

Screening Study for Early Detection of Scoliosis in School Children in Al-kharj City in Saudi Arabia

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Abstract: Background: School screening for scoliosis is a well-accepted technique for the early detection of spinal deformities. The aim of the present study was to describe the point prevalence of AIS and to evaluate the effectiveness of school screening in children with mean age of 12 years old in Al-Kharj city, Saudi Arabia. Methods: 1300 school children with mean age 12.05 ± 2.2 years were involved in the study. All subjects were recruited from the primary schools in Al-kharj city, Saudi Arabia, all of them were fulfilled an educational course to improve the knowledge about AIS and learn the screening procedures including Adam's forward bending test and measurements of gibbus using scoliometer. Results: The prevalence of AIS defined as a positive Adam's forward bending test more than 5 degrees was 0.08%. Conclusion: the point prevalence of AIS in 12 years children was in agreement with previous studies.

Key words: Scoliosis • Screening • Scoliometer • School children

INTRODUCTION

Adolescent idiopathic scoliosis is present in 2 to 4 percent of children between 10 and 16 years of age. It is defined as a lateral curvature of the spine greater than 10 degrees accompanied by vertebral rotation. Scoliosis can be identified by the Adam's forward bend test during physical examination. Of adolescents diagnosed with scoliosis, only 10 percent have curves that progress and require medical intervention [1].

Idiopathic scoliosis is a complex three dimensional deformity of the spine characterized by a lateral deviation and axial rotation. Classification is according to the age of onset; infantile, from birth to 3 years; juvenile from 3 to 8 years and adolescent from 10 years to maturity. Idiopathic scoliosis is also classified into early onset (<5 years) or late onset (>5 years) [2].

Prevalence rates of idiopathic scoliosis vary from 0.35 to 13%, depending on the defined Cobb angles, screening age and sex. In addition, there are regional and population-based differences in prevalence rates. The

influence of geography on human biology is determined by socioeconomic and environmental factors, such as temperature, humidity and lighting that are transferred and expressed in human cells by specific mediators [3]. School-based screening for adolescent idiopathic scoliosis has been performed in certain countries for many years. It often involves the administration of one or more screening tests before a student is referred for radiography, when the spinal curvature is diagnosed and assessed. School-based screening was advocated primarily for the purpose of early detection, so that conservative treatments could be applied and thus minimize the chance of invasive surgery [4].

In recent years, The Scoliosis Research Society and the American Academy of Orthopaedic surgeons, the Paediatric Orthopaedic Society of North America and the American Academy of Paediatrics have endorsed scoliosis screening, while The Canadian Task Force on the Periodic Health examination, the British Orthopaedic Association and the British Scoliosis Society do not recommend screening [5].

The optimal age for scoliosis screening is still under debate. School screening has generally been performed between the ages of 10 to 14 years in conjunction with a school health examination [5]. The Scoliosis Research Society has recommended annual screening of all children aged 10-14 years. The American Academy of Orthopaedic Surgeons has recommended screening girls at 11 and 13 years and screening boys at age 13 or 14 years. The American Academy of Paediatrics has recommended annual scoliosis screening with the forward bending test at routine health supervision visits [6].

As resources are limited in many screening programs, it is important that screening for idiopathic scoliosis be targeted at the optimal age group, in whom conservative management, such as bracing, can be instituted to control curve progression and reduce the need for surgery. Early detection by comprehensive screening programs enables early institution of conservative treatment, with the aim of reducing the number of patients with curves reaching a magnitude that requires surgical treatment. School-based screening can be used to identify children who may have scoliosis as well as those who may be at high risk for the disease; however, the screening procedure should not be considered a diagnostic test [3].

Scoliosis curves have the highest risk for progression during adolescent growth spurts. It is therefore important to identify when patients are in their peak growth velocity and to tailor treatment strategies to mitigate curve progression during this period. Once skeletal maturity is achieved, the risk for progression decreases dramatically [7]. The objective of the present study was to determine the current prevalence of scoliosis among school children aged 10-14 years in Al-Kharj society.

MATERIALS AND METHODS

A 1-year cross-sectional epidemiologic study was performed to determine the prevalence and distribution of scoliosis parameter in school children in AL-Kharj society in Saudi Arabia. From September 2012 to May 2013, 1117 boys were screened for scoliosis in schools in AL-Kharj society, ages ranged from 10 to 14 years (mean age 12.05 ± 2.2 years) and the schools were randomly selected with no special consideration for geographic or economic representation. However, all screened children were of Saudi origin, with the child and both parents having been born in Saudi Arabia. There were no duplicate screenings of children or schools.

Procedures:

- The parents of examined children have consent form to fill with the approval to make the child included in the study.
- Demographic data including child's name, age, weight and height were taken.
- Clinical assessment: physical examination was conducted by observing the patient standing for assessment of asymmetry of the shoulder, ribs, scapula, waist and hips. Shoulder asymmetry was assessed by the relative position of both shoulders and recorded as normal, asymmetry. Description of the trunk over pelvis was recorded as positive trunkal shift.
- In the Adam's forward bending test axial trunk rotation (ATR) or prominence of the Para spinal muscles in the thoraco/lumbar and or lumbar area were measured in degrees using a scoliometer.
- The forward bending test was performed with the child bent forward while allowing the upper extremities to hang freely with the palms opposed in a relaxed manner.
- Children who had axial trunk rotation (ATR) more than (5°) on scoliometer were scored.

RESULTS

The descriptive and percentile analysis of data for total and examined children with positive scoliometer (ATR) readings was calculated. Demographic data of total and examined children was shown in table 1 and figure 1.

DISCUSSION

Adolescent idiopathic scoliosis (AIS) is present in 2-4% of children between 10 and 16 years of age. It is defined as a lateral curvature of the spine greater than 10° accompanied by vertebral rotation. Scoliosis can be identified by the Adam's forward bend test during physical examination [8, 9].

The goal of screening is to detect those who will be at risk for developing scoliosis in the school aged population. In evaluation of the effectiveness of screening for scoliosis it should also be taken into account the knowledge gained and contribution it offers in clinical research of idiopathic scoliosis aetiology. The lack of a deeper insight on school screening issue, its value and negative impact of its discontinuation in some countries was the trigger for a recent decision of the

Table 1: Demographic and percentile data of children

	No of Examined children	Mean age (Year)	Mean height (Cm)	Mean weight (Kgm)	Mean of the curve (degree)	No. of children > 5° (% from examined)
Total children number	1117	12.05±2.2	143.17±8.4	38.49±10.5	5.01	9 (0.8%)



Fig. 1: Screened children

Scoliosis Research Society (SRS) presidential line to create an International task force for the better study of the school screening issue and creation of a "white paper" with recommendations based on recent knowledge on the topic [10].

Direct evidence of the effectiveness of scoliosis screening would require controlled prospective studies demonstrating that persons who receive screening have better outcomes than those who are not screened. Documentation is limited, but few studies including a recent study from the Netherlands, have demonstrated that scoliosis cases detected through screening had lower chances of having surgery than otherwise detected patients [11, 12]. There are some studies reporting that patients with scoliosis detected by screening are younger than referred cases, have smaller curve size and reduced risk to progress to > 45° and thereby having surgery. On the other hand, the number of referrals to local scoliosis clinics is increased by screening [13, 14].

It has been argued that screening could have psychological labelling effects to subjects and increase exposure to radiographs. In the present study, attempts have been made to limit psychological labelling by providing adequate verbal and written information to children and parents before and after screening.

The optimal age for scoliosis screening is still under debate. School screening has generally been performed between the ages of 10 to 14 years in conjunction with a school health examination. The challenge in screening is to detect clinically significant curves in immature children which have the potential of progression [15].

In our study, we found a scoliosis prevalence of 0.8% among 1117 schoolchildren, which is similar to previously published reports. We carried out this study over a 1-year

period using school-based screening, which helped to identify the trends in scoliosis prevalence in Al-Kharj population.

We used a scoliometer reading of 5° as a cutoff in our screening; however, there are several recommendations that suggest a scoliometer reading of 7°-7.5° as a cutoff point to screen for scoliosis [16]. However, our goal was not to miss even a single case of scoliosis. Therefore, the comparatively higher false-positive rate in our study is justified. Another advantage of this cutoff was that it was very easy and convenient to use and we could screen for children who needed further investigations.

Ohtsuka *et al.* [17] published a study of the prevalence of idiopathic scoliosis in 1.24 million Japanese school children who were screened over a period of 8 years. Using a cutoff Cobb angle of 15° or more, they reported prevalence rates of 1.77 and 0.25% in 13-14-year-old girls and boys, respectively. Another aspect of their study was that they used Moiré topography for screening. However, in our study we found prevalence of 0.8 which was lower than their study. Another point of difference is that we used a scoliometer reading on the forward bending test, not the Moiré topography, for our screening.

In a school-based screening study, Stirling *et al.* [18] reported prevalence rates of 0.4 and 2.2% in 9-11-year-old and 12-14-year-old English girls, respectively; the boys had prevalence rates of 0.1 and 0.3% in the two age groups. Soucacos *et al.* [19] reported a prevalence of 1.7% in a screening of 82,900 9 to 14-year-old Greek schoolchildren during a 1-year prospective study. In a point prevalence survey of 72,699 schoolchildren, Wong *et al.* [20] noted that the prevalence rates were low in 6-7- and 9-10-year-olds but increased rapidly to 1.37

and 2.22% for 11-12- and 13-14-year-old girls, respectively, suggesting increasing prevalence as age increases between the ages of 7 and 14. In their study of age- and sex-specific prevalence among 29,195 children, Morais *et al.* [21] also noted that prevalence rates increase between ages 8 and 15, more markedly so for girls than for boys. Suh *et al.* [22] reported overall prevalence rate of scoliosis in 10-14-year-old schoolchildren (elementary and middle school) with Cobb angles of 10° or more as 3.26% and girls had a higher prevalence (4.65%) than boys (1.97%). However, our findings are different than all of the above because our study showed prevalence rate is 0.8.

Limitations of the Study: One important limitation of this study was that it was not a longitudinal study; therefore, we are not able to comment on the spontaneous resolution or progression of curves or the effects of bracing and percentage of subjects receiving operative treatment. The inter-tester reliability was not tested. This variability in experience could influence evaluation of patient characteristics and the recommended treatment. Cost effectiveness of scoliosis school-based screening for a large population has also been criticized. Additionally, it was not possible to study the psychological impact on patients who were diagnosed with clinically minor scoliosis and their parents. We were unable to evaluate how many children had been diagnosed previously or had been previously treated. In a long-term cross-sectional study, especially in a large population, we believe it would be difficult to identify all such issues and long follow-up in a large study group would be difficult due to several reasons, such as drop-out and loss to follow-up. In our study, we avoided such issues by screening one by one in selected schools and of course, we were careful to screen each child only once.

ACKNOWLEDGMENT

Authors are grateful to the Deanship of Scientific Research, Salman bin Abdulaziz University, Saudi Arabia for financial support to carry out this work. Project No. (1/1433).

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