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Detection of Adolescent Idiopathic Scoliosis among Nepalese Children Through the School Screening Program

Rohit Kumar Pokharel[1], Rajesh Bahadur Lakhey[1], Dinesh Kafle[1], Lakahn Lall Shah[1].

[1]Department of Orthopaedics and Trauma Surgery (Spine Unit), Institute of Medicine, Tribhuvan University Teaching Hospital, Maharajgunj, Kathmandu, Nepal.

ABSTRACT

Introduction: Idiopathic Adolescent Scoliosis (IAS) is the commonest type of scoliosis without any known cause. There has been studies in different countries and population on IAS; and its prevalence rate varies for different population. There has been no reported study done in Nepal on prevalence of adolescent idiopathic scoliosis (AIS). The aim of this study was to detect and evaluate the prevalence of idiopathic adolescent scoliosis in school children in different parts of Nepal.

Methods: This was a descriptive cross sectional study conducted at five schools from different geographical parts of Nepal, from January 2010 to December 2010. Scoliosis screening was done in 5 schools from different geographical locations of Nepal. Children (from grade 6 to 10; age more than 10 years) with positive Adam's forward bending test and scoliometer angle of 5 degrees or more were subjected for radiographic evaluation of the spine. The criterion for the diagnosis of scoliosis was detection of Cobb's angle of more than 10 degrees. Evaluation of scoliosis according to the age, gender, ethnic group, spinal region and magnitude of curve was done.

Results: Out of 1094 children screened, 31 (2.83%) were referred for radiological evaluation; and 12 of them had lateral spinal curvature of more than 10 degrees. Hence the prevalence of scoliosis was 1.09%. The girl to boy ratio of distribution of scoliosis was 3:1 for larger curves of more than 20 degrees. Maximum number of scoliosis cases was seen in girls of 13 years, and the right sided thoracic scoliosis was most common. There is no ethnic predominance of scoliosis.

Conclusion: Prevalence of idiopathic scoliosis among school children who need treatment in Nepal is low; however, school screening program has its epidemiological value.

Keywords: prevalence; idiopathic scoliosis; school screening.

INTRODUCTION

Idiopathic Adolescent Scoliosis (IAS) is the commonest type of scoliosis without any known cause.[1] Lots of work is being done to establish genetic cause of IAS.[2,3,4] The prevalence of scoliosis is approximately 2% to 3% in the 10 to16 year age group.[1] The overall female male ratio for scoliosis is 3.6:1. Mass scoliosis screening in school environment, provides the opportunity to diagnose the condition and make referral for appropriate medical care.[5]

Early detection of the deformity is of paramount importance to prevent further progression of the scoliosis and to reduce number of surgeries for scoliosis.[6,7,8,9] Screening at school for the early detection of scoliosis has been introduced and being practiced in many countries.[10-21,33-40]

Previous studies have both encouraged [7,8,31,33,37,41] and discouraged routine screening. Opponents to scoliosis screening have focused on concerns about a low predictive value of screening, and the cost effectiveness of referral.[23-27] There have also been concerns about the possibility of unnecessary treatment including brace use, and radiation hazard.

Correspondence

Dr. Rohit Kumar Pokharel
Department of Orthopaedics and Trauma Surgery (Spine Unit)Institute of Medicine, Tribhuvan University Teaching Hospital. Maharajgunj, Kathmandu.
Email: pokharel.rohit@gmail.com

In our context, patients do not come to hospitals at the early stages of the disease due to multiple reasons. Painlessness, deformity covered by clothing in teenage, social stigma, lack of knowledge among parents, and availability of the proper health institutions are some of the factors for delayed presentation. In this situation, the significance of the treating physicians going to the susceptible population in search of the disease cannot be exaggerated. There has been no reported study done in Nepal on prevalence of adolescent idiopathic scoliosis (AIS). Report of this study, though the sample size is small, will provide baseline information on prevalence of AIS in Nepal.

METHODS

A prospective epidemiological study was performed to assess the prevalence and distribution of various scoliotic parameters in the school children in five schools located at different geographical location of Nepal. The schools at easily commutable distance from road and with X-ray facility nearby were selected. The study was carried out during January 2010 to December 2010. Schools where the scoliosis screening programs were conducted were shown in Table 1.

Location of the school (district)	Name of the school
Capital city (Kathmandu)	Shivapuri Higher Secondary School, Maharajgunj
Himalayan district (Rasuwa)	Nilkantha Higher Secondary School, Betrabati
Mountainous district (Kavre)	Purna Sanjivani Higher Secondary School, Dhulikhel
Inner Terai district (Udayapur)	Little Flower Higher Secondary School Bokse
Terai district (Saptari)	Shree Shankar Higher Secondary School, Rupnagar

Table 1. Description of schools

The school children studying in grade 6 to 10 (more than 10 years of age) were screened. The management committee of each school was contacted and permission was obtained before and during the screening program. The school and teachers were given a detailed explanation of the importance and methods of screening for scoliosis. Consent was taken from the parents too after informing them about the intentions of the study, the details of the examination procedure, and the clinical importance of early detection.

School screening team visited each school. Boys and girls were examined separately and privacy was maintained during examination. Teachers, especially lady teachers eased the anxiety of the girls. Personal information (date of birth, gender, grade of study, relevant family history) was filled by student themselves. The physical attributes in terms of height, weight and sings of secondary sexual development (age of menarche among girls, voice change and hair distribution in boys) were recorded. Each child then was examined by orthopedic surgeons for any spinal and other deformities. The child was asked to stand in an erect, relaxed position, and any abnormality of the torso or the upper or lower extremities (including lateral deviation of the spine, asymmetry of the waist, shoulders, or scapulae; and limitation of joint motion) was recorded. The forward bending test (of Adam) then was performed. The child was asked to bend forward while allowing the upper extremities to hang freely with the palms opposed in a relaxed manner, and the back was viewed from the back as well as from the side. Scoliometer was used to measure any hump detected during Adams forward bending test.[41,44]

Abnormalities involving the trunk or spine (shoulder asymmetry, scapular prominence, pelvic/hip prominence, space between arm and body, head center over the pelvis, any tell tale sign of spinal disease) were recorded. The children with positive forward bending test and scoliometer angle of 5 degrees or more were sent for the radiographic evaluation at the nearby hospital. Postero-anterior radiographs were made and were assessed immediately. The cases of idiopathic scoliosis were only selected and Cobb's angle was measured.[22] The criterion for diagnosis of scoliosis in our screening was the presence of Cobb's angle of more than 10 degrees.[41]

RESULT

The total of 1094 children from 5 different schools was screened. Out of them 549 were males and 545 were females. The average age of the children screened was 13.35 years; ranging from 10 to 22.5 years.

The total number of children, with positive Adam Forward Bending test and hump of more than 5 degrees was 31. They were sent for radiological evaluation, thus the referral rate was 2.83%. Number of children referred for X-ray was about 4.32% in Saptari, 3.57% in Udayapur, 2.50% in Rasuwa, 1.89% in Kavre and 1.44% in Kathmandu (Table 2).

Table 2. Distribution of lateral curvatures (positive Adam's forward bending test and scoliometer) according to the schools from different districts.

Schools from	Total no. children with deformity N(%)	Normal	Total
Saptari	8 (4.32)	177	185
Udaypur	4 (3.57)	108	112
Kathmandu	7 (2.02)	339	346
Rasuwa	6 (2.50)	234	240
Kavre	6 (2.84)	205	211
Total	31 (2.83)	1063	1094

Antero-posterior and lateral view X-rays were taken. Nineteen of them, 10 girls and 9 boys, had lateral curvature of 0 – 10 degrees with girl boy ratio of 1.14:1. Four of them had no scoliosis. Cobb's angle of greater than 10 degrees was detected in 12 children; 8 with curve of 11-20 and 3 with curve of 21 -30 and one girl had scoliosis curve of 41 degrees. Girl boy ratio was 3:1 and 2:1 for Cobb's angle of 11-20 and 21-30 degrees respectively (Table 3). Overall, the scoliosis was more common among the girls (1.7:1); and larger curve was more common among girls (3:1).

During the screening program 2 cases were found to have scoliosis secondary to limb length discrepancy in one and neurofibromatosis in another case, and are not included in 31 cases.

Table 3. Distribution of Idiopathic Adolescent Scoliosis according to gender and magnitude of the curve.

Magnitude of Curve	No. of children	No. of girls	No. of boys	F : M Ratio
0 - 10	19	10	9	1.11:1
11-20	8	6	2	3:1
21-30	3	2	1	2:1
31 -40	0	0	0	
>41	1	1	0	
Total	31	19	12	

Anatomically, the right sided thoracic curvature was most common type of scoliosis (50%) and rest half was shared by thoraco-lumbar and lumbar scoliosis equally (25% each) (Figure 1).

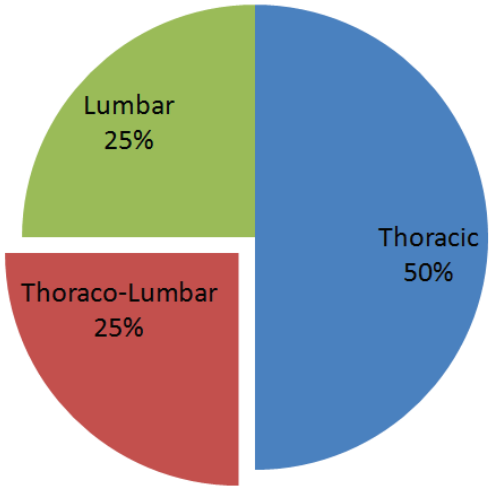


Figure 1. Anatomical Distribution of curve

There were 5 cases of scoliosis in 13 years age group followed by 3 cases in 14 years group, 2 cases in 12 years and one each in 11 and 15 years age groups (Figure 2).

The school screening program for the early detection of spinal deformities was introduced and reported in nineteen seventies[7,10,13,16-19,23,37,39,46] and is now being practiced in different contries.[11,12,14,15,21,32-37,40,41] Routine clinical screening for scoliosis, however, continues to be controversial.[30] American Academy of Orthopaedic Surgeons(AAOS), the Scoliosis Research Society (SRS), the Pediatric Orthopaedic Society of North America (POSNA), and the American Academy of Pediatrics (AAP), representing the primary care

providers for adolescents with idiopathic scoliosis, do not support any formal recommendations against scoliosis screening. The AAOS, SRS, POSNA, and AAP maintain their commitment to avoid the inappropriate use of spine radiographs.[42]

DISCUSSION

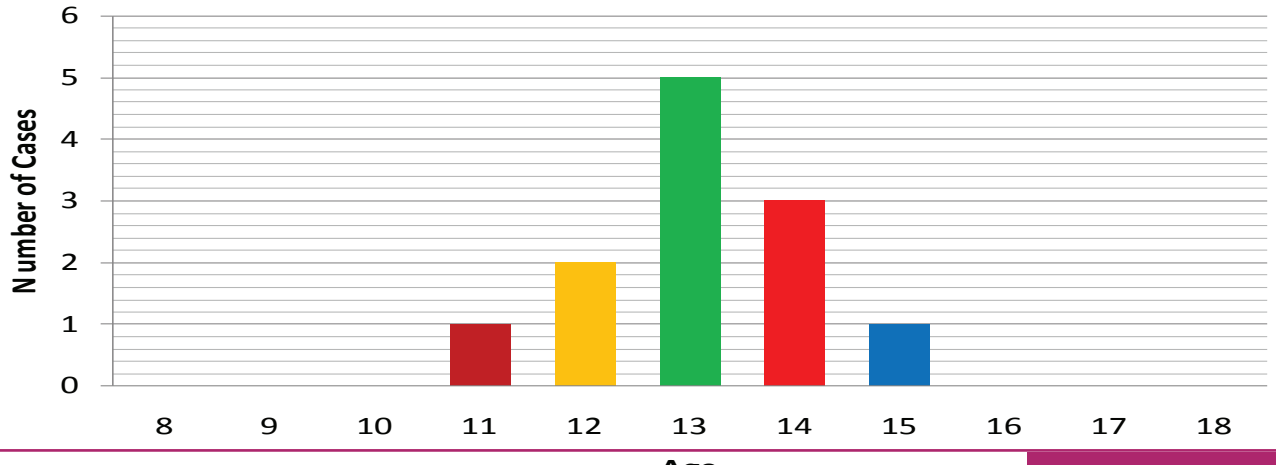
Though Adam's forward bending test has been criticized for its reliability it has been widely used for school clinical detection of spinal deformities.[28] The cut- off point of trunk rotation measured by scoliometer is commented to be optimized before referral for radiological evaluation.[29] The use of proper screening tests thus has been recommended to minimize the referrals for radiographs.[41] We used the Adam's forward bending test and scoliometer (5 degree) to detect deformity in the spine. Thirty one children were referred for radiological evaluation, and the referral rate was 2.83%. This is less than previous reports.[7,14,29] Lower rate of referral may be because the primary screening was done by trained orthopedic residents and final evaluationwas done by spine surgeons, on the spot. In our study, out of 31 cases referred for radiographs 87% had scoliosis. Scoliosis of more than 10 degrees was detected in 44.44% of the cases. Of the 12 cases, 8 (66.66%) had lateral curvature of 11-20 degrees and 3 (25%) has scoliosis of 21-30 degrees and one girl has 41 degrees of right thoracic curve with compensatory lumbar curve. In Bosnia Herzegovina 83.5% of referred cases were detected to have scoliosis with lower threshold of 10 degrees without any serious curvature.[12] In a Turkish study, major curve of >20 degrees was detected in 27.3% of the referred cases[38] which is slightly lower than our study (33.33%).

Over all prevalence of scoliosis, curvature more than 10 degrees, in our study is 1.09% of the children screened which is very close to a study report from Minnesota,[7] Nigeria,[14] Israel,[29] Greece,[32] and Japan.[46] Overall prevalence of scoliosis was much lower in India[20,21] and in Norway.[41] In the Indian report, the study included all sorts of spinal deformity, and paralytic scoliosis was the most common type.[20] In lower Assam of India the incidence was low but the average age of the screened children was 10.6 years[21] which is lower than our children (13.4 years). Prevalence of scoliosis of >10 degrees was reported to be higher, 1.2-2.3% in Rochester Minn city[25] and 2.2% in Portugal.[45] The incidence of idiopathic scoliosis was 13.6% in a report by Brook et al.[31]

School screening programs has been conducted in different parts of world to detect idiopathic scoliosis using different parameters and age group. Generally, positive forward bending test, socliometer of>5degrees, Moe topography were used as basis for referral for radiological evaluation.[28,33,34,35,40] Use of 10 degrees or >10 degrees has given some difference in prevalence rate. However, the prevalence rate is almost similar in most of the studies.

Nepal has great geographic diversity with diverse ethnic groups. To find out any difference in prevalence of AIS according to the ethnic group we conducted the school screening program in five different places. There were no cases of scoliosis in Inner Terai region (Udayapur). In Rasuwa, one of the Himalyan region district, scoliosis was seen in 8.33% of the screened children. Prevalence of scoliosis was same (16.66%) in Saptari and Kavre districts. Saptari (Terai) is usually resided by Indo-Aryan people while Kavre (mountain) is mostly resided by Tibeto-mangoloid peoples. However, there are a big number of mixed societies. Most (33.33%)

Figure 2. Prevalence of scoliosis according to the age.



of the scoliosis cases were detected from Kathmandu, the metropolitan capital city. This shows that AIS has no ethnic predominance. Contradicting to our finding, report from Johanuasberg showed that scoliosis was more common among white students (2.5%) compared to the black students (0.03%).[13] Similarly, a Greek study showed 10% prevalence of scoliosis and higher percentage of scoliosis was noted in fair haired blue eyed children as compared with dark complexioned children.[19] In Singapore, there was a significantly higher prevalence of AIS in Chinese girls as compared with Malay and Indian girls.[36]

AIS is predominantly common among girls and its incidence increases with higher age group. In our series, overall scoliosis was more common among the girls (1.7:1). Girl boy ratio was 3:1 for larger curves. In a report from Italy, overall prevalence of scoliosis had female-to-male ratio of 1.25:1.0, but the ratio varied directly with the severity of the curve; that is, 1:1 for curves of 6 to 10 degrees, and 5.4:1 for curves of more than 20 degrees.[16] In a Swedish study, curves of >10 degrees was detected in 3.2% of girls and 0.5% of boys.[18] Similar report of girls' predominance was reported from Israel,[15] Japan,[33] Korea[35] and Turkey.[38]

Most of the curves detected in the screening was thoracic (50%), followed by thoracolumbar and lumbar scoliosis, 25% each. This is same as seen in studies from Norway,[17] Bosnia Herzegovina,[12] and Korea[35] but differs from that from Greece, where thoracolumbar and lumbar curves were more predominant.[32] Most of the curves in our study were right sided; similar reporting was from a Korean study[35] and Wisconsin County USA.[47] There is a different report from Greece,[32] where left curves were greater in number.

Most of the cases detected, with curve of <30 degrees, did not need active orthopedic treatment. One case with 41 degree curvature was advised for brace treatment since her age was 15 years; menarche started 4 years back and has Risser's sign of stage IV. This may not justify the cost effectiveness of the screening program but value of school screening program as an epidemiological study cannot be overlooked. As recommended Grivas TB et al.[43] we also support that school screening programs should be continued not only for early detection of IS or for health care purposes, but also as a basis for epidemiological surveys until we learn much more about the aetiology of AIS.

However this was a study with small sample size for a prevalence study, thus more extensive large scale study is recommended in future.

CONCLUSION

Prevalence of AIS in Nepal is almost same as reported in many places of the world. Despite of controversies, school screening program should be continued not only for early detection of the deformity but also for an epidemiological study of a spine disease among children. Properly trained orthopedic resident and spine surgeon in the screening team might clinically detect true cases of scoliosis and reduce the number of referral.

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