



## The Use of Pedicle Screws in Children 10 Years of Age and Younger With Growing Rods

Karen S. Myung, MD, PhD<sup>a</sup>, David L. Skaggs, MD, MMM<sup>a,\*</sup>, Charles E. Johnston, MD<sup>b</sup>, Behrooz A. Akbarnia, MD<sup>c</sup>, Growing Spine Study Group

<sup>a</sup>Children's Orthopaedic Center, Children's Hospital Los Angeles, Orthopaedic Surgery #69, Los Angeles, CA 90027, USA

<sup>b</sup>Department of Orthopaedic Surgery, Texas Scottish Rite Hospital for Children, 2222 Welborn Street, Dallas, TX 75219, USA

<sup>c</sup>San Diego Center for Spinal Disorders, 4130 La Jolla Village Drive, Suite 300, La Jolla, CA 92037, USA

Received 16 March 2012; revised 3 July 2014; accepted 7 July 2014

---

### Abstract

**Study Design:** Retrospective review of a multicenter database.

**Objectives:** To evaluate the incidence of implant-related complications of pedicle screws versus hooks in children with early-onset scoliosis treated with growing rods.

**Summary of Background Data:** Because growing rods have a high rate of implant complications compared with spinal fusion, this challenging, fusionless group of patients is a provocative environment in which to evaluate implant-related complications of pedicle screws.

**Methods:** A total of 159 patients with growing rods treated at 18 institutions were included. Inclusion criteria were children aged less than 10 years who had growing rod surgery between 1998 and 2008 with minimum 2-year follow-up from index surgery. Charts and radiographs were evaluated only for complications directly related to a pedicle screw or hook. The researchers evaluated 464 pedicle screws and 643 hooks.

**Results:** Of the 464 pedicle screws, there were 17 complications (3.7%) directly related to screws: acute loss of fixation (2), migration (14), and breakage (1). Of the 643 hooks, there were 47 complications (7.3%): acute loss of fixation (28), migration (16), and unspecified loss of fixation (3). When loss of fixation occurred, the mean time to loss of fixation was similar for both implants: 33 months for hooks and 30 months for screws ( $p = .95$ ). There were no complications involving neurologic or vascular injury directly related to a hook or screw.

**Conclusions:** Pedicle screws in growing rod constructs had fewer implant-related complications than hooks in patients with early-onset scoliosis in a minimum 2-year follow-up period ( $p = .02$ ). It is encouraging that there were no neurological or vascular injuries associated with either implant in 159 children with over 4.5 years of mean follow-up, in a provocative, fusionless environment.

© 2014 Scoliosis Research Society.

**Keywords:** Pedicle screw; Complications; Growing rod; Safety; Early-onset scoliosis

---

### Introduction

Distraction-based posterior spinal instrumentation without fusion, including growing rod surgery, is a common surgical treatment option for progressive early-onset scoliosis (EOS). The goals of growing rod surgery include correction of the spinal deformity, maintenance of correction during growth, and promotion of spinal growth and lung development. The types of anchor fixation used in growing rod surgery most commonly include hooks and pedicle screws and, in some cases, sublaminar wires. Growth-friendly systems such as growing rods experience additional stresses to implants from motion, which are not seen in definitive spinal fusion. Several studies have shown

---

Author disclosures: KSM (none); DLS (grants from POSNA, SRS, personal fees from Biomet, Medtronic; non-financial support from Growing Spine Study Group, Scoliosis Research Society, Growing Spine Foundation Medtronic Strategic Advisory Board; personal fees from expert testimony; personal fees from Biomet; Medtronic, Stryker, Wolters Kluwer Health–Lippincott Williams & Wilkins; other from Medtronic, Stryker, Biomet, Medtronic, outside the submitted work; patent issued from Medtronic); CEJ (none); BAA (none).

Funding for the Growing Spine Study Group, which made this study possible, was provided by the Growing Spine Foundation.

\*Corresponding author. Children's Orthopaedic Center, Children's Hospital Los Angeles, Orthopaedic Surgery #69, Los Angeles, CA 90027, USA. Tel.: (323) 361-4648; fax: (323) 361-1310.

E-mail address: [DSkaggs@chla.usc.edu](mailto:DSkaggs@chla.usc.edu) (D.L. Skaggs).

a high rate of implant-related complications in growing rod constructs compared with definitive spinal fusion [1–4].

Although the use of pedicle screws in children over age 10 years is widely accepted and is approved by the Food and Drug Administration, there are lingering concerns about the use of pedicle screws in younger children, such as their smaller pedicular anatomy, suboptimal bone quality, and strength of fixation. In an effort to address these concerns, a recent study analyzed patients aged 10 years old and younger who underwent various types of spinal surgery, and reported no difference in the incidence of pedicle screw–related complications compared with case-matched patients older than 10 years [5]. There is also a concern that pedicle screws may later result in smaller spinal canal sizes owing to passage of the pedicle screws through the neurocentral synchondroses of the spine in a skeletally immature child [6]. However, a retrospective study of 19 consecutive cases in which 91 thoracic and lumbar pedicle screws were used in the treatment of various pediatric spinal disorders in 1- and 2-year-old children suggested that pedicle screw fixation can be performed safely without negative effects on vertebral growth [7].

Nevertheless, the question remains whether pedicle screws are safe to use in growth-friendly systems to treat young patients with EOS. The growing rod construct is a provocative setting in which to scrutinize the safety of pedicle screws in the pediatric population with progressive deformity, because these constructs apply additional stresses to implants that are not seen in definitive fusion systems. The purpose of this study was to evaluate the absolute incidence of implant-related complication rates and safety issues directly associated with pedicle screws and hooks in growing rod surgery, regardless of construct design.

## Materials and Methods

A query of a multicenter EOS database identified a total of 159 patients who underwent growing rod surgery at 18 different institutions. The data queried were collected both prospectively and retrospectively. The researchers obtained institutional review board approval to participate in this study at each institution. Patients were included based on the following criteria: 1) diagnosis of EOS; 2) age 10 years or younger at index surgery; 3) index growing rod surgery occurred between 1998 and 2008; 4) complete history included surgical note and preoperative and postoperative radiographs; 5) there was a minimum 2-year follow-up from index surgery. A medical chart and radiographic review was performed at each institution only for complications directly related to a pedicle screw or hook that was placed at the index surgery. Data from each institution were entered into the EOS database using standardized case report forms by the individual institution. The database was then queried for this study. The database included a total of 470 enrolled patients with surgical and nonsurgical EOS.

Of the 470 patients, 270 had a minimum of 2 years' follow-up data. Of these 270 patients, 159 had surgery and a complete clinical and radiographic history. Complications included acute loss of fixation (pullout or dislodgement), migration over time (loosening or plowing over time), implant breakage, and skin issues directly related to the implant. Constructs with both pedicle screw and hook anchors were defined as hybrid constructs.

The authors used Student *t* test to evaluate the significance of difference between the numbers of complications in each group. The difference in rates of infection between the 2 study groups was evaluated for statistical significance at a 95% confidence interval by comparing the rates of standard error of the difference multiplied by *Z*. The lower and upper limits of the 95% confidence interval (CI) for a proportion were calculated.

## Results

Among the 159 patients who met inclusion criteria, the mean age was 5.0 years (range, 1–9 years) at index surgery. Based on the classification of EOS [8], of the 159 patients, 46 had neuromuscular scoliosis (29%), 42 congenital scoliosis (26%), 37 idiopathic scoliosis (23%), and 34 syndromic scoliosis (21%). The mean length of follow-up for all patients was 56 months (range, 24–134 months). A total of 464 pedicle screws and 643 hooks were evaluated. There were 24 pedicle screw-only constructs, 73 hook-only constructs, and 62 hybrid constructs.

Implant-related complications occurred in 37 of 159 patients (23%). Pedicle screw complications occurred in 11 patients (4 neuromuscular scoliosis, 2 congenital scoliosis, and 5 idiopathic scoliosis). Hook complications occurred in 26 patients (5 neuromuscular scoliosis, 12 congenital scoliosis, 8 idiopathic scoliosis, and 1 syndromic scoliosis). Implant-related complications more often occurred in congenital scoliosis patients (14 of 42; 33%), followed by idiopathic scoliosis patients (13 of 37; 35%). Implant-related complications were less frequent in neuromuscular scoliosis patients (9 of 46; 20%) and syndromic scoliosis patients (1 of 34; 2.9%).

A total of 168 screws were used in 24 pedicle screw-only constructs. 8 of which had complications (4.8%). Most were loosening complications (7 of 9; 78%). A total of 371 hooks were used in 73 hook-only constructs, 28 of which had complications (7.5%). In 62 hybrid constructs 296 screws and 271 hooks were used; 9 screws (3.0%) and 19 hooks (7.0%) had complications. Among the 61 patients with hybrid constructs, none had both a hook and pedicle screw complication. However, patients had 1 to 4 complications. On average, 17 pedicle screw complications occurred in 11 patients: 1.5 per patient. Similarly, 47 hook complications occurred in 26 patients: 1.8 per patient. During the study period, 4 patients had 4 implant-related complications from implants placed at the index surgery.

Download English Version:

<https://daneshyari.com/en/article/4095611>

Download Persian Version:

<https://daneshyari.com/article/4095611>

[Daneshyari.com](https://daneshyari.com)