RADIOGRAPHIC IMPLICATIONS OF THE SURGICAL WAITING LIST FOR THE TREATMENT OF SPINAL DEFORMITY

IMPLICAÇÕES RADIOGRÁFICAS DA LISTA DE ESPERA CIRÚRGICA PARA TRATAMENTO DE DEFORMIDADE DA COLUNA VERTEBRAL

IMPLICACIONES RADIOGRÁFICAS DE LA LISTA DE ESPERA QUIRÚRGICA PARA EL TRATAMIENTO DE DEFORMIDAD DE LA COLUMNA VERTEBRAL

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ABSTRACT

Objective: The aim of this study was to evaluate the implications of long waiting times on surgery lists for the treatment of patients with scoliosis. Methods: Radiographs of 87 patients with scoliosis who had been on the waiting list for surgery for more than six months were selected. Two surgeons answered questionnaires analyzing the radiographs when entering the waiting list and the current images of each patient. Results: Data from 87 patients were analyzed. The mean waiting time for surgery was 21.7 months (ranging from seven to 32 months). The average progression of the Cobb angle in the curvature was 21.1 degrees. Delayed surgery implied changes in surgical planning, such as greater need of instrumentation, osteotomies, and double approach. Conclusions: Long waiting lists have a significant negative impact on surgical morbidity of patients with scoliosis, since they increase the complexity of the surgery. ***Level of evidence: IV. Type of study: Descriptive study.***

Keywords: Scoliosis; Waiting list; Treatment; Preoperative care.

RESUMO

Objetivo: A meta desse estudo foi avaliar as implicações das longas listas de espera de cirurgia no tratamento dos pacientes portadores de escoliose. Métodos: Foram selecionados radiografias de 87 pacientes portadores de escoliose que estavam na lista de espera por cirurgia há mais de seis meses. Dois cirurgiões responderam questionários, analisando as radiografias de entrada na lista de espera e as imagens atuais de cada paciente. Resultados: Dados de 87 pacientes foram analisados. A média de espera pela cirurgia foi de 21,7 meses (variando de sete a 32 meses). A média de progressão do ângulo de Cobb na curvatura foi de 21,1 graus. A demora pela cirurgia implicou em alterações no planejamento cirúrgico, como maior necessidade de instrumentação, osteotomias e dupla via de acesso. Conclusão: As longas listas de espera tem um significativo impacto negativo na morbidade cirúrgica dos pacientes com escoliose, por aumentar a complexidade da cirurgia. ***Nível de evidência: IV. Tipo de estudo: Estudo descritivo***

Descritores: Escoliose; Listas de espera; Tratamento; Cuidados pré-operatórios.

RESUMEN

Objetivo: El objetivo de este estudio fue evaluar las implicaciones de los largos tiempos de espera en las listas de cirugía para el tratamiento de pacientes con escoliosis.. Métodos: Se seleccionaron radiografías de 87 pacientes con escoliosis que habían estado en la lista de espera para cirugía durante más de seis meses. Dos cirujanos respondieron cuestionarios analizando las radiografías al entrar en la lista de espera y las imágenes actuales de cada paciente. Resultados: Se analizaron los datos de 87 pacientes. El tiempo promedio de espera para la cirugía fue de 21,7 meses (variando de siete a 32 meses). La progresión promedio del ángulo de Cobb en la curvatura fue de 21,1 grados. La demora de la cirugía implicó cambios en la planificación quirúrgica, como mayor necesidad de instrumentación, osteotomías y doble vía de acceso. Conclusiones: Las largas listas de espera tienen un impacto negativo significativo en la morbilidad quirúrgica de los pacientes con escoliosis, ya que aumentan la complejidad de la cirugía. ***Nivel de evidencia: IV. Tipo de estudio: Estudio descriptivo.***

Descriptores: Escoliosis; Listas de espera; Tratamiento; Cuidados preoperatorio.

INTRODUCTION

Scoliosis is defined by the Scoliosis Research Society (SRS) as a deviation of the spine in the coronal plane greater than 10 degrees. It is a condition that mainly affects children and adolescents. Adolescent Idiopathic Scoliosis (AIS) only affects 1.2% of individuals between 12 and 14 years of age.[1] Etiologically, scoliosis can be classified into several types, idiopathic being the most common (Chart 1).[2]

The risk of progression of the curvature in idiopathic scoliosis depends on several factors, such as the age of the patient at the time of diagnosis, sexual maturity, the Risser Sign (ossification of the iliac crest), sex, and the degree and location of the curve.[2] As for congenital scolioses, progression varies in accordance with age, the location of the curve, and the type of abnormality (formation and segmentation). The thoracolumbar transition is the site of most progression.[3]

Study conducted at the Hospital Estadual Mario Covas da Faculdade Medicina do ABC, Santo André, SP, Brazil.
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Chart 1. Etiological classification of spinal deformities according to the Scoliosis Research Society.

Idiopathic	Neuropathic	Myopathic
Congenital	Neurofibromatous	Mesenchymatous
Traumatic	Osteochondrodystrophies	Tumoral
Metabolic	Contractures of soft tissues	Hysterical
Functional	Rheumatoid Disease	Thoracogenic

Long surgery wait lists, such as in Canada and the United Kingdom, are products of the public health system.[4] During the waiting period, patient conditions may continue to worsen, leading to aggravated symptoms, and, therefore, leading to a negative impact on the mental health and quality of life of the patients.[5-6]

The long wait times for scoliosis surgery can lead to serious consequences if the vertebral deformity progresses, such as increased curvature, rigid deformities, and thus, require more aggressive surgery to achieve an effective correction.[7]

A recent study showed an increase in perioperative morbidity, increased surgical time, a greater need for blood transfusions, and a higher number of instrumented vertebrae.[8]

In hospitals of high complexity in the Brazilian public health system, patients with scoliosis of the spine can wait for a long time for surgical treatment, reflecting a significant social and economic problem.

The objective of this study was to radiographically evaluate the impact of long wait times for treatment of patients with scoliosis in a Brazilian public hospital.

METHODS

We selected 112 patients diagnosed with scoliosis in a tertiary hospital in the public health system who were waiting for corrective surgical procedures in the period between August 2013 and January 2016.

Patients up to 18 years of age with an angle of curvature greater than 40 degrees measured using the Cobb method[9] and who had been in the surgery wait queue for longer than six months were the included in the study. The decision about the surgical procedure was defined after an agreement between the surgeon and the patient and their relatives.

The exclusion criteria were patients who were not indicated for surgery, patients who had undergone a previous surgical procedure, and those with degenerative scoliosis.

Epidemiological data were obtained from the electronic medical records of patients of the outpatient Spine Surgery Clinic of the Hospital Estadual Mario Covas da Faculdade Medicina do ABC. Statistical analysis of this information was conducted using Excel for Windows® version 2003 and SPPS® 10.0.

All the patients had radiographs taken at the time of entering the waiting list, called the initial time (IT), and at the last outpatient consultation, called the final time (FT). These radiographs were evaluated by two surgeons, experts in scoliosis from different hospitals, using a questionnaire (ATTACHMENT 1). The evaluators did not know any of the subjects of any of the radiographic exams. The questionnaires included surgical planning information, such as the angle of the curve, skeletal maturity (Risser Sign),[10] King et al.[11] and Lenke et al.[12] classifications, access approaches, need for osteotomy, amount of instrumentation, and degree of difficulty. The IT and FT measurements were compared graphically and analyzed using the statistical significance test.

All patients signed the Informed Consent Form. This study was approved by the Institutional Review Board of the Faculdade de Medicina do ABC as opinion number 377252.

RESULTS

Of the 112 patients initially selected, 87 had complete radiographs. The average age of these 87 patients at the time they were placed on the surgery waiting list was 10.7 years. The patients remained on the waiting list for the procedure, or up until the time of the study, for an average of 21.7 months, ranging from 7 to 32 months.

There was a significant average progression of the Cobb angle of the principal curve as shown in Figure 1. In addition to the magnitude of the curve, the patients were classified according to the King and Lenke criteria. The most frequently encountered curves were type II in 42 patients and 3BN in 34 patients, respectively.

Among the deformities observed in our study, 14 congenital scolioses (from failures in formation, in segmentation, or mixed) were identified, 21 neuromuscular scolioses (from cerebral palsy, from myopathies), three neurofibromatoses, and 49 idiopathic scolioses (infantile, juvenile, and adolescent), as displayed in Figure 2.

Table 1 shows the data collected by the surgeons specialized in the surgical technique, the estimated duration of the hospitalization, and the estimated surgical time.

The average estimated surgical time increased from four to six hours. In the evaluation by the surgeons, the surgical time ranged from three to five hours in the IT and from 4.5 to eight hours in the FT.

The average hospitalization time was 5 days if the patient underwent surgery at the IT, while at the FT, this was seven days, an average increase of two days in the duration of the hospitalization.

Regarding the surgical technique chosen, both the evaluators preferred to add other procedures to the initial approach. In the IT, 62 patients were chosen for a posterior arthrodesis technique with

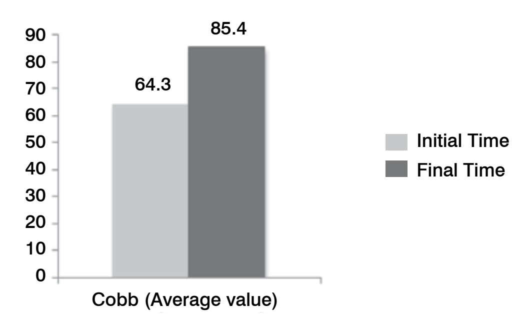

Figure 1. Average value of the Cobb Angle at the time of entering the waiting line (initial time) and at the time of the final outpatient consultation (final time).

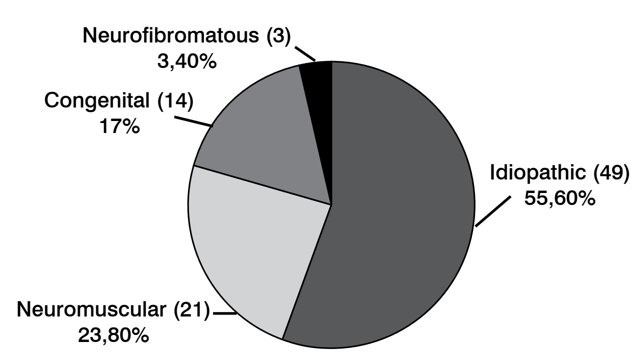

Figure 2. Types of deformity of the 87 patients.

Table 1. Comparison of the data collected by the surgeons in relation to the two times in the waiting line.

	Initial time (IT)	Final time (FT)
Surgical technique	Posterior arthrodesis = 62	Posterior arthrodesis = 34
	AP + Anterior release: 25	AP + Anterior release: 53
Surgical time (hours)	4	6
Duration of hospitalization (days)	5	7
Degree of difficulty (0 – 10)	4/10	6/10

AP = Posterior Arthrodesis.

instrumentation. Twenty-five patients had been indicated for a dual combination approach (anterior and posterior). In comparison, in the FT, the expert surgeons changed the recommended approaches of 28 of the 62 patients to posterior arthrodesis associated with anterior release.

When the levels of difficulty of the surgery estimated by the experts were compared, both confirmed an increase in the level of difficulty in 87 patients, from 4/10 to 6/10. The degree of difficulty did not decrease for any of the patients. There was no statistical difference in the number of pedicle screws or in the increase in the number of levels required for arthrodesis.

DISCUSSION

Several factors are related to the risk of progression of the vertebral deformity, such as sex, menstruation, and the Risser Sign. These factors are essential to the choice of treatment.[13-17]

Scoliosis with a high angle value in adolescents has a higher incidence among females, reaching a proportion of 8:1. However, the mildest vertebral deformities occur without any significant predominance for either of the sexes. In children younger than 10 years of age, the sex of the patients is a good predictor of the risk of progression. In our study, we observed a predominance of accentuated curves in the girls.

One of the methods used to evaluate skeletal maturity is by identifying the ossification of the iliac crest (Risser Sign). An iliac crest with less than 75% ossification (up to stage III) indicates skeletal immaturity and is associated with a chance of progression of the curve three times higher that patients with Risser IV and V.[18]

The date of first menstruation is a milestone in the growth process, and, in relation to spinal deformity, its existence indicates a lower risk of curve progression. After menarche, the chance of progression of the deformity is approximately 20%, unlike before menstruation when the risk of accentuated curvature rises to 50%.[19] When the type of curve of the deformity was compared to the chance of curve progression, a study reported that thoracic curves located to the right had a higher risk of progression than thoracic curves to the left.[17]

A study conducted in New Zealand used the Scoliosis Research Society questionnaire (SRS-30) to evaluate the quality of life of 31 patients with idiopathic scoliosis awaiting surgery and compared the results with those of 40 patients who had undergone the surgical procedure. The study observed that with an increase in the length of time waiting for the surgery there was a statistically significant decrease in the domains of pain, satisfaction with the treatment, and appearance.[20]

Ahn et al. analyzed 88 patients with adolescent idiopathic scoliosis who were on a surgery waiting list for at least six months, and they noted a need for additional surgery in thirteen (14.8%) of the patients due to progression of the curvature as opposed to only in two (1.6%) adolescents who had been waiting for less than six months. Other findings were an increase in surgical time and in the duration of hospitalization. The degree of surgical correction achieved was less in the patients who had waited for more than six months. They concluded that the maximum acceptable wait time to reduce the risk of additional surgeries due to the progression of the curve is five months.[7]

Dabke et al.,[21] in a study in the United Kingdom, observed significant progression in the curve in 50% of the 101 patients with scoliosis who waited eleven months for the surgical procedure. The increase in curvature was more significant in the patients with congenital and neuromuscular deformities.

In a more recent study, eleven patients with idiopathic scoliosis with an average wait time of 24 months were evaluated up until the preoperative period via a questionnaire with surgical planning data and the researchers observed that, due to the increasing curve and the worsening deformity, there was an estimated increase in surgical time, in the degree of difficulty of the procedure, and in blood loss, in addition to the need for need for anterior approach release.[22]

Neto et al.[23] studied 170 patients with spinal deformities waiting for surgical procedures in a tertiary hospital school in the Brazilian public system and they observed a predominance of congenital and neuromuscular deformities, mainly among the female patients. Lima Júnior et al.[24] in a study of adolescents with idiopathic scoliosis in the same hospital service perceived that of the 51 patients, 42 were females with an average age of 15 years. The average value of the principal curve was 60 degrees and the average wait time for surgery was 25 months.

In agreement with the above-mentioned authors, in our study we observed an estimated increase in surgical time and a longer hospital stay as compared to the time at which the patient entered the waiting queue for the procedure. These surgical planning estimates can be explained by the increased angulation and rigidity of the curvature, by the additional need for osteotomies, and the association of more than one approach. The reason behind the variation in surgery wait time is the high demand from more urgent surgical cases (spinal trauma, myelopathies, tumors, and disc pathologies associated with acute neurological deficit) and the number of vacancies (beds and pediatric ICU) reserved for more complex surgeries and for children with low skeletal maturity.

CONCLUSIONS

Our study observed a significant change in surgical planning for patients with scoliosis while they were waiting for surgery. This implies an increase in the probability of adverse events, greater surgical morbidity, and an increase in public health system costs.

All authors declare no potential conflict of interest related to this article.

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Attachment 1. Questionnaire.

Radiographic evolution of patients with scoliosis in the surgical waiting line	
Patient: ______________________	King classification: __________
Date: _____/______/_______	Lenke classification: ____________
Age (years): _________	Surgery suggested:
Sex (M/F): _______	☐ Instrumentation and anterior fusion
Risser: ______	☐ Instrumentation and posterior fusion
Etiology of the scoliosis: ______________________	☐ Anterior release and posterior instrumentation
Main curve: ____________________	☐ Anterior and posterior instrumentation and fusion
Apical vertebra: _________	Osteotomy (Yes / No)? _________ Which levels? ___________
Cobb (degrees):__________	Proximal level of the instrumentation: _________
Secondary curve: ____________________	Distal level of the instrumentation: _________
Apical vertebra: __________	How many pedicle screws? _________
Cobb (degrees): _________	Degree of difficulty: 0 (Easy) – 1 – 2 – 3 – 4 – 5 – 6 – 7 – 8 – 9 – 10 (Difficult)