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QUEUE PROFILE FOR PEDIATRIC SCOLIOSIS SURGERY IN A REFERENCE HOSPITAL IN THE BRAZIL'S MIDWEST

PERFIL DA FILA PARA CIRURGIA DE ESCOLIOSE PEDIÁTRICA EM HOSPITAL REFERÊNCIA DO CENTRO OESTE

PERFIL DE LA FILA PARA CIRUGÍA DE ESCOLIOSIS PEDIÁTRICA EN HOSPITAL DE REFERENCIA EN EL CENTRO OESTE DE BRASIL

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ABSTRACT

Objective: To describe the epidemiological profile of the list of patients with pediatric scoliosis (0 to 18 years old) treated at a tertiary public hospital in the Midwest Region. Methods: A cross-sectional analytical study of patients with scoliosis from the orthopedic service of a reference center was carried out, and data collected on age, sex, date of menarche, weight, height, etiology, curve classification, form of referral, treatment performed before and after care and waiting time for surgery after indication. The sample consisted of 60 patients randomly selected among those treated. Results: 60 patients were evaluated, 44 (73.3%) were female, and 16 (26.7%) were male, with a mean age of 13.4 years. Until the moment of the study, six patients underwent surgery after being treated at the reference center. Idiopathic scoliosis was the most frequent in 38 (63%) patients. No conduct had been performed in 47 (78.3%) patients before referral to the reference center. Aftercare at the reference center, surgical treatment was indicated in 44 (73.3%) patients. The mean waiting time for surgery after the indication was 22 months, ranging from 6 to 40 months. Conclusions: The list of patients with pediatric scoliosis treated at the reference center in the Midwest region is composed of young girls with idiopathic scoliosis who, for the most part, did not have the indication of using a brace before being referred to the reference center, and most of them had an indication for surgery for adequate treatment. ***Level of Evidence IV; Descriptive Study.***

Keywords: Spine; Elective Surgical Procedures; Scoliosis; Patient Outcome Assessment.

RESUMO

Objetivo: Descrever o perfil epidemiológico da lista de pacientes com escoliose pediátrica (0 a 18 anos) atendidos em hospital público terciário da Região Centro-Oeste. Métodos: Foi realizado estudo analítico transversal de pacientes com escoliose do serviço de ortopedia do centro de referência e coletados dados de idade, sexo, data da menarca, peso, altura, etiologia, classificação da curva, forma de encaminhamento, tratamento realizado antes e após o atendimento e tempo de espera para cirurgia após indicação. A amostra foi composta por 60 pacientes selecionados randomicamente. Resultados: Dos 60 pacientes avaliados, 44 (73,3%) eram do sexo feminino e 16 (26,7%) do sexo masculino, com idade média de 13,4 anos. Até o momento do estudo, seis pacientes foram submetidos a cirurgia após o atendimento no centro de referência. A escoliose idiopática foi a mais frequente em 38 (63%) pacientes. Nenhuma conduta havia sido realizada em 47 (78,3%) pacientes antes do encaminhamento ao centro de referência. Após o atendimento no centro de referência, o tratamento cirúrgico foi indicado em 44 (73,3%) pacientes. O tempo médio de espera pela cirurgia após a indicação foi de 22 meses, variando de 6 a 40 meses. Conclusões: A lista de pacientes com escoliose pediátrica atendidos no único centro de referência da região Centro-oeste é composta por meninas jovens, com escoliose idiopática, que em grande parte não tiveram a indicação do uso de colete antes do encaminhamento ao centro de referência, e tiveram em sua maioria indicação de cirurgia para tratamento adequado. ***Nível de Evidência IV; Estudo Descritivo.***

Descritores: *Coluna Vertebral; Procedimentos Cirúrgicos Eletivos; Escoliose; Avaliação de Resultados da Assistência ao Paciente.*

RESUMEN

Objetivo: Describir el perfil epidemiológico de pacientes con escoliosis pediátrica (0 a 18 años) atendidos en un hospital público terciario de la Región Centro Oeste. Métodos: Se realizó un estudio analítico transversal de pacientes con escoliosis del servicio de ortopedia del centro de referencia y se recogieron datos sobre edad, sexo, fecha de la menarquia, peso, talla, etiología, clasificación de la curva, forma de derivación, tratamiento realizado antes y después de la atención y el tiempo de espera para la cirugía después de la indicación. La muestra estuvo constituida por 60 pacientes seleccionados aleatoriamente. Resultados: De los 60 pacientes, 44 (73,3%) eran mujeres y 16 (26,7%) hombres, con edad media de 13,4 años. Hasta el momento del estudio, seis pacientes fueron intervenidos quirúrgicamente. La escoliosis idiopática fue la más frecuente, en 38 (63%) pacientes. En 47 (78,3%) pacientes no se había realizado ninguna conducta

Study conducted by the Spinal Surgery Department of the Centro Estadual de Reabilitação e Readaptação Dr. Henrique Santillo (CRER), Goiás, GO, Brazil.
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antes de la derivación al centro de referencia. Tras la atención en el centro de referencia, se indicó tratamiento quirúrgico en 44 (73,3%) pacientes. El tiempo medio de espera de la cirugía fue de 22 meses, con un rango de 6 a 40 meses. Conclusiones: La lista de pacientes con escoliosis pediátrica atendidos en el único centro de referencia de la región Centro Oeste está compuesta por niñas jóvenes, quienes en su mayor parte no tenían indicación de uso de ortesis, y la mayoría tenía indicación de cirugía para un adecuado tratamiento. ***Nivel de evidencia IV; Estudio Descriptivo****.*

Descriptores: *Columna Vertebral; Procedimientos Quirúrgicos Electivos; Escoliosis; Evaluación del Resultado de la Atención al Paciente.*

INTRODUCTION

Scoliosis is a three-dimensional spine deformity with different types, classifications, and etiologies, which directly impact the disease's onset, prognosis, and treatment. Still, the pathological consequences are similar and can include respiratory impairment, gait impairment, pelvic imbalance, pain, and difficulty in performing daily activities, resulting in physical and emotional morbidity.[1]

The complexity of the surgery, the need for expensive implants, neurophysiological monitoring, and the high medical and hospital costs result in waiting lists in countries with public health systems. In places like Canada, the United Kingdom, and New Zealand, the average waiting time for surgery ranges from 2.5 weeks to 2.9 years.[2] In Brazil, a study carried out at a quaternary center in São Paulo with data from 2018 estimated an average wait of 21 months. There is no demographic data for the other regions of Brazil. However, in countries without a public health system, data on the number of scoliosis surgeries and waiting times are still limited.[3,4]

During the waiting period, the patient's condition can worsen, with worsening symptoms and negative results for the patient's mental health and quality of life.[5] Prolonged waiting time can increase the angular value of the deformity, worsening stiffness and, consequently, more complex surgeries, which are more expensive and carry higher risks for the patient. In cases where adolescents waited more than six months for surgery, there was a greater risk of prolonged hospitalization, longer surgical times, lower levels of deformity correction, and a greater likelihood of needing a second surgery.[6,7]

This study aimed to describe the epidemiological profile of pediatric scoliosis patients (0 to 18 years old) treated at a tertiary public hospital (referral center) in the Midwest region, characterizing the need for surgical treatment and the time until surgery.

MATERIAL AND METHODS

The work was carried out with the approval of the ethics and research committee (CAAE: 35250220.2.2002.5082). The Informed Consent Form (ICF) was given to the patients and their legal guardians.

A cross-sectional analytical study was carried out on 60 pediatric scoliosis patients referred to and treated at the orthopedics service of the only referral center in the Midwest region over one year. The data was collected in December 2022. All patients with scoliosis between the ages of 0 and 18 were included. Data was collected (through an interview with the legal guardian and access to medical records) on the following variables: age, gender, date of menarche (when applicable), weight (in kilograms), height (in meters), etiology according to the *Scoliosis Research* Society,[8] curve classification according to Lenke *et al*.,[9] forms of referral, initial treatment carried out before the referral center, indication of treatment after specialized care and waiting time for surgery after surgical indication.

RESULTS

The epidemiological and anthropometric profile of patients with scoliosis seen at a referral center over one year, corresponding to the number of new patients referred to the service, is shown in Table 1. At the time of data collection, of the 60 patients seen, 44 (73.3%) were female and 16 (26.7%) male, with an average age of 13.4 years (ranging from 4 to 18 years). The average weight of the patients was 42.9 kg, and the average height was 1.51m (Table 1). Of all the girls, 34 (77%) had already menarche, with an average age of 12.1 years (ranging from 9 to 15 years).

Of the 60 patients seen at the referral center over one year, surgical treatment was indicated for 44 (73.3%) patients (Figure 1) who were directed to the waiting list for scoliosis surgery. Of these, only six have undergone surgery to date. The average waiting time for surgery for patients who underwent surgery was 22 months, ranging from 6 to 40 months. This time was estimated between the date of the surgical indication (inclusion on the waiting list) and the surgery date.

Of the 16 patients who underwent conservative treatment after specialized care, 13 patients (81%) were referred for serial clinical observation, and three patients (19%) were referred for a brace (orthosis). All the patients who underwent surgery were female, of whom only one had not experienced menarche, and the others were between 11 months and 3.5 years after menarche (average 2.2 years).

As for the etiology of scoliosis, idiopathic was the most frequent in 38 patients (63%) of the sample (Figure 2), and the most frequent type of curve was 1AN (23.7%) in 9 of the 38 patients (Table 2). No conservative or surgical treatment was previously performed in 47 (78.3%) of the 60 patients before they were referred to the referral center. In the initial specialist assessment, only ten patients (16.7%) had worn a brace during treatment, and only three patients had been referred to the referral center for surgery.

Delays in care were observed in 39 (65%) patients, the main reasons being delays in getting care at the referral center (54.8%), difficulties in scheduling surgery (41.9%), and other clinical difficulties such as comorbidities and the patient's clinical condition that prevented surgery (3.2%), such as low weight, worsening lung function, hemodynamic instability or infection. Of the 44 patients with an indication for surgery, at the end of the study, only 6 (13%) had been operated on, while 38 (86%) were awaiting the procedure.

Table 1. Epidemiological and anthropometric profile of patients with scoliosis treated at a reference center in the Midwest.

Variable	Female	Male
Sex (%)	44 (73.3)	16 (26.7)
Age group (%)		
0 - 5	0 (0)	2 (12.5)
6 - 10	5 (11.4)	2 (12.5)
11 - 15	27 (61.4)	7 (43.8)
16 - 18	12 (27.2)	5 (31.2)
Weight (mean ± SD in kg)	45.6 ± 10.66	35.6 ± 13.66
Height (mean ± SD in m)	1.54 ± 0.11	1.43 ± 0.25

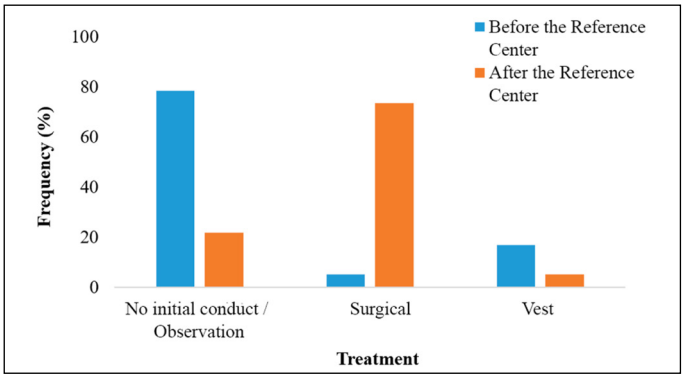

Figure 1. Treatment is indicated before and after treatment at the reference center.

Table 2. Classification of idiopathic scoliosis according to Lenke et al.[9]

Criteria	Classification[9]	n
Type of curve	Lenke 1	22
	Lenke 2	2
	Lenke 3	6
	Lenke 4	1
	Lenke 5	5
	Lenke 6	2
Lumbar modifier	A	13
	B	6
	C	19
Sagittal modifier	+	1
	N	31
	-	6

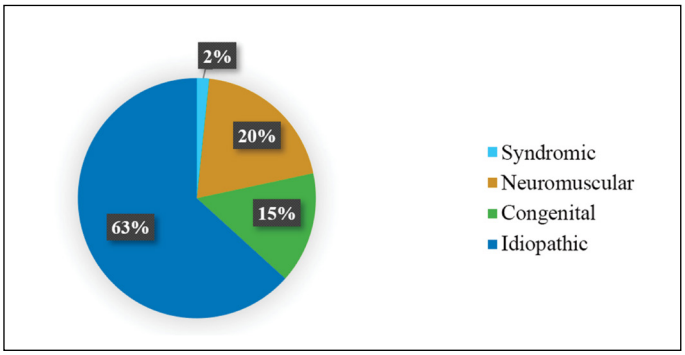

Figure 2. The etiology of pediatric scoliosis in the sample.

Concerning the form of referral, 55 (92%) patients arrived at the referral center via an appointment made within the Public Health System (SUS) by the first place of first assistance. (Figure 3)

DISCUSSION

The data obtained in this study show that most pediatric scoliosis patients seen at the referral center are female, with a mean age of 13.4 years, and have already gone through menarche. In addition, the most common etiology was idiopathic, with the 1AN curve being the most frequent. Of the patients in the study, the vast majority are still awaiting surgery, and only 5% were indicated to continue with conservative treatment (brace). In comparison, 13 (21.6%) patients were indicated for serial clinical observation. Of the patients who had already undergone surgery by the time of the study (13%), the average wait was 22 months.

An epidemiological study carried out in 2011 described the clinical and radiographic parameters of patients with adolescent idiopathic scoliosis (AIS) on the waiting list for elective surgical treatment at a high-complexity tertiary university hospital of the SUS in São Paulo and obtained a list of 51 patients, 42 female and nine male, with a mean age of 15.5 years and a mean wait of 25.4 months (ranging from 2 to 180 months), with data similar to that of the present study.[10]

The waiting list for spinal surgery is a reality in most countries that have a public health system, and the long wait for the procedure is associated with an increase in the angular value, greater rigidity of the curve, worsening of the pathological condition, as well as being the target of dissatisfaction and questioning on the part of doctors and patients.[11]

Female patients seen at a referral center in the Midwest region have an incidence of pediatric scoliosis 2.8 times higher than that of males. Data from the Scottish National Health Service study, carried out from 2005 to 2018, with a sample of 2,205 children and adolescents, obtained similar data, with a 2.2 higher incidence of spinal deformities in females, with a higher proportion of idiopathic scoliosis in the sample (1,250 cases, 56.7%).[12]

The progression of scoliosis is associated with skeletal immaturity

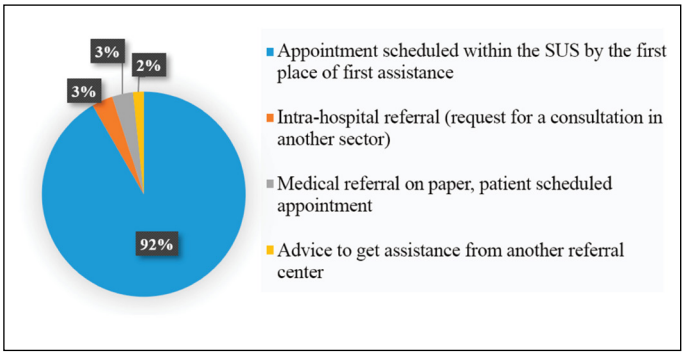

Figure 3. How patients with pediatric scoliosis are referred to the referral center.

and is assessed through bone age, Risser's sign, and menarche.[6] At the time of the interview, most female patients (58.8%) had already had menarche for over two years. The long menarche period means these patients come to the specialist at the end of their growth period, making it impossible to use a brace or any other form of conservative treatment.

The delay in the initial assessment by the specialist in patients with advanced skeletal maturation makes it impossible to wear a brace and increases the need for surgical intervention. The indication for surgery depends on factors such as the degree of deformity, the patient's age, and the use of conservative treatment. Thus, the initial assessment by the specialist would not be enough to reduce the indication for surgery. Although the risk of curve progression is not related to the age of menarche, the occurrence of menarche indicates a 20% reduction in curve progression.[3] Larger and more rigid deformities are common with increasing curve severity, requiring more complex surgery to achieve effective correction.[3]

In Canada, a study assessed the potential impact of waiting lists on the surgical care and perioperative management of patients with scoliosis.[7] The patients waited for surgery for an average of 24 months (range 17 to 30 months) and had an average curve progression of 25.3° during the waiting period.[7] The average waiting time (22 months) after the indication for surgery for the patients who underwent surgery in this study was lower than the average obtained by these authors. However, it should be noted that at the time of the interview, 38 of the patients evaluated in this study were still waiting for surgery at the referral center. In some cases, the delay in diagnosis and the start of clinical treatment may have led to a worsening of the patient's curve and degree of scoliosis, culminating in the indication of surgical treatment at the time of treatment at the referral center.

The reference center in the Midwest region performs an average of 48 scoliosis surgeries a year. Around 30 patients are seen at the clinic weekly for assessment and screening, with an average of five new cases of scoliosis a month. The waiting list grows weekly depending on the number of new cases. At the time of data collection, the waiting list for scoliosis surgery was 53 patients long. The COVID-19 pandemic has resulted in the postponement or suspension of elective surgeries, including those for spinal deformities, which can further increase waiting times and accentuate the progression of the disease, leading to worse results from surgical treatment.[4]

Waiting for surgery is associated with greater morbidity, a fact also observed in other studies in which the main problems resulting from the delay in surgical correction of scoliosis included curve progression, a greater number of surgeries required for effective treatment, a lower final curve correction, increased surgical time and length of hospital stay.[7,13,14] Waiting can also cause physical and emotional problems for patients.[15]

A study in Ireland examined the impact of preoperative curves greater than 70° versus those ≤ 70° in patients with AIS undergoing posterior spinal fusion.[16] The results showed a mean surgical waiting time of 33 weeks, significantly longer in patients with preoperative curves greater than 70°.[16] Delaying surgery is directly associated with greater intraoperative blood loss, a greater number of levels

requiring arthrodesis, a longer surgical duration, and an increase in the cost of surgical treatment.[16] The longest waiting time recorded in the Irish study16 was 72 weeks (18 months), lower than the average time obtained in the present study, reinforcing how prolonged waiting times negatively affect the patient and the health system.

A study carried out in Brazil[3] evaluated the implications of long waiting lists for surgery in the treatment of 87 patients with scoliosis, with an average waiting time of 21.7 months (ranging from 7 to 32 months) and obtained an average progression of the Cobb angle in the curvature of 21.1°, as well as negative impacts on patient morbidity, increased surgical complexity and a higher frequency of idiopathic scoliosis (n= 49, 55.6%)[3], data similar to that of the present study. (Figure 2)

In a study that retrospectively evaluated the medical records of patients operated on between 2007 and 2010 in Scotland,[17] the average waiting time for surgery was 12 months, ranging from 6 to 16 months. The delay in performing the surgery resulted in an average increase of 12° in curvature, longer operative time, increased need for intensive care units, longer hospitalization, and an increase in total cost, estimated at 25%.[17]

In a study carried out in Saudi Arabia[18] to evaluate the effect of surgical waiting time on curve progression, the type of surgery performed, and the outcome in patients with AIS, an average curve progression of 24º was observed during the waiting period, with additional levels of fusion being required in 15 of the 55 cases undergoing surgery. According to this study, the ideal waiting time for surgical correction of scoliosis should be less than six months,[18] although other authors suggest that the maximum acceptable waiting time for surgery in the treatment of AIS is three months.[14]

A study carried out in a hospital in Texas, USA, pointed to the high cost of scoliosis surgery as one of the limiting factors, with an average hospital expense of US$126,284 and an average hospital cost of US$44,126.[19] The spinal implant, the surgery department's labor force and the medical/surgical beds were the factors that contributed most to the high overall cost.[19] In Brazil, there is no data on the specific cost of pediatric deformity surgeries, which requires further studies.

In Korea,[20] the incidence of AIS was 1.44 times higher in females than males. The most frequent age group is 10 to 14 years old, similar to this article (Table 1). The data from the current study shows that referrals to the referral center are made by appointment within the SUS by the primary care center. Although this data shows assertiveness about referrals, the lack of action in 78.3% of cases is worrying. Above all, the low recommendation for vests (present in only 5% of cases) (Figure 1) is a warning sign since this is one of the most effective measures in the non-surgical treatment of scoliosis, especially in pediatric patients before skeletal maturation.[21]

Data obtained in the literature from the study of using the vest in adolescents with idiopathic scoliosis demonstrated the vest's ability to significantly reduce the progression of high-risk curves for surgery, positively altering the natural evolution of scoliosis.[21] Most of the patients in the study (n= 20, 58.8%) were assessed by the specialist two years after menarche, demonstrating the end of skeletal immaturity and making any kind of effective conservative treatment impossible.

In the evaluation with the specialist, surgical treatment was indicated for 44 (73.3%) patients, and only 6.8% used the brace. This demonstrates the patient's delay in getting an appointment at the basic health units, revealing that in most cases, they may have been evaluated by the general orthopedist (without a specialty in the spine) too late, or the latter did not have the knowledge to correctly indicate the brace, contributing negatively to the patient's prognosis, adding to this the delay in receiving care at the specialized center and the time it takes to perform the surgery.

A systematic review of six observational studies identified as the main negative outcomes the wait for AIS surgery, the need for additional spinal surgery, the increase and worsening of the Cobb angle, the change of surgical plan, and the increase in surgery time, as well as significantly higher average costs in those who waited more than six months.[22]

The existence of waiting lists and delays in performing surgical procedures are an inevitable product of public health systems, justified by the argument of optimizing resources and containing health costs. For patients with scoliosis, these lists negatively impact the progression of the deformity and physical and mental health.[2]

Another worrying factor highlighted by this study is the low indication for the use of the vest in the initial care of patients, which could reduce the progression of scoliosis and the need for surgery, helping in the financial and budgetary management of the public health system, reducing the wait and the costs of surgery, in addition to the benefits to the physical and mental health of patients with pediatric scoliosis.[21]

The limitation of this study is that data was collected from the only reference center in the Central-West Region over one year, which allows only a partial assessment of the panorama of children and adolescents with spinal deformities requiring surgery in the country as a whole. In addition, this study did not obtain important data regarding queue management, the criteria for selecting cases to be operated on, and the total size of the waiting list for scoliosis surgery. It was also impossible to collect data on the progression of scoliosis from the first visit to the referral center until the surgery, as this information was not available in the medical records.

CONCLUSION

The list of pediatric scoliosis patients seen at the only referral center in the Midwest region is made up of young girls with idiopathic scoliosis, most of whom did not wear a brace before being referred to the referral center. Due to the long waiting time, most patients had already reached skeletal maturity (usually more than two years after menarche) at the time of their consultation with the specialist.

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