

Research Article

One Third of Scoliosis Referrals to an Orthopaedic Office Result in Treatment Being Recommended

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OPEN ACCESS**Keywords**

- Adolescent idiopathic scoliosis
- Referral patterns
- Curve magnitude

Abstract

Background: The American Academy of Pediatrics (AAP) recommends that patients with scoliosis with a Cobb angle over twenty degrees be referred for orthopedic care. The purpose of this study was to examine how referral patterns are related to curve magnitude at presentation and need for intervention in patients with idiopathic scoliosis.

Methods: This study was a retrospective review of all patients presenting in an outpatient setting for evaluation of scoliosis over ten years of age. Exclusion criteria were non-idiopathic scoliosis or previous spine surgery. Data was collected on demographics, curve magnitude at presentation, referral source, treatment recommendations and whether surgery was eventually recommended.

Results: Of 570 patients who met inclusion criteria, 52% were referred for evaluation by their primary care providers (PCPs), 18% were second opinions, 15% were referred by school screening, and 6% were primary self-referrals. There was a significant difference amongst the referral sources with regards to the Cobb angle at presentation ($p < 0.001$), treatment recommendations ($p < 0.001$), and likelihood of recommending surgery ($p < 0.001$). Overall, 62% of patients met AAP criteria of 20 degrees for referral. No patient with a curve magnitude of less than 20 degrees at presentation had treatment recommended.

Conclusions: Thirty-eight percent of patients presenting for scoliosis evaluation at our tertiary pediatric medical center did not meet AAP guidelines for referral, and none of these patients had treatment recommended for scoliosis. Second opinion and primary self-referred patients presented with larger curves and were significantly more likely to require treatment than those referred from school screening or PCPs.

ABBREVIATIONS

AAP: American Academy of Pediatrics; **PCP:** Primary Care Providers; **PA:** Posteroanterior Radiograph ; **AIS:** Adolescent Idiopathic Scoliosis; **ANOVA:** Analysis Of Variance

INTRODUCTION

The Scoliosis Research Society defines scoliosis as a lateral deviation of the spine of greater than ten degrees as measured by the Cobb angle on a posteroanterior radiograph (PA) [1]. The American Academy of Pediatrics recommends that otherwise healthy patients who have spinal curvature of twenty or more degrees be referred to an orthopaedic subspecialist.2 Additionally, patients who have an atypical history, physical examination, or radiographic finding for adolescent idiopathic scoliosis (AIS) including painful scoliosis, stiffness, rapid

progression in a previously stable curve, extensive progression in a patient after skeletal maturity, abnormal neurologic findings, or findings associated with clinical syndromes should be referred [2].

The goal of referral for AIS is to identify patients in whom early treatment may slow or stop curve progression.2 Natural history studies have demonstrated that only a small proportion of curves less than twenty degrees progress significantly [3]. While bracing moderate to severe curves, remains controversial, braces are rarely initiated in patients with curves less than 25 degrees [4,5].

Previous studies have demonstrated high levels of inappropriate referrals for "scoliosis" in the adolescent population. Anywhere from 42-75 percent of new patients being

referred to an orthopaedic surgeon for evaluation of scoliosis have been found to have lateral deviation of their spines of less than ten degrees on radiographs taken at the referral center [6-11]. A Boston study demonstrated that less than five percent of patients referred to orthopaedic surgery for AIS were treated with bracing and less than one percent underwent surgery [12].

The primary purpose of this study was to examine how referral patterns were related to curve magnitude at presentation and need for intervention in patients with idiopathic scoliosis. A secondary aim of this study was to examine what percentage of our patient population met criteria for referral as proposed by the American Academy of Pediatrics. Additionally, this study sought to determine if there were any patients who did not meet criteria for referral, yet required intervention beyond observation during the study period.

PATIENTS AND METHODS

All patients who presented to our institution for a new visit with the ICD-9 Code 737.30 (scoliosis and kyphoscoliosis, idiopathic) from January 1, 2004 to December 31, 2010 were evaluated for inclusion in this study and a cohort of 631 patients were randomly selected.

Patients were excluded from the study if 1) they were determined to have neuromuscular, congenital, or other non-idiopathic type of scoliosis, 2) they were less than ten years old at the time of presentation, 3) they had undergone previous surgical intervention, or 4) the source of referral could not be determined from the patient's chart. Patients who were previously treated with a brace or chiropractic manipulation were not excluded from this study.

Data was collected on demographic information, including age at presentation, sex, and insurance type. Charts were queried for information regarding previous treatments, and type of referral (primary self, school screening, primary care physician (PCP), or second opinion). Radiographs were examined and radiographic data was collected, including levels involved, curve magnitude, and Risser stage.

Data was also collected on treatment recommendations at the first visit and whether the patient continued to follow-up. Patients were considered "lost to follow-up" if they did not return for their recommended follow-up visit. For those patients who continued to follow-up, charts were queried to determine which patients were recommended to undergo a surgical intervention.

Statistical methods

Patients were divided into groups for comparison based on the origin of their referral: primary care physician (PCP), orthopaedic surgeon (second opinion), school screening, or self-referral. Data was analyzed using IBM Statistical Program for the Social Sciences, version 21.0 (IBM, Somers, NY).

Descriptive statistics were compiled for all variables. Fischer's exact tests were used to compare the categorical variables, while Analysis of Variance (ANOVA) tests were used to compare continuous variables amongst the groups. Post-hoc Bonferroni's tests were conducted for significant ANOVA tests. A p-value of less than 0.05 was considered statistically significant.

RESULTS

A cohort of 631 patients with idiopathic adolescent scoliosis was evaluated for inclusion in this study and 570 patients had data available on the source of referral (90 percent). Almost 58 percent of referrals originated from a PCP. Twenty percent of referrals were second opinion requests, 17 percent were from a school-screening program, and 5.6 percent were primary self-referrals (Chart 1). There was no significant difference amongst the groups with regards to sex (Chart 2). Patients who were seen as a second opinion were significantly older than patients with all other sources of referrals ($p < 0.001$) (Chart 3a and 3b).

There was a significant difference amongst the groups with regards to insurance status ($p < 0.001$) (Chart 4). Patients who were referred by their PCP ($p = 0.001$) and those referred by a school screening program ($p = 0.036$) were significantly more likely to be publicly insured than those referred by other means. Patients who were referred as a second opinion were significantly more likely to be privately insured ($p < 0.001$).

At the time of presentation, there was a significant difference in major Cobb angle amongst the referral pattern groups ($p < 0.001$). Patients who were referred by their PCP (mean 23.72 degrees) or from a school-screening program (mean 23.02 degrees) tended to have the smallest major Cobb angles at presentation, while those presenting for second opinions had the largest major Cobb angle (mean 40.02 degrees) (Chart 5a and 5b).

Moreover, there was significant difference amongst the groups regarding the number of patients who met criteria for referral to an orthopaedic surgeon ($p < 0.001$) (Chart 6). Overall, 62% of the patients met guidelines for referral. Almost 90% of patients being seen as second opinions met criteria for referral to an orthopaedic surgeon. However, only slightly more than half of patients referred by their PCP met referral criteria as set forth by the primary care governing bodies. Less than half of those patients identified on school screening met criteria for referral.

There was a significant difference amongst the referral groups regarding the recommendations made for treatment at the initial visit ($p < 0.001$) (Chart 7). Patients who were referred by their PCP ($p = 0.010$) or as part of a school screening program ($p = 0.002$) were significantly more likely to have observation alone recommended as their initial treatment. Less than one-third of patients referred by their PCP required any type of treatment for their scoliosis beyond observation. Patients who were referred as second opinions were significantly more likely to have surgery recommended as their initial treatment ($p < 0.001$).

There was no significant difference amongst the groups with regards to the number of patients recommended to continue to follow-up ($p = 0.08$). And, there was no significant difference with regards to the number of patients who completed the recommended duration of follow-up ($p = 0.211$). Of those patients who completed their recommended duration of follow-up, there was a significant difference amongst the groups in the number of patients eventually requiring surgical intervention ($p = 0.035$) (Chart 8).

Of those patients who did not meet guidelines for specialty referral, no patient required brace treatment or surgical

treatment during the study period. Ten patients were referred for advanced imaging secondary to atypical back pain. None of these patients required additional intervention beyond symptomatic management with physical therapy and/or anti-inflammatory medication.

DISCUSSION

With the current health care policy focus on rising costs, the focus on specialty care over primary care is often cited as an inciting factor [12-14]. Previous evidence demonstrates that effective primary care reduces the need for specialty care and thus may aid in cost containment [15]. Moreover, in areas where pediatric subspecialty care is scarce, shifting care to the primary care setting, when appropriate, may decrease waiting times and better utilize the resources of specialists for patients who are truly in need of these services [12].

Previous authors have cited high numbers of “inappropriate” referrals to the orthopaedic surgeon for evaluation of scoliosis. Anywhere from 42-75% of new patients being referred for evaluation of scoliosis have been found to have lateral deviation of their spines of less than ten degrees [6-11]. In this study, 38% of all patients seen for AIS and 48% of patients referred by a primary care provider for evaluation for AIS did not meet AAP criteria for specialty referral. None of these patients went on to require treatment.

A Canadian study conducted after the discontinuation of their school screening program found that 42% of patients referred for suspected idiopathic adolescent scoliosis did not demonstrate any clinically significant deformity [11]. In a 2002 study from Washington, DC, authors found that 46% of the 577 patients evaluated for scoliosis had no evidence of a clinically significant lateral deviation of the spine [8]. In British Columbia, out of 167 previously screened and medically evaluated patients referred for scoliosis, 75% had no significant curve [10].

A Boston Children’s Hospital study demonstrated that less than five percent of patients referred to orthopaedic surgery for AIS were treated with bracing and less than one percent underwent surgery [12]. A quality improvement initiative by this group sought to shift care from the pediatric orthopaedist to the primary care setting. By providing education, decision support materials, and longitudinal feedback, the Boston Children’s group demonstrated a twenty percent reduction in orthopaedic surgery visits for AIS.

This study was limited in that was a retrospective study. Not all charts included information on a source of the referral. Excluding those that did not clearly state a source of referral could introduce a bias, as the practitioner may have been more likely to cite a particular referral source, while not identifying others. In addition, we included patients who had previously been treated by non-operative means including chiropractic manipulation and brace treatment. It is possible that these previously treated patients were different than their peers. The study did not differentiate amongst types of braces, nor did it differentiate who prescribed and monitored brace treatment. Thus this was a heterogeneous group and findings about this group may be more difficult to interpret. Finally, we did not differentiate if our patients had radiographs prior to referral. This information

was not reliably available in patient’s charts, and thus was not included as a data point in our study. It is likely that those patients who did have previous radiographs would present with larger curves, however we are unable to prove this hypothesis.

Patients referred as second opinions are significantly more likely to require treatment. Over half of these patients went on to require surgery during the study period. In addition, these patients tended to be privately insured and were generally older than patients referred from other sources. Second opinion patients are a distinct population when compared to those presenting from other referral sources. These patients were all referred after being evaluated by an orthopaedic surgeon. The high proportion of patients requiring surgery in this group is most likely secondary to the fact that most of these patients were identified as having scoliosis in need of treatment and were referred for surgical intervention.

More than eighty percent of patients referred by their PCP or by school screening programs were managed with observation and serial imaging with no need for bracing or surgical intervention during the study period. Moreover, no patient with a lateral deviation of the spine of less than twenty degrees required brace or surgical treatment. These findings provide additional evidence that idiopathic adolescent scoliosis with lateral deviation of less than twenty degrees could safely be managed by PCPs.

CONCLUSION

In summary, this study demonstrates that a majority of those patients referred for the evaluation of idiopathic scoliosis by PCPs and school screen do not meet criteria for referral to a specialist. And, none of these patients went on to require treatment with a brace or surgery. With appropriate education and decision support, a vast majority of these patients could be managed in the primary care setting. Second opinion and primary self-referred patients tend to present with larger curves and are significantly more likely to require treatment than those referred for other reasons. Second opinion patients were also more likely to meet referral guidelines.

CONFLICT OF INTEREST STATEMENT

David skaggs

Grants: POSNA & SRS, Paid to Columbia University (Projects: RSS SSI and Rib vs. Spine); Consulting fee or honorarium: Biomet; Medtronic; Board Membership: Growing Spine Study Group, Growing Spine Foundation, Medtronic Strategic Advisory Board; Committee Chair: Scoliosis Research Society; Expert testimony: legal expert in medical malpractice cases (<5% of income); Payment for lectures including service on speakers’ bureaus: Biomet; Medtronic; Stryker; Patents: Medtronic (patent holder); Royalties: Wolters Kluwer Health - Lippincott Williams & Wilkins; Biomet Spine; Payment for the development of educational presentations: Stryker; Biomet, Medtronic; Other: Institutional support from Medtronic (fellowship program)

What’s known on this subject

The American Academy of Pediatrics recommends that patients with scoliosis with a Cobb angle over twenty degrees be referred for orthopedic care, as patients with curves of less than twenty degrees rarely require intervention.

What this study adds

38% of patients presenting for idiopathic adolescent scoliosis evaluation at our tertiary pediatric medical center did not meet AAP guidelines for referral, and none of these patients had treatment recommended for scoliosis.

Contributors' statement

Rachel goldstein: Rachel Goldstein designed the study, collected the data, drafted the initial manuscript, revised the manuscript and approved the final manuscript as submitted.

Elizabeth joiner: Elizabeth Joiner aided in conceptualizing and designing the study, reviewed and revised the manuscript and approved the final manuscript as submitted.

David L. skaggs: David Skaggs conceptualized the study and aided in the design of the study, reviewed and revised the manuscript, and approved the final manuscript at submitted.

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