Sacroiliac (SI) Joint Trauma

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Kadlec Regional Medical Center

PAOS, Phoenix, AZ, February 2020

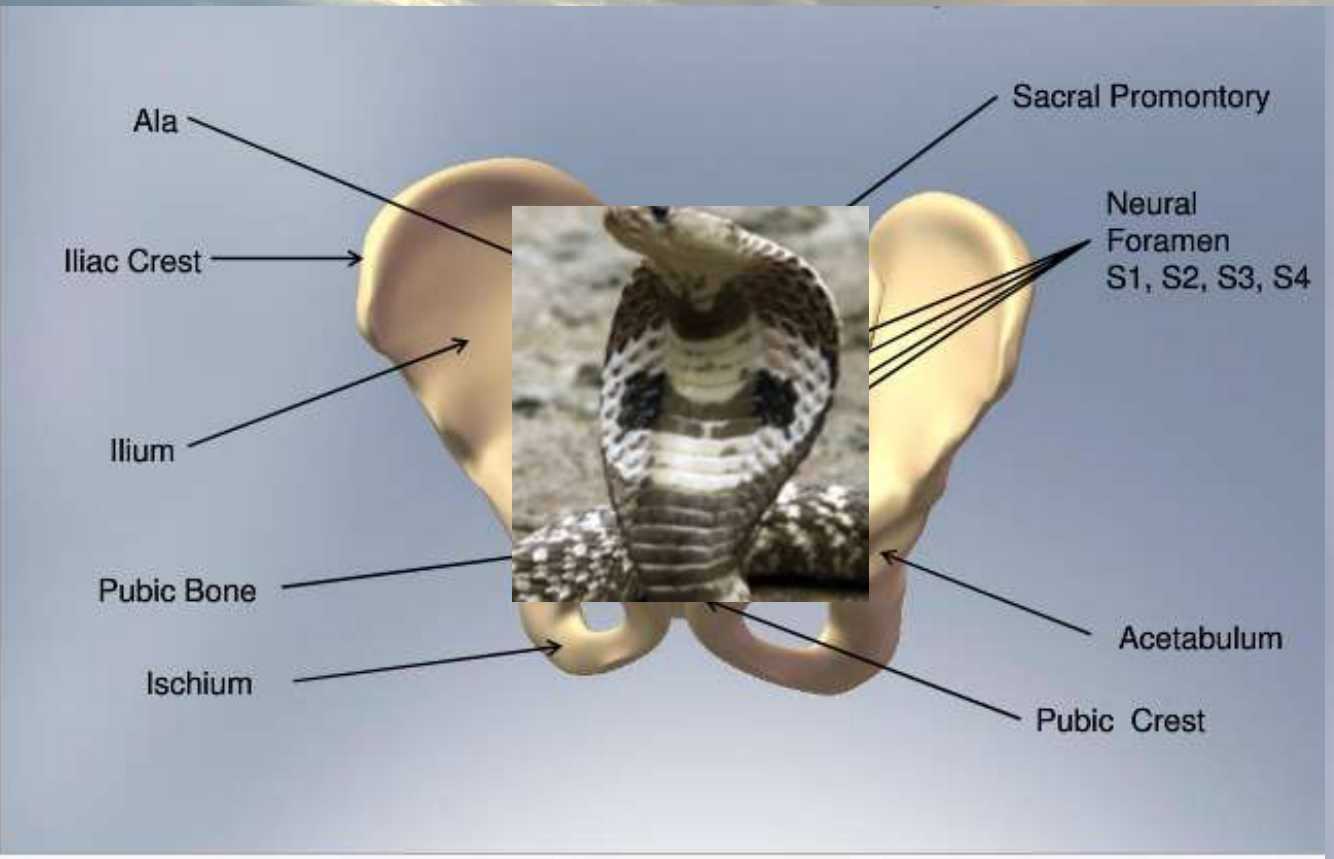
Objectives

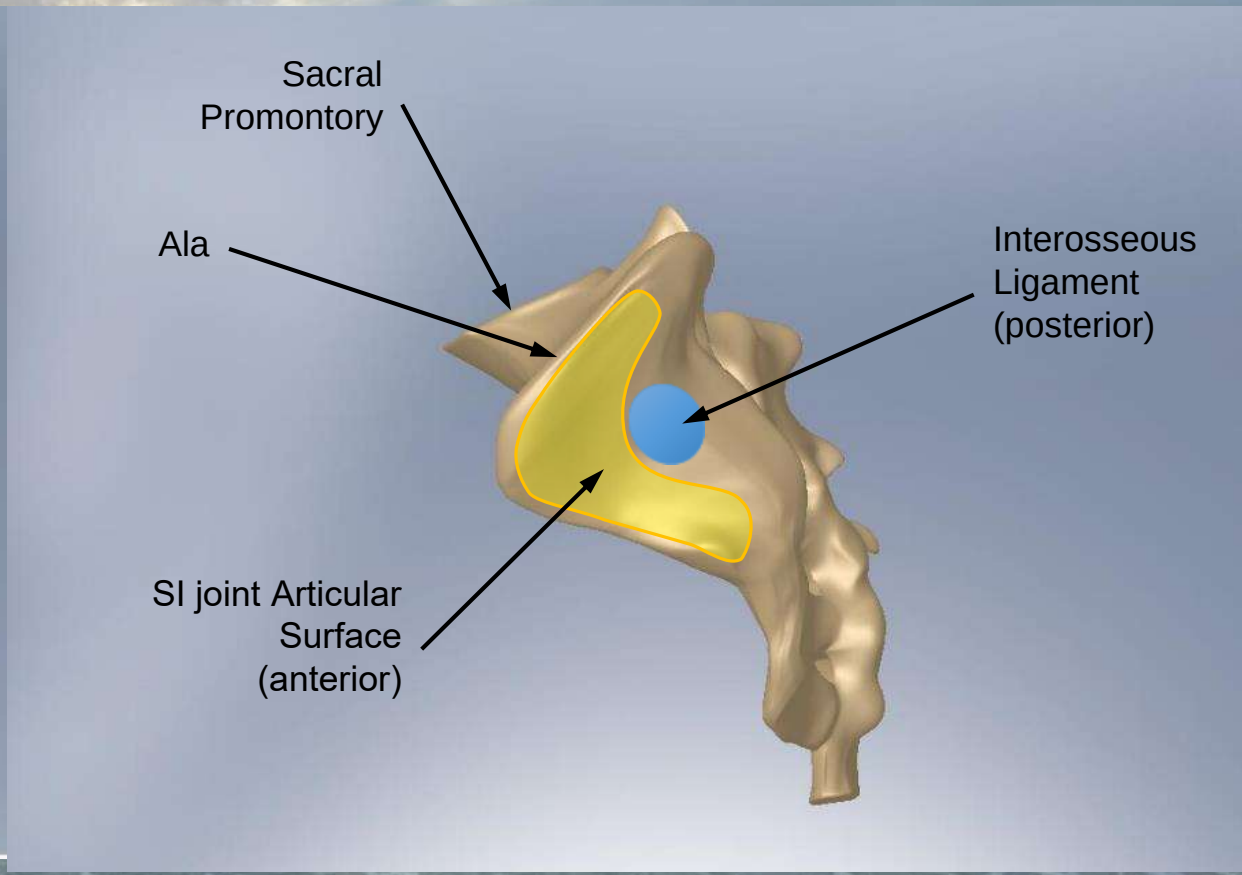
- Understand the anatomy of the SI Joint
- Identify clinical & radiographic characteristics of acute vs. chronic SI joint trauma
- Identify treatment options
- Laugh a little
- Get out early enough to get some good dinner

Disclosures

- I am a paid consultant of SI-Bone
  - I’m interested in this topic, though nothing commercial will be presented
- I also took this photo
- I’m getting hungry

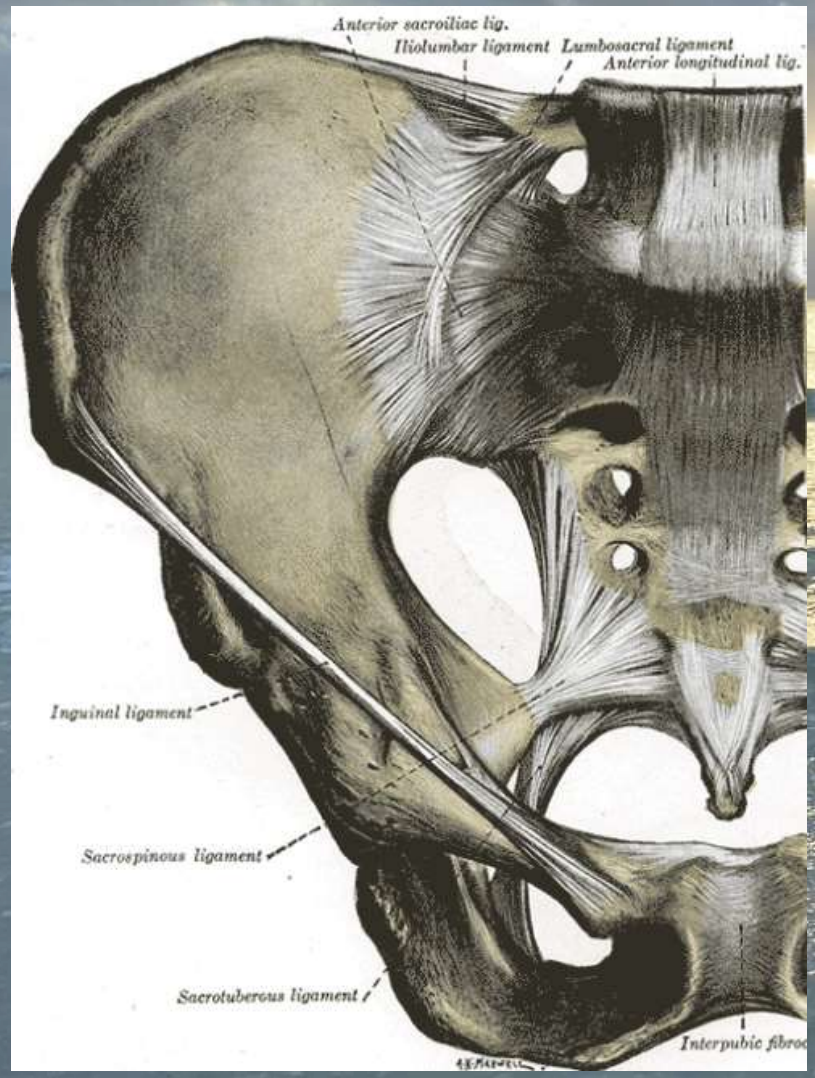
Anatomy


Ala
Sacral Promontory
Neural Foramen S1, S2, S3, S4
Iliac Crest
Ilium
Pubic Bone
Acetabulum
Ischium
Pubic Crest

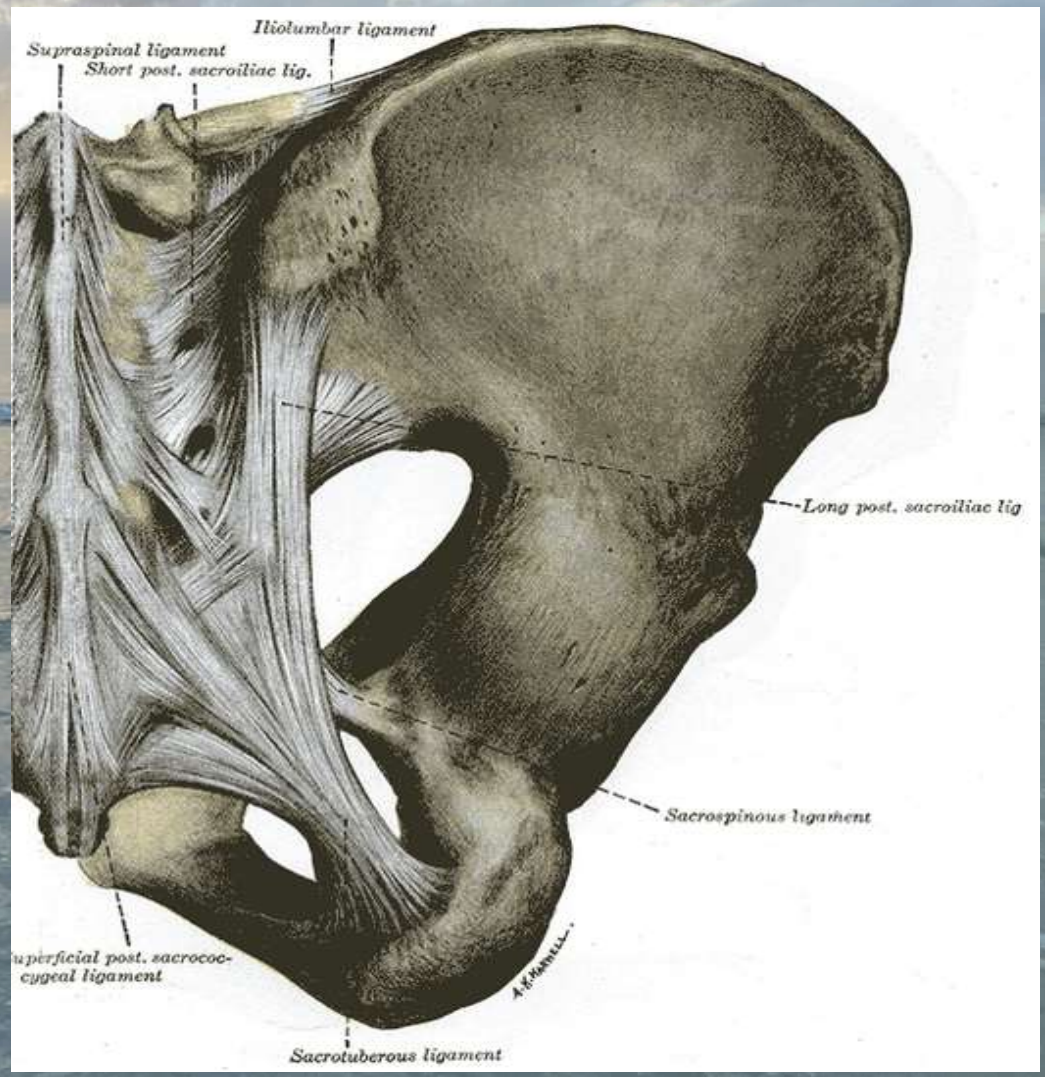

Sacral Promontory
Ala
Interosseous Ligament (posterior)
SI joint Articular Surface (anterior)

Anatomy

Anterior Ligaments



Posterior Ligaments



SI Joint Motion[1,2]

Multi-planar Motion

Simultaneously rotate and translate through 3 axes of motion

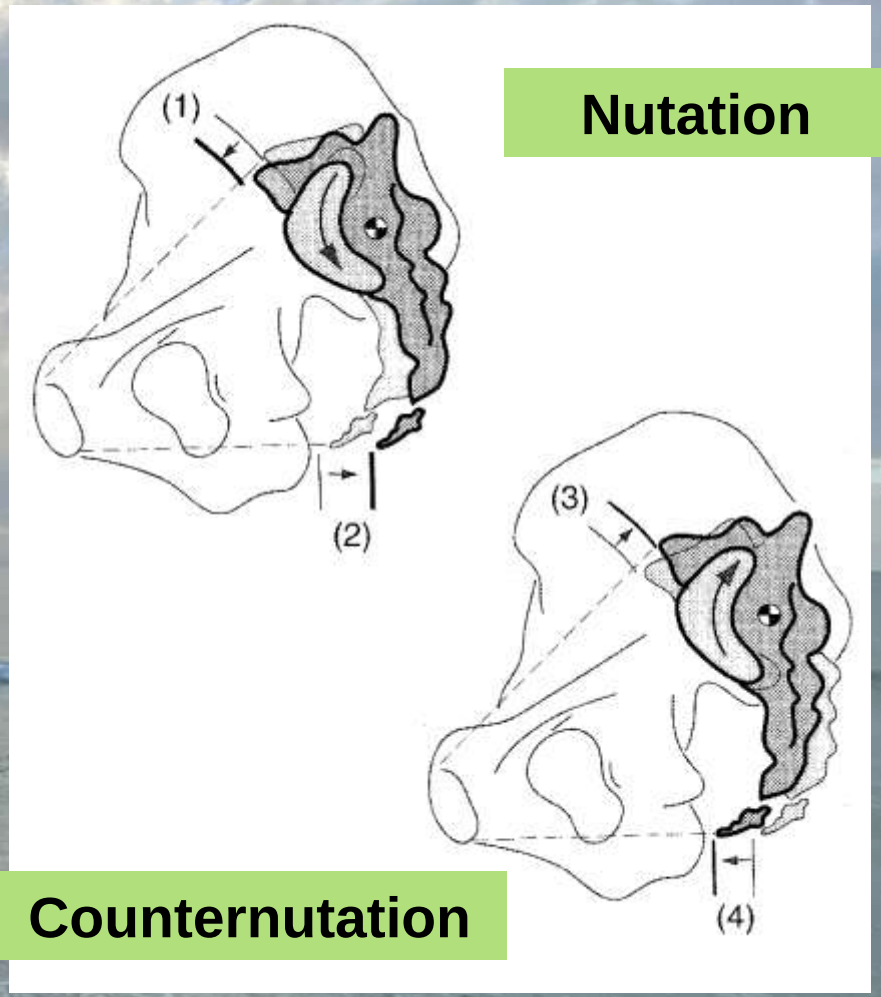
Motions (< 4° in any plane)

Nutation/Counternutation

- Males: 1-2°
- Females: 2-4°

Sacral Translation

(A-P motion) up to 1.6mm



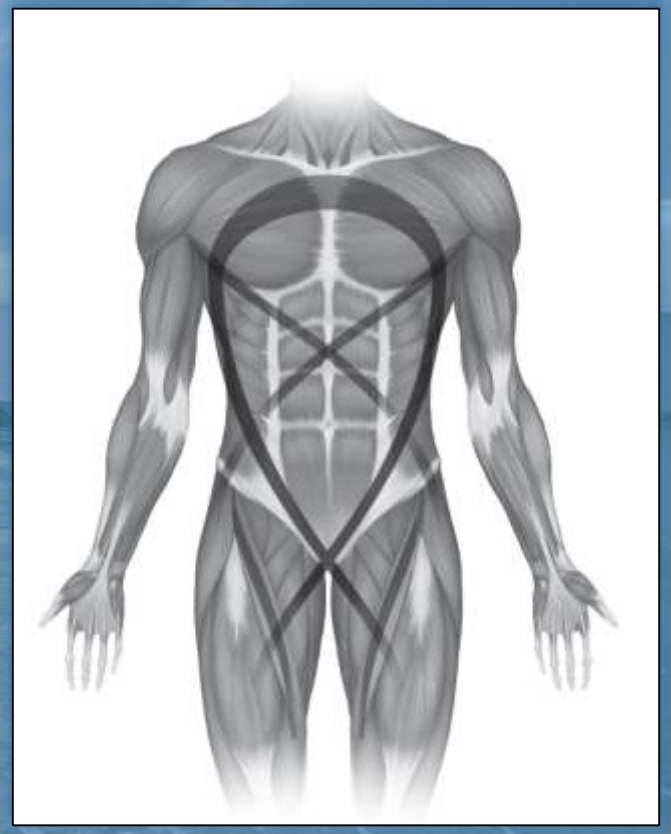
No difference in motion between symptomatic and asymptomatic joints

Forst – *Pain Physician* 2006

The Model of Self-Locking Mechanism

FORM Closure (Structural Integrity):

The shape of the sacrum and the integrity of the supporting ligaments contribute to SI joint stability



FORCE Closure (Joint Compression):

The external dynamic forces created by contraction of the stabilizing muscles and their fascial and ligamentous attachments

Vleeming 1990 (Part 1 & Part 2)

Acute Trauma and the SI Joint

Pelvic Fractures

- Most common causes
  - Motorcycles
  - Pedestrian vs. motor vehicle
  - Fall > 15 feet
  - Motor vehicle collision
- Mortality
  - 7-14%
  - 30% with severe or open fractures
  - Most deaths due to other traumatic causes

- Concomitant injuries in >90% of patients with pelvic fractures
- Most deaths due to:
  - Head Injury
  - Non-pelvic hemorrhage
  - Lung Injury
  - Thromboembolic events
  - Multi-system organ failure

Pelvis is like a pretzel…..

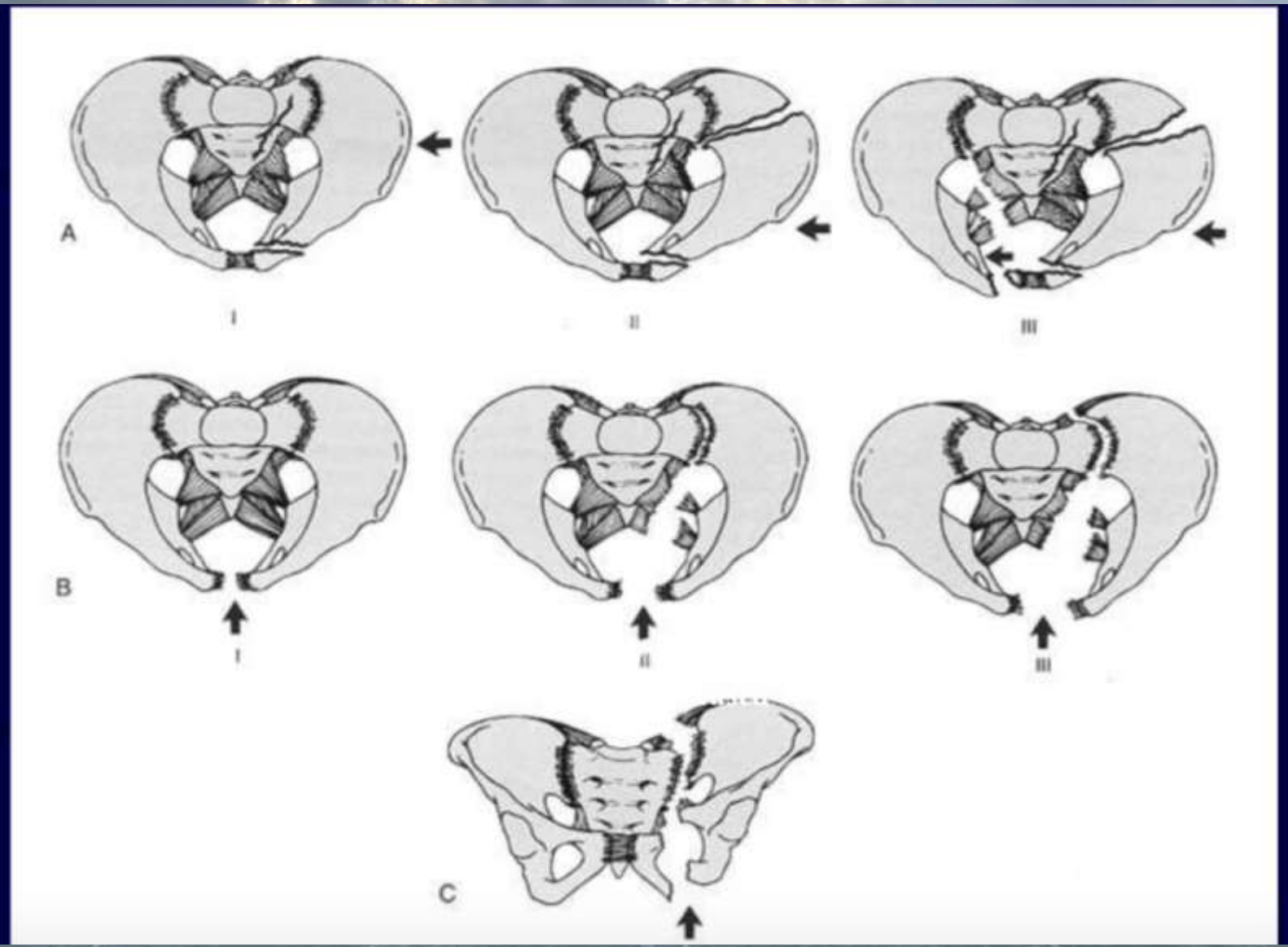
- It can’t break in just one spot…
  - Except in kids
- Where it breaks determines effect on SI joint

Young and Burgess Classification: Mechanistic description

Lateral Compression (LC)

Anteroposterior Compression (APC)

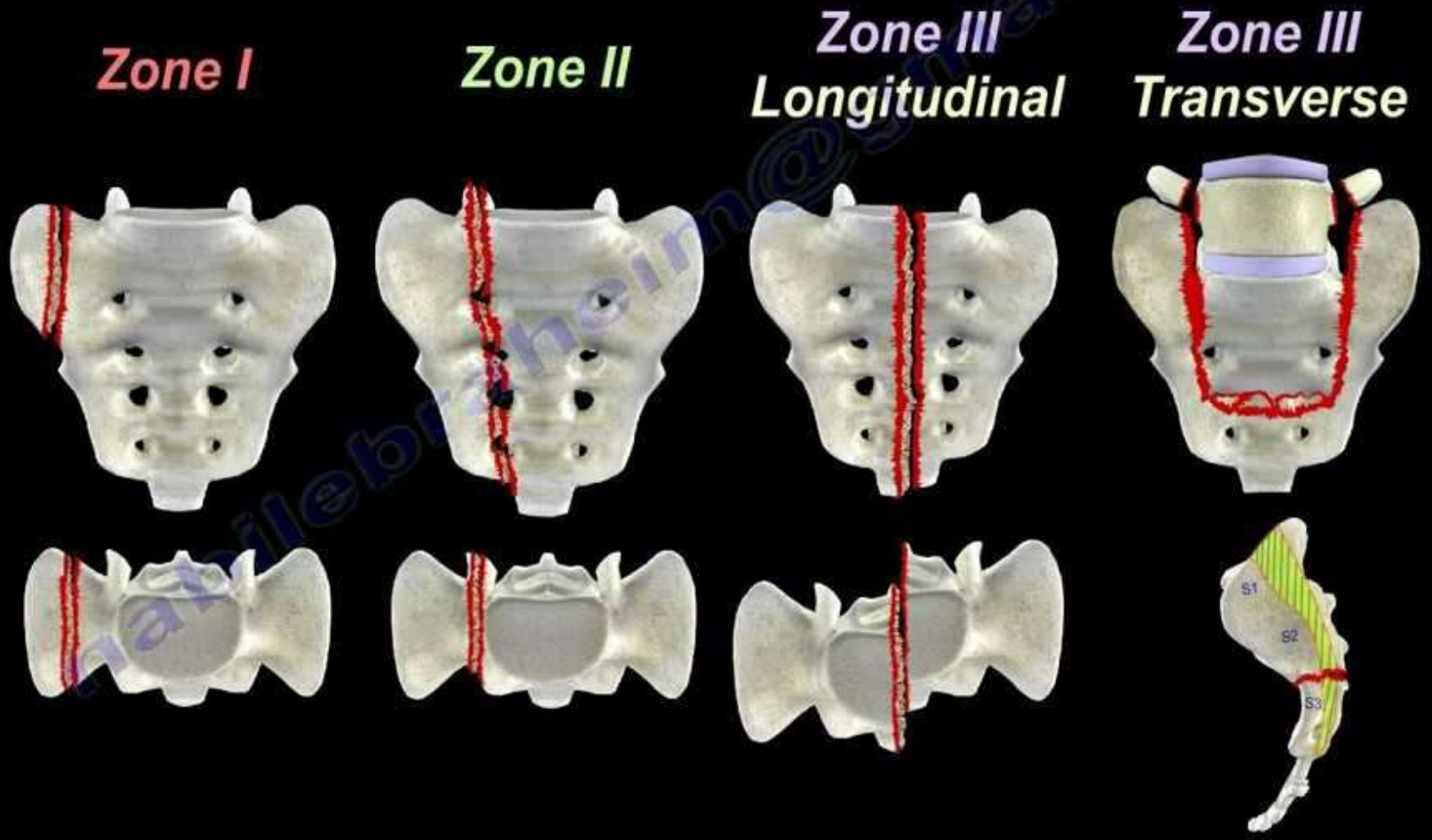
Vertical Shear (VS)



Sacral Fractures

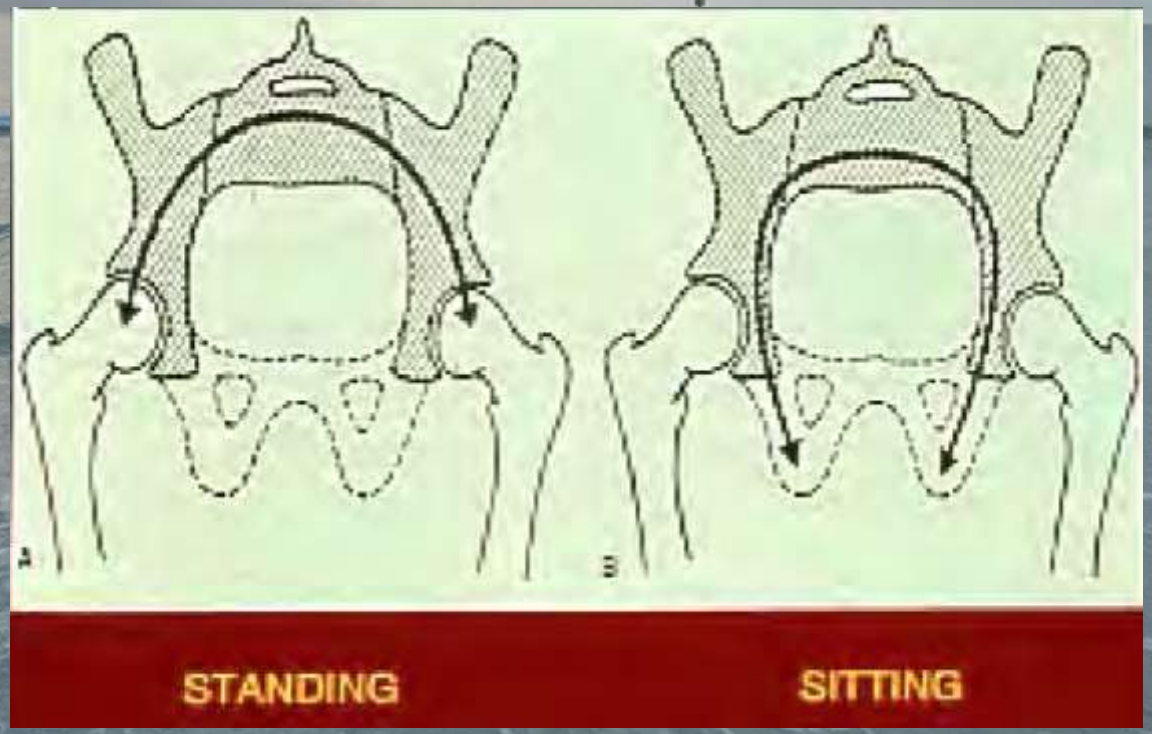
Types of Fractures of the Sacrum

Modified from the Denis Classification



Is it stable?

- Stability = ability to support physiologic load
- Loads may be when sitting, side lying, standing, or otherwise per patient need
- Posterior Pelvic ring integrity is important in load transfer from torso to lower extremities



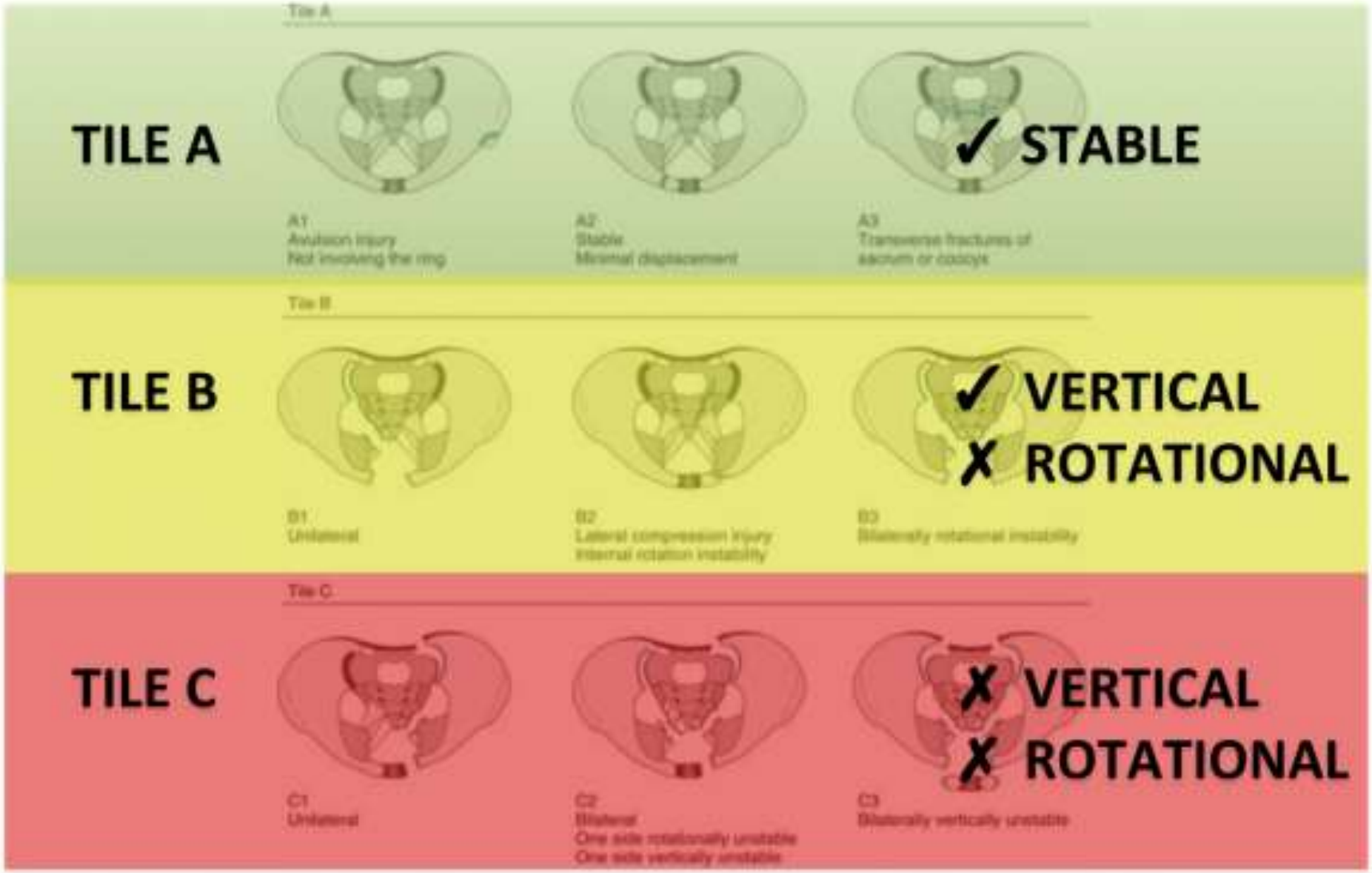
Instability Defined

- Loss of Posterior ring integrity often leads to instability
- Loss of Anterior ring integrity *may* contribute to instability, and *may* be a marker of posterior ring injury
- Tile classification
  - Based on instability patterns

TRAUMA

Sometimes, bad things happen to good people.
Sometimes, these "good people" also happen to be idiots.

Tile Classification



Is it stable?

- Is there deformity?
  - Deformity on presentation predicts instability

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- Is there deformity?
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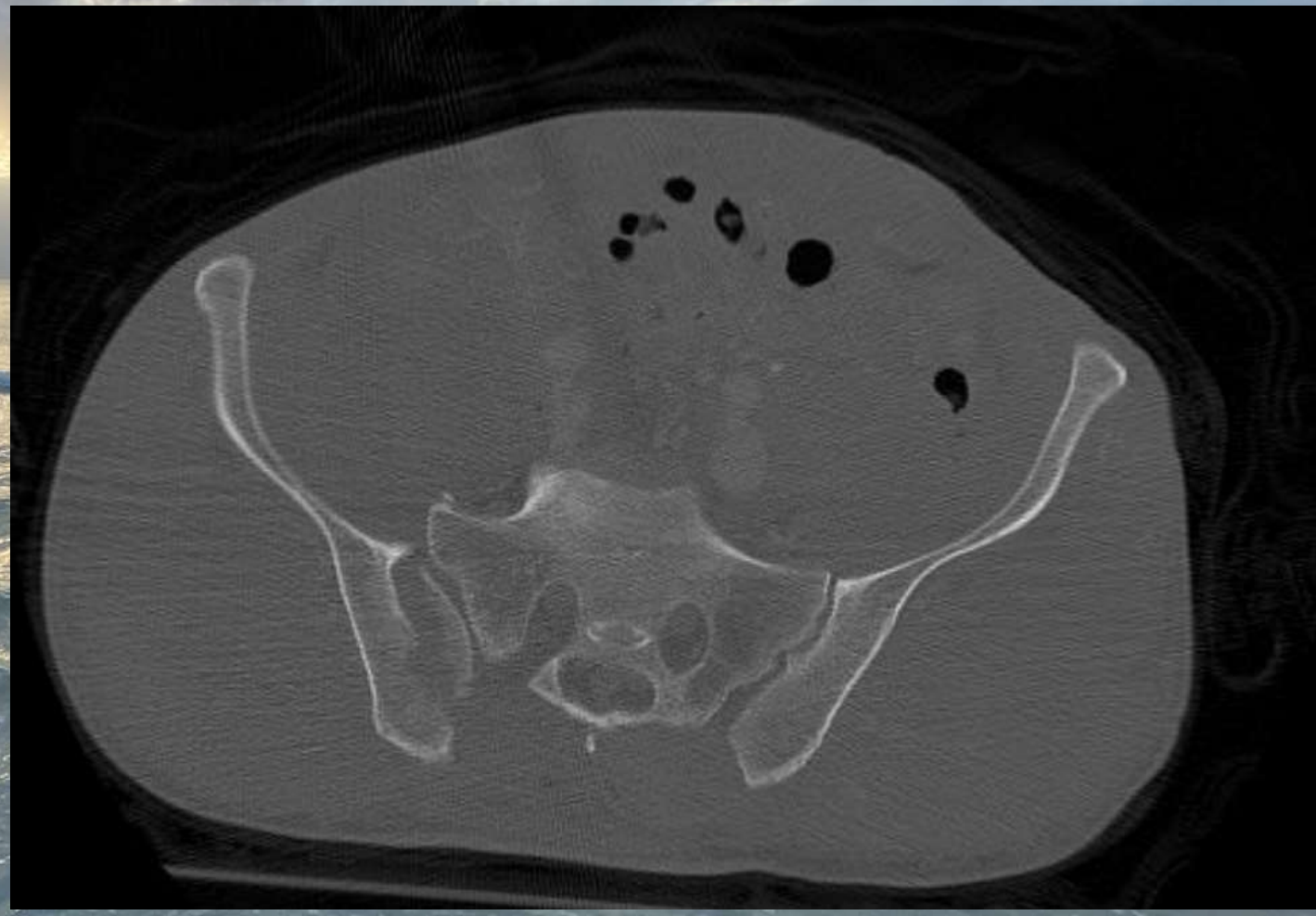
- Is the posterior pelvic ring intact?



Is it stable?

- Is there deformity?
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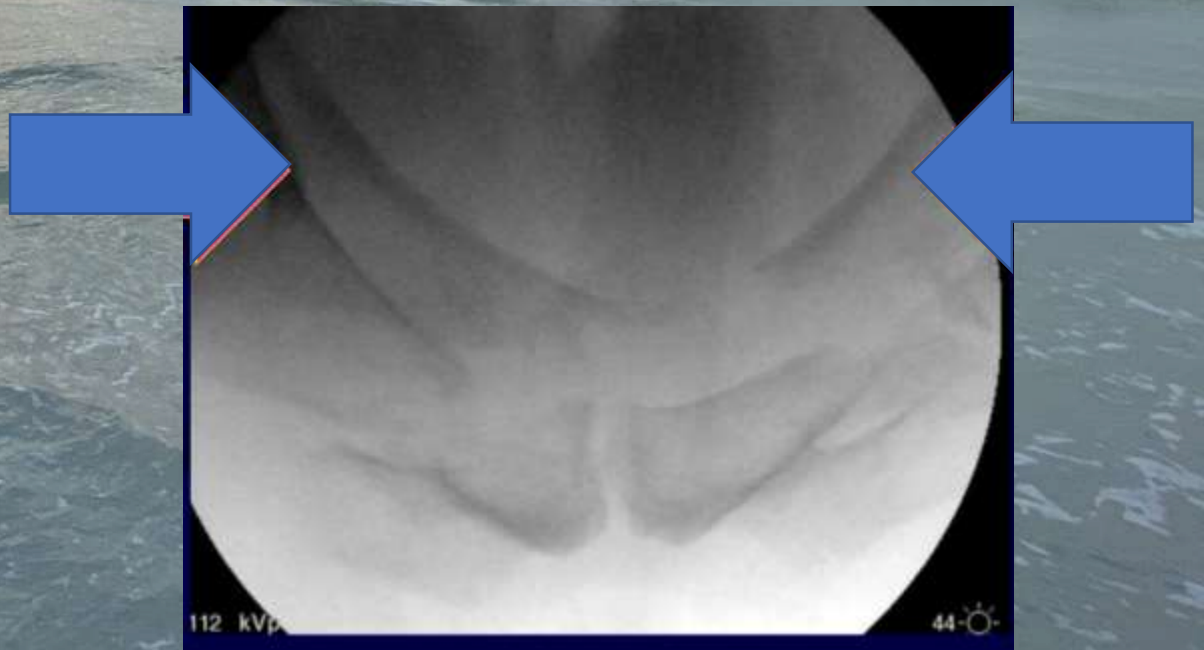
- Is the posterior pelvic ring intact?
- Stress test under fluoro



Is it stable?

- Is there deformity?
  - Deformity on presentation predicts instability
- Is the posterior pelvic ring intact?
- Stress test under fluoro
- Other clues to soft tissue injury?
  - Lumbar TP process fracture
  - Ischial spine avulsion
  - Lateral sacral avulsion

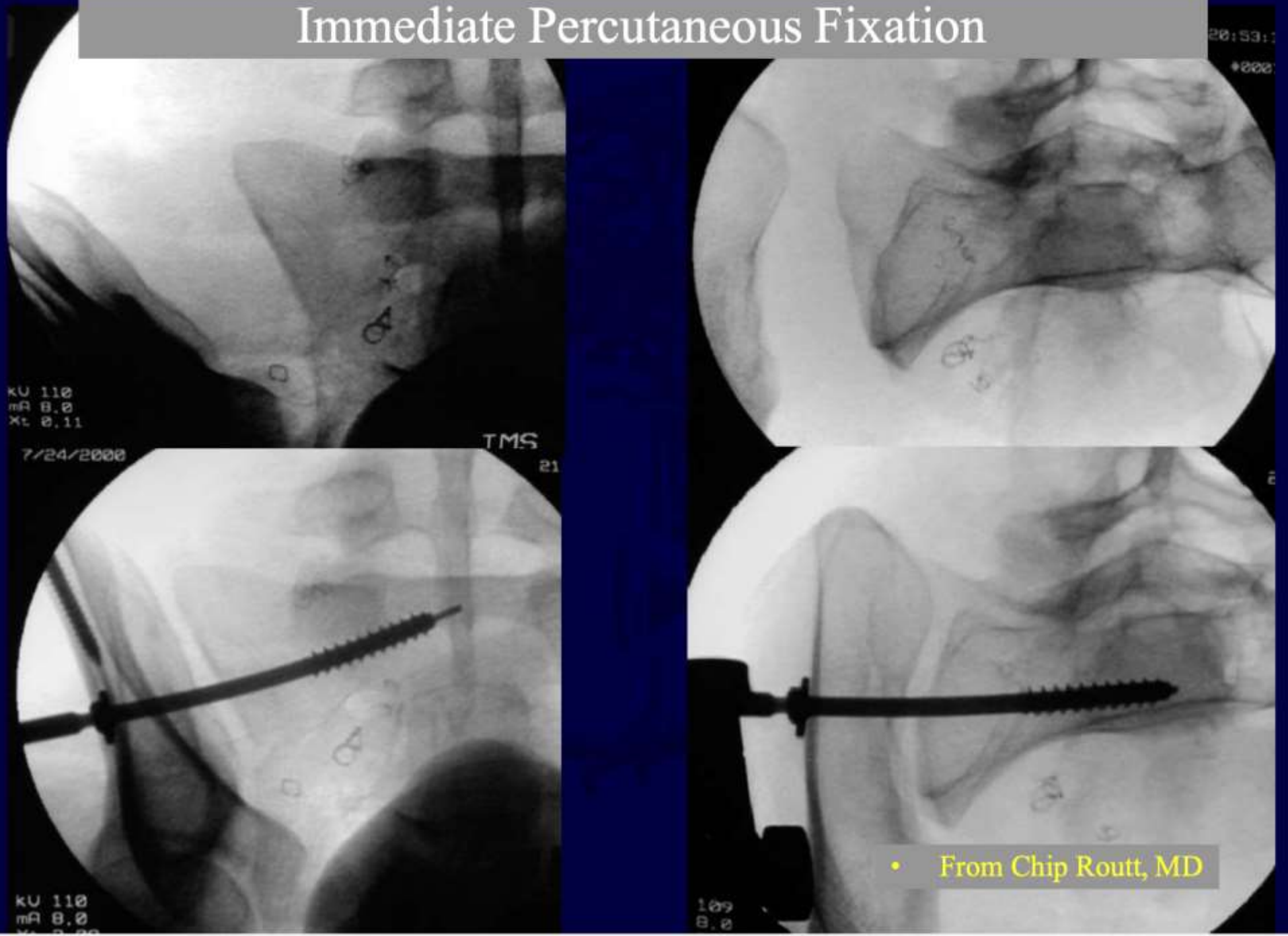
TRAUMA

Lifelong Fear of Airplanes for Toddlers
Your Doing it Right!

Operative Indications

- Active resuscitation
  - Close down pelvic ring, conserve volume

Immediate Percutaneous Fixation



- From Chip Routt, MD

Operative Indications

- Active resuscitation
  - Close down pelvic ring, conserve volume
- Assist in mobilization
  - Decreased motion at the joint = decreased pelvic pain = increased mobility
- Prevent long term functional impairment
  - 30-50% average of post-traumatic SI joint dysfunction/pain after pelvic ring injuries

Non-operative Management

- Lateral compression injuries with minimal (<1.5cm) displacement
- Pubic rami fractures with no posterior displacement/injury
    - These indications are currently under question in geriatric patients with insufficiency fractures….stay tuned…

Non-operative Management

- Lateral compression injuries with minimal (<1.5cm) displacement
- Pubic rami fractures with no posterior displacement/injury
- Minimal gapping of pubic symphysis
  - No associated with SI joint disruption
  - 2.5cm or less, no increased motion with stress testing
    - Not an absolute number, so ruling out SI joint pathology is critical!
    - There is significant physiologic motion in the peri-partum period, often resolving post-partum

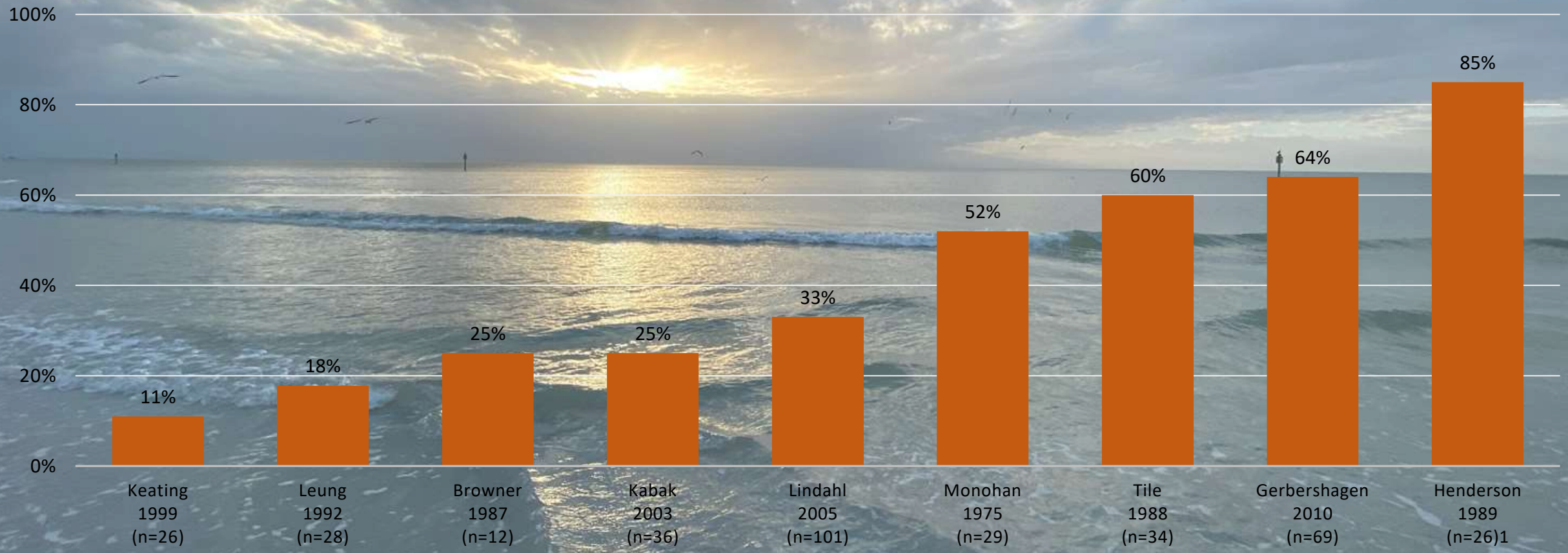
Non-Operative Considerations

- X-rays/CT are a static representation of a dynamic/fluid situation
  - Deformity may be worse than what is seen on imaging
    - Especially if binder/sheet was placed in the field
  - Stress radiographs may be helpful
  - Post-mobilization radiographs should be obtained in conservatively managed patients to ensure no significant changes
  - Look for evidence of instability
    - Lumbar TP fxs
    - Sacrotuberous/sacrospinaous ligament avulsions
    - Etc.

TRAUMA

THE NIGHT SCAR SAW 'TWILIGHT'
WAS A NIGHT HE WOULD NEVER FORGET....

30-50% of Pelvic Trauma Patients Develop SIJ Pain



1. Monahan, Injury 1975
2. Henderson, Journal of Orthopaedic Trauma 1989
3. Keating, Journal of Orthopaedic Trauma 1999
4. Browner, Journal of Trauma 1987
5. Sevki Kabak, Journal of Orthopaedic Trauma 2003
6. Tile, Journal of Bone and Joint Surgery 1988
7. Leung, Injury 1992
8. Hans Jürgen Gerbershagen, The Journal of Trauma 2010
9. Jan Lindahl, Acta Orthopaedica 2005

What about injuries that aren't high energy trauma?

Potential Causes of SIJ Pain: Traumatic

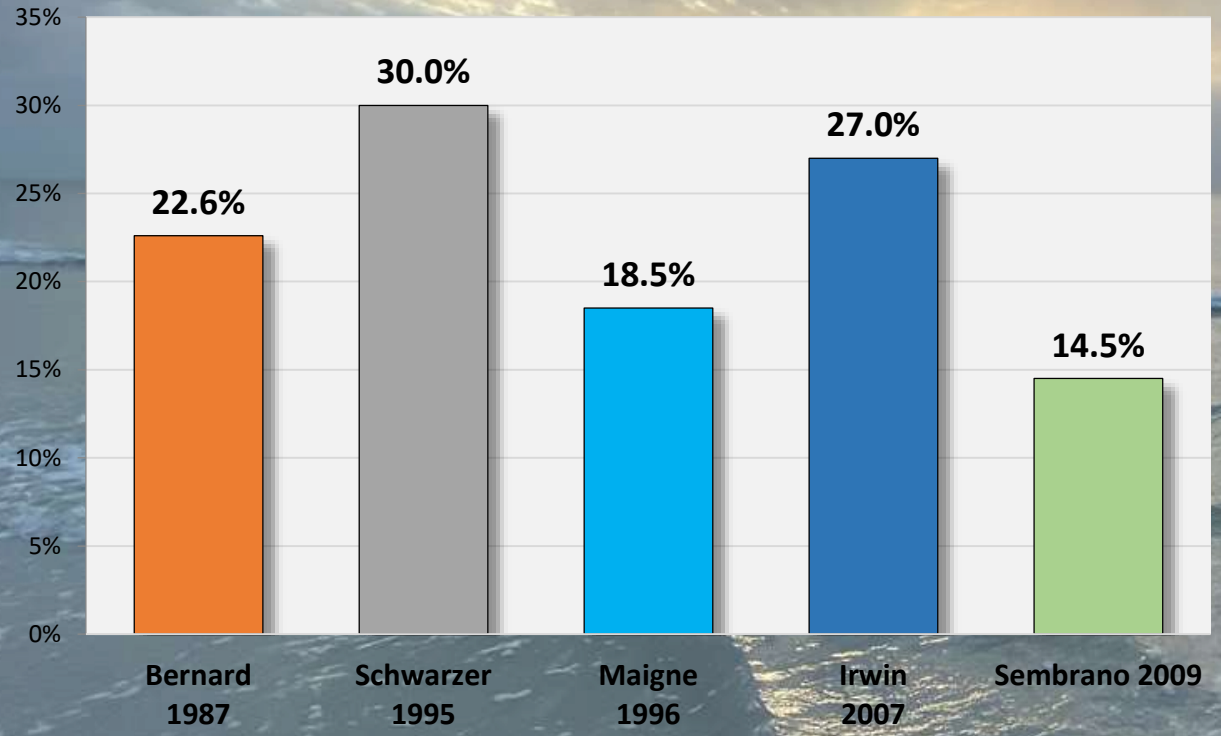
- **MVA: Foot on Brake**
  - Even if no overt instability on films
  - Axial load
- **Slip and Fall**
- **Lifting and Twisting**
- **Traction Injuries**

Potential causes of SI joint pain: Gradual onset

- **Laxity of the SI joint / Pregnancy**
- **Repetitive Forces on SI joint and Supporting Structures**
- **Biomechanical Abnormalities**
  - Leg length inequality
  - Pelvic obliquity/scoliosis
- **Adjacent Segment Degeneration**
  - After lumbar spinal fusion

Prevalence of SI Joint Pain

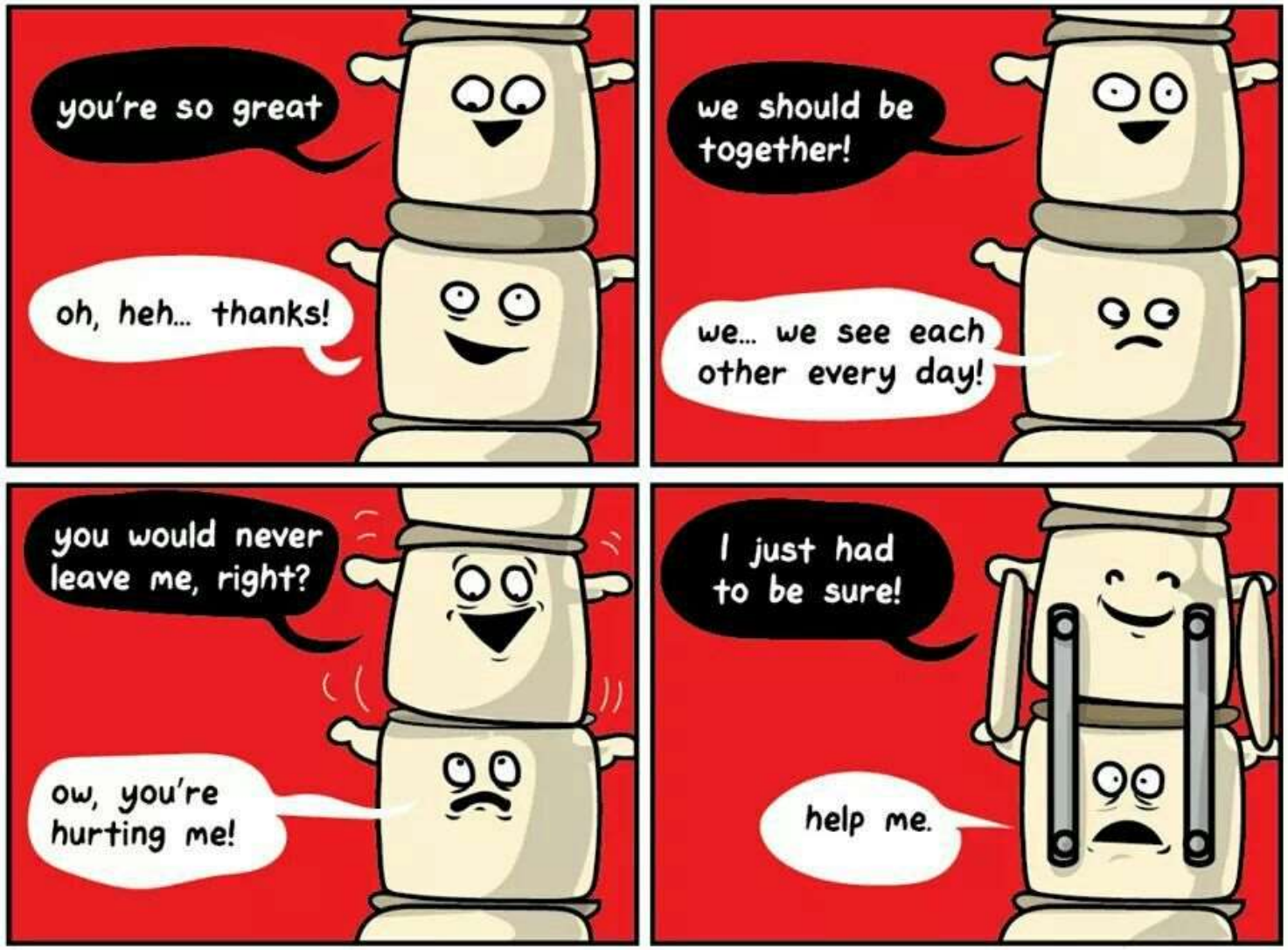
15-30%
Component of Chronic LBP



32-43%
Symptomatic Post-Lumbar Fusion

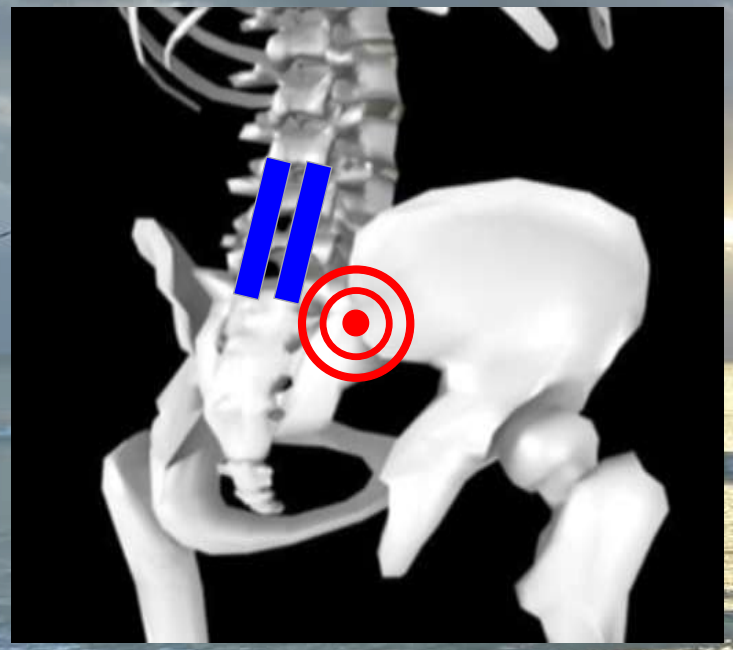
DePalma – *Pain Med* 2011

32% Katz 2003
35% Maigne 2005
43% DePalma 2011
40% Liliang 2011



- Speaking of traumatic spine experiences…..

Adjacent Segment Degeneration



75% of post-lumbar fusion patients showed SI joint degenerative changes on CT scan 5 years after

vs.
only 38% age- and gender-matched controls without prior lumbar fusion

Ha 2008

Lumbar fusion leads to increases in angular motion and joint stress at the SI joint

Ivanov 2009

1. Ha – *Spine* 2008
2. Ivanov – *Spine* 2009

Sacral Insufficiency Fractures

- Mechanism unknown or fall from standing height
- Often presents subacutely with persistent LBP
- May need CT/MRI to diagnose
  - Bone quality is poor, tough to see on XR
  - Often found on Lumbar spine MRI

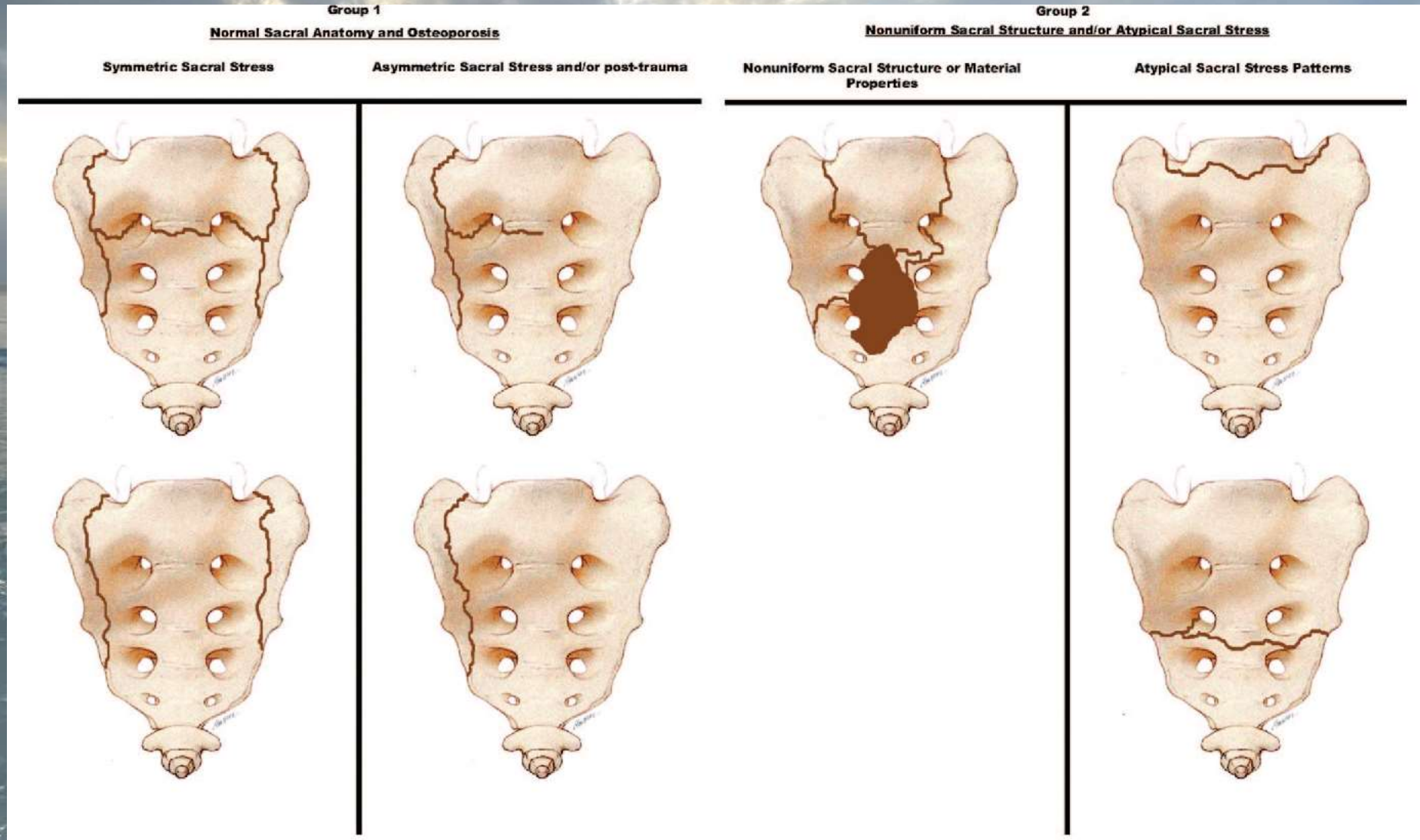


Figure 4. Common patterns emerged for sacral insufficiency fractures and a biomechanical classification system is introduced. There are

Exacerbating activities

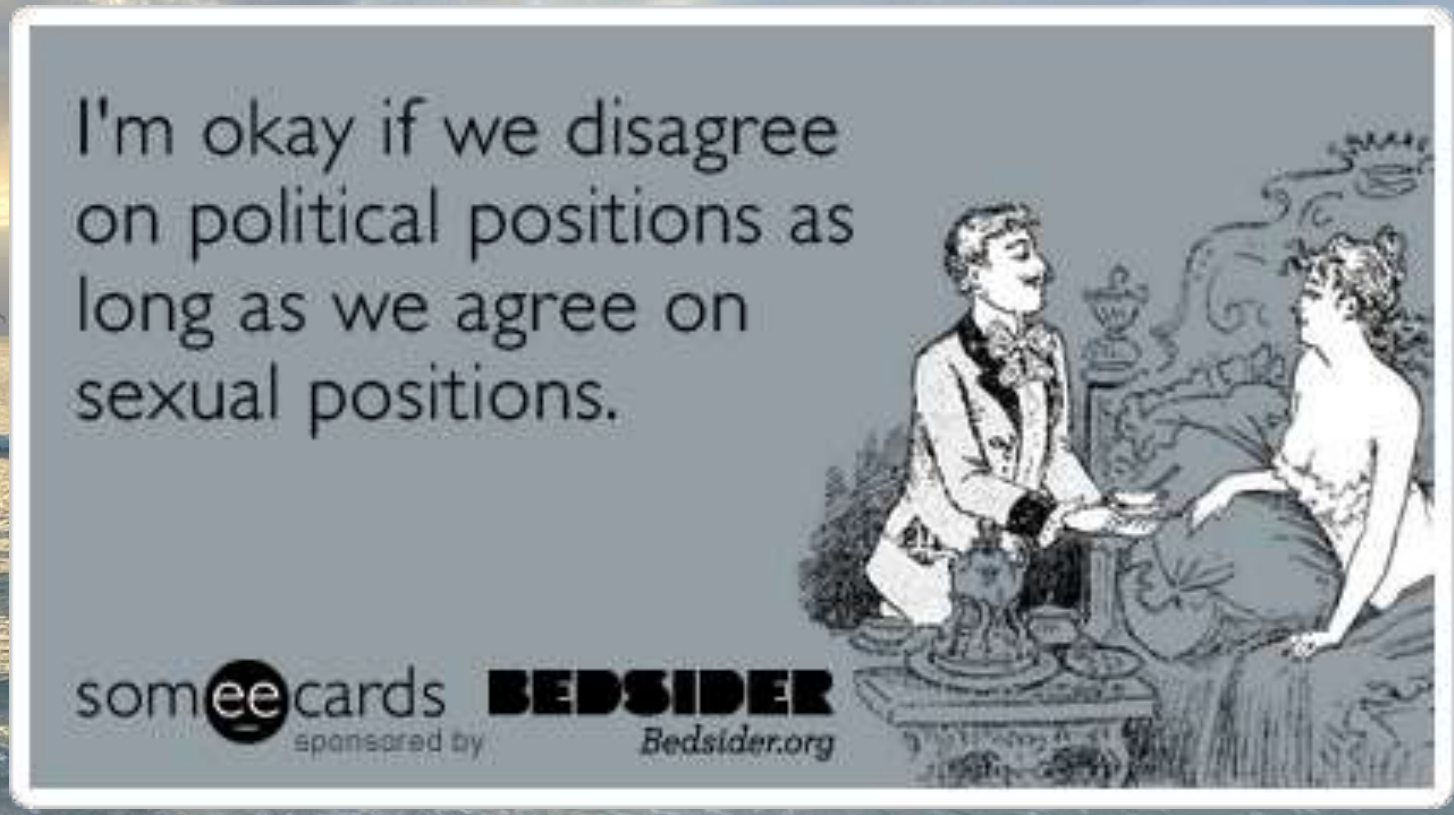
Unilateral Weight Bearing

- Putting on Socks/Shoes
- Ascending/Descending Stairs
- Getting in and out of Car
- Prolonged Walking

(85% of gait cycle is single leg stance)

Janda 1983

Sexual Intercourse



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(85% of gait cycle is single leg stance)

Janda 1983

Sexual Intercourse

Pain with Transitional Motions

- Supine to painful side
- Sit to stand
- Rolling over in bed
- Getting in /out of bed

Pain while Stationary

- Sitting on affected side
- Prolonged standing/sitting

SI Joint Pain: Highly Burdensome

Medical Devices: Evidence and Research

Dovepress

ORIGINAL RESEARCH

Sacroiliac joint pain: burden of disease

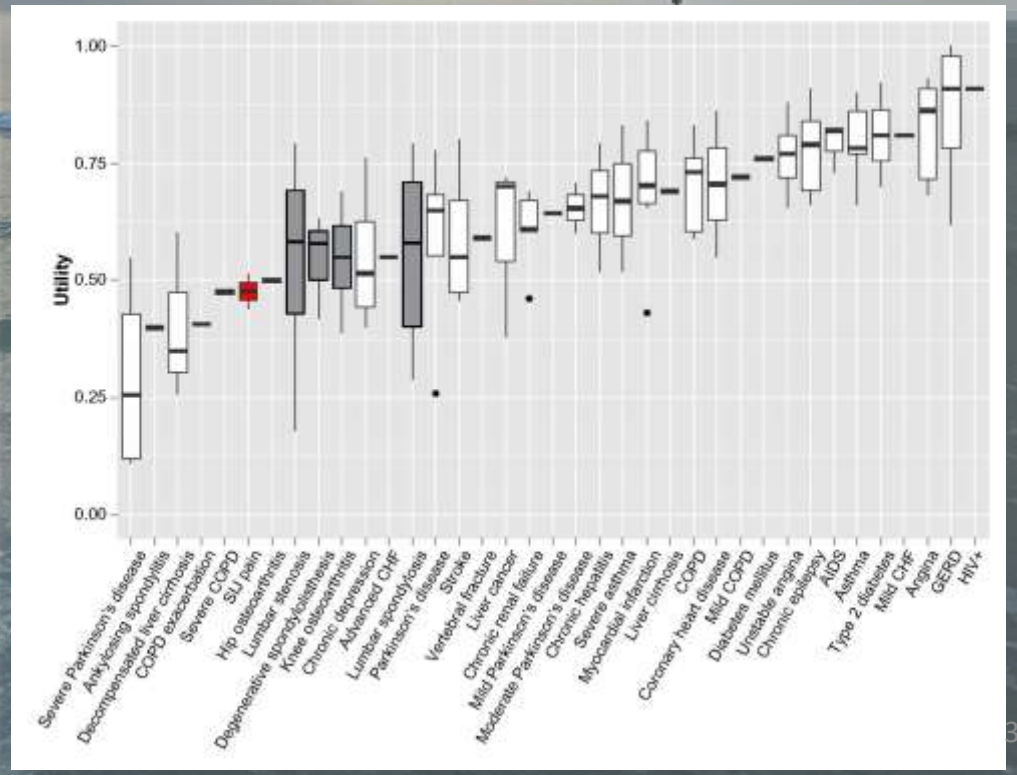
This article was published in the following Dove Press journal:
Medical Devices: Evidence and Research
12 April 2014
Number of times this article has been viewed

Daniel Cher[1]
David Polly[2]
Sigurd Berven[3]

[1]SI-BONE, Inc., San Jose, CA, USA; [2]Department of Orthopedic Surgery, University of Minnesota, Minneapolis, MN, USA; [3]Department of Orthopedic Surgery, University of California San Francisco, San Francisco, CA, USA

Objectives: The sacroiliac joint (SIJ) is an important and significant cause of low back pain. We sought to quantify the burden of disease attributable to the SIJ.

Methods: The authors compared EuroQol 5D (EQ-5D) and Short Form (SF)-36-based health state utility values derived from the preoperative evaluation of patients with chronic SIJ pain participating in two prospective clinical trials of minimally invasive SIJ fusion versus patients participating in a nationally representative USA cross-sectional survey (National Health Measurement Study [NHMS]). Comparative analyses controlled for age, sex, and oversampling in NHMS. A utility percentile for each SIJ subject was calculated using NHMS as a reference cohort. Finally, SIJ health state utilities were compared with utilities for common medical conditions



Cher – *Med Device Evid Res* 2014

Differential Diagnosis:
Aiming at the Right Target

Multiple possible pain generators

Lumbar Spine

SI Joint

Hip

Appropriate Work-up

- History will often tell the story
- Imaging
  - Sometimes positive, but often no—descript
  - Advanced imaging for appropriate cases
  - Often found as an “Incidentaloma” on lumbar MRI, pelvic CT
- Physical exam:
  - Fortin finger test

SI Joint Provocative Tests

Distraction

①

Thigh Thrust

②

FABER

③

Compression

④

Gaenslen's

⑤

3 of 5 positive tests

provides discriminative power for diagnosing SI joint pain

Szadek – *J Pain* 2009

Laslett – *J Man Manip Ther* 2008

SI Joint: Provocative Tests

3 out of 5 provocative tests performed in **combination**, show a high degree of sensitivity and specificity:

1. **Distraction* (Highest PPV**)**
2. **Thigh Thrust***
3. **FABER**
4. **Compression***
5. **Gaenslen's Maneuver**

	Laslett [1,2]	Szadek [3]
	3 or more positive tests	
Sensitivity	**91%**	**85%**
Specificity	**78%**	**76%**

* Most sensitive of tests
** PPV = *positive predictive value*

1. Laslett – *Man Ther* 2005
2. Laslett – *J Man Manip Ther* 2008
3. Szadek – *J Pain* 2009

SI Joint Treatment Continuum

Treatment Intensity

Medications
(NSAIDS, opiates, etc.)

Physical Therapy

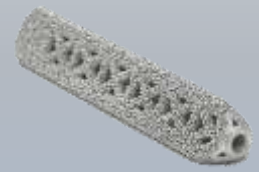
External Support
(SI Joint Belt)

Therapeutic SI Joint Injections
(anesthetic & steroids)

Radiofrequency Ablation

Non-Surgical Management

MIS SI Joint Fusion



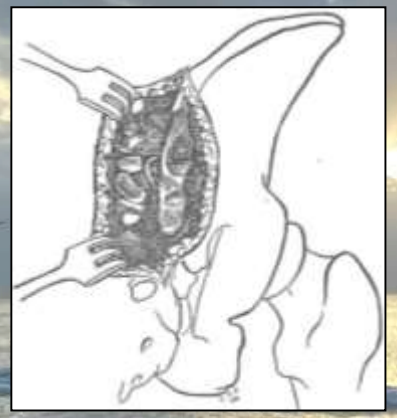
Open SI Joint Fusion

Surgery

Surgical Treatment

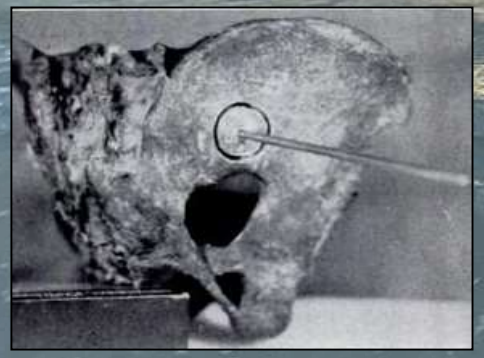
Historical: Open, invasive

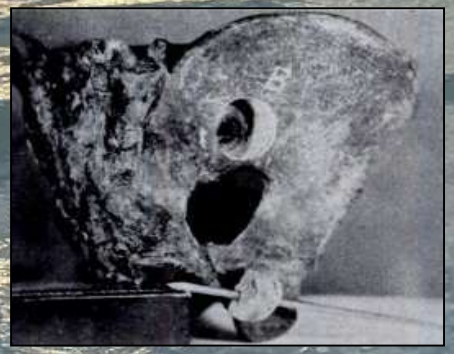
Smith-Petersen 1926



Campbell 1927

Gaenslen 1927



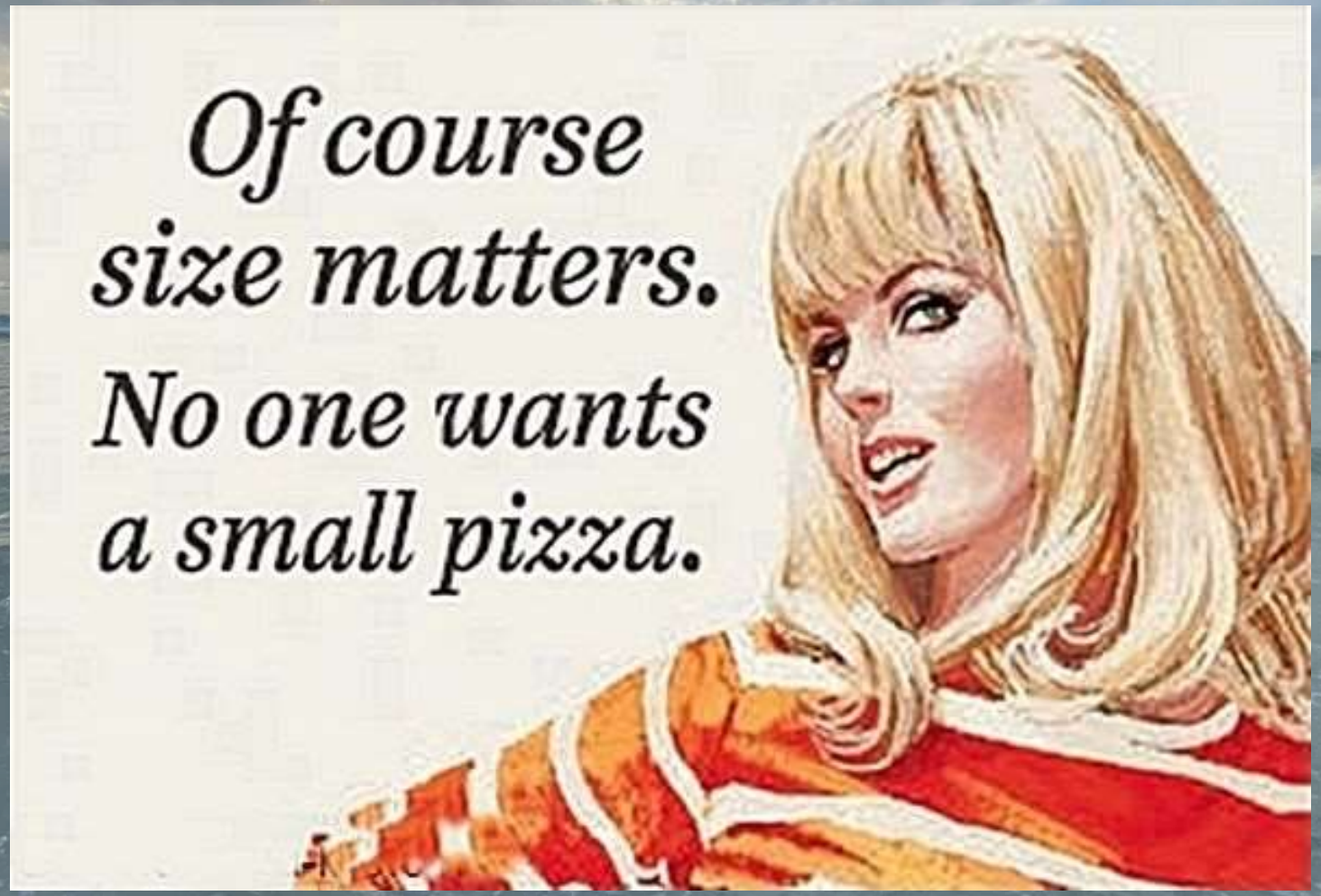


Bloom 1937

Modern: Minimally invasive

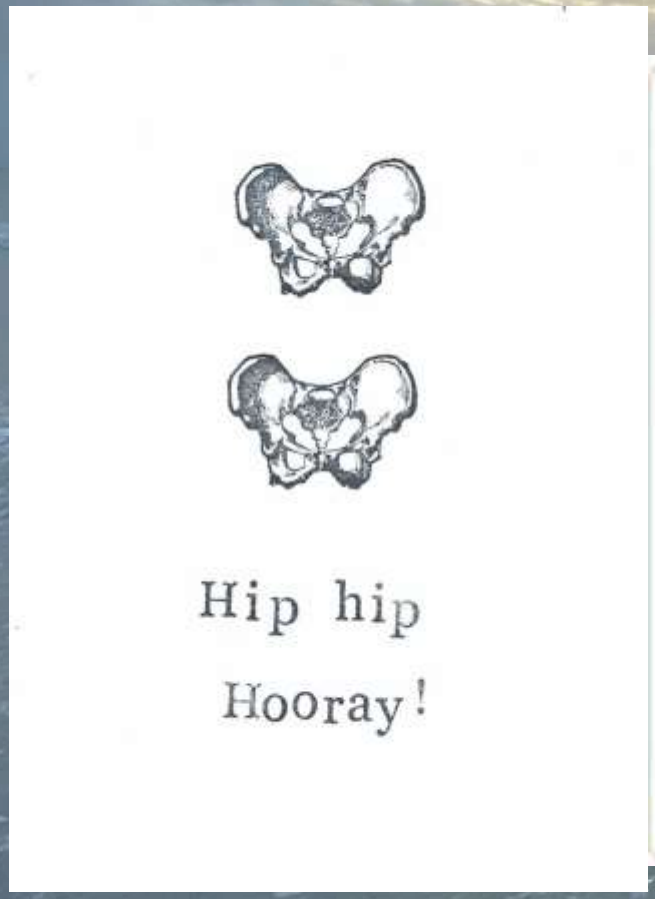
MIS Incision compared to a dime

When choosing surgical options….

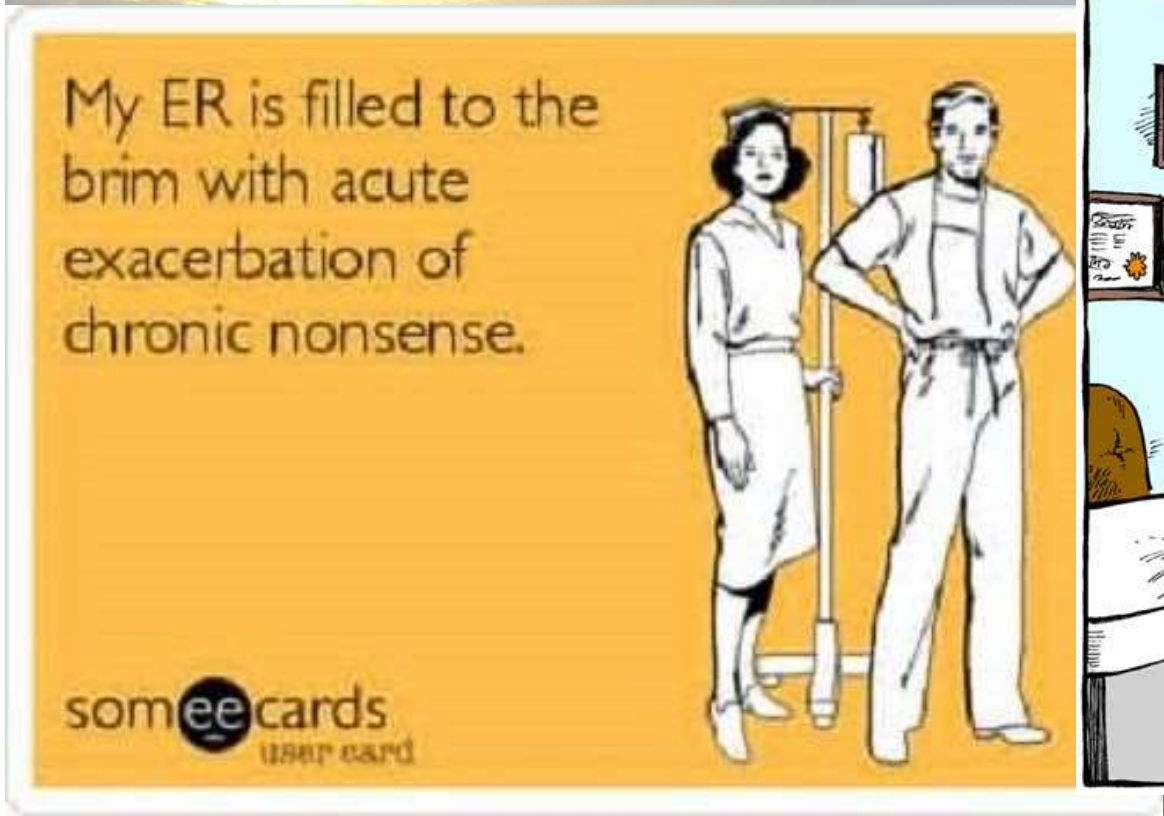


Summary

Learned Anatomy

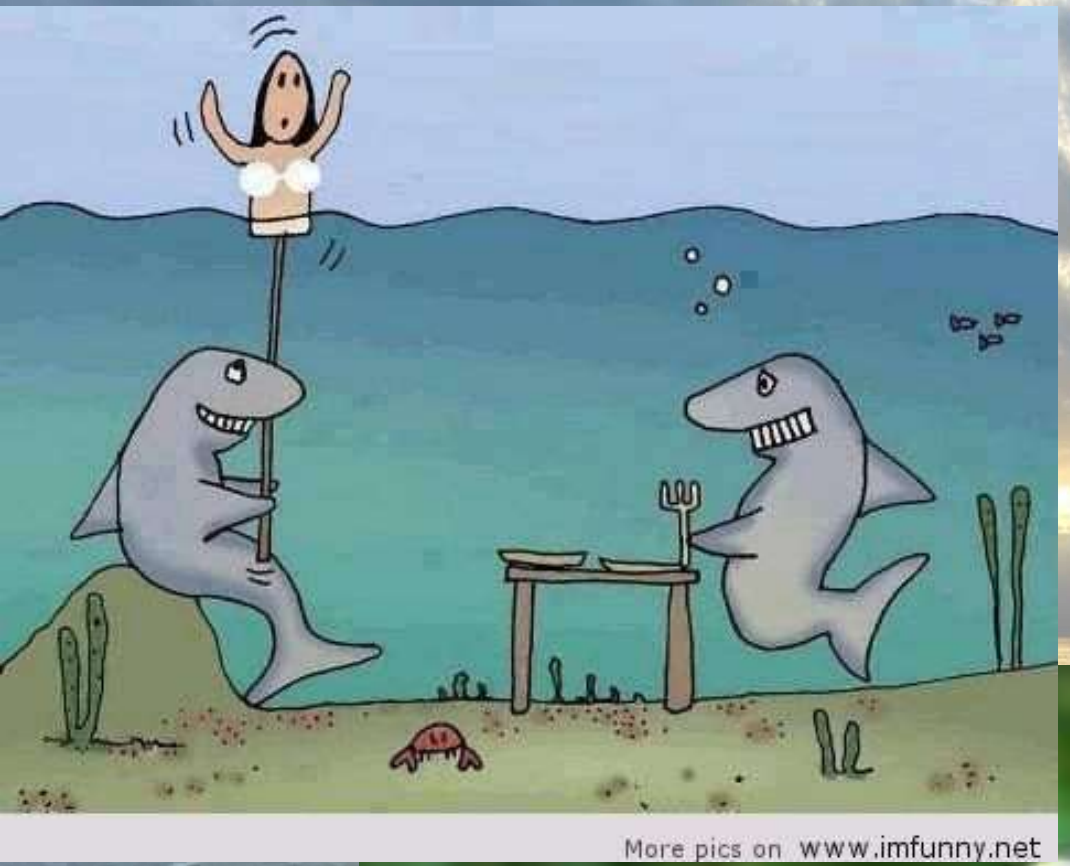


- Acute vs Chronic Considerations



- Treatment Options

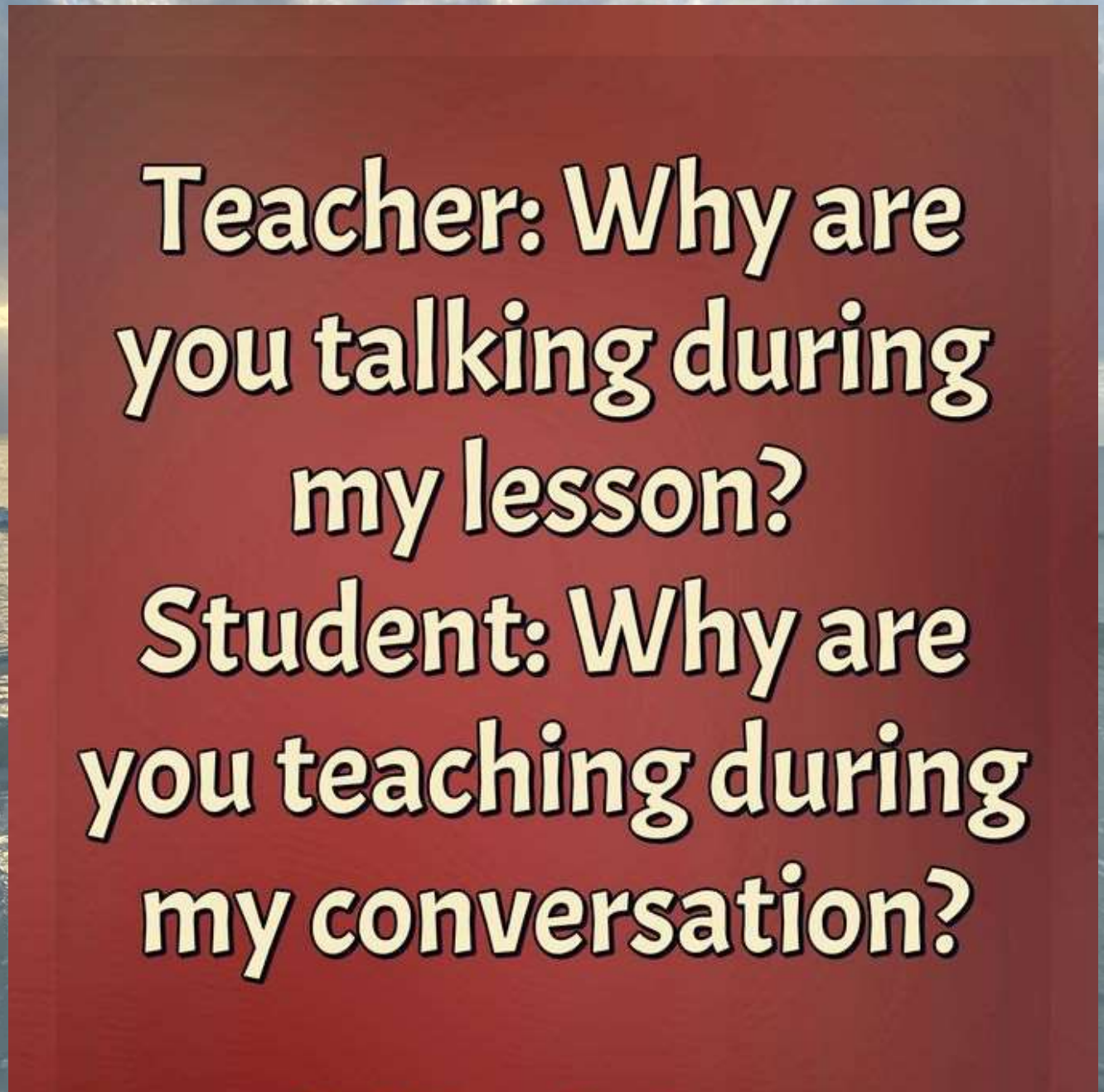
Let's Eat!


More pics on www.imfunny.net


DUNN
LUMBER
MY THREE FAVORITE
THINGS ARE
EATING MY FAMILY AND
NOT USING COMMAS


Challenge Accepted

Questions?


Teacher: Why are you talking during my lesson?
Student: Why are you teaching during my conversation?

Thank you!