Epidemiological patterns of scoliosis in a spinal center in Saudi Arabia

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ABSTRACT

Objectives: To study the patterns of scoliosis seen in a major Spinal Unit in Saudi Arabia.

Methods: Medical records of 192 Saudi patients with scoliosis seen between 1992 and 1997 at the Spinal Unit of the Riyadh Medical Complex (which is a major spinal unit in the Kingdom) were studied and analyzed and epidemiological data was collected.

Results: Fifty nine percent of all cases of scoliosis were idiopathic, 7% were secondary to poliomyelitis and 17% were congenital scoliosis. The mean age of discovery of idiopathic scoliosis was 12.5 years and at presentation was 16 years. The mean Cobb's angle at presentation was 58°. Adolescent type constituted 74% of idiopathic curves with a male to female ratio of 1:3.8. Thoracic curves were the most common followed by the double major curves. Half of the curves were right sided. Infantile idiopathic scoliosis constituted 8% with male to female ratio of 4:1 and here left thoracic curves formed 50%. The juvenile type constituted the remaining 18% with male to female ratio of 1:1.5.

Conclusion: The pattern of scoliosis in our study is comparable in many aspects with other studies carried out elsewhere, with the exception of delay in patients age at referral. We believe that our data could reflect a possible pattern of the epidemiology of scoliosis in Saudi Arabia, given the fact that there is no National Registry. To avoid delay in management, community education will help in the early detection of cases.

Keywords: Epidemiology, scoliosis.

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Scoliosis is derived from the Greek word meaning curvature. When used in medical literature, it signifies a lateral curvature of the spine.[1] In the 10th century, Albucasis (Abu Al Qasim 936-1013) made the distinction between different posterior, anterior deformities and lateral curvatures.[2] Scoliosis is classified, based on the etiology, into different types.[1] Idiopathic, congenital and neuromuscular scoliosis are the common types. Other etiologies include neurofibromatosis, trauma, infection, tumor and nonstructural scoliosis.[3] Idiopathic scoliosis is defined as lateral curvature of the spine of unknown origin.[7] It is the most common type of scoliosis.[1-3] The reported prevalence of idiopathic scoliosis in the general population is influenced by the study method employed and the minimum Cobb's angle used to define true scoliosis.[4] When a Cobb's angle of 10° is used as the minimum angulation to define scoliosis, the prevalence is 2 to 3% in most of the studies. It drops to 0.3% for curves greater than 20°.[4] Idiopathic scoliosis is classified according to the patient's age at onset. Infantile idiopathic scoliosis (onset is under 3 years of age), juvenile (from 3 to 10 years of age), and adolescent and adult (above 10 years of age).[5] Congenital scoliosis is caused by one of 2 types of structural bony abnormality, Type I congenital scoliosis is caused by failure of formation (e.g. hemivertebrae). Type II is failure of segmentation

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(e.g. unsegmented bar), a combination of the two types is possible.[5,6] Neuromuscular scoliosis is scoliosis associated with a neuromuscular condition including cerebral palsy, poliomyelitis, myelomeningocele, etc.

Studying patterns of scoliosis epidemiology can be accomplished by different methods. School screening programs is a method which has been adopted by many countries.[7] In the United Kingdom (UK), school screening has been abandoned due to lack of precision, generating many false positive cases, and raising skeptical questions concerning radiation dosage, and cost or benefit of each screening program.[8] There has been no previous study on epidemiology of scoliosis in Saudi Arabia apart from 2 school screening programs for scoliosis in Jeddah and Riyadh.[9,10] The purpose of the present study is to determine the epidemiological patterns of scoliosis in a major spinal referral center in Saudi Arabia.

Methods. We retrospectively analyzed the data on all of the cases of scoliosis seen in the spinal unit in the Riyadh Medical Complex between 1992 and 1997. Two hundred and fifty patients diagnosed to have scoliosis were seen, 58 patients were not Saudis and were excluded from the study. From the records of these patients, we determined the age at the presentation to the spinal clinic, and the age when the scoliosis was first noticed. Information on the sex of the patient, the area of Saudi Arabia the patient came from and the person who discovered the deformity all was collected and analyzed. The deformity was studied regarding the part of the spine involved (thoracic, thoracolumbar, lumbar or double major curves) and the side of the deformity. The cause of the scoliosis was determined. The causes were classified into 4 categories; idiopathic, congenital, neuromuscular and others (e.g. neurofibromatosis, trauma). Idiopathic scoliosis was subdivided into infantile, juvenile and adolescent according to the age at discovery. All the patients included in this study underwent standing thoraco-lumbosacral spine x-ray, posteroanterior and lateral views as well as the supine lateral bending films. On these x-rays, the type, apex, Cobb's angle and side of the curvature was noted.

Table 2 - Who noticed scoliosis.

Scoliosis was discovered by:	Percentage
Medical Staff	39%
Mothers	37%
Fathers	19%
Brothers	3%
Sisters	2%

Results. There were 123 female patients (64%) and 69 male patients (36%). The etiologies, number of patients and the percentage are shown in Table 1. There were 21 patients (11%) who presented with neuromuscular scoliosis, 14 patients (7%) had poliomyelitis at early childhood, 4 patients (2%) had cerebral palsy, 1 patient (0.5%) had muscular dystrophy and 2 patients (1%) had myelomeningocele. Twenty five (13%) patients presented with scoliosis associated with etiologies other than the above common causes, 7 of them (3.5%) had neurofibromatosis, 5 had history of trauma to their spine without neurological deficit, 5 patients had associated connective tissue syndromes (2.5%), 7 patients were found to have nonstructural scoliosis, and one patient had destructive lesion of L3. Of the connective tissue syndromes 2 were Marfan's syndrome, 1 Ehlers-Danlos syndrome and 2 osteochondrodystrophy. It was found that, most of the patients were discovered to have scoliosis by medical staff (39%) and mothers (37%) (Table 2). About 55% of the patients were referred from outside the Riyadh area (the central province) (Table 3).

Table 4 summarizes the mean age at discovery, the mean age at presentation and the mean Cobb's angle at presentation of the 3 main etiological types. With idiopathic scoliosis, there were 34 males (30%) and 79 females (70%). The mean age at discovery was

Table 1 - Percentages of the 4 etiologies of scoliosis.

The etiology of scoliosis	Number of patients	The percentage
Idiopathic scoliosis	113	59%
Congenital scoliosis	33	17%
Neuromuscular Scoliosis	21	11%
Others	25	13%

Table 3 - Referred Area.

The area, patients referred from	Percentage
Middle Province	44%
Southern Province	25%
Northern Province	15%
Eastern Province	29%
Western Province	7%

Table 4 - Cobb's angle and presentation age of the main types of scoliosis.

Type	Number	Mean age at presentation	Mean age at discovery	Mean Cobb's Angle at presentation
Total	192	15.2	11.4	58.6
Idiopathic	113	16.0	12.5	58.0
Congenital	33	8.8	4.8	38.8
Neuromuscular	21	18.6	16.8	96.0

12.5 years, while the mean age at presentation was 16 years. The mean Cobb's angle at presentation for idiopathic curvature was 58°. Thoracic curves constituted (46%), followed by the double major curves (36%), thoracolumbar curves (11%) and lumbar curves (5%). Right sided curves formed 49%, left sided, 14% and both sides, as in double major curves, 37%. Only 9% of patients with idiopathic scoliosis had received previous treatment for the scoliosis. Table 5 shows the distribution of idiopathic scoliosis according to age, sex, side and location. There were 15 males (45%) and 18 females (55%) diagnosed to have congenital scoliosis, with a male to female ratio of 1:1.2. The mean age at presentation was 8.8 years. The mean age at discovery was 4.8 years. Fifty four percent of the congenital curves involved the thoracic vertebrae, 23% thoracolumbar and 23% lumbar curves. There were 52% left sided curves, 37% right sided and the rest were combined right and left side involvement. The average magnitude of the curves at presentation was 38.8°. Of these patients, 36% had associated congenital anomalies, Table 6.

Fourteen patients had scoliosis secondary to poliomyelitis. They presented at a mean age of 18 years and the male to female ratio was 1:1. Twelve of these patients had thoracolumbar curve and 2 patients had thoracic curves. The magnitude at presentation was 107°. Only 4 had received previous treatment. The magnitude at presentation of the neuromuscular scoliosis was 96°.

Discussion. The objective of this study was to identify some of the epidemiological patterns of scoliosis in one of the largest spinal units in Saudi Arabia. Most of these patients were referred from peripheral remote areas. All of them were examined clinically and radiologically by a spinal surgeon. There was a delay of 3.5 years from the time of discovering the idiopathic curve to the time of presentation to the spinal unit despite only 9% of these patients receiving previous specific treatment for scoliosis. So the delay in presentation can be explained by family negligence or by the existing inefficient medical care.

Most of the Cobb's angles in these patients came within the surgical range (>40%). The average curve magnitude at sporadic presentation can be as high as 50°.[8] As high as 39% of these patients were discovered by medical staff, which reflects the lack of family awareness about back deformity, or being in a conservative community, the girls here are covered and do not participate in sports, so noticing a back deformity by any family member or friends is unlikely. Similar results were reported by Belstead et al.[11] With the exception that only 16.5% were discovered by medical staff. Which may be because of different cultures.

Table 5 - Age, sex and location distribution of idiopathic scoliosis.

Type of idiopathic scoliosis	Percentage	Male:Female Ratio	Angle at presentation	Location	Side
Infantile (0 - 3) years	8%	4:1	85	Thoracic curve 50% Thoracolumbar curve 33% Double major curve 17%	Right side 33% Left side 50% Double Curve 17%
Juvenile (>3 - 10)	18%	1:1.5	66	Thoracic curve 53% Thoracolumbar curve 15% Lumbar curve 6% Double major curve 26%	Right side 65% Left side 10% Double curve 25%
Adolescent and Adult > 10 years	74%	1:3.8	53	Thoracic curve 44% Thoracolumbar curve 8.5% Lumbar curve 7.5% Double major curve 39.5%	Right side 46% Left side 13% Double curve 40%

Table 6 - Associated congenital anomalies.

Associated Anomaly	Number of patients
Chest deformities and delayed milestones	2
Spondylolisthesis and spina bifida	1
Bilateral club feet	1
Klipple Feil syndrome	3
Cleft palate, atrophy right ear, fascial asymmetry	1
Abscent thumbs	1
Rectovaginal fistula	1
Multiple congenital anomalies	2

The relative frequency of the different types of idiopathic scoliosis shown in our study were 8% infantile, 18% juvenile and 74% adolescent curves. In Europe, different studies showed the frequency of the infantile type to be more common than that reported in the United States.[12] In the study of 157 children with idiopathic scoliosis seen in Edinburgh between 1968 and 1971, 41% had infantile, 7% juvenile and 52% had adolescent curves.[13] However, this frequency was changed in that clinic when 153 children were seen between 1980 to 1983; 4% had infantile, 7% juvenile, and 89% had adolescent curves.[14] The proportion of children with idiopathic juvenile scoliosis in our study was 18% which is well within the range of 12-21% reported in other studies.[15] The majority of patients having infantile curves were males (75%), 50% of these curves were left sided thoracic, although these results do not match exactly with other studies,[15] but they show the same prevalence of male and left side affection.

We found that most of the juvenile curves were thoracic 53% followed by double major curves 26%, thoracolumbar curves 16% and lumbar curves 5% and the majority of the curves were right-sided. These findings are almost similar to a study carried out by Figuerido and James who reported 98 children with juvenile idiopathic scoliosis seen between 1951 and 1979 at the Princess Margaret Rose Hospital in Edinburgh, single thoracic curves were most common (62%); the great majority were right-sided. A double curve pattern was found in 22% and single thoracolumbar curves in 15%.[16]

Adolescent idiopathic scoliosis accounts for 74% in our study with a female predominance of 3.8:1 similar to some of the studies which showed 80% adolescent curve proportion, and 3.6:1 female to male ratio.[17,18] In a literature review, the most common curve patterns in adolescent idiopathic scoliosis are the single right thoracic, followed by the double major curves. Our findings are consistent with these patterns.[12-19] Poliomyelitis is now a rare cause of scoliosis in Europe and the United States. In our study, it was found that 7% of scoliosis patients were secondary to poliomyelitis; being the most common cause of neuromuscular scoliosis. Fortunately, the mean age at presentation was 18 years, which means that poliomyelitis is regressing due to the development of the vaccination. The scoliotic curves associated with poliomyelitis tends to be severe.[20] In our study the average magnitude was 107° at presentation.

In conclusion, except for poliomyelitis, the epidemiological patterns we found are similar to those in Europe and the United States. Delayed presentations may be reduced by family education and awareness of back deformities and improvement in medical care, which in turn will help in early detection and better outcome of scoliosis management.

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