Pelvic Ring Disruption Cases

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Disclosures

- No financial disclosures for this talk

- "I get by with a little help from my friends"

  Some slides in this talk are from colleagues

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Instability

As with any musculoskeletal articulation,
STABILITY relies on three factors to variable degrees:

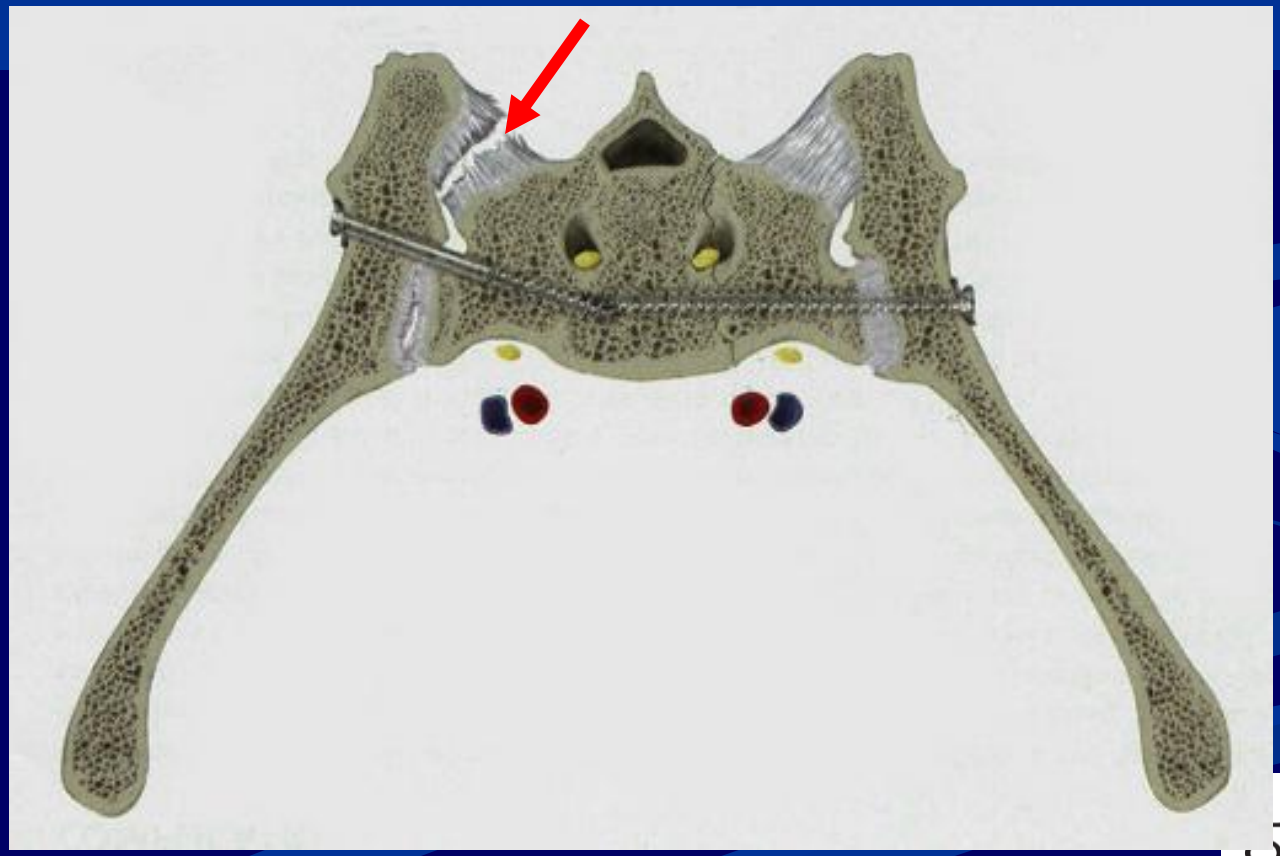
Bony Stability

Soft Tissue Stability

Dynamic Stability

Instability

Interosseous sacroiliac ligaments are the most important for posterior stability



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OTA/AO Classification

61 A) **Stable Pelvic ring**
- $61A_1$ Avulsion fractures
- $61A_2$ Iliac wing fractures
- $61A_3$ Transverse sacral fractures

61 B) **Partial instability**
- $61B_1$ open book
- $61B_2$ lateral compression (usually stable)
- $61B_3$ bilateral injuries

Both “APC 2” and “LC1” included here

61 C) **Complete instability**
- $61C_1$ unilateral
- $61C_2$ bilateral - complete and partial
- $61C_3$ bilateral - both complete

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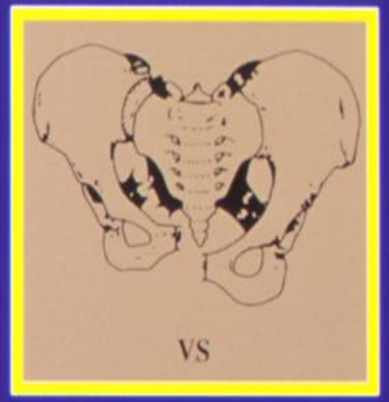
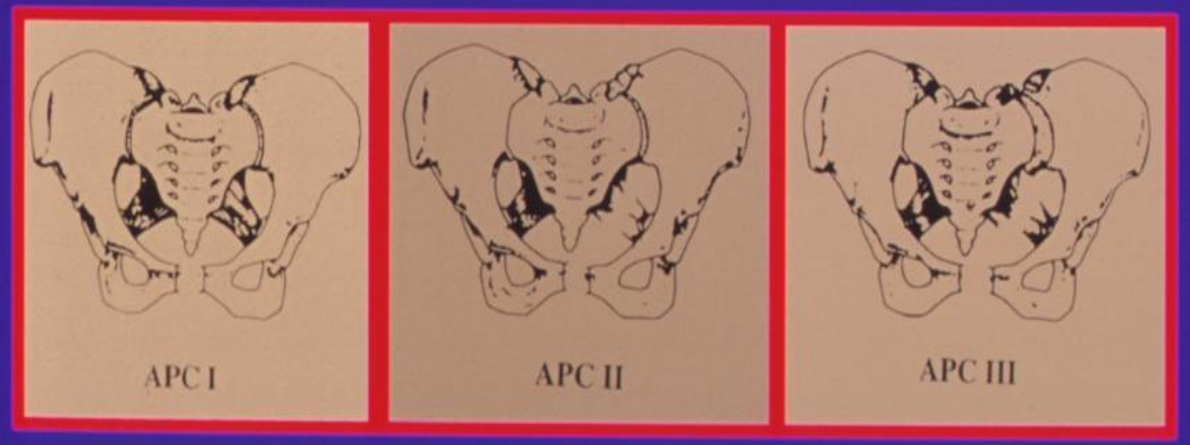
Young & Burgess System

Lateral Compression

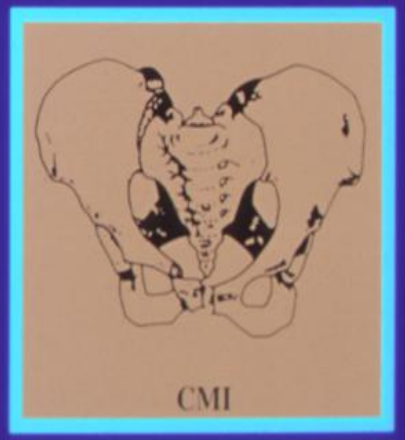
Vertical Shear



Anterior-Posterior Compression



Combined Mechanical Injury



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Bucholz

- **Bucholz Classification is my preference**

Type I - Anterior injury with minimal posterior involvement

Type II - Rotationally unstable, “vertically” stable

Type III - Rotationally and “vertically” unstable

	Bucholz	Tile	OTA/AO	Young Burgess	Letournel	Dennis
Stable Ring	I	A_1 B_2	61A $61B_2$	APCI LCI CMI*	*	*
Partial Instability	II	B_1	$61B_1$	APCII LCII LCIII CMI*	*	*
Complete Instability	III	C	61C	APCIII LCIII VS CMI*	*	*

* Can be associated with any form of instability

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Case 1

56 yo male

“T-Boned” (lateral impact) in MVC

Hemodynamically stable

Minimally mobile - internal compression on pelvic stress exam

Tender with palpation of sacrum on left

N/V exam intact

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CT shows incomplete left sacral alar fracture

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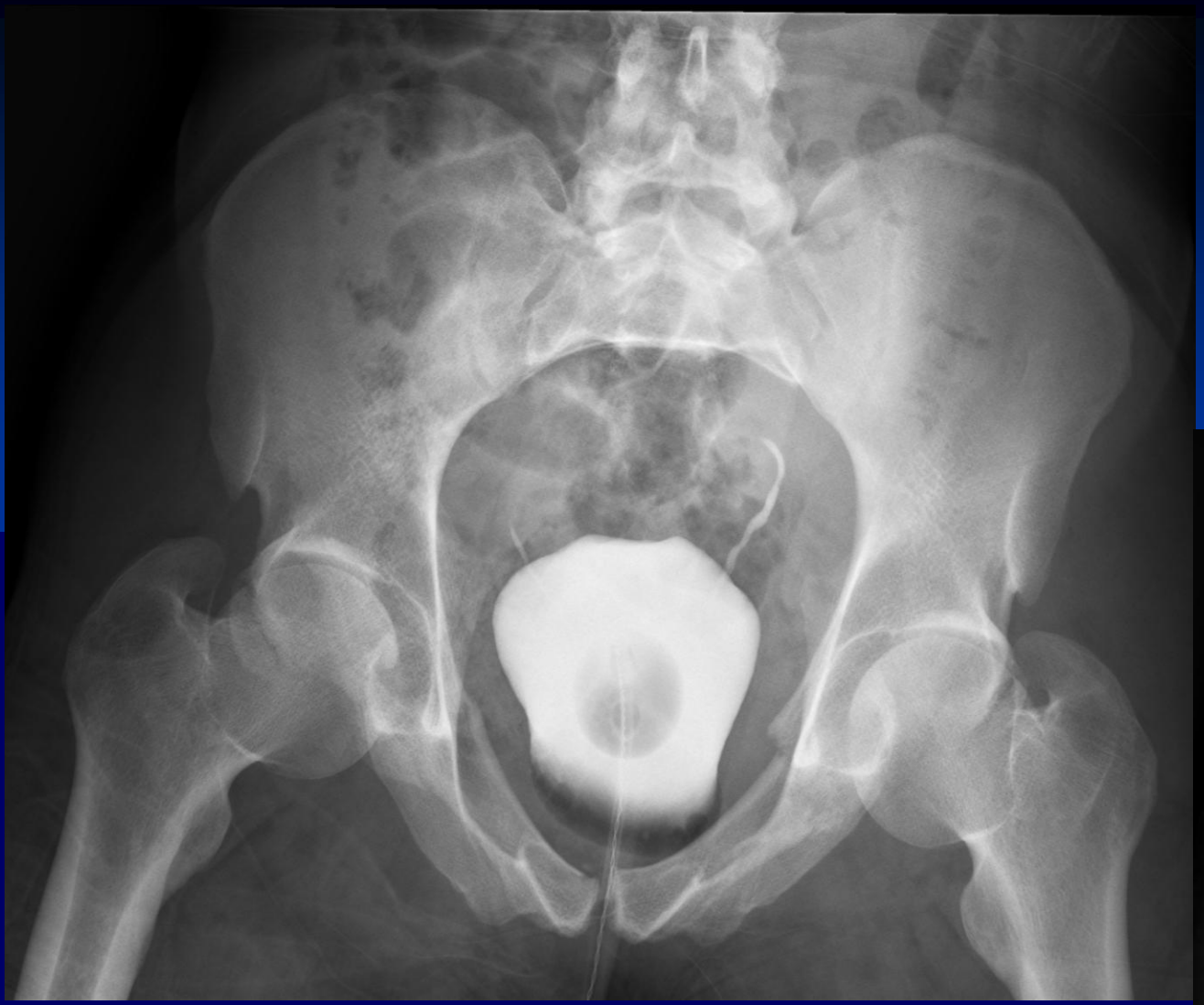
Inlet and Outlet views



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Treatment Recommendations

Is Operative Fixation Indicated?

What weight bearing status?

What follow up is needed?

Is there a role for Physiotherapy?

What if weight bearing is painful and cannot mobilize after several days?

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12 Month f/u

Painless ambulation

Case 2

30 yo male

1 hour after motorcycle accident

initial vital signs:

- blood pressure 100/60
- heart rate 100

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Case 2

During establishment of access

- blood pressure declines to 90/60
- heart rate 110
- respiratory rate 40

- What does this tell us?

Hemodynamic Instability

- SBP < 90mmHg
- Unresponsive to fluids/blood

- Mortality:
  - Shock on admission associated with pelvic fracture is the most reliable predictor of ISS, transfusion requirement and death (40%)

ATLS: Acute Phase (1 -2 hrs)

Identify the primary cause(s) of hypotension:

- mediastinal injury
- myocardial infarction
- quadriplegia
- terminal brain injury
- hypothermia
- **Hypovolemia**

Acute Phase (1 - 2 hrs)

Identify the primary cause(s) of hypovolemia:

- intrathoracic bleeding
- intraperitoneal bleeding
- retroperitoneal bleeding (pelvic injury)
- open wounds
- Multiple closed extremity fractures

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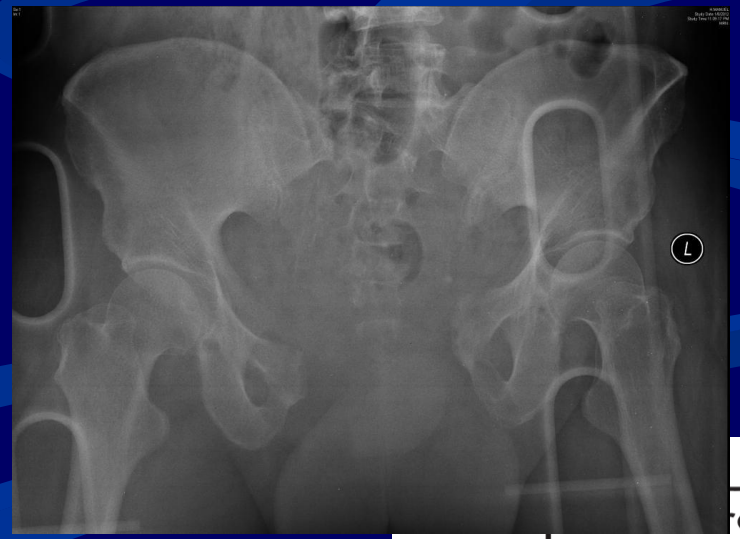
What does our patient need?

- Resuscitation
- Coagulation
  - Hypothermia
  - Acidosis
  - Low Ca (citrate)
  - Consumption of platelets
- Stability

Does this patient need additional Xrays ?

- AP pelvis film is sufficient to determine stability for resuscitation
- Other studies
  - determine method of definitive treatment
    - Inlet view
    - Outlet view
    - CT scan



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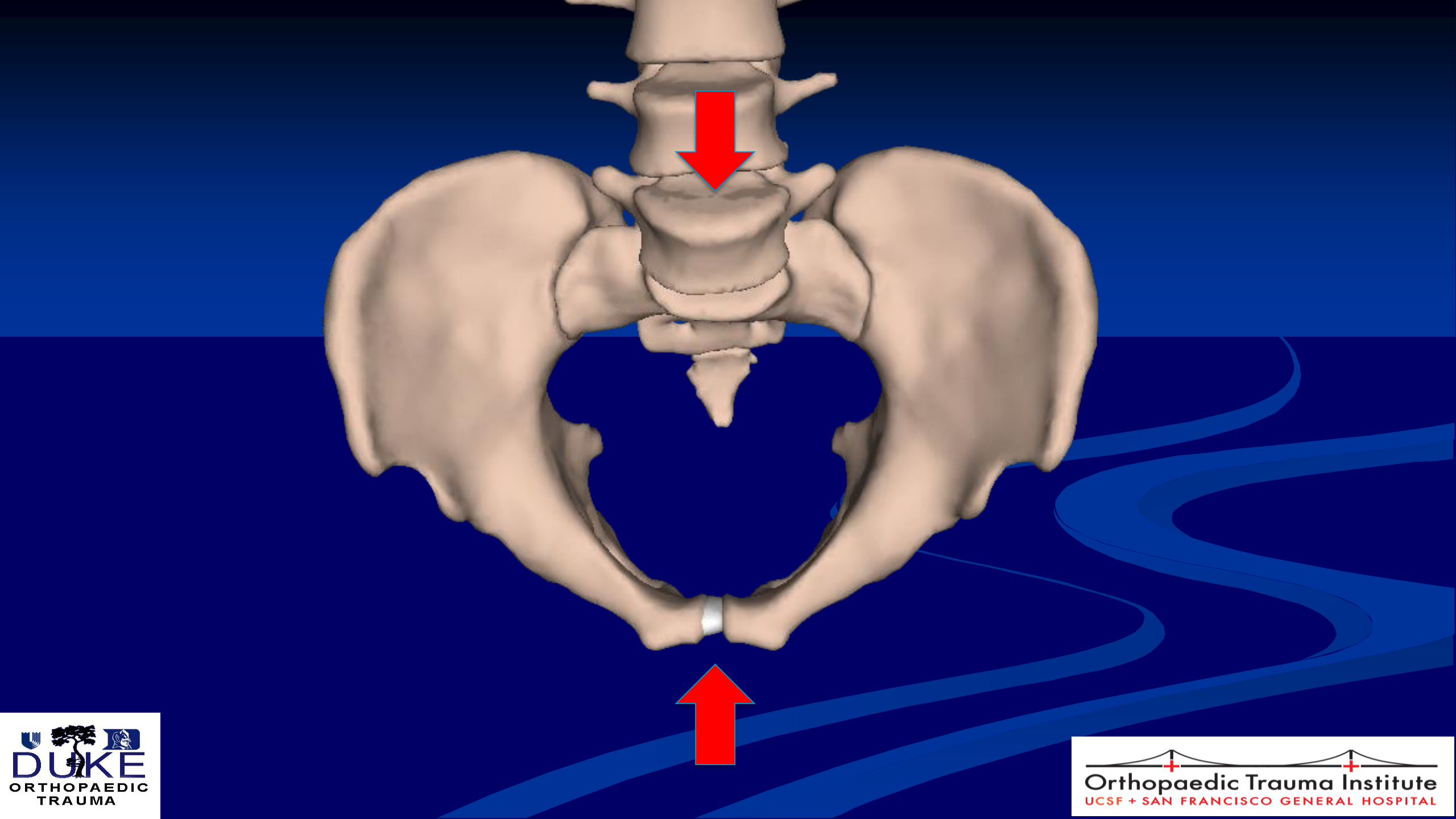
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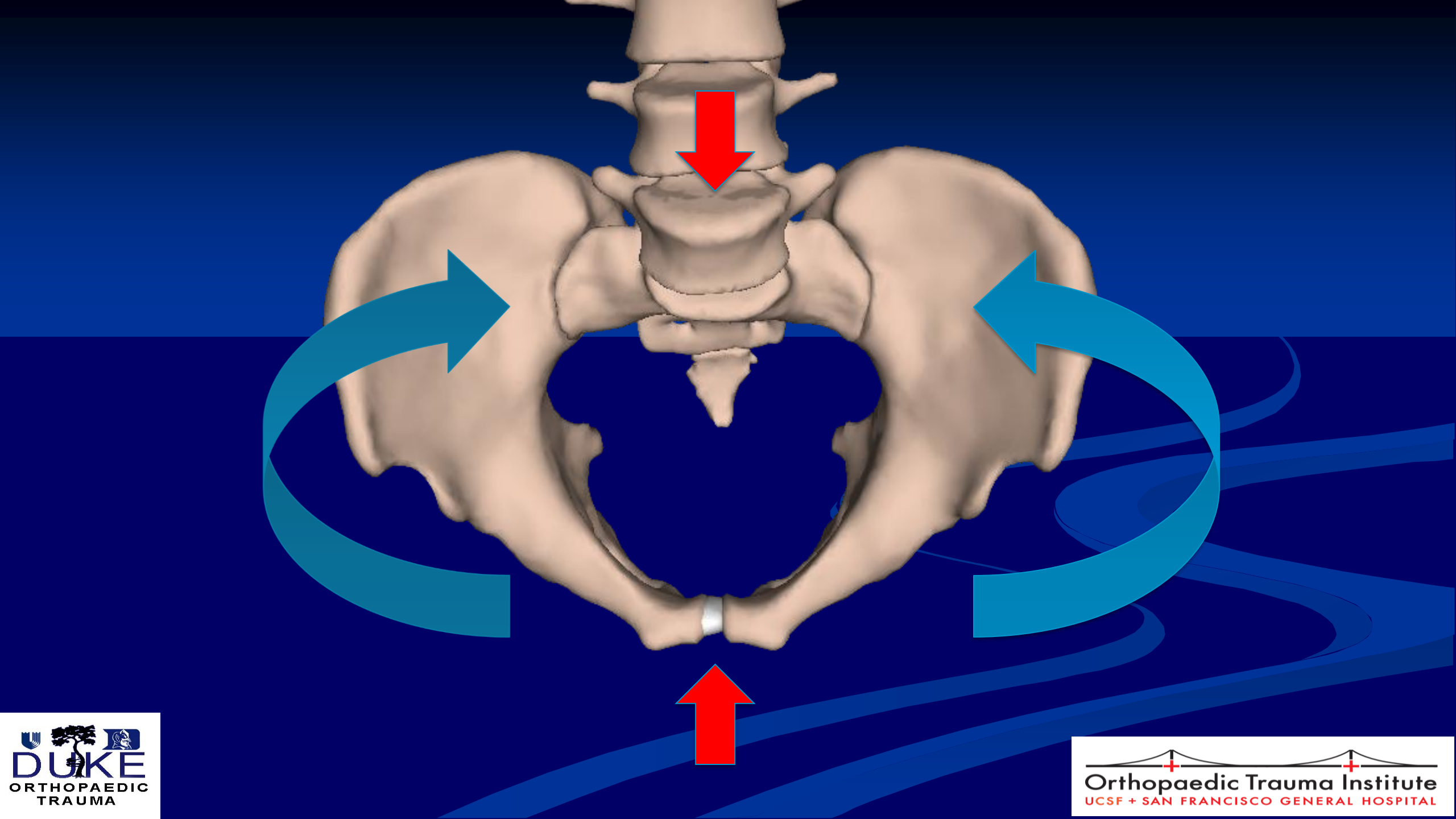
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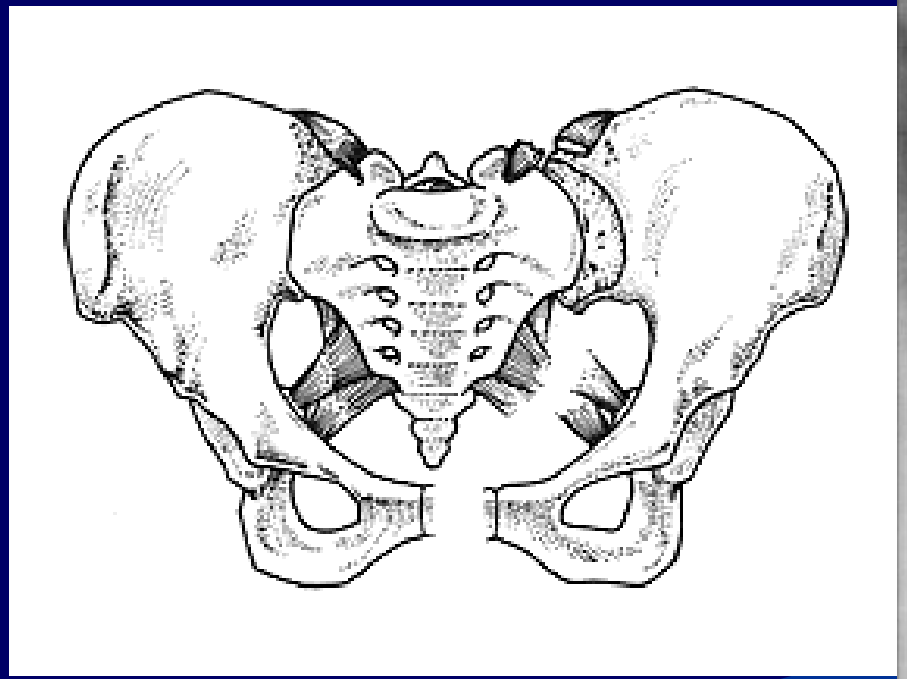
Anterior-Posterior Compression

Hemipelvis External Rotation
Tensile Failure of Anterior Pelvic Ring
Increased incidence of hemorrhage, urologic injuries



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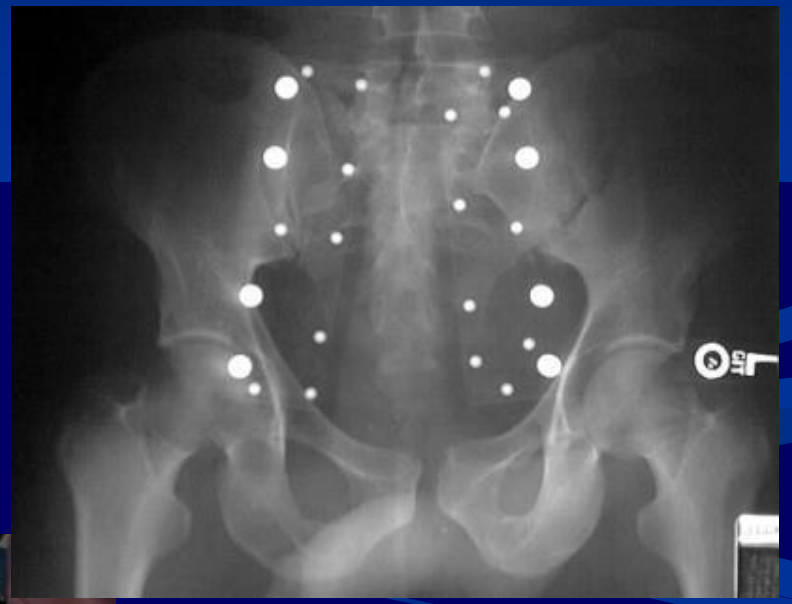
Containment/Reduction of Pelvic Volume

- Anti-shock sheeting



- Commercial Binders

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Containment/Reduction of Pelvic Volume

Binder/Sheets

Easily Applied during resuscitation
Portable
Versatile
Can convert to ExFix, ORIF

May block access to abdomen, femoral vessels
May hide injuries - Skin/Bone

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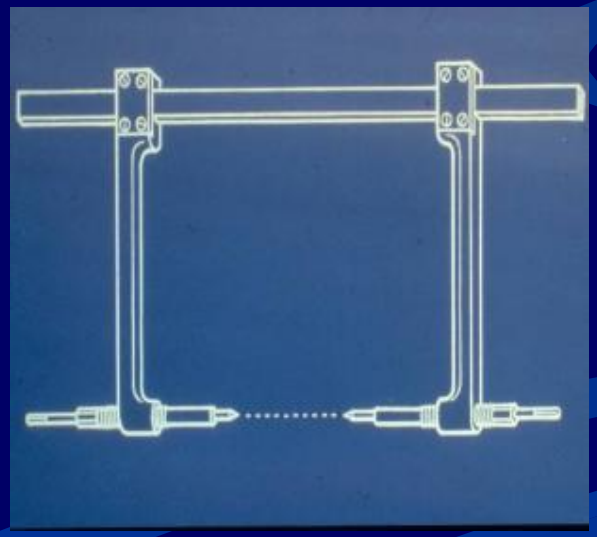
Pt. has acute abdomen, going to OR for exploratory laparotomy

Containment/Reduction of Pelvic Volume

- External Fixation

- C-clamp



Timing:
Which do you need first?
Pelvic stability or laparotomy ?

- Ghanayem, Wilber, et al: JTrauma 95
- Grimm, Vrahas, et al: JTrauma 98

- pelvic ex fix before laparotomy
  - Need to have surgeon to surgeon communication

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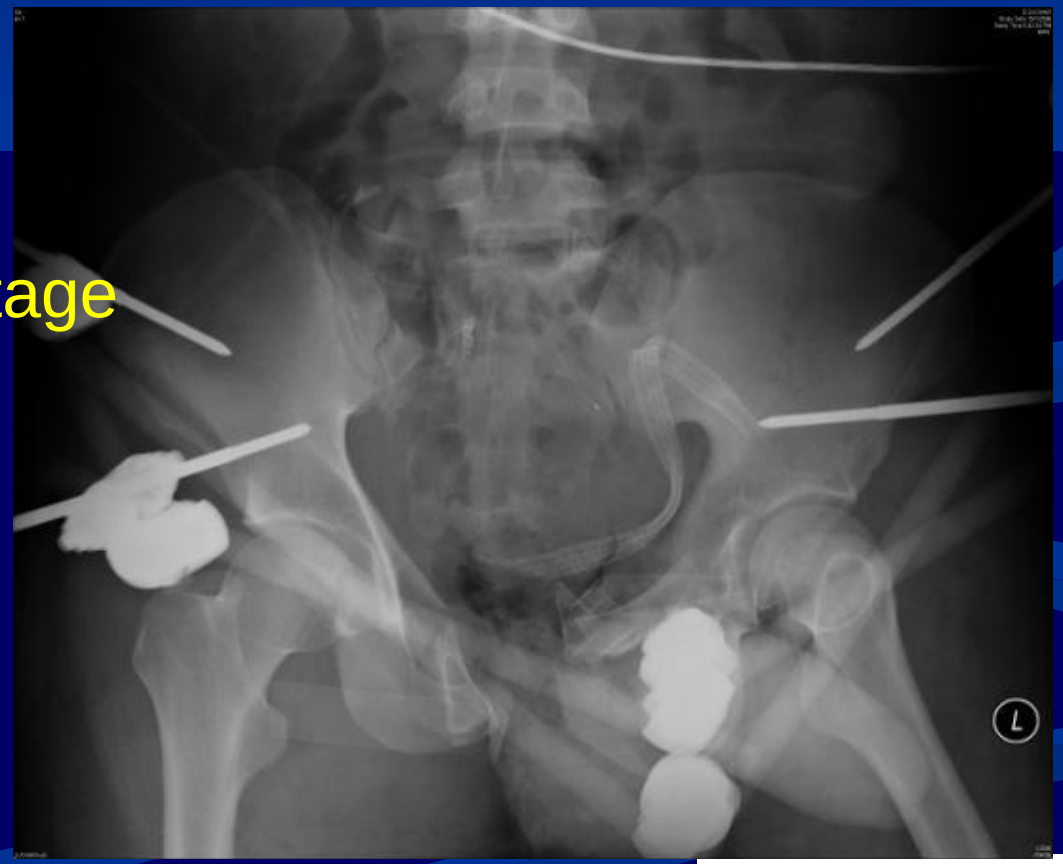
External Fixation

Advantages

- Easy, rapid application
- Improved patient mobility for interventions
- Useful in various patterns of injury
- May contribute to final fixation montage



Disadvantages

- Pin tract infection
- Poor control of posterior ring
- Induce additional deformity

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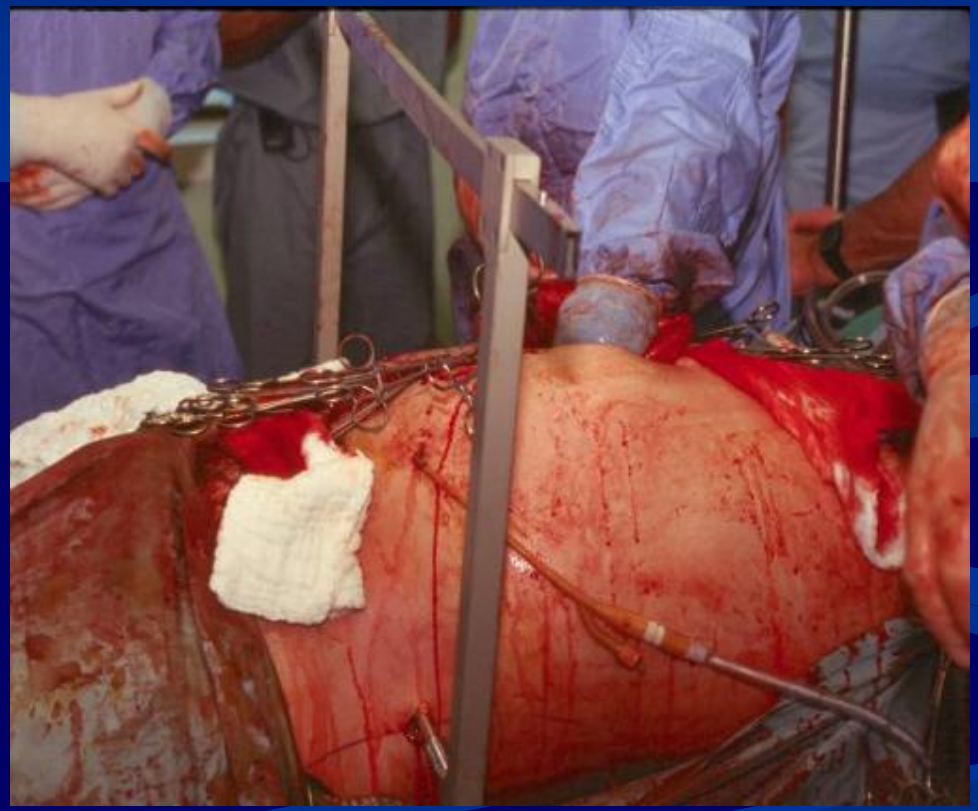
C-Clamp

Advantages

- Does not impair access
- Useful with open abdomen
- Improved posterior ring control
- Left on during anterior procedures

Disadvantages

- Pin sites infection
- May interfere with posterior approach
- Understand posterior pelvic injury prior to application



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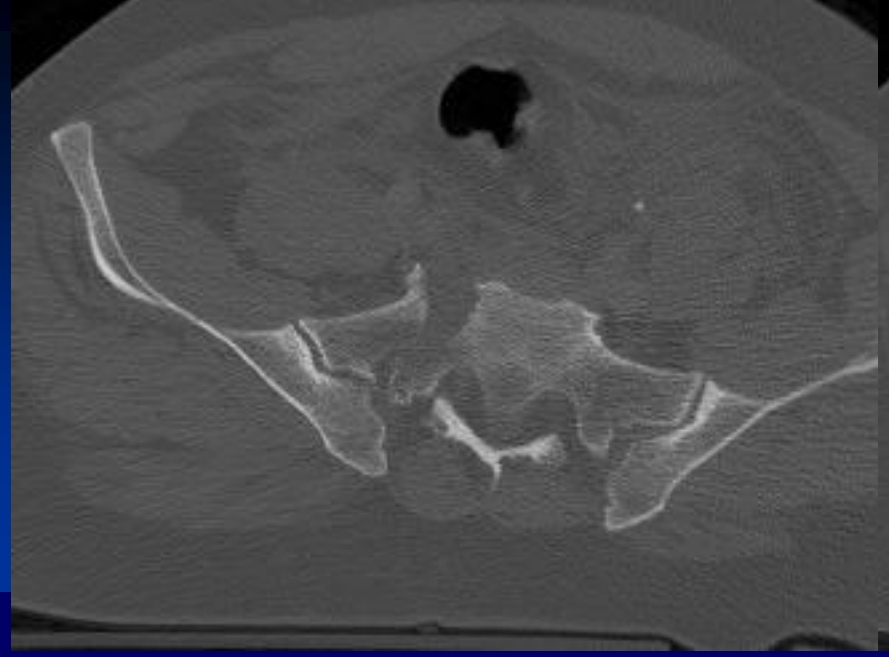

What reduction techniques?

How to assess reduction?

Timing of definitive fixation?

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Case 3

24 yo male – pedestrian vs auto

Presents with tense abdomen

SBP 80, Pulse 115

Motion detected in pelvis on Stress exam in ED

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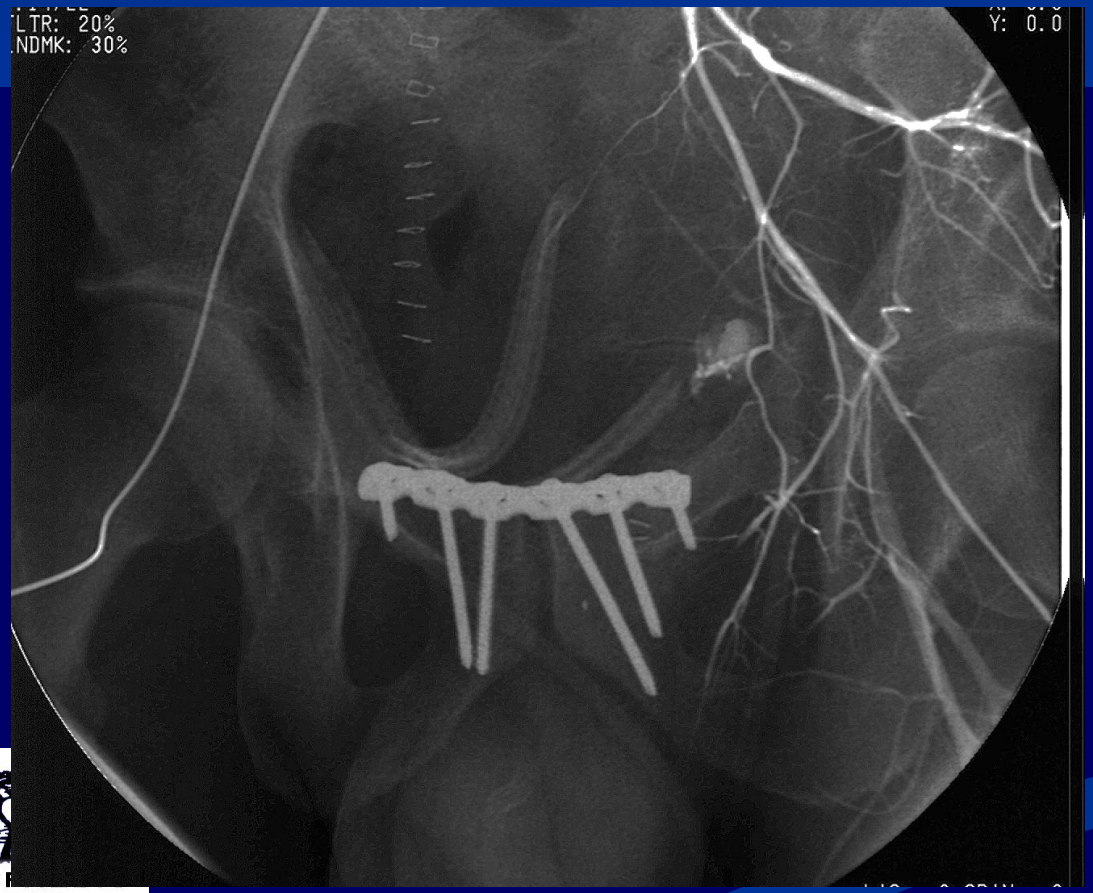
Goes to OR – Exploratory Laparotomy, Splenectomy

Reduce and plate pubic symphysis while there

Persistent drop in Hgb levels and SBP in 90's – Now What?



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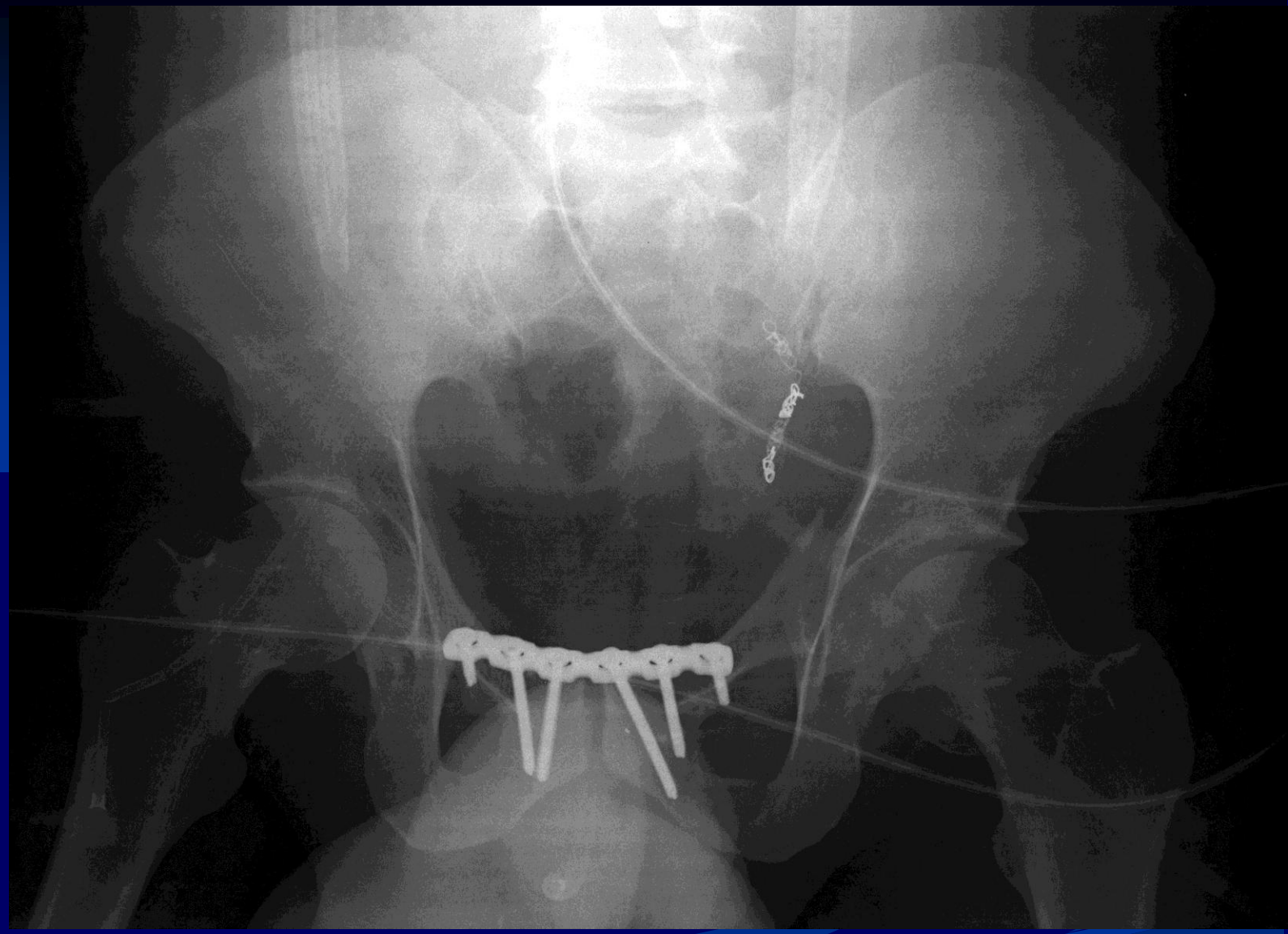
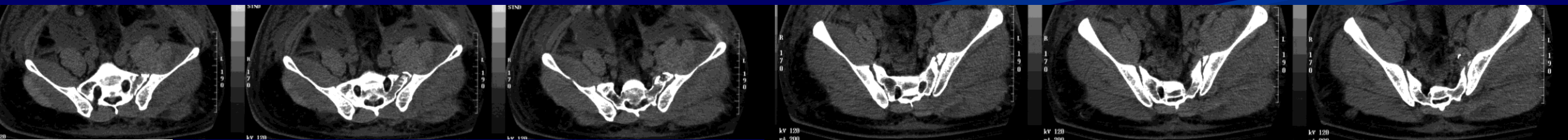
How would you classify this pelvic ring injury?

Is further fixation required?





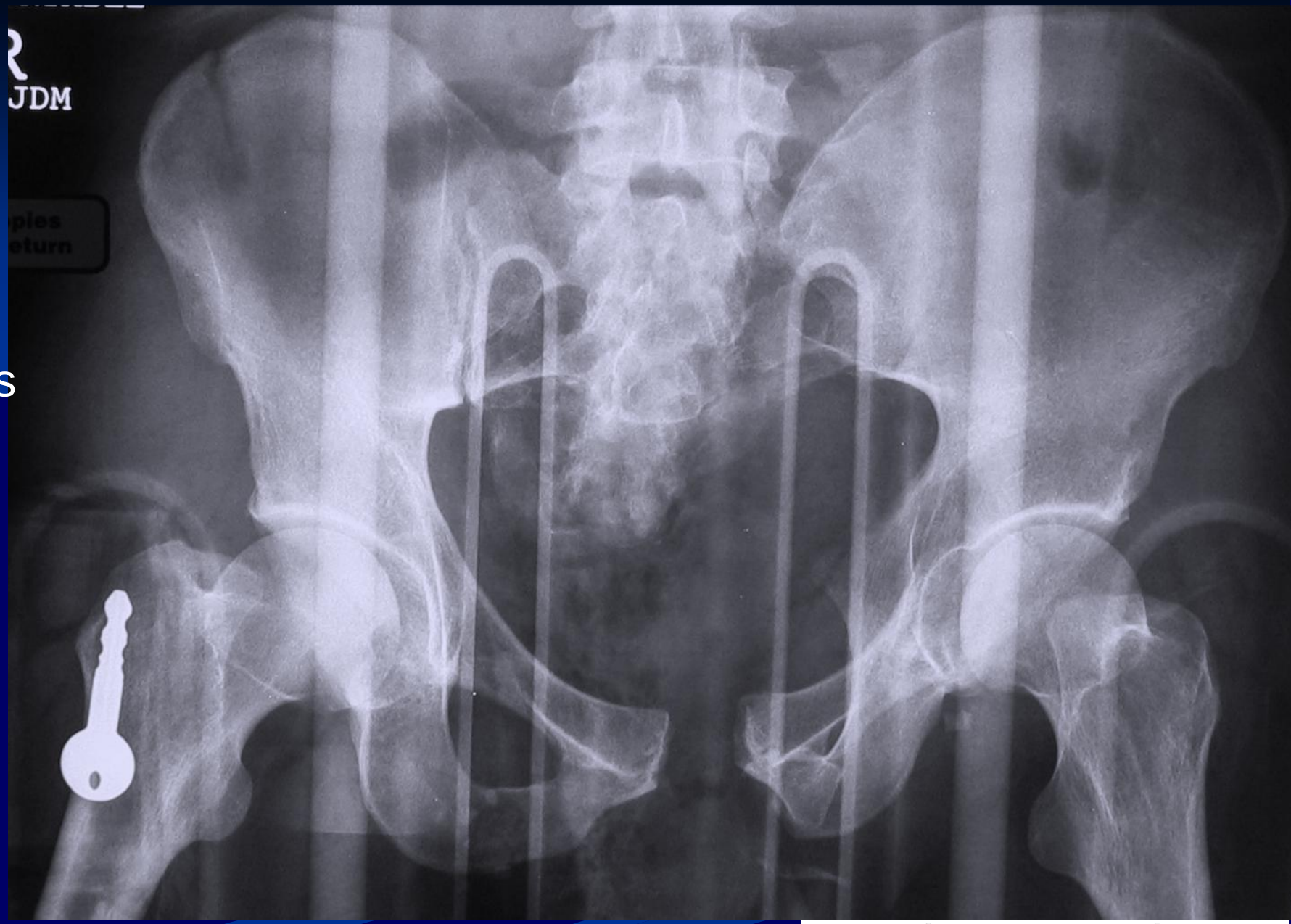
Case 4

45 yo male – MVC

Presents with SBP of 110
Drops to < 90 over 2 hours

Has motion of pelvis on stress exam

Unable to move left foot/ankle



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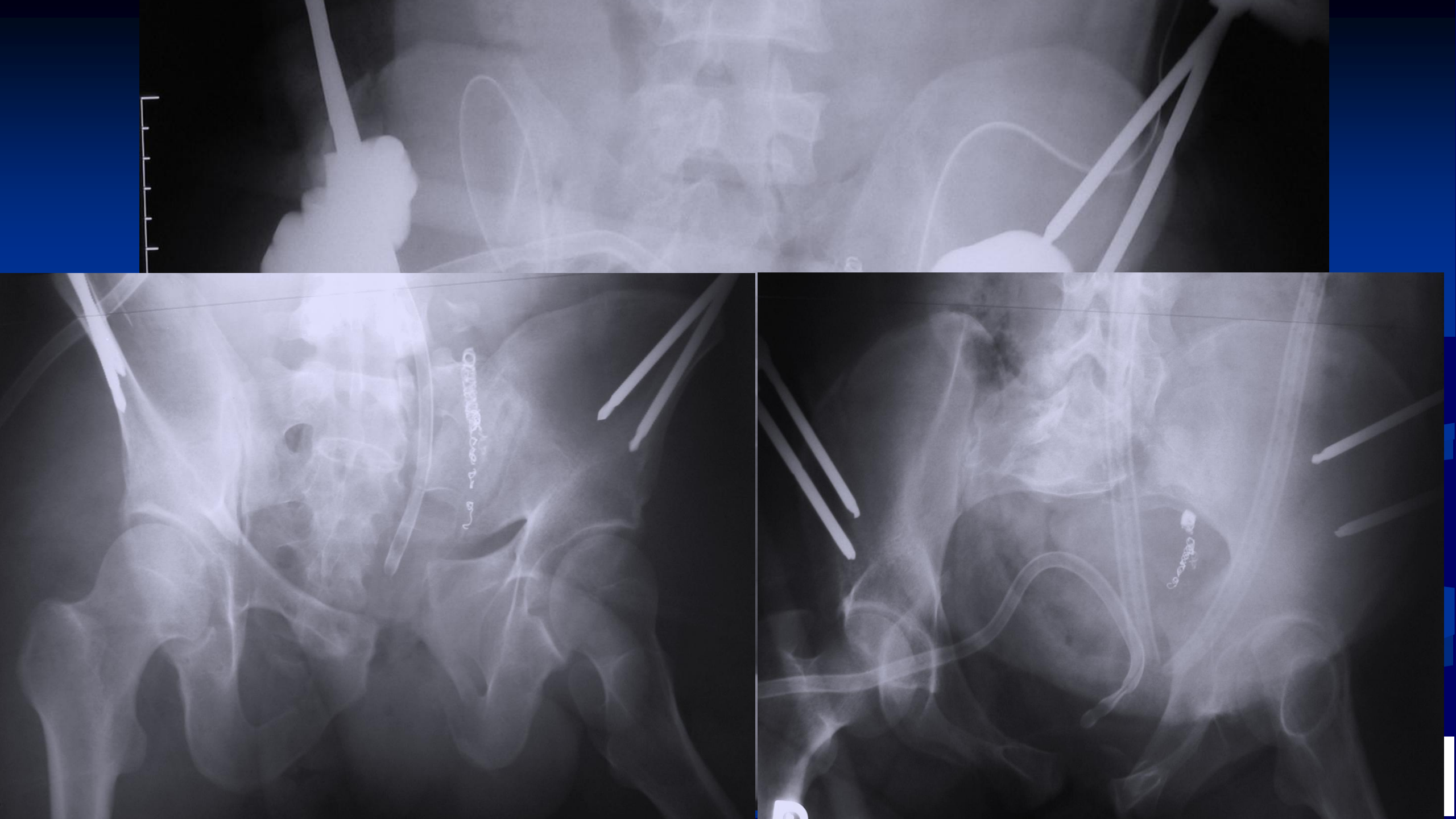
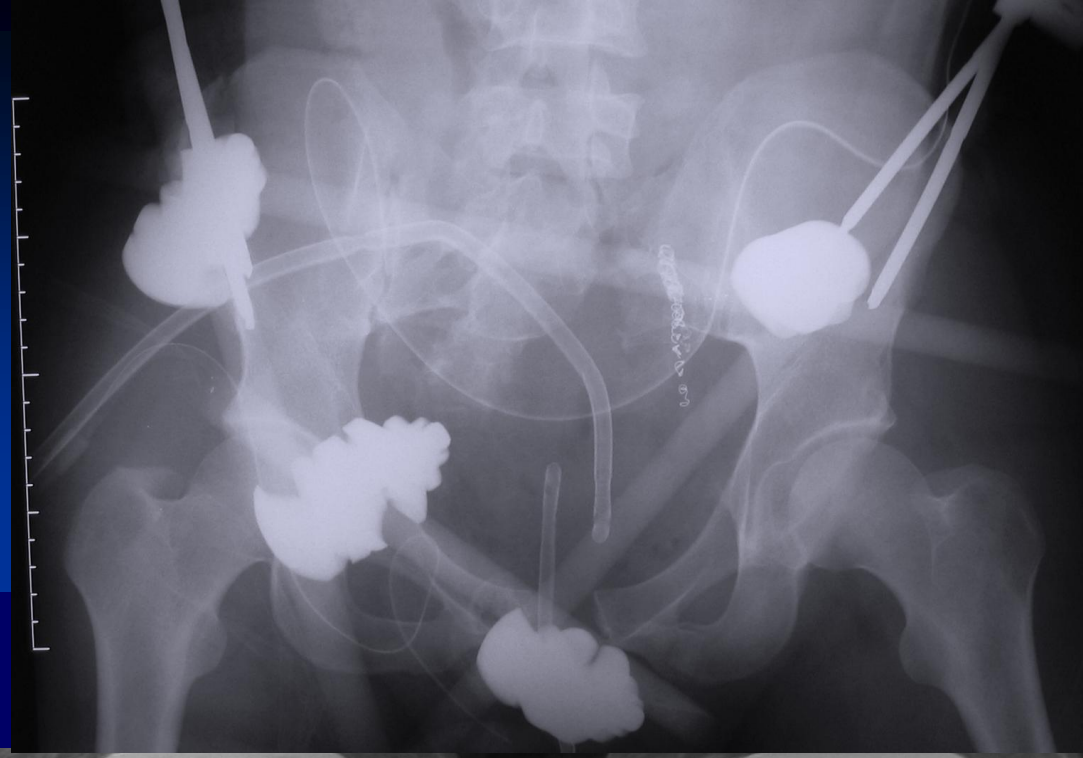
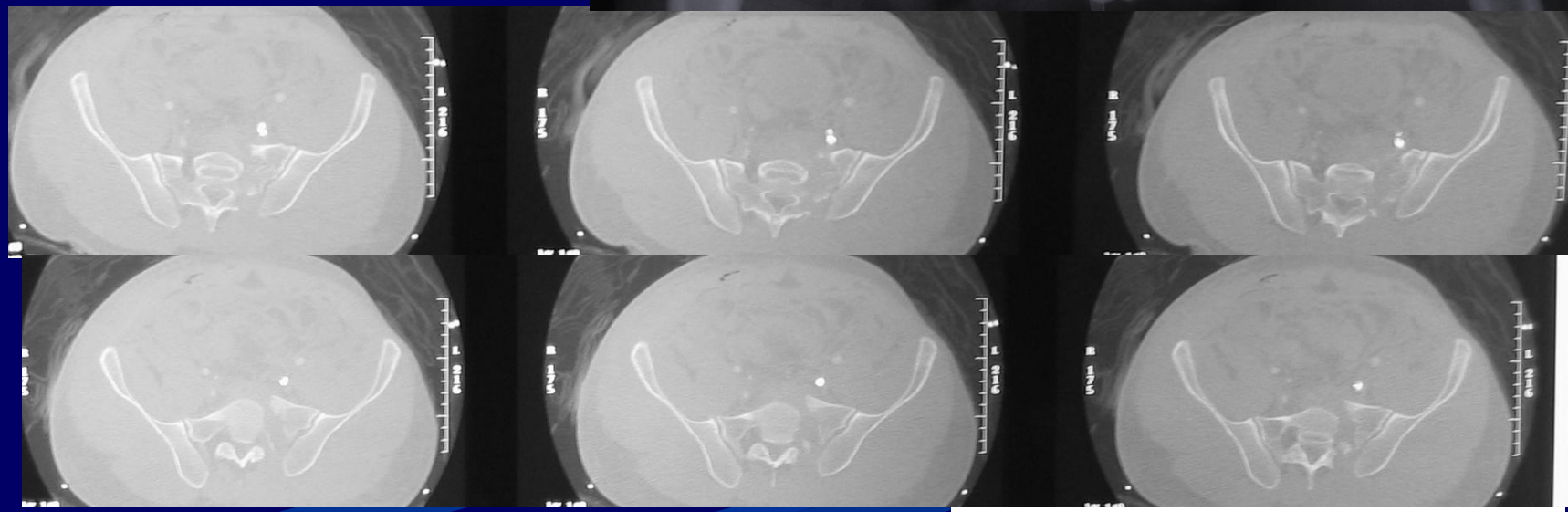
- Patient requires emergent care
- To angiography and then for ex-fix to remove binder
- After hemodynamically stable – imaging and f/u exam
- No improvement in motor exam in left foot



- What is classification of this pelvic ring injury?
- What treatment is needed?





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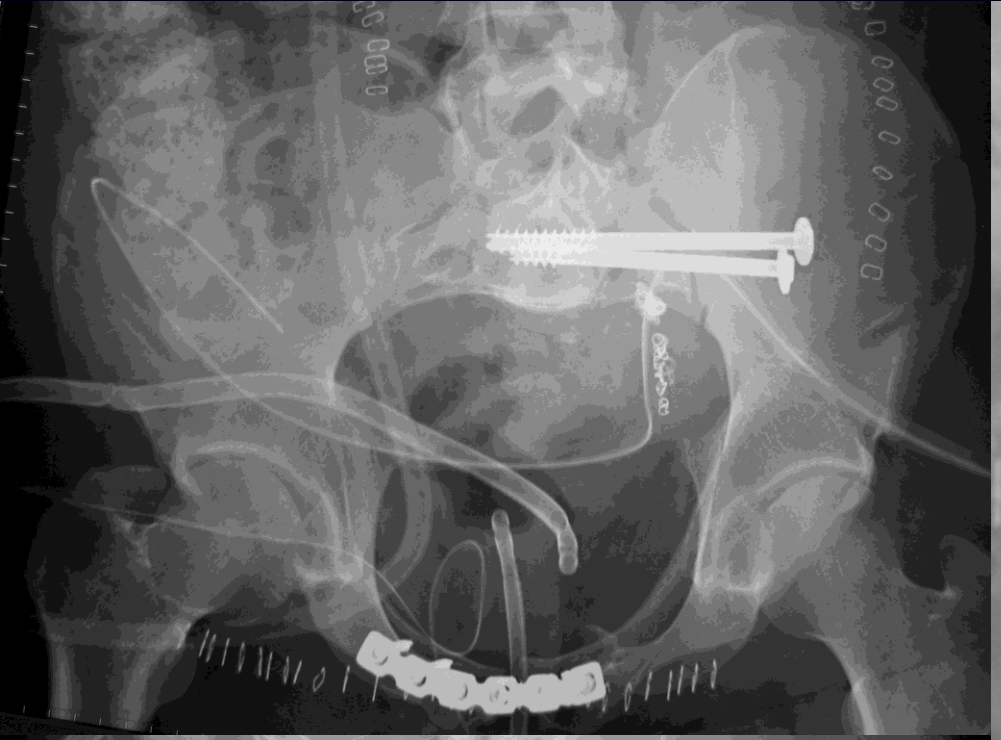

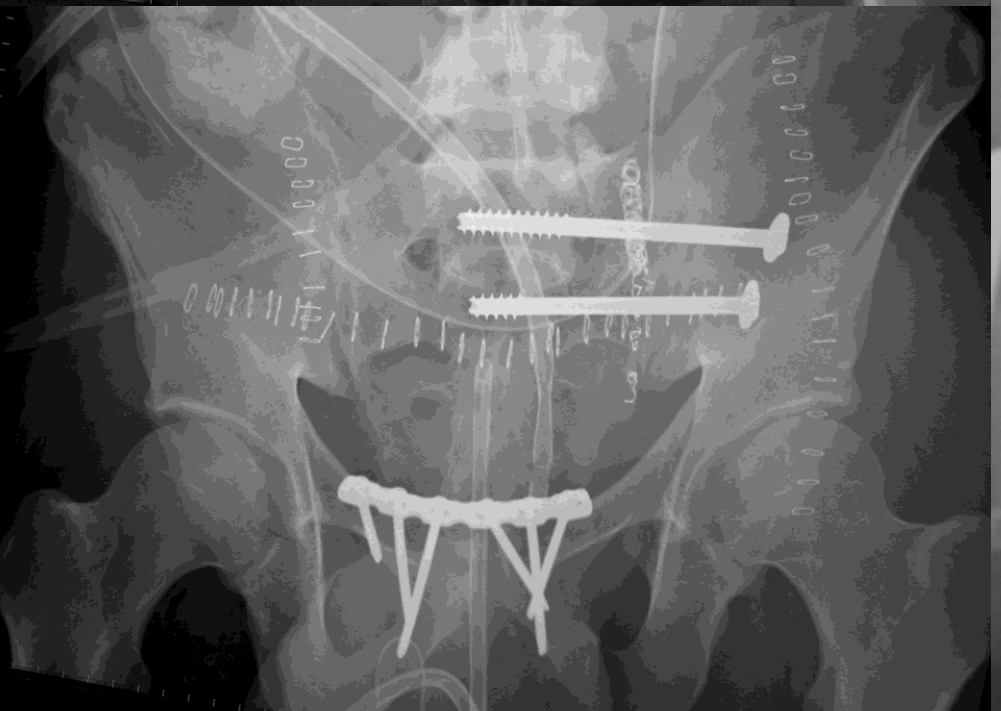

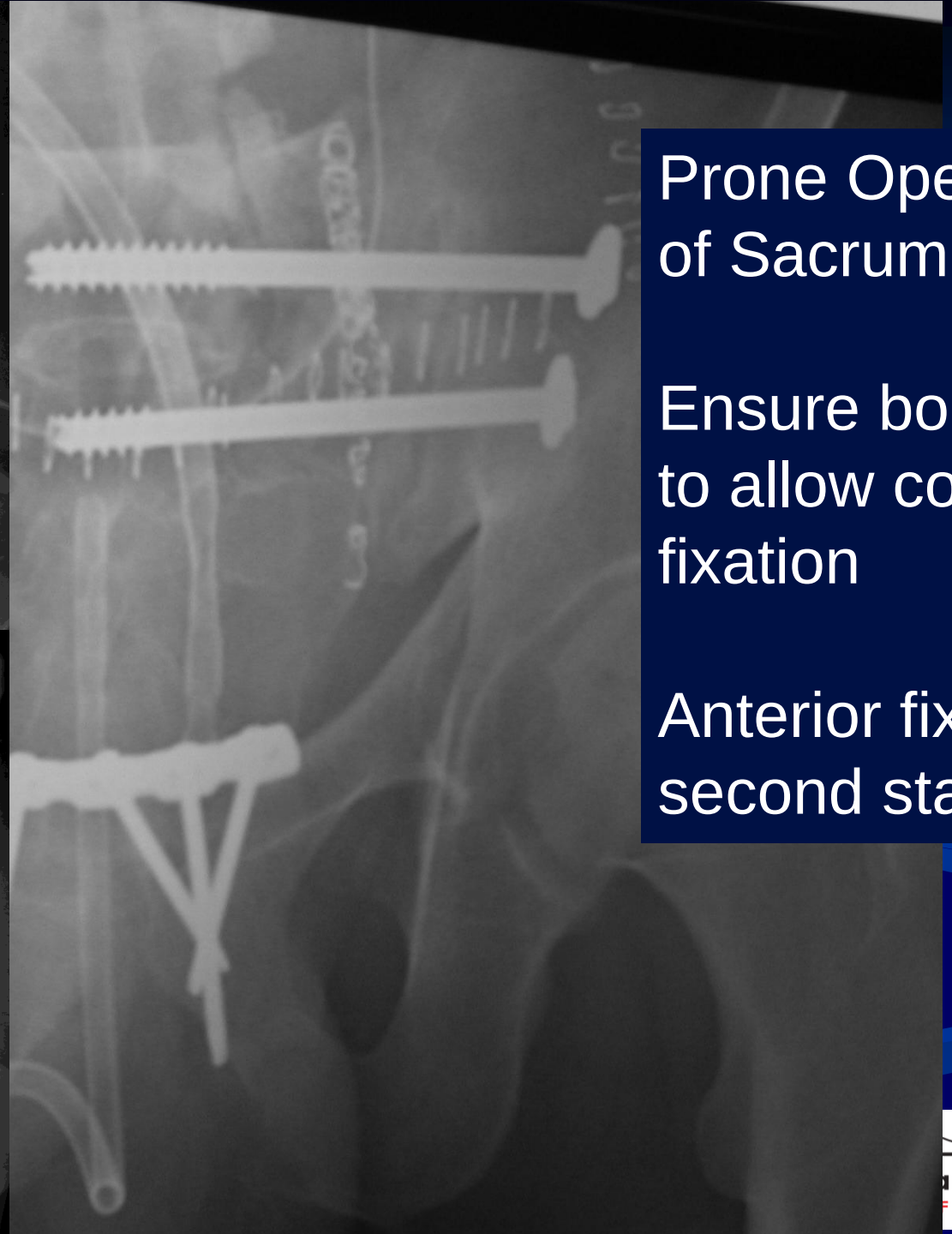

Prone Open Reduction of Sacrum

Ensure bony reduction to allow compression fixation

Anterior fixation in second stage

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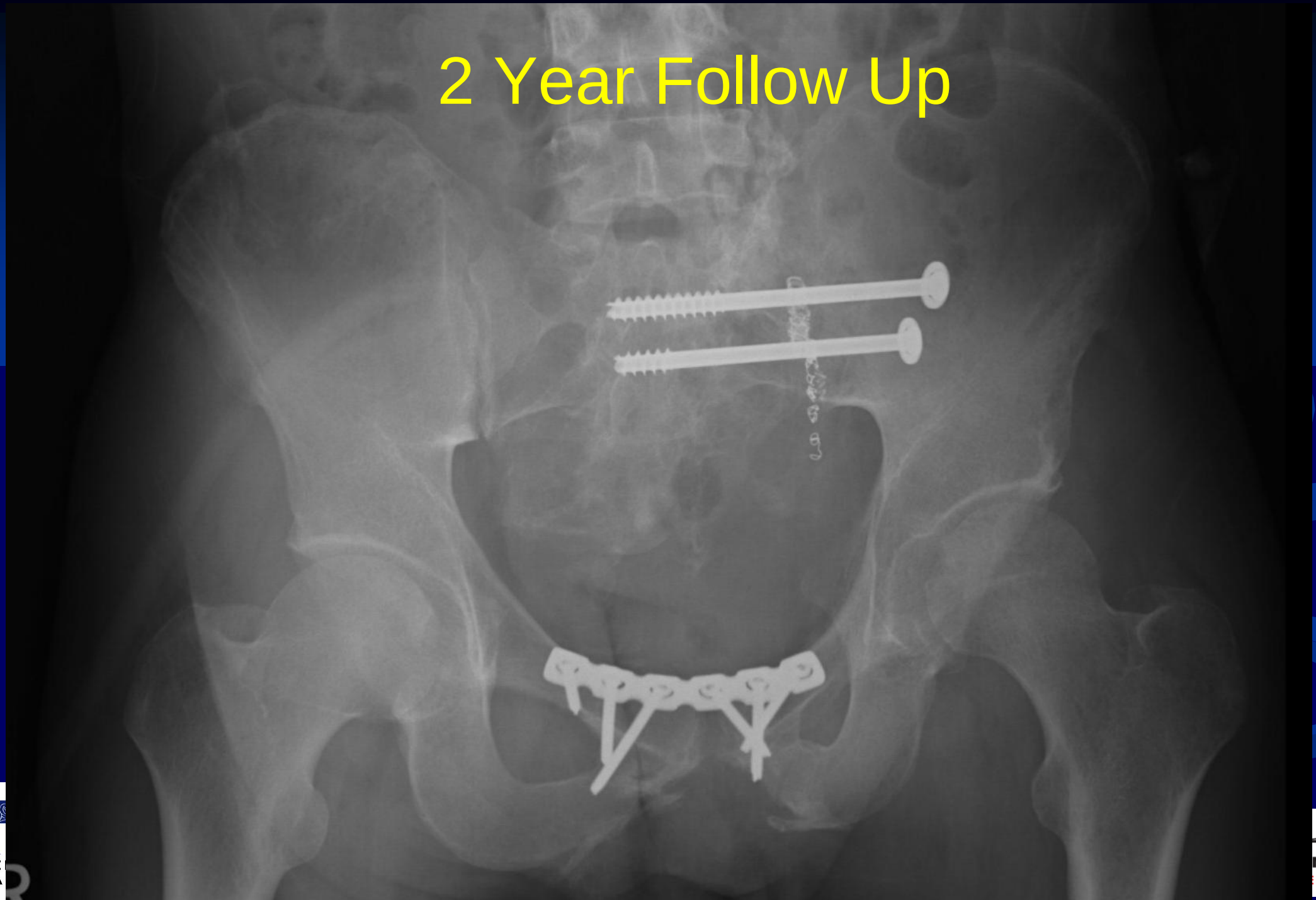
2 Year Follow Up



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Case 5

70 yo male

Struck by car

Hypotensive, tachycardic

Responds initially to fluids and blood

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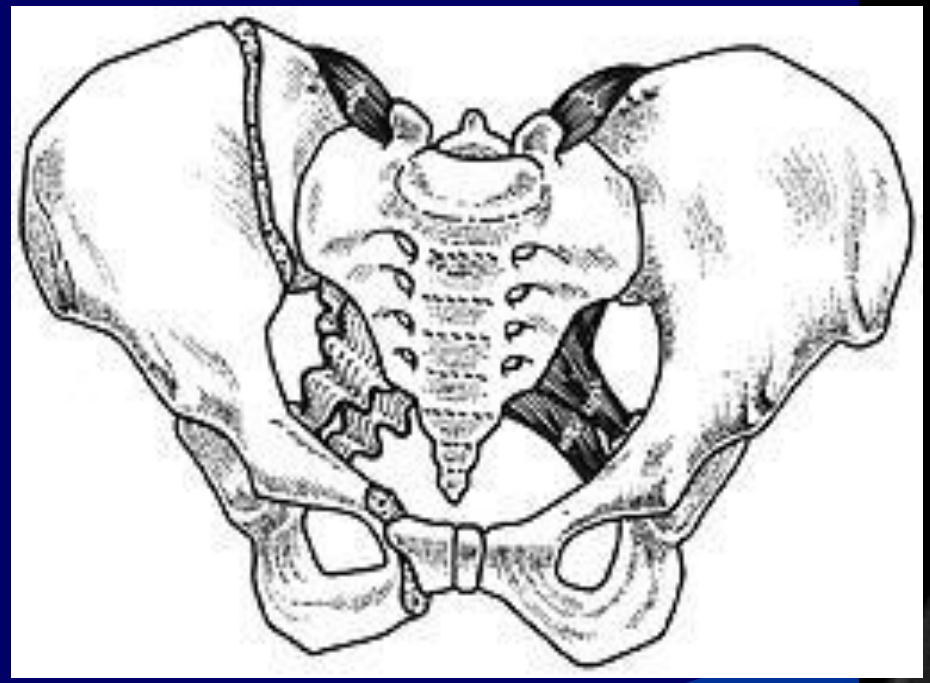
Lateral Compression

Hemipelvis Internal Rotation

Compressive Failure of Anterior Pelvic Ring

Increased incidence of head, neck, visceral injuries



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After initial response, BP trends downward. Responds again to blood but only to SBP 100

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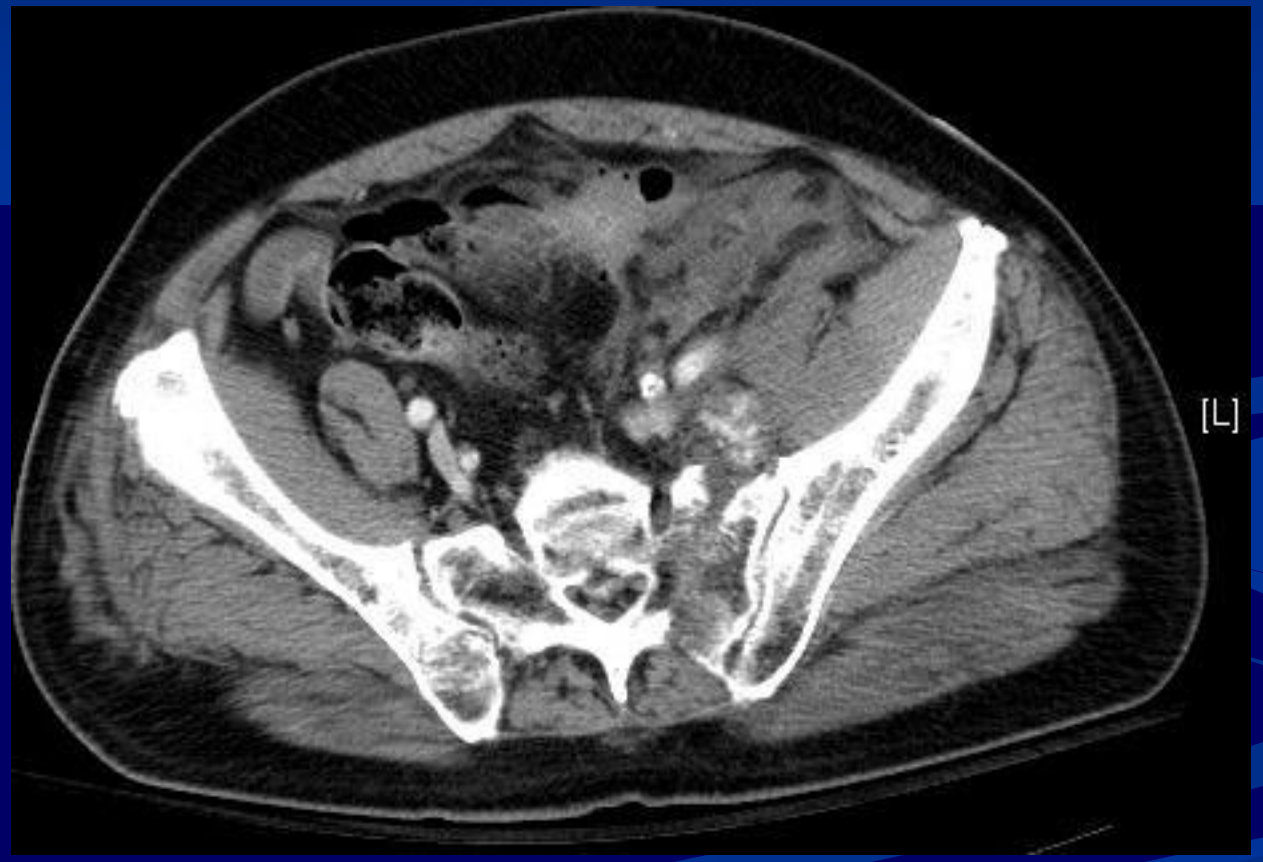
Contrast CT scan to rule out intraabdominal injury



Contrast Extravasation Highly predictive for rapid arterial bleeding
D Stephen JT 1999

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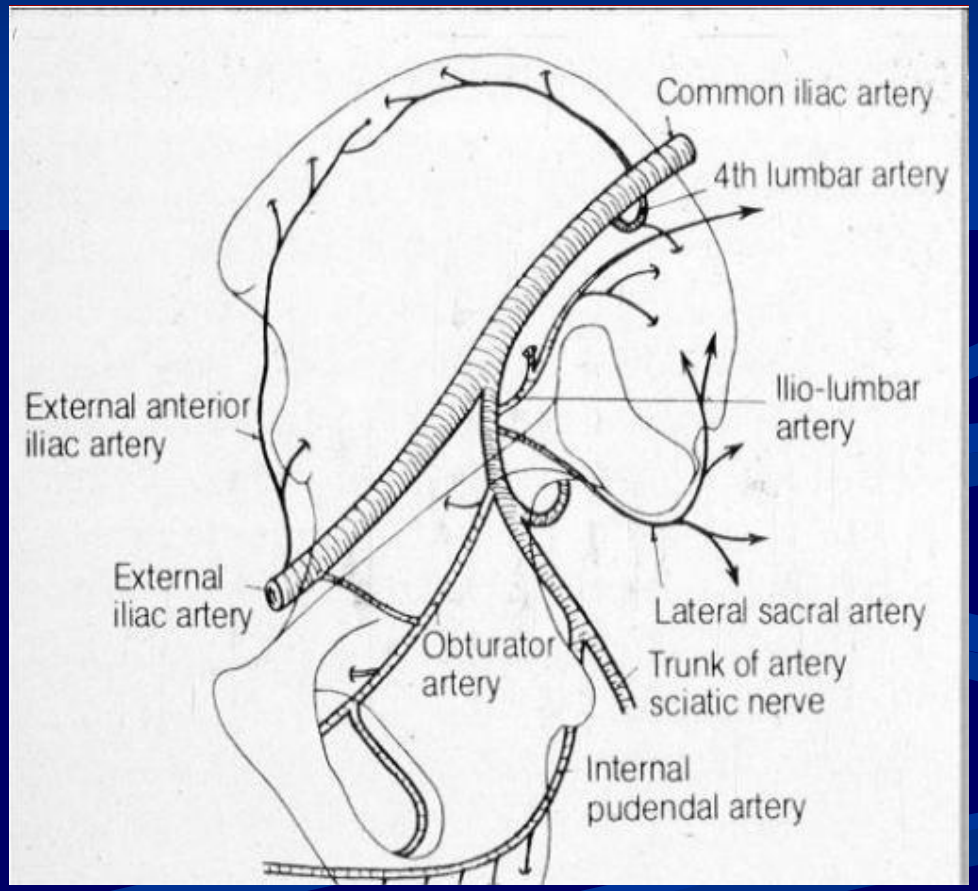
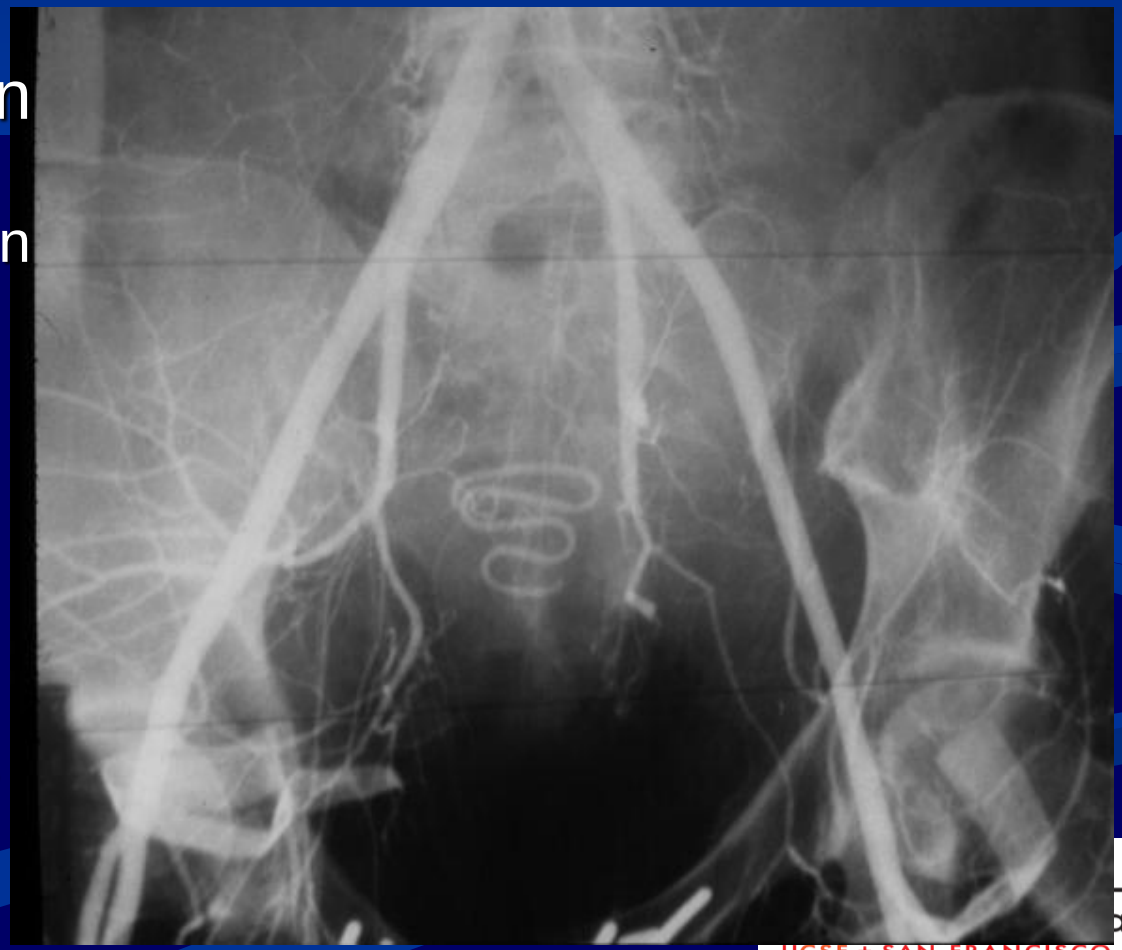
Most common arterial injuries

- Branches of Internal Iliac
  - Superior gluteal
    - Displacements through sacrum SI joint or greater notch
  - Obturator
    - Displacements through obturator canal



Angiographic Embolization

- Nonresponders
- Persistent Hypotension
  - Fluid resuscitation
  - Mechanical Stabilization
- High risk displacements
  - Greater sciatic notch (SGA)
  - Obturator canal
- Mechanically stable pelvic ring with hemodynamic instability



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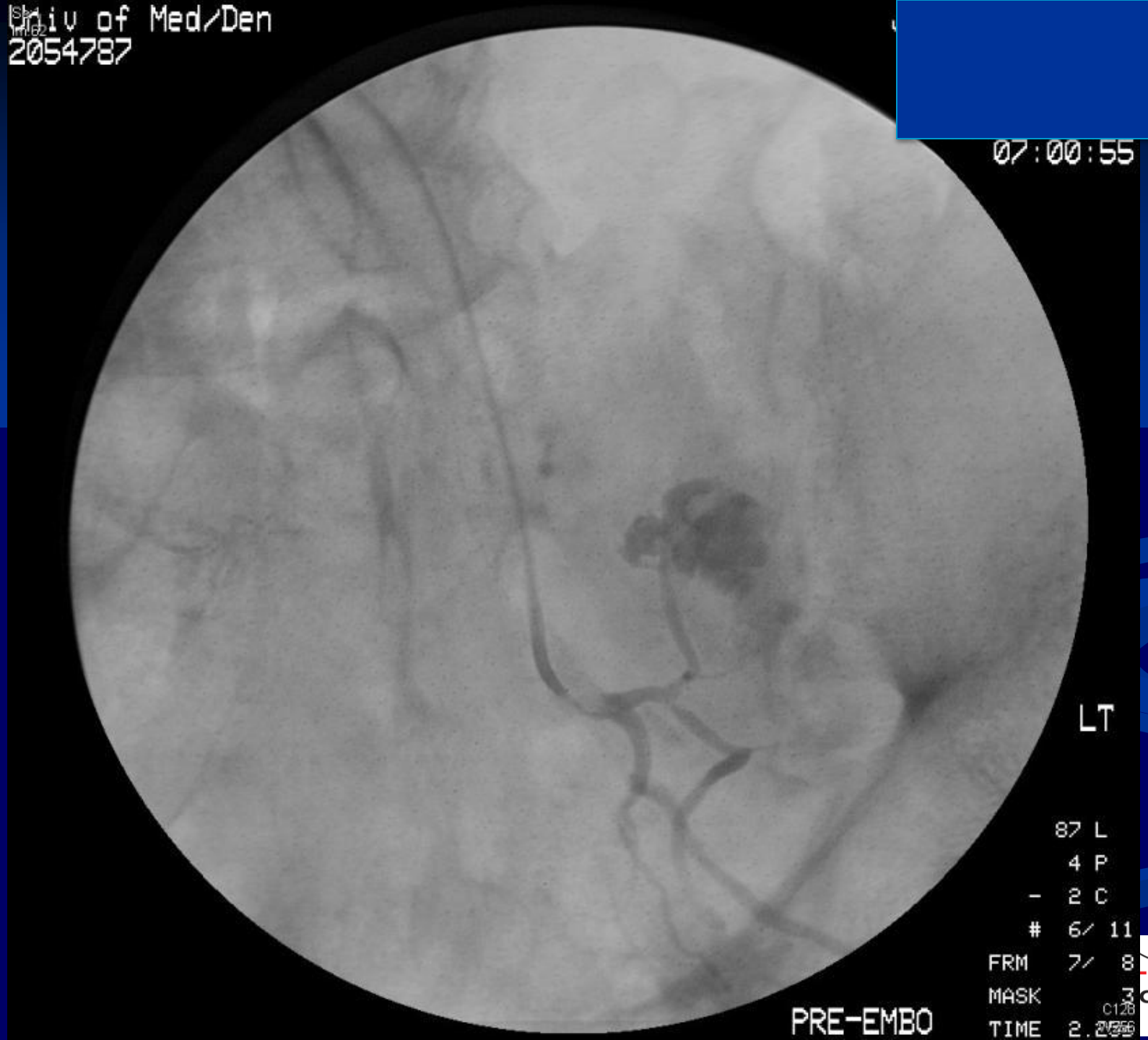

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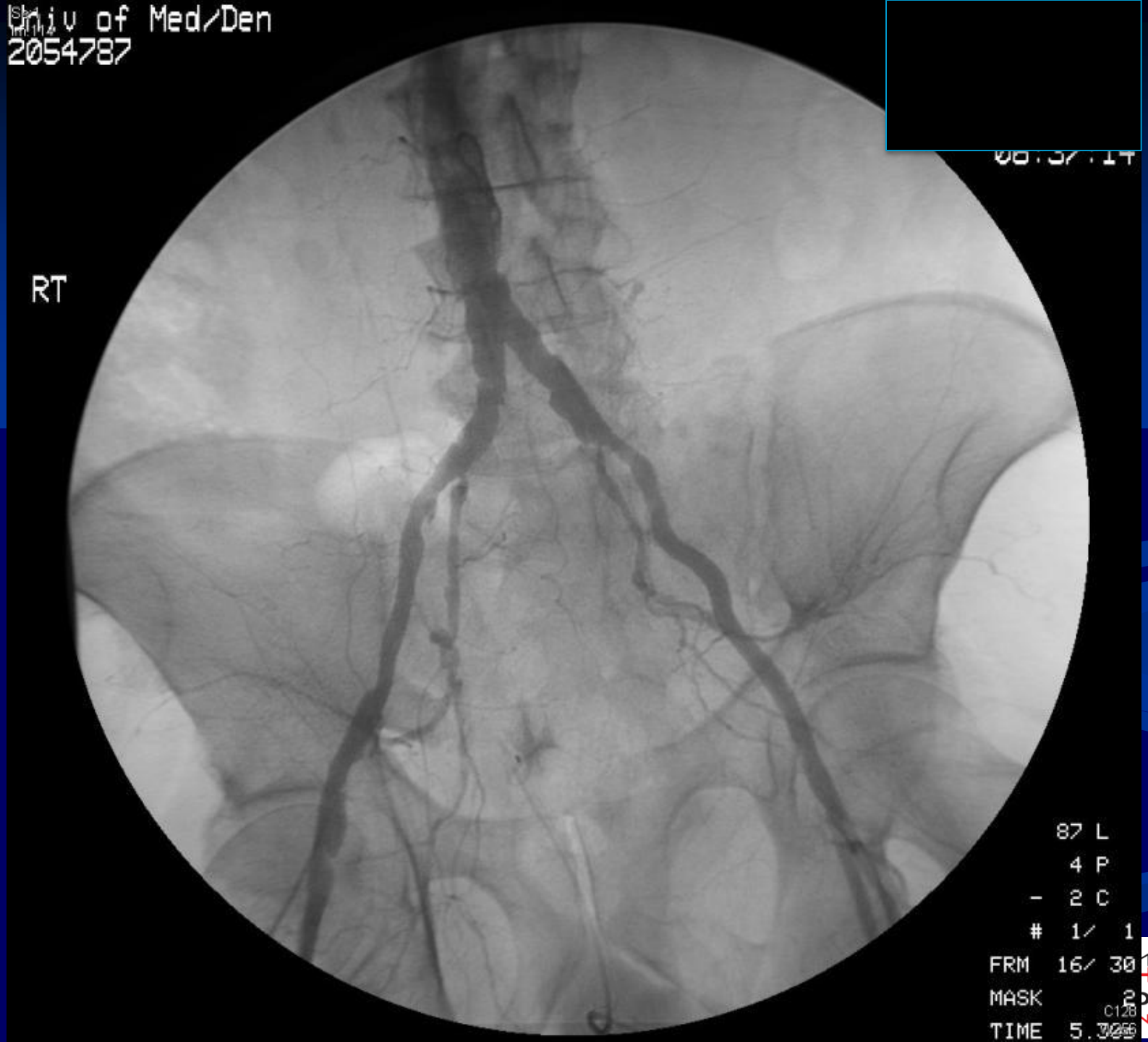

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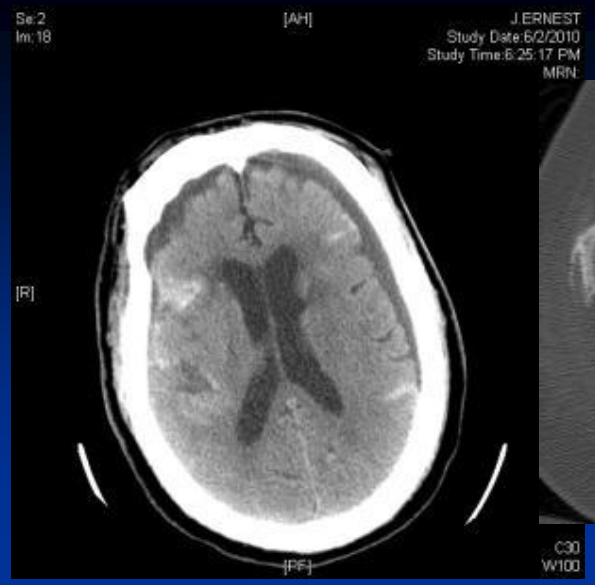
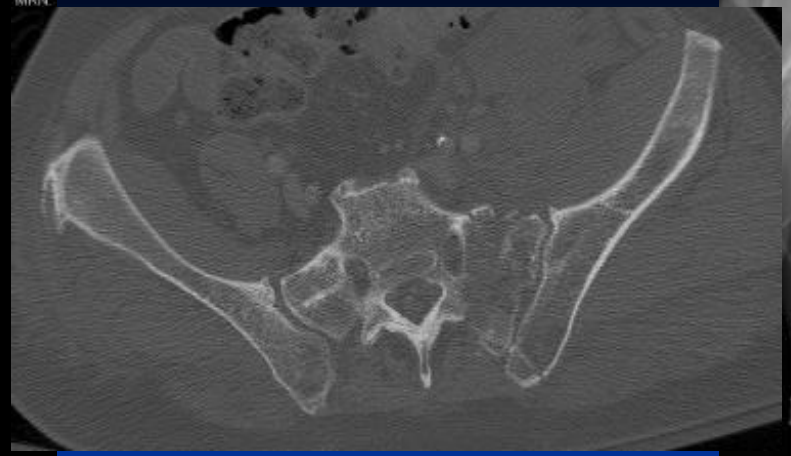
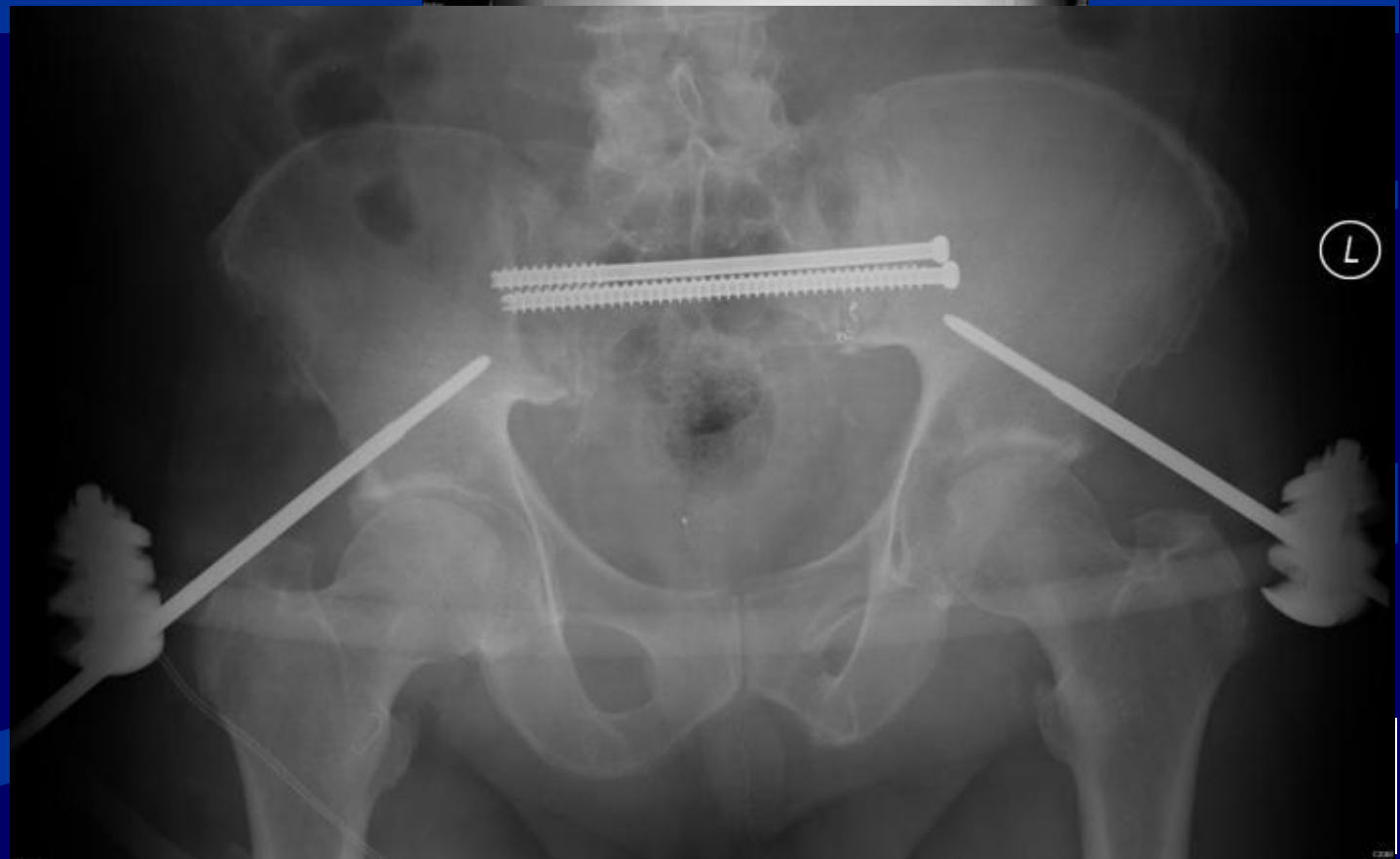




Definitive Treatment?

When to remove ex-fix?



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