SACROPELVIC FIXATION: INDICATIONS AND TECHNIQUES

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INDICATIONS

- Poor sacral fixation
- Long construct above
  - L3 or above
- Sagittal or coronal imbalance
- L5-S1 pseudoarthrosis
- L5 or S1 defect (tumor, infection, resection)

SURGICAL OPTIONS

- S1 “tricortical” screw
- S2 screws
- Jackson intrasacral buttress
- Dunn McCarthy S rod
- Galveston technique
- Iliac screws
- Double iliac screws
- Iliosacral screws
- S2-alar iliac screws
SURGICAL OPTIONS

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WHEN IS SACRAL FIXATION SUFFICIENT?

- Short construct
  - L3?
  - L1?
- Good sagittal and coronal balance
- Good sacral fixation
- Good L5-S1 interbody fusion

WHEN IS SACRAL FIXATION SUFFICIENT?

- Devlin, Boachie et al. Spine 1990

HIGH FAILURE RATES WITH LONG FUSIONS TO THE SACRUM
LESSONS FROM NEUROMUSCULAR SCOLIOSIS

- Galveston fixation
- → iliac screws

LESSONS FROM NEUROMUSCULAR SCOLIOSIS

- Galveston fixation
- → iliac screws
- Dunn-McCarthy S rod
- For distorted, narrow pelvis: eg, kyphectomy
- Little application for non-syndromic use

IMPROVED DISTAL FIXATION

- S2 alar screws
- Tacoma plate
- Chopin block
- S1 tricortical screws
- Jackson intrasacral buttress

ANATOMIC CONSIDERATIONS FOR SACROPELVIC FIXATION

<table>
<thead>
<tr>
<th>S1 screws</th>
<th>Middle sacral vessel injury</th>
<th>Superior hypogastric plexus injury</th>
<th>Sacral fracture</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1 diverging screws</td>
<td>Internal or common iliac artery injury</td>
<td>S1 joint injury</td>
<td>Sympathetic chain injury</td>
</tr>
<tr>
<td>Sacral straight ahead</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S2 converging screws</td>
<td>Superior hypogastric plexus injury</td>
<td>Colon perforation</td>
<td></td>
</tr>
<tr>
<td>Iliac screws</td>
<td>Superior gluteal artery injury</td>
<td>Internal iliac vessel injury</td>
<td>Hip joint damage</td>
</tr>
</tbody>
</table>

Adapted from Macagno and O'Brien, Fusion to the sacrum; Ch 99 in Bridwell and Chezwall, Techniques of spinal surgery
COMPLICATIONS
- Alar fixation: little additional strength
- Prominent hardware
- Pseudoarthrosis
- Hardware failure

IMPROVED PELVIC FIXATION
- Iliascal fixation

IMPROVED PELVIC FIXATION
- Iliac screws
- Double iliac screws

McCord et al. Spine 1992
75 YO WM WITH LONG STANDING LBP AND CLAUDICATION

UNILATERAL ILIAC SCREW

STRENGTH OF SACROPELVIC FIXATION

McCord et al, Spine 1992
COMPLICATIONS

- Hardware prominence
- Screw removal
- Gait abnormalities
- Short step
- "waddle"
- SI joint pain

Emami et al.

Emami et al. - 67 patients (81 initial cohort)
5 year Follow-up
Iliac screws removed in 23 pts
7 broken screws
Screw halos in 29 pts
No SI joint arthritis

ILIAC FIXATION OUTCOME

Tsuchiya et al., Spine 2006
67 of 81 patients at 5 years

Chang, Sponseller, Kebaish, and Fishman, Spine 2009
based on CT's of 20 young patients.
S2 ALAR –ILIAC S2AI

“SAI”

Slides courtesy of Khaleb Kebaish, MD

SURGICAL TECHNIQUE

HOW IT ALL STARTED?

Slides courtesy of Khaleb Kebaish, MD

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SURGICAL TECHNIQUE S2AI

• Starting point: midway between S1 & S2 foramina
• Long 2.5 mm drill
• Trajectory: 45° to floor
  20-30° caudal
  Varies w. pelvic obliquity & sacral tilt
  *Aim for the AIS*
• Confirm bony end point with a probe

Slides courtesy of Khaleb Kebaish, MD
Screw path just above sciatic notch

Fluoroscopy is helpful
  Iliac oblique, Tear drop
  - Diameter 8-10 mm
  - Length 80-100

With thanks to Shane Burch, MD
Outcomes and Complications of Sacro-Pelvic Fixation Using S2 Alar-Iliac (S2AI) Fixation in Adult Deformity patients: A prospective Study with 2-Year Follow-Up

Khaled Kebaish, MD, Mostafa El Dafrawy, M.D., Hamid Hassanzadeh, M.D., Philip Neubauer, M.D., Eric Tan, M.D., Paul Sponseller, MD

- 146 patients
- 2 year clinical & radiographic F/U
- 2 patients lost to follow up
- Average age: 59 yrs (21-80)
- 35% of patients had > one comorbidity

**COMPLICATIONS**

<table>
<thead>
<tr>
<th>Major Complications</th>
<th>N=25 17%</th>
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</thead>
<tbody>
<tr>
<td>Pulmonary embolism</td>
<td>2</td>
</tr>
<tr>
<td>Deep Wound Infection</td>
<td>1</td>
</tr>
<tr>
<td>Pseudarthrosis</td>
<td>1</td>
</tr>
<tr>
<td>Vascular Injury</td>
<td>1</td>
</tr>
<tr>
<td>Hemorrhage</td>
<td>1</td>
</tr>
<tr>
<td>CVAs</td>
<td>1</td>
</tr>
<tr>
<td>Hematoma requiring evacuation</td>
<td>1</td>
</tr>
<tr>
<td>Acute renal failure</td>
<td>1</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>1</td>
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<tr>
<td>Neuro deficit</td>
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<tr>
<th>Minor Complications</th>
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<tr>
<td>Ureta</td>
<td>1</td>
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<tr>
<td>Urinary Tract Infection</td>
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<tr>
<td>Superficial wound infection</td>
<td>6</td>
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<tr>
<td>Wound dehiscence</td>
<td>2</td>
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<tr>
<td>Methemoglobin</td>
<td>2</td>
</tr>
<tr>
<td>Ileus</td>
<td>7</td>
</tr>
</tbody>
</table>

Slides courtesy of Khaled Kebaish, MD

**SCREW MISPLACEMENT**
SCREW MISPLACEMENT

S2AI FIXATION SPECIFIC COMPLICATIONS

<table>
<thead>
<tr>
<th>Complication</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screw Breakage</td>
<td>8 (5 pts)</td>
</tr>
<tr>
<td>Screw Misplacement</td>
<td>2</td>
</tr>
<tr>
<td>Minimal Screw loosening (&lt;2mm)</td>
<td>16 screws (6%)</td>
</tr>
<tr>
<td>Reoperation</td>
<td>4</td>
</tr>
</tbody>
</table>

Reoperation

Slides courtesy of Khaleb Kebaish, MD

EFFECT ON THE SI JOINT

- There was no evidence of SI joint fusion
- No significant change in joint space
- No significant SI joint pain

Corlett EN, Bishop RP. Ergonomics 1976

- 32 consecutive pediatric patients
- 2 years Follow-up
- S2AI better correction pelvic obliquity
- Lower infection rate

Low Profile Pelvic Fixation With the Sacral Alar Iliac Technique in the Pediatric Population Improves Results at Two-Year Minimum Follow-up

Paul D. Spannuth, MD,* Ryan M. Zimmerman, MD,† Philip S. Kis, BS,* Albert F. Falti-Farr Gunve, MD,† Ahmed S. Mohamed, MBBS, MSIC,* Tai-Li Chang, MD,† and Khaleb M. Kebaish, MD*
SACRO-PELVIC FIXATION USING S2AI SCREWS IN ADULT DEFORMITY SURGERY: MIN 5-YEAR FOLLOW-UP

S. STRIKE, H. HASSANZADEH, MD; F. NAFF, MD; PD SPONZELER, MD; K. KEBAISH, MD

- 70 patients
- prospective
- 5 y followup
- Complications related to S2AI
  - 3 pts, 5 S2AI screw breakage
    Not operated on
  - Screw loosening
    - >2 mm
    - >4 mm

IMPORTANT ROLE OF INTERBODY FUSION

- Several articles demonstrate the decreased instrumentation stresses when long constructs are combined with distal circumferential fusion


THANK YOU