

## SUBSPECIALTY PROCEDURES

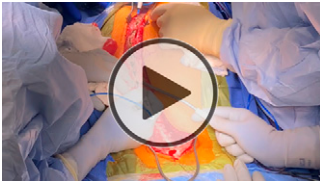
## SPINAL FUSION WITH SACRAL ALAR ILIAC PELVIC FIXATION IN SEVERE NEUROMUSCULAR SCOLIOSIS

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Published outcomes of this procedure can be found at: *J Bone Joint Surg Am.* 2018 Apr 4; 100(7):556-63, and *Spine (Phila Pa 1976).* 2010 Sep 15;35(20):1887-92.

*Investigation performed at the Department of Pediatric Orthopaedics, Johns Hopkins University, Baltimore, Maryland*

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**Abstract**

**Background:** Neuromuscular scoliosis is characterized by rapid progression of curvature during growth and may continue to progress following skeletal maturity. Posterior spinal fusion in patients with cerebral palsy and severe scoliosis results in substantial improvements in health-related quality of life<sup>1</sup>. Correction of pelvic obliquity can greatly improve sitting balance, reduce pain, and decrease skin breakdown. The sacral alar iliac (SAI) technique has key advantages over prior techniques, including the Galveston and iliac-screw techniques. The SAI technique eliminates the need for subcutaneous muscle dissection over the iliac crest, does not require the use of connectors from the rod to the iliac screw, and decreases the risk of implant prominence<sup>2</sup>.

**Description:** We demonstrate how to perform posterior spinal fusion with SAI pelvic fixation in a patient with cerebral palsy. In correcting the scoliosis, we utilize the segmental 3-dimensional technique, which includes compression, distraction, transverse approximation to 1 rod at a time, and derotation around 2 rods. We also demonstrate SAI pelvic fixation with identification of the screw starting point on the lateral-caudal border of the first sacral foramen and trajectory toward the anterior inferior iliac spine.

**Alternatives:** Nonoperative alternatives include bracing, trunk support, contouring of sitting surfaces (such as wheelchairs), and physical therapy to slow curve progression during growth periods and delay the need for surgical treatment<sup>3,4</sup>. Decision-making is shared with the family following education about the risks and benefits. Families who are satisfied with the function of the child at baseline should not be persuaded into pursuing surgical treatment.

**Rationale:** Neuromuscular scoliosis can include difficulty sitting secondary to increased pelvic obliquity, along with poor trunk control and balance. Surgical intervention is considered in patients with curves exceeding approximately 50°, as these curves will often continue to progress even after maturity<sup>5</sup>. In patients with neuromuscular scoliosis, indications for pelvic fixation include pelvic obliquity of >15°, poor control of the trunk as indicated by lack of independent sitting or standing, and location of the apex of the curve in the lumbar

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spine. SAI screws are utilized as a low-profile option for pelvic fixation to avoid implant prominence and an increased risk of skin breakdown and infection, which are associated with traditional sacroiliac screws<sup>2,6</sup>.

**Expected Outcomes:** Miyanji et al. reported quality outcomes in patients with cerebral palsy and Gross Motor Function Classification Scores of  $\geq 4$ <sup>1</sup>. In that study, caregivers completed a validated disease-specific questionnaire grading the health-related quality of life of the patient preoperatively and at 1, 2, and 5 years postoperatively. Complication data were prospectively collected for each patient and preoperative outcome scores were compared at each of the postoperative time points. Survey scores at 1, 2, and 5 years postoperatively were significantly higher compared with baseline preoperative values.

Sponseller et al. compared the 2-year postoperative radiographic parameters of 32 pediatric patients who underwent SAI fixation and 27 patients who underwent pelvic fixation with the sacroiliac technique<sup>2</sup>. Among patients who underwent SAI fixation, the mean correction of pelvic obliquity was  $20^\circ \pm 11^\circ$  (70% correction) and the mean Cobb angle  $42^\circ \pm 25^\circ$  (67%). Among patients who underwent pelvic fixation with the sacroiliac technique, those values were  $10^\circ \pm 9^\circ$  (50%) and  $46^\circ \pm 16^\circ$  (60%), respectively. SAI screws provided significantly better pelvic obliquity correction ( $p = 0.002$ ) but no difference in Cobb correction or complications compared with other traditional techniques.

### Important Tips:

- Family discussion prior to surgical treatment is paramount.
- Perform preoperative neurologic examination<sup>7</sup>.
- Examine the cranium carefully for a ventriculoperitoneal shunt or prior cranial reconstruction prior to cranial traction.
- Transcranial neuromonitoring may be useful. Use descending neural motor evoked potentials when no signals from transcranial monitoring are obtained<sup>8</sup>.
- Sink the SAI screw until it lines up with the S1 screw. Bury the SAI screw so it is not prominent.
- Measure rods longer in order to ensure adequate length for compression and distraction in correction of the pelvic obliquity.
- Use a T-square to verify adequate spinopelvic alignment<sup>9</sup>.
- Postoperatively, the use of incisional vacuum-assisted closure can decrease soiling in these patients.

### Acronyms and Abbreviations:

SAI = Sacral alar iliac  
 CP = Cerebral palsy  
 AIS = Adolescent idiopathic scoliosis  
 SMA = Spinal muscular atrophy  
 IONM = Intraoperative neuromonitoring  
 GMFCS = Gross Motor Functional Classification System  
 DNMEP = Descending neural motor evoked potential  
 TXA = Tranexamic acid  
 FFP = Fresh frozen plasma  
 ASIS = Anterior superior iliac spine  
 AIIS = Anterior inferior iliac spine  
 PJK = Proximal junctional kyphosis

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