

ANALYSIS OF THE SECONDARY CURVES IN PATIENTS UNDERGOING SELECTIVE ARTHRODESIS LENKE I

ANÁLISE DAS CURVAS SECUNDÁRIAS EM PACIENTES SUBMETIDOS A ARTRODESE SELETIVA LENKE I

ANÁLISIS DE LAS CURVAS SECUNDARIAS EN PACIENTES SOMETIDOS A ARTRODESIS SELECTIVA LENKE I

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ABSTRACT

Objective: To radiographically evaluate the behavior of the secondary curves in the coronal and sagittal planes in patients with AIS classified as Lenke I, who underwent surgical treatment of selective arthrodesis by posterior approach. **Methods:** Retrospective study which analyzed 40 patients with AIS, being 33 female. The measurement of the radiographic parameters used followed the recommendations by Cobb. **Results:** The average correction of the thoracic proximal, primary and lumbar curves was 34.73%, 75.06% and 64.64%, respectively. **Conclusion:** Surgical treatment by selective arthrodesis in cases of AIS Lenke type I provide correction of compensatory curves in the coronal and maintenance in the sagittal plane.

Keywords: Arthrodesis; Scoliosis; Adolescent.

RESUMO

Objetivo: Avaliar radiograficamente o comportamento das curvas secundárias nos planos coronal e sagital em pacientes portadores de EIA classificados como Lenke I, que foram submetidos a tratamento cirúrgico de artrodese seletiva por via posterior. **Métodos:** Estudo retrospectivo no qual foram analisados 40 pacientes portadores de EIA, sendo 33 do sexo feminino. A mensuração dos parâmetros radiográficos utilizados seguiu o preconizado por Cobb. **Resultados:** A média de correção das curvas torácicas proximal, principal e lombar foi de 34,73%, 75,06% e 64,64% respectivamente. **Conclusão:** O tratamento cirúrgico por artrodese seletiva em casos de EIA Lenke tipo I proporciona correção das curvas compensatórias no plano coronal e manutenção do plano sagital.

Descritores: Artrodese; Escoliose; Adolescente.

RESUMEN

Objetivo: Evaluar radiográficamente el comportamiento de las curvas secundarias en el plano coronal y sagital en pacientes con EIA clasificados como Lenke I, que se sometieron a tratamiento quirúrgico selectivo por artrodese por vía posterior. **Métodos:** Estudio retrospectivo, que analizaron a 40 pacientes con EIA, siendo 33 del sexo femenino. La medición de los parámetros radiológicos utilizados siguió las recomendaciones de Cobb. **Resultados:** La corrección media de las curvas torácica proximal, principal y lumbar fue 34,73%, 75,06% y 64,64%, respectivamente. **Conclusión:** El tratamiento quirúrgico mediante artrodese selectiva de los casos de EIA Lenke tipo I proporciona la corrección de las curvas de compensación en el plano coronal y el mantenimiento en el plano sagital.

Descriptores: Artrodese; Escoliosis; Adolescente.

INTRODUCTION

Adolescent idiopathic scoliosis is the most common form of spinal deformity. It is defined as a deformity of more than 10° in the coronal plane, associated with rotation of the vertebrae and costotransverse joints, and with no defined etiology.¹⁻³ Several theories have been studied, such as changes in collagen, hormonal changes, and more recently, genetic changes,⁴ but we still do not have a complete definition of its origin.

The treatment for this type of deformity depends on the degree and the location of the curve, and is based on the degree of potential growth of the patient.⁵ In curves greater than 45°, measured using the Cobb method, surgery is indicated in patients with growth potential.⁶ The goals of surgical treatment are to correct the curve, to recover balance in the coronal and sagittal planes, to prevent progression

and possible cardiopulmonary complications, and consequently, to provide esthetic improvement.

Several classification systems have been proposed which, depending on the type of deformity, can be used to define the type of proposed treatment. The classification of Lenke et al.^{7,8} examines not only deformities in the coronal plane, as suggested by King et al.,⁹ but also the secondary curves and sagittal balance, since changes in these measurements can directly impact the surgical decision.

The Lenke classification brought great advances to the interpretation of deformities because it clearly defined what would be the main curve, a secondary proximal curve, a secondary distal curve, and the relevant sagittal modifiers,^{7,8} criteria that were previously poorly standardized in the literature. Following this standardization,

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there was a significant increase in publications using the Lenke classification.^{7,8}

In curves classified as Lenke I, studies show that selective arthrodesis is the appropriate treatment for this type of pathology, as it enables correction of the compensatory curves by performing an arthrodesis involving fewer segments, benefiting the patient.^{10,11}

The objective of this study is to evaluate the behavior of the secondary curves radiographically, both in the coronal and the sagittal planes, by assessing the pre- and postoperative exams of patients with adolescent idiopathic scoliosis classified as Lenke I submitted to posterior approach selective arthrodesis surgery.

CASE SERIES AND METHODS

A retrospective study, conducted following approval of the Institutional Review Board (IRB) – Santa Casa de Misericórdia de Vitória (12041313.0.0000.5065), in which 40 patients with AIS classified as Lenke I were analyzed; 33 female, with an average age of 14.7 years, ranging from a minimum of 11 to a maximum of 22 years of age.

The inclusion criteria were: patients with AIS classified as Lenke type I, between 10 and 22 years of age, indicated for surgery due to spinal deformity, and in follow up at Hospital Santa Casa de Misericórdia.

The exclusion criteria were patients who did not agree to sign the Informed Consent Form, those who did not have the pre-established radiographs taken, and those who refused surgical treatment.

The radiographic parameters used for this study were measured following the recommendations of Cobb,¹² for which panoramic radiographs are taken of the spine in the orthostatic position, in the pre- and immediate postoperative periods and after 4 weeks.¹³ (Figure 1)

The compensatory curves were also measured using the Cobb method¹² as the standard in panoramic pre- and postoperative radiographs of the spine in the orthostatic position, as described.

A descriptive analysis was used to describe or summarize the sample of children and adolescents with scoliosis.

The Student's t test was used to compare the preoperative and postoperative evaluations. A level of significance of 5% was adopted, and a confidence interval of 95%. The statistical program used in the analyses was IBM's SPSS Statistics version 21.

RESULTS

The sample was composed of 40 patients who met the inclusion criteria of the study. We compared the pre- and postoperative spinal radiographs of adolescents and young adults between the ages of 11 and 22 years old with AIS with Lenke type I curves with indication for surgery, and who had no other vertebral deformities.

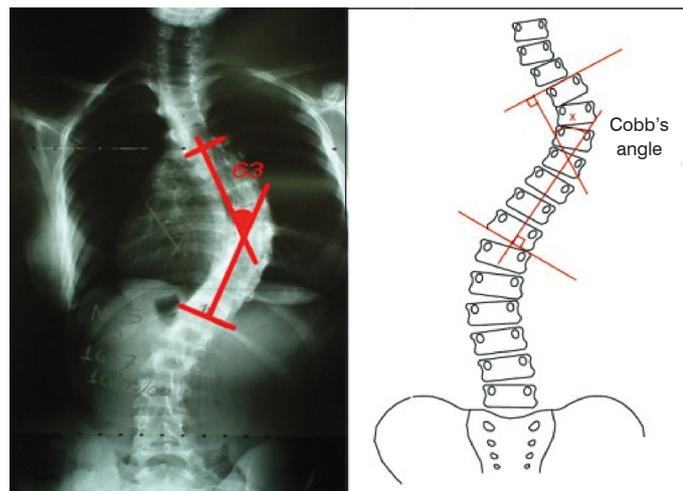


Figure 1. Cobb method for measuring the principal and secondary curves.

The averages of the Cobb index in the anteroposterior preoperative radiographic exam were 29.97° for the proximal thoracic curve, 59.08° for the principal thoracic curve, and 35.26° for the lumbar curve. The average postoperative measurements were 19.56°, 14.73°, and 12.5° respectively, with corrections percentages of 34.73%, 75.06%, and 64.64% for their respective curves, as shown in Table 1.

Table 1. Comparative analysis between the curves pre- and postoperatively.

Averages – AP radiographs	Proximal Thoracic	Principal Thoracic	Thoracolumbar
Preoperative	29.97°	59.08°	35.26°
Postoperative	19.56°	14.73°	12.5°
Percentage of postoperative correction	34.73%	75.06%	64.64%

Table 2 shows the analysis of the cervical, thoracic, thoracolumbar, and lumbar profiles in the pre- and postoperative periods.

Table 2. Analysis of the pre- and post-operative profiles.

Averages	Thoracic profile	Thoracolumbar profile	Lumbar profile
Preoperative	27.41°	8.37°	45.72°
Postoperative	25.44°	4.88°	38.94°
Improvement	2.1°	3.6°	6.5°

Statistical Analysis

The Student's t test for paired samples was used to compare the preoperative and postoperative evaluations through the differences in the averages of the degrees. (Table 3)

Table 3. Comparison between preoperative and postoperative by the Student's t test.

	Paired differences				P value
	Average	Standard deviation	Confidence interval of 95% of the difference		
			Lower	Upper	
Proximal thoracic – proximal thoracic correction	16.824	16.601	11.031	22.616	<0.001
Thoracic – thoracic correction	32.829	10.211	29.321	36.336	<0.001
Lumbar – lumbar correction	17.722	12.377	13.535	21.910	<0.001
Proximal thoracic – postoperative proximal thoracic	10.030	41.359	-4.635	24.696	<0.001
Thoracic – postoperative thoracic	43.974	9.925	40.757	47.192	<0.001
Lumbar – postoperative lumbar	23.176	11.666	19.106	27.247	<0.001
Cervical profile – postoperative cervical profile	-4.000	14.111	-9.004	1.004	0.011
Thoracic profile – postoperative thoracic profile	2.588	12.415	-1.744	6.920	0.233
Thoracolumbar profile – postoperative thoracolumbar profile	2.794	7.248	0.265	5.323	0.031
Lumbar profile – postoperative lumbar profile	7.882	10.020	4.386	11.379	<0.001

DISCUSSION

The goal of surgical treatment of AIS is to correct deformity in the coronal and sagittal planes, through arthrodesis of the lowest number of segments possible, in order to avoid possible complications such as degenerative disease of the non-fused segments, principally in the lumbar region.¹⁴⁻¹⁷ Applying the concept of selective arthrodesis permits us to control and partially correct the main thoracic curve, and to maintain the mobility of the segments, particularly in the lumbar segments.

Lenke et al.¹⁸ demonstrated that after selective arthrodesis surgery, the correction of the compensatory lumbar curve is spontaneous and consistent. In a study published by Ritzman et al.,¹⁹ a correction of 49% was achieved. Sun et al.²⁰ conducted a study with 43 patients with adolescent idiopathic scoliosis submitted to selective posterior arthrodesis, and concluded that the restoration of coronal balance was compensated mainly by the non-fused distal segments.

Wong et al.²¹ reported shorter surgical time in patients submitted to posterior selective arthrodesis and consequently a lower risk of complications. The study published by Fisher and Kim²² shows that selective arthrodesis in AIS is a way to correct the curve, recover

balance, and maintain flexibility by leaving a higher number of segments free. Yu et al.²³ state that this type of treatment is effective and safe, maintaining good balance in the coronal and sagittal planes.

In this study, selective arthrodesis of the principal thoracic curve resulted in a correction of 75%, while for the secondary curves, though not directly targeted in the surgery, significant correction was obtained, with 34.73% correction in the proximal thoracic curve and 64.64% in the lumbar curve. The thoracolumbar profile showed a reduction of 41% in the average angle in the sagittal plane, while the thoracic and lumbar profiles showed reductions of 7.7 and 14.1%, respectively.

CONCLUSION

Surgical treatment of Lenke type I AIS by means of selective arthrodesis provides correction of the compensatory curves in the coronal plane and maintenance of the sagittal plane.

All authors declare no potential conflict of interest concerning this article.

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