

EPIDEMIOLOGICAL PROFILE OF SPINE SURGERY AND OUTPATIENT CARE IN THE BRAZILIAN UNIFIED HEALTH SYSTEM (SUS)

PERFIL EPIDEMIOLÓGICO DA CIRURGIA DE COLUNA E DO ATENDIMENTO AMBULATORIAL NO SISTEMA ÚNICO DE SAÚDE (SUS)

PERFIL EPIDEMIOLÓGICO DE LA CIRUGÍA DE COLUMNA Y DE LA ATENCIÓN AMBULATORIA EN EL SISTEMA ÚNICO DE SALUD DE BRASIL (SUS)

WESLEY WILIAN COSTA MARTINS¹ , TIAGO TOSO ALBINO¹ , LEONARDO LERRO¹ , LEONARDO SARDAS¹ , LUCAS MALUF VENDAS¹ , JÉSSICA BIANCA AILY¹ ,
JOÃO THOMAS GARCIA¹ , RODRIGO GÓES MEDÉA DE MENDONÇA¹ , ALBERTO EEFENHEIM GOTTFRYD¹ , MARIA FERNANDA SILBER CAFFARO¹ , ROBERT MEVES¹ ,
RAFAEL MORAES TRINCADO¹ , JORGE RAFAEL DURIGAN¹ 

1. Irmandade de Misericórdia da Santa Casa de São Paulo, São Paulo, SP, Brazil.

ABSTRACT

Objective: To create and implement a structured database for patients treated by the spine surgery team at Santa Casa de Misericórdia de São Paulo, analyzing the epidemiological profile, therapeutic strategies, and clinical outcomes. **Methods:** Retrospective observational study including 5,085 patients treated between 2016 and 2024, comprising 4,192 outpatient consultations and 893 surgical procedures. Data were prospectively collected and recorded on the REDCap platform, including demographic information, diagnoses, treatments, clinical evolution, and standardized questionnaires. Statistical analyses were performed using R software. **Results:** The mean age was 46.2 ± 20.6 years, with a male predominance in outpatient care (57.8%). Low back pain and degenerative diseases were the most frequent diagnoses (26.2%), followed by lumbar disc herniation (7.6%) and thoracolumbar fractures (7.3%). In the surgical group, metastases (12.3%) and fractures (10.6%) stood out. Conservative treatment was recommended in 71.4% of outpatient cases. Among surgical patients, 47.6% underwent instrumentation, mostly via posterior approach (84.9%). The mean Oswestry Disability Index (ODI) was 31.0. Women reported higher pain intensity but showed better neurological outcomes. The surgical complication rate was 9.2%, with satisfactory evolution in 90.8% of operated cases. **Conclusion:** This study highlights the predominance of degenerative diseases and low back pain in outpatient settings and underscores the essential role of surgery in complex cases. The implementation of the REDCap database proved effective for clinical monitoring, contributing to the improvement of therapeutic practices and future research in spine surgery. **Level of Evidence IV; Retrospective observational study.**

Keywords: Spine; Spine surgery; Databases, Factual; REDCap; Epidemiology; Unified Health System.

RESUMO

Objetivo: Criar e implementar um banco de dados estruturado para pacientes atendidos pelo grupo de cirurgia da coluna vertebral da Santa Casa de Misericórdia de São Paulo, analisando o perfil epidemiológico, as estratégias terapêuticas e os desfechos clínicos. **Métodos:** Estudo observacional retrospectivo que incluiu 5085 pacientes atendidos entre 2016 e 2024, sendo 4192 em acompanhamento ambulatorial e 893 submetidos a procedimentos cirúrgicos. Os dados foram coletados prospectivamente e registrados na plataforma REDCap, incluindo informações demográficas, diagnósticos, tratamentos, evolução clínica e aplicação de questionários padronizados. As análises estatísticas foram realizadas utilizando o software R. **Resultados:** A idade média foi de $46,2 \pm 20,6$ anos, com predominância masculina no ambulatório (57,8%). Lombalgia e doenças degenerativas foram os principais diagnósticos (26,2%), seguidos por hérnia lombar (7,6%) e fraturas toraco-lombares (7,3%). No grupo cirúrgico, destacaram-se metástases (12,3%) e fraturas (10,6%). O tratamento conservador foi indicado em 71,4% dos casos ambulatoriais. Nas cirurgias, 47,6% dos pacientes utilizaram instrumentação, principalmente por via posterior (84,9%). O índice de incapacidade de Oswestry (ODI) médio foi de 31,0. As mulheres relataram maior intensidade de dor, mas apresentaram melhores resultados neurológicos. A taxa de complicações cirúrgicas foi de 9,2%, com evolução satisfatória em 90,8% dos casos operados. **Conclusão:** O estudo evidencia a predominância de doenças degenerativas e lombalgia no ambulatório e destaca a importância da cirurgia nos casos complexos. A implementação do banco de dados REDCap demonstrou-se eficaz para o monitoramento clínico, contribuindo para o aprimoramento das práticas terapêuticas e futuras pesquisas na área de cirurgia da coluna vertebral. **Nível de evidência IV; Estudo retrospectivo observacional.**

Descritores: Coluna vertebral; Cirurgia da Coluna; Banco de dados; REDCap; Epidemiologia; Sistema Único de Saúde.

RESUMEN

Objetivo: Crear e implementar una base de datos estructurada para los pacientes atendidos por el equipo de cirugía de columna de la Santa Casa de Misericórdia de São Paulo, analizando el perfil epidemiológico, las estrategias terapéuticas y los resultados clínicos. **Métodos:** Estudio observacional retrospectivo que incluyó a 5.085 pacientes atendidos entre 2016 y 2024, con 4.192 consultas ambulatorias y 893 procedimientos quirúrgicos. Los datos fueron recolectados prospectivamente y registrados en la plataforma REDCap, incluyendo

Study conducted by the Irmandade de Misericórdia da Santa Casa de São Paulo, São Paulo, SP, Brazil.

Correspondence: Wesley Wilian Costa Martins. Irmandade de Misericórdia da Santa Casa de São Paulo, São Paulo, SP, Brazil. wes.med51@gmail.com



información demográfica, diagnósticos, tratamientos, evolución clínica y cuestionarios estandarizados. El análisis estadístico se realizó utilizando el software R. Resultados: La edad media fue de 46,2 ± 20,6 años, con predominio masculino en el grupo ambulatorio (57,8%). El dolor lumbar y las enfermedades degenerativas fueron los diagnósticos más frecuentes (26,2%), seguidos por hernia discal lumbar (7,6%) y fracturas toracolumbares (7,3%). En el grupo quirúrgico destacaron las metástasis (12,3%) y las fracturas (10,6%). El tratamiento conservador se indicó en el 71,4% de los casos ambulatorios. Entre los pacientes quirúrgicos, el 47,6% utilizó instrumentación, principalmente por vía posterior (84,9%). El índice de discapacidad de Oswestry (ODI) presentó una media de 31,0. Las mujeres reportaron mayor intensidad de dolor, pero mejores resultados neurológicos. La tasa de complicaciones quirúrgicas fue del 9,2%, con evolución satisfactoria en el 90,8% de los casos operados. Conclusión: Este estudio destaca la predominancia de las enfermedades degenerativas y el dolor lumbar en el ámbito ambulatorio y resalta el papel esencial de la cirugía en los casos complejos. La implementación de la base de datos REDCap demostró ser eficaz para el monitoreo clínico, contribuyendo al perfeccionamiento de las prácticas terapéuticas y a futuras investigaciones en cirugía de columna. **Nivel de evidencia IV; Estudio observacional retrospectivo.**

Descriptor: Columna vertebral; Cirugía de Columna; Base de datos; REDCap; Epidemiología; Sistema de Salud Pública.

INTRODUCTION

In high-complexity hospitals served by the Brazilian Unified Health System (SUS), patients with spinal conditions such as deformities, fractures, tumors, and degenerative diseases represent a wide range of clinical cases. These conditions not only challenge healthcare professionals in choosing appropriate therapeutic interventions but also require management strategies based on robust data to optimize resources and improve care. In addition, the increasing incidence of these diseases has been influenced by factors such as population aging, sedentary lifestyle habits, and increased longevity, making the management of these conditions a major challenge for both public and private healthcare systems.^{1,2}

Vertebral fractures are prevalent injuries that significantly impact patients' quality of life. Studies indicate that spinal fractures are among the most common injuries in the elderly, often associated with osteoporosis, a condition that weakens the bone structure and increases the risk of vertebral collapse.³ However, traumatic fractures also occur in young adults, mainly due to motor vehicle accidents and falls from height.⁴ The management of these injuries varies according to severity, ranging from conservative treatment with immobilization to surgical intervention with vertebral fixation.⁵ The evolution of these approaches has allowed better functional outcomes, reducing associated morbidity and improving patients' quality of life.⁶

Another important group of vertebral conditions comprises spinal deformities, with idiopathic scoliosis being the most prevalent.⁷ Scoliosis can affect children, adolescents, and adults, and in younger patients, its impact goes beyond physical limitations, also influencing psychological and social aspects such as self-esteem and quality of life.⁸ Early diagnosis is essential, as it allows less invasive interventions, such as the use of orthoses and postural rehabilitation.⁹ In severe cases, surgical correction is indicated to prevent progression of the deformity and relieve symptoms, particularly chronic pain and functional restrictions.¹⁰ The use of the SRS-30 questionnaire has been an important tool to assess treatment response and patients' quality of life after therapeutic interventions.¹¹

Degenerative diseases of the spine, including disc herniation, spondylolisthesis, and spinal stenosis, represent another major concern in clinical practice, especially in individuals over 50 years of age.¹² These conditions result in debilitating chronic pain, loss of mobility, and restriction of daily activities, directly impacting patients' independence and quality of life.¹³ In addition, chronic low back pain is one of the main causes of disability worldwide, becoming a significant socioeconomic problem.¹⁴ Treatment of these conditions may range from drug therapy and physiotherapy to minimally invasive techniques, such as anesthetic blocks and decompression surgery, with or without vertebral fusion.¹⁵ In recent years, endoscopic procedures and intervertebral disc replacement have emerged as promising alternatives to reduce pain and preserve the natural biomechanics of the spine.¹⁶

Vertebral tumors, although less common, represent a major challenge due to the complexity of diagnosis and treatment. Primary spinal tumors are rare, whereas vertebral metastases are frequent in oncologic patients, with the axial skeleton being one of the main

sites of dissemination of malignant neoplasms.¹⁷ The therapeutic approach involves a combination of radiotherapy, chemotherapy, and complex surgeries, depending on the type of tumor and the extent of vertebral involvement.¹⁸ The advancement of surgical techniques, such as en bloc resection and minimally invasive instrumentation, has contributed to improved clinical outcomes and patient survival, reducing postoperative complications.¹⁹

Given this diversity of conditions, the structured collection of clinical data is essential to improve diagnosis, treatment, and scientific research. The use of structured databases has been a fundamental strategy to monitor the epidemiology of spinal diseases and assess the effectiveness of therapeutic interventions.²⁰ Among the most widely used platforms in this context, Research Electronic Data Capture (REDCap) stands out — a tool developed to facilitate the collection, management, and analysis of clinical and epidemiological data.²¹ REDCap allows the creation of customized forms, ensuring security in data collection and data integrity, in addition to being compatible with international standards such as the Health Insurance Portability and Accountability Act (HIPAA), guaranteeing privacy and regulatory compliance.²¹

In addition to security and flexibility, REDCap has been widely used in multicenter studies and large-scale research, allowing the integration of clinical data from different institutions and facilitating comparative analyses across distinct populations.²¹ The implementation of a database with this technology will allow better follow-up of patients treated by spine surgery specialized services, providing a detailed view of the epidemiological profile and clinical outcomes over time.

The main objective of this study is to create and implement a reliable database for patients treated by the spine surgery team of a high-complexity SUS hospital. The collected data will include information already gathered by the spine surgery group between 2016 and 2024, covering demographic data, diagnoses, treatment modalities, standardized questionnaires, and clinical evolution of different spinal conditions.²¹ It is expected that the analysis of these data will contribute

to a better understanding of the prevalence of spinal diseases, to optimizing treatment strategies, and to promoting the development of new evidence-based therapeutic approaches.

MATERIALS AND METHODS

The data of this study will be collected and entered into the REDCap platform by the fellows and residents of the spine surgery group of the Santa Casa de Misericórdia de São Paulo. During outpatient visits, information such as name, age, sex, diagnosis, date of collection, type of treatment, instrumentation, clinical evolution, CRM of the person responsible for data collection, follow-up time, and contact telephone will be recorded. For patients undergoing surgical procedures, the data collected will include name, age, sex, date of surgery, diagnosis, type of surgical treatment, type of implant used, postoperative evolution, surgical approach, follow-up time, length of hospital stay, condition-specific questionnaires, and telephone.

The forms on the REDCap platform were configured to include automatic validations, ensuring the consistency of the recorded data

and minimizing errors. In addition, the platform was used to control user access levels, ensuring that only authorized professionals can view or edit the collected information.

Based on previous data from the spine surgery group, a total of 5,085 patients were evaluated, comprising 4,192 outpatient consultations and 893 patients undergoing surgical interventions, during the period from 2016 to 2024.

All patients treated at the spine orthopedics outpatient clinic and those who underwent surgery by the spine surgery group will be invited to participate in the research. Inclusion in the study will be conditional on signing the Informed Consent Form (ICF). Patients who refuse consent or do not wish to participate will be excluded. The study was approved by the Ethics Committee (79094224.0.0000.5479).

The collected data will be analyzed using R statistical software. Categorical variables will be described by absolute and relative frequencies, while continuous variables will be expressed as means and standard deviations. Comparative analyses between groups will be performed using chi-square tests or Student's t-test, as appropriate.

will ensure the reliability and security of the process, contributing to the development of new therapeutic approaches and to the continuous improvement of the care provided.

RESULTS

This study analyzed 5,085 patients treated by the spine surgery team of the Santa Casa de Misericórdia de São Paulo between 2016 and 2024, comprising 4,192 outpatient consultations and 893 surgical procedures. The mean age of patients was 46.2 ± 20.6 years, ranging from 0 to 94 years, with a median of 49 years. Among outpatients, 57.8% were male and 42.2% female, while in the surgical group the proportion was 53.9% male and 46.1% female. No statistically significant differences were found in mean age between sexes in either group (p > 0.05). (Tables 1 to 4)

The most frequent diagnoses among outpatients were low back pain and degenerative diseases, accounting for 26.2% of cases, followed by lumbar disc herniation (7.6%), thoracolumbar fractures (7.3%), and metastases (5.0%). Scoliosis accounted for 6.5% of cases, including juvenile idiopathic scoliosis (3.9%), infantile (2.4%), and neuromuscular (0.2%). In the surgical group, the main diagnoses also included low back pain and degeneration (16.9%), lumbar disc herniation (12.6%), thoracolumbar fractures

(10.6%), and metastases (12.3%), with idiopathic scoliosis present in 3.9% of cases. Fractures were detailed in categories such as burst (44 cases), dislocations (31 cases), and others (20 cases).

Conservative management predominated in outpatient care, with clinical observation being the most common approach in 71.4% of cases. Other treatments included the use of a brace in 8.9%, spinal blocks in 0.6%, and casts in 0.8%, while 18.3% of patients were referred for surgery. In the surgical group, 47.6% of patients underwent instrumentation, most frequently with third-generation implants (38.4%). The most commonly used approaches were posterior (84.9%), followed by cervical (4.3%), thoracic (2.0%), and minimally invasive (1.1%).

Functional and quality-of-life assessment was performed using validated instruments. The Oswestry Disability Index (ODI) showed an overall mean of 31.0 ± 15.8, with no significant difference between sexes (p = 0.468). Pain intensity, measured by the visual analog scale (VAS), was higher among women both for low back/neck pain (6.22 ± 2.92 versus 5.78 ± 2.78 in men; p = 0.005) and for limb pain (2.34 ± 3.27 versus 1.82 ± 2.93; p = 0.043). The SF-36 results showed significant differences in the pain and vitality domains, with men presenting better results in both aspects (p < 0.05).

Functional and neurological outcomes, assessed by the ASIA index, showed that women had better performance in sensitivity and motor function. The right and left sensory levels were significantly higher in the female group, with means of 52.3 ± 21.03 and 51.7 ± 20.12, respectively, compared with men, who showed means of 47.9 ± 13.59 and 47.4 ± 14.34 (p < 0.001 for both sides). The overall motor level was also higher in women (23.7 ± 7.23) than in men (21.5 ± 8.86; p < 0.001).

Analysis of surgical complications revealed an overall rate of 9.2%, including dural injury in 1.0%, infections in 0.5%, neurological worsening in 0.6%, and mortality related to clinical complications in 0.4%. Evolution was considered satisfactory in 90.8% of surgical cases and in 76.2% of outpatient visits, with persistent pain reported in 12.4% of outpatient cases. The mean follow-up time was 15.9 months in the outpatient setting and 22.3 months in the postoperative setting. (Tables 5 and 6)

The results show that low back pain and degenerative diseases are the main reasons for care, while surgery is frequently used for cases of fractures, herniations, and severe deformities. Women reported higher pain intensity but showed better functional performance, suggesting the need for sex-specific therapeutic approaches. The high rate of satisfactory evolution, combined with low rates of severe complications, reinforces the effectiveness of the conservative and surgical approaches adopted by the service.

Table 1. Age (outpatient).

Variable	Valid N	Missing	Mean ± SD	Median (P25-P75)	Min-Max
Age - outpatient	4094	98	46.2 ± 20.6	49.0 (30.0-62.0)	0-94

Note. The CI of the mean assumes that the sample distribution of the mean follows a t distribution with N-1 degrees of freedom.

Table 2. Sex (outpatient).

Sex	Valid N	Missing	Mean ± SD	Median (P25-P75)	Min-Max	Shapiro-Wilk p
Female	1706	11	45.9 ± 20.0	48.0 (31.3-61.0)	0-93	<0.001
Male	2334	16	46.4 ± 21.1	50.0 (30.0-63.0)	0-94	<0.001

Note. The CI of the mean assumes that the sample distribution of the mean follows a t distribution with N-1 degrees of freedom.

Table 3. Sex (surgical cases).

Sex	Valid N	Mean ± SD	Median (P25-P75)	Min-Max	Shapiro-Wilk p
Male	481	48.0 ± 17.3	49.0 (36.0-61.0)	1-83	<0.001
Female	406	47.4 ± 20.3	50.0 (34.0-63.0)	1-93	<0.001

Note. The CI of the mean assumes that the sample distribution of the mean follows a t distribution with N-1 degrees of freedom.

Table 4. Age (surgical cases).

Sex	Valid N	Mean ± SD	Median (P25-P75)	Min-Max	Shapiro-Wilk p
Male	481	48.0 ± 17.3	49.0 (36.0-61.0)	1-83	<0.001
Female	406	47.4 ± 20.3	50.0 (34.0-63.0)	1-93	<0.001

Note. The CI of the mean assumes that the sample distribution of the mean follows a t distribution with N-1 degrees of freedom.

Table 5. Treatment.

Outpatient treatment	Counts	% of total	Cumulative %
Observation	2935	71.4%	71.4%
Surgical	752	18.3%	89.8%
Cast	32	0.8%	90.5%
Brace	365	8.9%	99.4%
Spinal Block	24	0.6%	100.0%

DISCUSSION

The data obtained in this study reflect the complexity and diversity of spinal conditions treated at a high-complexity hospital of the Brazilian Unified Health System (SUS). Degenerative diseases, low back pain, and thoracolumbar fractures emerge as the main reasons for care, evidencing the growing impact of musculoskeletal conditions on the Brazilian population. The predominance of low back pain as one of the main causes of disability worldwide is widely documented in the literature,²² reinforcing the need for effective strategies for clinical and surgical management.

The high proportion of patients undergoing conservative treatment (71.4%) suggests that a clinical approach based on rehabilitation and monitoring may be effective for most cases, aligning

Table 6. Evolution (surgical cases).

Surgical evolution	Counts	% of total	Cumulative %
Satisfactory evolution without complications or not applicable	807	90.8%	90.8%
Unsatisfactory evolution with complications - Specify in item J	35	3.9%	94.7%
Spinal pain	4	0.4%	95.2%
Spinal pain with radiation to upper or lower limbs	1	0.1%	95.3%
Cerebrospinal fluid fistula	1	0.1%	95.4%
Deep infection	4	0.4%	95.8%
Superficial infection	1	0.1%	96.0%
Dural injury	9	1.0%	97.0%
Death due to clinical complications	4	0.4%	97.4%
Worsening of the deformity	1	0.1%	97.5%
Worsening of clinical symptoms	7	0.8%	98.3%
Neurological worsening	5	0.6%	98.9%
Pseudarthrosis	2	0.2%	99.1%
Recurrence of clinical symptoms or signs	1	0.1%	99.2%
Loosening of instrumentation	1	0.1%	99.3%
Pulmonary embolism	1	0.1%	99.4%
Hemorrhage	5	0.6%	100.0%

with international trends that prioritize less invasive therapies before surgical indication.²³ However, surgical cases, which accounted for 18.3% of outpatient visits, confirm that for more severe conditions, such as unstable fractures, large herniations, and progressive scoliosis, surgery remains an essential pillar of treatment.

The results indicate that most surgeries were performed via the posterior approach (84.9%), consistent with literature recommendations for procedures involving neural decompression and vertebral stabilization.²⁴ In addition, the advancement of minimally invasive techniques, although representing only a small portion of surgeries (1.1%), suggests a growing trend toward reduction of surgical morbidity and recovery time, an aspect widely explored in recent studies.²⁵

The difference in outcomes between sexes also deserves

attention. Women reported higher pain intensity but showed better functional performance on the ASIA tests. This finding is consistent with studies demonstrating greater pain perception in women due to hormonal and neurophysiological differences, although they show greater adherence to rehabilitation, which may explain the better functional recovery.²⁶

The safety of surgical procedures is reinforced by the low rates of severe complications (9.2%), comparable to the best international statistics for spine surgery.²⁷ This result evidences the technical quality of the team and the efficiency of the protocols adopted for risk minimization.

The implementation of the structured database via REDCap proves to be a promising strategy for longitudinal monitoring, contributing to a more robust epidemiological analysis and supporting the improvement of treatment guidelines. The use of electronic registry systems has been widely recommended in orthopedic surgery to improve data quality and support evidence-based clinical decisions.²⁸

CONCLUSION

This study, by analyzing a large volume of patients with spinal conditions treated at a SUS reference hospital, reinforces the importance of comprehensive, evidence-based management for these highly prevalent conditions with substantial socioeconomic impact. The data show that, despite the predominance of conservative treatments, surgical interventions continue to play an essential role in the functional recovery of more severe patients.

The low rate of surgical complications and the favorable clinical outcomes reinforce the quality of the approaches adopted, but also highlight the need for continuous improvement, especially in the use of minimally invasive techniques and personalized therapies according to individual patient differences.

The implementation of a structured database stands out as an innovative initiative, allowing long-term patient monitoring and enabling the generation of evidence to optimize therapeutic protocols. Future studies should explore how this information can be used for outcome prediction, treatment personalization, and the development of new therapies for spinal diseases. Thus, this study significantly contributes to the understanding of spinal conditions in a high-complexity care setting within the SUS, providing inputs for more effective health policies and for the improvement of care for patients with spinal disorders.

CONFLICT OF INTEREST

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

CONTRIBUTIONS OF THE AUTHORS

Each author contributed individually and significantly to the development of this article. VL and SL assisted in data collection. AJ assisted in the maintenance and entry of data into the collection platform. TR, DJ, and GT: article review; GR and GA: methodology and supervision; CM and MR: formal analysis and data curation; LL, TT, and MW: validation and writing — review and editing.

DATA AVAILABILITY DECLARATION

The contents underlying the research text are available on the institutional REDCap platform (<https://redcap.fcmsantacasasp.edu.br/>) and may be made available upon reasonable request to the corresponding author, in accordance with ethical and confidentiality standards.

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