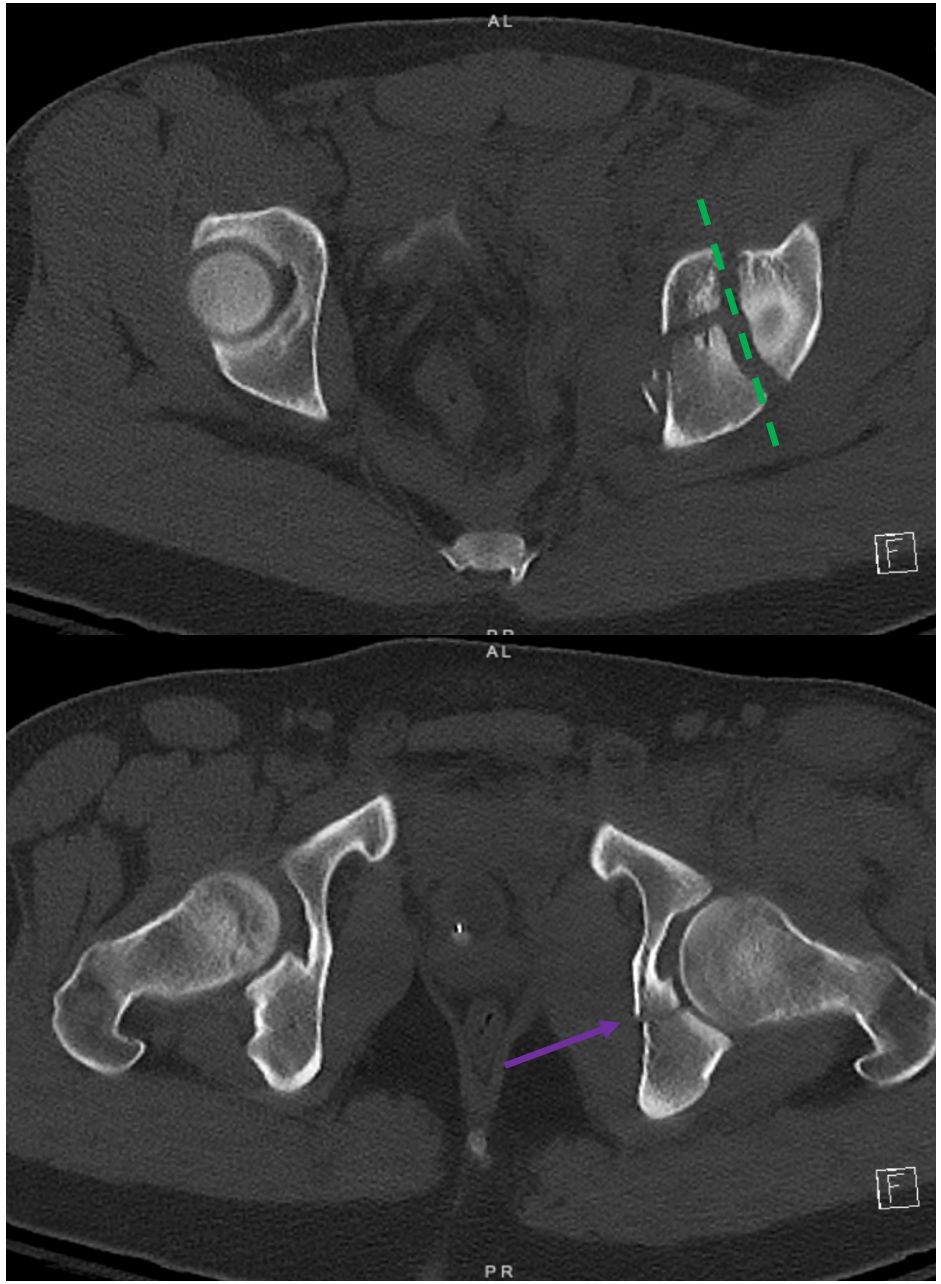
- Iliac oblique
  - Disruption of greater sciatic notch[1], or posterior column *(red arrow)*
  - Best depicts any subluxation of femoral head[1]



Tornetta III, P et al. Rockwood & Greens Fractures in Adults. Philadelphia: Lippincott Williams & Wilkins, 2019

T-Type Fractures

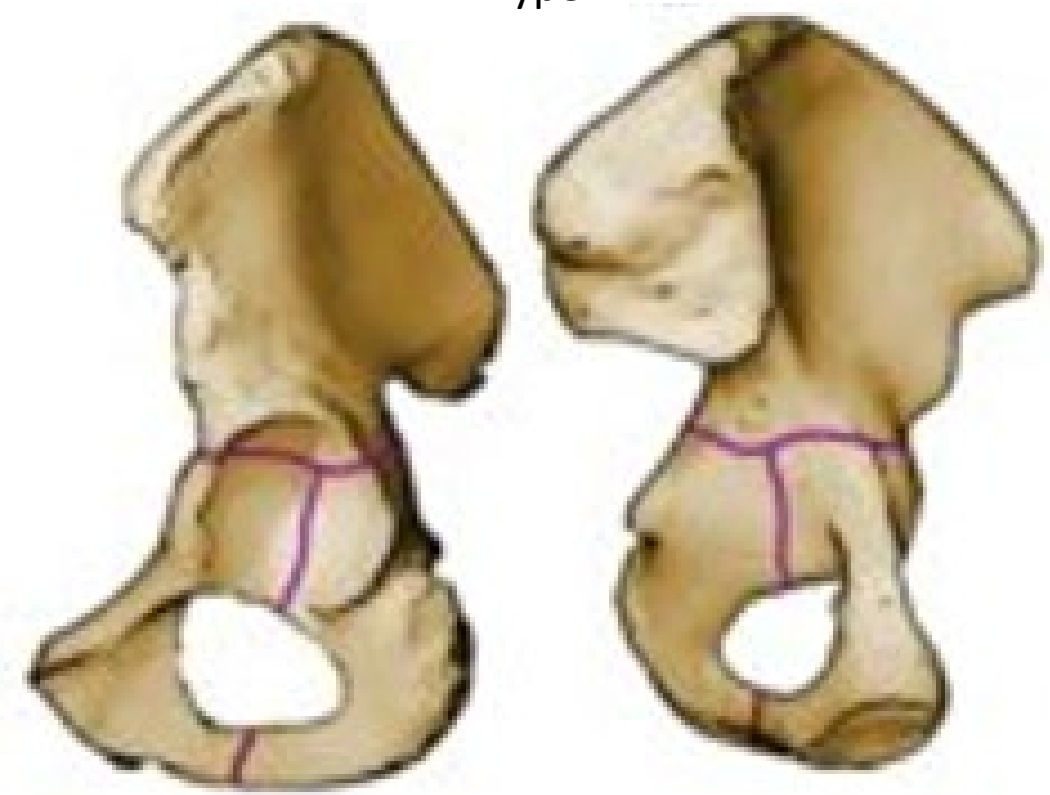
- CT
  - Transverse component **vertically (sagittally) oriented** on axial cuts[1]
  - Best modality for diagnosing minimally displaced vertical components[1]



Images courtesy of Dr. Raymond Wright, MD

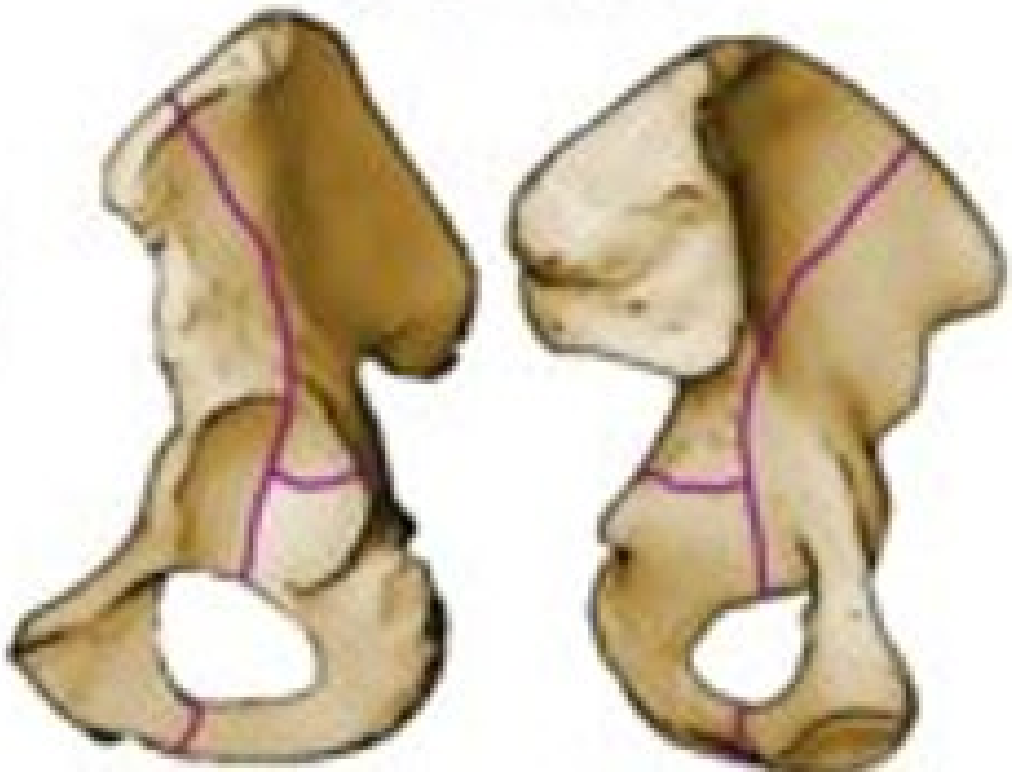
T-Type vs. Anterior Column + Posterior Hemitransverse

T-Type



Tornetta III, P et al. Rockwood & Greens Fractures in Adults. Philadelphia: Lippincott Williams & Wilkins, 2019

Anterior Column +
Posterior Hemitransverse



Tornetta III, P et al. Rockwood & Greens Fractures in Adults. Philadelphia: Lippincott Williams & Wilkins, 2019

Both Column Fractures

- **No continuity between axial skeleton and articular surface of acetabulum**[1,2]
- Typically very comminuted[1]
- Complexity is variable[1]

Tornetta III, P et al. Rockwood & Greens Fractures in Adults. Philadelphia: Lippincott Williams & Wilkins, 2019

Both Column Fractures

- AP
  - Disruption of all 6 of Letournel's radiographic lines[1]
  - Femoral head often remains congruent with roof & anterior column[1]
  - Commonly associated with fracture of contralateral pubic body[1]
    - Due to displacement of ipsilateral superior pubic ramus fragment noted.
  - Iliac wing fracture visualized when present[1]
    - May be incomplete[1]

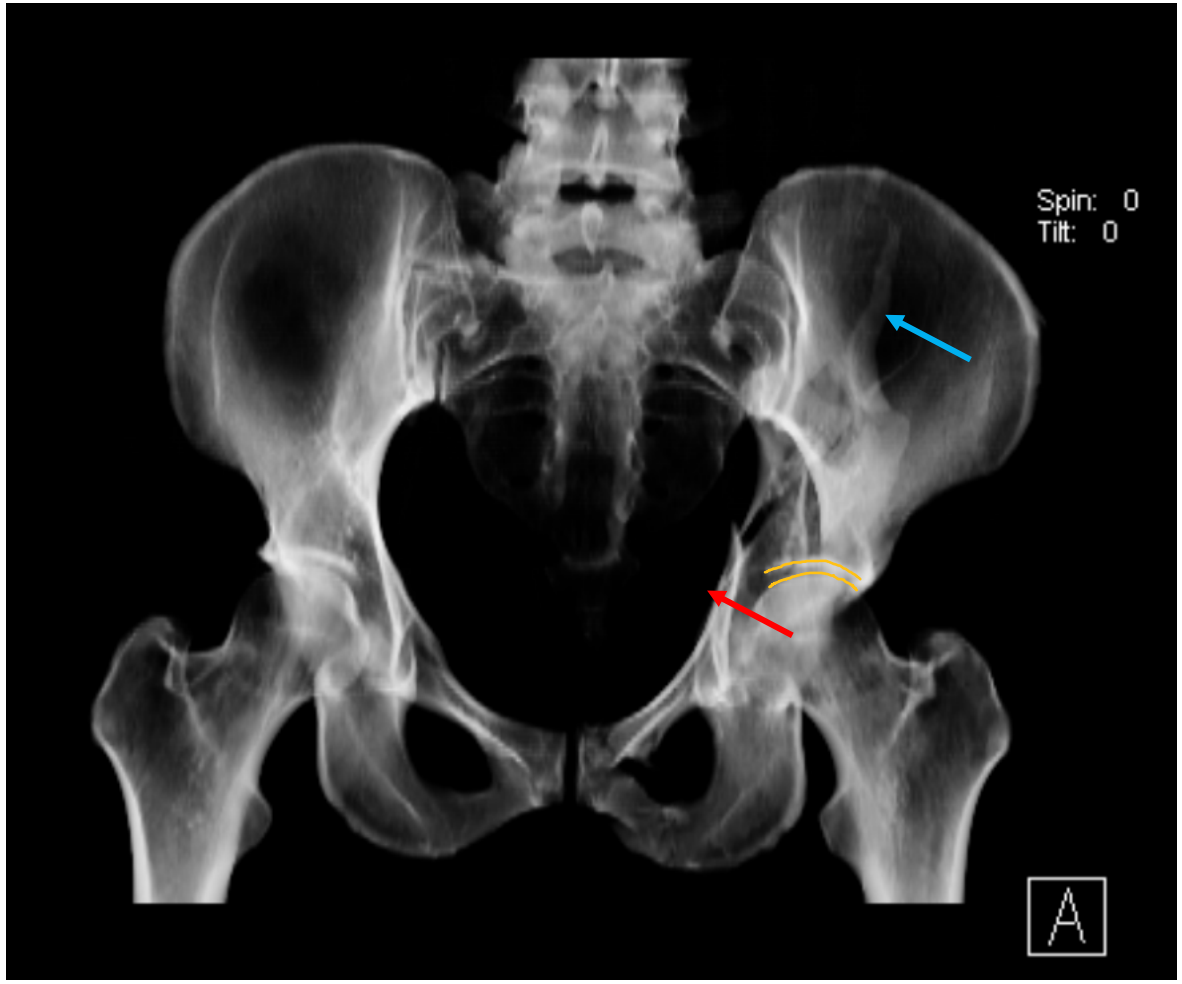


Image courtesy of Dr. Raymond Wright, MD

Both Column Fractures

- Obturator oblique
  - Spur sign[1,2]
    - Spike of non articular intact ilium
    - Visible due to medial displacement of acetabulum
  - Confirms secondary congruence[1] between femoral head and acetabulum
  - Rupture of obturator ring[1]

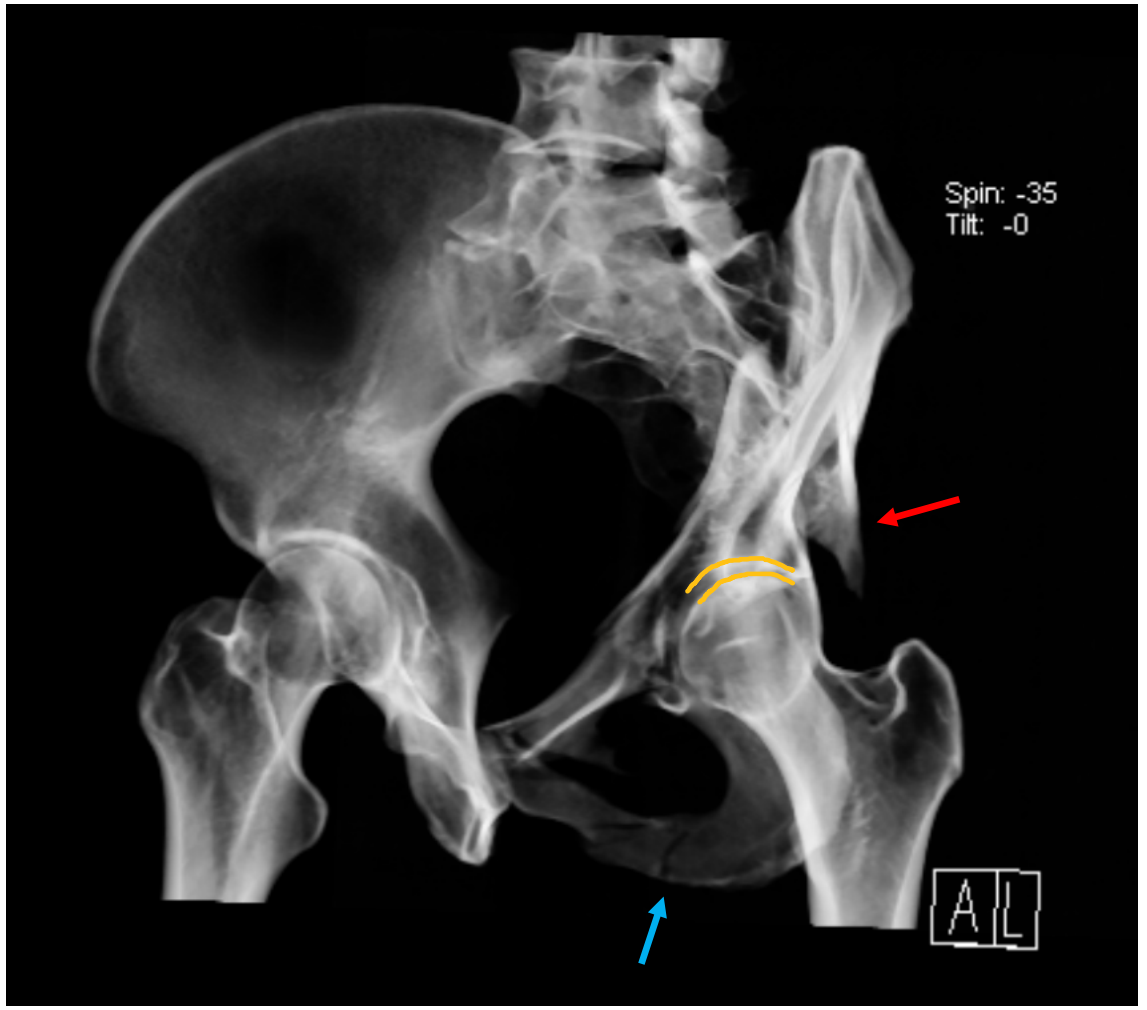


Image courtesy of Dr. Raymond Wright, MD

Both Column Fractures

- Iliac oblique
  - Best depicts displacement of posterior column[1]
  - Best depicts any fractures extending into the ilium of the ilium[1]

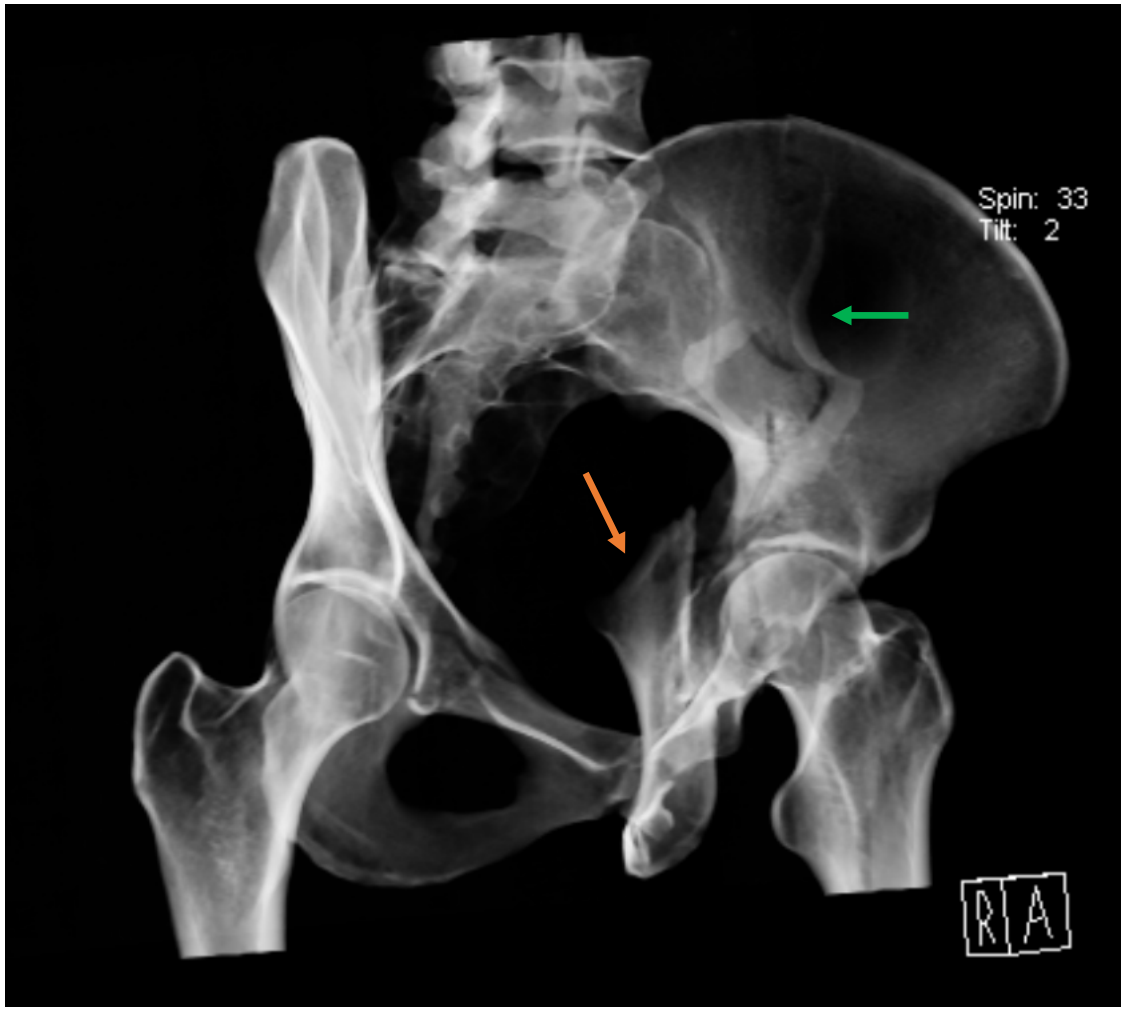


Image courtesy of Dr. Raymond Wright, MD

Both Column Fractures

- Axial CT
  - Evaluate for any intact strut of bone extending from sciatic buttress to articular acetabulum[4]
    - Spur sign of the iliac wing
  - At level of roof, fracture typically coronally oriented[1]
  - Evaluate for associated
    - Marginal impaction
    - Intra-articular fragments
    - Sacral fracture or SI joint injury

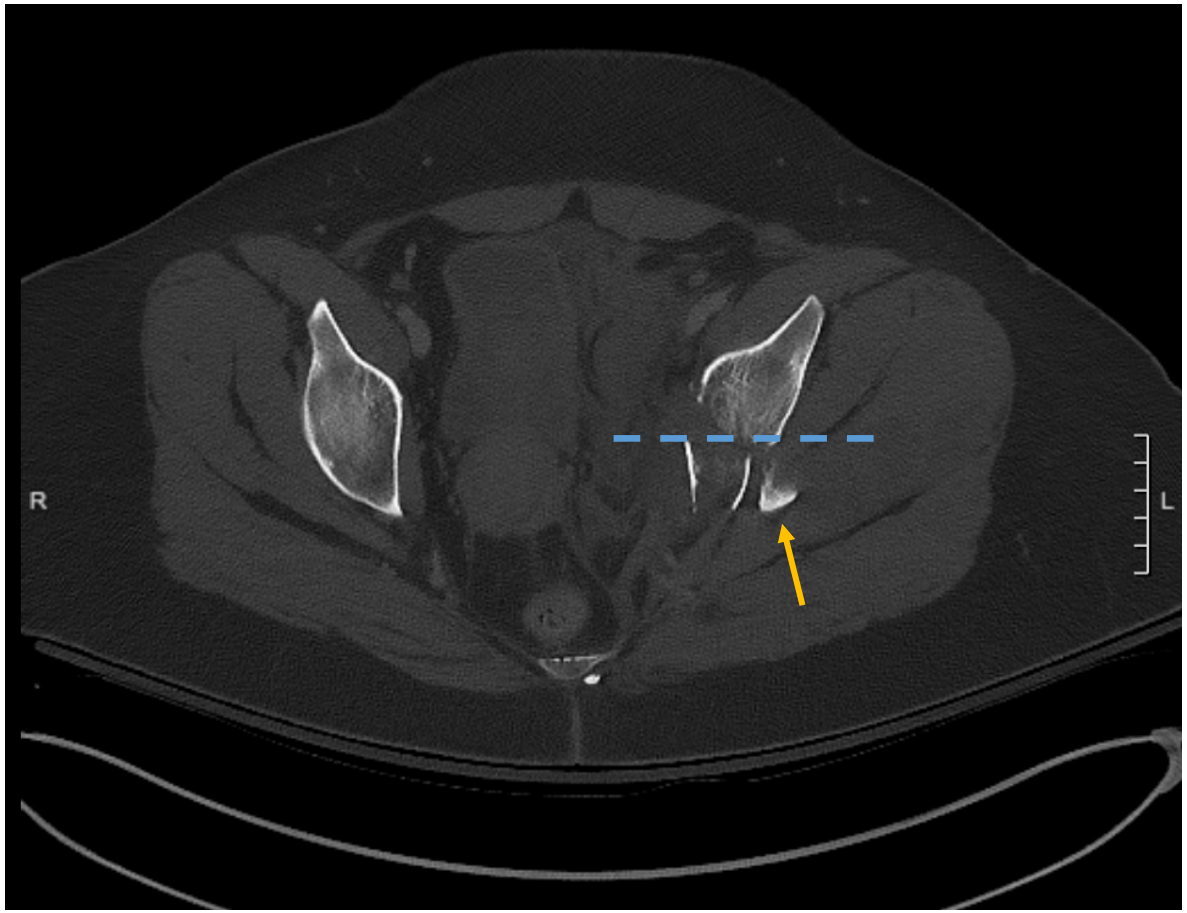
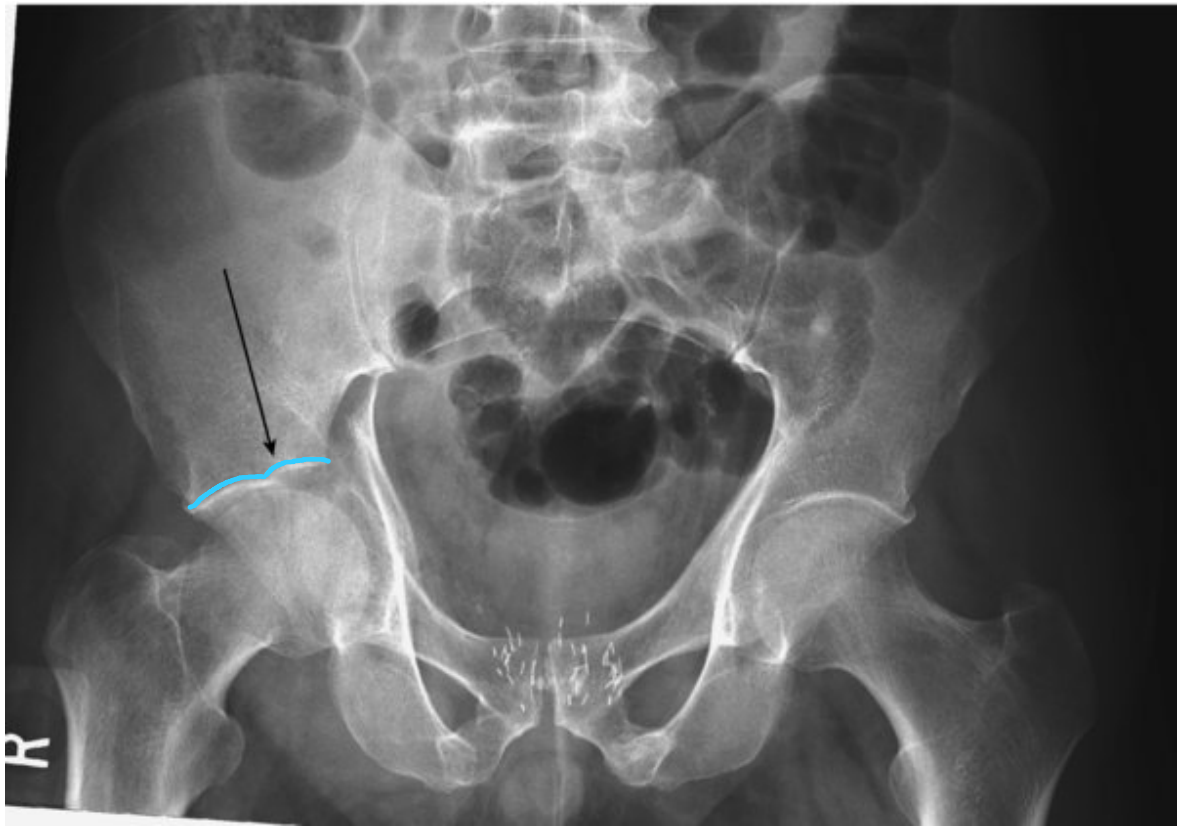


Image courtesy of Dr. Raymond Wright, MD

Fracture Characteristics

The Gull Sign

- Represents impaction of the superomedial acetabular roof[5]
  - Reminiscent of gull's wing
- Indication of osteopenic bone[5]
- Poor prognostic sign[5,6]
- Predicts failure in patients with acetabular fractures >60yo[5]
  - Inability to achieve anatomic reduction
  - Early loss of reduction



Tornetta III, P et al. Rockwood & Greens Fractures in Adults. Philadelphia: Lippincott Williams & Wilkins, 2019

Marginal Impaction

- Impacted osteochondral fragment[2]
- Displaced by femoral head as it dislocates[2]
- Common in posterior wall fractures[2]
- Sometimes visible on plain radiographs, but more easily visualized on CT[2]

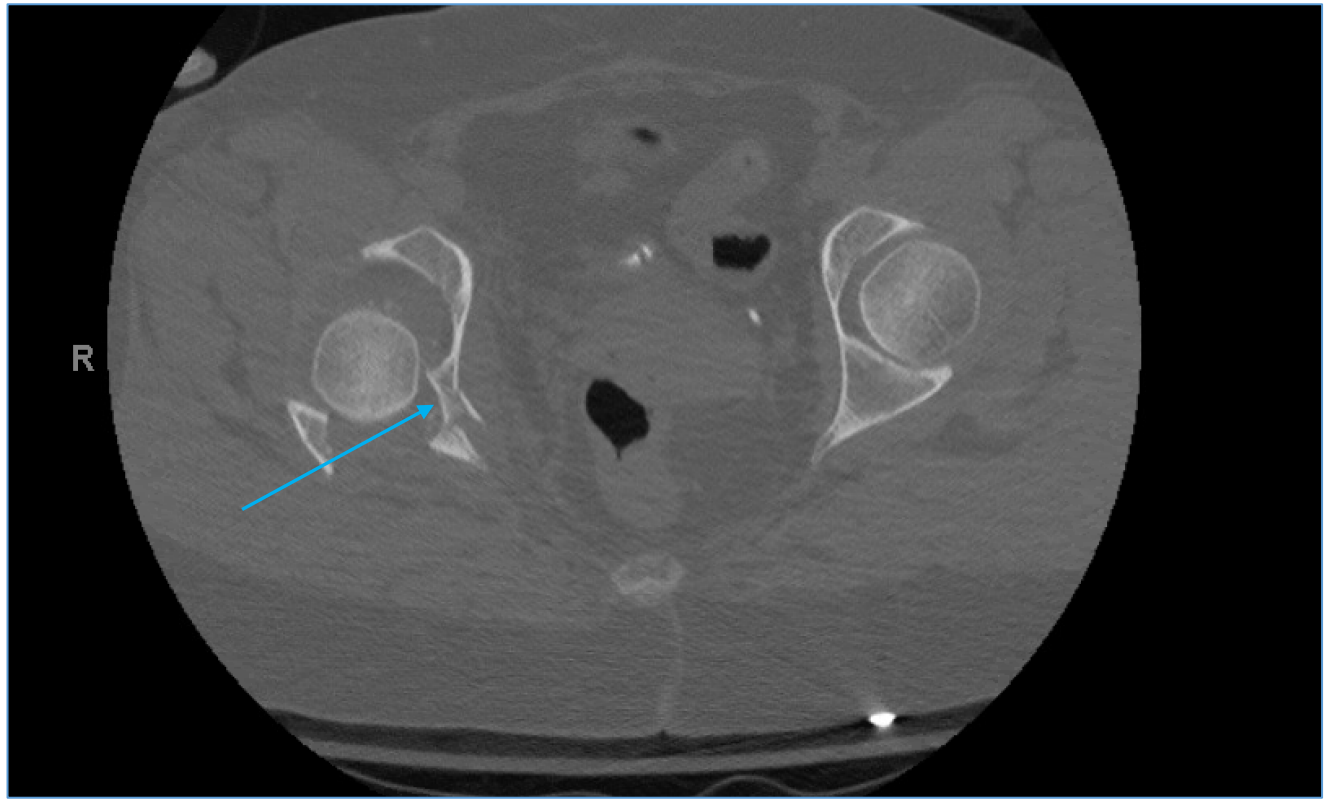
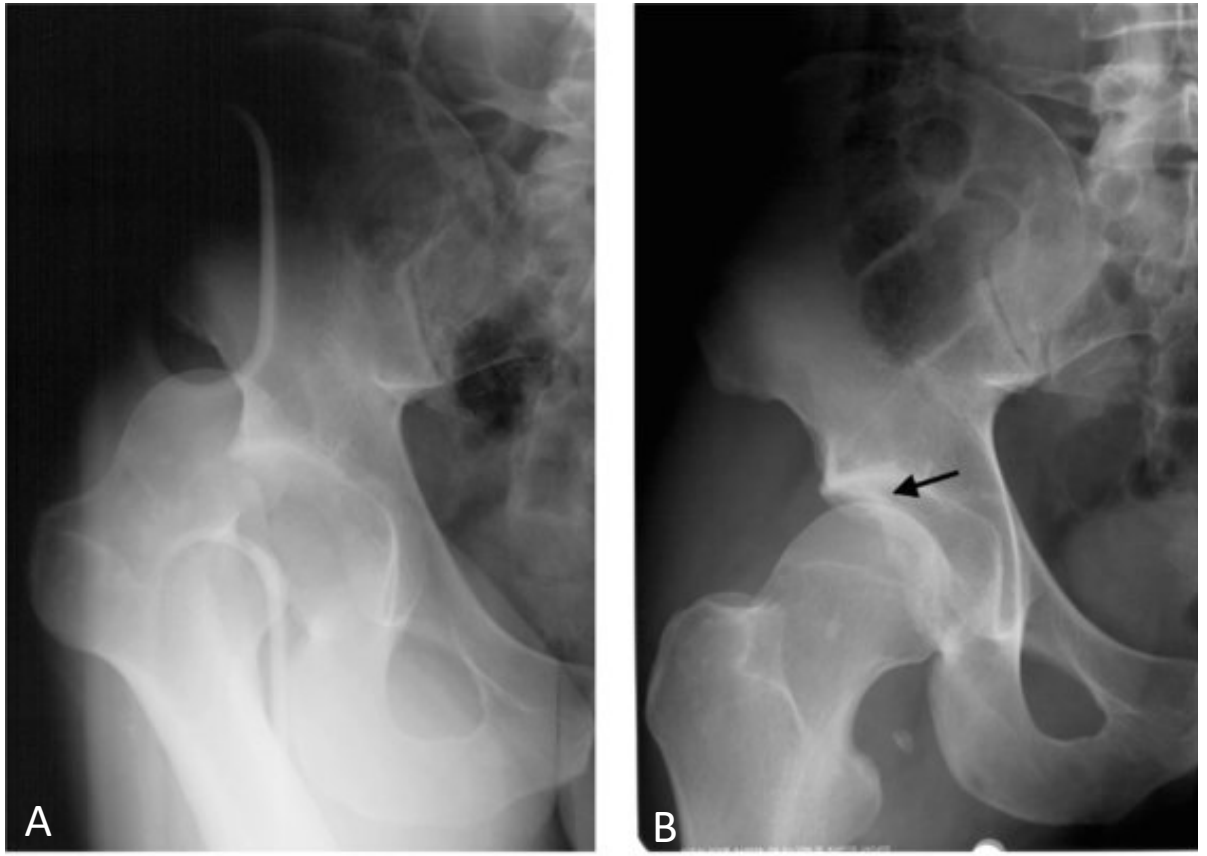


Image from Laura Blum, MD

Incarcerated Fragments

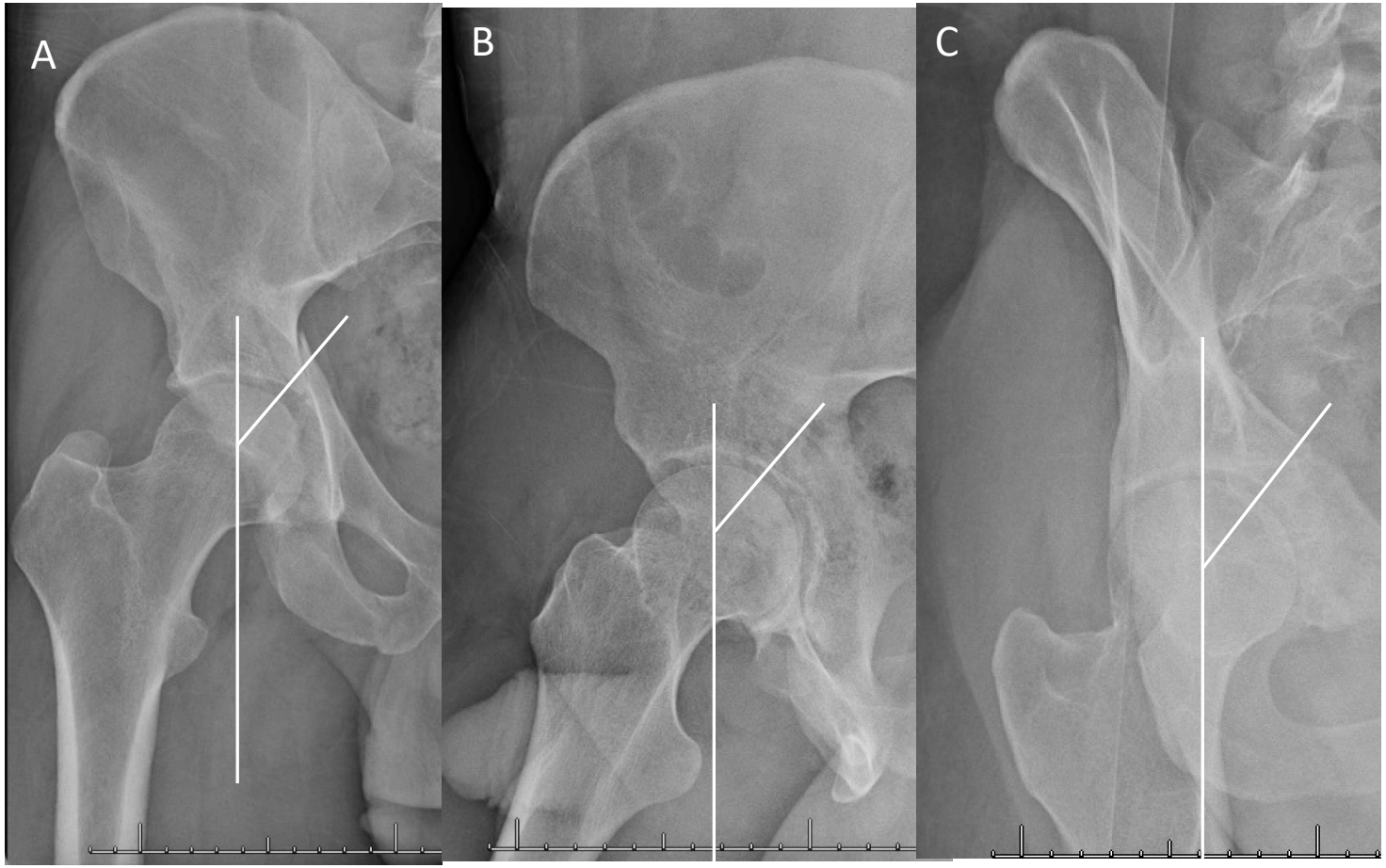
- Diagnosis
  - Post-reduction films: non-concentric joint space[1]
  - Fragment often visualized either:
    - Extruded toward external border
    - Partly within cotyloid fossa



Tornetta III, P et al. Rockwood & Greens Fractures in Adults. Philadelphia: Lippincott Williams & Wilkins, 2019

Roof Arc Angle

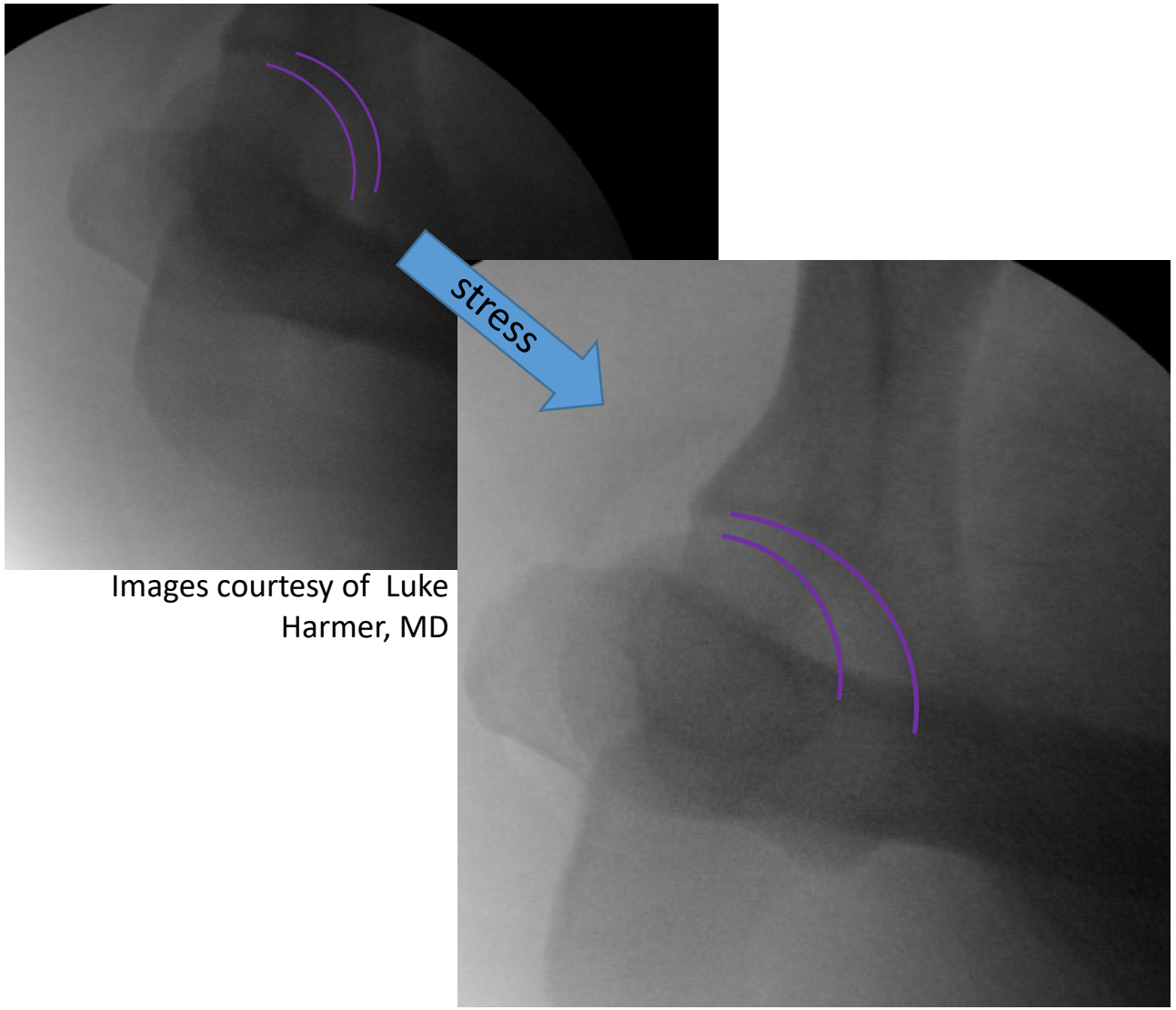
- Three angles measured on AP (A), iliac oblique (B), and obturator oblique (C)[7]
  - Vertical line drawn through center of acetabulum
  - Another line, 45 degrees from that starting at the center of the acetabulum
- If fracture falls within the angle drawn on any of the views, considered to be in weight-bearing dome[7]
  - Relative indication for surgery



Images from Laura Blum, MD

Stress Exam Under Anesthesia

- Dynamic stress views
  - Typically used to evaluate stability of posterior wall fractures[2]
  - Assess for congruity while loading force through the femur longitudinally[2]:
    - Flex >90 degrees
    - Flex, internally rotate approximately 20 degrees → assess for congruity



Images courtesy of Luke Harmer, MD

CT Evaluation

CT Evaluation: Associated Injuries

- Soft tissue
  - Morel-Lavallee
- Genitourinary
- Orthopaedic
  - Pelvic hematoma
    - Bladder often shifts away from midline
    - Can indicate subtle pelvic ring or acetabular injury
  - Pelvic ring[2]
    - Sacral fracture
    - Sacroiliac joint disruption
    - Contralateral rami fractures
  - Proximal femur/femoral head[2]

Tornetta III, P et al. Rockwood & Greens Fractures in Adults. Philadelphia: Lippincott Williams & Wilkins, 2019

Image courtesy of Dr. Laura Blum, MD

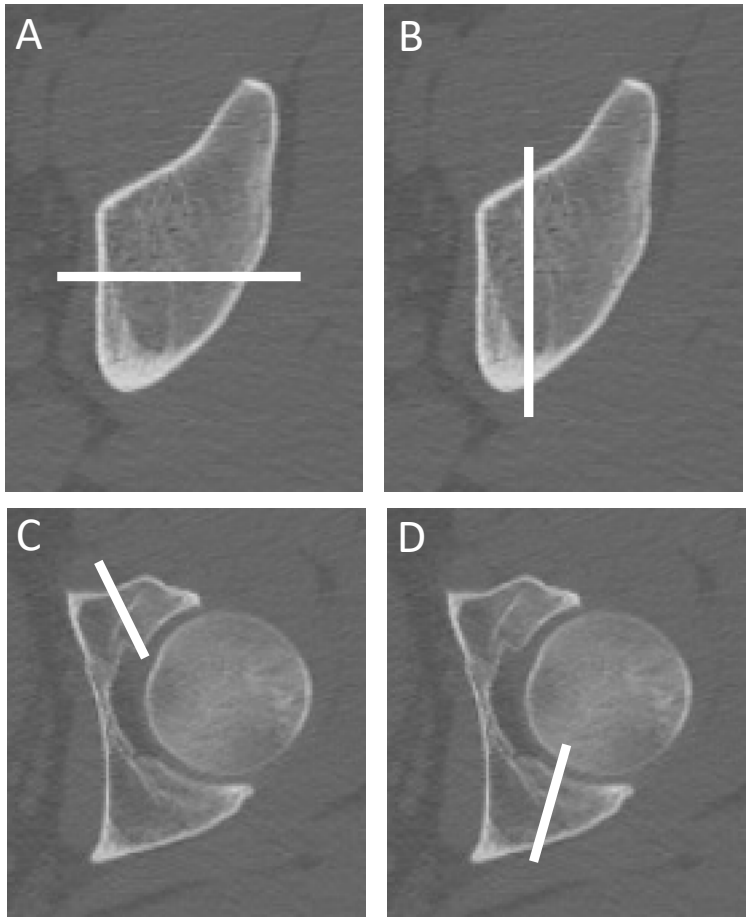
CT Evaluation: Acetabulum

- Dedicated pelvic CT
  - 2-3mm cuts
- Used only in conjunction with plain pelvic radiographs[1,4]
- Axial cuts provide the most information regarding relationship of fracture line to articular surface[4]

Image courtesy of Dr. Raymond Wright, MD

CT Evaluation: Acetabulum

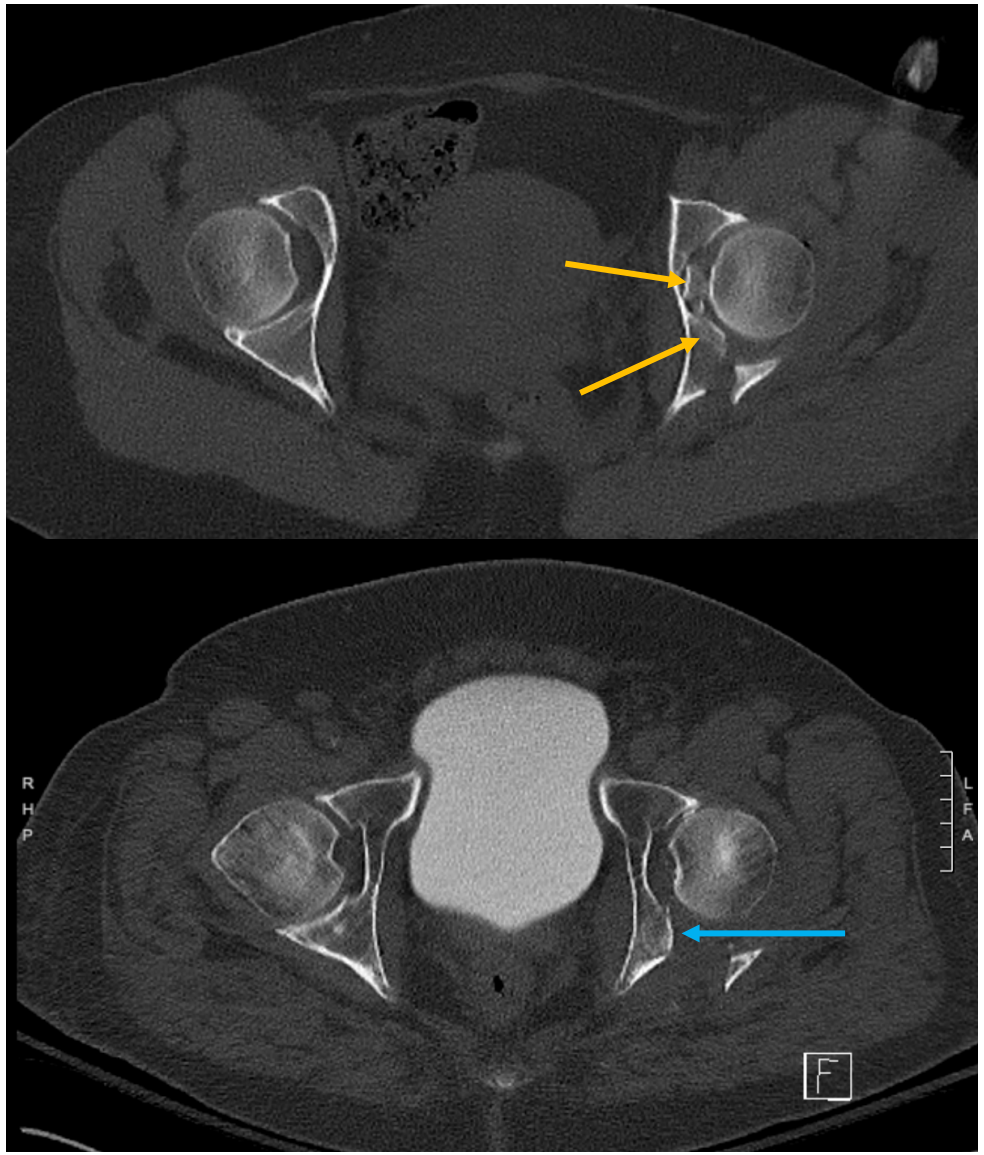
- Recognizing patterns
  - Axial view
    - A.) **Column fractures: Horizontal** (coronal) orientation[1,4]
    - B.) **Transverse: Vertical** (sagittal orientation)[1,4]
    - C.) Anterior wall: Oblique[1,2]
      - Travels anteriorly and medially
      - ~45 degrees
    - D.) Posterior wall: Oblique[1,2]
      - Travels anteriorly and laterally
      - ~45 degrees



Images from Laura Blum, MD

CT Evaluation: Acetabulum

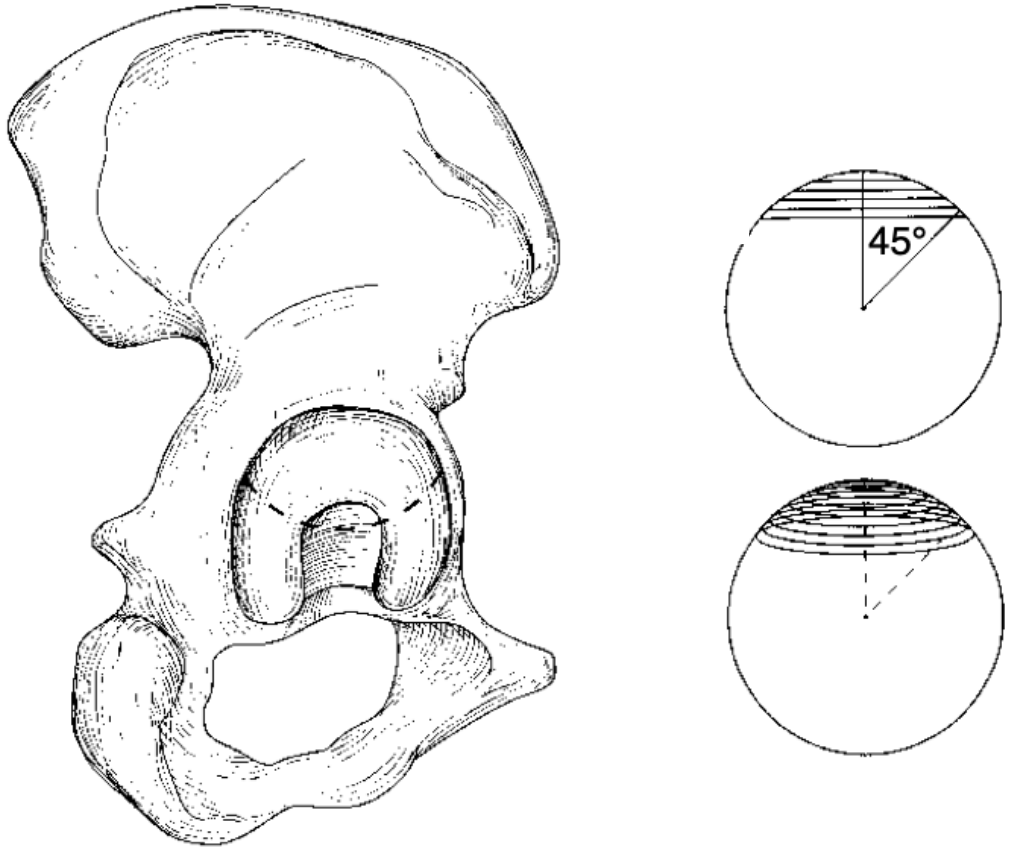
- Better characterizes fractures[1,4]
  - Marginal impaction
  - Intra-articular fragments
  - Fragment size
  - Fragment displacement/rotation
  - Reduction of femoral head
    - Concentrically reduced, subluxed, dislocated
  - Better identify minimally displaced fractures
  - Femoral head impaction



Images courtesy of Dr. Raymond Wright, MD

Suchondral Arc

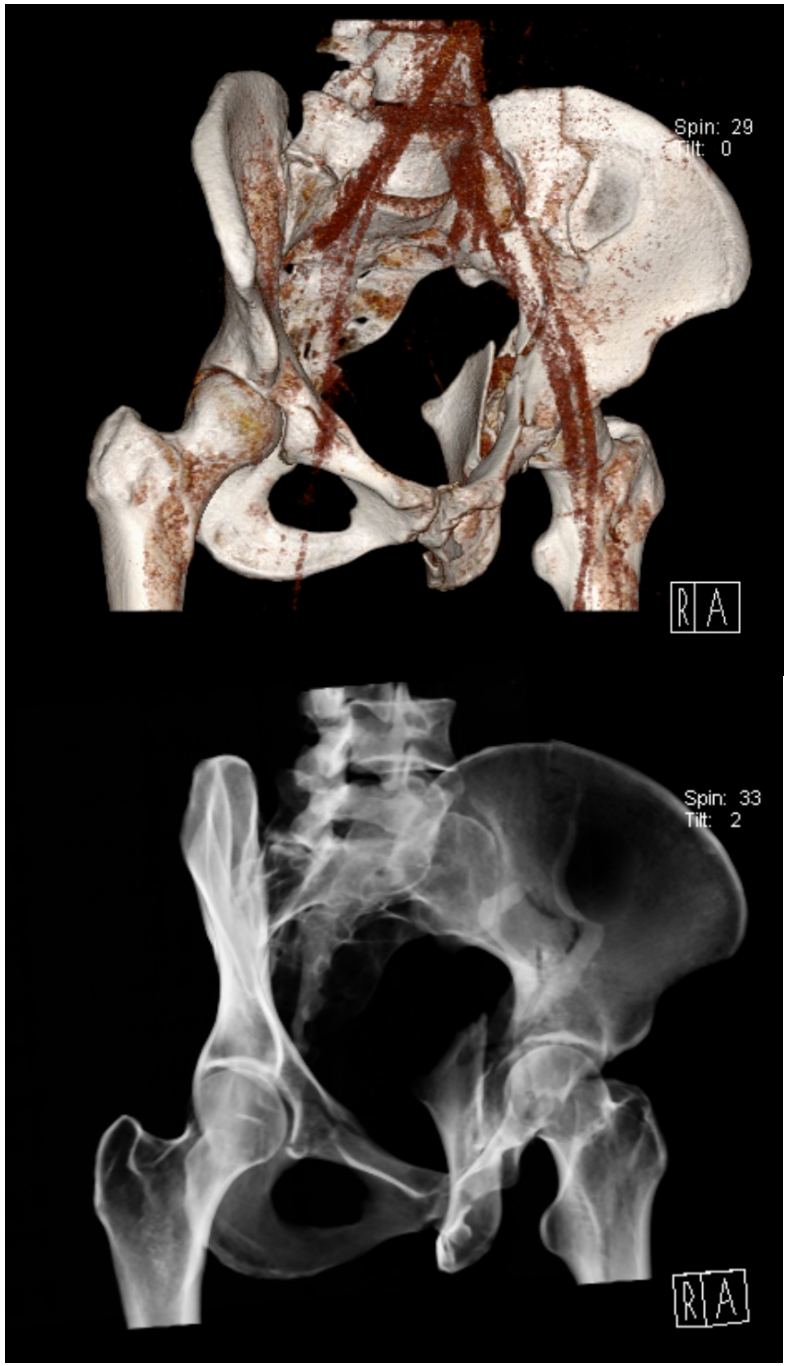
- Method used to assess articular continuity[8]
  - Superior 10mm of the acetabulum
  - Axial CT scan
  - Must know thickness of CT cuts[4]
    - ie. 2mm cuts → 5 “clicks” through the scan starting at the most superior portion of acetabular roof
    - Each line on the image represents 2mm cut on CT scan
- Analogous to roof arc angle
  - If fracture visualized within top 10mm, considered to involve the weightbearing dome[4]



Tornetta P 3rd. Displaced acetabular fractures: indications for operative and nonoperative management. J Am Acad Orthop Surg. 2001 Jan-Feb;9(1):18-28. doi: 10.5435/00124635-200101000-00003. PMID: 11174160.

CT Evaluation: 3D Recons

- Help to visualize how the fracture pattern will appear intra-operatively[4]
  - Can be helpful to plan reduction maneuvers and lag screw placement
- Improves 3D understanding of fracture[2,4]



Images courtesy of Dr. Raymond Wright, MD

Classification Algorithm

Classification Algorithm

- Systematic approach for classifying acetabular fractures based on plain radiographs[4]
  - AP + judets
- First step is determining the involvement of ilioischial and iliopectineal lines[4]

Both Disrupted	Transverse Transverse + posterior wall T-type Both column Anterior column + posterior hemitransverse
Only ilioischial disrupted	Posterior column Posterior column + posterior wall
Only iliopectineal disrupted	Anterior column
Neither disrupted	Posterior wall Anterior wall

Classification Algorithm:
Both lines disrupted

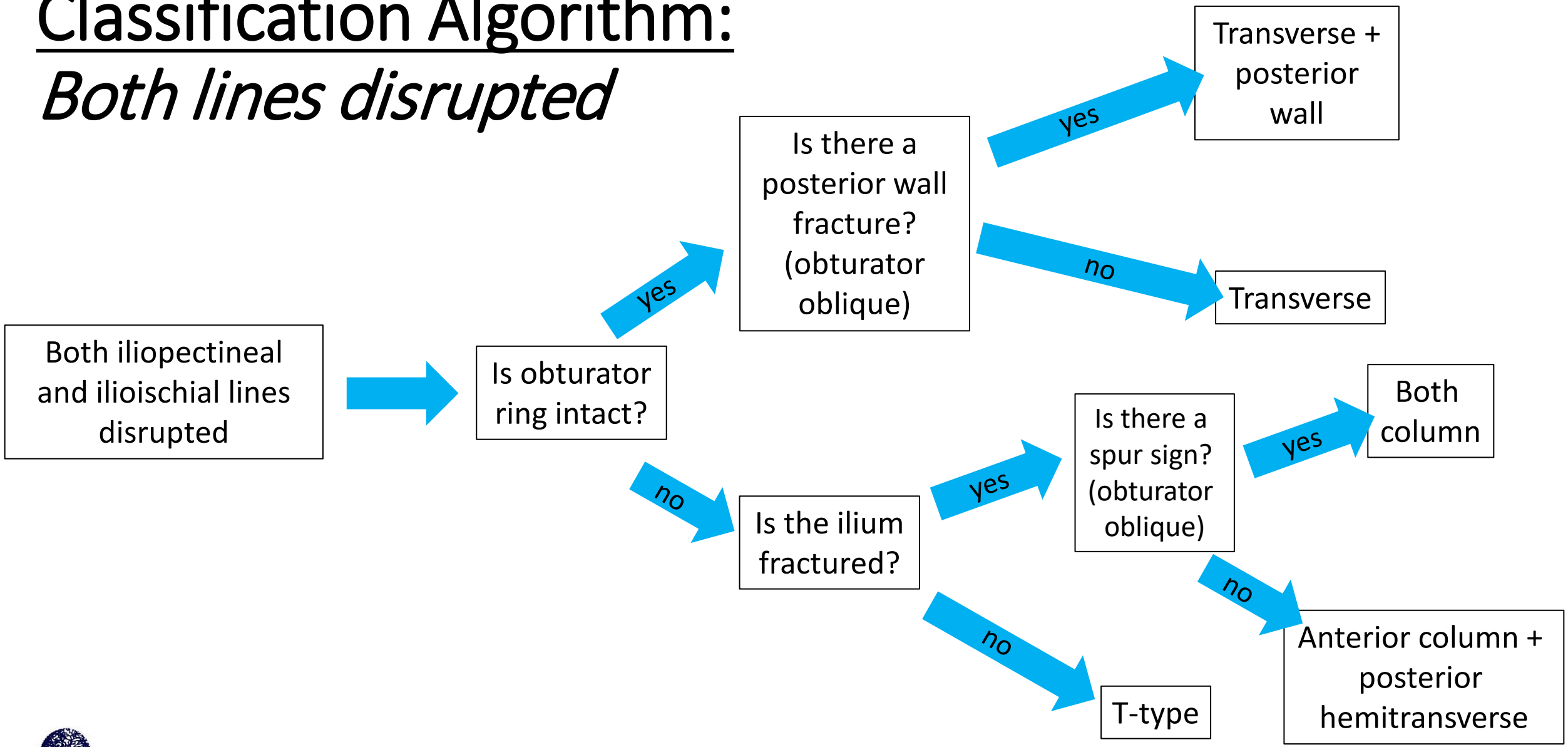
1. Both lines disrupted
    - Fracture must be:
        - Transverse
        - Transverse + posterior wall
        - T-type
        - Both column
        - Anterior column + posterior hemitransverse

2. Evaluate obturator ring[4]
    - Intact
    - Disrupted
3. Evaluate for involvement of the ilium[4]
    - Iliac oblique view
4. Evaluate for spur sign[4]
    - Obturator oblique view

Mauffrey, et al[4]

Classification Algorithm:

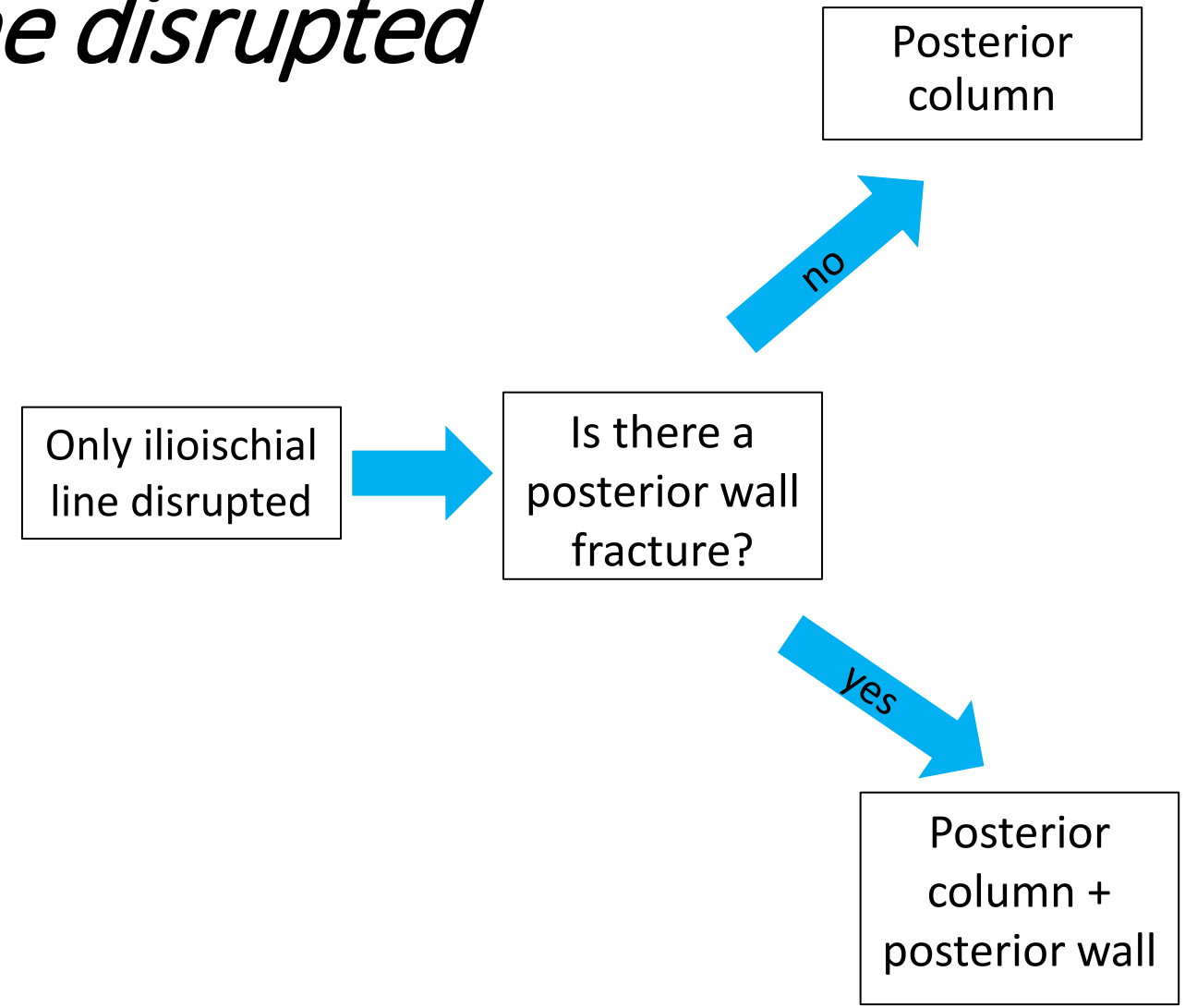
Both lines disrupted



Mauffrey, et al[4]

Classification Algorithm:
Only iliopectineal line disrupted

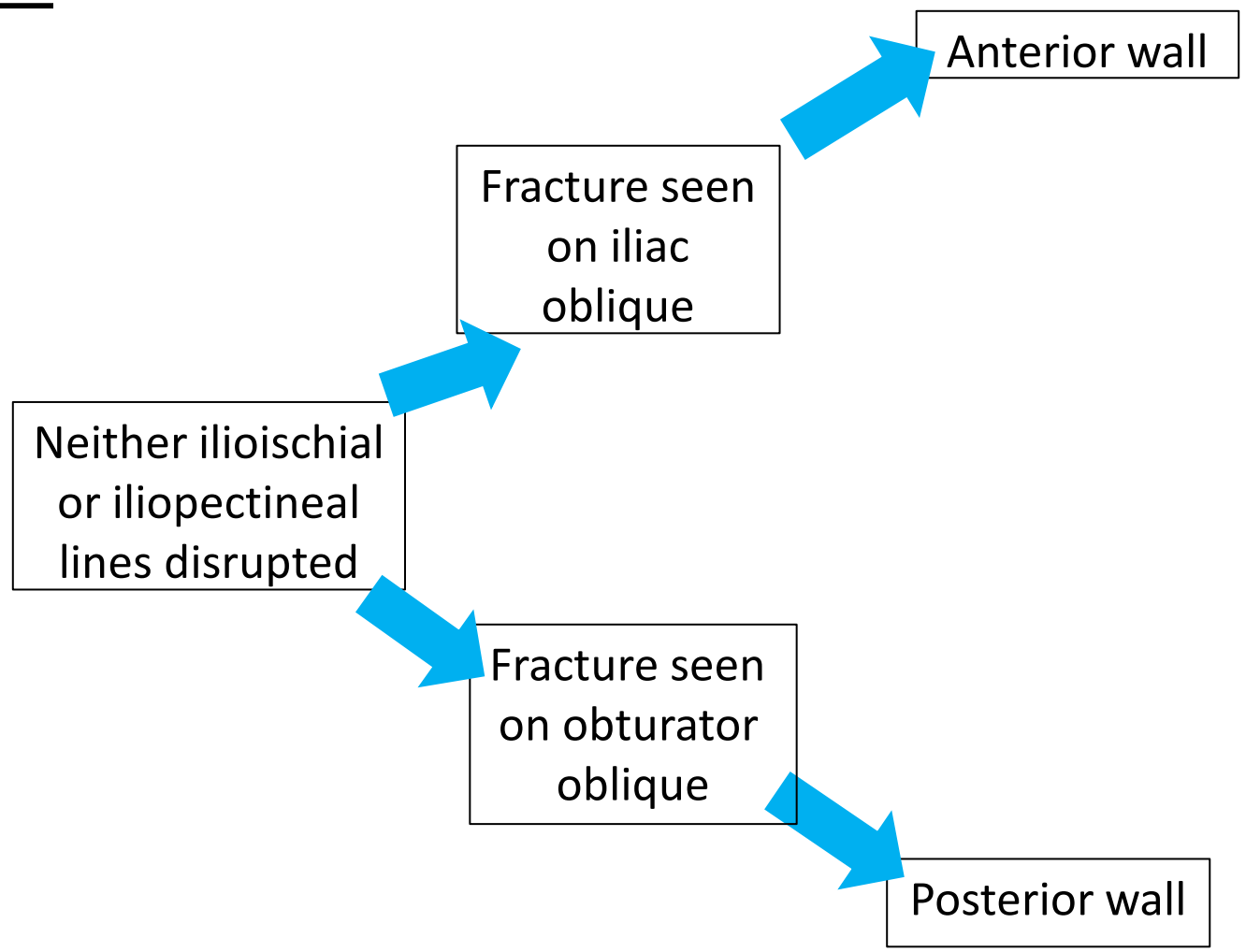
- If only the ilioischial line is disrupted[4]
  - Fracture must be either:
    - Posterior column
    - Posterior column + posterior wall
  - Differentiate based on presence of posterior wall fracture[4]
    - Obturator oblique view



Mauffrey, et al[4]

Classification Algorithm:
Neither line disrupted

- If neither iliopectineal or ilioischial line is disrupted[4]
  - Both columns must therefore be intact
  - The fracture is either:
    - Anterior wall
    - Posterior wall
- Evaluate judet views to determine which[4]



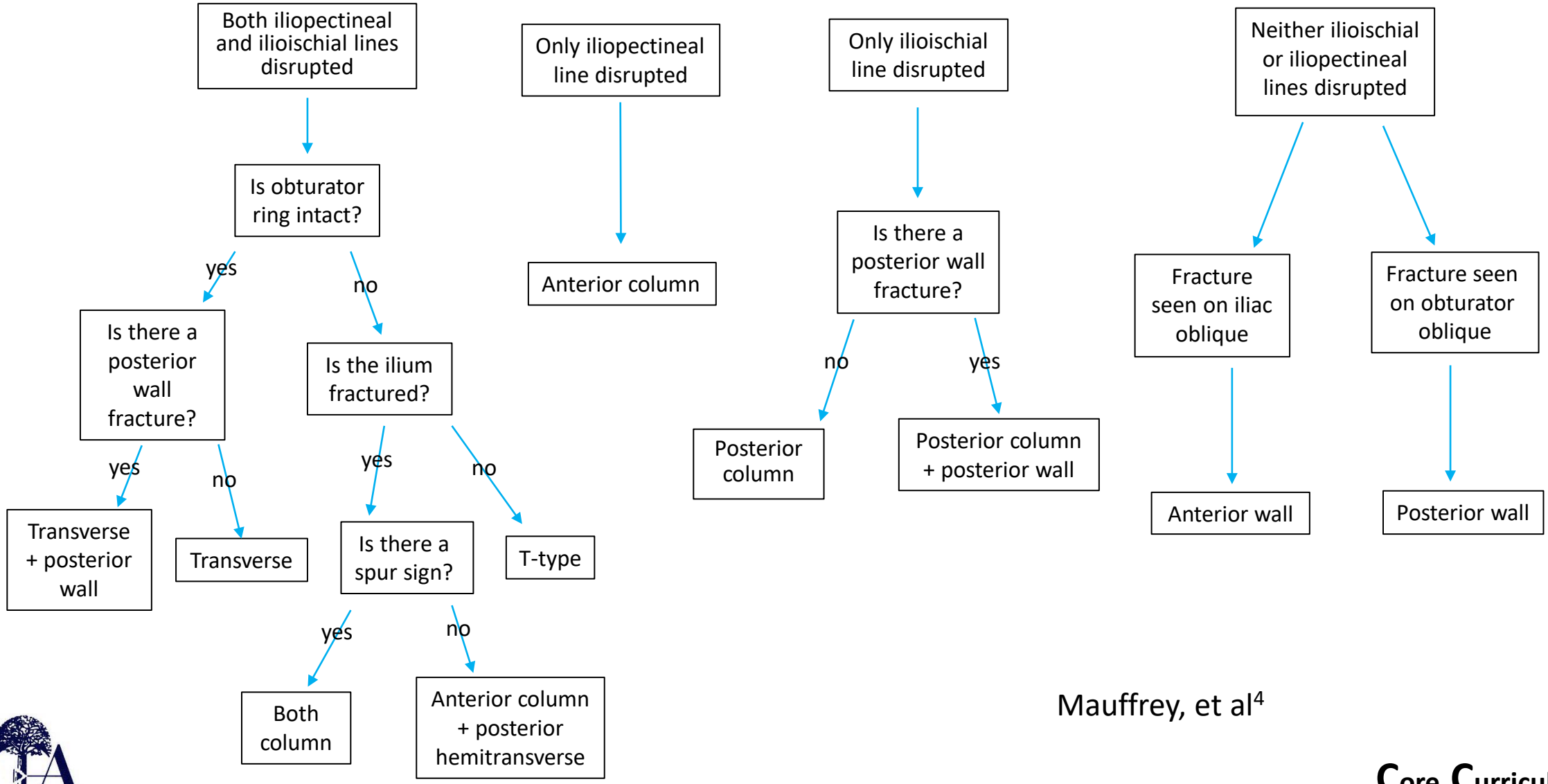
Mauffrey, et al[4]

Classification Algorithm:
Only iliopectineal line disrupted

If only the iliopectineal line is disrupted, the *only possibility* is an isolated anterior column fracture[4]!

Mauffrey, et al[4]

Classification Algorithm: *Put it all together*



Mauffrey, et al[4]

Summary

- Three radiographic views for every acetabulum
  - AP
  - Judet's
    - Obturator oblique
    - Iliac oblique
- Letournel's six radiographic landmarks[1]
  - Iliopectineal line → anterior column
  - Ilioischial line → posterior column
  - Teardrop
  - Acetabular roof
  - Anterior wall
  - Posterior wall

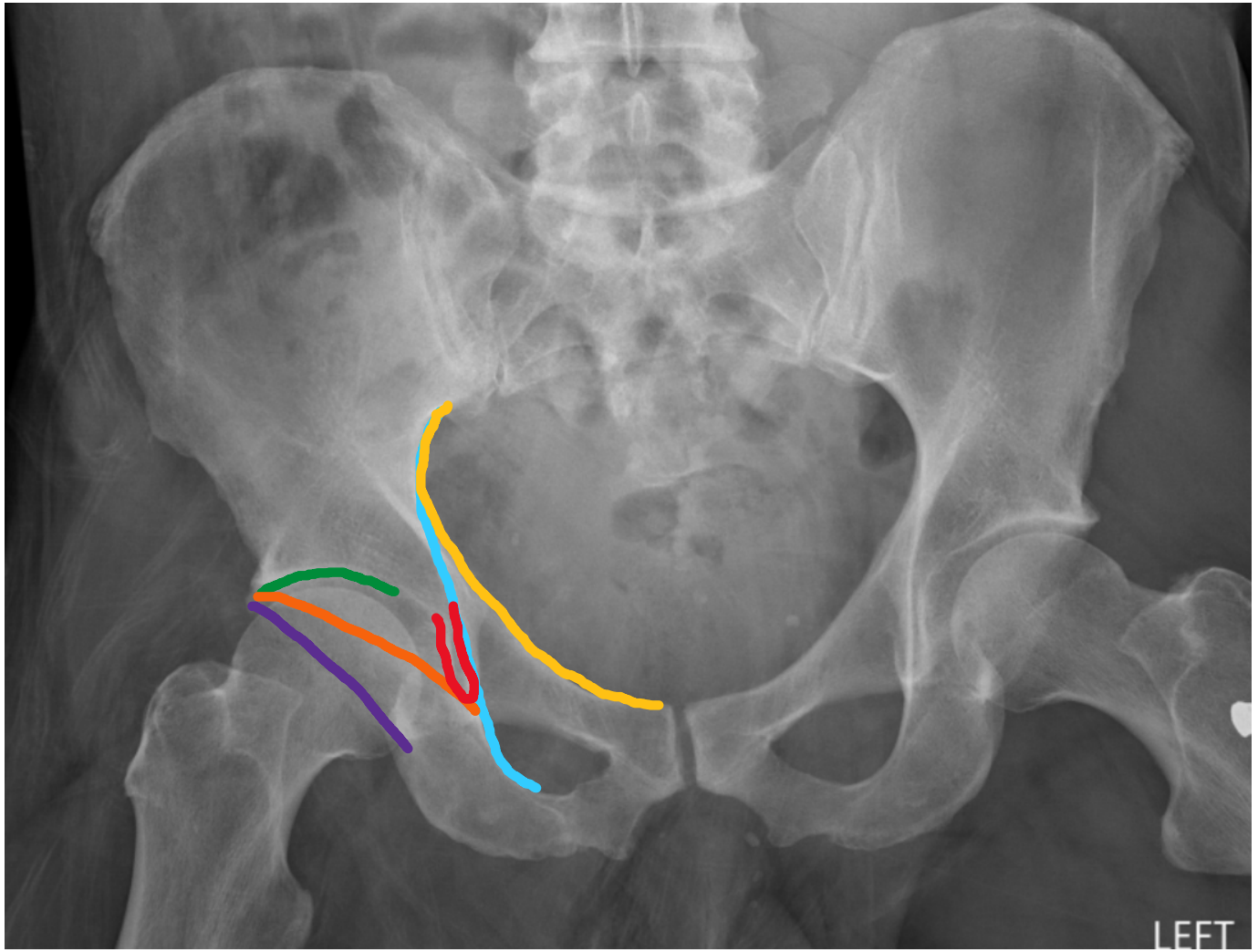


Image courtesy of Dr. Raymond Wright, MD

Summary

- Judet Views
  - Obturator oblique
    - Anterior column
    - Posterior wall
  - Iliac oblique
    - Posterior column
    - Anterior wall

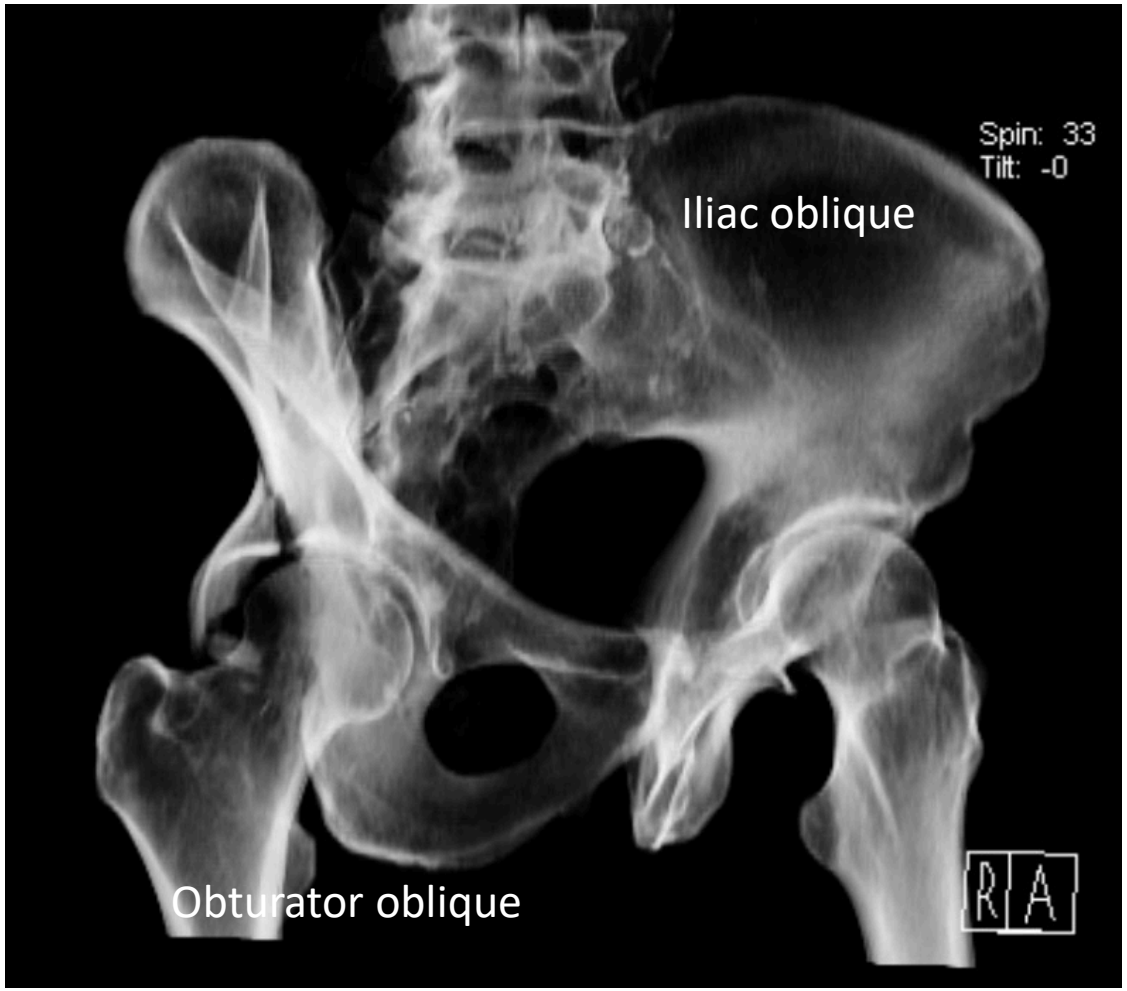
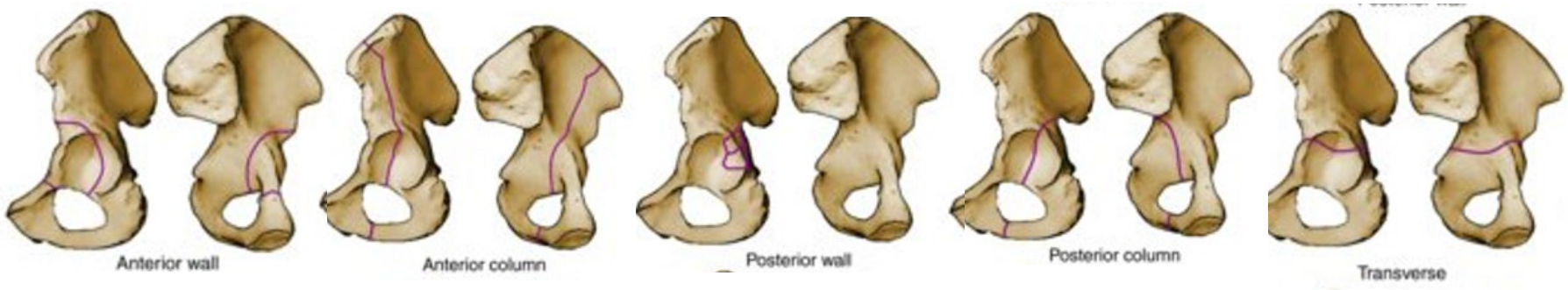
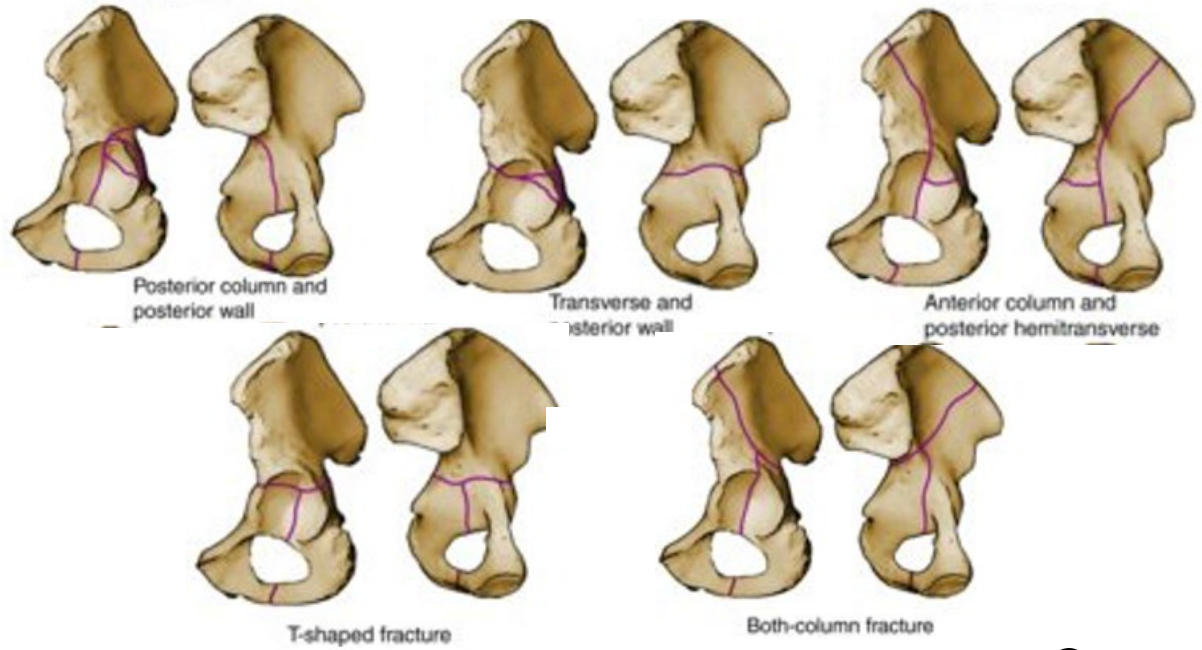


Image courtesy of Dr. Raymond Wright, MD

Summary

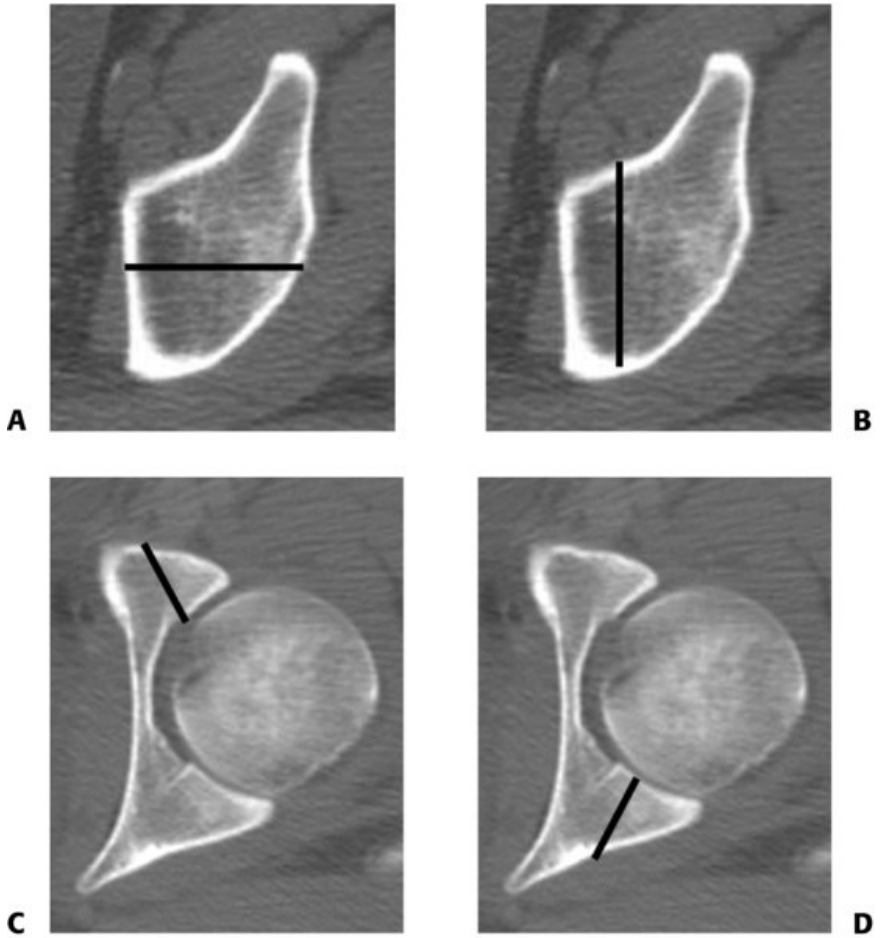
- Classification
  - Elementary Patterns
    - Posterior wall
    - Posterior column
    - Anterior wall
    - Anterior column
    - Transverse
  - Associated Patterns
    - Posterior column + posterior wall
    - Transverse + posterior wall
    - T-type
    - Anterior column + posterior hemitransverse
    - Both column





Summary

- Recognizing patterns
  a) Column fractures: horizontal
     a) Coronal plane
  b) Transverse fractures: vertical
     a) Sagittal plane
  c) Anterior wall: anterior and midline
  d) Posterior wall: anterior and peripheral



Tornetta III, P et al. Rockwood & Greens Fractures in Adults. Philadelphia: Lippincott Williams & Wilkins, 2019

Summary

- Classification algorithm
  - Develop a systematic process by which to evaluate imaging in order to accurately classify acetabular fractures.
  - Evaluate
    1. Integrity of liopectineal & ilioischial lines
    2. Integrity of obturator ring
    3. Fracture extension into ilium
    4. Judet views for associated wall fracture

Both Disrupted	Transverse Transverse + posterior wall T-type Both column Anterior column + posterior hemitransverse
Only ilioischial disrupted	Posterior column Posterior column + posterior wall
Only iliopectineal disrupted	Anterior column
Neither disrupted	Posterior wall Anterior wall

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