

EPIDEMIOLOGY AND MORTALITY OF THORACOLUMBOSACRAL SPINAL ARTHRODESIS IN BRAZIL: THE LAST 10 YEARS

EPIDEMIOLOGIA E MORTALIDADE DA ARTRODESE TORACO-LOMBO-SACRA NO BRASIL: OS ÚLTIMOS 10 ANOS

EPIDEMIOLOGÍA Y MORTALIDAD DE LA ARTRODESIS TORACOLUMBOSACRAL EN BRASIL: LOS ÚLTIMOS 10 AÑOS

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ABSTRACT

Objective: To describe the epidemiology and mortality of thoracolumbosacral arthrodesis surgery in Brazil in the last 10 years. **Methods:** Study conducted using data from the SIH of the Unified Health System (SUS) covering the time period from 2008 to 2018 for all regions of Brazil. The data obtained were analyzed using the BioStat 5.3 program, using Chi-square statistical tests, observing a p-value <0.05 and a 95% confidence interval. **Results:** A total of 66,631 anterior or posterior approach TLS surgeries were registered. The overall mortality rate was 9.37 deaths per thousand procedures. There are regions with mortality much higher than the national average. The mortality rate increases proportionally with the number of levels involved in posterior arthrodesis. **Conclusions:** The study of the epidemiological profile of thoracolumbosacral arthrodesis is important, especially in a country whose population is heterogeneous but has different mortality rates among regions. Therefore, it is necessary to create measures that identify and prevent the factors that lead to the death of patients undergoing such a procedure. **Level of evidence II; Retrospective, analytical, quantitative and descriptive study.**

Keywords: Arthrodesis; Spine/surgery; Epidemiology.

RESUMO

Objetivo: Descrever a epidemiologia e a mortalidade da cirurgia de artrose toraco-lombo-sacra no Brasil nos últimos 10 anos. **Métodos:** Estudo realizado a partir do SIH do Sistema Único de Saúde (SUS), abrangendo uma série temporal de 2008 até 2018, de todas as regiões do Brasil. Os dados obtidos foram analisados com o programa BioStat 5.3, através de testes estatísticos Qui-quadrado, observando o p-valor < 0,05 e o intervalo de confiança de 95%. **Resultados:** Foram registradas 66.631 cirurgias com abordagem TLS por via anterior ou posterior. A razão de mortalidade geral foi de 9,37 óbitos por mil procedimentos. Há regiões com mortalidade muito superior que a média nacional. A taxa de mortalidade aumenta proporcionalmente com o número de níveis envolvidos na artrose posterior. **Conclusões:** O estudo do perfil epidemiológico da artrose toraco-lombo-sacra mostra-se importante, sobretudo em um país cuja população é heterogênea e possui diferentes taxas de mortalidade entre as regiões. Portanto, torna-se necessária a criação de medidas que identifiquem e previnam os fatores que levam os pacientes submetidos a tal procedimento ao óbito. **Nível de evidência II; Estudo analítico, retrospectivo, quantitativo e descritivo.**

Descritores: Artrose; Coluna Vertebral/cirurgia; Epidemiologia.

RESUMEN

Objetivo: Describir la epidemiología y la mortalidad de la cirugía de artrodesis toracolumbosacral en Brasil en los últimos 10 años. **Métodos:** Estudio realizado a partir del SIH del Sistema Único de Salud (SUS), abarcando una serie temporal de 2008 a 2018, de todas las regiones de Brasil. Los datos obtenidos fueron analizados con el programa BioStat 5.3, a través de tests estadísticos de Chi-cuadrado, observando el valor de p <0,05 y el intervalo de confianza de 95%. **Resultados:** Fueron registradas 66.631 cirugías de abordaje TLS por vía anterior o posterior. La razón de mortalidad general fue de 9,37 decesos por mil procedimientos. Hay regiones con mortalidad muy superior al promedio nacional. La tasa de mortalidad aumenta proporcionalmente con el número de niveles involucrados en la artrodesis posterior. **Conclusiones:** El estudio del perfil epidemiológico de la artrodesis toracolumbosacral es importante, especialmente en un país cuya población es heterogénea y posee diferentes tasas de mortalidad entre las regiones. Por lo tanto, es necesario crear medidas que identifiquen y prevengan los factores que llevan a los pacientes sometidos a tal procedimiento al deceso. **Nivel de evidencia II; Estudio analítico, retrospectivo, cuantitativo y descriptivo.**

Descriptor: Artrodesis; Columna Vertebral/cirugía; Epidemiología.

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INTRODUCTION

In recent years, surgical procedures involving spinal fixation have evolved, beginning in the lumbar region and, later, in the thoracic spine, enabling the correction of various traumatic, oncological, and degenerative diseases,¹ as well as the correction of deformities like scoliosis.²

Scoliosis is characterized as an abnormal condition of the lateral curvature of the spine that affects on average 3% of the population.³ It is classified into different types, including congenital, neuromuscular, and idiopathic,⁴ which corresponds to 65% of the cases.^{5,6} Traumatic injuries to the spine and spinal cord can be defined as any injury to a spinal segment with or without involvement of the spinal cord and/or the nerve roots, reaching annual worldwide rates of 50 cases per million individuals and incurring costs of \$300 million per year.⁷⁻⁹

It is also known that performing surgical procedures involving the spine has increased in recent years, resulting in an increase in postoperative complications, including death.¹⁰

Early diagnosis and treatment are critical to achieving satisfactory outcomes in order to prevent neurological deterioration, the progression of kyphotic deformities, and possible complications.¹¹

In this context, there are few studies that address thoracolumbosacral spinal arthrodesis and its mortality rate by macroregion in Brazil. Thus, the objective of this study is to describe the epidemiology and mortality of thoracolumbosacral arthrodesis surgery in Brazil in the last 10 years.

METHODS

This is a quantitative, retrospective, descriptive study conducted using data collected from the database made available by the Unified Health System (SUS), covering the time period from 2008 to 2018 and accessed via the electronic address <http://www.datasus.gov.br>. All the cases of patients submitted to thoracolumbosacral (TLS) arthrodesis were included in this study. The tables concerning mortality rates were also prepared with data obtained from DATASUS.

The data were grouped according to procedure: anterior thoracolumbosacral arthrodesis – one level (0408030232), two levels

(0408030240), three levels (0408030259); and posterior thoracolumbosacral arthrodesis – one level (0408030267), two levels (0408030291), three levels (0408030275), four levels (0408030305), five levels (0408030283), six levels (0408030313), and seven levels (0408030321), as publicly available in the DATASUS Hospital Information System [Sistema de Informações Hospitalares do DATASUS (SIH-SUS)].

The data obtained were analyzed using the Biostat 5.3 program by means of the chi-square test, with a p-value < 0.05 and a confidence interval of 95%. It was not necessary to submit this study to the Institutional Review Board because the data in question was accessed on a public domain database.

RESULTS

Between 2008 and 2018, 66,631 anterior or posterior approach TLS surgeries were recorded. When stratified by the macroregions of Brazil, the South accounted for 34.4% (n=22,921), followed by the Southeast with 34.3% (n=22,848). The North was in fifth place, contributing 2,207 cases, which correspond to 3.3% of the universe studied. (Table 1)

Six hundred and twenty-four deaths were recorded during the period studied, corresponding to 0.93% of all the researched procedures. (Table 2)

When the deaths were distributed by macroregion, the Southeast region was in first place with 46.6% (n=291), followed by the South (34.5%, n=215) and Northeast (8.7%, n=54) regions. The North region accounted for 2.9% (n=18) of all recorded deaths. (Table 2)

The total mortality found was 9.37 deaths for every thousand procedures performed. The Southeast had a higher rate during the period studied (12.74 deaths per thousand procedures), followed by the South (9.38 deaths per thousand procedures) and the North (6.29 deaths per thousand procedures). The Central-West was the macroregion with the lowest mortality ratio (4.57 deaths per thousand procedures performed). (Table 3)

We determined that the overall mortality rate for posterior approach thoracolumbosacral arthrodesis tends to increase proportionally according to the number of operated levels (p-value < 0.0001).

Table 1. Distribution of the procedures performed between 2008 and 2018 by type of thoracolumbosacral arthrodesis (anterior or posterior approach), their levels and respective percentages, by macroregion. Belém, Pará, Brazil, 2019.

Arthrodesis	Level	S	%	Se	%	Cw	%	Ne	%	N	%	Total*	%
Anterior approach	I	304	23.2%	630	48.2%	88	6.7%	211	16.1%	75	5.7%	1308	100%
	II	235	24.1%	414	42.5%	53	5.4%	184	18.9%	88	9.0%	974	100%
	III	148	20.0%	325	43.9%	51	6.9%	156	21.1%	60	8.1%	740	100%
Posterior approach	I	3295	36.5%	3048	33.8%	1635	18.1%	843	9.3%	199	2.2%	9020	100%
	II	7393	38.8%	5648	29.6%	2999	15.7%	2482	13.0%	552	2.9%	19074	100%
	III	4766	32.3%	4634	31.4%	2514	17.0%	2353	15.9%	494	3.3%	14761	100%
	IV	3469	33.6%	3967	38.4%	1441	13.9%	1107	10.7%	346	3.3%	10330	100%
	V	1724	31.5%	2174	39.8%	446	8.2%	820	15.0%	302	5.5%	5466	100%
	VI	548	32.2%	750	44.0%	162	9.5%	201	11.8%	42	2.5%	1703	100%
	VII	1039	31.9%	1258	38.6%	682	21.0%	227	7.0%	49	1.5%	3255	100%
Total		22921	34.4%	22848	34.3%	10071	15.1%	8584	12.9%	2207	3.3%	66631	100%

S: South; SE: Southeast; CW: Central-West; NE: Northeast; N: North; Confidence interval 95%; *p<0.05 (χ² test = 2007.6439; p< 0.0001). Source: Ministry of Health – SUS Hospital Information System (SIH/SUS).

Table 2. Distribution of deaths reported between 2008 and 2018 by type of thoracolumbosacral arthrodesis (anterior or posterior approach), their levels and respective percentages, by macroregion. Belém, Pará, Brazil, 2019.

Arthrodesis	Level	S	%	Se	%	Cw	%	Ne	%	N	%	Total*	%
Anterior approach	I	4	26.7%	8	53.3%	1	6.7%	2	13.3%	0	0.0%	15	100%
	II	2	25.0%	4	50.0%	1	12.5%	0	0.0%	1	12.5%	8	100%
	III	4	28.6%	7	50.0%	1	7.1%	1	7.1%	1	7.1%	14	100%
Posterior approach	I	5	16.7%	15	50.0%	1	3.3%	7	23.3%	2	6.7%	30	100%
	II	19	23.5%	47	58.0%	5	6.2%	8	9.9%	2	2.5%	81	100%
	III	38	30.2%	47	37.3%	18	14.3%	16	12.7%	7	5.6%	126	100%
	IV	54	38.3%	66	46.8%	12	8.5%	8	5.7%	1	0.7%	141	100%
	V	25	29.8%	45	53.6%	4	4.8%	7	8.3%	3	3.6%	84	100%
	VI	30	56.6%	22	41.5%	0	0.0%	1	1.9%	0	0.0%	53	100%
	VII	34	47.2%	30	41.7%	3	4.2%	4	5.6%	1	1.4%	72	100%
Total		215	34.5%	291	46.6%	46	7.4%	54	8.7%	18	2.9%	624	100%

S: South; SE: Southeast; CW: Central-West; NE: Northeast; N: North; *p<0.05 (χ² test=69.8553; p=0.0102). Confidence interval 95%. Source: Ministry of Health – SUS Hospital Information System (SIH/SUS).

Table 3. Mortality ratio between 2008 and 2018 according to type of thoracolumbosacral arthrodesis (anterior or posterior approach) and their levels by macroregion. Belém, Pará, Brazil, 2019.

Arthrodesis	Level	M S	M SE	M CW	M NE	M N	Total*
Anterior approach	I	13.16	12.70	11.36	9.48	0.00	11.47
	II	8.51	9.66	18.87	0.00	11.36	8.21
	III	27.03	21.54	19.61	6.41	16.67	18.92
Posterior approach	I	1.52	4.92	0.61	8.30	10.05	3.33
	II	2.57	8.32	1.67	3.22	3.62	4.25
	III	7.97	10.14	7.16	6.80	14.17	8.54
	IV	15.57	16.64	8.33	7.23	2.89	13.65
	V	14.50	20.70	8.97	8.54	9.93	15.37
	VI	54.74	29.33	0.00	4.98	0.00	31.12
	VII	32.72	23.85	4.40	17.62	20.41	22.12
Total		9.38	12.74	4.57	6.29	8.16	9.37

M: Mortality; S: South; SE: Southeast; CW: Central-West; NE: Northeast; N: North; * $p < 0.05$ (χ^2 test = 175.5712; $p < 0.0001$), Confidence interval 95%. Note: To calculate mortality, the total number of procedures performed by approach and respective level was used as the denominator. The number of deaths was divided by the denominator and multiplied by one thousand. Source: Ministry of Health – SUS Hospital Information System (SIH/SUS).

DISCUSSION

It is known that the main goals of spinal surgery are to increase functional capacity and relieve pain.¹² Its indication depends on the details of each patient and it rarely causes death. Thus, the risk of life-threatening complication should be as low as possible.¹³

In the Unified Health System (SUS), TLS arthrodesis can be performed electively and classified as anterior approach (I, II, and III levels) or posterior approach (I to VII levels) and recorded in the Hospital Information System (SIH). During the study period, 66,631 procedures were recorded.

However, stratification of the number of procedures by Brazilian region revealed considerable discrepancies. Among the possible reasons are the continental size of Brazil and the difference in distribution of hospitals that offer services of high complexity involving spinal surgery across the country. In this sense, the South region, which has a greater number of hospitals that offer spinal surgery services and a greater population consequently has the greatest absolute number of surgeries, about 10 times higher than the North region.^{14,15}

Regarding the absolute number of deaths related to the procedures analyzed, the Southeast region is in first place with 46.6% of deaths, followed by the South (34.5%, $n=215$) and Central-West (8.7%, $n=54$) regions.

In the SIH, there is no information about which factors led to patient death or whether the cause of death was direct or indirect. Death by direct cause occurs from complications during the surgical procedure

due to interventions, omissions, or incorrect treatment, while death by indirect cause involves aggravating factors existent prior to surgery.¹⁶

In a study conducted in Finland based on information systems, it was possible to identify several variables, such as reason for surgery, sex, age, and causes of direct and indirect death, making it easier to set real goals to resolve or minimize focal points that lead to patient death,¹² which is not tangible with the SIH database.

When calculating the mortality ratio, we found a TLS arthrodesis mortality rate (MR) of 9.37 cases per thousand procedures, corresponding to 0.94% of the entire universe. This result is significant when compared to the results of countries where the overall average is 0.08%.¹²

Studies that evaluate the quality of life of patients submitted to spinal arthrodesis suggest that the increase in extension is unrelated to the worst clinical outcomes.¹⁷ In this study, however, we found the highest mortality rates in patients submitted to arthrodesis with the number of levels involved in the surgery.

Mortality rate is known to be a sensitive indicator of a population's quality of life and reflects the quality of service being provided to users. Thus, the imperative to improve the qualification of both professionals and the various techniques for performing procedures involving the TLS region is evident.

It is important for the SIH to add variables to the system to facilitate access, to enable more thorough research, and to disseminate information to the academic community to stimulate further study and to minimize complications.

In this study, deaths could not be correlated to medical errors, surgery sequelae, risks, or direct or indirect causes of death. Nevertheless, it can be concluded that TLS arthrodesis is a widely used procedure for surgical correction of Unified Health System patients and, therefore, there needs to be a greater effort to identify the factors that lead to high morbidity and mortality in several Brazilian macroregions.

CONCLUSION

The study of the epidemiological profile of thoracolumbosacral arthrodesis is important, especially in a country whose population is heterogeneous and has different mortality rates between region. Thus, it is necessary to create measures that identify and prevent the factors that lead to the death of patients undergoing such procedures.

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