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Effect of Preoperative Indications Conference on Procedural Planning for Treatment of Scoliosis

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Abstract

Study Design—This study determines the rate of change in the scoliosis surgery plan in cases presented in preoperative indications conference.

Objectives—To determine the effect of preoperative indications conference on the plan of surgery and to identify characteristics that increased the likelihood of change.

Summary of Background Data—Preoperative indications conferences are used as a teaching and planning tool. Levels of fusion, construct options, and necessity for osteotomies are often debated in the planning of scoliosis surgery.

Methods—Scoliosis surgeries were presented at preoperative indications conference with four attending pediatric orthopedic surgeons present. The operative surgeon committed to a surgical plan before conference. A consensus-based plan was made without knowledge of the operative surgeon's preconference plan. Changes of plan were classified as major, minor, or no change.

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Results—Of the 107 surgical plans, 50 were index surgeries, 13 were revisions, and 44 were scheduled growing rod lengthenings. There were two major changes, including a change to a growing construct from planned fusion, and a change in fusion levels in an adolescent idiopathic scoliosis (AIS) patient. There were 13 minor changes, which included changes in fusion levels (1 to 3; mean = 1.23) and the addition of an osteotomy. The rate of change was 28% for index surgeries and 7.69% for revisions. Of the 14 changes in the 50 index surgeries, there were 8 AIS, 3 cerebral palsy, 1 congenital scoliosis, 1 Ehlers-Danlos, and 1 patient with an undetermined neuromuscular condition. There was 1 change in 13 revision surgeries. There were no changes for growing rod lengthenings and no cancellations as a result of indications conference.

Conclusions—Although revision scoliosis surgery is complex, index AIS/JIS surgery was most subject to the influence of indications conference. This likely reflects controversy around choosing levels of fusion.

Level of Evidence—IV.

Keywords

Scoliosis; Consensus-based decision making; Surgical planning

Introduction

Developing a plan for surgery requires the examination of a variety of factors. Because of the vast collection of variables contributing to the planning process, significant weight is placed on the interpretation of clinical cases by individual physicians. Preoperative indications conferences are commonly held at academic medical centers and are used both to teach, and as a forum for the discussion of surgical planning. Although the exact prevalence of pre-operative indications conferences in surgical departments is not explicitly stated within the literature, it is frequently listed as an element of orthopedic surgery residency program curriculums across the United States. Its use as an arena for discussion provides the opportunity for consultation and modification of operative plans based on peer feedback obtained from fellow surgeons [1]. As such, there is the potential for the exchange of information on recent literature, operative techniques, and firsthand experiential insight related to specific surgical interventions, procedures, and outcomes.

Current literature provides support for consensus-based measures as a tool for clinical decision making [2]. Specifically, nominal group decision methods have been used among health-care organizations for the development of educational programs, the establishment of clinical practice guidelines, and technological assessments [3]. These techniques can be used to develop solutions to medical and surgical problems for which there is an inadequate evidence base, no optimal treatment choices, and a lack of understanding of what ideal patient management should be [2,4,5]. In fact, consensus-based decision-making sessions are believed to be advantageous compared with individualized decision making, as collective decision making by experts claims to more effectively identify appropriate treatments [1,6]. Within the field of pediatric orthopedics, clear indications for surgery exist for adolescent idiopathic scoliosis (AIS) and early-onset scoliosis (EOS) patients. However, despite the presence of supported indications criteria and established guidelines for scoliosis treatment,

decisions on spinal fusion levels, construct options, and the need for osteotomies are often the subject of debate in surgical planning [7,8]. Furthermore, many of the guidelines on the surgical correction of scoliosis have become more complex, as of late, because of increased controversy and debate [9–13]. Consequently, this has led to increased variability in the choice of instrumentation and surgical approach [9–15].

Preoperative indications conferences provide an appropriate setting to allow a colloquy among clinicians to resolve treatment debates and aid in the development of surgical plans. The purpose of this study is to determine the effect of preoperative spine deformity indications conferences on intended surgical plans, and to identify characteristics that increase the likelihood for alterations in operative plans. Scientific literature is presently scant on the efficacy and merit of such an intervention. As such, this study will provide foundational information on the influence these decision-making sessions can have on surgical plans.

Materials and Methods

Indications conference

Spine deformity indications conferences, within our institution's Division of Pediatric Orthopaedic Surgery, were examined. Four pediatric orthopedic surgeons, one orthopedic surgery fellow, three orthopedic surgery residents, and several medical students and observers attended these weekly, hour-long meetings. All pediatric orthopedic surgeons, participating in the conference, submitted cases to be presented during the meeting. Specific variables related to each participating surgeon (ie, years of practice, fellowship training, number of cases included in study, etc.) are presented in Table 1. Nonparticipant physicians included fellows and/or resident physicians who were present for educational purposes and did not present any subjective opinion to the plan determined by the participating physicians. During the meetings, residents presented each scheduled scoliosis case with the history and physical exam, as well as coronal, sagittal, and lateral bending radiographs. No magnetic resonance imaging (MRI) or computed tomographic (CT) images were included in the conference and any additional supplemental clinical information was provided by the operating surgeon. Before the meeting, the operating surgeon was asked to commit to a plan and was instructed to not discuss this plan with other participating physicians. Discussions commonly revolved around the selection of vertebral levels for fusion, instrumentation types, the choice of traction, and osteotomies.

Case descriptions

Cases included in the study were elective spine surgeries for patients with AIS and EOS between October 22, 2012, and October 29, 2013. Cases were excluded from the study if they were not preoperative, if fewer than three of the four pediatric orthopedic spine surgeons were present for the conference, or if the operating surgeon was unable to commit to a surgical plan before the conference. Documentation of preoperative and consensus plans is presented in Tables 2 and 3.

Data collection

For the cases included in this study, preoperative and surgical information were collected from the electronic medical records. During the conferences, consensus-based decisions on additional procedures, osteotomies, changes in levels operated, and changes in surgical approach were noted. Operative notes recorded after surgery were also obtained to identify true changes in the surgical plan. Changes in surgical plan were classified as major, minor, or no change. Major change was defined as a cancellation of surgery, a change of fusion levels (≥ 4 levels), or a change from fusion to growing-based techniques. Minor change was defined as a change in fusion levels (<4 levels) or the addition of procedures. No change was defined as the absence of any difference between the preoperative and operative plan. In addition, the patient diagnosis, type of surgery (index, revision, scheduled lengthening, etc.), and details of the proposed surgery (levels operated, construct chosen, osteotomies, etc.) for each case were documented.

Descriptive analyses were performed to elucidate the rate at which surgical plans changed from the original proposed procedure, the overall degree of change in surgical plans and the type, and rate, of change seen for a given type of surgery.

Results

Descriptives

One hundred seven presented cases met the established criteria for inclusion into this study. Of the 107 surgical plans examined, 50 (46.7%) were index surgeries, 13 (12.1%) were revisions, and 44 (41.1%) were scheduled growing rod lengthenings (Table 4). For all surgical cases studied, there was 100% compliance between consensus-based operative changes proposed during preoperative indications conference and the procedure dictated in the surgical note. The rate of the change in the preoperative plan was 28% for index surgeries and 7.69% for revisions, whereas scheduled growing rod lengthenings did not result in any change in surgical plan. Irrespective of surgery type, there were 2 incidences of major procedural change and 13 total incidences of minor procedural change.

Index surgery

Of the 50 index surgeries, 14 experienced procedural changes. These 14 changes occurred across 8 patients carrying a diagnosis of AIS, 3 with cerebral palsy, 1 with congenital scoliosis, 1 with Ehlers-Danlos, and 1 undefined neuromuscular scoliosis. The primary modification seen in plans for index surgery fits into the minor change classification in which there was a change in fusion levels ranging from 1 to 3 (mean = 1.23). Changes in <4 fusion levels occurred in 12 of the index cases (85.7%). Among index surgeries, 2 major procedural changes were noted. In the first, a Shilla construct was chosen over the originally planned VEPTR (Vertical Expandable Prosthetic Titanium Rib) in an EOS patient. In the second, there was a change of ≥ 4 fusion levels; it was elected to fuse T8–L3, rather than T2–L3, in an AIS patient.

Revision surgery

Of the 13 revision surgeries studied, the only observed procedural change was a minor change involving the addition of an osteotomy. This procedural change was seen in a patient with AIS. Ultimately, no cancellations of surgery were seen as a result of preoperative indications conference.

Discussion

In order to come to a decision on surgery for scoliosis patients, factors such as the severity of deformity, radiographic evaluation, surgical and technical feasibility, and patient and parental expectations need to be examined [10]. Correction of the spinal deformity, achievement of a balanced posture, and preservation of spinal mobility are the primary goals of surgical treatment [16]. Surgery for AIS is indicated in patients with thoracic curves that are predicted to progress to greater than 45 to 50 degrees by the time of skeletal maturity [17,18]. Surgery for EOS is indicated in patients with coronal curves greater than 60 degrees with progression, and those patients with anticipated progression in which nonoperative treatments have either failed or are contraindicated [19]. Despite the presence of indications for surgery, much of the decision making, as it pertains to options for surgery, is still left up to the interpretation of aforementioned factors by the operating spine surgeon.

In the examination of the effects of preoperative indications conference at our single institution, it was found that spine surgical plans are subject to the influence of this clinical decision-making paradigm. Among the most common types of spine procedures we perform (index posterior spinal fusion with instrumentation, revision and growing rod lengthenings), index AIS/JIS surgery was most likely to have been affected by preoperative indications conference despite the complexities commonly encountered in revision scoliosis cases. More specifically, the effect of spine indications conference on AIS/JIS surgical plans primarily revolved around the selection of fusion/instrumentation levels. The determination of levels of fusion is one of the more controversial aspects of scoliosis surgery, and the findings of this study reflect the ongoing concerns within our field. To overcome this difficulty, consensus-based decision making was used. We also found full compliance between the consensus-based decisions formulated during indications conference and the actual operative procedure performed.

A clear strength of this study is its place as a pioneering study in establishing a methodology by which to examine the efficacy of consensus-based interventions in altering single-surgeon preoperative plans for spinal surgery. Despite this strength, limitations exist in our study. It is possible that more complex spine cases, such as revision cases for infected or failed posterior spinal fusions, were less likely to reflect a change in our study because of discussion held before, or outside of, the indications conference in an effort to provide such patients with an immediate operative plan at the time of the office visit. Our study also does not currently measure if such an alteration in the operative plan leads to a better clinical outcome for the patient. Such a study would require additional follow-up in the future. Lastly, the rates reported in this study reflect the group behavior of a single practice and is a constantly evolving number as we continue to collect more data. It would be worthwhile to build on the findings of this study and examine the characteristics of spine cases that are

more likely to necessitate counsel and peer examination. Although classifying each curve type, as outlined by the Lenke Classification System, can help to determine which segments of the deformity to fuse, selecting the individual levels by which to end or begin the fusion construct is clearly still the area of most variability and likewise is most influenced by preoperative indications conferences [20]. Overall, preoperative indications conference and consensus-based decision making can act as a tool to overcome clinical uncertainty.

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Table 1

Descriptive data of orthopedic surgeons participating in preoperative indications conference.

Surgeon	Fellowship trained (pediatric vs. spine)	Years in practice (since completion of fellowship)	Total number of cases included in study	Total number of cases changed
A	Pediatrics	11	60	7
B	Pediatrics	32	11	2
C	Pediatrics	9	27	4
D	Pediatrics	14	9	2
		66	107	15

Table 2

Index surgical cases with preoperative and consensus plans

Surgeon	Diagnosis	Preoperative plan	Consensus plan	Change from preoperative plan (Y/N) with classification
A	EOS	VEPTR Insertion	Change of Procedure - Shilla	Y (major)
A	Congenital Scoliosis	PSF T4 to L1	Change of Fusion Level (T4 to L2)	Y (minor)
A	AIS	PSF T4 to T1	Change of Fusion Level (T5-L1)	Y (minor)
A	Ehlers-Danlos	PSF T5-L4	Change of Fusion Level (T2-L4)	Y (minor)
A	AIS	PSF T3-L2	PSF T3-L2	N
A	AIS	PSF T10 to L3	PSF T10 to L3	N
A	AIS	PSF T2 to L4	PSF T2 to L4	N
A	Chromosomal Abnormalities	PSF T2 to Pelvis	PSF T2 to Pelvis	N
A	CP	PSF T2 to Pelvis	PSF T2 to Pelvis	N
A	AIS	PSF T2 to T12	PSF T2 to T12	N
A	Ehlers-Danlos	PSF T4 to L1	PSF T4 to L1	N
A	AIS	PSF T4 to L3	PSF T4 to L3	N
A	Ehlers-Danlos	PSF T5 to L1	PSF T5 to L1	N
A	AIS	PSF T6 to L2	PSF T6 to L2	N
A	AIS	PSF T9-L3	PSF T9-L3	N
A	Spinal Muscular Atrophy	VEPTR Insertion	VEPTR Insertion	N
A	Congenital Myopathy	VEPTR Insertion	VEPTR Insertion	N
A	AIS	Vertebral Stapling	Vertebral Stapling	N
A	AIS	Vertebral Stapling	Vertebral Stapling	N
A	CP	PSF T2-Pelvis	PSF T2 to Pelvis	N
A	AIS	PSF T2-L3	Change of fusion levels (T8-L3)	Y (major)
A	AIS	PSF T5-L1	Change of Fusion Level (T3/T4-L1)	Y (minor)
B	AIS	PSF T3 to L1	Change of Fusion Level (T3- L2)	Y (minor)
B	AIS	PSF T3 to L2	Change of Fusion Level (T3 - L3)	Y (minor)
B	Prader-Willi	PSF T1 to L2	PSF T1 to L2	N
B	Metabolic Dystrophic Disorder	PSF T2 to Pelvis, osteotomies	PSF T2 to Pelvis, osteotomies	N
B	CP	PSF T2 to Pelvis, traction	PSF T2 to Pelvis, traction	N
C	CP	PSF T2 to L5	Change of Fusion Level (T2-L4)	Y (minor)
C	AIS	PSF T3 to T11	Change of Fusion Level (T2-T11)	Y (minor)
C	AIS	PSF T4-L3	Change of Fusion Level (T3-L3)	Y (minor)
C	AIS	PSF T4- L3	PSF T4- L3	N
C	CP	PSF T2 to Pelvis	PSF T2 to Pelvis	N
C	Scheurman's Disease	PSF T2-L3, osteotomies	PSF T2-L3, osteotomies	N
C	AIS	PSF T3 to T12	PSF T3 to T12	N
C	Williams Syndrome	T3 to L3	T3 to L3	N
C	Defect in biosynthetic pathway, scoliosis	VEPTR Insertion	VEPTR Insertion	N
C	Metachromatic Leukodystrophy	VEPTR Insertion	VEPTR Insertion	N

Surgeon	Diagnosis	Preoperative plan	Consensus plan	Change from preoperative plan (Y/N) with classification
C	Achondroplasia	VEPTR Insertion	VEPTR Insertion	N
C	Achondroplasia	VEPTR Insertion	VEPTR Insertion	N
C	AIS	PSF T1-L3	PSF T1-L3	N
C	Neuromuscular Scoliosis	PSF T2-Pelvis	Change of Fusion Level (T3-Pelvis)	Y (minor)
C	AIS	PSF T2-L4	PSF T2-L4	N
D	AIS	PSF T3 to L1	Change of Fusion Level (T2-L1)	Y (minor)
D	CP	PSF T3 to Pelvis	Change of Fusion Level (T2- Pelvis)	Y (minor)
D	CP	PSF T2 to Pelvis	PSF T2 to Pelvis	N
D	Spondylolysis	PSF L4-Pelvis	PSF L4-Pelvis	N
D	Prader-Willi	PSF T2 to L3	PSF T2 to L3	N
D	CP	PSF T2 to Pelvis, traction	PSF T2 to Pelvis, traction	N
D	Myelomeningocele	PSF T2 to Pelvis, osteotomies	PSF T2 to Pelvis, osteotomies	N
D	AIS	PSF T3 to L2	PSF T3 to L2	N

AIS, Adolescent Idiopathic Scoliosis; CP, cerebral palsy; EOS, Early Onset Scoliosis; PSF, Posterior Spinal Fusion; VEPTR, Vertical Expandable Prosthetic Titanium Rib.

Table 3

Revision surgical cases with preoperative and consensus plans.

Surgeon	Diagnosis	Preoperative plan	Consensus plan	Change from preoperative plan (Y/N) with classification
A	AIS	Extension of PSF to L3	Change of fusion level (extension to L4)—addition of Ponte osteotomy	Y (minor)
A	Spondyloepiphyseal dysplasia	Removal of hardware, Shilla	Removal of hardware, Shilla	N
A	Muscular dystrophy	Removal of hardware, PSF	Removal of hardware, PSF	N
A	Muscular dystrophy	Removal of hardware, revision of VEPTR S hook	Removal of hardware, revision of VEPTR S hook	N
A	AIS	Distal extension of one level (with interbody)	Distal extension of one level (with interbody)	N
A	Juvenile-onset scoliosis	VEPTR removal	VEPTR removal	N
B	Myelomeningocele	Exploration of spinal fusion, reinsertion of spinal instrumentation	Exploration of spinal fusion, reinsertion of spinal instrumentation	N
B	Marden–Walker syndrome	Distal extension of one level	Distal extension of one level	N
B	AIS	Removal of hardware, irrigation and debridement	Removal of hardware, irrigation and debridement	N
B	Myelomeningocele	VEPTR to PSF	VEPTR to PSF	N
C	EOS	Revision of VEPTR	Revision of VEPTR	N
C	EOS	Revision of VEPTR	Revision of VEPTR	N
D	CP	Revision of distal instrumentation	Revision of distal instrumentation	N

AIS, adolescent idiopathic scoliosis; CP, cerebral palsy; EOS, early-onset scoliosis; PSF, posterior spinal fusion; VEPTR, vertical expandable prosthetic titanium rib.

Table 4

Rate of change from preoperative surgical plan in index, revision, and lengthening procedures.

Operative procedure	n (%)	Rate of change from preoperative plan (n, %)	Major changes ^a (n, %)	Minor changes ^b (n, %)
Index surgeries	50 (46.7)	14 (28)	2 (4)	12 (24)
Revision surgeries	13 (12.1)	1 (7.69)	0 (0)	1 (7.69)
Lengthening procedures	44 (41.1)	0 (0)	0 (0)	0 (0)
	107 (100)	14 (14.0)	2 (1.9)	13 (12.1)

^aCancellation of surgery, change of fusion levels (≥ 4 levels), or a change to growing-based techniques.

^bChange in fusion levels (<4 levels), or the addition of procedures.