

Clinical Study

Trunk imbalance in adolescent idiopathic scoliosis

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Abstract

BACKGROUND CONTEXT: Trunk imbalance (ie, frontal trunk shift measured with a plumb line from C7 to S1) is part of the clinical evaluation in adolescent idiopathic scoliosis (AIS), but its prevalence and relationship with scoliosis, back pain, and health-related factors are not well documented.

PURPOSES: The principal objectives are to document trunk imbalance prevalence and to explore the association between trunk imbalance and the following factors: Cobb angle, type of scoliosis, back pain, function, mental health, and self-image. The secondary objective is to determine back pain prevalence and the relationship between back pain and each of the following: Cobb angle, function, mental health, and self-image.

STUDY DESIGN/SETTING: This is a cross-sectional study in a scoliosis clinic of a tertiary university hospital center.

PATIENT SAMPLE: The sample includes youth with AIS (N=55).

OUTCOME MEASURES: The outcome measures were trunk imbalance prevalence and magnitude, and back pain prevalence and intensity using the Numeric Pain Rating Scale (NPRS) and the Scoliosis Research Society-22 (SRS-22) pain score, and the function, self-image, and mental health domains of the SRS-22.

METHODS: Trunk imbalance and back pain were assessed in 55 patients with AIS (Cobb angle: 10–60°). Patients completed the SRS-22 questionnaire and the NPRS. Correlations were done between trunk imbalance and scoliosis (Cobb angle, type of scoliosis), back pain (NPRS and SRS-22 pain score), and health-related factors using Pearson correlation coefficients (r) and logistic regression models.

RESULTS: Trunk imbalance prevalence is 85% and back pain prevalence is 73%. We found fair to moderate significant positive correlation between trunk imbalance and Cobb angle ($r=0.32-0.66$, $p<.05$) but not with back pain, function, mental health, self-image, or type of scoliosis. Lower self-reported pain significantly correlated with lower Cobb angles ($r=0.29$, $p=.03$), higher function ($r=0.55$, $p=.000$), higher self-image ($r=0.44$, $p=.001$), and better mental health ($r=0.48$, $p=.000$). There was a trend for trunk imbalance to be related with lower pain in logistic regression models.

CONCLUSIONS: The high prevalence of trunk imbalance in AIS highlights the importance of screening for this clinical sign in growing adolescents. Further research should be done with regard to the treatment of trunk imbalance and its implication on both Cobb angle and back pain. © 2016 Elsevier Inc. All rights reserved.

Keywords:

Adolescent idiopathic scoliosis; Back pain; Function; Posture; Quality of life; Self-image; Trunk imbalance

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Introduction

Adolescent idiopathic scoliosis (AIS) is a developmental pathology characterized by a three-dimensional deformity of the spine (eg, frontal translation, sagittal modification, and torsion of the spinous processes on the concave side of the scoliotic curve on radiographs) with unknown etiology and affects 2%–3% of adolescents [1]. Progressive scoliosis causes posture asymmetries and affects self-image or appearance and quality of life [2,3].

In AIS, trunk imbalance, defined as a shift of the trunk in the frontal plane, is part of the clinical evaluation [4,5]. It is measured on radiograph or with a suspended plumb line and corresponds to the horizontal distance between a line drawn from C7 and S1 [4–6]. Trunk imbalance and concave or convex spinal muscle activity asymmetries are related to scoliosis progression [7–10]. Trunk imbalance may also cause pain because of abnormal stresses on articular joints, intervertebral discs, and muscles [11]. Although trunk imbalance is an important component of the evaluation in AIS, only a few studies examine its prevalence and the relationships that exist between trunk imbalance and other aspects of scoliosis, including Cobb angle, type of scoliosis, pain, function, mental health, and self-image.

The Cobb angle, calculated from radiographs, is the gold standard with regard to monitoring scoliosis progression [12]. A correlation between Cobb angle and trunk imbalance exists in healthy individuals who assume a trunk list [13]; however, little is known about its relationship in those with AIS. The type of scoliosis may also be a prognostic factor in AIS [14], and its relationship with trunk imbalance is unknown.

The relationship between trunk imbalance and back pain in AIS is not clearly established [15,16]. One study showed that adults with trunk imbalance greater than 40 mm who had unoperated scoliosis had increased pain [15]. In a cohort study of 2,442 youths with AIS, there was no significant difference in pain experienced between the 220 individuals with trunk imbalance greater than 10 mm and those presenting a trunk imbalance less than 10 mm [16]. However, these results have never been challenged or duplicated.

Few studies examined the relationship between trunk imbalance and health-related factors such as mental health, self-image, and functional level in AIS. Using the Scoliosis Research Society-22 (SRS-22) questionnaire, no correlation was demonstrated between trunk imbalance and quality of life [4] and self-image [17] in AIS. However, Glassman et al. [15] found that adults with unoperated scoliosis with trunk imbalance greater than 40 mm have a significant poorer functional level compared with those having a trunk imbalance less than 40 mm.

The principal objectives of this study were to document trunk imbalance prevalence and to explore the association between trunk imbalance and the following factors: scoliosis magnitude (Cobb angle), type of scoliosis, back pain, function, mental health, and self-image. The secondary objective was to determine back pain prevalence and the

EVIDENCE & METHODS

Context

The authors present results of a study of 55 patients with adolescent idiopathic scoliosis (AIS) on the prevalence of trunk imbalance and its impact on physical function and self image. This was a cross-sectional study.

Contribution

Trunk imbalance was present in 85% of the patients studied. There was little clinically meaningful correlation between trunk imbalance and back pain, function, mental health, self-image or the type of scoliosis.

Implications

This study provides some useful epidemiologic information for the prevalence of trunk imbalance among patients with AIS. The population is too small, however, to allow for broader conclusions that may be capable of informing care or directing practice. Particularly since it is a cross sectional study, the work represents “a picture in time” for these patients and cannot evaluate or speak to the future development of back pain, functional impairment or declinations in mental health function. The authors appropriately recognize the limitations associated with this effort. Given the limitations associated with this work, the evidence presented here should probably be considered Level III-IV.

—The Editors

relationship between back pain and each of the following: Cobb angle, function, mental health, and self-image. Using Pearson correlation coefficients, we hypothesized (1) that trunk imbalance would be correlated with Cobb angle (single curvatures more so than double curvatures), back pain, and self-image, and (2) that back pain would be associated with Cobb angle and would have an impact on function, mental health, and self-image. We also hypothesized (3) that a significant (positive or negative) relationship between the type of scoliosis and the magnitude of trunk imbalance would be seen. In our study, we chose to use the clinical measurement of trunk imbalance (C7–S1) to evaluate our participants, as the plumb line can easily be used in clinical settings, and this method has been validated with measurements on radiographs [6]. Being able to establish a link between trunk imbalance and scoliosis curves with a simple and clinically relevant non-radiographic method would be of interest to screen for this clinical sign in growing adolescents.

Materials and methods

Participants

Fifty-five (55) participants (47 female, 8 male) aged 10 to 19 years presenting with AIS (Cobb angle between 10° and

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