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Clinical Study

Does the size of the rod affect the surgical results in adolescent idiopathic scoliosis? 5.5-mm versus 6.35-mm rod

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Abstract

BACKGROUND CONTEXT: Favorable clinical outcomes of surgical treatment with Cotrel-Dubousset instrumentation (CDI) or instrumentations that follow the principles of CDI, for adolescent idiopathic scoliosis (AIS) have been reported. However, there are few studies concerning the results with rods of different sizes.

PURPOSE: To find out whether the rod size affects the surgical results for AIS.

STUDY DESIGN: A retrospective cohort study based on the same spinal system with different sizes of rod.

PATIENT SAMPLE: A consecutive series of 93 patients, who underwent posterior correction with posterior instrumentation and fusion for AIS, were included and retrospectively analyzed.

OUTCOME MEASURES: Postoperative radiologic outcomes were evaluated using coronal curves, percentage of curve correction, and coronal global balance.

METHODS: Ninety-three patients treated during the period January 2000 to December 2008 were included in this study; 48 patients were treated with the Cotrel-Dubousset Horizon (CDH) M10 system with a 6.35-mm rod from January 2000 through December 2004, and a CDH M8 was used with a 5.5-mm rod in another 45 patients from January 2005 through December 2008. The Cobb angle, Risser grade, coronal curves, flexibility of curve, percentage of curve correction, coronal global balance, operative time, and estimated blood loss were measured and analyzed. The same parameters were used when the patient was followed at the OPD. All of the patients underwent regular follow-up for at least 2 years.

RESULTS: No statistical significance was observed in the demographic data, including age, sex, BMI, and Risser grade, between these 2 groups. The overall average percentage of correction was 60.0%±12.7%: 60.7%±12.5% for the CDH M10 group, and 59%±13.1% for the CDH M8 group. At the final follow-up, the overall average loss of correction was 4.8±3.9° for the CDH M10 group, and 4.3±4.0° for the CDH M8 group. The average percentage of correction at the final follow-up was 50.9%±15.1% for the CDH M10 group, and 51.1%±16.1% for the M8 group. No statistical significance could be observed in the radiologic parameters between these 2 groups.

CONCLUSION: The radiologic results for the 5.5-mm rod and the 6.35-mm rod were comparable in terms of correction, loss of correction, and coronal global balance.

Keywords: Adolescent idiopathic scoliosis; Cotrel-Dubousset Horizon instrumentation; CDH; Hybrid constructs; Rod size; Surgical results

FDA device/drug status: Approved (Cotrel-Dubousset Horizon M8 spine system, Cotrel-Dubousset Horizon M10 spine system).

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EVIDENCE & METHODS

Context
The choice of rod size used during scoliosis surgery can depend on many factors. The authors aimed to assess whether the use of two different rod sizes resulted in any radiographic differences after surgery.

Contribution
The group detected no statistical difference between radiographic outcomes using 5.5mm versus 6.35mm rods.

Implications
The study serves as a seed for further study using better methodology. The current study does not answer the question. It was underpowered to detect a difference and it is unclear whether selection bias was present. Furthermore, the findings are not generalizable beyond a particular instrumentation system and choice of metal.
—*The Editors*

Introduction

Idiopathic scoliosis may lead to progression of the curve, disabling pain and fatigue, cardiopulmonary symptoms, and high rates of mortality and morbidity [1]. However, favorable surgical results have been reported with improvement in pain relief, social function, and physical function among patients in whom fusion is achieved [1–5]. The clinical outcome of surgical treatment with Harrington instrumentation for adolescent idiopathic scoliosis (AIS) has been reported to be more favorable than with brace treatment [6]. Since its introduction in 1984, however, Cotrel-Dubousset instrumentation (CDI) has become the ''gold standard'' for treatment of idiopathic scoliosis [7,8]. CDI was designed to provide enough stability to allow suppression of any postoperative external support, and to achieve three-dimensional correction through distraction and compression with hooks or screws, and derotation of the rod [9,10]. Although the design differed from that of CDI, there have been several spinal instrumentation systems introduced following the principles of CDI in maneuvers for correction through compression, distraction, and derotation, such as Texas Scottish Rite Hospital instrumentation (TSRH) (Metronic, Minneapolis, MN, USA), the Moss-Miami Spine System (DePuy, Warsaw, IN, USA), Isola Spine System (DePuy, Warsaw, IN, USA), and Universal Spine System (USS) (Synthes GmbH, Zuchwil, Switzerland). Successful results have been reported using CDI and these instrumentations following the principles of CDI [11–14]. However, these instrumentations have different implant designs with various sizes of rod that can range from 4.5 mm to 7.0 mm. There are few studies on the results of surgical treatment of AIS based on the same instrumentation system using different rod sizes.

To resolve the problems of the design, the Cotrel-Dubousset Horizon (CDH) (Metronic, Minneapolis, MN, USA) has evolved, using the same principles as the original CDI system, but as a more convenient and more biomechanically sound system [15]. Successful uses of the CDH with superior results have been reported in treating AIS through both posterior and anterior approaches [16–19]. The CDH has two different implant systems with different sizes of connecting rod; the M8 system has a 5.5-mm diameter rod, and the M10 system a 6.35-mm rod. The design of the rest of the implants of the CDH M8 and M10 systems, including hooks, screws, and devices for transverse traction (DTTs), is the same. To find out whether the rod size affects the surgical results in AIS, we designed a retrospective cohort study based on the same spinal system with different sizes of rod.

Materials and methods

From January 2000 to December 2008, 95 consecutive patients with AIS were treated surgically at our hospital. The indications of surgery were Cobb angle more than 40° with progression in skeletally immature patients, and more than 50° or with back pain in skeletally mature patients younger than 20 years. Those patients who needed an anterior procedure, who had previous back surgery, or were lost to follow-up were excluded. Two of the 95 patients were lost to follow-up, so 93 were finally included in the study. Among the 93 included patients, 14 were male and 79 were female. Forty-eight patients were treated with CDH M10 from January 2000 through December 2004, and 45 with CDH M8 from January 2005 through December 2008 (Table 1). The CDH spinal system we used was made of titanium implantable metal (Titanium-6Aluminum-4Vanadium [Ti-6Al-4V] ELI [Extra Low Interstitial] Alloy). According to the King-Moe classification [20], 9 patients were type I, 26 were type II, 32 were type III, 3 were type IV, and 2 were type V. Twenty-one patients who could not be classified according to the King-Moe classification were categorized as having a thoracolumbar (15 patients) or lumbar (6 patients) curve [21] (Table 2).

Table 1
Demographic data of the patients

Patient's profiles	CDH M8	CDH M10	Total
Patient no. (M/F)	45 (8/37)	48 (6/42)	93 (14/79)
Age, mean±SD (range)	15.8±2.6 (11–20)	15.3±1.7 (13–20)	15.6±2.2 (11–20)
BMI, mean±SD	18.7±3.1	19.5±2.8	19.1±3.0
Risser grade, mean±SD	3.8±1.1	3.9±0.9	3.9±1.0

BMI, body mass index; CDH, Cotrel-Dubousset Horizon; SD, standard deviation.