
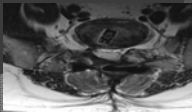



SACROILIAC FUSION
ALEX CASTELVI MD
ALLEGHENY GENERAL HOSPITAL
NEUROSURGERY
CASTELVI SPINE
MAY 2016

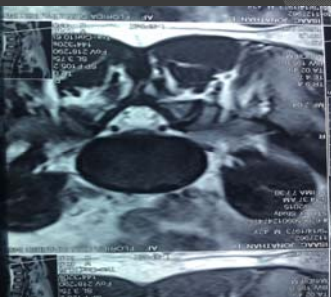
Case Presentation - 1 

- 52 yo Male Police Detective
- Hx of Prior Lumbar Fusion at L5-S1
- Chief Complaint
 - Right Buttock Pain
- PMR – SI injection with some relief of pain



Case Presentation - 2

- 44 y/o female
- 5 year history of low back pain
- Left sided L5 Radicular symptoms
- Total Disc Replacement
- 30% pain relief






Background – SI Dysfunction

Allegheny Health Network

- Back Pain
 - 2nd Most Common – clinician visits behind the common cold
 - 95% incidence rate
- Economic Cost
 - 60 to 200 Billion annually
- 1905 – Goldwaith and Osgood
 - Relaxation in pregnancy – Increased Vascularity of the sacroiliac joint




Background – SI joint Dysfunction

Allegheny Health Network


- 1921 – Smith Petersen
 - SI joint dysfunction suspected of causing low back pain
- 1934 – Mixter and Barr
 - Lumbar Intervertebral disc herniations
- 1987 – Waisbrod, Krainick, Gerbershagen
 - SI joint pain Reemerged




Back Pain – SI Dysfunction




- Low Back Pain – SI joint Dysfunction
- Bernard and Kirkaldy
 - Range – 13% to 32%
 - Largest Series – 1300 patients – 23%
- Hansen – 2007
 - Double Block Paradigm
 - 10-27%
 - False Positive Rate of 20% to 22% after one SI joint injection




SI joint pain – Lumbar Fusion




- 2003 – Katz
 - s/p lumbar fusion
 - 34 patients
 - 32% patients** – SI joint pain
 - Dx with injection of the SI joint
- Spine 2008 – Ha
 - 37 patients – lumbar fusion
 - CT scan – preop, 1 years, 5 years
 - Fusion group – 75% degeneration**
 - Nonfusion group – 38%




SI Joint Pain – Lumbar Fusion



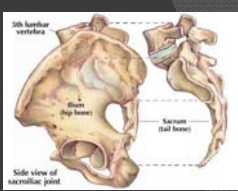
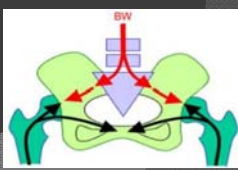
- Spine – Ivanov 2009
 - Finite Element Model
 - Simulated L4-5, L4-S1, L5-S1 Fusion
 - Increased motions of the SI joint**
 - Increase Stress**
- Pain Medicine - Liliang 2011
 - 130 patients – lumbar fusion
 - 52 patients - 40% - 3 positive provocative tests
 - 21/52 (40%) – diagnostic blocks




Sacroiliac Joint - Anatomy



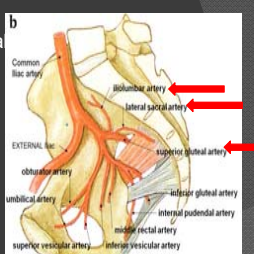
- True Diarthrodial Joint
 - Anterior – synovial joint
 - Posterior – syndesmosis
- Joint space – 1-2 mm wide
- C shaped joint – 2 lever arms interlock at the 2nd sacral vertebrae
- Main function
 - Stability and some motion
 - Less than 1 degree of motion
- Stability – Ridges and Large Ligaments


SI joint Anatomy



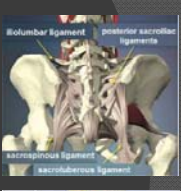

- Blood Supply
 - Posterior Divisions of Internal Iliac Artery
 - Iliolumbar
 - Lateral Sacral
 - Superior Gluteal Arteries
- Innervation
 - Superior Gluteal Nerve
 - Ventral Rami L4,L5
 - Lateral Branches of the dorsal rami – S1 and S2





Sacroiliac Ligaments



- Posterior Ligaments– Long and Short
 - Restraint – Sacral Extension
 - Nociceptors – Substance P
- Anterior Sacroiliac Ligament
- Interosseous Ligaments - important
 - Restraint – Sacral Flexion and Axial Rotation
 - Resist Separation
 - Mechanoreceptors/nociceptors – sub p and cgrp
- Sacrotuberous/Sacrospinous
 - Restraint – Sacral Flexion
 - No nerve fibers
- Iliolumbar
 - Ventral and Dorsal – forward flexion and side bending
 - nociceptors


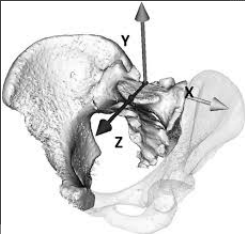



MOTION VS NO MOTION?





Biomechanics – SI Joint

- 2008 - Three-Dimensional Movements of the Sacroiliac Joint: A Systematic Review of the Literature and Assessment of Clinical Utility
- Rotation
 - X axis: -1.1 to 2.2 degrees
 - Y axis: -0.8 to 4 degrees
 - Z axis: -0.5 to 8 degrees
- Translation
 - X: -0.3 to 8 degrees
 - Y: -0.2 to 7.0 degrees
 - Z: -0.3 to 6 degrees



HOW DO WE DIAGNOSE THESE PATIENTS?



Diagnosis – SI Joint Dysfunction

AllegHENY Health Network

- Differential Diagnosis**
 - Inflammatory arthritis
 - Postpartum syndrome
 - Adjacent osteoarthritis
 - Paget's Disease
 - Trauma
 - Adjacent segment Degeneration – lumbar fusion
- Complaints**
 - Low Back Pain (72%)
 - Gluteal pain (94%)
 - Groin Pain (14%)
 - Radicular Symptoms (50%)

Diagnostic Imaging – SI joint

AllegHENY Health Network

- Xrays
- CT Scan
- MRI

Diagnosis – SI Joint Dysfunction

AllegHENY Health Network

- Physical Exam**
 - Tenderness
 - Distraction
 - Thigh Thrust
 - Compression
 - FABER
 - Gaenslen
 - Gillet Test
- Diagnostic Joint Injections**
 - Gold Standard
 - Results – transient improvement in symptoms

Sacroiliac Provocation Tests

Distraction

Thigh Thrust

FABER

Compression

Gaenslen's Maneuver

Types of Treatment – SI joint dysfunction

- Conservative Treatments
 - Physical Therapy – First Line
 - Anti Inflammatory medications
 - Sacral Belt
 - Sacroiliac Joint injections
 - Radiofrequency Ablation
- Surgical Treatments
 - Open Dorsal SI Fusion
 - Minimally Invasive Posterior SI Fusion
 - Minimally Invasive Lateral SI Fusion

Treatment Options: Surgical

Smith-Petersen 1926

Campbell 1927

Gaenslen 1927

Bloom 1937

iFuse 2008


Surgical Approaches – SI joint

- 3 approaches
 - Open Dorsal Approach
 - Minimally Invasive Dorsal Approach
 - Minimally Invasive Lateral Approach



OPEN VS MIS Sacroiliac Fusion

- 2013 – Smith
- 263 patients
- Results
 - MIS - decreased
 - Operative time
 - Blood loss
 - Hospital stay
 - Complications
 - VAS



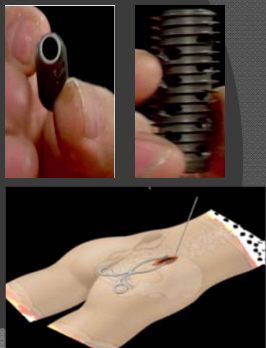
Minimally Invasive – SI Fusion



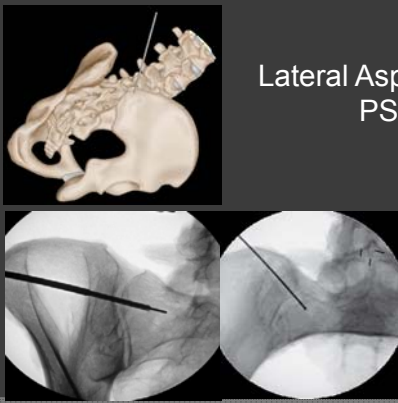
source: NUTECH

Techniques – Medtronic Rialto

- Dorsal Approach
- Cannulated Fenestrated Screws
- Dorsal Incision – 3cm inferior to the L5/S1 joint – at the PSIS



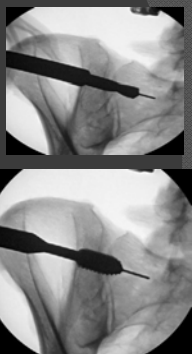
Lateral Aspect of the PSIS




Guidewire through the ilium – across the joint



Depth: 4-5cm


- Selecting Screw length
 - 1cm short of anterior sacral cortex
- Drill Depth
 - Selected implant size
 - Confirm drill position with fluoroscopy
- Tapping
 - Over guidewire
 - Set depth stop
 - Advance until contact with ilium
 - Remove Guidewire after tapping


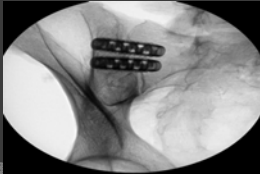
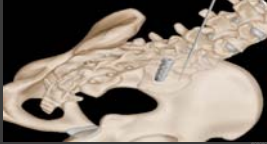
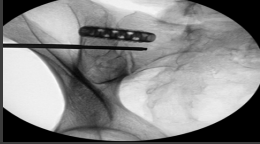




- Screw Implant
 - Insert until flush or 5mm countersunk into the ilium
- Multiple Screw
 - As needed
 - 8-10mm spacing















Technique - SIBONE

- Lateral Approach
- Titanium
- Triangular
 - Minimize rotation/micromotion
- Stronger than Screws
- >38,000 implants placed
 - No breakage



Allegheny Health Network

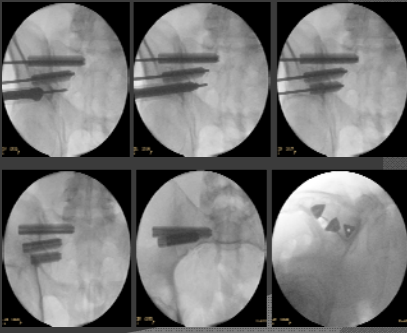


- Prone Position
- Rolls under chest and waist

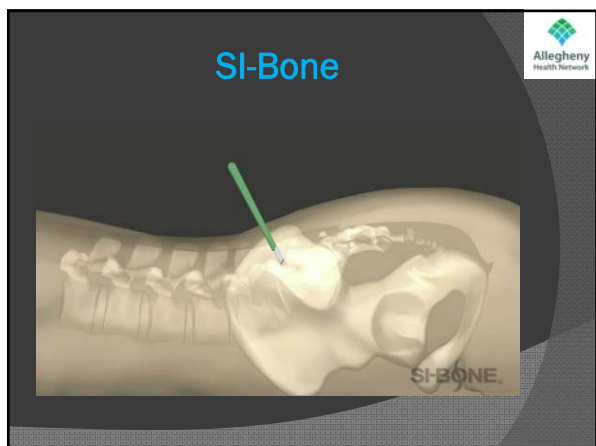
Allegheny Health Network

Technique SIBONE

- Pin
- Drill
- Broach
- Implant

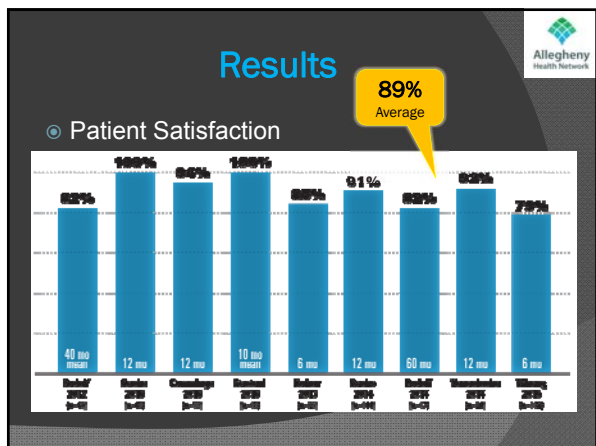


Allegheny Health Network




Complications

- Pain or discomfort due to the presence of the implant
- Migration, loosening or fracture of the implant
- Muscle pain – altered biomechanics
- Implant rejection
- Pseudoarthrosis
- Increased pain at treated or adjacent levels




SI Joint Fusion - Results




- April 2016 – IJSS – Duhon and Bitan
 - Triangular Titanium Implants for Minimally Invasive Sacroiliac Joint Fusion: 2-Year Follow-Up from a Prospective Multicenter Trial
- 172 patients, 149 (2yr) – 26 US sites
- Triangular Titanium Implants
- 1,3,6,12,18,24 assessments
 - VAS, ODI, SF-36, EQ-5D

SI joint Fusion - Results



- VAS
 - 79.8 to 26 – 24 months
- ODI
 - 55.2 to 30.9 – 24 months
- Quality of Life
 - Improvements with SF-36 and EQ-5D
 - 24 months
- Opioid Use
 - 76.2% to 55% - 24 months

SI Joint Fusion - Results


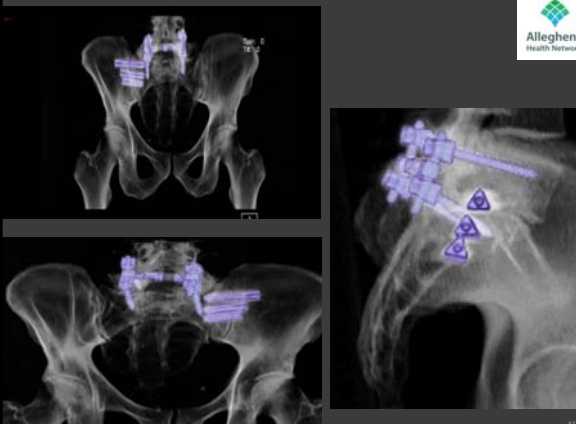


- 26 procedure related adverse events
- Device Related
 - 7 – neuropathic pain
 - 3 – buttock pain
 - 2 – SI pain after fall, inadequate device placement
 - 1 – hip pain periosteal bone growth around the implant
- Procedure Related
 - Buttock pain (2)
 - Foot weakness (1)
 - Ifuse impingement (3)
 - Nausea/vomiting (3)
 - SI joint pain (inadequate stabilization (4.6%) (8)
 - Urinary Retention
 - Vascular Injury
 - Wound Drainage/Infection (3.5%) (6)
 - Wound Numbness

Case Presentation - 1

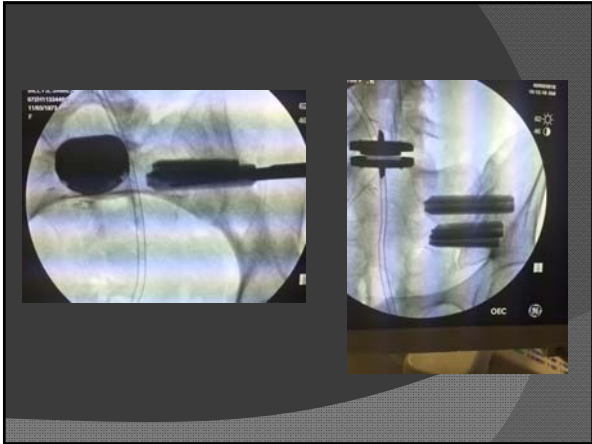
- Diagnostic Injection
 - May 2012
- Clinic Visit – July 2012
 - 100% relief for 1 week
- SI fusion – Sept 2012





Case Presentation - 2

- Diagnostic Injection
 - 85% relief with one injection with marcaine
 - Without steroids
- Refused Radiofrequency Ablation
- SI fusion performed
- Post Op
 - VAS: 8.7 to 2
 - ODI: 58 to 20



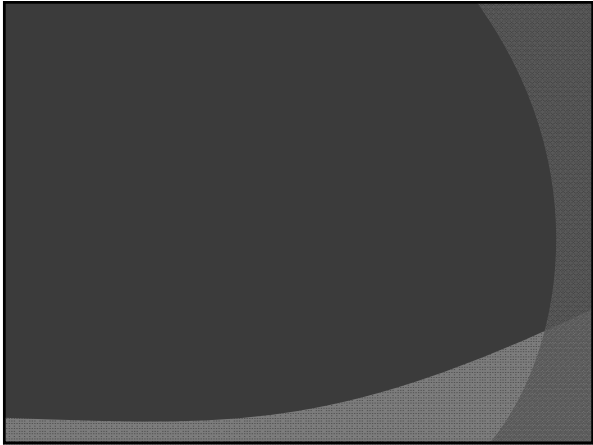


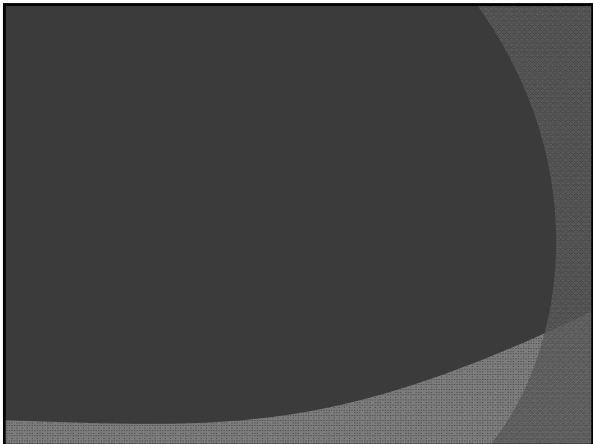
Conclusion

- ⦿ Thorough H/P
- ⦿ Think Outside the box
- ⦿ Controversial

Nulli Secundus







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- 25. Laslett et al , Diagnosis of sacroiliac joint pain: validity of individual and composite provocation tests. Man Ther. 2005; Aug;10(3):207-8.

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- Leonard Rudolf
- 1 and Robyn Capobianco*,2
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- 2SI-BONE, Inc., 3055 Olin Ave, Suite 2200, San Jose, CA 95128, USA

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- ◉ M. N. SMITH-PETERSEN
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- ◉ [J Spinal Disord Tech](#). 2003 Feb;16(1):96-9.
- ◉ **The sacroiliac joint: a potential cause of pain after lumbar fusion to the sacrum.**
- ◉ [Katz V](#)¹, [Schofferman J](#), [Reynolds J](#).

- ◉ Goldwaith JH, Osgood RB. A consideration of the pelvic articulations from an anatomical pathological and clinical standpoint. *Boston Med Surg J.* 1905. 152(21):593-601
- ◉ Bernard TN Jr, Kirkaldy-Willis WH. Recognizing specific characteristics of nonspecific low back pain. *Clin Orthop Relat Res.* 1987 Apr. 217:266-80. [\[Medline\]](#).

- ◉ 44 y/o female
- ◉ 5 year history LBP
- ◉ L5 radicular symptoms
- ◉ Tx TDR L5-S1
- ◉ 30% pain relief
