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Case Studies

Factors Influencing Surgical Decision Making in Adult Spine Deformity: A Cross-sectional Survey

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Abstract

Introduction: There is little consensus regarding the surgical management of adult spine deformity (ASD) because of its variable presentation and lack of accepted standardized surgical indications and classifications. The objective of this study was to evaluate factors influencing surgeons' decision making regarding ASD based on patient clinical and radiographic data.
Methods: A total of 28 international adult deformity surgeons were asked to complete an online survey of 10 spinal deformity cases. Case presentation included a clinical vignette with photographs, Oswestry Disability Index, and visual analog scores and imaging with 3-feet biplanar spinal radiographs with radiographic measurements. For each case, surgeons were asked whether surgical management would be beneficial, and to grade the factors influencing their decision according to a Likert scale. Descriptive statistics were used to evaluate surgeon demographics, surgical decision, and factors influencing it. Intra-observer and inter-observer reliability were studied using kappa statistics for the appropriateness of surgery and intra-class correlation coefficient statistics for factors influencing surgical decision.
Results: The intra-rater and inter-rater reliability in surgeons' decision-making process were evaluated to kappa values of 0.48 and 0.17, respectively, representing moderate and no agreement. The highest recommendation among surgeons (84.14%) regarding the beneficial effect of surgery was found for cases with severe deformities and cases with neurology. In severe deformity cases, balance was the most important factor in decision making, whereas in deformity cases with neurologic manifestations, neurology was the most important factor. In general, balance and functional status were the most important factors. Inter- and intra-rater agreement on factors importance was good (0.65 and 0.72, respectively).
Conclusions: Agreement between surgeons about the factors influencing surgical decision was good, and about the need for surgery was poor. Yet, each surgeon seemed relatively consistent about the consideration given to factors leading to a surgical decision for a given ASD patient.

Keywords: Decision making; Adult deformity; Factor

Introduction

Knowledge of the natural history of diseases has a vital role in treatment strategy, including spinal deformities [1]. Unlike the pediatric population, in which growth potential has a vital role in the operative or nonoperative treatment of deformities, treatment in the adult population is based on patients' symptomatology, disability, and, to a lesser degree, progression of deformity [2]. The increased rate of surgical complications in adult deformity patients [3] adds to the complexity in selecting treatment.

Donaldson et al. [4] found that the magnitude of the pediatric spinal deformity was the most important factor among orthopedic spine surgeons in decision making. However, there is high variability in surgical decision making for the adolescent idiopathic scoliosis population, and it was recommended that each case be treated individually based on surgeon's priorities [4,5].

When treating the adult with spinal deformity, many factors apart from clinical and radiographic appearance are shown to influence decision making [6]. Yet, in the world of adult spinal deformities (ASD), much variation exists in classification systems [7-9]. Because treatment principles in

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adult patients are led mainly by the symptomatology and less by the radiographic or cosmetic appearance, a symptom-oriented classification system of ASD was used in this study to assess the reliability of the treatment choice (operative vs. nonoperative) of spine deformity surgeons and the factors influencing their decision.

The working hypothesis of this study was that variability exists in the factors influencing surgeons' surgical decision making in the treatment of ASD. The objective was to query a group of spinal deformity surgeons about the level of importance of several clinical and radiological factors when considering surgical or conservative treatment of a variety of ASD cases.

To the authors' knowledge, this was the first study to evaluate factors associated with surgical decision making in ASD patients, to guide a more systematic approach to the treatment of ASD.

Materials and Methods

A total of 28 spine surgeons from the United States (17), China (8, all with Western surgical experience), and Canada (3), members of the Scoliosis Research Society, an International Spine Study Group, the Canadian Spine Society, and the Chinese Spine Society were asked to complete a survey (via the REDCAP ONLINE system, software developed by Vanderbilt University) on decision making of ASD cases. Institutional review board approval was received from the authors' institution and the surgeons consented to participate after an invitation letter. Patients with radiographic evidence of scoliosis greater than 30°, thoracic hyperkyphosis greater than 70°, or lumbar hypolordosis less than 20°—flatback were considered to have ASD.

Twenty outpatient patients of adult deformity were selected and assigned to a deformity category. Patients were chosen because they appeared in the clinic to be potential surgical candidates, excluding ill and senile patients. A total of 5 deformity categories were defined, with 4 cases per category. The 5 deformity categories were created based on the most pronounced patient disorder, as follows: A) severe unacceptable deformity (severe body listing, unable to keep balance standing or walking, could not see forward); B) deformity with neurology (weakness or/and claudication); C) progressive deformity (greater than 10° in 1 year); D) deformity with severe pain not responsive to other modes of treatment; and E) mild or moderate deformity, nonprogressive, without neurology or severe pain.

Each case vignette included a case scenario, responses to questionnaires (Oswestry Disability Index), visual analog scale, and self-rated body image as poor fair, good, and very good), biplane standing clinical photos, and biplane standing full spine radiographs. Radiographic data that were collected included the magnitude of the major scoliotic curve, shoulder or pelvis asymmetry in the coronal plane, thoracic kyphosis, lumbar lordosis, sagittal and coronal plumbline, and pelvic parameters (pelvic incidence, sacral slope, and pelvic tilt).

Each surgeon was randomized to 1 of 2 groups (Groups 0 and 1) and was asked to review 10 case vignettes (different for each group) and fulfill a questionnaire regarding the surgical background, the decision regarding operative versus nonoperative treatment, and factors affecting the decision making for each case (Table 1). The 10 patient-related factors (age, balance, body image, comorbidities, deformity progression, magnitude of deformity, functional status, psychology status, neurologic signs, and pain score) were ranked according to Likert-type scale, from 1 (factor not important at all) to 5 (factor very important).

Each surgeon saw a random case vignette of the 10 cases for a second time 1 month after the first reading.

Statistical analysis

Statistical analysis was performed with SPSS 10.0 (Chicago, IL) and SAS (Cary, NC). Numerical data were

Table 1
Surgeons' data on spine practice, preference on case management, and ranking of factors in surgical decision making.

Spine surgeon questionnaire on adult spine deformity					
1) How many years of practice in spine surgery do you have? 5 or less ☐ 6–10☐ > 10☐ > 20☐					
2) Which is your surgical background? Orthopedic☐ Neurosurgery☐ Both☐					
3) Have you been trained in a spine deformity fellowship? Yes☐ No☐					
4) What is the volume of spine deformity surgery cases you are performing per month? 5 or less☐ 6–10☐ > 10☐					
5) Would this patient benefit from surgery? Yes☐ No☐ Do not know☐					
Rank the factors below in your surgical decision making					
Five-point Likert scale	Not important at all: 1	Less than neutral: 2	Neutral: 3	Important: 4	Very important: 5
Age					
Balance					
Body image					
Comorbidities					
Deformity progression					
Functional status					
Magnitude of deformity					
Neurologic clinical signs					
Pain score					
Psychology and status					