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Clinical Study

Comparison of S2-Alar and traditional iliac screw pelvic fixation for pediatric neuromuscular deformity

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Abstract

BACKGROUND CONTEXT: Many pelvic fixation options exist for posterior spinal fusion of pediatric neuromuscular scoliosis, including standard iliac screws (SISs) or a more recently introduced S2-Alar (S2A) technique. However, little data exist comparing the clinical and radiographic outcomes of these techniques.

PURPOSE: This study aimed to dentify differences in clinical and radiographic outcomes for pediatric neuromuscular scoliosis patients treated with SIS or S2A pelvic fixation.

STUDY DESIGN/SETTING: This was a retrospective cohort study at a pediatric orthopedic clinic.

PATIENT SAMPLE: Patients aged 8–19 years undergoing posterior spinal fusion to the pelvis for neuromuscular scoliosis using SIS or S2A technique, with Gross Motor Function Classification System (GMFCS) Level 4 or 5 were included.

OUTCOMES MEASURES: Postoperative complication rates associated with pelvic fixation method were the outcome measures.

METHODS: Charts and radiographs were reviewed for demographics, intra- and postoperative course, levels of instrumentation, operative correction, and implant failure (IF). Postoperative complications were classified according to the Accordion scale.

RESULTS: We studied 50 patients (28 SIS, 22 S2A) aged 14.0±2.8 years and an average follow-up of 3.5±1.7 years. The average number of levels fused was 16.5±1.1 with an average curve correction of 48°±21° postoperatively. A significant difference in radiographic IF rates was noted between SIS and S2A groups (57% vs. 27%, p=.02). No difference was noted between groups for frequency or severity of postoperative complications, inclusive of wound infections. Subgroup analysis demonstrated equivalent IF rates when comparing the S2A group with the SIS group with cross-links.

CONCLUSIONS: The S2A group generally demonstrated improved rates of radiographic IF compared with the SIS group, but the rates became equivalent when a cross-link was added to an SIS construct. Further, no difference in postoperative complication rates were identified between SIS and S2A groups.

Keywords: Complications; Cross-links; Iliac screws; Neuromuscular; Pelvic fixation; Scoliosis

Introduction

Progressive neuromuscular scoliosis (NMS) can compromise the ability of non-ambulatory pediatric patients to comfortably seat in a wheelchair and tolerate activities of daily living. Spinal fusion with instrumentation to the pelvis is used to correct and stabilize the spinal deformity, level pelvic obliquity, and improve sitting balance. Since the development of the Luque-Galveston technique in 1984, numerous pelvic constructs have been described with various short to mid-tem success rates [1–4]. In the current era of spinal instrumentation, modular iliac screws have become widely used as they have eliminated

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The current study received IRB approval from Connecticut Children's Medical Center.

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the need for the technically demanding three-dimensional Galveston rod bending and offer greater pull-out strength than smooth rod fixation [5]. The S2-Alar (S2A) screw fixation technique has more recently been developed and uses a more medial starting point than traditional iliac screws. The alteration in starting point obviates the need for offset connectors to connect to the primary rods, potentially improving the implant profile of the construct and limiting soft tissue dissection [2,6,7].

Although S2A fixation has theoretical benefits for wound management and implant stability, there are sparse data comparing the radiographic and clinical outcomes of this pelvic construct with the more traditional iliac screw method in a pediatric neuromuscular population [8]. The current study examines the clinical and radiographic outcomes of pediatric patients with NMS treated with either standard iliac screws (SISs) or S2A constructs.

Materials and methods

This study was approved by the Connecticut Children's Institutional Review Board. A single institution, retrospective chart and radiograph review was performed of all patients who underwent spinal instrumentation between November 2003 and October 2014. Inclusion criteria consisted of age between 8 and 20 years of age, diagnosis of NMS, Gross Motor Function Classification System Level 4 or 5, received posterior spinal instrumentation with extension to the pelvis using SIS or S2A technique, and followed up for a least 1 year postoperatively (Figs. 1 and 2) [9]. Patients were excluded if the spinal deformity was idiopathic or postoperative follow-up was incomplete. Radiographs were considered to be sufficient if posteroanterior and lateral sitting radiographs were available preoperatively and at the time of follow-up.

A total of three surgeons were involved in the performance of all pelvic fixation surgeries during the study period. One of the three surgeons performed strictly SIS fixation, whereas the other two surgeons performed both SIS and S2A technique. The first S2A fixation was performed in 2009, and the technique increased in prevalence in the study cohort thereafter.

Patient charts and radiographs were reviewed for variables with possible relationship to implant failure (IF), including demographics, primary medical diagnosis, major

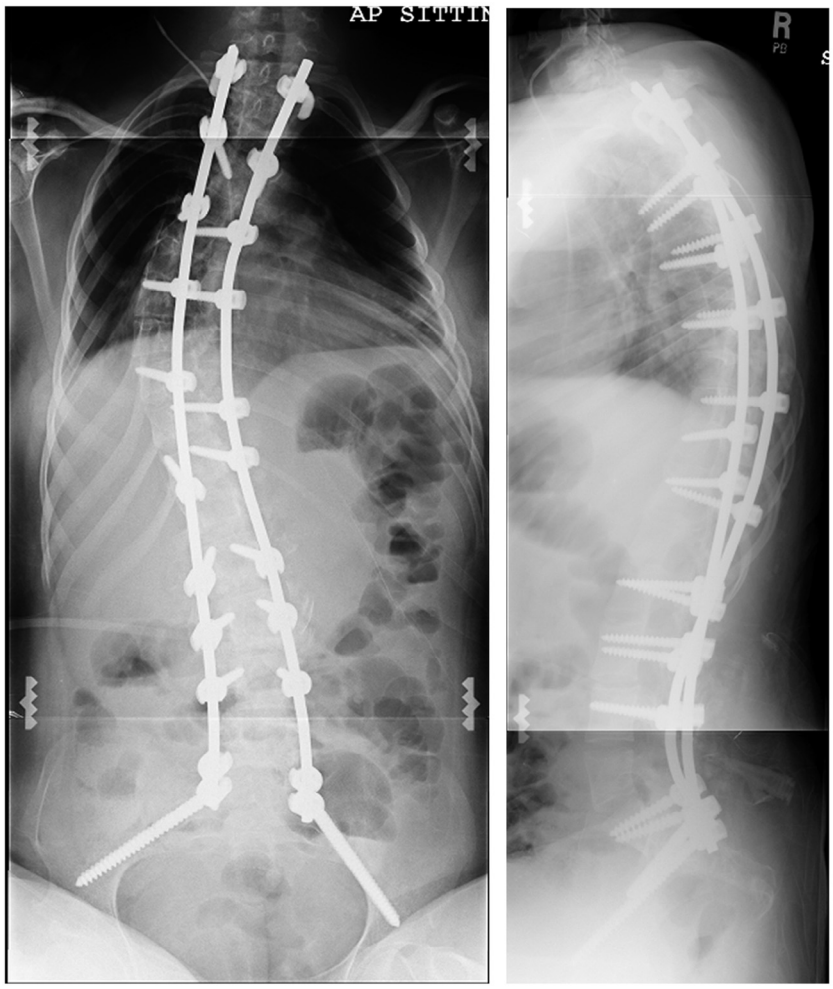

Fig. 1. Sitting AP (Left) and lateral (Right) projections of a 14-year-old girl with spastic quadriplegia following typical posterior spinal fusion from T2 to the pelvis for neuromuscular scoliosis. Pelvic fixation has been achieved using an S2-Alar technique augmented with S1 pedicle screws. AP, anteroposterior.