Iliosacral Screws Indications

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What Injuries Are Amenable?

- Sacroiliac
- Sacral
- Iliac
- Combination

CRPFPP – Indications – *Injured Zones*

- SI Joint
- Sacral
- Combination
- U-H-Y
CRPFPP – Indications – *Injured Zones*

- Adults
- Kids

CRPFPP – Indications – *All Ages*

- Adults
- Kids

CRPFPP-Indications- *Resuscitation*

- Acute
- Reduction
- Support
- Quick
- Safe
- Temporary
- Definitive
CRPFPP – Indications - Urgent

• Manipulator
• Frame
• Screws
• Stability

CRPFPP – Indications - Polytrauma

• “TSFO” – “SSTNO”
• Get Off the Algorithm
• Manipulate-Support
CRPFPP – Indications - Polytrauma

- “TSFO” – “SSTNO”
- Get Off the Algorithm
- Manipulate-Support

CRPFPP – Indications - Instability

- Common
- Biomechanics
- Anterior
- Posterior
- Each Site
- Supportive

CRPFPP – Indications - Instability

- Displacement
- Deformity
- Manipulate
- Support
CRPFPP – Indications - **Tissues**

- Open
- Degloving
- Necrosis
- Flank
- Abdomen
- Other

CRPFPP – Indications - **Obesity**

- Abdomen
- Buttock
- Flank

CRPFPP - Indications - **Obesity**

- Res Ipsa Loquitur
- Stability
- Minimal Exposure
CRPFPP - Indications - *Chronic*

- Instability
- Postpartum
- Old Trauma
- Pain
- Arthritic
- Nonunion
- Insufficiency
CRPFPP – Indications - Pathological

- Tumor
- Primary
- Metastatic

CRPFPP – Indications - Pathological

- Radiation Necrosis
- U-Type Sacral

CRPFPP – Indications - Insufficiency

- Senior
- Frailty
- Medications
- Low Lumbar Spine Surgery
CRPFPP – Indications - *Insufficiency*

- Fortify
- Fill
- Anterior & Posterior
- All Sites

CRPFPP – Indications - *Acetabular*

- Combination
- SI
- Sacral
- Others

CRPFPP - Contraindications

- Complete SI
- ManipRed Failure
- Tunnel Debris
- Others
Summary

• Posterior Pelvis
• Lateral Iliac Cortex
• Osteology
• Reduction
The Iliosacral Screw: Anatomy, Equipment, & Technique

Jonathan Eastman, MD
University of California, Davis

Disclosures

- I have no disclosures

Learning Objectives

- Understand upper sacral segment anatomy
  - Recognize variability
- Appreciate osseous fixation pathways
- Realize importance of preoperative planning
- Safely and reproducibly place iliosacral screws
Spectrum of Anatomy

“Normal”

“Dysmorphic”

Miller and Routt. JAAOS 2012
Spectrum of Anatomy

“Normal”  “Dysmorphic”

Osseous Fixation Pathways

Osseous Fixation Pathways

“Normal”
Osseous Fixation Pathways

“Dysmorphic”

Variable Sagittal Plane Alignment

Consistent Extraosseous Anatomy

Staying Within the Vestibule
- L5 Nerve Root
  - Lateral ala
  - “High and anterior”
- S1 Nerve Root
  - Central ala
  - “Low and posterior”
- Common Iliac Vessels
  - Medial Ala
  - “High and Anterior”
Preoperative Planning

Intraoperative Fluoroscopy

Outlet View

Graves and Routt. J Trauma 2011

Preoperative Planning

Inlet View
Preoperative Planning

Outlet View

Preoperative Planning

AP Rollover View

Lateral View

Miller and Routt: JAAOS 2012
Lateral View

Reduction is a Prerequisite

Reduction is Mandatory
Reduction is Mandatory

Reduction is Mandatory

Reduction is Mandatory
Iliosacral Screw Technique

Equipment Needed

- 1.6 mm Kirschner wire
- 4.5 mm cannulated drill
- Threaded guidewire
- Cannulated screws
  - Fully threaded
  - Partially threaded
- Washer

Patient Positioning

- Supine
- Lumbosacral bump
  - Two blankets in midline
- Prep low and posterior
Start Site

Drill Insertion and Orientation

Drill Advancement
Verify on Lateral View

Advance Into Sacral Body

Inlet  Outlet

Evaluate Drill Path
Advance Wire to Final Position

Inlet

Outlet

Measure Depth

Screw Insertion
Verify No Screw Intrusion

Inlet  AP Rollover

Final Position

Inlet  Outlet

Conclusion

- Knowledge of anatomy is paramount
- Understand posterior ring variability
- Preoperative planning vital
- Reduction mandatory
- Execute screw placement safely and reproducibly
Thank You!
Posterior Pelvic Ring Injuries: Exposure & Techniques

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Orthopaedic Associates of Michigan
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The following relationships exist:
Partial Owner: Midtowne Surgical Center
Grants: OTA, NIH, DOD
Boards non reimbursed: OTA, MAOA, AOA OTB

Posterior Pelvic Ring ORIF
Indications
- SI Joint Fracture/Dislocation
- Posterior Ilium Fractures
- Sacral Fractures/Dislocations
  +/- foraminal encroachment
- "Late" Reduction/Fixation
  (>5 days)
Contraindications

- Degloving Injuries
- Vascular Injuries s/p Interventional Radiology

Posterior Pelvic Ring Approaches

**Supine**
- Anterior, Iliac Window

**Prone**
- Posterior, Paramedian
- Posterior, Midline
Anterior – Supine: Posterior Ring Indications

SI Disruptions
SI Joint Fracture/Dislocations (Crescent Fx)
Iliac Fractures

Iliac Window

• Indications
  – SI disruptions & Fx/Dislocations (crescent)
  – Ilium & Iliac wing fx
  – Associated acetabular fx
• Technique
  – Incision 2 cm distal to iliac crest
  – Elevate external oblique muscle
  – Extend anteriorly past ASIS
    • Identify and release lateral femoral cutaneous (LFC) n
    • +/- release inguinal ligament
  – Extend posteriorly dividing internal oblique muscle
  – Dissect deep to sciatic notch & posterior SI joint
    • Insert blunt Homan retractor into notch careful of sciatic n.
    • Insert blunt Homan posteriorly and cephalad to SI joint
Supine – Anterior Iliac Window

Limit Dissection to 2.0cm
Careful of Notch Retractor Placement

Pillow Under Knee – Relax Iliopsoas
Supine Anterior Clamp Placement

King Tong Clamp

Clamp Placement Limited By Obesity & Edema

SI Joint Dislocation
ORIF Anteriorly (Screws)

24 M, MVC

Hypotensive
No Motor LE
Post Op CT

Final Imaging

SI Joint Dislocation
ORIF Anteriorly (Plates)

3.5 mm Plates
90-90 Fixation
SI Joint Dislocation
ORIF Anteriorly (Plates)

ORIF Anteriorly (Plates)

SI Joint Dislocation
ORIF Anteriorly (Plates)

Resuscitation in SICU
Post Op CT Malreduction of SI

L5 Nerve Root
SI Joint Dislocation
ORIF Anteriorly (Plates)

Return for ORIF Open 5 Days Later
Fixation of Rt High Root Ramus & SI

Put Screws Into Bone

Iliac Wing Fx
### Posterior Pelvic Ring Approaches

<table>
<thead>
<tr>
<th>Supine</th>
<th>Anterior, Iliac Window</th>
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<table>
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<tr>
<th>Prone</th>
<th>Posterior, Paramedian</th>
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<td>Posterior, Midline</td>
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### Posterior Indications

- SI Disruptions
- SI Joint Fracture/Dislocations (Crescent Fx)
- Sacral Fractures
- Late (ie > 5 days) Reductions
- Fixation Failure ReDo's

### Posterior Approaches

- Prone
- Laminectomy rolls
  - Spine table with anterior ex-fix
- Eye protection (blindness 1/10,000)
- +/- distal femoral traction
- Seal rectum & perineum
Set Up

Exposure: Skin Incision

Historical reports of unacceptably high infection rates
- 18-27%
- Kellam, OCNA 1987, 18, 25-41

More recent reports demonstrate acceptable rates
- 3.4%
- Stover, CORR 2012 470(8) 2141-7

Contraindications

Degloving Injuries

Vascular Injuries s/p Interventional Radiology
SI Joint Fracture Dislocation
Crescent Fracture, Posterior ORIF

Small Sacral Safe Zone
Small Crescent Fragment

SI Joint Fracture Dislocation
Crescent Fracture, Posterior ORIF

SI Dislocation
Approach

Sacral Fractures: Approach and Reduction

Posterior Open Approach
Midline vs Paramedian

Vertical Paramedian
Clean fracture directly
Accurately reduce
Strategic clamp applications
Avoid over compression
Vertical Paramedian
Intraoperative traction
Clamp from spinous process to PSIS
Schantz pin into PSIS
Use the inferior (tension) read

Posterior Open Approach
Midline vs Paramedian

Posterior Sacral Fracture
Clamp Placement

Sacral Malreduction and Iliosacral Screws

Reilly et al, JOT, 2003
Sacral Malreduction and Iliosacral Screws
Reilly et al, JOT, 2003

<table>
<thead>
<tr>
<th>Displacement</th>
<th>Decreased X-S Area</th>
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<tbody>
<tr>
<td>5mm</td>
<td>30%</td>
</tr>
<tr>
<td>10mm</td>
<td>56%</td>
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<tr>
<td>15mm</td>
<td>81%</td>
</tr>
<tr>
<td>20mm</td>
<td>90%</td>
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</tbody>
</table>

Can’t place 2 screws in 50% of 15mm, 66% of 20mm
Can’t place 1 screw in 17% of 15mm, 20% of 20mm

Reduction
Lateral - GSNs
ICDs - Ala - L5 Root
Pantaloon - S1 Root
“Safe” Zone
Start Site-Aim-Length

Sacral Fractures: Fixation Options
SI screws (1 vs 2)
Transiliac plate
Tension band plate
Dorsal plate
Sacral bars
Transiliac screw
Lumbopelvic Fixation
Sacral Fracture ORIF Posterior (Screws)

62 F MVA
Stable Hemodynamically
Sacral Fracture
ORIF Posterior (Screws)

Dorsal Plating of “Transverse” Sacral Fxs

Sacral Fracture
Posterior ORIF (Plates)
Sacral Fracture
Posterior ORIF (Plates)

Transiliac Dorsal Plating

Similar concept
Requires reduction
Open technique
"Trans" vs "Dorsal"
Same location as bars
Lumbopelvic Fixation (LPF)

LPF Indications

- Comminuted Sacral Fx
- Intraforaminal Sacral Fx requiring decompression (ie osseous removal)
- Small Safe Zone inadequate for SI screw
- Extension into L5 S1 Articulation (Facet Fx)
- Revision Sacral Surgery with osteotomy requiring a reduction (Cephalad to Caudad) technique

Pelvic for LPF Imaging

**Sciatic Buttress**

<table>
<thead>
<tr>
<th>Iliac Oblique</th>
<th>Obturator Oblique</th>
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<tbody>
<tr>
<td><img src="image1.png" alt="Image" /></td>
<td><img src="image2.png" alt="Image" /></td>
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Sacral Alar Iliac Pelvic Fixation

Sciatic Buttress

Sacral alar iliac pelvic fixation

Standard Iliac Fixation Trajectory

Sacral Alar Iliac Fixation Trajectory
32 yo male, logging injury

Triangular Fixation

WBAT
After Healing

Lumbopelvic Fixation
17 F, MVA
Hypotensive
Left LE Sciatic Nerve Palsy
65 M, Sacral Alar Fracture
Pubic Symphysis Plating

3 Months Post Op
SI screw Loosening
Cephalad Migration
PS Plate Breakage
Posterior Injury
Subtle Instability Neglected

Posterior Pelvic Ring ORIF

Appropriate Fracture Selection
All Fracture Patterns early or late
Caution with: 1. Degloving & 2. Interventional Radiology

Appropriate Approach
Supine (Anterior) - iliac
Prone (Posterior) – midline vs. paramedian

Appropriate Implant Insertion
Screw, Plate, Lumbopelvic, Combo
Coordinated with Clamp Placement

Appropriate Layered & Skin Closure
Percutaneous Pelvic Fixation: Avoiding Complications

James Krieg, MD
Philadelphia, PA

Disclosures
• Consultant to Acumed

Complications
• Errant screw placement
  – Neurologic damage
  – Vascular damage
• Loss of fixation
  – Inappropriate placement
  – Inadequate fixation
Errant screw placement

- Knowledge of anatomy
- Safe screw corridors
- Reduction

Why are they dangerous?

Where are they dangerous?
How to avoid screw errors

- Know anatomy
How to avoid screw errors

• Know anatomy
• Lateral view

How to avoid screw errors

• Know anatomy
• Lateral view
• Tactile feedback
  – Follow wires advance

How to avoid screw errors

• Know anatomy
• Lateral view
• Tactile feedback
  – Follow wires advance
• Reduction
Failures of fixation

• Error in technique
• Error in judgement

Technical Errors

• Screw intrusion
  – Screws generate force by converting rotational movement into translation/compression
  – Force generated by screw threads countered by head

Prevent screw head intrusion

• Use a washer
• Fluoro to assess screw insertion
Correct screw intrusion

- Semitubular plate

Technical tip:
Long screws, fully threaded screws

Technical tip:
Long screws, fully threaded screws
Errors in judgement: Inadequate fixation

Summary

• Imaging, planning, anatomy
• Technical tips to avoid errant screws
• Multiple screws, long, fully threaded
• Judgment in indications, planning to avoid failures of fixation