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The Risk of Curve Progression and Surgery in African Americans With Adolescent Idiopathic Scoliosis

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Abstract

Study Design: Retrospective clinical cohort study.
Objective: To determine if certain risk factors (age, curve magnitude, skeletal maturity, gender, and curve pattern) traditionally associated with curve progression and surgical intervention in the general population apply equally to African Americans.
Summary of Background Data: Currently, information is limited on the role that a patient's race plays in the risk of curve progression of adolescent idiopathic scoliosis (AIS), and existing studies have conflicting results.
Methods: Retrospective search of records identified patients who were African American, had been diagnosed with AIS, had a major curve Cobb angle of 10 degrees or more, and had at least two clinical visits with spinal radiographs at least 90 days apart to determine the risk factors for surgical treatment, and 2 years apart to determine the risk factors for curve progression. Patients with a medical condition likely to cause scoliosis were excluded.
Results: Of 738 African American patients with AIS, 223 were assessed for surgical risk factors, and 72 were assessed for curve progression risk factors. Fifty-six (29.17%) had progression of the major coronal curve, and 38 (17.04%) underwent surgery. Age at presentation and curve magnitude at presentation were significant risk factors for surgical intervention. Curve magnitude at presentation was a significant risk factor for curve progression. No significant relationships were found for gender or curve type as they relate to surgical intervention or curve progression.
Conclusion: Age and curve magnitude at presentation were significantly associated with surgery, as is true in other scoliosis populations. Curve magnitude at presentation was associated with curve progression. In contrast to studies in other populations, however, no significant association was observed between curve progression and age at presentation, curve type, or gender, or between surgery and curve type or gender.
Level of Evidence: Level III, prognostic cohort study.

Keywords: Adolescent idiopathic scoliosis; African American patients; Curve progression; Risk factors

Introduction

A major focus of research in adolescent idiopathic scoliosis (AIS) over the last 30 years has been the determination of the likelihood of disease progression and, ultimately, the need for intervention [1-11]. This is

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especially pertinent because of the relatively infrequent need for surgery compared to the overall prevalence of AIS [12-15]. Previous studies have determined the likelihood of curve progression based on a variety of risk factors, including age, gender, curve magnitude and type, skeletal maturity, and pubertal status at presentation, and authors have developed formulae to calculate the risk of progression in individual patients based on these factors [5,6,9,16].

One limitation of most of these studies is that they do not consider patient race as a factor or are conducted in racially homogenous populations, such as studies that include predominantly Caucasian or Asian patients [1-11]. The few studies that have looked at race as a factor in AIS have focused mainly on access to care [17,18]. Nuño et al. [17] found that nonwhite patients were less likely to receive surgical intervention, whereas Zavatsky et al. [18] saw a greater likelihood of surgical intervention among African American patients.

Furthermore, racial differences have been demonstrated in other pediatric disease processes. Heterotaxy syndrome has shown a predilection for Hispanic infants [19], and Hispanics have a higher age-standardized incidence rate (ASIR) for Langerhans cell histiocytosis [20], whereas children of African descent have a lower ASIR compared with Caucasian children. Autoimmune diseases such as systemic lupus erythematous and autoimmune hepatitis also have various racial associations, with higher rates in African Americans in some studies [21,22]. The causes for these racial disparities are multifactorial and include factors such as geography, genetics, socioeconomics, and access to care. Regardless of the factors involved, race has been implicated as a factor in the prevalence and incidence of a wide variety of childhood diseases.

The purpose of this study was to examine AIS curve progression and surgical intervention in African American patients to determine if they are subject to the same risk factors and rates of progression as the general population.

Methods

Design and subjects

After institutional review board approval (University of Tennessee Health Science College [UTHSC IRB no. 11-01362-XP]), a retrospective search identified all African American patients who presented to our institution with a diagnosis of AIS (International Classification of Diseases, Ninth Revision [ICD-9] diagnosis code: 737.30) between 2000 and 2011. Data were retrieved from the time of presentation until one of the following endpoints was met: completion of clinical follow-up, initiation of bracing, or surgical intervention.

Inclusion criteria were African American race, diagnosis of AIS, 10 to 18 years old at presentation, major curve Cobb angle of 10 degrees or more, and at least two clinical visits, with radiographs of the spine at least 90 days apart to evaluate surgical treatment risk factors and 24 months apart to assess curve progression risk factors. Thirty-three patients underwent surgical stabilization within the first 2 years of initial presentation; therefore, excluding these patients due to follow-up under 2 years would have greatly altered the findings related to risk factors associated with the need for surgical stabilization. Exclusion criteria were presence of a medical condition likely to produce scoliosis as a secondary effect (eg, cerebral palsy, neuromuscular disease, Marfan syndrome, or Friedreich ataxia) and absence of radiographic or medical records.

The initial medical record search identified 738 African American patients with a presumed diagnosis of AIS; however, detailed review of the medical records of this group revealed that many had associated diagnoses that excluded them from the study or had inadequate imaging for initial measurements. This further reduced the study sample to 489 subjects. From this group of 489 subjects, an additional 266 were eliminated from analysis because they had only their initial radiograph or had only two visits within 90 days of each other. Therefore, 223 subjects remained for evaluation of factors related to the need for surgical intervention, 72 subjects remained with a minimum of 24 months' follow-up to assess risk factors of curve progression. Although this database allows for evaluation of data on initial presentation for a large cohort of patients, this review is only focusing on those patients with at least 2 visits. The majority of our exclusions were for lack of follow-up. Most of the patients excluded had only their initial visit and either failed to keep follow-up appointments or were deemed to be at low risk for progression based on their maturity and initial curve magnitude (Table 1). As expected, the excluded group was older and had a smaller curve magnitude than the included group; however, gender, curve type, and maturity status were similar between the two groups.

For the first visit, date of presentation, date of birth, age, gender, race, menarche status for females, and any associated cardiac, pulmonary, endocrine, or other conditions were recorded. For follow-up visits, the date of follow-up and age were recorded, as well as the clinical endpoint.

Imaging analysis

Radiographs included standard posteroanterior and lateral views of the spine. Curve magnitude was measured in both the coronal and sagittal planes using the Cobb angle method. All curve end vertebral levels and apical vertebrae were noted, as well as the direction of convexity. Thoracic kyphosis was measured from the superior end plate of T5 to the inferior end plate of T12. To assess skeletal maturity, the Risser grade of the iliac crest was recorded on a scale of 0 to 5, and the triradiate cartilage was recorded as being open or closed [23].

Coronal curves with an apex between T2 and T11 were categorized as main thoracic curves. Curves with an apex