

Iliac Screw Placement in Neuromuscular Scoliosis Using Anatomic Landmarks and Uniplanar AP Fluoroscopic Imaging with Postoperative CT Confirmation: Technical Note

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Introduction

Neuromuscular scoliosis is a challenging pathology to treat. Surgical correction can entail long fusion constructs extending to the pelvis. This fragile patient population is poorly tolerant of the wide exposure required to place iliac screws by direct palpation and the deformity inherent to these patients makes obtaining adequate lateral intraoperative x-rays for traditional image guided placement of iliac screws difficult.

Operative Technique:

Posterior segmental instrumented spinal fusion techniques were utilized at the cranial levels utilizing pedicle screws, hooks, sublaminar polyester bands, and rods with multiple correction techniques.

Methods

A clinical and radiographic assessment of 12 pediatric patients with neuromuscular spinal deformity (mean age 14.25 years; range 10-20 years) who underwent spinal instrumentation and fusion to the pelvis long (mean 15 levels; range 10-18 levels) at a single institution from 2007 to 2013 with an average follow-up of 31.8 months. Iliac screws were placed using the described technique. The accuracy of iliac screw placement was assessed with routine postoperative CT.

Fluoroscopic imaging is used to obtain an inlet view of the pelvis via a caudal projection (Figure 1). Fluoroscopy is oriented orthogonal to the plane of the pelvic inlet with the beam directed approximately 20 degrees cephalad-to-caudad. The sciatic notch is identified bilaterally on fluoroscopy to assist with trajectory (Figure 2A) After exposing the PSIS and the top of the outer table of the iliac crest to help guide mediolateral screw trajectory, the iliac screw entry site is placed within the most distal 1 cm of the posterior superior iliac spine. A rongeur is used to remove cortical bone so that the screw head may be counter-sunk to minimize hardware prominence. A pedicle finder is then advanced and guided both by the contour of the outer table of the iliac crest and the AP image of the pelvis, keeping the tip of the instrument within the width of the sciatic notch (Figure 2B). This is followed by tap and iliac screw placement. Screw length and diameter are determined by measured length of a ball-tipped probe in the bony canal and intraoperative assessment of the width of the iliac crest, respectively. Either pedicle screws or laminar hooks are used at the rostral end of the construct for all patients. Local autograph, allograft and rh-BMP-2 is routinely used.

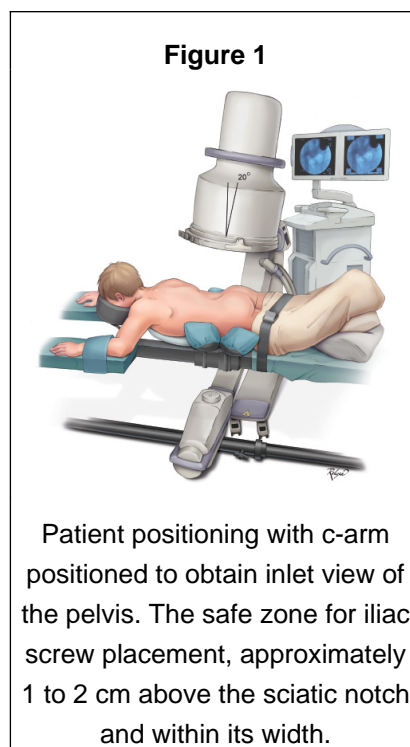


Figure 1
Patient positioning with c-arm positioned to obtain inlet view of the pelvis. The safe zone for iliac screw placement, approximately 1 to 2 cm above the sciatic notch and within its width.

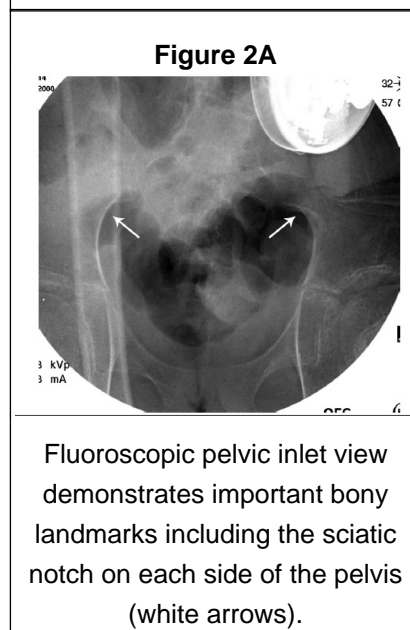


Figure 2A
Fluoroscopic pelvic inlet view demonstrates important bony landmarks including the sciatic notch on each side of the pelvis (white arrows).

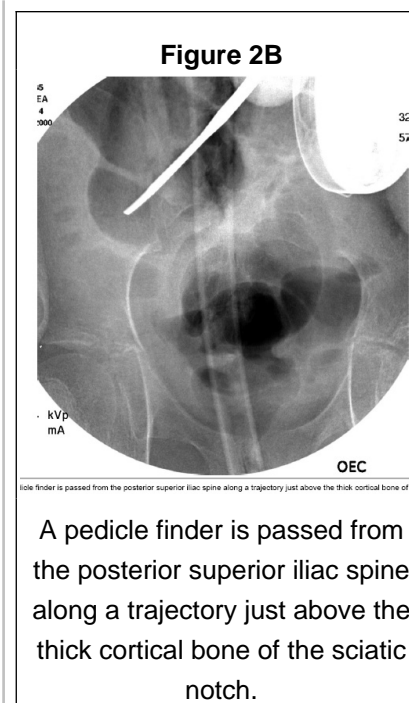


Figure 2B
A pedicle finder is passed from the posterior superior iliac spine along a trajectory just above the thick cortical bone of the sciatic notch.

Results

A total of 12 patients had 24 screws placed as part of a long segment fusion to the pelvis for neuromuscular scoliosis. Median blood loss was 979 cc (95% CI: 506-1,452cc) and operative time 448 minutes (95% CI: 407-539 min). One patient developed pseudoarthrosis at L5-S1; however, there were no iliac screw misplacements, and no complications directly related to the technique of iliac screw placement. The average coronal Cobb angle measured 62 degrees before surgery and 44.3 degrees immediately after surgery. At last follow-up, mean coronal Cobb angle was maintained at 39.5 degrees.

Conclusions

A less invasive technique for iliac screw placement can be performed safely with a low likelihood of screw misplacement. This technique offers the biomechanical advantages of iliac fixation without the soft tissue exposure typically needed for safe screw insertion. The technique relies on identification of the PSIS and high quality AP fluoroscopic imaging for a view of the pelvic inlet.

Learning Objectives

By the conclusion of this session, participants should be able to 1) describe challenges associated with the operative treatment of neuromuscular scoliosis 2) describe traditional methods of iliac screw placement and why these are suboptimal for neuromuscular scoliosis patients 3) describe less invasive method of placing iliac screws using posterior iliac spine and single AP pelvic inlet view as guidance.

References

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