THE SACROILIAC (SI) JOINT & SACRAL INSUFFICIENCY FRACTURES

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Evaluating the SI Joint

• Patient history
• Perform physical examination
• Palpation
• Provocative tests (minimum 3 out of 5 tests should be positive)
• Review or order imaging studies – for abnormalities / asymmetry
• Administer diagnostic injections
Faber

- Flexion
- Abduction
- External Rotation
Lateral Compression
Thigh Thrust
Distraction
Ex. Ankylosing spondylitis case spondyloarthritis on active inflammatory lesions MRI before and after treatment with etanercept

*Song et al., Ann Rheum Dis 2011;70:590–596.*
During physical exam, patients with sacroiliac (SI) joint pain may exhibit any/all of the following symptoms:

- Low back pain
- Palpable tenderness of the posterior pelvic sacroiliac (SI) region
- Pain from provocative maneuvers to the hip (i.e. Faber test) and the absence of neurologic deficit
- Joint asymmetry as seen on CT and MRI
Sacral Insufficiency Fractures & Augmentation

- History
- Anatomy
- Function
- Pathology
- Imaging
- Techniques of augmentation

Sacral insufficiency fractures were originally described by Lourie in 1982.

2000- Dehdashti et al., first reported sacral cementoplasty

Lourie H ., JAMA 1982;248:715–7
Dehdashti et al., Cardiovasc Intervent Radiol 2000;23:235–7
Sacrum - Anatomy

- A shield-shaped bone
- A kyphotic structure with a sagittal angulation ranging from 0° to 90°

Lyders et al., AJNR Feb 2010
Sacrum

- History and importance
- Anatomy
- Function
- Pathology
- Imaging
- Techniques of augmentation

- Serving as the base for the spinal column as well as the keystone for the pelvic ring

Anatomical and Biomechanical Analyses • Linstrom et al
Leads to Classification
Re-analysis

- **Classic Trauma Denis** scheme less applicable as the quality of bone and its ability to heal is not the same
- Based on neural involvement and stability

Denis et al., *Clin Orthop.* 1988;227:67-81
• Goes along with biomechanical modeling
• Sacral insufficiency fractures occur at consistent locations

Linstrom et al., Spine • Volume 34 • Number 4 • 2009
Insufficiency Fractures

- Sub-type of stress fracture
- Results from normal stress applied to weak abnormal bone
- Unilateral or bilateral
- High incidence of concomitant pelvic fractures
Sacral Insufficiency Fractures
Risk Factors

- **Osteoporosis** - most common
- Radiation
- Steroid induced osteopenia
- Rheumatoid arthritis
- Any lytic **neoplasm** / mets, MM
- Paget disease
- Renal osteodystrophy
- Hyperparathyroidism
Epidemiology of SIF

- Almost 2% of women who present to ER with LBP
- Antecedent trauma - rarely identified and is usually minor
- Low back pain presentation
- Pain typically radiates to buttocks, hips or groin
- Can be point tender to palpation
- 45% have malignancy in their history

Lyders et al., AJNR 2010
injection is the diagnostic "litmus test."

• Administer diagnostic injections (75% pain relief from one injection, or 50% pain relief from two injections to confirm SI joint diagnosis)

• Steroids

• Fusion- minimally invasive and surgical methods
Sacral Imaging

- History and importance
- Anatomy
- Pathology
- Function
- Imaging
- Techniques of augmentation
Plain Films

- Acute fractures
- Subacute fractures
- Chronic fractures
- Lucent lines or cortical disruption
- Sclerotic bands usually parallel to SI joints
Plain Films = NOT THE STANDARD OF CARE

- < 20-38% of pelvic ring fractures identified
- Osteoporosis and bowel gas are not helpful!

Peh et al., Clin Imaging 1995
Nuclear Medicine

- Tc99m-labeled MDP - very sensitive ~96%
- Positive predictive value 92%
- Posterior planar images put sacrum closest to detector
- “Honda or H pattern” 20-40%

Fujii et al., Clin Nuc Med 2005
Nuclear Imaging

• **Bone Scintigraphy is nonspecific**—infection, tumor, fracture…

• Lytic lesions may take weeks to become “hot”-uptake tracer

• SPECT helpful—differentiates djd…

AJSM 2013
CT

- Similar to plain film patterns just better!
- Coronal > sagittal
- Sclerosis
- Fracture lines with or without callous > 75%
- Sensitivity 60-75%
- Great detail if fractures extend into neural foramina
- Can help differentiate tumor
CT- Imaging

- Can be complimentary to MRI and Nukes

- **Linear vertical** or oblique medullary sclerosis on CT when delay in diagnosis, representing some healing

- Ct + Nukes \(\sim\) MR
MRI

- Sensitivity near 100% with T2 STIR & T1W sequences & multiple planes
- Bone marrow edema & fracture lines

Lyders et al., AJNR 2010
Imaging- MR

“*The Gold Standard*”

- Can delineate edema & fracture lines
- T1w- low signal *marrow*
- T2w- high signal *edema*
- Fat suppression *Neccessary*
Management of Sacral Insufficiency Fractures

• The standard of care for the treatment of SIFs has been conservative management, with variable courses of bed rest, rehabilitation, and analgesics.

• Case series and prospective studies suggest that sacroplasty is a safe and effective procedure, providing early symptomatic relief in patients with SIFs.

CT Guided
Post CT
## Methods & Issues

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<tr>
<th>Fluoroscopic</th>
<th>CT</th>
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<td>• Real time injection</td>
<td>• See neural boundaries and lesions more precisely</td>
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Radiation dose and speed vary by operator

Similar for both
65 y.o.f. bed ridden due to pain
Fell while walking dog

Brook AL, Mirsky DM, Bello JA:. Sacroplasty
Spine (Phila Pa 1976); 2005 Aug 1;30(15):E450-4
Place Needles Within Fracture Lines
Cement tends to follow least resistant path along lines of fxs.
Coccyx Augmentation

Young pt fell on ICE
Pain 9/10 VAS
Wanted to return to work…
Anterior sacral lytic met-lung cancer

- VAS 10+++ 
- No posterior approach
Trans-iliac sacral cementation
Avoids Neural Elements
- can add tumor ablation
PMMA Cementoplasty in Symptomatic Metastatic Lesions of the S1 Vertebral Body

Amir R. Dehdashti, Jean-Baptiste Martin, Beatrix Jean, Daniel A. Rüfenacht

Neuroradiology—HUG, University Hospital of Geneva, CH-1211 Geneva 14, Switzerland

A.R. Dehdashti et al.: PMMA Cementoplasty in Symptomatic Metastases of S1
First Reported Sacral Augmentation

- 3 pts with metastatic disease to S1
Largest Series to Date

Spine
Original research
Multicenter study to assess the efficacy and safety of sacroplasty in patients with osteoporotic sacral insufficiency fractures or pathologic sacral lesions

Keith Kortman¹, Orlando Ortiz², Todd Miller³, Allan Brook³, Sean Tutton⁴, John Mathis⁵, Bassem Georgy⁶
Largest Series to Date

- 243 patients
- 204 with painful sacral insufficiency fractures
- 39 with symptomatic sacral neoplastic lesions

- The average pre-treatment VAS score of 9.2±1.1 was significantly improved after sacroplasty to 1.9±1.7 in patients with sacral insufficiency fractures \((p<0.001)\)

- The average pre-treatment VAS score of 9.0±0.9 in patients with sacral lesions was significantly improved after sacroplasty with neoplasm to 2.6±2.4 \((p<0.001)\)

- There were no major complications or procedure-related deaths
Outcomes - other centers
Decrease Narcotics and Increase Mobility

Kamel et al., Eur Radiol (2009) 19: 3002–3007

Fig. 2 Two plots show the distribution of analgesic use in the study cohort (a) before and (b) after sacroplasty.
Lessons

- *Patient Selection is key to good outcomes*
- *Informed Consent: risks, benefits, and alternatives*
- Conservative management involves various combinations of bed rest, rehabilitation, analgesics & narcotics

Lyders et al. 31 (2): 201. (2010)
THE JOURNAL OF BONE & JOINT SURGERY
VOLUME 86-A · NUMBER 1 · JANUARY 2004
SIF’s Summary

• Commonly are missed or delayed diagnosis

• The incidence of sacral insufficiency fracture is increasing within growing population of osteoporosis & oncologic cases with increased survival

• The overall 1-year mortality rate associated with pelvic insufficiency fractures is ~14%

Conclusion

- Sacral augmentation in well selected patients can decrease pain
- Sacral augmentation can improve mobility and quality of life!

Thank You

- **Sacrum Profanum** is a festival presenting music from the XX century, which has obtained the status of one of the most interesting music events in Europe
- “World’s best artists presenting 20th-century music”