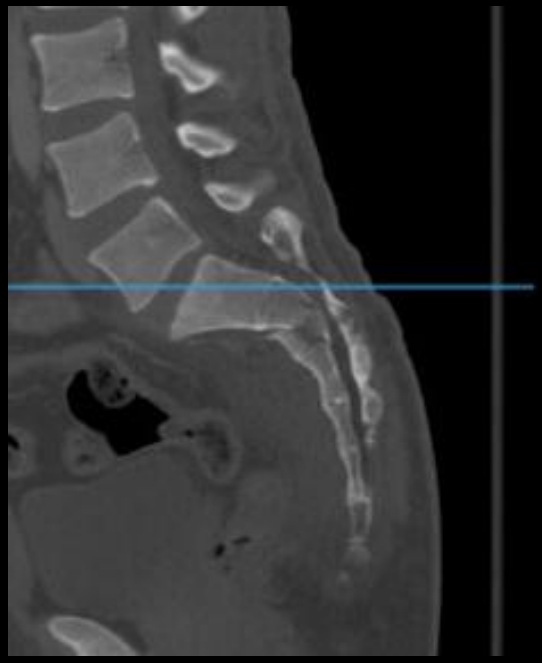
Sacral Fractures: Which Ones Need Surgery and What Kind?

Thursday, April 23, 2025

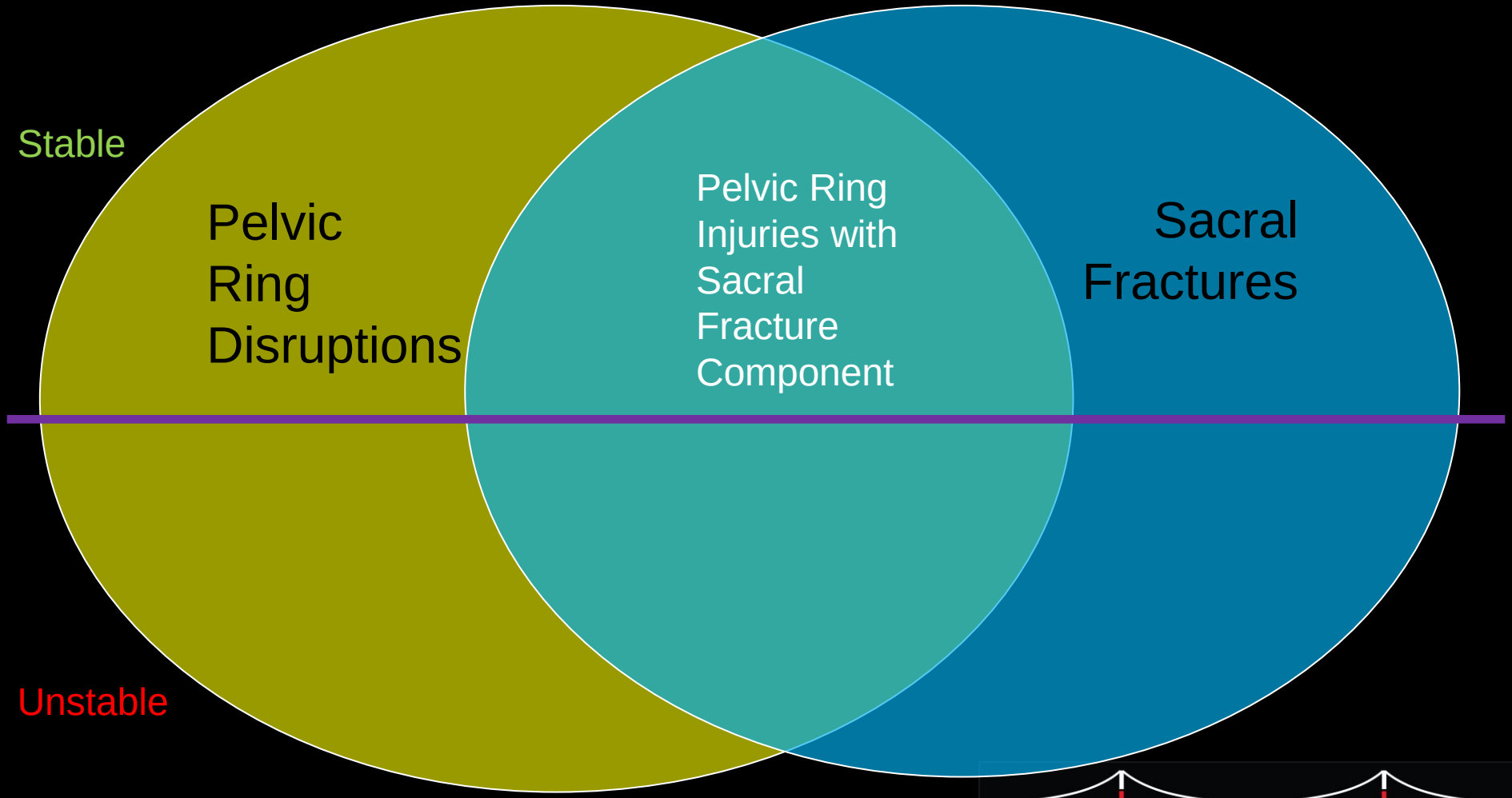


Ashraf N. El Naga
Assistant Clinical Professor
Departments of Orthopaedics and Neurosurgery
University of California, San Francisco

Director, Orthopaedic Spine Service
Zuckerberg San Francisco General Hospital

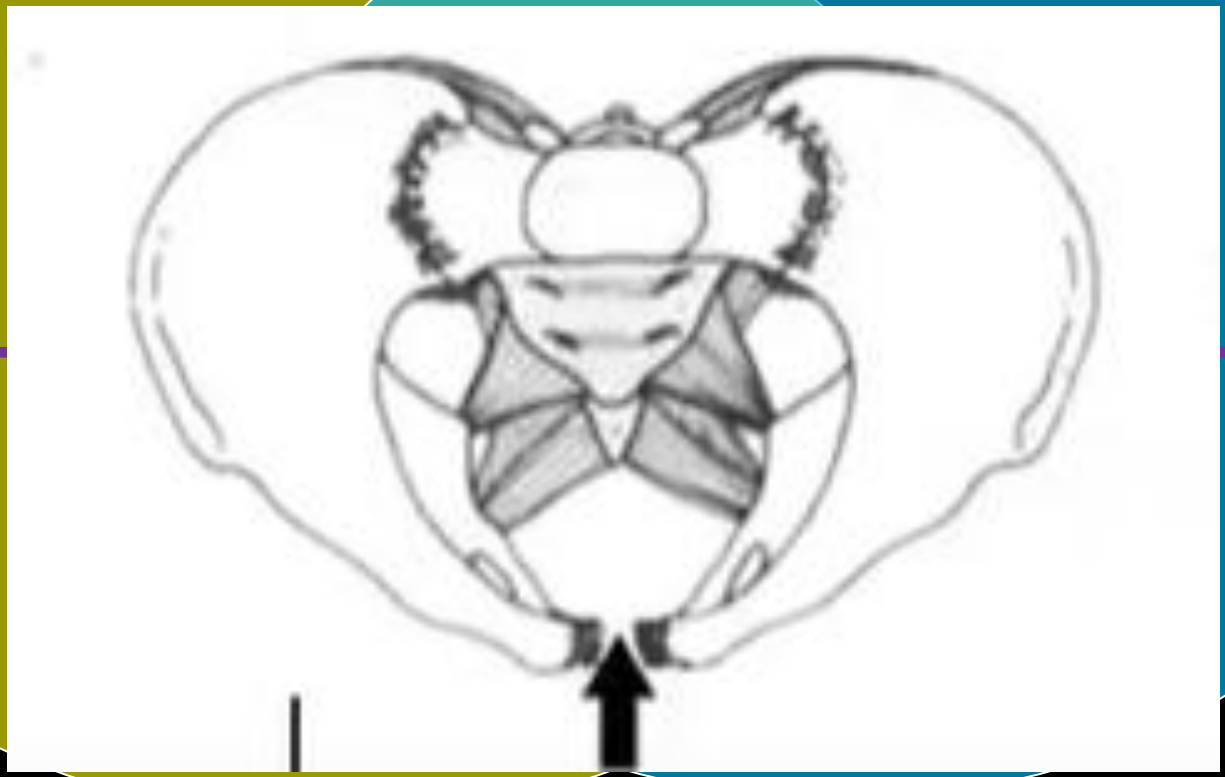
Orthopaedic Trauma Institute
UCSF + SAN FRANCISCO GENERAL HOSPITAL

Sacral Fractures in Relation to Pelvic Ring Disruptions



Orthopaedic Trauma Institute
UCSF + SAN FRANCISCO GENERAL HOSPITAL

Sacral Fractures in Relation to Pelvic Ring Disruptions

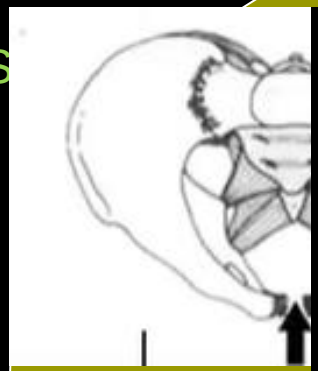


Stable

Unstable

Orthopaedic Trauma Institute
UCSF + SAN FRANCISCO GENERAL HOSPITAL

Sacral Fractures in Relation to Pelvic Ring Disruptions

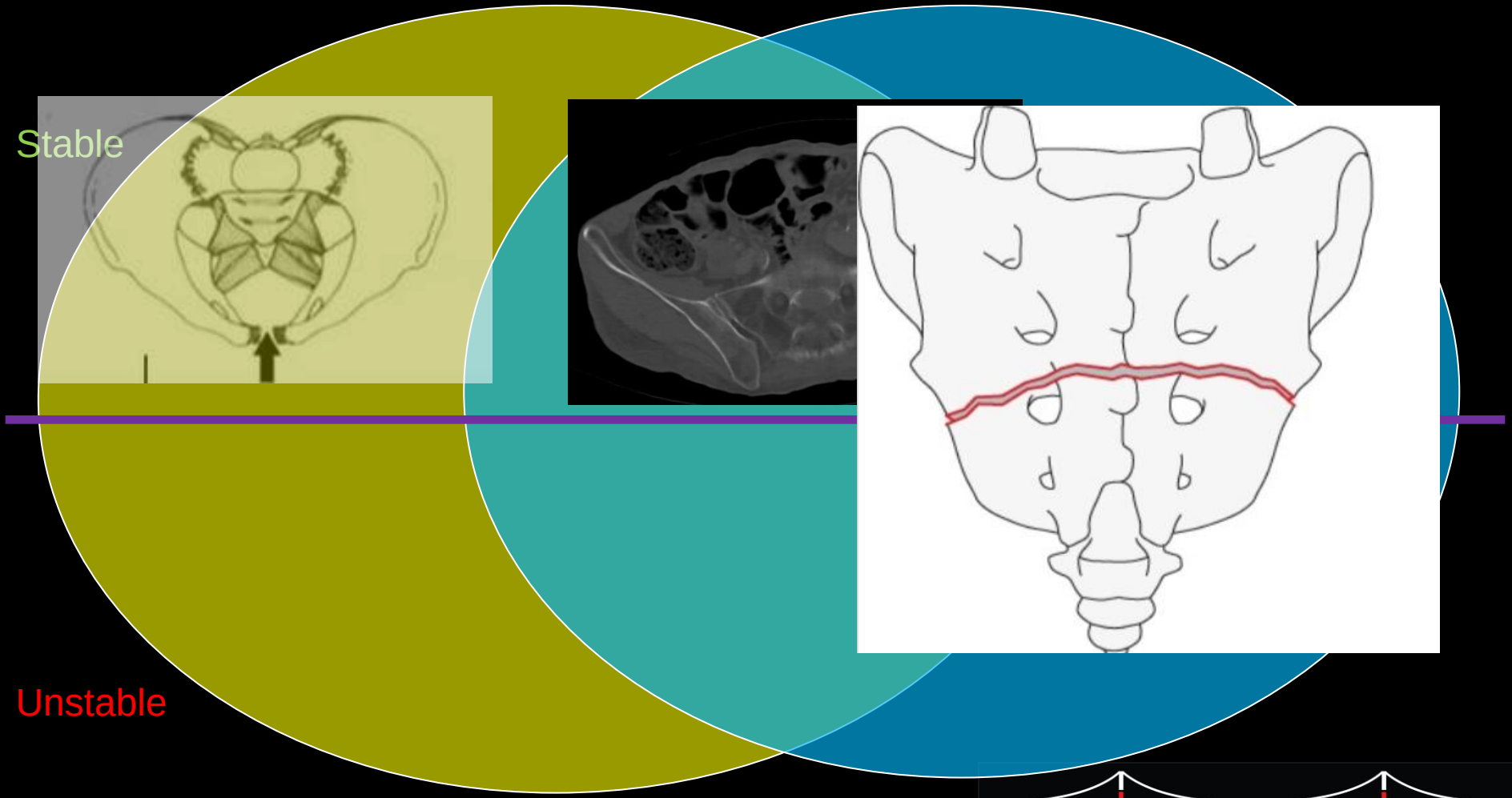


S

Unstable

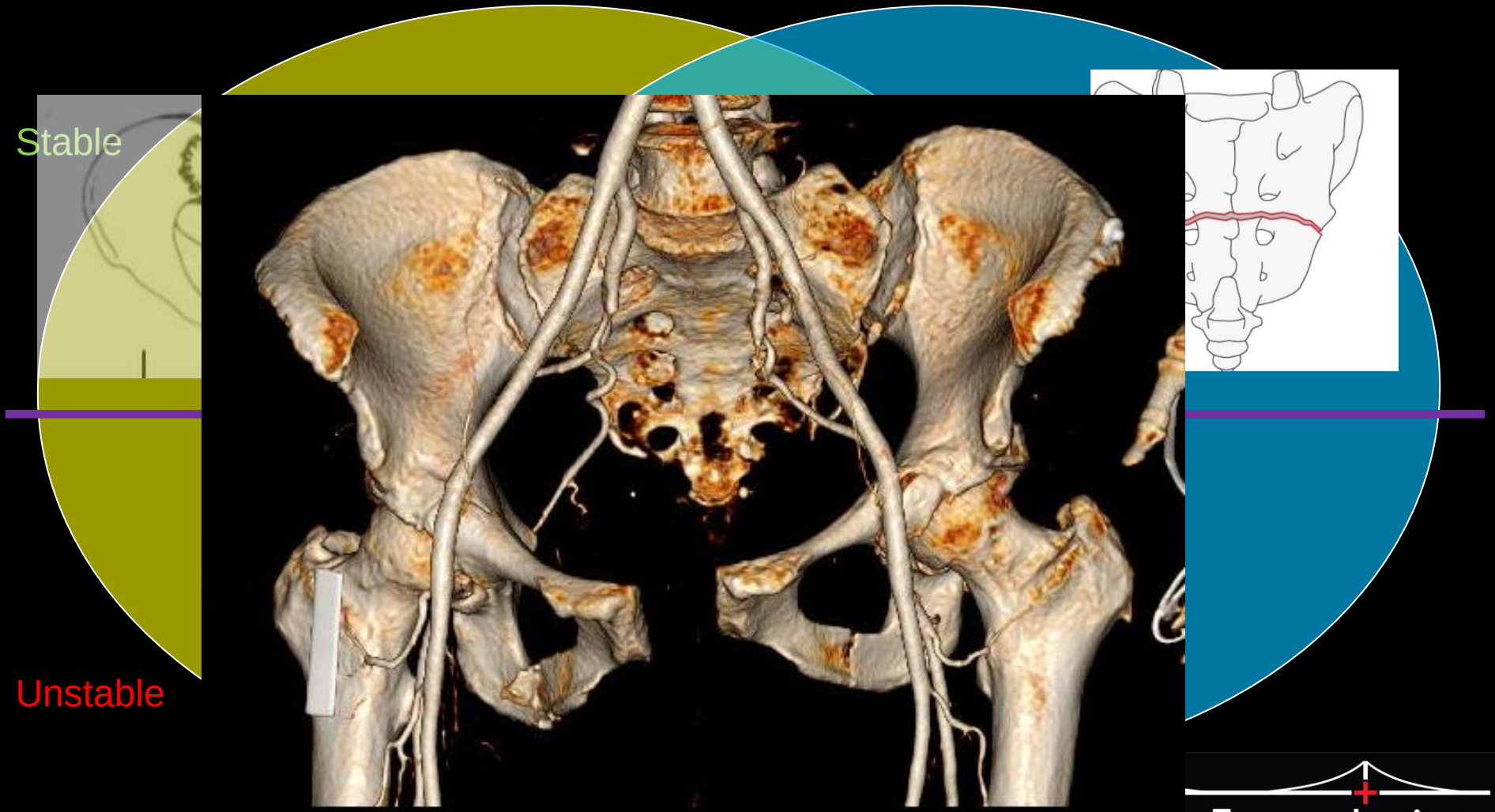
Orthopaedic Trauma Institute
UCSF + SAN FRANCISCO GENERAL HOSPITAL

Sacral Fractures in Relation to Pelvic Ring Disruptions

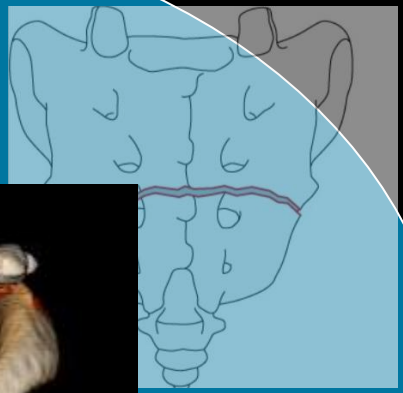


Orthopaedic Trauma Institute
UCSF + SAN FRANCISCO GENERAL HOSPITAL

Sacral Fractures in Relation to Pelvic Ring Disruptions



Sacral Fractures in Relation to Pelvic Ring Disruptions

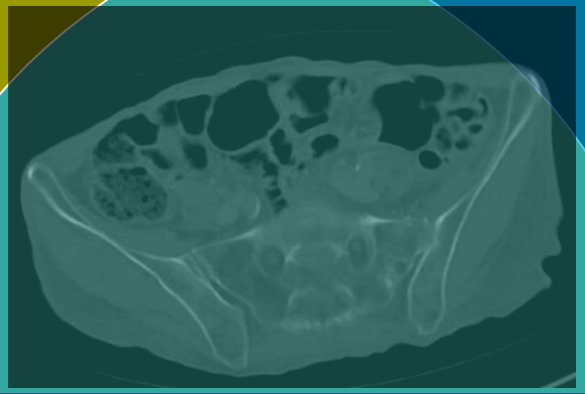


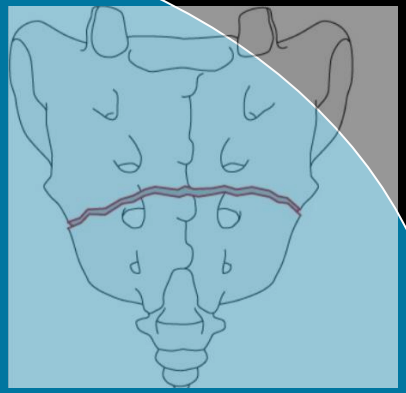
Sacral Fractures in Relation to Pelvic Ring Disruptions

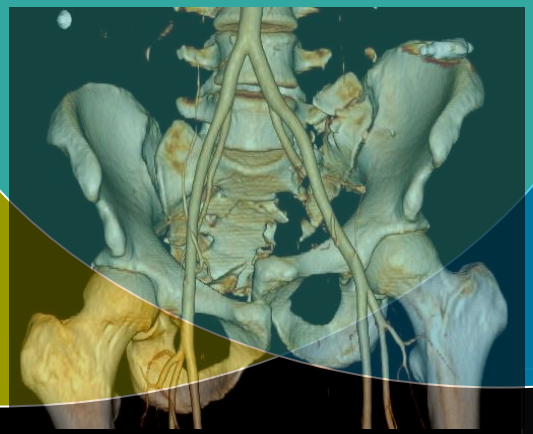
Stable

Unstable

Sacral Fractures in Relation to Pelvic Ring Disruptions



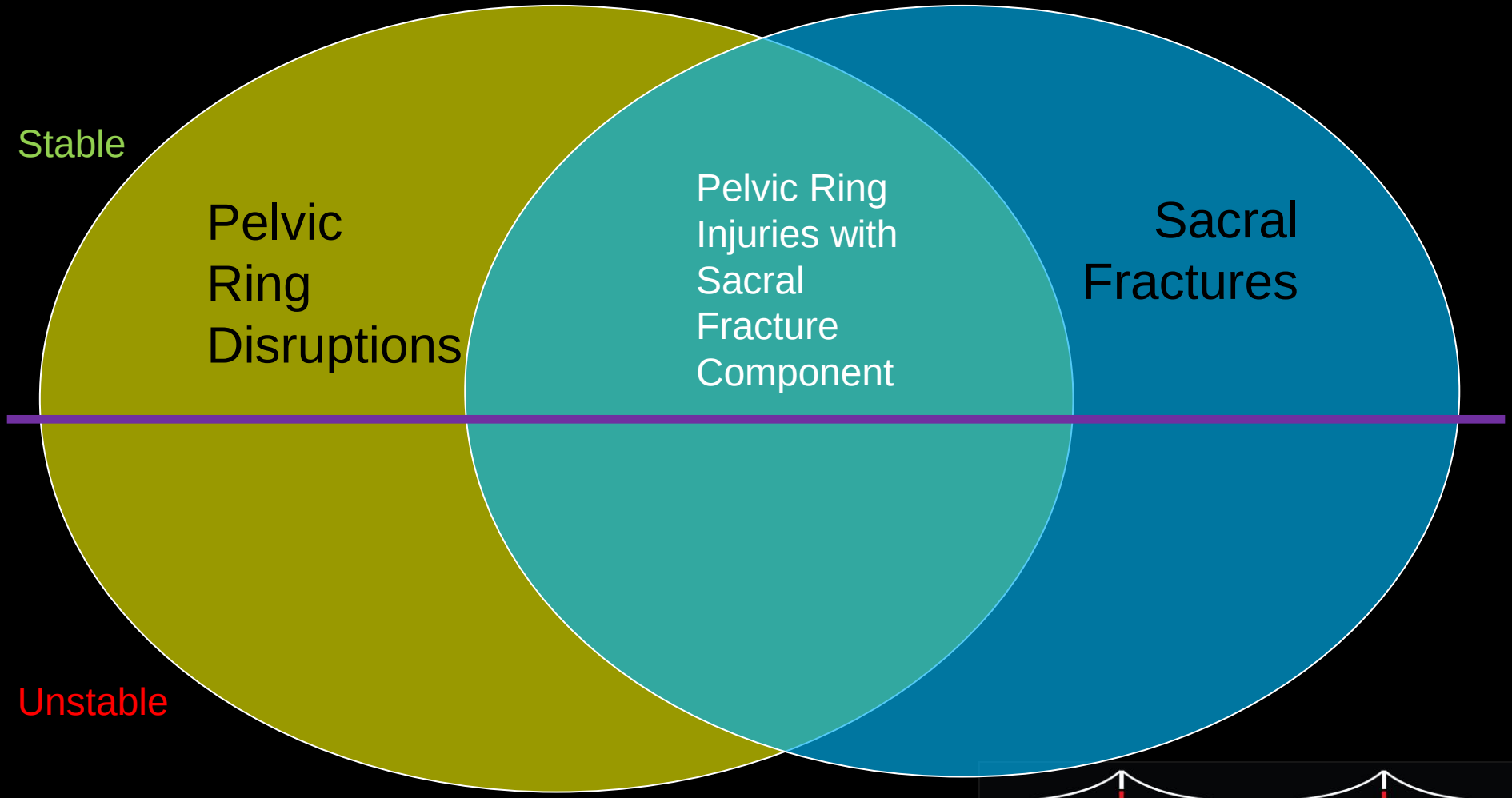




Stable

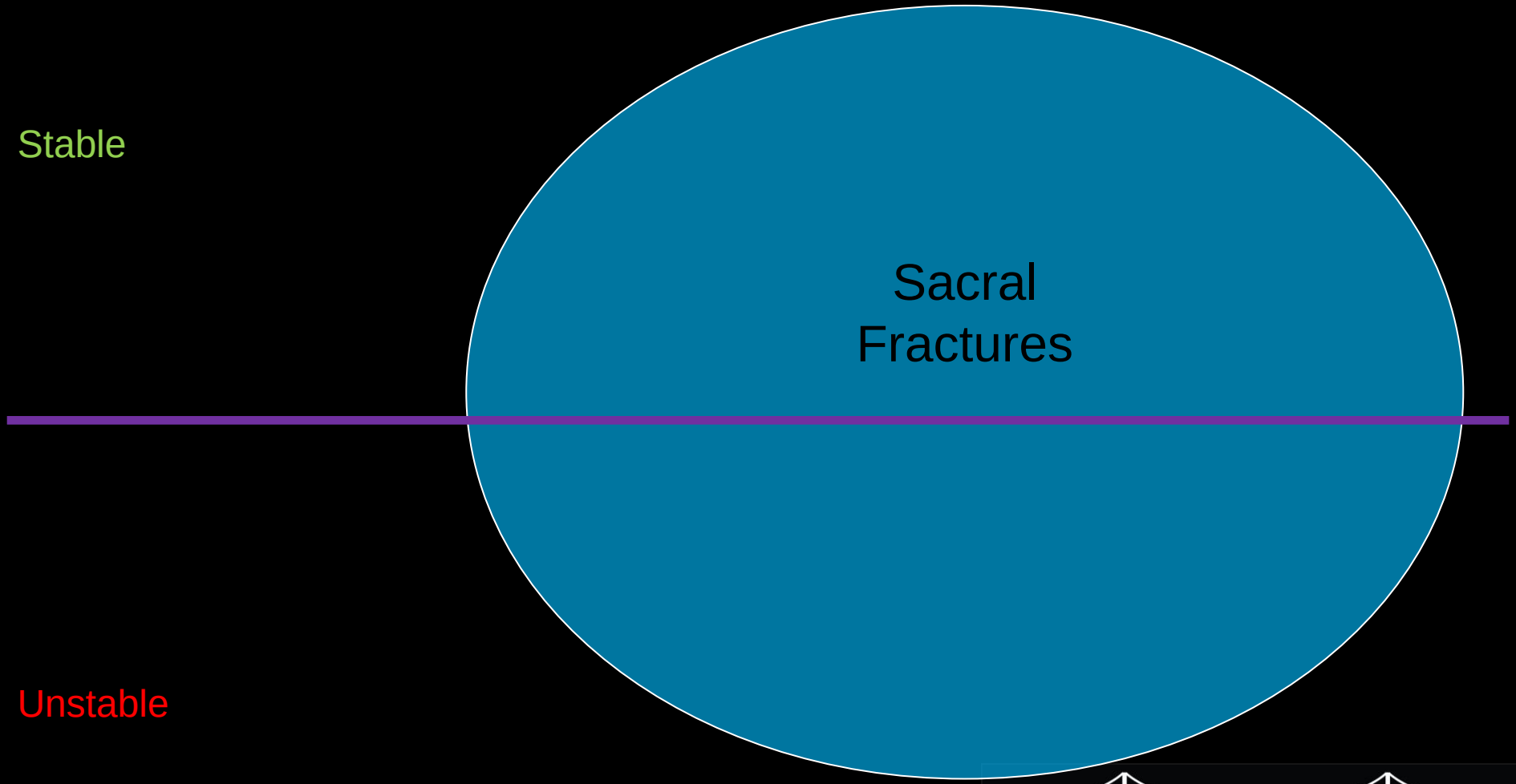
Unstable

Sacral Fractures in Relation to Pelvic Ring Disruptions



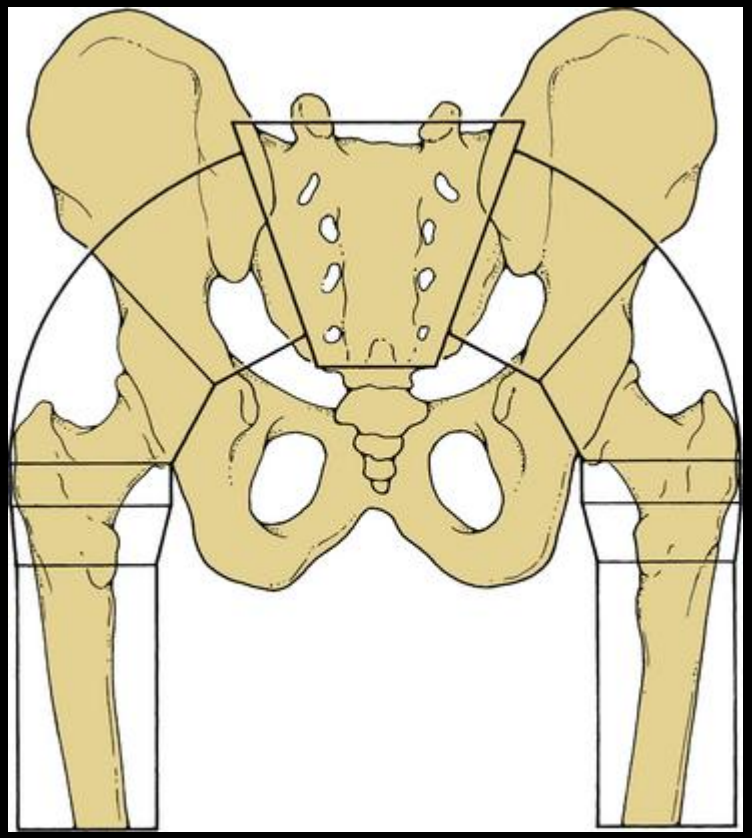
Orthopaedic Trauma Institute
UCSF + SAN FRANCISCO GENERAL HOSPITAL

Sacral Fractures in Relation to Pelvic Ring Disruptions



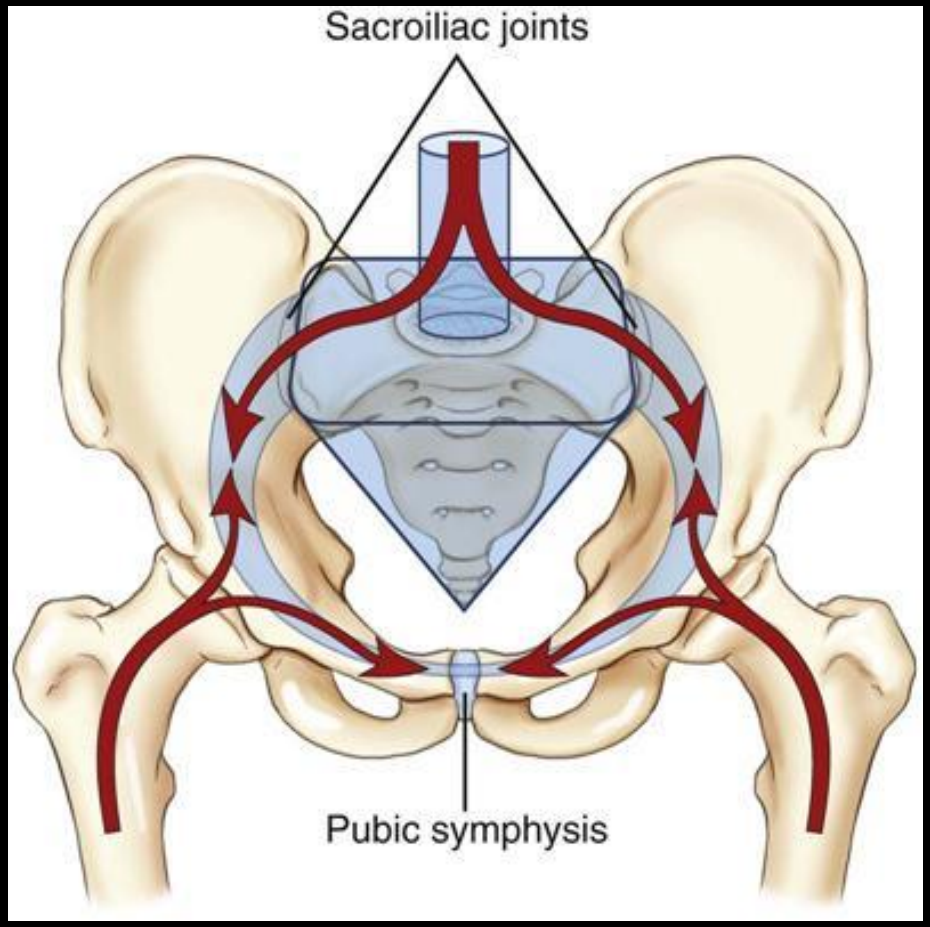
Sacral Fracture Patterns

- Injuries that relate to the ability of transmit load between the spine and the pelvis

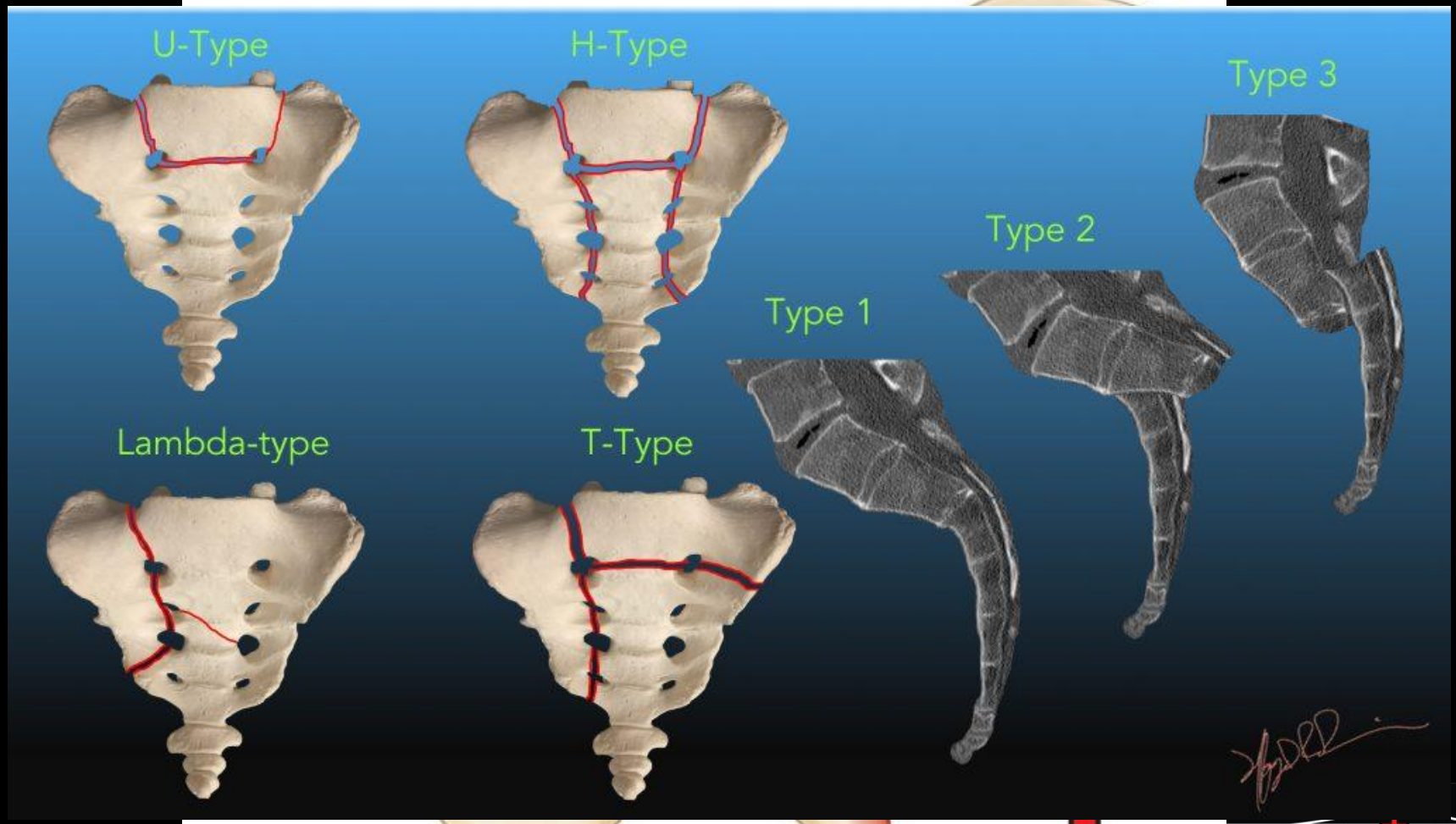


Sacral Fracture Patterns

- Injuries that relate to the ability of transmit load between the spine and the pelvis



Sacral Injury Patterns



Objectives

1. Understand the salient clinical features of these sacral injuries
2. Discuss the clinical factors that guide treatment for sacral fractures
3. Understand the treatment options for sacral fractures and when to consider spinopelvic fixation

Injury Patterns

- Two main groups
  - Injuries with vertically sacral fracture orientation
  - Injuries with transverse sacral fracture orientation

Isolated vertical patterns

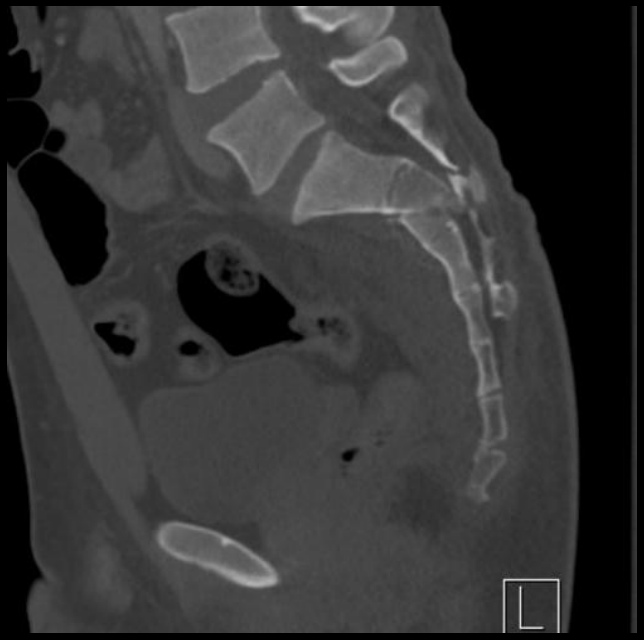
- Factors to consider

1. L5/S1 facet stability (Isler classification)
2. Vertical hemipelvis translation
3. Transitional anatomy (sacral dysmorphism)
4. Weight bearing goals

Orthopaedic Trauma Institute
UCSF + SAN FRANCISCO GENERAL HOSPITAL

Transverse patterns

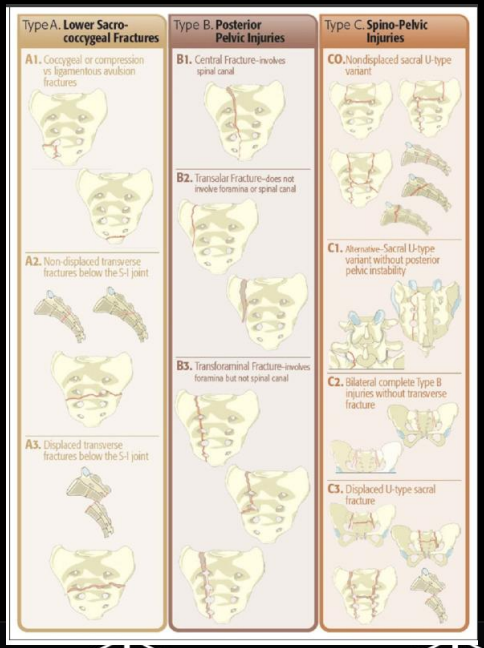
- Factors to consider
  1. Sacral kyphosis
  2. Neurological status
  3. Whether hemipelvi are connected



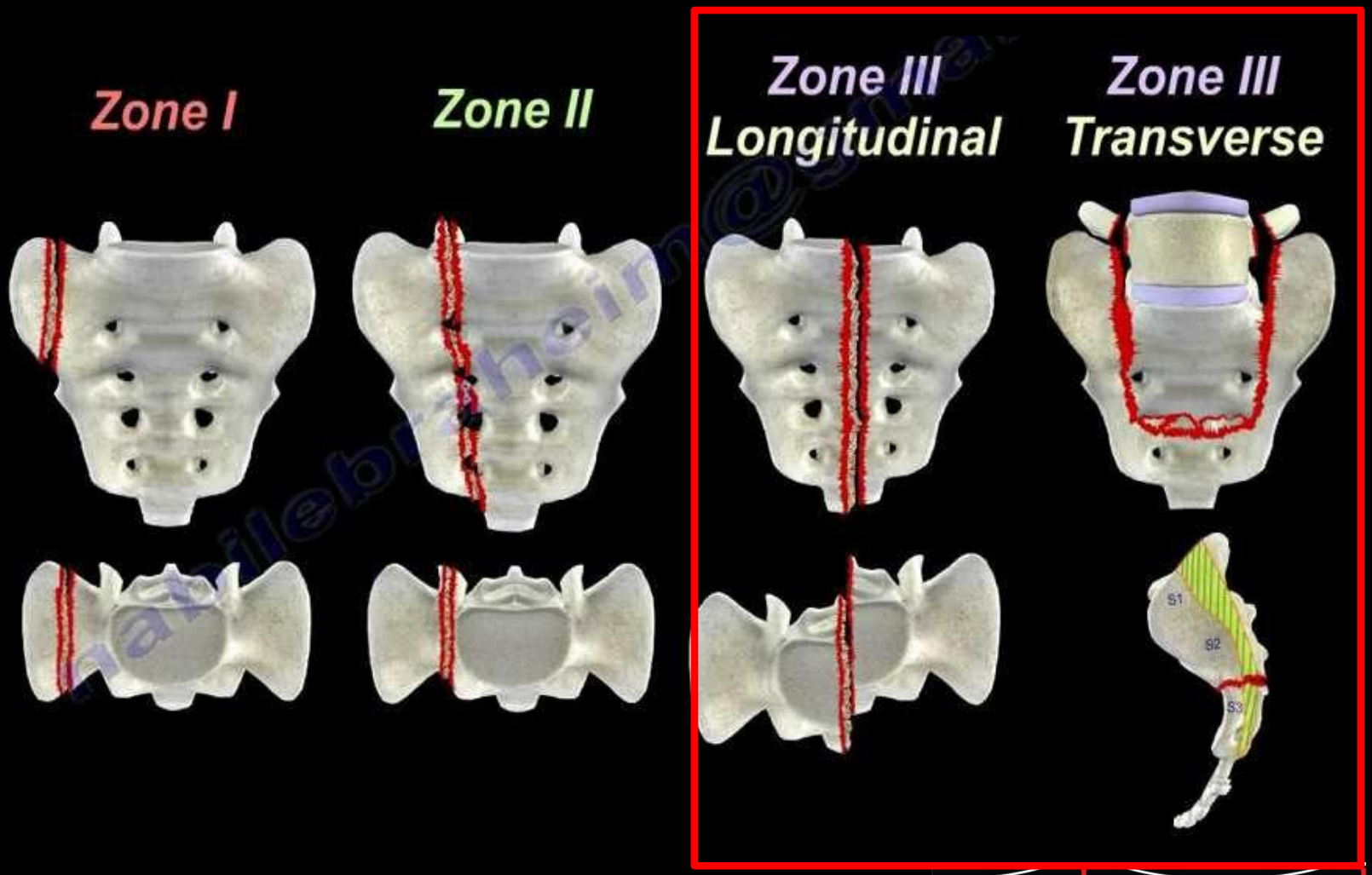
Sacral Fracture Classification Systems

- Denis Classification
- Isler Classification
- Roy Camille classification

AOSpine Sacral Classification

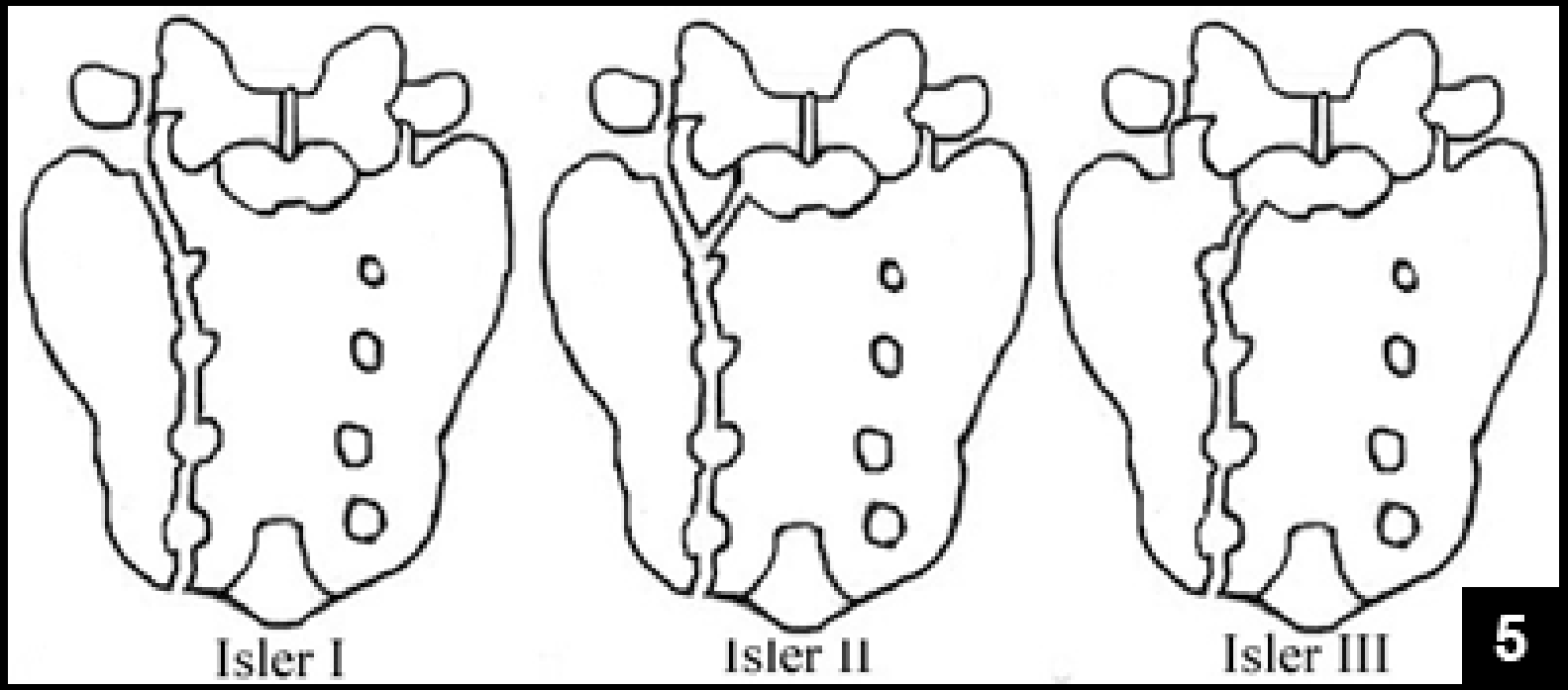


Denis Classification



Outcome: Neurologic injury

Isler Classification



Outcome: Lumbosacral stability

Journal of Orthopaedic Trauma
Vol. 4, No. 1, pp. 1–6
© 1990 Raven Press, Ltd., New York

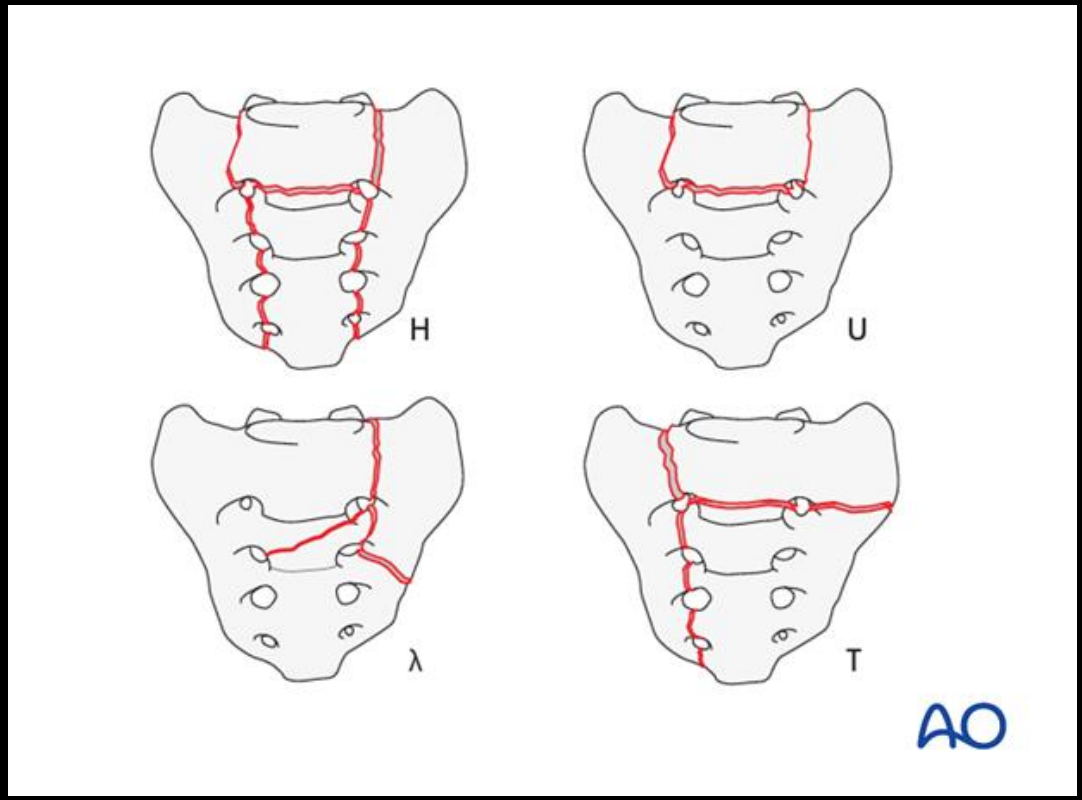
Lumbosacral Lesions Associated with Pelvic Ring Injuries

Balz Isler

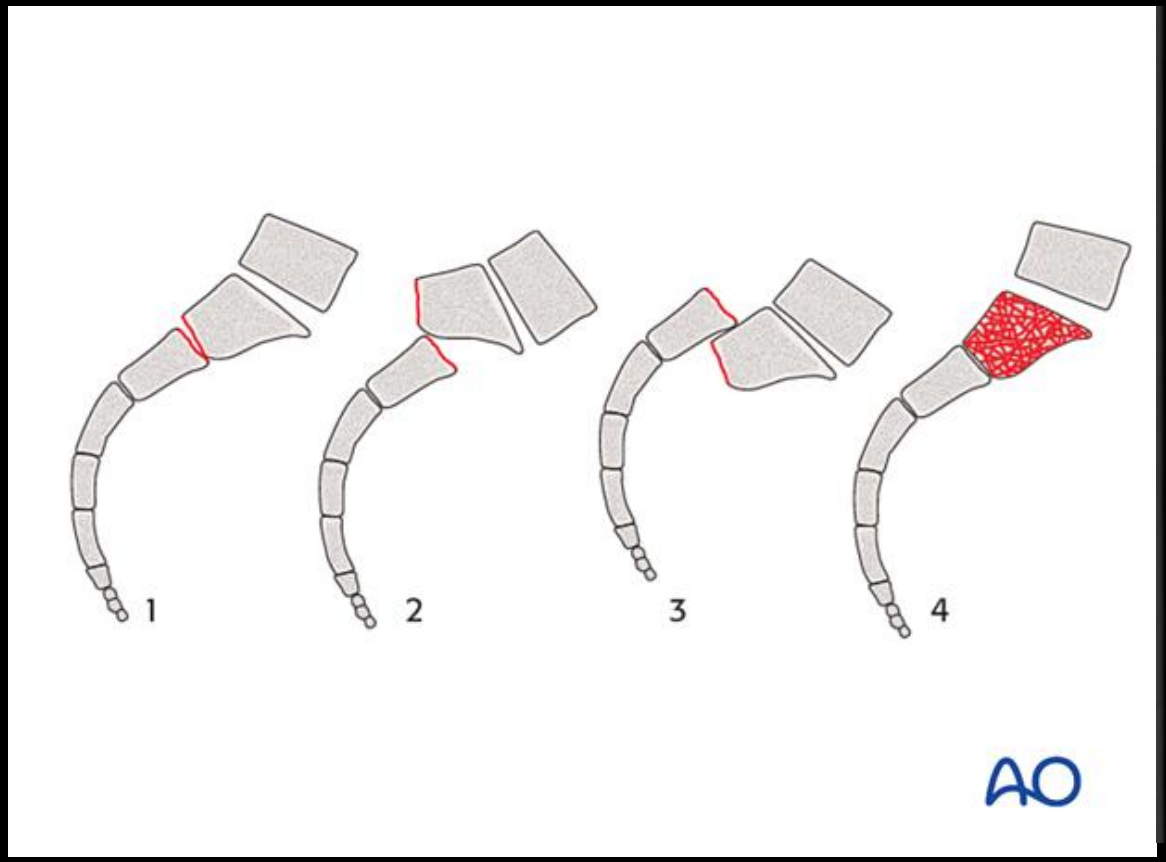
Department of Orthopaedics, University of Berne, Inselspital, Bern, Switzerland

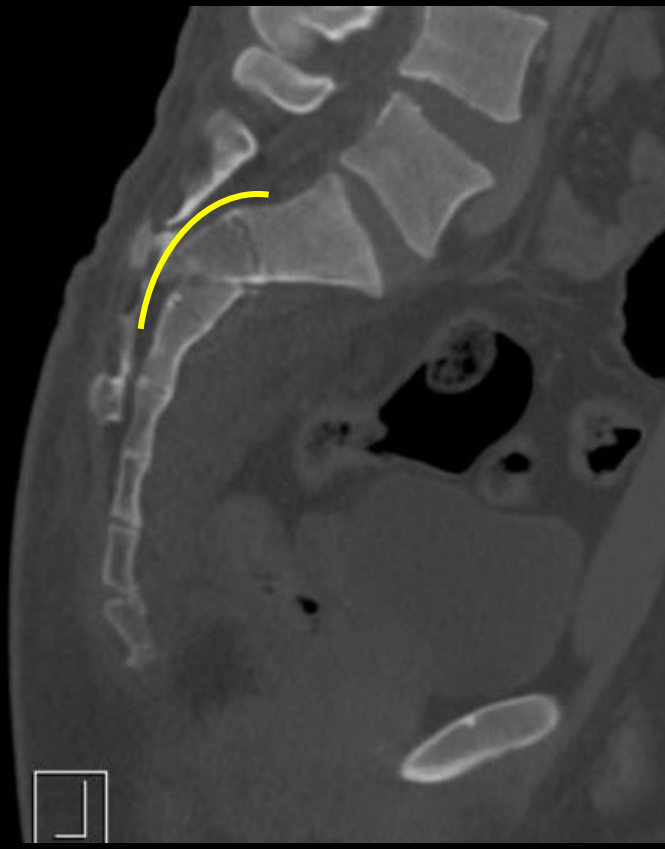
Descriptive Classification

- Transverse Zone III fractures

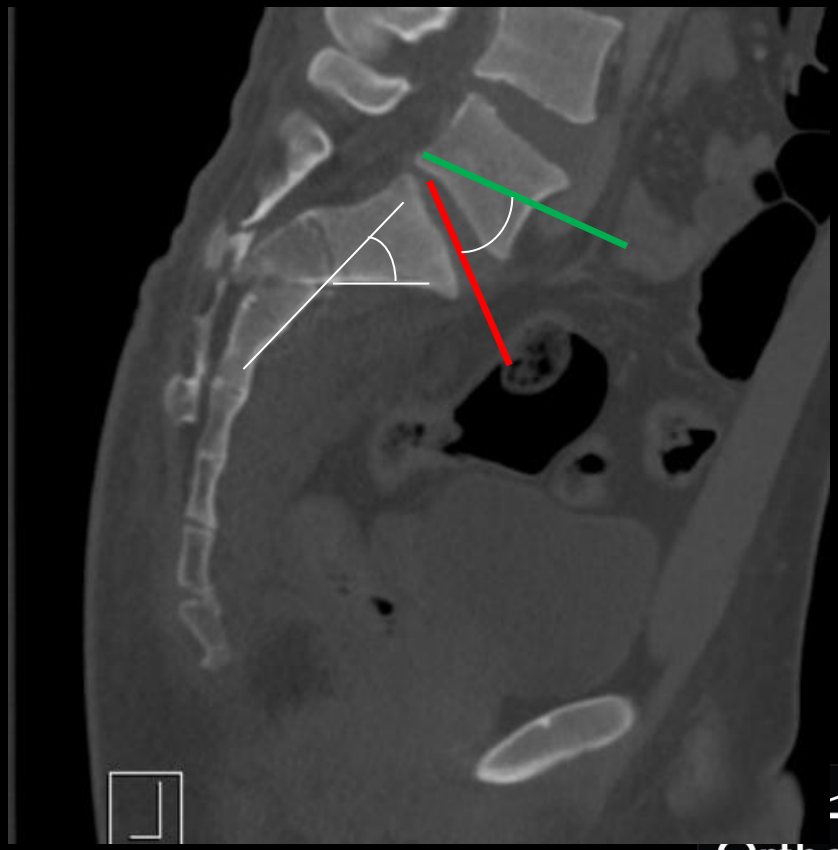


Roy- Camille Classification





Sacral Kyphosis

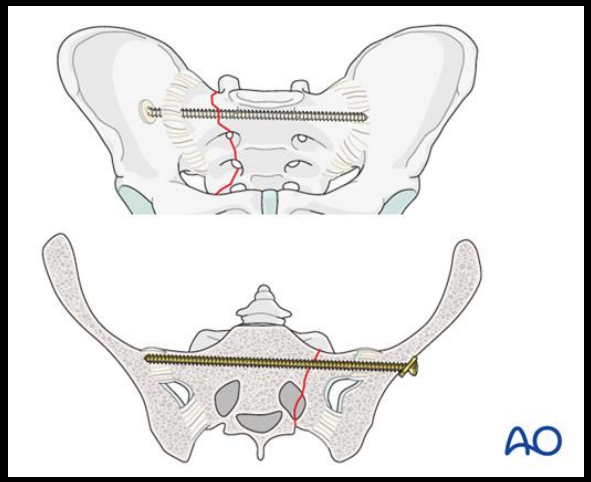


When to call spine?

1. Neurologic deficits (bowel/ bladder deficits, perianal sensory changes)
2. Significant sacral kyphosis
3. Displaced facet fracture
4. Supplemental fixation to enable weight bearing after pelvic ring fixation

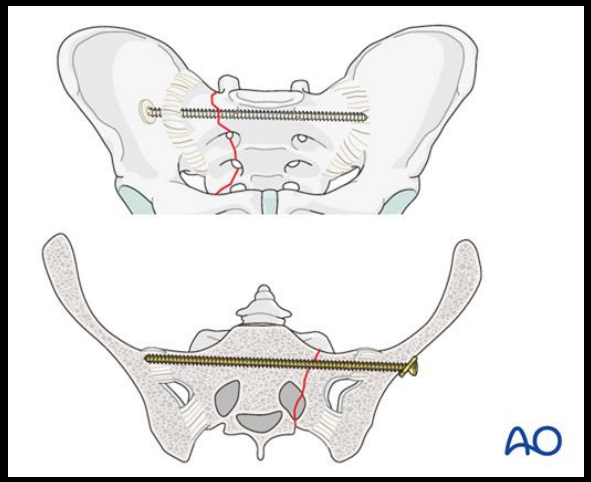
Operative Treatments

Iliosacral screw fixation



Operative Treatments

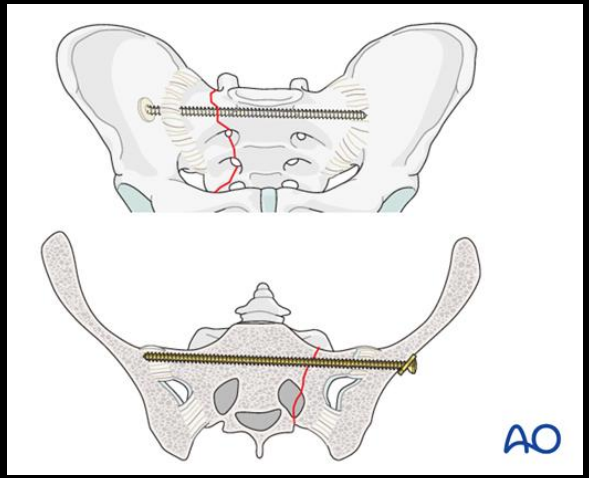
Iliosacral screw fixation

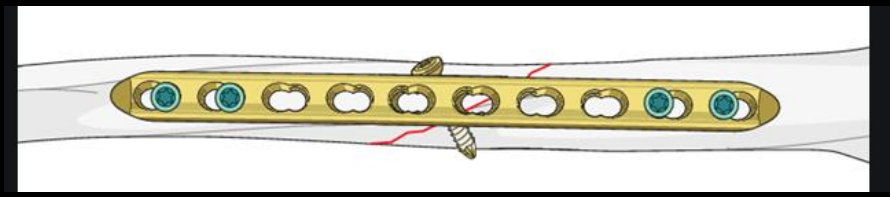


Posterior lumbopelvic fixation

Iliosacral Screw Fixation

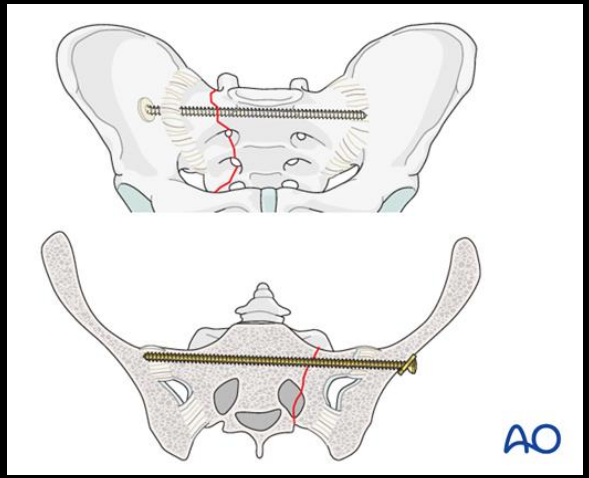
- Pros
  - Safe
  - Minimally invasive
  - Prone or supine
  - Fracture compression

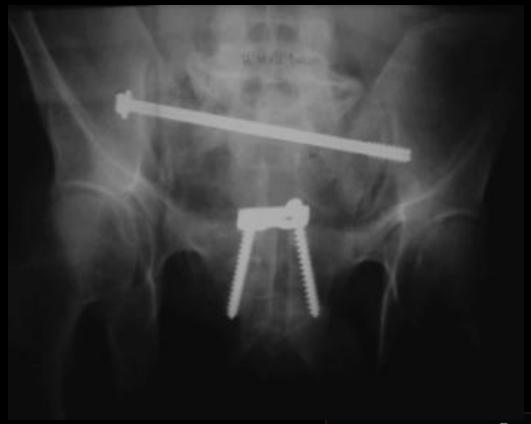




Iliosacral Screw Fixation

- Pro
  - Safe
  - Minimally invasive
  - Prone or supine
  - Fracture compression
- Con
  - Poor at resisting shear forces
  - Need good fluoro images





Sagi, H Claude MD; Militano, Ulises MD; Caron, Troy DO; Lindvall, Eric DO A Comprehensive Analysis With Minimum 1-Year Follow-up of Vertically Unstable Transforaminal Sacral Fractures Treated With Triangular Osteosynthesis. Journal of Orthopaedic Trauma: May 2009 - Volume 23 - Issue 5 - p 313-319

Spinopelvic Fixation

Spinopelvic fixation

- Pro
  - Can be minimally invasive (if no reduction needed)
  - Superior to resisting flexion extension, axial rotation, especially in models with sacral comminution

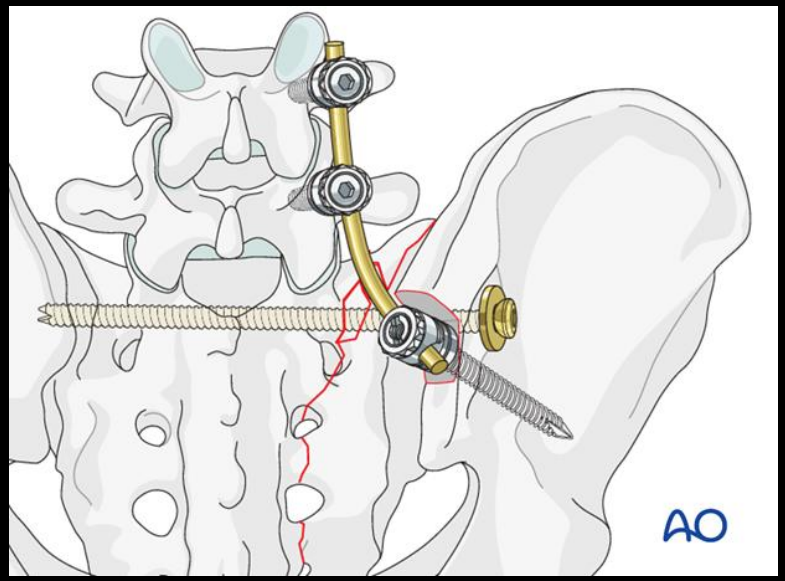
Spinopelvic fixation

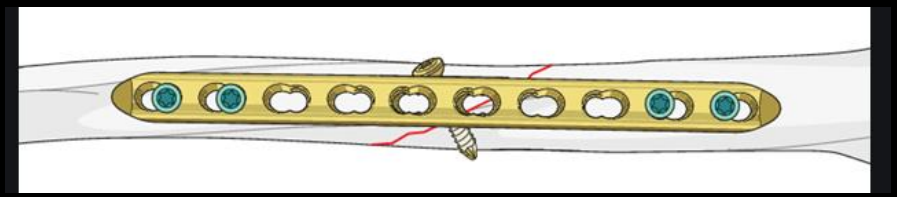
Spinopelvic fixation

- Pro
  - Can be minimally invasive (if no reduction needed)
  - Superior to resisting flexion extension, axial rotation, especially in models with sacral comminution
- Con
  - Invasiveness
  - Limit lumbar motion (if extended up to lumbar spine)
  - Increased hardware irritation (technique dependent)
  - Necessitates prone position
  - Posterior incision may overly Morel lesion

Triangular osteosynthesis

- Combined techniques
  - LPF acts like neutralization plate





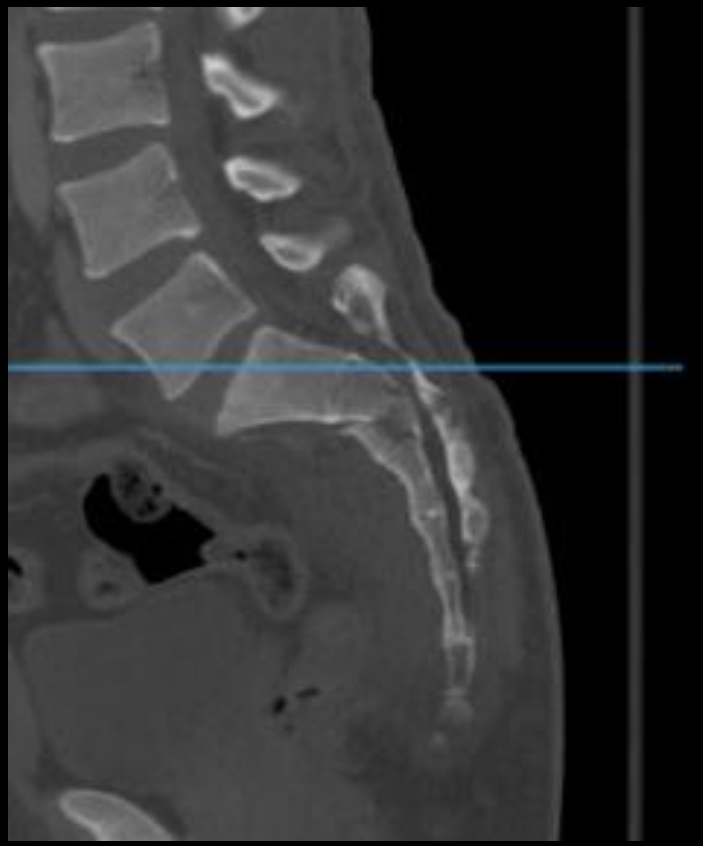
Goals of Treatment

- Bony union of the fracture in physiologic alignment
- Optimize the potential for recovery of neurologic deficits if present
- Minimize potential complications associated with prolonged recumbency and bedrest (early mobility/weight bearing)

Choosing a Fixation Strategy?

Choosing a Fixation Strategy?

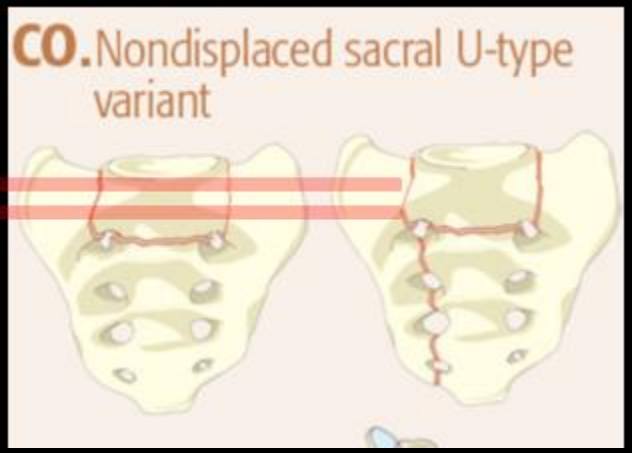
- Is a neurologic decompression needed?
  - Ongoing nerve compression?



Orthopaedic Trauma Institute
UCSF + SAN FRANCISCO GENERAL HOSPITAL

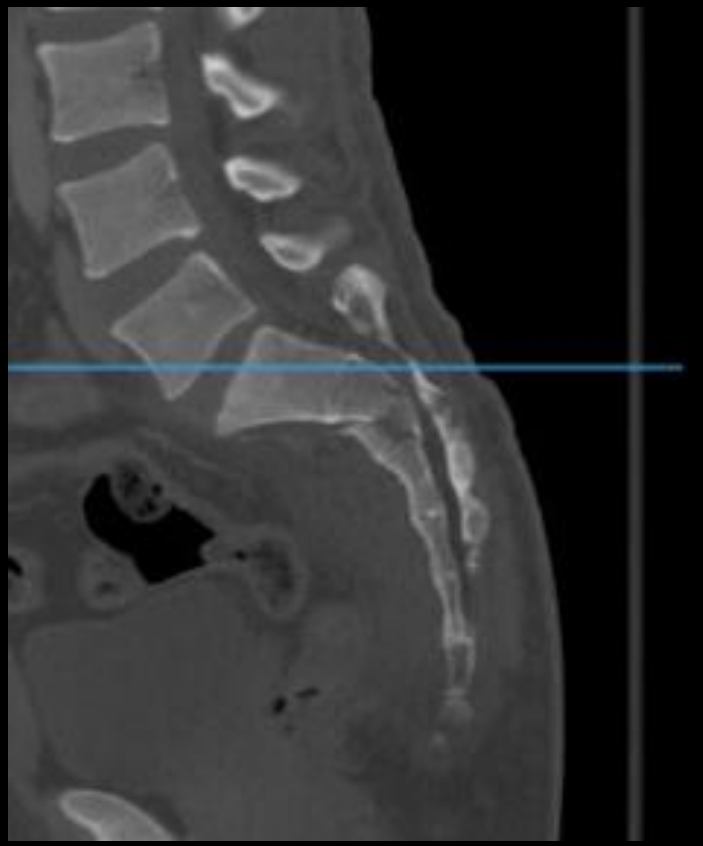
Choosing a Fixation Strategy?

- Is a neurologic decompression needed?
  - Ongoing nerve compression?
- How will we reduce the fracture?
  - Closed
  - Percutaneous
  - Open



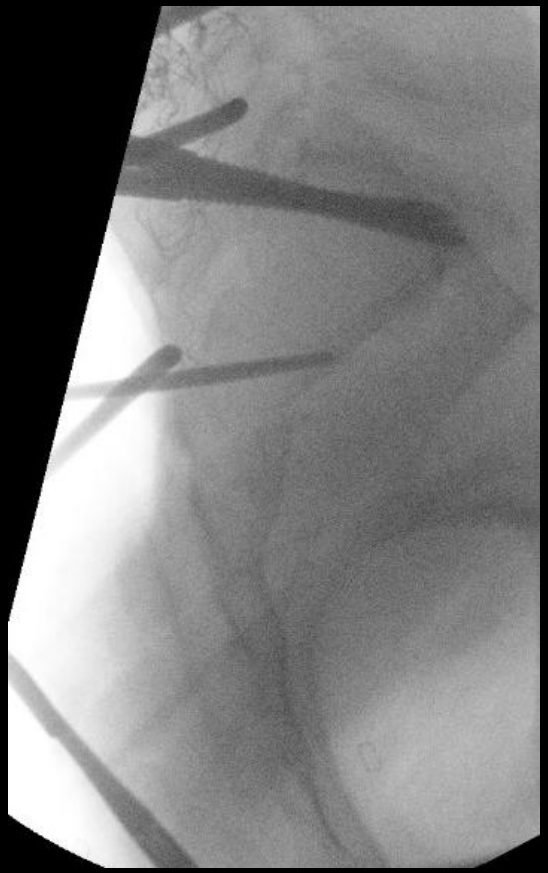
Choosing a Fixation Strategy?

- Is a neurologic decompression needed?
  - Ongoing nerve compression?
- How will we reduce the fracture?
  - Closed
  - Percutaneous
  - Open



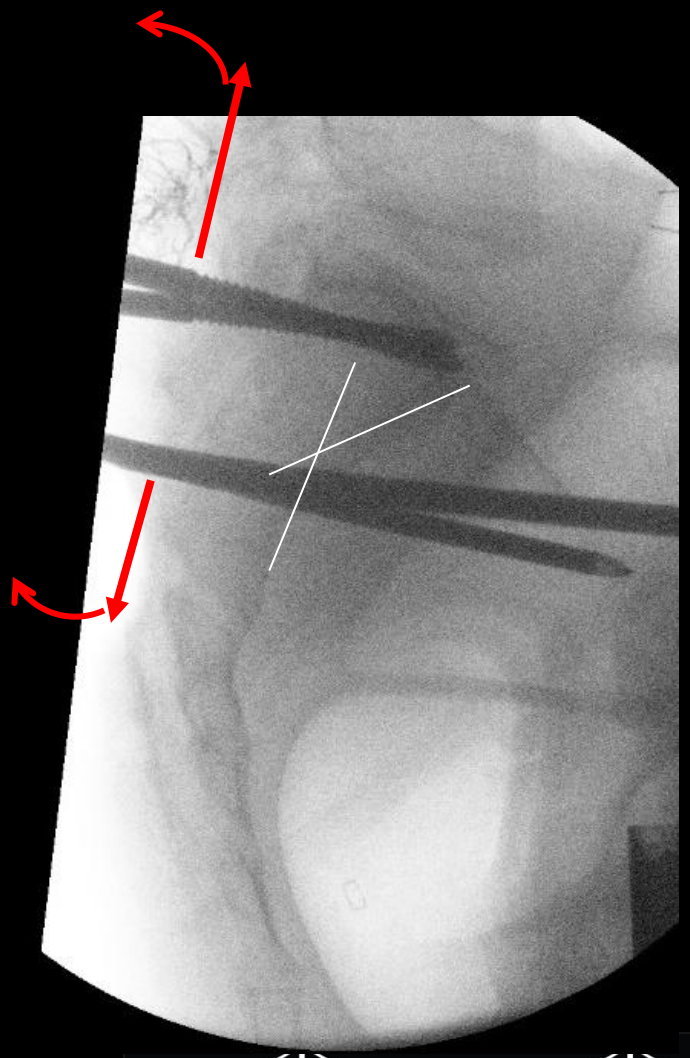
Orthopaedic Trauma Institute
UCSF + SAN FRANCISCO GENERAL HOSPITAL

Case # 1: H type with Sacral Kyphosis



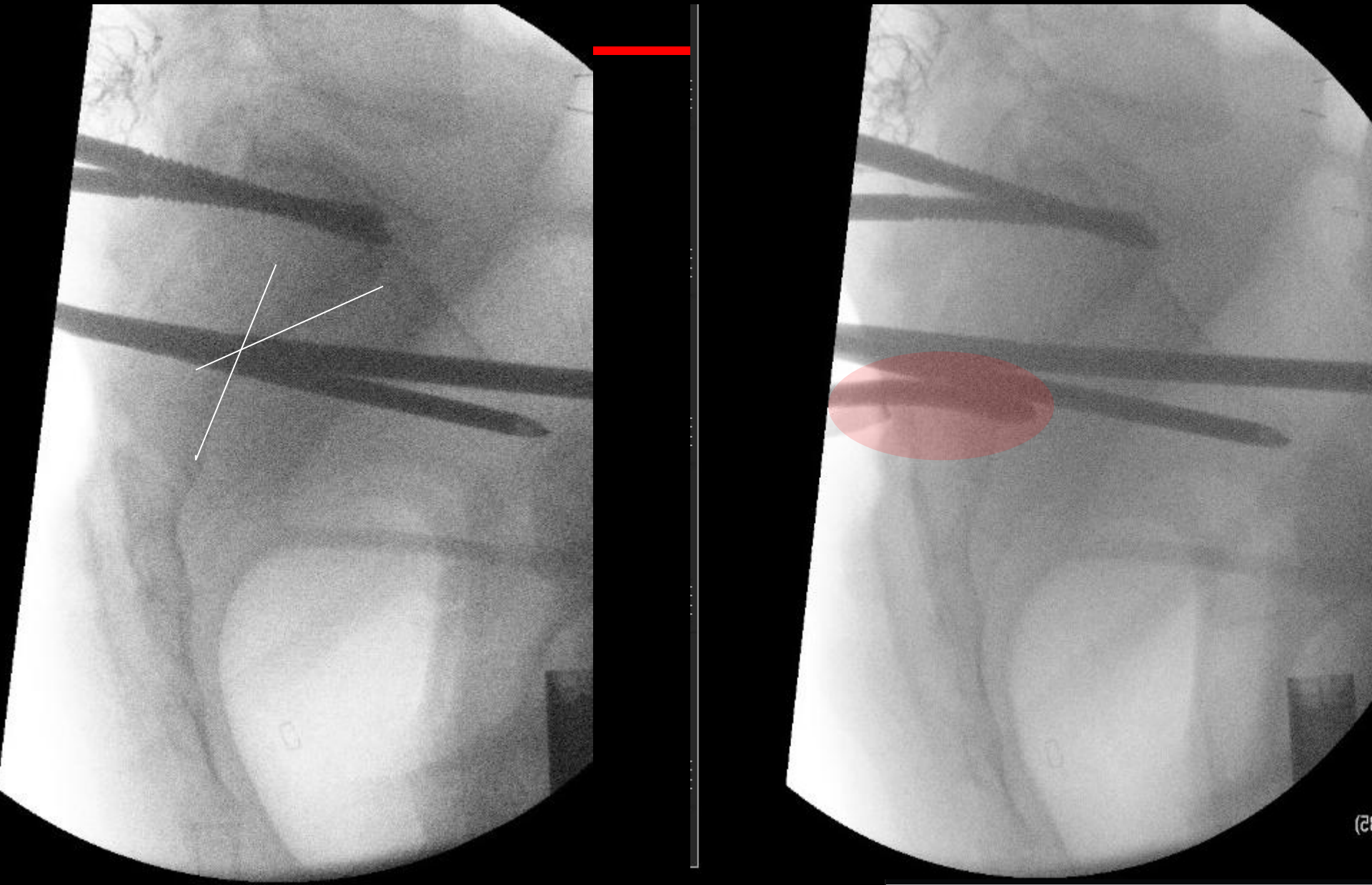
Orthopaedic Trauma Institute
UCSF + SAN FRANCISCO GENERAL HOSPITAL

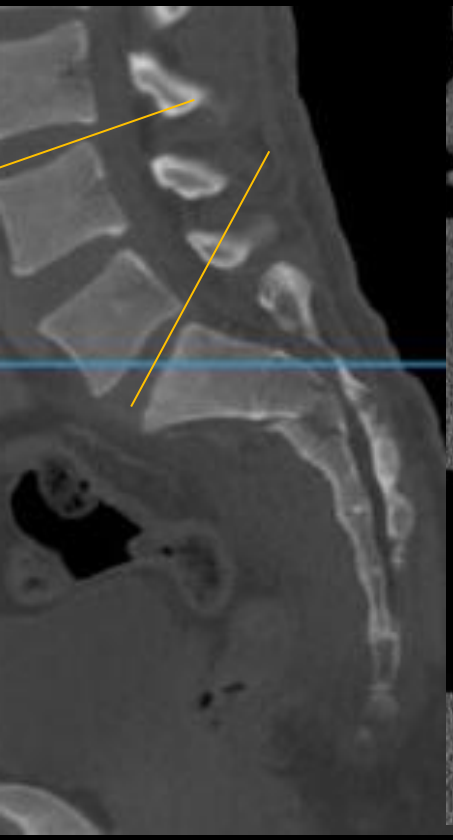
Reduction

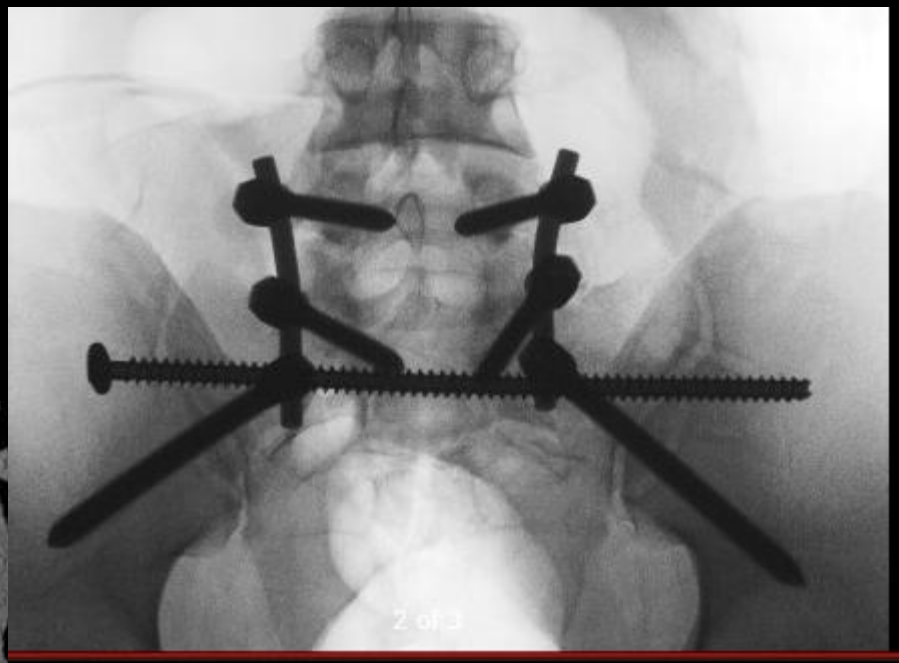


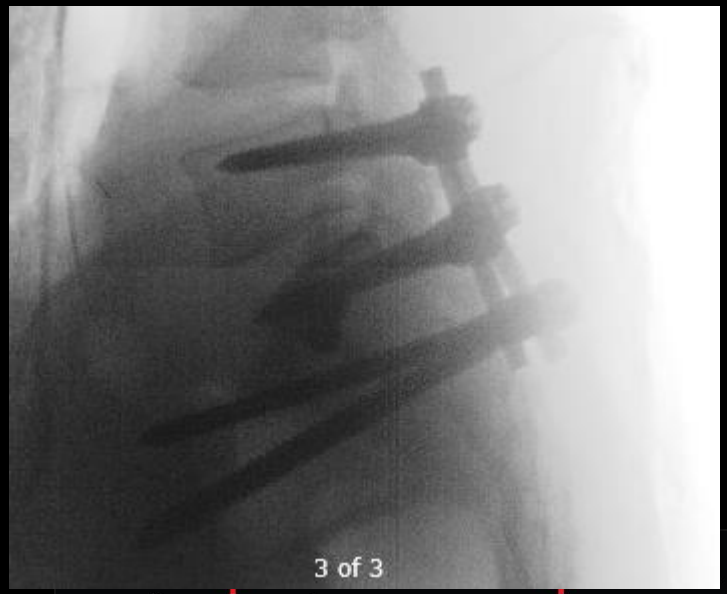
Short
Kyphosis

Reduction









Compensatory Lumbar Lordosis

Choosing a fixation strategy?

- Is a neurologic decompression needed?
  - Ongoing nerve compression?
- How will we reduce the fracture?
  - Closed
  - Percutaneous
  - Open
- Do we need to fuse lumbosacral junction
  - Displaced L5/S1 facet?

Choosing a fixation strategy?

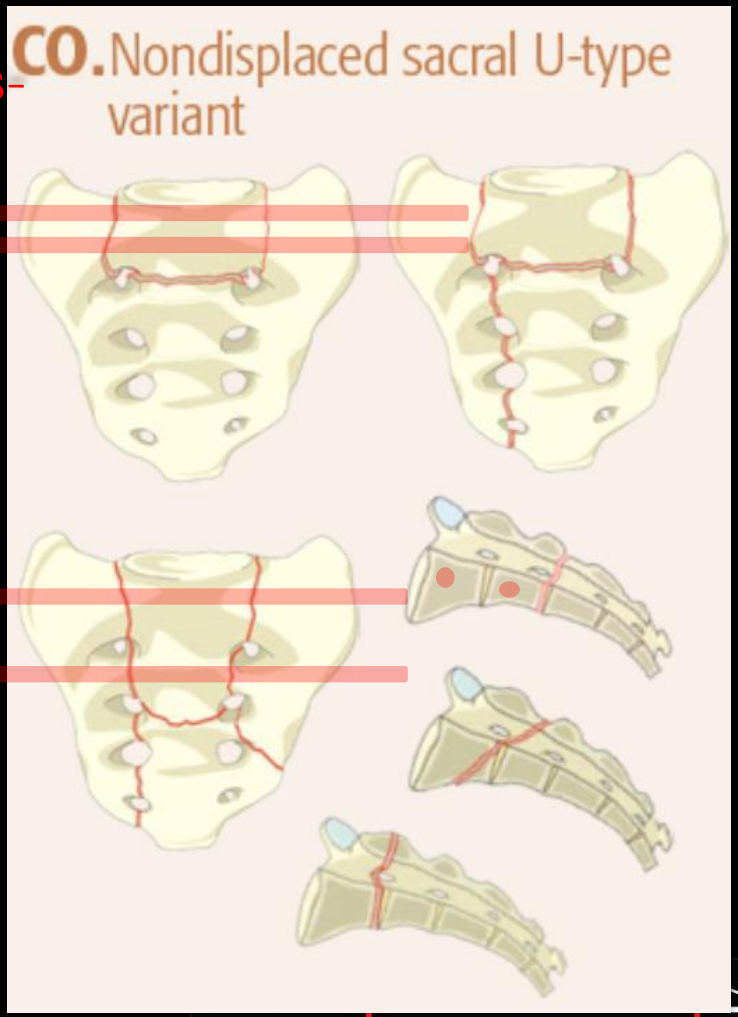
- Is a neurologic decompression needed?
  - Ongoing nerve compression?
- How will we reduce the fracture?
  - Closed
  - Percutaneous
  - Open
- Do we need to fuse lumbosacral junction?
  - Displaced L5/S1 facet?
- How will we instrument?
  - Osseous corridors available (sacral dysmorphism?)
  - Percutaneous or open

Choosing a fixation strategy?

- Is a neurologic decompression needed?
  - Ongoing nerve compression?
- How will we reduce the fracture?
  - Closed
  - Percutaneous
  - Open
- Do we need to fuse lumbosacral junction?
  - Displaced L5/S1 facet?
- How will we instrument?
  - Osseous corridors available (sacral dysmorphism?)
  - Percutaneous or open
- Weight bearing considerations?

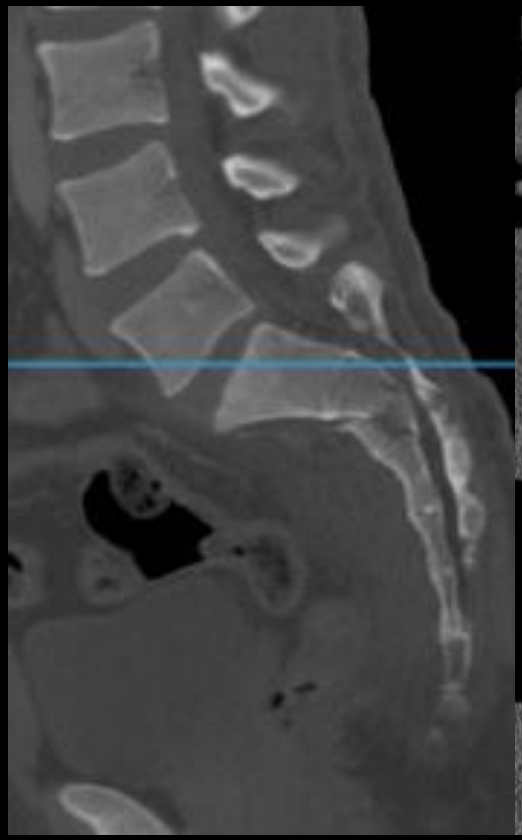
Minimally Displaced U type Fractures

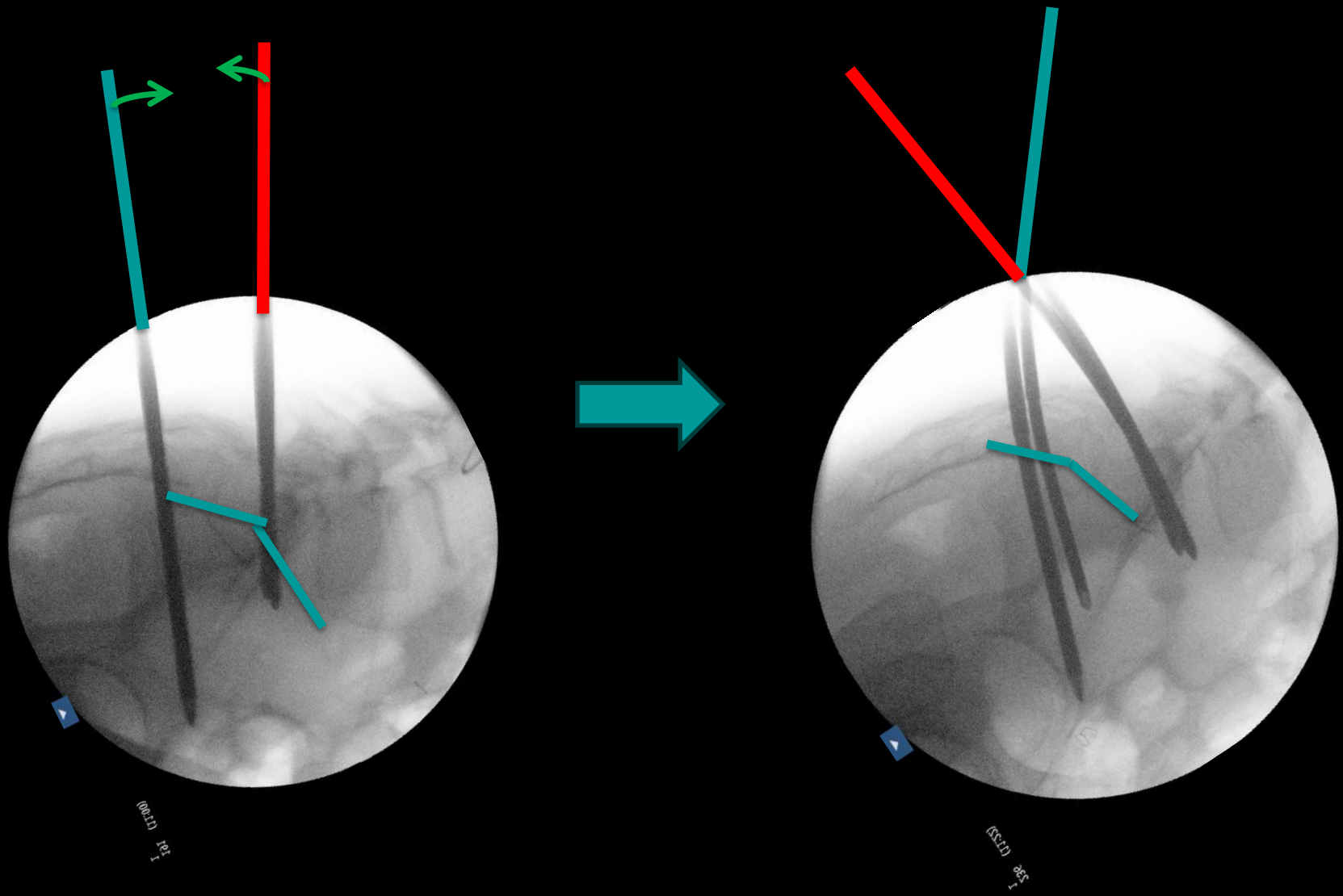
- Generally treated with transiliac trans-sacral screws



Displaced U type Fractures

- Generally treated with lumbopelvic fixation

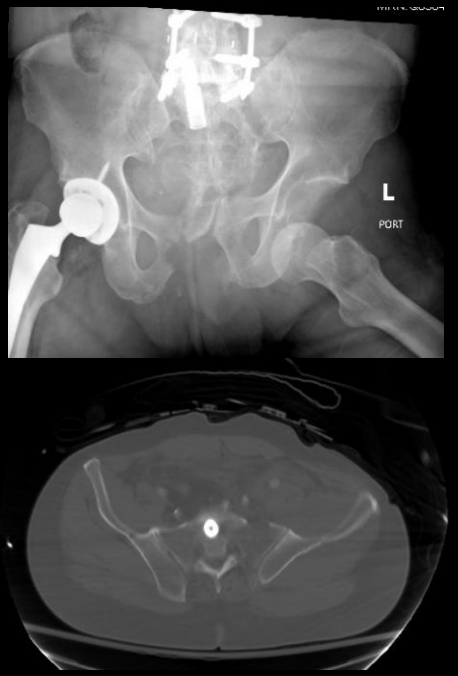




Orthopaedic Trauma Institute
UCSF + SAN FRANCISCO GENERAL HOSPITAL

Spinopelvic Fixation For Sacral Fractures

- Absolute Indications
  - Unstable lumbosacral junction
  - Pelvic morphology precludes sufficient traditional fixation
    - Dysmorphism/transitional anatomy, preexisting hardware
  - Inadequate proximal fixation due to fracture morphology with iliosacral screws alone
- Relative indications
  - Displaced vertical shear component
  - Supplemental fixation to allow for immediate WBAT
  - Narrow corridors
- No indications
  - Stable ring fracture
  - S/p traditional pelvis ORIF and can WBAT or can tolerate a period of limited weight bearing



Summary

- Wide spectrum of injuries
- Development of a comprehensive classification scheme
- Goals of fracture reduction and decompression of any compressed nerves
- Prioritize early mobilization and weight bearing!!!

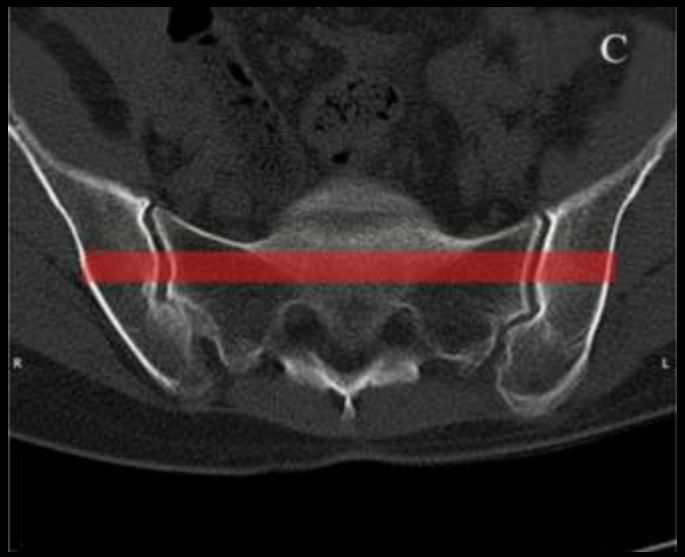
Thank You

Ashraf.ElNaga@ucsf.edu

Orthopaedic Trauma Institute
UCSF + SAN FRANCISCO GENERAL HOSPITAL

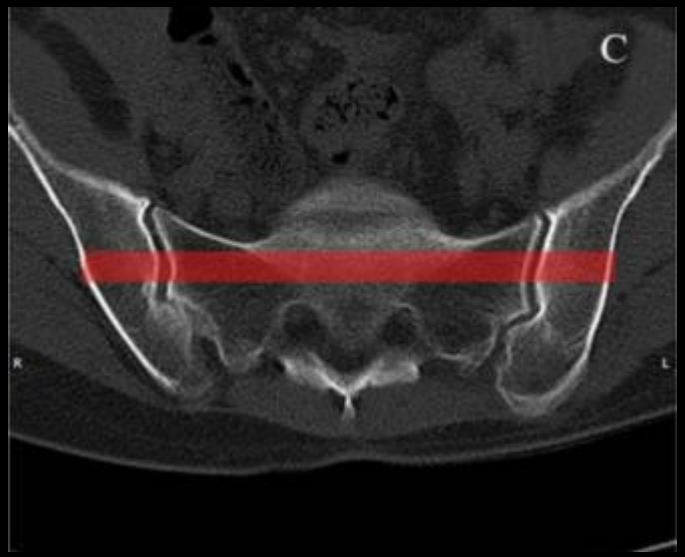
Upper Sacral Segment Variability

Non Dysmorphic

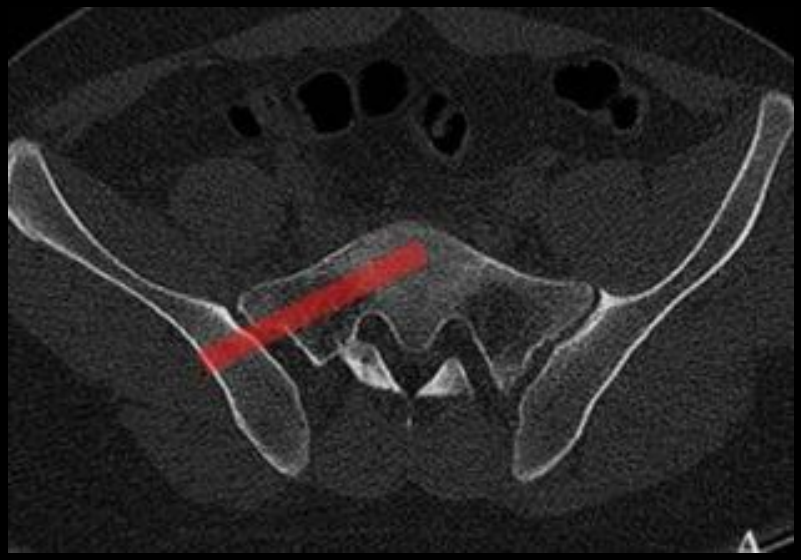


Upper Sacral Segment Variability

Non Dysmorphic



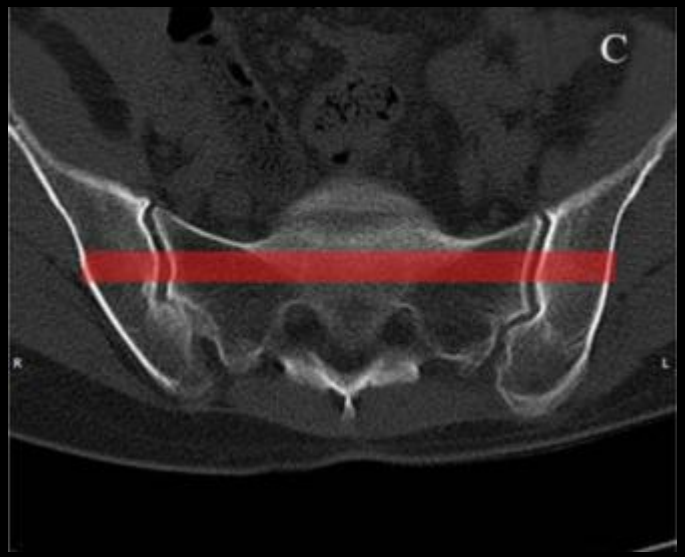
Dysmorphic



Orthopaedic Trauma Institute
UCSF + SAN FRANCISCO GENERAL HOSPITAL

Upper Sacral Segment Variability

Non Dysmorphic



Dysmorphic