

IS IT POSSIBLE TO DETERMINE THE PREVALENCE OF ADULT THORACIC SCOLIOSIS WITH A CHEST X-RAY?

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ABSTRACT

Objective: In this study, we planned to examine the prevalence of adult thoracic scoliosis in Turkey.

Materials and Methods: A retrospective, cross-sectional evaluation of randomized digital standing posterior-anterior plain chest radiographs of 1200 patients aged 25 and older, consisting of 600 women and 600 men, was performed. If there is no curvature in the thoracic spine it was measured between T1- T12 but if there is curvature, it was performed with the Cobb angle measurement tool of the PACS system using the Cobb method. The measured curvatures were divided into four groups. The first group consisted of patients with coronal curvature of less than 10° the second group consisted of patients with coronal curvature between 10° and 19°, the third group consisted of patients with a curvature of 20° 29°, and the fourth consisted of patients with curvature of 30° or higher.

Results: Scoliosis was detected in 51 (8.5%) of 600 female patients, 39 (6.5%) of 600 male patients, and 90 (7.5%) of all patients. When the male and female groups were examined, no statistically significant difference was found between the two (p=0.118). However, a statistically significant positive correlation was found between age and Cobb angle (p=0.018).

Conclusion: Postero-anterior plain chest radiographs can easily be used to determine the prevalence of adult scoliosis. However, more studies should be conducted with larger sample groups to get a better picture of the prevalence of adult thoracic scoliosis in the community.

Keywords: Adult thoracic scoliosis, chest X-ray, prevalence

INTRODUCTION

Scoliosis is defined as a coronal spine curvature with a Cobb angle of 10° or more⁽¹⁾. Adult scoliosis is a term that refers to all forms of scoliosis that occur skeletally in adults, regardless of whether the deformity develops before or after skeletal maturation⁽¹⁾. Adult scoliosis is examined in three groups: Primary degenerative scoliosis, progression of idiopathic adolescent scoliosis in adult life, and secondary adult curves⁽²⁾. Adult degenerative scoliosis is included in adult scoliosis. As longer life spans are achieved thanks to the medical advances, the prevalence of age-related spinal degeneration and adult degenerative scoliosis have increased accordingly⁽³⁾. It is important to figure out the prevalence of adult scoliosis to fully determine its overall burden on the society. Review of the literature shows that studies on the prevalence of scoliosis are mostly related to thoracolumbar scoliosis^(4,5). Thus, the information on thoracic scoliosis is quite limited. Besides the existing studies only examined either the patients aged 25-64 years or those aged 50 years or older^(6,7). The literature

therefore lacks a comprehensive study covering all adult groups.

The aim of this study is to determine the prevalence of thoracic scoliosis in all adult aged 25 years and older who have completed spinal maturation and to examine its effects on age, gender and Cobb angle using routine standing posterior-anterior chest radiographs.

MATERIALS AND METHODS

A cross-sectional evaluation was made by retrospectively scanning digital standing posterior-anterior plain chest radiographs of 1200 (600 female, 600 male) patients aged 25 and older in a tertiary public hospital. Patients were excluded from the study if they were previously applied spinal instrumentation, in case of presence of a detected spinal pathology (presence of concomitant spinal radiographs and/or computed tomography and/or magnetic resonance imaging), and if radiographs are of poor image quality. The date of January 1, 2021 was determined as the beginning of the study and the posterior-anterior plain chest radiographs of 600

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female and 600 male patients aged 25 years and older that were performed since that date at the emergency department or outpatient clinics due to various indications were obtained through the ExtremePACS (Hacettepe Teknokent A.Ş., Ankara, Turkey) PACS system and evaluated. Coronal thoracic spine curvature was measured by 3 different experienced clinicians (OO. FD. OB.) and averaged for each patient. If there is no curvature in the thoracic spine it was measured between T1-T12 but if there is curvature, measurement was performed with the Cobb angle measurement tool of the PACS system using the Cobb method. The measured curvatures were divided into four groups according to the study of Reamy and Slakey⁽⁸⁾. The first group consisted of patients with coronal curvature of less than 10° the second group consisted of patients with a coronal curvature of between 10° and 19°, the third group consisted of patients with a curvature of 20° to 29°, and the fourth consisted of patients with a curvature of 30° or more. The study was conducted in accordance with the principles of the Declaration of Helsinki and local ethics committee approval was obtained.

Statistical Analysis

The data were evaluated using SPSS 25.0 (IBM Corp., Armonk, NY, USA). Histogram and normality graphs and Kolmogorov-Smirnov test of normality were used for distribution analysis, and the data were not normally distributed. Descriptive statistical methods were used for demographic data. The data are expressed as mean ± standard deviation. The presence of scoliosis in two independent groups (male and female) was compared using the Pearson chi-square test. Spearman correlation analysis was used to compare two quantitative data. A value of $p < 0.05$ was considered significant.

RESULTS

A total of 1200 patients, 600 women and 600 men, aged 25 years and older, who visited our emergency department and outpatient clinics, were examined. The mean age of women was 46.51 ± 24.00 , and that of men was 44.83 ± 16.38 while overall mean age was 45.68 ± 20.55 . Scoliosis was detected in 51 (8.5%) of 600 female patients, 39 (6.5%) of 600 male patients, and 90 (7.5%) of all patients. No statistically significant difference was found between the female and male patient groups ($p = 0.118$). Of 90 patients with scoliosis, 72 (80%) had curvature between 10° and 19°, 9 (10%) had curvature between 20° and 29°, and another 9 (10%) had curvature of 30° or higher (Table 1). A statistically significant positive correlation was found between age and the increase in Cobb angle ($p = 0.018$) (Table 2).

DISCUSSION

This study estimated the prevalence of thoracic adult scoliosis to be 7.5% in adults aged 25 years and older. It has been observed that, albeit not statistically significant, it was more common in women than it is in men, and a statistically significant relationship was found between age and Cobb angle.

Prevalence estimation can be obtained from pilot studies or previous studies⁽⁹⁾. However, estimating prevalence for sample size calculations is not an easy task, given the overall scarcity of conclusive prevalence studies in this area and the extensive prevalence figures available⁽⁹⁾. Our study is a pilot study as well. While calculating the sample size, we decided to determine a sample size larger than the previous studies had. Review of the literature shows that the number of sample groups rarely exceeded 1000^(6,7,10) and generally they were below 1000. The sample size in our study is 1200.

There are approximately 25 times more studies about adult lumbar scoliosis than adult thoracic scoliosis. There is a shortage of prevalence studies on adult thoracic scoliosis. Therefore, more studies on this subject and more conclusive results with meta-analyses are needed. We have not found any study on adult thoracic prevalence carried out in Turkey. Most of the studies in this area are related to idiopathic scoliosis, especially adolescent idiopathic scoliosis⁽¹¹⁻¹⁶⁾. In these studies, the prevalence of adolescent idiopathic scoliosis was found to be 2.5% which is compatible with the prevalence of the cases in other countries⁽¹⁷⁻²⁰⁾. Since adult scoliosis includes both the persistence or progression of adolescent scoliosis in adult life and adult degenerative scoliosis, 7.5% prevalence rate is not an unexpected value. While adolescent idiopathic scoliosis is more common in females according to the prevalence studies carried out in Turkey and in the world⁽¹¹⁻²⁰⁾ and although more females suffer from adult thoracic scoliosis than males, this difference is not statistically significant. Whereas scoliosis is statistically more common in females during adolescence, the fact that this disparity disappears in adulthood suggests that degenerative scoliosis is more common in males. The fact that men are more involved in working life and are more open to trauma and spinal degeneration make us think that the disparity between men and women in idiopathic scoliosis may disappear in adult scoliosis.

In this study, we found a statistically significant relationship between age and Cobb angle showing that this angle increased

Table 1. Relationship between gender and scoliosis groups

n (%)	Female	Male	Total
Group 1 (Cobb Angle: 0°-9°)	549 (91.5%)	561 (93.5%)	1110 (92.5%)
Group 2 (Cobb Angle: 10°-19°)	40 (6.7%)	32 (5.3%)	72 (6%)
Group 3 (Cobb Angle: 20°-29°)	4 (0.7%)	5 (0.8%)	9 (0.8%)
Group 4 (Cobb Angle > 30°)	7 (1.2%)	2 (0.3%)	9 (0.8%)
Total	600	600	1200

Table 2. Relationship between age and Cobb angle

	Cobb Angle P(r) ¹
Age	0.018 (0.68)*

¹*Statistically significant ($p < 0.05$)

with aging. With the advances in the medical field, the expected lifespan has increased. Along with it, the exposure of the spine to degenerative processes has also rose. Since degenerative spine diseases inflate with age⁽²¹⁻²⁴⁾, the rise in the prevalence of degenerative scoliosis due to degenerative spine diseases is an expected result. For this reason, the relationship between age and Cobb angle that this study put forward is a predictable result.

CONCLUSION

There are very few studies in the literature on adult thoracic scoliosis which, to our knowledge, has not been studied in Turkey at all. In addition to this study, many more studies should be carried out and a reliable literature should be built for more conclusive results.

Ethics

Ethics Committee Approval: The study approval was obtained from University of Health Sciences Turkey, Gaziosmanpaşa Training and Research Hospital, Clinical Research Ethics Committee (approval no: 08, date: 02.02.2022).

Informed Consent: A retrospective, cross-sectional study.

Peer-review: Externally and internally peer-reviewed.

Authorship Contributions

Concept: Ö.Ö., F.D., S.K., Design: Ö.Ö., O.B., A.M.T., Data Collection or Processing: Ö.Ö., O.B., E.C., Analysis or Interpretation: Ö.Ö., F.D., Literature Search: Ö.Ö., A.M.T., S.K., Writing: Ö.Ö., E.C.

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