

Diagnosing and Managing Acute Pelvic Instability

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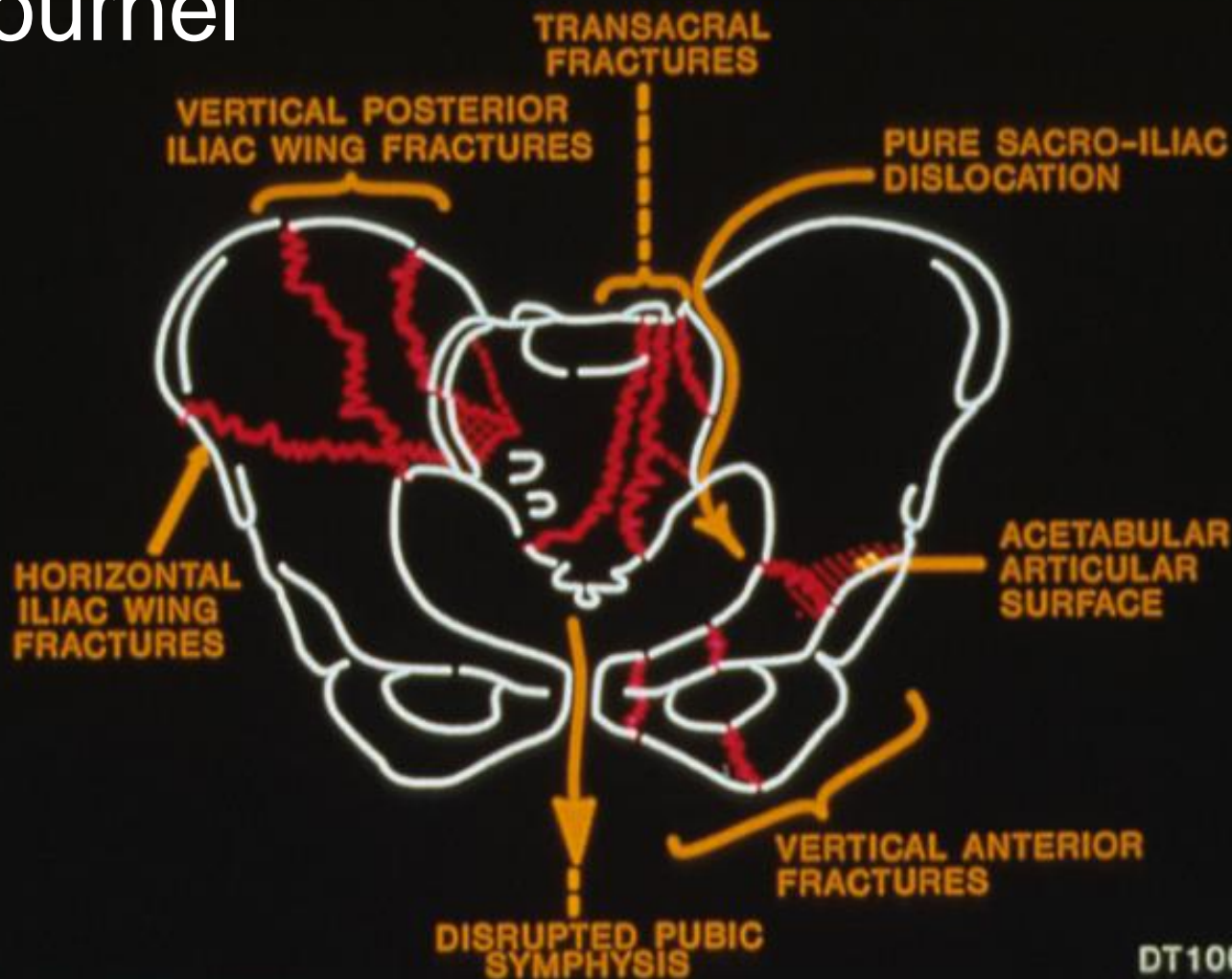
Duke University Health System

Disclosures

No Disclosures relevant to this presentation

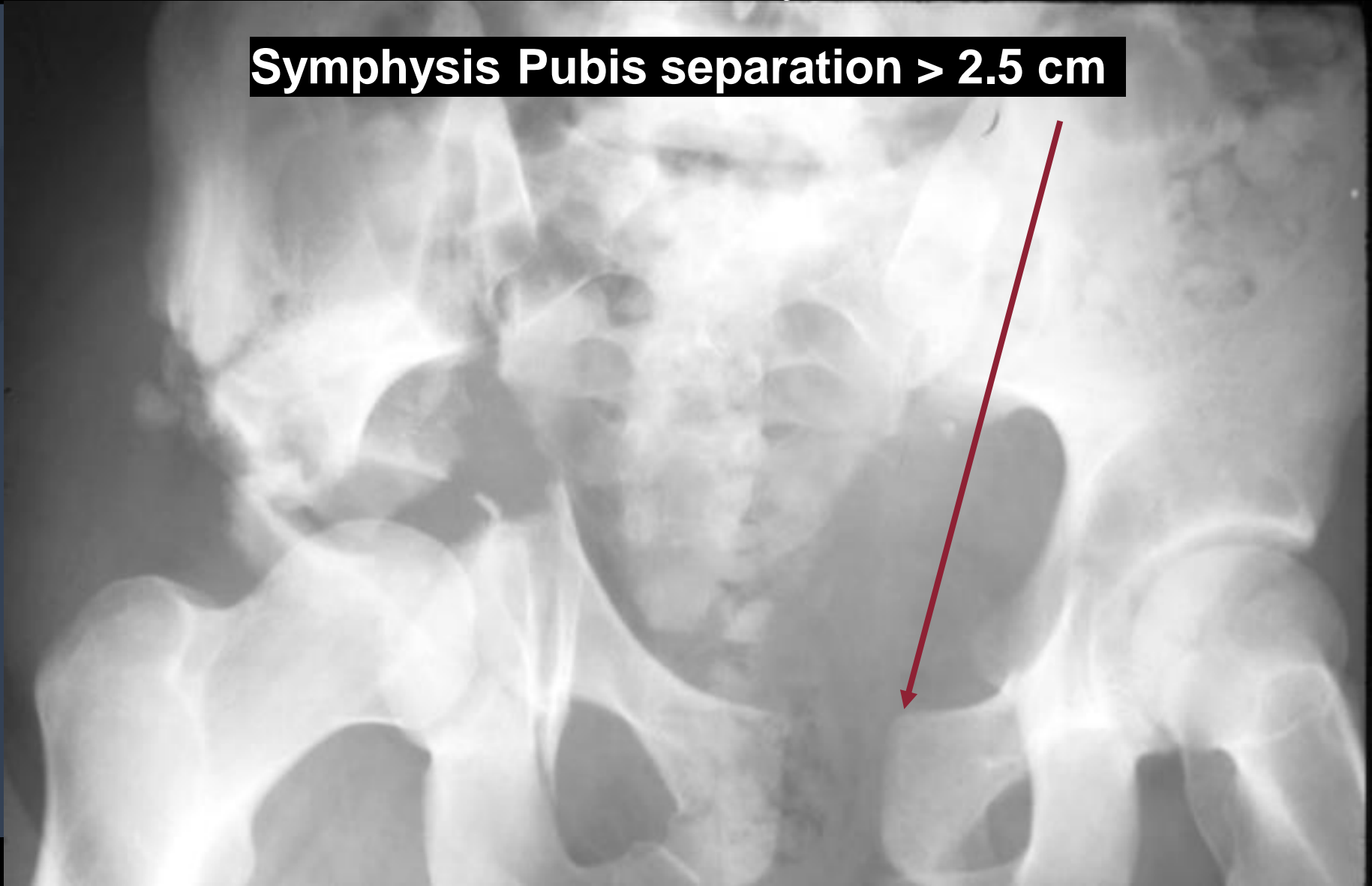
Assessment of Pelvic Stability

Letournel



Radiographic Signs of Anterior Pelvic Instability

Symphysis Pubis separation > 2.5 cm



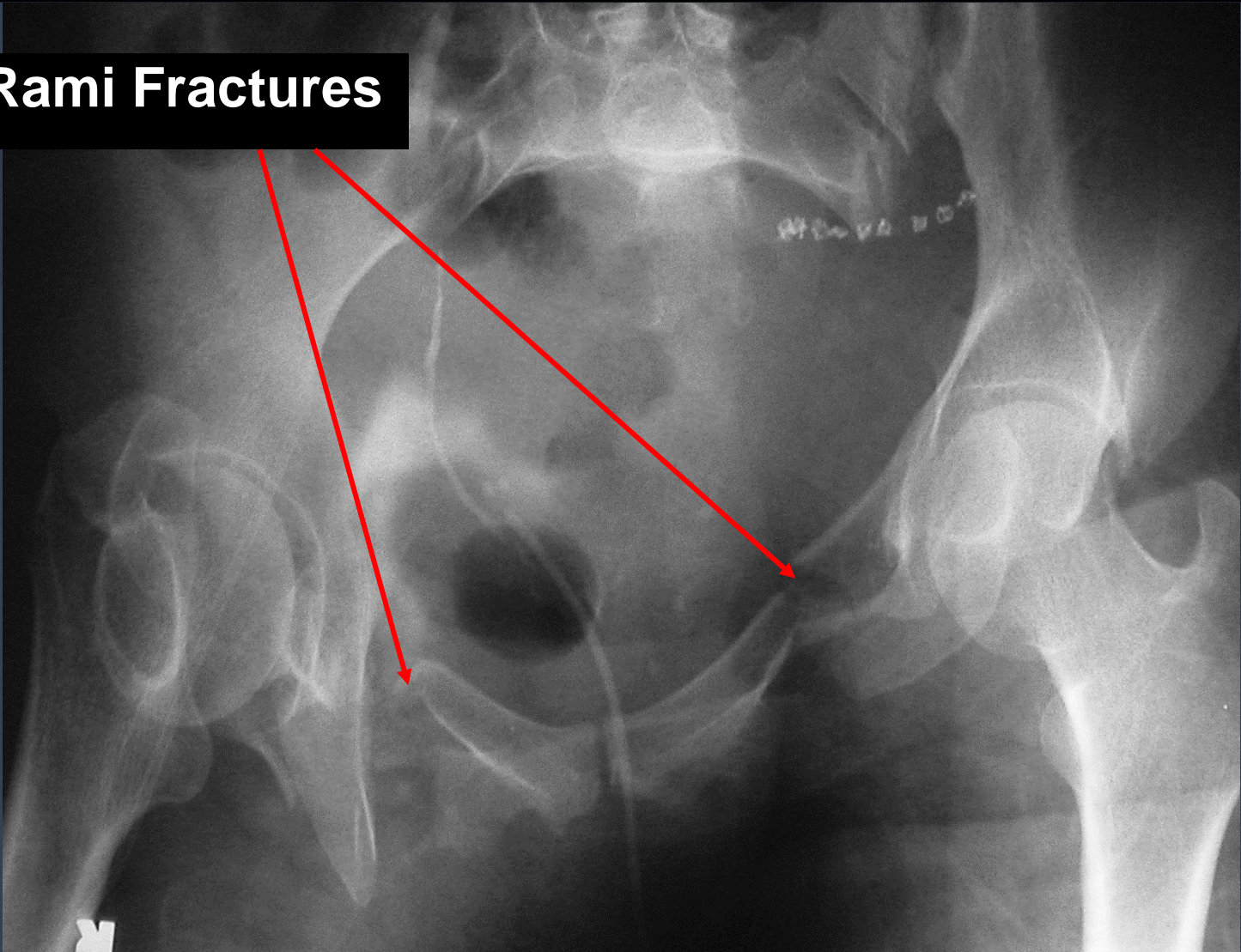
Radiographic Signs of Anterior Pelvic Ring Instability

Acetabulum Fracture



Radiographic Signs of Anterior Pelvic Ring Instability

Pubic Rami Fractures



Radiographic Signs Of Pelvic Instability

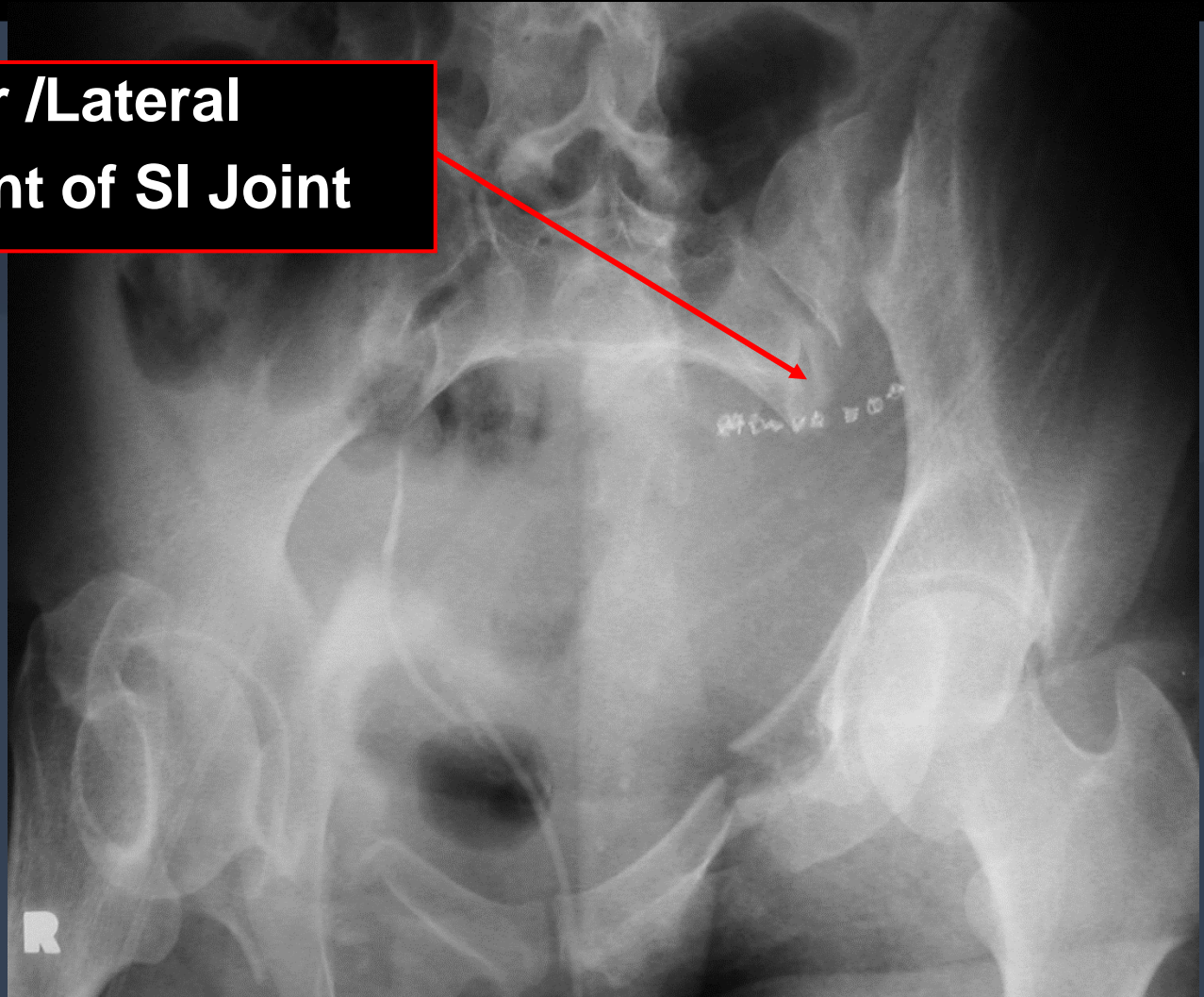
Rotational Instability –

Posterior SI ligaments and /or Pelvic floor ligament intact



Radiographic Signs of Posterior Pelvic Ring Instability

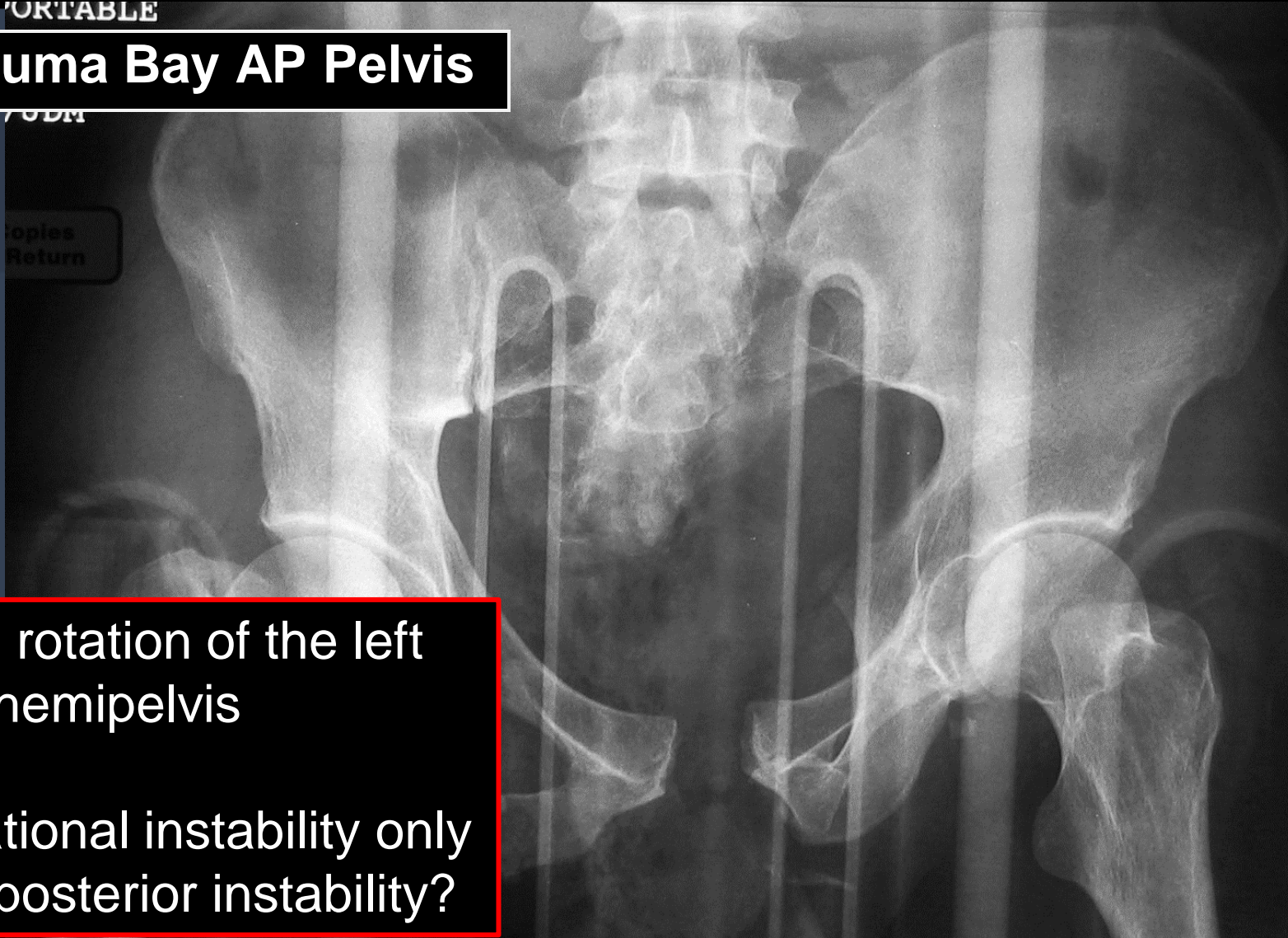
**Superior /Lateral
Displacement of SI Joint**



Radiographic Signs of Posterior Pelvic Ring Instability

PORTABLE
70DM
copies
Return

Initial Trauma Bay AP Pelvis



External rotation of the left hemipelvis

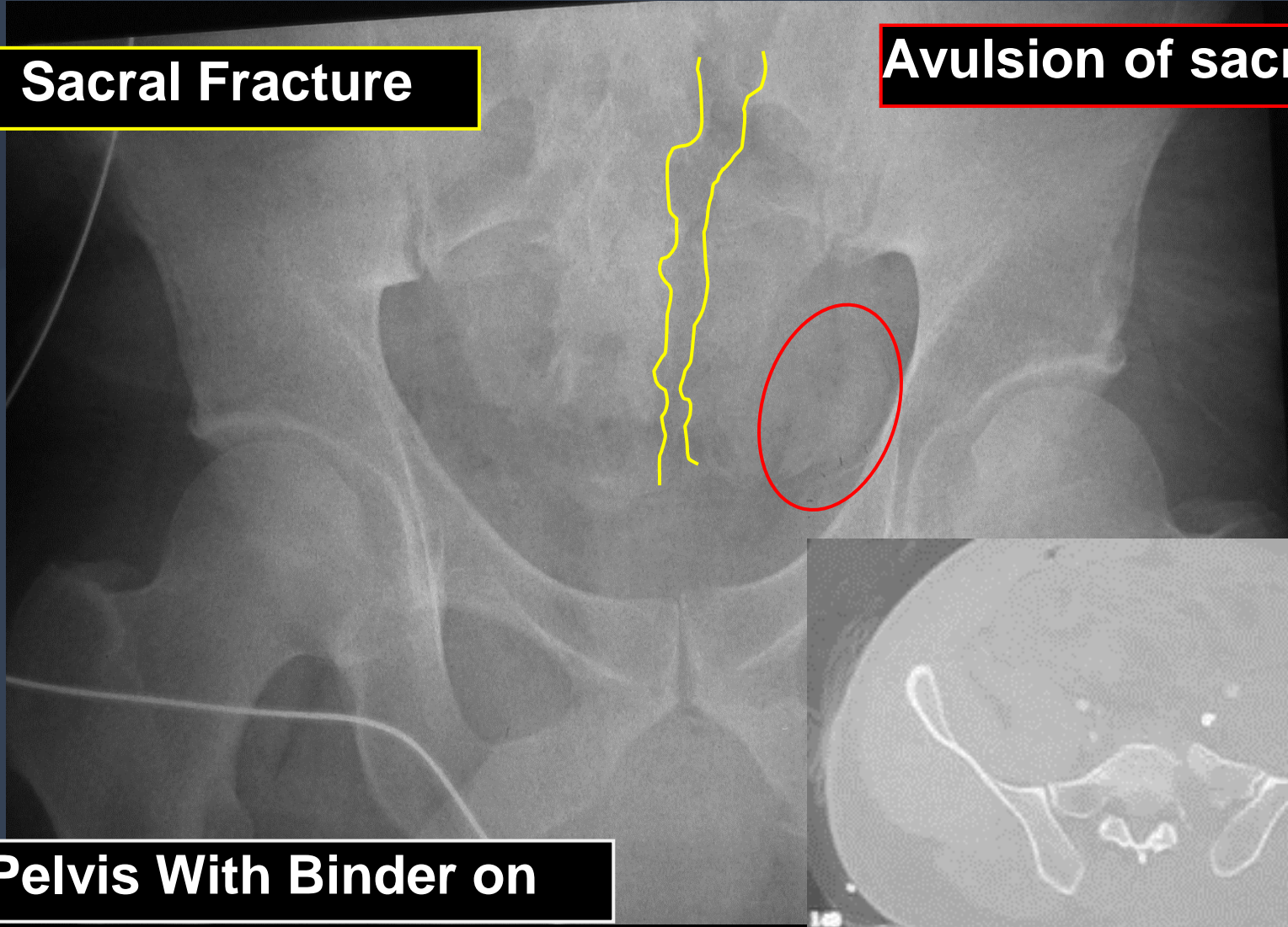
Is this rotational instability only or global posterior instability?

Radiographic Signs of Posterior Pelvic Ring Instability

Sacral Fracture

Avulsion of sacrum

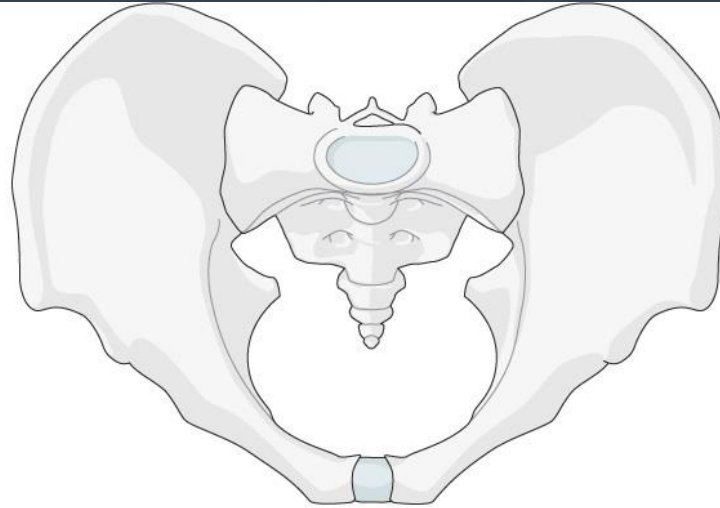
AP Pelvis With Binder on



Classification & Indications for Surgery

OTA/AO Classification

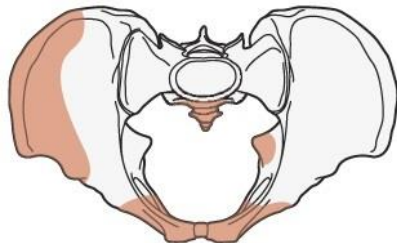
Location: Pelvis, **pelvic ring** 61



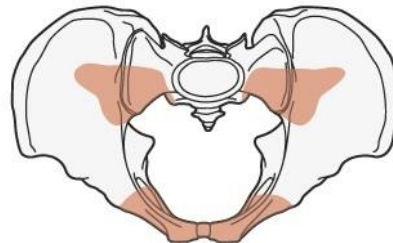
Non-Operative

Types:

Pelvis, pelvic ring, **intact posterior arch**
61A

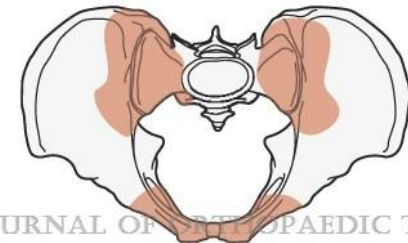


Pelvis, pelvic ring, **incomplete disruption of posterior arch**
61B



Operative

Pelvis, pelvic ring, **complete disruption of posterior arch**
61C

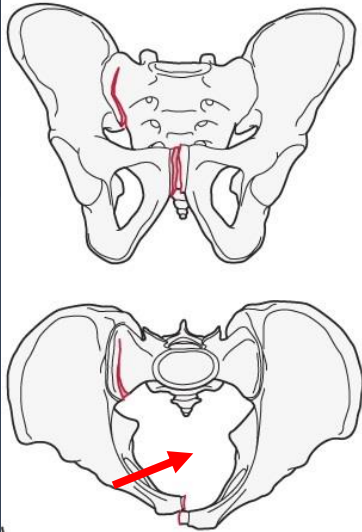


Classification & Indications for Surgery - 61B2

Subgroups:

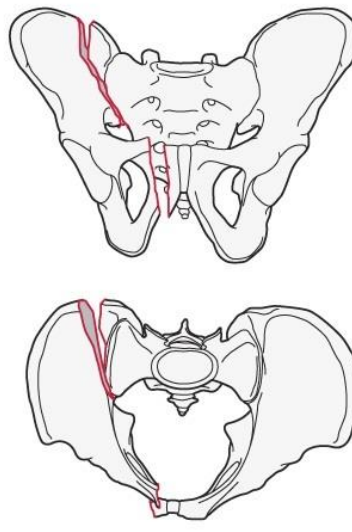
Lateral compression fracture of the sacrum with internal rotation instability (LC1)

61B2.1*



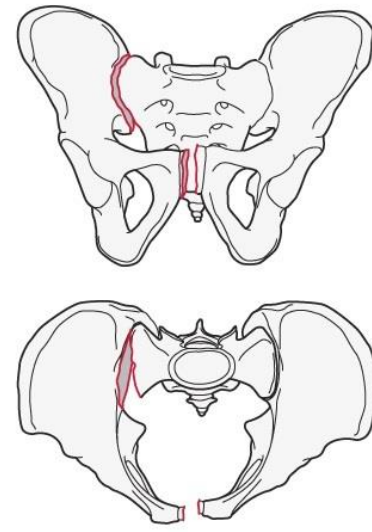
Lateral compression fracture of the ilium (crescent) with internal rotation instability (LC2)

61B2.2*



Open book or external rotation instability (APC2)

61B2.3*



Do 61B2.1
(LC1) need
fixation?

Operative with
Posterior Ring
displacement

Operative with
>2 cm diastasis

Is Early Weight Bearing OK in LC1 Injuries?

118 patients with LC1 pelvic ring injury

Less than 10mm displacement

Allowed to mobilize and advance weight bearing as tolerated

1 patient failed non-op care and required operative care

Sembler-Soles JOT 2009



Is Early Weight Bearing OK in LC1 Injuries?

117 patients with LC1 pelvic ring injury

Less than 5 mm displacement at time of injury

Allowed to advance weight bearing as tolerated

TABLE 2. Rates of Displacement Observed With Combined Pelvic Fracture Characteristics*

Characteristic	Total Number	Number of Displaced	Rate of Displacement
Incomplete sacral fracture + none or unilateral rami fracture	54	0	0%
Incomplete sacral fracture + bilateral rami fractures	22	2	9%
Complete sacral fracture + no rami fracture	2	0	0%
Complete sacral fracture + unilateral rami fracture	17	6	33%
Complete sacral fracture + bilateral rami fractures	22	15	68%

*Rami fractures include ipsilateral and contralateral injuries to the sacrum.

Does Iliosacral Screw Fixation Improve Pain in LC1 Injuries?

194 patients with LC1 injuries in multi-center study
Surgeon determined Operative fixation or Non-op care
No Difference in Pain at 6 or 12 weeks

Tornetta et al JOT 2019



Retrospective review found small differences
only in pain related scores with operative
care in LC1 injuries

Hagen et al CORR 474 2016



Orthopaedic Trauma Institute
UCSF + SAN FRANCISCO GENERAL HOSPITAL

ORIGINAL PAPER



Patients with LC1 injury unable to ambulate > 5 ft by HD#2 taken to OR for Stress EUA

Case	Age	Sex	Mechanism	Complete sacral fracture	Rami	Displacement on LSP (%)	Feet	Time (day)	Investigation	Control Groups
1	72	M	None
...	20 (day 2)	S1 TSTI	None
...	40 (day 2)	S2 SI	Rami screw
...	100 (day 1)	S2 TSTI	Rami screw
...	70 (day 1)	S2 TSTI	Rami screw

Table 3 Patients with displacement on lateral stress radiographs treated under mobilization protocol

Case	Age	Sex	Mechanism	Complete sacral fracture	Rami	Displacement on LSR (%)	Feet
1	72	M	C				
						(day 9)	S1 TSTI None
						20 (day 2)	S1 TSTI Rami screw
						40 (day 2)	S2 SI Rami screw
	88	F	T			100 (day 1)	S2 TSTI Rami screw

less radiograph, *TSTI* transacral transiliac, *SI* sacroiliac

Unstable Pelvic Ring Injuries

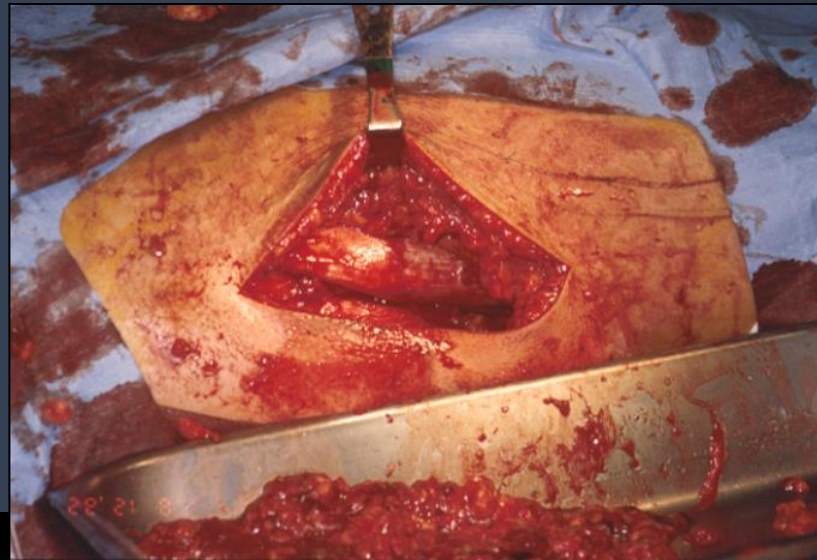
Now that we understand instability –

What does acute management look like?

After acute resuscitation – How do we approach definitive management?

Pre-operative Considerations

- Other injuries may dictate the positioning of the patient
 - Severe pulmonary/thoracic trauma
 - Unstable spine trauma
 - Severe soft tissue injuries (abrasion/contusion)
 - Associated degloving (i.e. Morel-Lavalle)



Preoperative Considerations

Associated injuries are common and treatment must be coordinated with other teams

General Surgery

Urology, Neurosurgery

Combined injuries may require exploratory laparotomy



Pre-operative Considerations

What Reduction and Fixation is needed for the patient?

Open or Closed reduction?

Percutaneous or open fixation?

Is the patient stable for definitive fixation?

Case Presentation

29 yo male - MVC

Hypotension upon arrival in ED

FAST exam negative

Binder applied

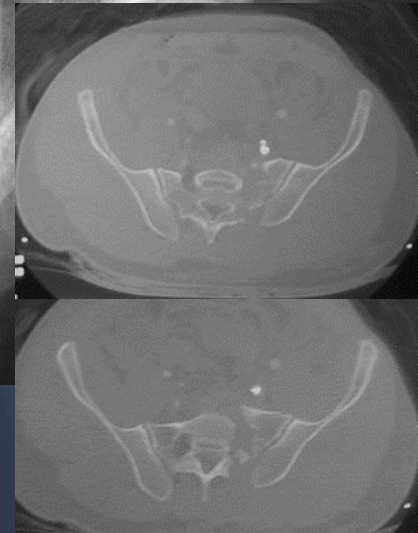
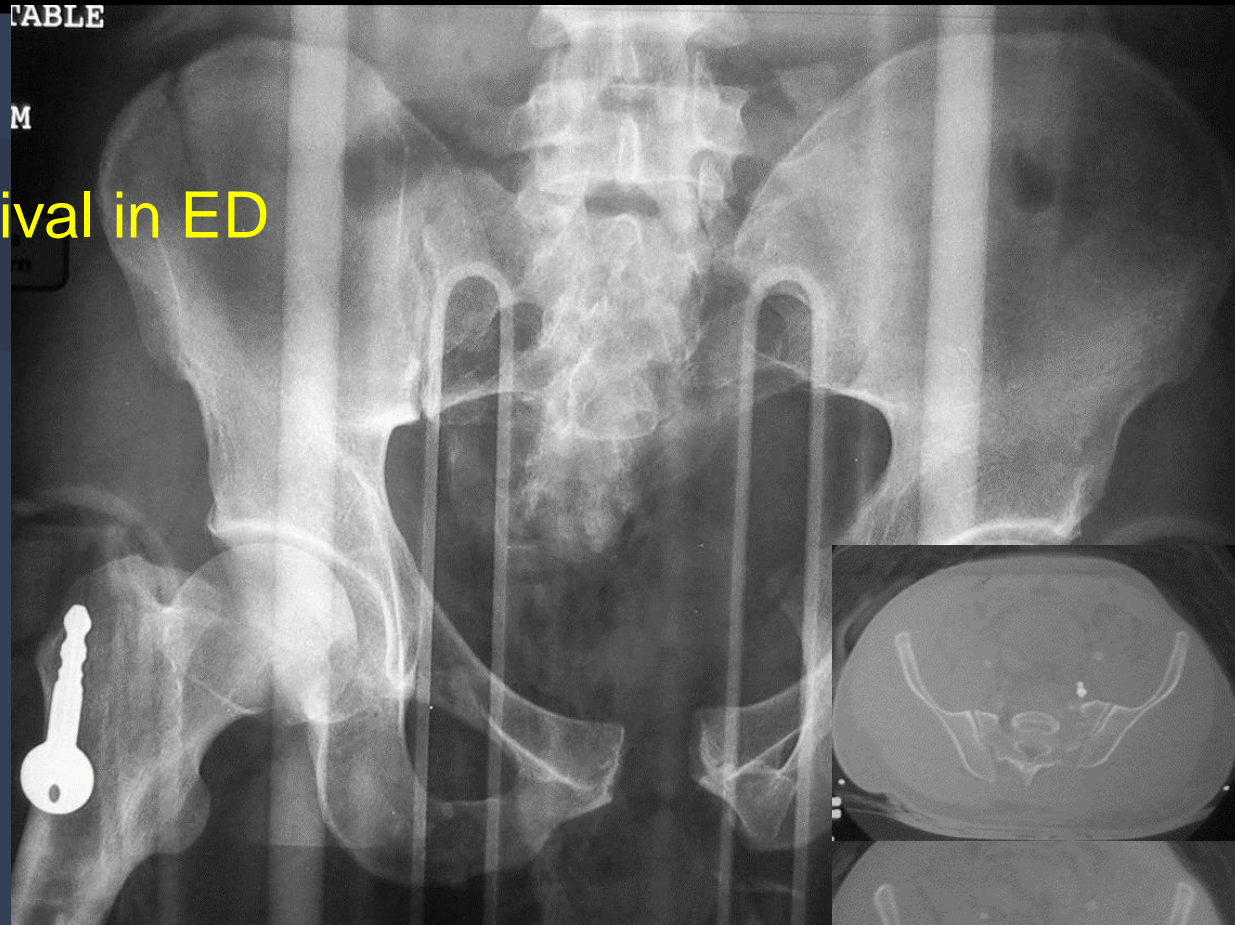
CT-bladder rupture

Angiography

OR – S/P tube

External Fixation

TABLE

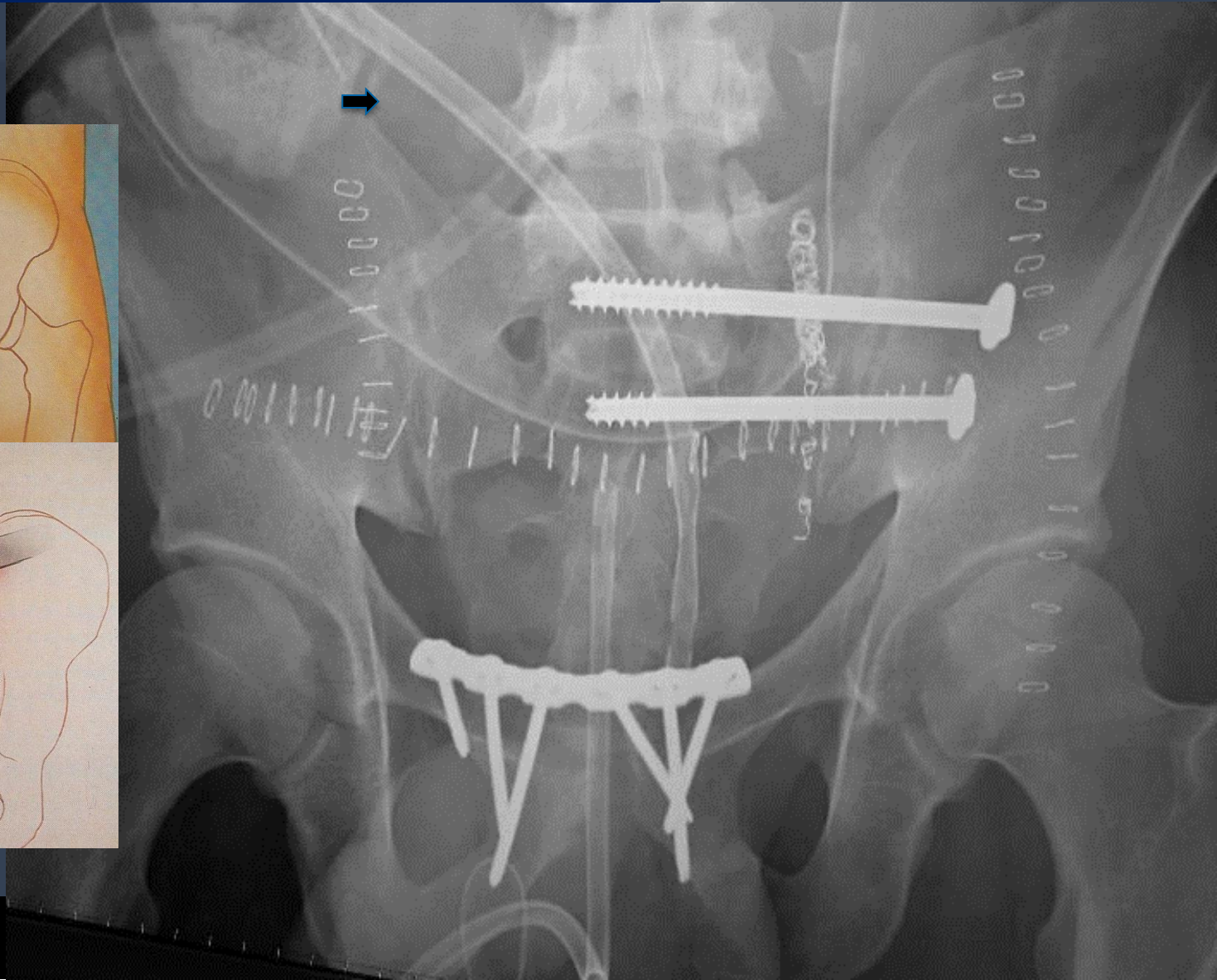
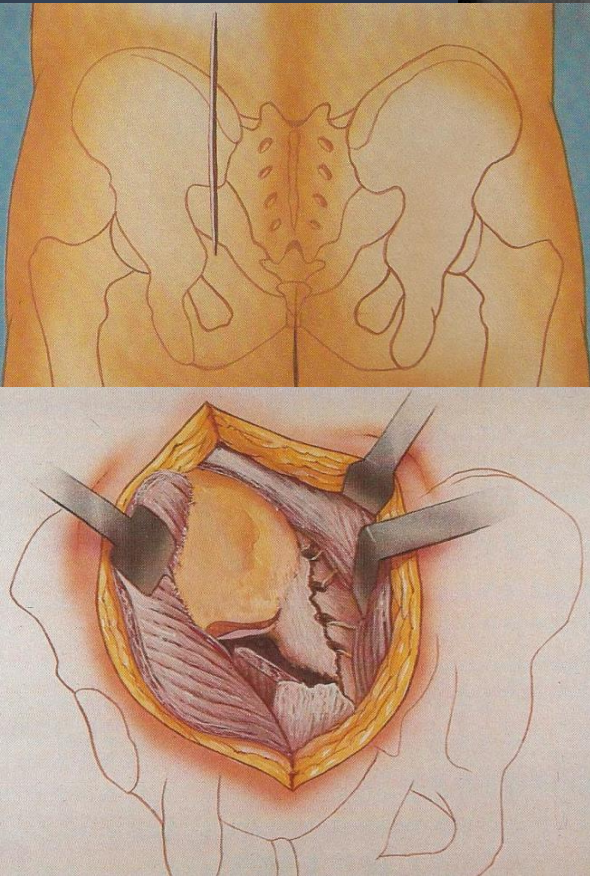


Temporizing External Fixation Globally Unstable – 61C



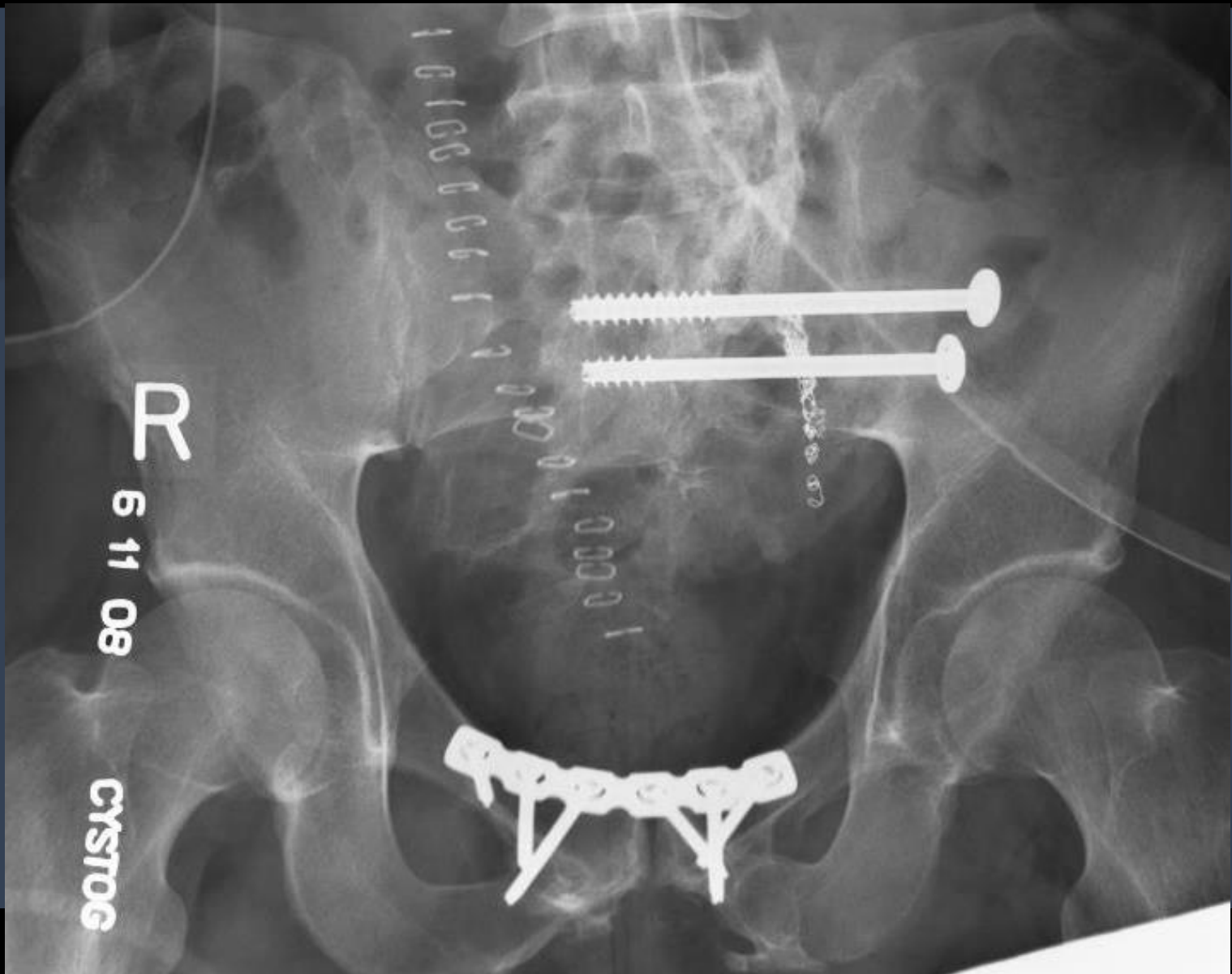
Approach the
posterior injury first

Open reduction Sacrum (prone) Open reduction Symphysis (supine)





4 Year F/U



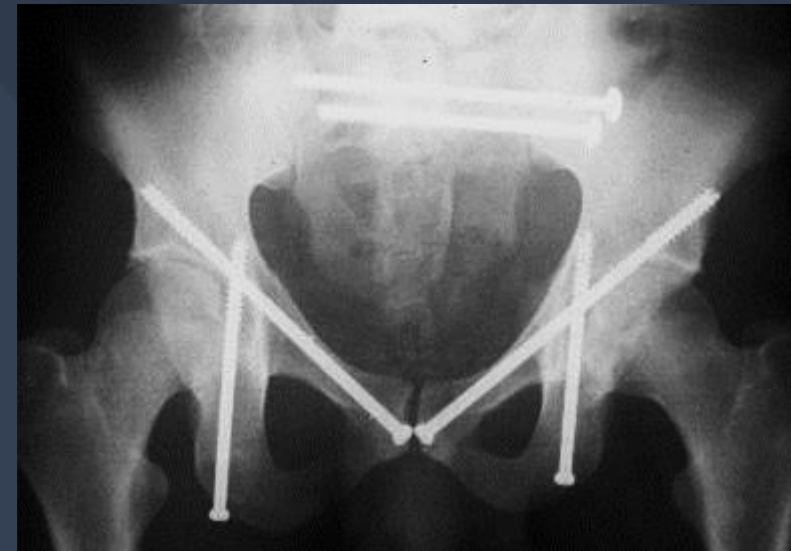
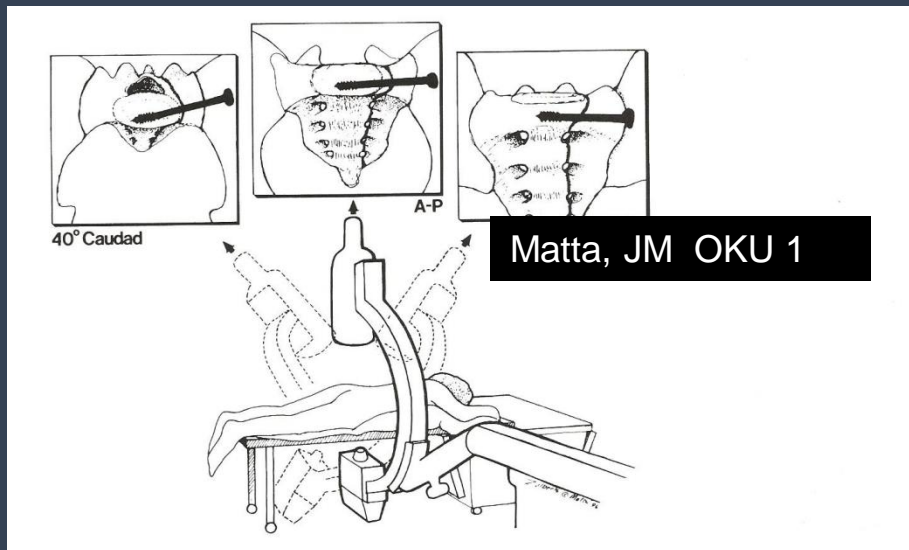
What has changed in the past 30 years?

1) Changes in Timing of Fixation

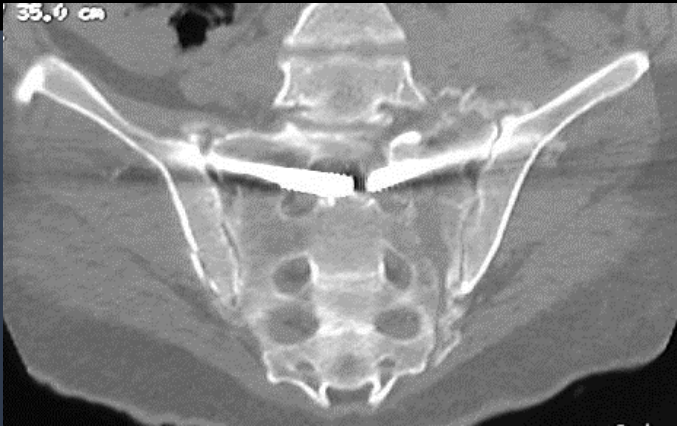
Pelvic fracture care practiced in referral centers

Pelvic fracture care is common in most trauma centers

2) Advances in percutaneous fixation techniques



Understanding of the effect of malreduction on the safe placement of iliosacral screw fixation



The Effect of Sacral Fracture Malreduction on the Safe Placement of Iliosacral Screws

*Mark C. Reilly, *Christopher M. Bono, †Behrang Litkouhi, *Michael Sirkin, and
*Fred F. Behrens

**Department of Orthopaedic Surgery, New Jersey Medical School, Newark, New Jersey, and †Manhattan College, School of Engineering, Bronx, New York, U.S.A.*

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Improved understanding of the “Osteology” variations of sacral morphology

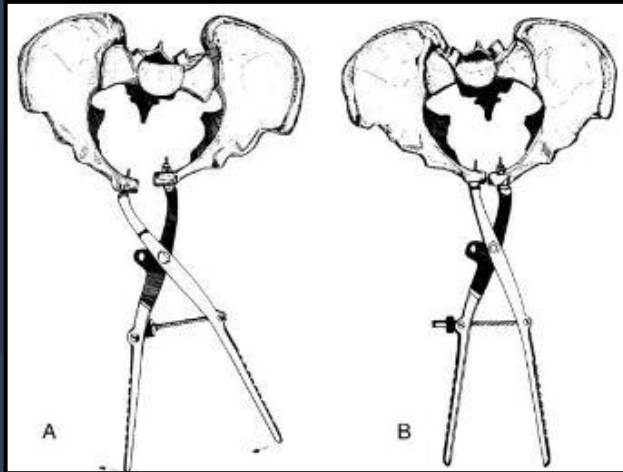


Anatomic Determinants of Sacral Dysmorphism and Implications for Safe Iliosacral Screw Placement.

Kaiser, Scott; Gardner, Michael; Liu, Joseph; Routt, ML; Morshed, Saam; MD, PhD

Closed Reduction Adjuncts

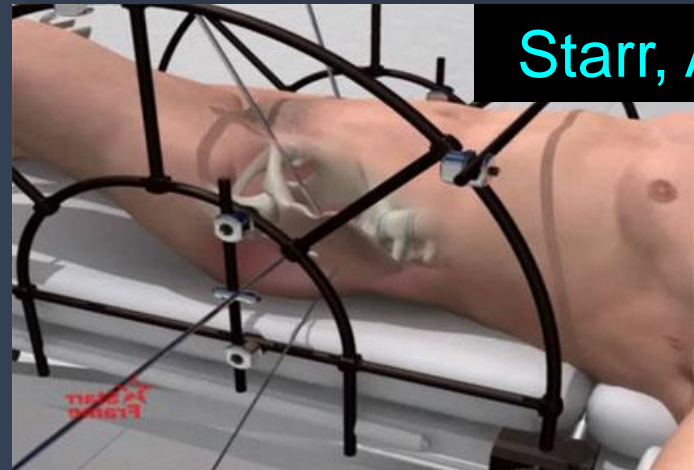
Matta, JM



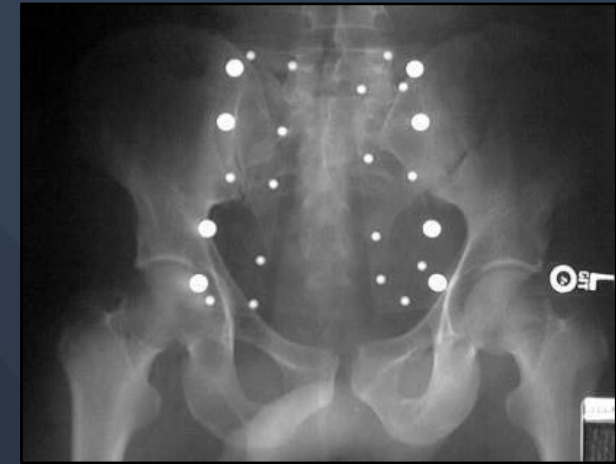
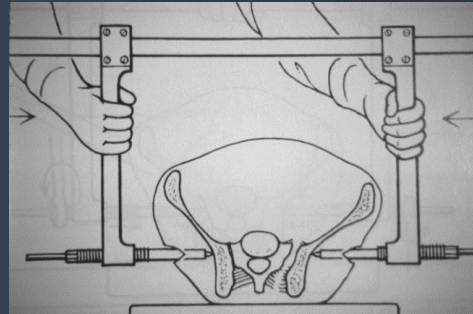
Tornetta, P & Matta, JM CORR 1996



Starr, A



Pelvic Binder/Clamp As a Reduction Tool

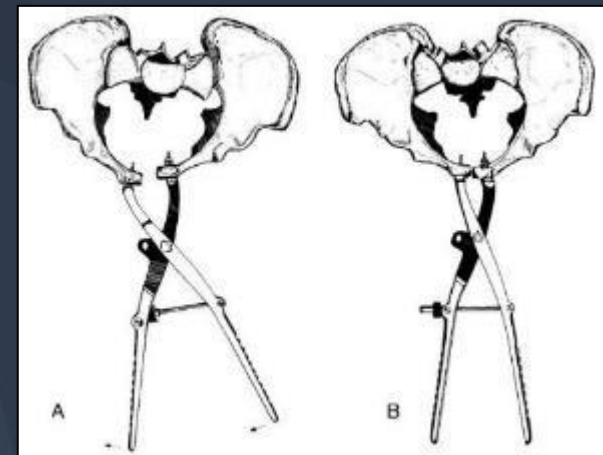


A pelvic clamp – like a pelvic binder - can be an excellent reduction tool for a disrupted pelvic ring

Each device has its own limitations for fixation

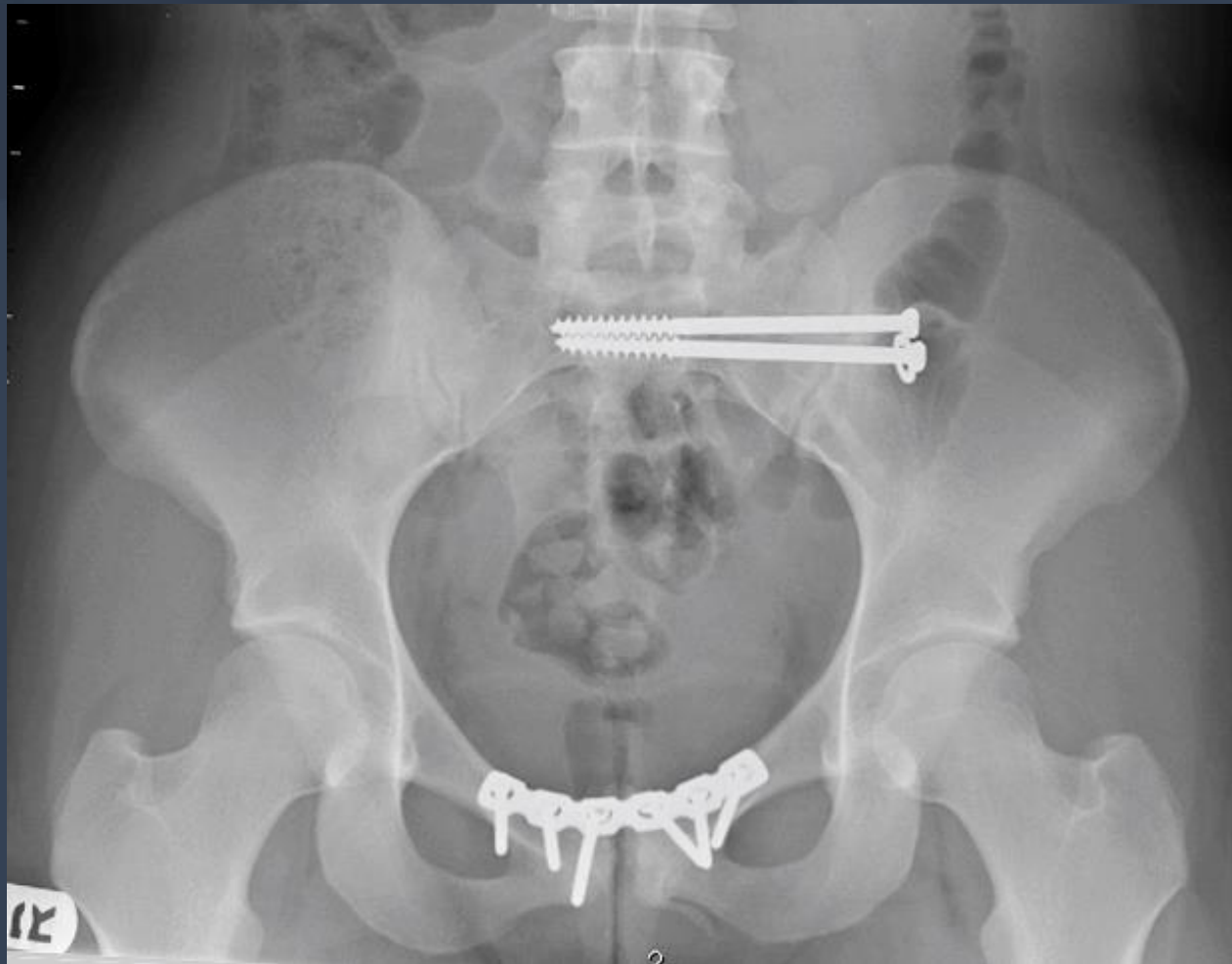
SI joint Dislocation and Pubic Symphysis Diastasis

The ideal case to start with anterior ring reduction



Tornetta, P & Matta, JM CORR 1996

Closed reduction of 61C1 injuries – approaching posterior ring first
Supine position – Iliosacral screw fixation,
Compared Closed Reduction and Open Reduction
Final displacement equivalent



Case Example

30 yo male

1 hour after motorcycle accident

initial vital signs:

blood pressure 90/60

heart rate 110



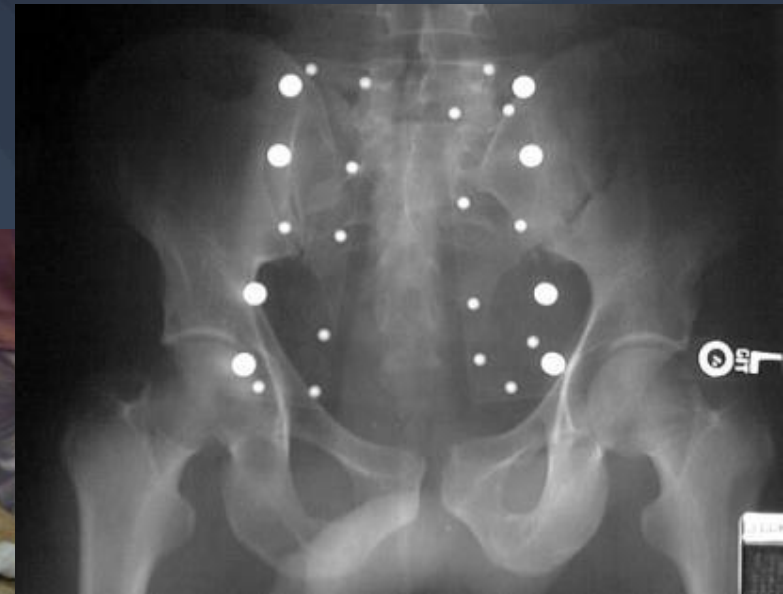
Case courtesy of Mark Reilly

Containment/Reduction of Pelvic Volume

Anti-shock sheeting



Commercial Binders



Containment/Reduction of Pelvic Volume

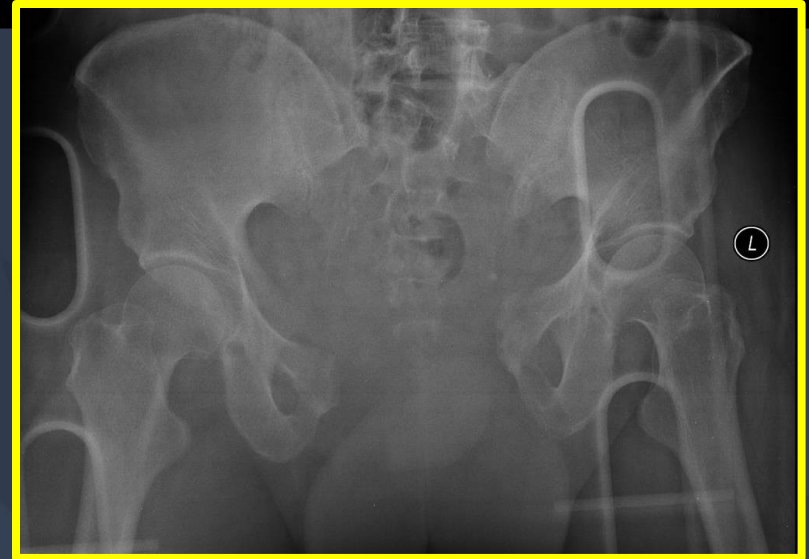
Easily Applied during resuscitation
Portable, Versatile
Convert to ExFix, ORIF

May hide injuries
Skin/Bone



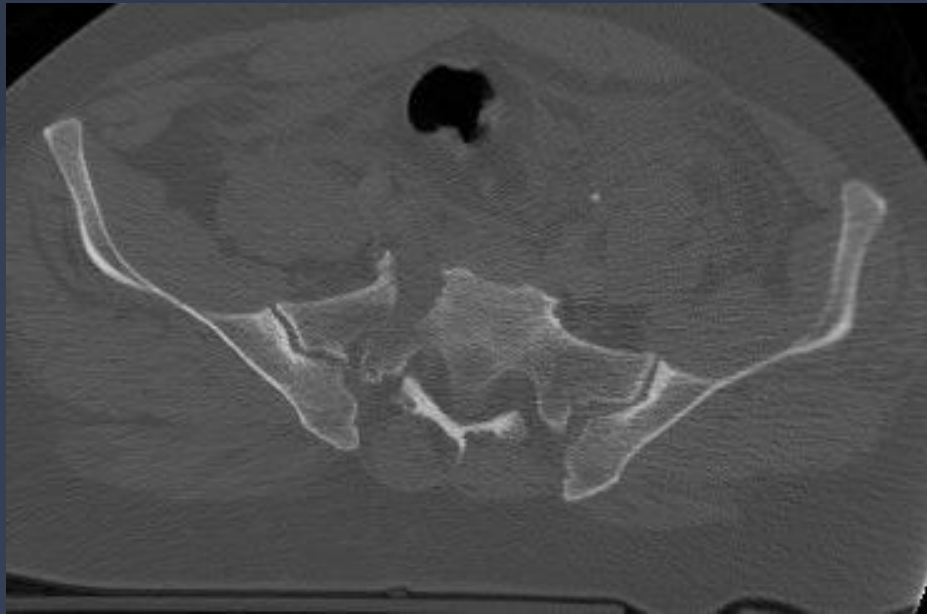
Acute Pelvic Stabilization

Best reserved for cases with bony displacement that increases intra-pelvic volume combined with hypotension

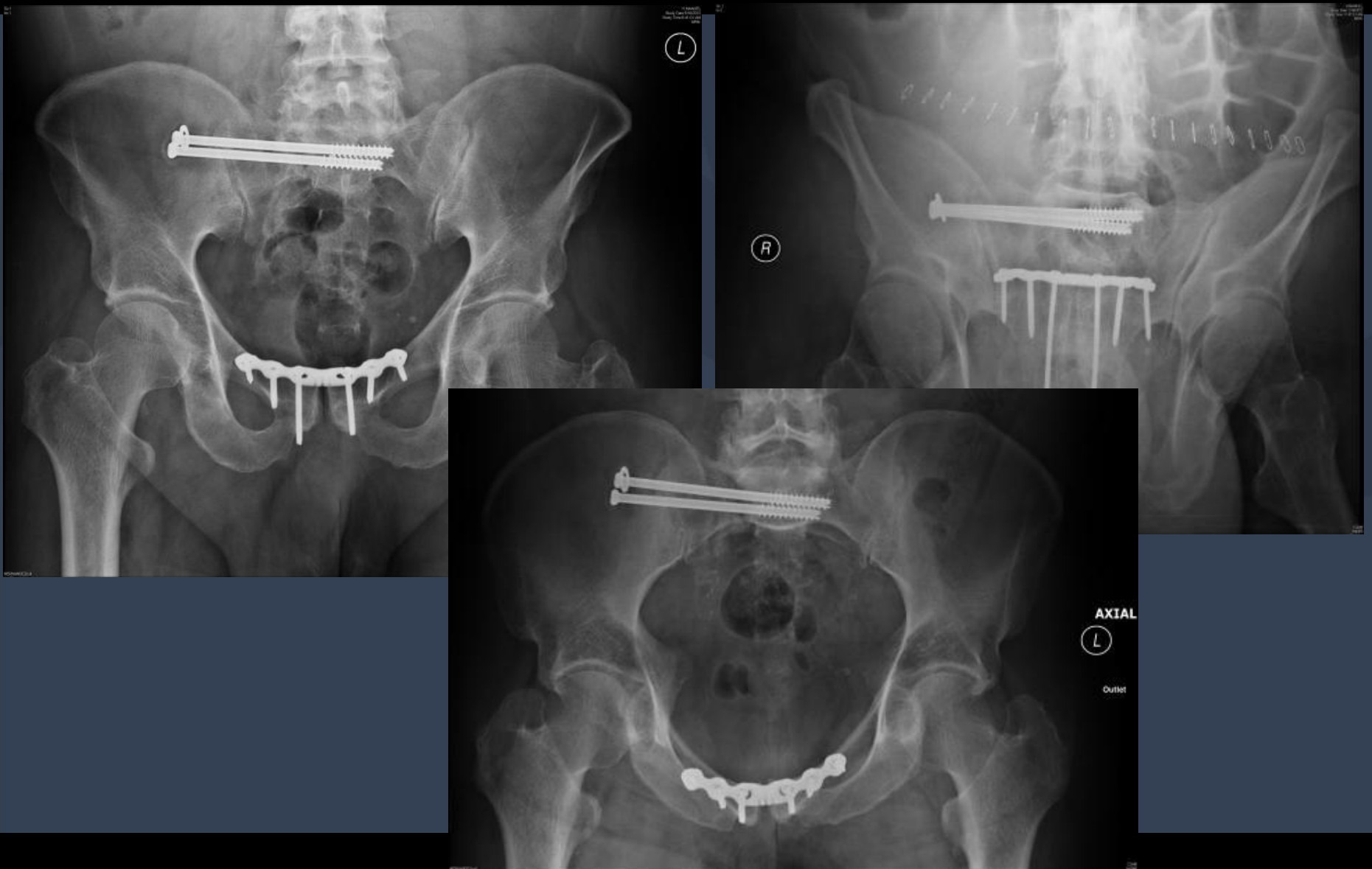


A Lateral Compression injury does not benefit from further pelvic compression!

Posterior Soft-Tissues remain intact Unstable Pelvic Injury 61B3

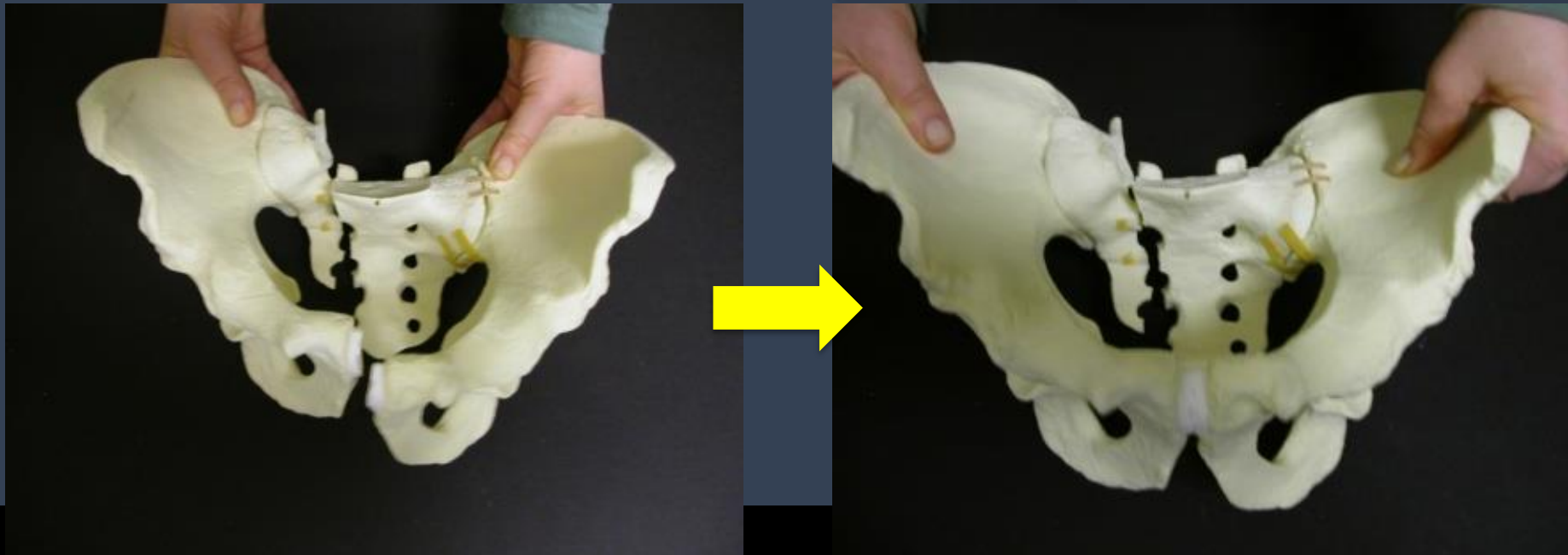


Closed Reduction and Percutaneous Fixation Then Treatment with ORIF Anterior Ring



Premise: Begin in the Anterior pelvic ring –
Anterior Reduction Will Reduce the Posterior Pelvic Ring

In OTA/AO Type 61C injuries:
Anterior ORIF does not consistently reduce the posterior ring



The primary indication for an open approach to the Pelvic Ring is Reduction

Reduction is almost always a bigger problem than fixation



E Letournel
JM Matta

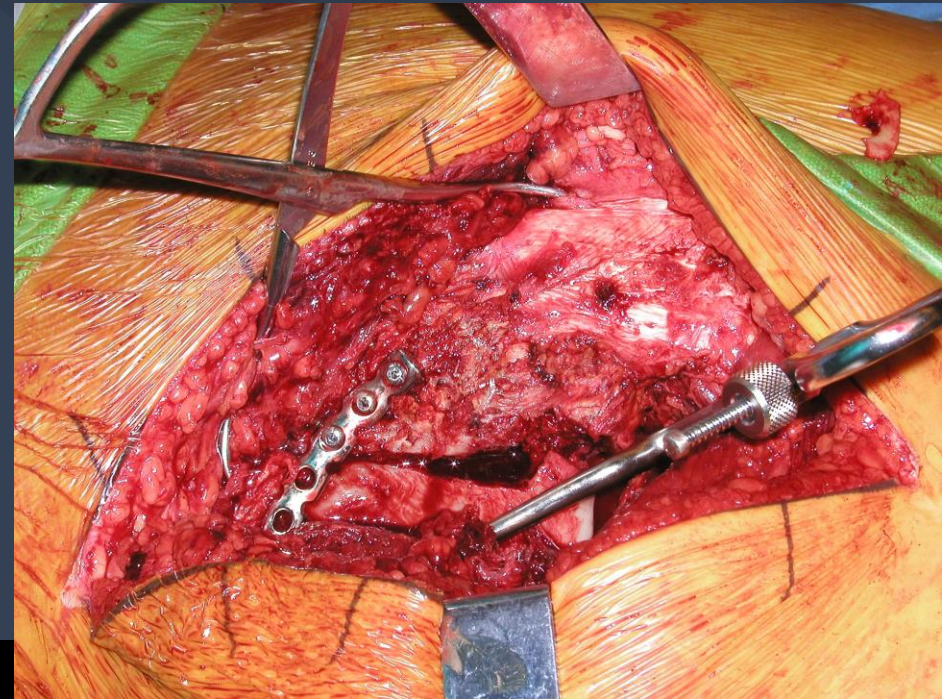
Open Reduction Posterior Pelvic Ring: Infection NOT common complication

236 patients with 268 surgical approaches

Infection rate 3.4%

No soft tissue reconstruction required

Infections handled easily



Stover MD, Clin Orthop Relat Res. 2012

Approach the
posterior injury first

Some say rules are made to be broken....
Think carefully before you do!

Summary

The majority of pelvic ring injuries can be treated non-operatively with early mobilization

Displaced pelvic ring injuries are typically unstable

Pelvic binders work best for injuries that increase intra-pelvic volume

Identify and treat instability -10mm Displacement of the posterior pelvic leads to increased pain and dysfunction

Thank You!