ORIGINAL ARTICLE

Epidemiology of adolescent idiopathic scoliosis in Isfahan, Iran: A school-based study during 2014–2015

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Background: Scoliosis is a three-dimensional deformity of the spine with lateral curvature in addition to the rotation of vertebral bodies. The aim of the present study was to determine the prevalence of adolescent idiopathic scoliosis (AIS) in our society and its demographic-related factors. **Materials and Methods:** This was a cross-sectional study that took place from November 2014 to March 2015 in Isfahan, Iran. During the period of study, 24 schools were randomly chosen from six zones by a simple random sampling method. In each school, about 120 students were randomly selected and evaluated. Anterior forward bending test and scoliometry were done in all students and suspicious ones referred to Alzahra spine clinic for further evaluation. The diagnosis of AIS was based on radiographic finding and Cobb angle more than 10°. Data about age, sex, height, body mass index, hand dominancy, and type of schoolbag were recorded. **Results:** A total number of 3018 children were evaluated and 19 were diagnosed with AIS that showed the prevalence of 0.62%. None of the study variables had a significant relation with the presence of AIS. The cutoff point for the detection of AIS with scoliometry was calculated as 3.5, with a sensitivity of 73.7% and specificity of 86.7%. **Conclusion:** The prevalence of AIS in our area was 0.62%, which was lower than previous reports and did not have a relation with demographic factors; however, screening surveys identify a significant number of children with AIS who could benefit from preventive treatment.

Key words: Adolescent idiopathic scoliosis, prevalence, scoliometry, screening

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INTRODUCTION

Scoliosis is a three-dimensional deformity of the spine with lateral curvature in addition to the rotation of vertebral bodies.[1] Scoliosis research society classified this condition considering the age of the patients when the diagnosis made. Infantile idiopathic scoliosis presents in children younger than 3 years old that has an association with heart diseases, hip dysplasia, and mental retardation. Another type is juvenile idiopathic scoliosis which presents in patients between 4 and 9 years old. The last type is adolescent idiopathic scoliosis (AIS) which occurs between 10 years and the skeletal maturity. The exact cause of idiopathic scoliosis is not described, and it is a multifactorial condition.[2]

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Previous studies in other countries showed a wide range of 0.47%–13% for the prevalence of AIS,[3-5] which shows the impact of this disease on the health society. Treatments in idiopathic scoliosis vary from bracing to spinal fusion, which shows the importance of early detection and treating the affected patients.

Several screening methods for the early detection of AIS have been described. One of the most applicable methods which have been used in several previous researches in school screening was Adams forward bending test (AFBT).[6-8]

In this study, we aimed to determine the prevalence of AIS in our society and its demographic-related factors in the central part of Iran.

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MATERIALS AND METHODS

Participant and setting

This was a cross-sectional study that took place from November 2014 to March 2015 in Isfahan, Iran. The sampling method in this study was cluster sampling. During the period of study, 24 schools were randomly chosen from six zones of Isfahan using a simple random sampling method. In each school, about 120 students were randomly selected and evaluated.

Eligibility criteria

The inclusion criteria were children aging 10–14 years old with no mental disorders or special diseases such as cerebral palsy. Those students who had acute musculoskeletal pain according to influenza or other disorders were excluded. Moreover, we excluded foreign races according to the relevance of idiopathic scoliosis with genetic and synchronization of the participants. Children were also excluded if they did not show up for the follow-up.

Data gathering

The collected data included age, sex, dominant hand, weight, height, and also type of bag and weight of it. Boys were asked to take off their shirts, and girls were asked to wear a backless shirt.

Four medical students who were instructed by a spine surgeon were responsible for clinical examination of students in the schools. These medical students screened the alignment of the shoulders and back of the participants in posterior, anterior, and lateral views. In addition, participants were examined by AFBT. Scoliometry was done in all students. Suspicious participants referred to Alzahra Hospital Spine Clinic for more evaluations. Standard radiographies were obtained, and the diagnosis of scoliosis was done by the Cobb angle more than 10°.

Ethical issue

The protocol of this study was approved by the Institutional Review Board of Isfahan University of Medical Sciences, and informed consent was obtained from students and parents (grant number: 293020).

Statistical analysis

Statistical analyses were performed using statistical software (SPSS, Inc., version 18, Chicago, IL, USA). Quantitative variables including height, weight, body mass index, bag weight, and scoliometry were presented as mean ± standard deviation and compared using independent *t*-test. Qualitative variables including sex and bag type were presented as number (%) and compared using the Chi-square test. Mann–Whitney test and Fisher's exact test were also used on an as-needed basis. Receiver operating characteristic (ROC) analysis was done to determine the diagnostic value of scoliometry and the best cutoff point for the diagnosis of AIS.

RESULTS

Demographic data

A total number of 3018 children from 24 schools in Isfahan province were screened for AIS. Of them, 335 (11.10%) including 102 (34.3%) males and 233 females (65.7%) had positive AFBT and were referred to the spine clinic for further evaluations. Finally, 19 children (0.62%) were diagnosed to have AIS. Of these 19 children, 13 were female and 6 were male. The mean age of children with AIS was 12.26 ± 1.48 years and Cobb's angle was 15.47° ±4.93°. Detailed data about the patients' curve are shown in Table 1.

We evaluated the relation between some demographic factors including age, sex, dominant hand, weight, height, and also type of bag and its weight with the presence of AIS which showed no significant association ($P > 0.05$). Detailed data are shown in Table 2.

Scoliometry and receiver operating characteristic analysis

As it is shown in Table 2, there was a statistically significant difference in the scoliometry measurement between patients diagnosed with AIS and who did not (6.11 ± 2.49 and 2.37 ± 1.61, respectively). ROC analysis was performed to evaluate the diagnostic value and to determine the best cutoff point of scoliometry for the diagnosis of AIS. As it is shown in Figure 1, the area under the curve was 0.88. The cutoff point was 3.5°, with a sensitivity of 73.7% and specificity of 86.7%.

DISCUSSION

The aim of the present study was to determine the prevalence of AIS among schoolchildren in Isfahan, one of the largest cities which are located in the central part of Iran. The overall prevalence was 0.62% which was similar to another study in Turkey[9] and within the lower spectrum of the range of previous studies in other parts of our country and the world.[3,7,9-11]

Table 1: Curve characteristics of patients with adolescent idiopathic scoliosis

	Apex			Total (%)
	Thoracic (%)	Thoracolumbar (%)	Lumbar (%)	
Curve characteristics				
Right side	3 (37.5)	1 (12.5)	4 (50)	8 (42.10)
Left side	0 (0.0)	4 (50)	4 (50)	8 (42.10)
Double curve	3 (50)	0 (0.0)	3 (50)	3 (19.80)

Data are presented as *n* (%) of patients

Table 2: Study variables among children with or without adolescent idiopathic scoliosis

Variable	Scoliosis		*P*
	No (%)	Yes (%)	
Age (year)[€]			
10	479 (99.4)	3 (0.6)	0.57
11	463 (99.1)	4 (0.9)	
12	788 (99.7)	2 (0.3)	
13	755 (99.3)	5 (0.7)	
14	501 (99.0)	5 (1.0)	
Sex[¥]			
Male	1499 (99.6)	6 (0.4)	0.11
Female	1500 (99.1)	13 (0.9)	
Height (cm)[§]	151.22±11.10	151.97±8.397	0.76
Weight (kg)[§]	44.94±12.94	42.63±9.40	0.43
BMI[§]	19.34±3.89	18.36±3.29	0.27
Hand dominancy[£]			
Left	385 (99.0)	4 (1.0)	0.23
Right	2594 (99.4)	15 (0.6)	
Bag weight (kg)[§]	3.35±1.25	3.42±1.35	0.79
Scoliometry (°)[§]	2.37±1.61	6.11±2.49	<0.0001*
Bag type[¥]			
Bucket bag	238 (99.6)	1 (0.4)	0.41
Trolley bag	33 (97.1)	1 (2.9)	
Backpack	2627 (99.4)	16 (0.6)	
Other types	101 (99.01)	1 (0.99)	

Data are presented as *n* (%) and mean±SD. [€]Mann–Whitney test; [¥]Chi-square test; [£]Fisher's exact test; [§]Independent *t*-test, **P*<0.05 considered statistically significant. BMI=Body mass index; AIS=Adolescent idiopathic scoliosis; SD=Standard deviation

It has been reported in the literature that carrying heavy bags by the schoolchildren can affect their posture, but the relation between the weight of schoolbag and the presence of scoliosis is not established.[12] Our data showed that there was no significant relation among schoolbag characteristics and its carrying style and the presence of AIS.

Another important item which has been evaluated in this study was the application of scoliometer. Scoliometer is an inclinometer that measures the asymmetry between two sides of the trunk and indicates axial trunk rotation. There are several previous studies that have been evaluated and validated for their countries. Coelho *et al*. evaluated the diagnostic value of scoliometry and its correlation with Cobb angle and calculated the diagnostic value for 5–10° of scoliometry and revealed that 5° is the best cutoff point for the diagnosis of AIS.[13] Huang's study showed at least 5° of scoliometry for the screening.[14] There are also studies that suggested 7° for the cutoff point;[15] however, for the use of this device, its cutoff point and diagnostic value should be localized according to the disease prevalence. We found that this cutoff point should be 3.5° for the use of scoliometry, which correlates with a 10° Cobb angle. By considering this cutoff point, we can use scoliometry for the diagnosis of AIS, with a sensitivity and specificity of 73.7% and 86.7%, respectively. This cutoff point is lower than that reported values in previous studies.

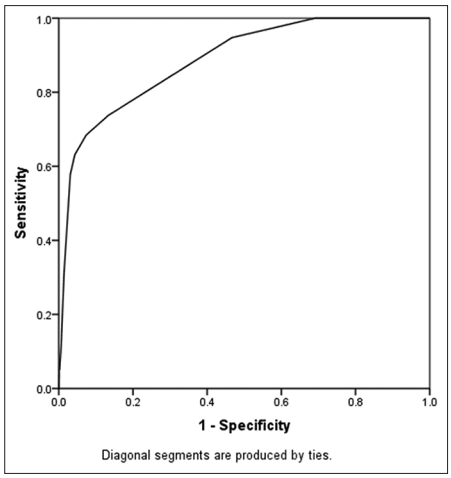

Figure 1: Receiver operating characteristic curve for the best cutoff point of scoliometry in the diagnosis of adolescent idiopathic scoliosis

CONCLUSION

We deduce that the prevalence of AIS is 0.62% in our area, which is lower than previous reports and does not have a relation with demographic factors such as schoolbag and its carrying style. The cutoff point of the application of scoliometry in the diagnosis of AIS was 3.5°.

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Conflicts of interest

There are no conflicts of interest.

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