Original Article

Epidemiological and Diagnostic Characteristics of Scoliosis in Children in a Single Tertiary Centre in Abidjan

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Abstract

Introduction: Scoliosis is the most frequent spine deformity in children. Epidemiological data are available in Western countries due to the systematic screening policies implemented at school. Unfortunately, in our country, there are neither national data nor screening policy for scoliosis. Are the epidemiological and diagnostic characteristics of scoliosis in our practice similar to the data in the literature? **Patients and Methods:** We retrospectively reviewed 106 medical records of patients under 19 years old between 2010 and 2019 at the 'Vivre Debout' Centre for structural scoliosis confirmed by spine X-ray with a Cobb angle ≥10°. The epidemiological and diagnostic characteristics were noted. The data were treated with Excel 2010. **Results:** The mean frequency of scoliosis was 10 cases/year. The male-to-female sex ratio was 1:1.3. The mean age at diagnosis was 11.2 ± 2.13 years. There was a family history of scoliosis in two cases (1.8%). Twenty-four girls (39.3%) out of 61 had had menarche at the time of diagnosis. The mean time from noticing deformity to consultation was 17.9 ± 21.9 months. Lateral deviation of the spine (n = 77; 72.6%), hump (n = 12; 11.3%) and pain (n = 3; 2.8%) were the main complaints for consultation. In 14 cases (13.2%), the discovery was fortuitous during a medical examination for another complaint. The curvature was single in 88 cases (83%) and double in 18 (17%). The convexity was right in 69 cases (65.1%) and left in 37 (34.9%). Curvatures were thoracic (n = 57; 53.8%), lumbar (n = 10; 9.4%) and thoracolumbar (n = 39; 36.8%). The average Cobb angle was 35.2° ±10.71° (range: 11°–90°). Curvatures were moderate (20°–40°) in 49 cases (46.2) and severe (>40°) in 18 (17%). The aetiologies were predominated by idiopathic causes (n = 79; 74.5%), followed by congenital (n = 16; 15.1%) and neuromuscular (n = 11; 10.4%) causes. **Conclusion:** Scoliosis is uncommon in our practice. It is characterised by single curvature. The predominance of moderate and severe curvatures was due to delayed consultation.

Keywords: Child, cobb angle, hump, scoliosis

Introduction

For true structural and three-dimensional deformities of the spine, scoliosis is the most frequent deformity of the spine in children. They associate a lateral deviation of the spine with a curvature angle or Cobb angle ≥10°, and vertebral rotation.[1-3] Their prevalence varies between 2% and 3% in the general population.[1,4-11] They more frequently affect adolescent girls.[12,13] Aetiologies vary and are dominated by idiopathic causes in 75%–80% of cases.[3,4] According to several authors,[14-16] the prevalence of scoliosis varies by country, race and ethnicity. Kebaish *et al*. noted a prevalence of 11.1% amongst whites and 6.5% amongst African Americans.[15] In China, the prevalence of idiopathic scoliosis (IS) was 2.5%.[14] In sub-Saharan Africa, this IS prevalence varies between 2.3% and 55% in the school population.[10,13,17,18] The scoliosis screening must be early. It helps to identify forms with high risk of progression and contribute to early treatment. For this reason, many countries have introduced school screening in their health policy. The diagnostic delay leads to severe forms which surgical management is cumbersome, expensive with risk of complications. In our country, there is no school screening policy. Commonly called 'Bosse' in our regions, the populations give scoliosis a mystical-religious character, which contributes to delaying treatment.[19] Series

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in sub-Saharan Africa were based on school screening and reported institutional prevalence.[10,13,17,18] This allowed them to know the characteristics of adolescent IS. On the other hand, there are poor data on scoliosis in Côte d'Ivoire. Given the lack of screening policy in our environment, are the characteristics of scoliosis in our practice similar to the data in the literature?

Patients and Methods

This retrospective study was conducted at the 'Vivre Debout' Centre in Yopougon University Hospital. Created in 2000 with the support of NGO Handicap International Belgique, the 'Vivre Debout' Centre is located within the Yopougon Teaching Hospital. It specialises in the making of orthopaedic devices.

The study included all records of patients under the age of 19 years treated between 2010 and 2019 for structural scoliosis confirmed on whole-spine radiography with a Cobb angle ≥10°. Incomplete records, and records of patients with functional scoliosis, were not included. The studied variables were epidemiological (gender, age at diagnosis, school status and family history of scoliosis) and diagnostic (delay from noticing deformity to the consultation, number of curvatures, convexity, site of the curvature, Cobb angle and aetiologies). Congenital scoliosis refers to a spinal deformity caused by vertebrae that are not properly formed.

Data were entered using Excel 2010 software. Quantitative variables were presented as mean ± standard deviation (range).

Results

Out of 154 case files, 106 (68.8%) were obtained. The mean annual frequency of scoliosis was 10 cases. The male-to-female ratio was 1:1.3. The mean age at diagnosis was 11.2 ± 2.13 years (range: 0.8–18 years). Congenital cases were diagnosed at a mean age of 3.25 ± 2.16 years. Eighty-three patients (78.3%) were schoolchildren. Twenty-four (39.3%) out of 61 girls had had menarche at the time of diagnosis. Nine patients (8.5%) had lower-limb length inequality (≤3 cm) and two had equinus varus clubfoot (1.8%). A family history of scoliosis was found in two patients (1.8%) and a history of omphalocele treatment has been reported for one case (0.9%). The mean time from noticing deformity to the consultation was 17.9 ± 21.98 months. Lateral deviation of the spine (n = 77; 72.6%), gibbosity or 'hump' (n = 12; 11.3%) and pain (n = 3; 2.8%) were the main complaints for consultation. In 14 cases (13.2%), the discovery was fortuitous during a medical examination for another complaint. The curvature was unique in 88 cases (83%) and double in 18 cases (17%). The curvature was right in 69 cases (65.1%) and left in 37 cases (34.9%). The diagnostic characteristics are summarised in Table 1. The mean Cobb angle was 35.2° ±10.71° (range: 11°–90°). Curvatures were mild (10°–20°) in 39 cases (36.8%), moderate (20°–40°) in 49 (46.2) and severe (>40°) in 18 (17%). Scoliosis was of idiopathic (n = 79; 74.5%), congenital (n = 16; 15.1%) and neuromuscular (n = 11; 10.4%) origin. The aetiologies are summarised in Table 2.

Table 1: Clinical characteristics according to the aetiologies of scoliosis

	Number of cases, *n* (%)	Idiopathic scoliosis (*n*=79), *n* (%)	Congenital scoliosis (*n*=16), *n* (%)	Neuromuscular scoliosis (*n*=11), *n* (%)
Gender				
Male	45 (42.4)	36 (33.9)	5 (5.2)	4 (3.7)
Female	61 (57.6)	43 (40.5)	11 (10.4)	7 (6.6)
Average age at diagnosis (years)	11.2±2.13	13.9±3.30	3.2±2.16	13.6±0.94
Number of curvature				
Single	88 (83)	68 (64.1)	12 (11.3)	8 (7.6)
Double	18 (17)	11 (10.4)	4 (3.7)	3 (2.8)
Thoracic and thoracolumbar	11 (10.4)	7 (6.6)	1 (0.9)	3 (2.8)
Thoracic and lumbar	7 (6.6)	4 (3.7)	3 (2.8)	0
Curvature				
Right	69 (65.1)	55 (51.8)	10 (9.4)	4 (3.7)
Left	37 (34.9)	24 (22.6)	6 (5.6)	7 (6.6)
Curvature topography				
Thoracic	57 (53.8)	50 (47.1)	4 (3.7)	3 (2.8)
Thoracolumbar	39 (36.8)	20 (18.8)	11 (10.4)	8 (7.6)
Lumbar	10 (9.4)	9 (8.2)	1 (0.9)	0
Average Cobb angle (°)	35.2±10.71	22.7±15.2	29.6±8.3	53.3±4.18
Cobb angle (°)				
10-20	39 (36.8)	32 (30.2)	7 (6.6)	0
21-40	49 (46.2)	42 (39.6)	6 (5.6)	1 (0.9)
41-60	13 (12.3)	4 (3.7)	1 (0.9)	8 (7.6)
>60	5 (4.7)	1 (0.9)	2 (1.9)	2 (1.9)

Table 2: Aetiologies of scoliosis

Aetiologies	Effective
Idiopathic scoliosis (years)	79
Infantile (0-3)	7
Juvenile (4-9)	13
Adolescent (10-19)	59
Congenital scoliosis	16
Isolated hemi-vertebrae	7
Vertebral block	3
Interpedicular bar	2
Hemi-vertebrae + vertebral block	2
Vertebral bars + hemi-vertebrae	2
Neuromuscular scoliosis	11
Cerebral palsy	6
Infantile spinal atrophy	1
Neurofibromatosis	1
Marfan syndrome	1
Arthrogryposis	2

Discussion

The objective of this study was to describe the epidemiological and diagnostic features of scoliosis in children in our context. This study has limitations due to its retrospective nature. It is monocentric with a very limited sample size. Some anthropometric data (weight, height and body mass index), stage of pubertal development (tanner scale) and the stage of bone maturation (Risser stage and bone age) were not defined in most records. The investigation of genetic and intraspinal abnormalities was limited by technical and economic constraints. Our results should not be generalised.

However, the epidemiological and diagnostic data observed in this study can be superposed on the data in the literature.

In sub-Saharan Africa, few studies[10,13,17-20] have concerned scoliosis. In our country, in the absence of screening and a national database, we believe that this relative hospital frequency is underestimated. School screening policies began in the 1960s in the USA.[10,14,21] Later, some countries such as Japan, Hong Kong or South Africa made it compulsory in their school health policy,[5,14,22] which enabled them to know the prevalence of IS but also analyse the cost related to screening.[1] However, the different prevalence reported in the literature must be interpreted with caution because the definition of scoliosis and the study populations are not uniform.[14,16,23] For example, in a study from Australia, scoliosis was defined by a Cobb angle ≥5°.[14]

The prevalence of IS varies by country: 2.3% in Turkey,[1] 22% in Brazil[24] and 0.16%–0.5% in Saudi Arabia.[31] In sub-Saharan Africa, this prevalence was 5.3% in Nigeria,[10] 3.3% in Ghana,[13] 39% in Rwanda[17] and 8.3% in South Africa.[18] The predominance of adolescents IS is common to all series. A study conducted in a district of Mainland China in 2000 reported that the incidence of scoliosis amongst Chinese adolescents was 0.75% to 2.4%.[22] This prevalence was 0.87% and 1%–3% in Tokyo (Japan)[21] and the USA,[2,14] respectively.

The mean age and female predominance observed in this series were similar to the data of several authors.[6,16,24-26] The cause of the difference between the two sexes is unknown. For Fadzan and Bettany-Saltikov, these can be due to the spine architecture of girls where spines are thinner with narrower vertebral bodies than boys.[9] Kruse *et al*.[27] explained this by a difference in genetic load or 'Carter effect' between males and females. Thus, the male sex would require a greater genetic load to contract scoliosis. In contrast, Adegoke *et al*.[10] in Nigeria and Van Rensberg[18] in South Africa reported a male predominance of 1.5:1 and 1.1:1, respectively.

In the series by Serbescu *et al*.[28] in Romania and Zurita Ortega *et al*.[29] in Mexico, the mean age at diagnosis was lower: 9.8 years and 8.5 years, respectively. Their study populations only included children between the ages of 7 and 12 years.

In the present series, two patients had a family history of scoliosis. The rate of girls having had their menarche is similar to that of Yilmaz *et al*.[1] findings (37.3%) in Turkey but much lower than that (78.8%) of Théroux *et al*.[26] in Quebec.

The lateral deviation of the spine was the main reason for consultation. Patients consulted an average of 18 months after the onset of signs. This delay in consultation also reported in Nepal by Pokharel *et al*.[6] is multifactorial: (a) the finding is difficult in children or adolescents constantly dressed, especially when the scoliosis is balanced or has a slight or moderate curvature; (b) parents think that the broken back of their children is voluntary and synonymous with playing smart; (c) the remoteness of health centres from specialised structures and (d) and the initial use of traditional healers and prayer houses because of the mystical-religious attributed to scoliosis by our populations. Tiaho *et al*.,[19] in their study done in Côte d'Ivoire, noted that 39.4% of patients had used traditional healers before the first consultation.

In our series, the scoliosis was of right convexity in more than two-thirds of the cases whatever the topography. This result is similar to the findings of several authors.[3,6,8,14,30] For Konieczny *et al*.[30] in Germany, the pre-existing rotation pattern in the spine varies with age. This rotation occurs on the right side from adolescence onwards, which is consistent with the predominant age group in our series. Conversely, Yilmaz *et al*.[1] in Turkey found a predominance of the left side in 60.1% of cases.

Single and thoracic curvatures predominated in this series, which is consistent with data from several other authors.[1,3,10,14,26,28] Lumbar scoliosis predominated in Yilmaz *et al*. series.[1] On the other hand, Theroux *et al*.[28] had noted a predominance of thoracolumbar forms.

In the present series, two out of three patients had moderate or severe curvature, which is certainly related to the diagnostic delay. This contrasts with the predominance of mild forms (<20°) reported in the series by Yilmaz *et al*.[1] and Du *et al*.[14] after school screening.

Scoliosis can be seen at any age, with aetiologies varying according to age groups and series. The predominance of idiopathic causes found in our series is consistent with the data in the literature.[2,4,9,31] The distribution of aetiologies found in our series is consistent with that observed in Arab countries according to Tsirikos *et al*.:[4] idiopathic (59%), congenital (17%), neuromuscular (11%) and unclassifiable (13%) causes.

The congenital causes represent 10% of scoliotic deformities according to Mackel *et al*.[32] Their prevalence is 1 per 1000–2000 live births, and the risk of occurrence is linked to environmental or genetic factors according to several authors.[32-34] According to Mackel *et al*., more than half of these congenital forms are diagnosed after the age of 3 years and a quarter in the 1st year of life, which agrees with our data.[32] They are dominated by the hemi-vertebrae such as in the series of Zhang *et al*. (46%).[35] These vertebral abnormalities can be diagnosed by antenatal ultrasound from the 12th week of gestation or by magnetic resonance imaging.[36] According to several authors,[33,37,38] these congenital scoliosis are associated in 15%–43% of cases with intraspinal abnormalities that we have not looked for.

The aetiologies of neuromuscular scoliosis are dominated by cerebral palsy (CP). This CP is mainly due to cerebral damage from hypoxia.[39,40] In our context, the poor monitoring of pregnancies, home deliveries and the under-equipment of our first-level health centres could explain the perinatal cerebral suffering. This neuromuscular scoliosis had the most severe curvatures. This could be explained by muscle collapse or weakness of the axial musculature, the trunk muscle hypertonia or the disharmonious control of trunk musculature around the spinal axis.[41,42] Considering this neuromuscular scoliosis, the predominance of thoracolumbar curvature observed in our study is similar to that of Manzone *et al*.[39] Apart from CP, the rarity of other aetiologies is consistent with the data in the literature. In our practice, genetic and neuromuscular abnormalities are clearly underdiagnosed due to the technical platform and the high cost of laboratory examinations. Indeed, all samples are sent and analysed outside the country which creates an additional cost for parents who are often desperate, without medical insurance.

In general, spinal deformities lead to psychological, cosmetic and therapeutic problems and above all affect the quality of life of these scoliotic children and their families.[43,44] These children are marginalised in our community. This has an impact on school results, absenteeism and sometimes school dropouts.

Conclusion

With an annual hospital frequency of ten cases, scoliosis is infrequent in our practice. They mainly affect girls, and adolescent IS is the most common form. They are characterised by late consultation (18 months). Single curvature was the most observed. Moderate and severe curvatures accounted for two-thirds of the cases observed in our hospital. A more detailed prospective and cross-sectional study including anthropometric data, bone maturation and pubertal development was needed to properly define epidemiological data.

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Conflicts of interest

There are no conflicts of interest.

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