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The Effect of Two Attending Surgeons on Patients With Large-Curve Adolescent Idiopathic Scoliosis Undergoing Posterior Spinal Fusion

Liam Bosch, BA[a], Carla Boan, MS[a], Miranda Falk, PA-C[a], Greg R. White, MD[a], M. Wade Shrader, MD[b,*]

[a]*Center for Pediatric Orthopaedics, Phoenix Children's Hospital, 1919 East Thomas Road, Phoenix, AZ 85006, USA*
[b]*Department of Orthopaedic Surgery and Rehabilitation, University of Mississippi Medical Center, 2500 North State Street, Jackson, MS 39216, USA*
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Abstract

Study Design: Retrospective, chart review.
Objectives: The objective of this study is to investigate the impact of using two surgeons for posterior spinal fusion (PSF) in patients with AIS with large-magnitude curves (greater than 70°).
Summary of Background Data: Previous studies have shown that intraoperative risk factors can be reduced by having two surgeons operate simultaneously.
Methods: A retrospective chart review identified 47 patients between January 1, 2009, and December 31, 2014, who underwent a posterior spinal fusion (PSF) with AIS with large-magnitude curves (greater than 70°). Patients with large-magnitude curves due to neuromuscular diseases or any defined pathology other than idiopathic scoliosis were excluded, as well as patients with kyphotic or kyphoscoliotic curves.
Results: There was no statistical difference between the total operative time, anesthesia time, estimated blood loss (EBL), %EBL, and blood transfusion units. Total operative time for the two-surgeon group and single-surgeon group was 212.11 and 238.07 minutes, respectively ($p = .078$). The two-surgeon group averaged 0.26 blood transfusion units versus 0.39 units for the single-surgeon group ($p = .50$). Average hospital length of stay was decreased in the two-surgeon group (5.16 vs. 6.82 days, $p = .002$).
Conclusions: The use of two surgeons for PSF for AIS has previously been shown to decrease operative time and blood loss, factors that are correlated with prolonged hospital stay and increased risk of both neurologic and nonneurologic complications. However, in this study, the technique of having two experienced orthopedic spine surgeons work simultaneously to perform pedicle screw–only posterior spinal fusion on large-magnitude AIS curves greater than 70° did not improve blood loss or operative time. Further study needs to continue to identify ways to minimize complications for patients who undergo spinal fusion.
Level of Evidence: Level III, retrospective, comparative study.

Keywords: Posterior spinal fusion; AIS; Scoliosis

Introduction

Adolescent idiopathic scoliosis (AIS) is the most common cause of spinal deformity [1,2]. Scoliosis that occurs in the adolescent period (after age 10) does not constitute a statistically higher risk of mortality [3]. However, it does threaten pulmonary function over time [4,5]. Curves greater than 60° risk respiratory compromise by the fourth decade of life. Severe scoliotic curves that are not surgically corrected can progress after skeletal maturity and eventually impact respiratory muscle efficiency by placing these muscles in positions inconducive to their functioning [6].

For these reasons, it is important to treat progressive and large-curve scoliosis in adolescence. Surgical correction of larger deformities is associated with higher perioperative morbidity [7]. For this reason, it is important to mitigate risk factors to the greatest extent possible. There is a correlation between increased surgical time and greater intraoperative blood loss [8]. Increased blood loss during surgery also

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*Corresponding author. Department of Orthopaedic Surgery and Rehabilitation, University of Mississippi Medical Center, 2500 North State Street, Jackson, MS 39216, USA. Tel.: (601) 984-1000; fax: (601) 815-1722.
E-mail address: mshrader@umc.edu (M.W. Shrader).

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correlates with prolonged hospital and ICU stay [9]. Excessive bleeding and prolonged hypotension during surgery are a risk factor for neurologic complications [7]. Prolonged anesthesia time and excessive blood loss are cited as factors contributing to nonneurologic complications whereas ICU stay length is a predictor of both surgical site infection rate and long-term survival rate [7,10,11].

Previous studies have shown that intraoperative risk factors can be reduced by having two surgeons operate simultaneously [12-15]. Halanski compared a single surgeon and a two-surgeon cohort performing posterior spinal fusion in patients with AIS and showed significantly lower operative times, exposure to allogenic blood transfusions, and improved curve correction with the two-surgeon cohort [15]. The curves in Halanski's paper included curves with a mean value of 56 degrees. Additionally, Ames studied the use of two attending surgeons on a more complex surgical case: pedicle subtraction osteotomy [14]. Perioperative outcomes were significantly improved for the two-surgeon group in regard to mean percentage estimated blood loss and average surgical time.

The purpose of this study is to investigate the impact of using two surgeons for posterior spinal fusion (PSF) in patients with AIS with large-magnitude curves (greater than 70°).

Materials and Methods

Available data on all eligible patients referred to a tertiary care pediatric hospital between January 1, 2009, and December 31, 2014, were used to perform a retrospective chart review of patients undergoing PSF with AIS with curves greater than 70°. The subjects were identified by a search of the hospital's ICD-9 and discharge diagnoses. Patients were not contacted. Forty-seven patients were identified, 28 of whom had two attending surgeons whereas 19 underwent PSF performed by a single attending surgeon (one of the two surgeons in the two-surgeon group) assisted by a resident or physician assistant. The choice of using two surgeons for this cohort was simply by scheduling availability, and not by any patient selection criteria by the treating surgeons. Any patients who underwent posterior osteotomies or significant posterior releases were excluded in this analysis. All patients underwent similar operative procedures with pedicle-screw only constructs. Patients in the two groups underwent identical surgical and anesthetic protocols. All patients in each group received intraoperative tranexamic acid as part of our standard protocol.

Data collection of patient and injury demographics included patient age, gender, weight, American Society of Anesthesiologists (ASA) classification, severity of curve, anesthesia time, total operative time, estimated blood loss (EBL), percent estimated blood loss (%EBL), blood transfusions, spinal levels fused, and hospital length of stay. % EBL was calculated as EBL divided by total estimated blood volume, which was estimated as weight in kilograms multiplied by either 75 mL/kg for males or 65 mL/kg for females. The severity of the curve was assessed by measuring the Major Cobb angle from standing, preoperative radiographs. Levels fused were chosen using standard criteria, including bending films. Typically, bending films were used to determine a subjective sense of flexibility; measurements of curve stiffness were not performed at the time of this study.

Patients with large-magnitude curves due to neuromuscular diseases or any defined pathology other than idiopathic scoliosis were excluded, as well as patients with kyphotic or kyphoscoliotic curves. Patients requiring any staged procedures (such as a combined anterior and posterior fusion) or those requiring osteotomies (Ponte or Smith-Peterson) also were excluded. There were four surgeons involved in the study, all experienced with pediatric spine deformity, and all more than five years out from their pediatric orthopedic fellowship. All pedicle screws were carefully placed with the free-hand technique. All screws were scrutinized with fluoroscopy and flat-plate radiography to identify malpositioned screws. Postoperative CT scans were not utilized to assess for screw position. The first assistant in the single-surgeon series was a Physician Assistant with three to eight years of experience over the course of the study. She assisted some with dissection and exposure, but did not place pedicle screws in the patients in this series.

Perioperative complications including infection were analyzed. All patients were followed out to a minimum of one year. The Student *t* test was used to compare the three major variables of blood loss, anesthesia time, and hospital length of stay, age, Cobb angle, number of spinal levels fused, and patient ASA classification between the single-surgeon and two-surgeon groups. Levene's test for equality of variances was used to compare the two groups in terms of age, severity of curve, spinal levels fused, and patient ASA classification. Equal variances were assumed unless they were statistically different, in which case equal variances were not assumed. A Chi-Square test was used to compare categorical variables between the groups. A power analysis was not performed on this retrospective review. Statistical significance was designated at $p < .05$.

Results

Patients in the single-surgeon group and the 2-surgeon group were demographically similar with no significant

Table 1
Patient demographics and curve characteristics.

Data	Single-surgeon group	Two-surgeon group	p value
Patients (n)	28	19	
Average age (years)	13.57	13.05	.334
Average gender (1 = male, 2 = female)	1.82	1.79	.790
Average Cobb angle (degrees)	78.42	84.02	.049
Average levels fused	12.75	13.11	.170
Average ASA score	1.61	1.58	.880

ASA, American Society of Anesthesiologists.