

Surgical Timing in Patients with Vertebral Metastases and Neurological Impairment in the Public Health System: A Case Series and Literature Review

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ABSTRACT

Introduction: Vertebral metastases account for 40% of all bone metastases and are often complicated by spinal cord compression, which constitutes an emergency. Decompression surgery within the first 48 hours has been proposed as the most effective strategy. In the public health system of the Autonomous City of Buenos Aires (CABA), Argentina, the care of these patients is affected by the heterogeneity of the healthcare system and the resources available. **Materials and Methods:** A retrospective, descriptive case series study was conducted at a public hospital in CABA between 2018 and 2023. Patients aged >18 years with vertebral metastases and neurological deficits who underwent surgery were included. Patients with incomplete data or no neurological deficits were excluded. Clinical, functional, and prognostic variables were analyzed using descriptive statistics. **Results:** Fourteen patients were included (12 women and 2 men; median age, 59 years). The main causes of surgical delay were a lack of surgical supplies, delayed diagnosis, and poor treatment adherence. **Conclusions:** Problems related to surgical delays in patients with vertebral metastases and neurological impairment were documented to raise awareness of this issue. A lack of surgical supplies and delayed diagnosis were identified as the main areas requiring improvement.

Keywords: Spinal neoplasms; spinal cord compression; neurological deficits; spine; surgery; access to health services.

Level of Evidence: IV

Oportunidad quirúrgica en pacientes con metástasis vertebrales y lesión neurológica en el ámbito público de la salud: serie de casos y revisión bibliográfica

RESUMEN

Introducción: Las metástasis vertebrales representan el 40% de todas las metástasis óseas y, a menudo, se complican con la compresión del neuroeje, lo que representa una urgencia. La cirugía de descompresión dentro de las primeras 48 h se postula como la estrategia más eficaz. En el sistema público de la Ciudad Autónoma de Buenos Aires (CABA), Argentina, la atención de estos pacientes está condicionada por la heterogeneidad del sistema de salud y los recursos disponibles. **Materiales y Métodos:** Se realizó un estudio retrospectivo, descriptivo de una serie de casos en un hospital público de la CABA, entre 2018 y 2023. Se incluyó a pacientes >18 años con metástasis vertebral y déficit neurológico, tratados con cirugía. Se excluyó a los pacientes con datos incompletos y sin déficits neurológicos. Se analizaron variables clínicas, funcionales y pronósticas mediante estadística descriptiva. **Resultados:** Se incorporó a 14 pacientes (12 mujeres, 2 hombres, mediana de edad: 59 años). Las causas principales de la demora quirúrgica fueron la falta de materiales quirúrgicos, el diagnóstico tardío y la falta de adherencia al tratamiento. **Conclusiones:** Se documentaron conflictos en la demora quirúrgica de pacientes con metástasis vertebrales y daño neurológico, con el objetivo de visibilizar esta problemática, y se destaca la falta de material quirúrgico y el diagnóstico tardío como las principales causas por mejorar.

Palabras clave: Neoplasias espinales; compresión de la médula espinal; déficits neurológicos; columna vertebral; cirugía; accesibilidad a los servicios de salud.

Nivel de Evidencia: IV

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INTRODUCTION

Vertebral metastases are the most common secondary skeletal oncologic lesions and account for approximately 40% of bone metastases. Compression of the neuraxis is the most severe complication and occurs in 5-10% of patients.¹⁻³

Neurological involvement is common in patients with advanced cancer and delayed diagnosis.³ Progressive neurological deficit is a surgical emergency, and decompression surgery within 48 hours of the onset of neurological deficit is considered the safest and most effective strategy.⁴⁻¹³ However, the optimal timing of surgery in patients with vertebral metastases and neurological deficits remains controversial.

It is estimated that diagnosis is delayed by two months from the onset of the first significant symptom until the neurological deficit is adequately documented.¹ Most patients experience pain before the onset of neurological symptoms, make multiple visits to the emergency department, and, in some cases, have no previous diagnosis of the primary malignancy. Other factors reported in the literature include delays in referral to a specialized center and limited availability of imaging studies.¹⁻⁷

In our setting, the care of these patients may be affected by the heterogeneity of the healthcare system and the resources available, making it difficult to implement evidence-based recommendations in daily practice. In the authors' experience, issues related to the availability of appointments, diagnostic studies, operating room time, anesthesia, intensive care unit beds, and surgical implants are among the difficulties faced by spine surgeons when attempting to treat these patients within the optimal therapeutic window.

We present a series of patients with vertebral metastases and neurological deficits who underwent surgery at a public hospital and analyze surgical delays and their associated causes.

MATERIALS AND METHODS

A descriptive, retrospective case-series study was conducted in patients with vertebral metastases and neurological deficits who underwent surgery at a single public hospital in the Autonomous City of Buenos Aires between January 2018 and January 2023. Patients were selected according to the following criteria: adults of both sexes with pathological vertebral fractures due to metastatic disease and clinical and imaging evidence of neuraxis compression. Impairment was assessed using the *American Spinal Injury Association* (ASIA) Impairment Scale, and patients with grades A, B, C, and D were included.^{14,15}

Data were obtained from the medical records for the following variables: age, sex, neurological deficit according to the ASIA scale, comorbidities, underlying malignancy, general condition according to the Karnofsky Performance Status, survival score according to the Tokunashi score, mechanical instability determined by the *Spine Instability Neoplastic Score* (SINS), and surgical delay (calculated as the time from the onset of neurological deficit, according to the medical records, to decompression surgery). In addition, factors contributing to surgical delay after surgery was indicated were recorded. These factors were grouped into the following categories: clinical instability, implant-related delays, intensive care unit bed availability, anesthesiologist availability, operating room availability, and other factors.

Statistical Analysis

Categorical variables are expressed as numbers and percentages and were analyzed using the χ^2 test. Numerical variables are presented as means or medians and were analyzed using Student's *t*-test or the Mann-Whitney U test according to whether their distribution was normal or nonparametric, respectively. A *p* value <0.05 was considered statistically significant.

Statistical analyses were performed using SPSS version 25. The principles of the Declaration of Helsinki for research involving identifiable patient data were followed. Confidential, anonymized records were used.

RESULTS

Twenty patients with vertebral metastases and neurological deficits who underwent surgery and were hospitalized at our center during the study period were identified. Six were excluded because of missing data. The final sample consisted of 14 patients, 12 women (85.7%) and two men (14.3%), with a median age of 59 years (range, 36-69). The most common primary tumor was breast cancer (35.7%), followed by lung cancer (21.4%) and prostate cancer (21.4%) (Figure 1).

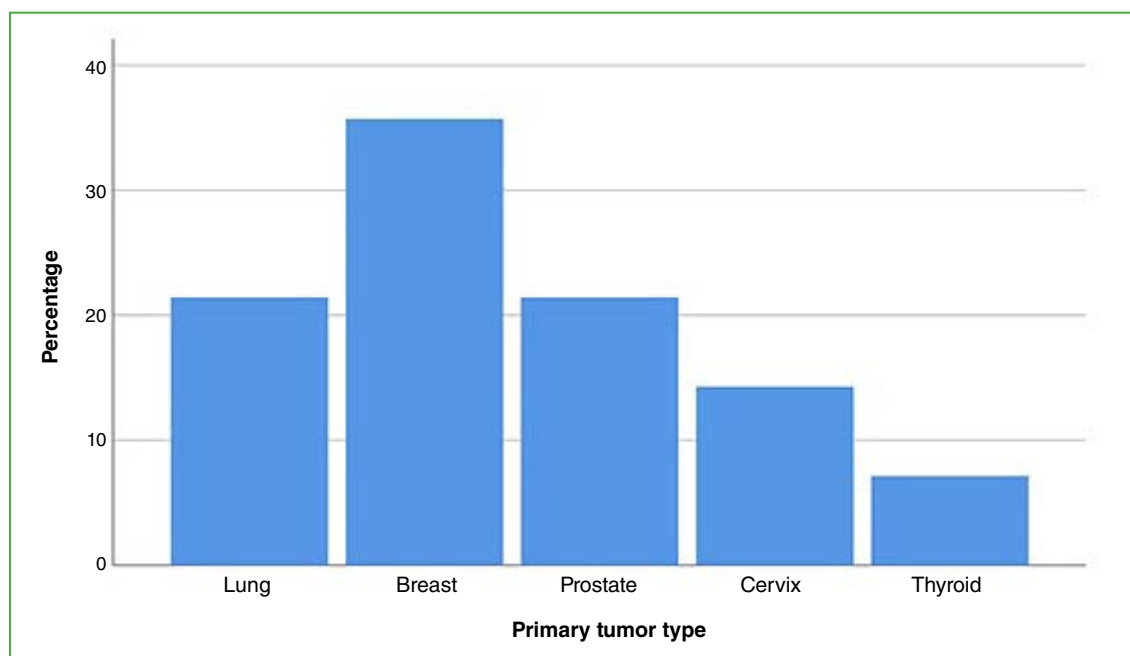


Figure 1. Distribution of primary tumor types: breast cancer (35.7%), lung cancer (21.4%), prostate cancer (21.4%), cervical cancer (14.3%), and thyroid cancer (7.1%).

Neurological status was assessed using the ASIA scale. Grade D accounted for 57.1% of patients, grade C for 28.6%, and grade B for 14.3%. According to the Karnofsky score, 35.7% were able to work and care for themselves, 35.7% were unable to work and required some assistance, and 28.6% required extensive care.

According to the SINS, 28.6% of patients were classified as unstable and 71.4% as potentially unstable. **Figure 2** shows the Tokuhashi scores for patient prognosis.

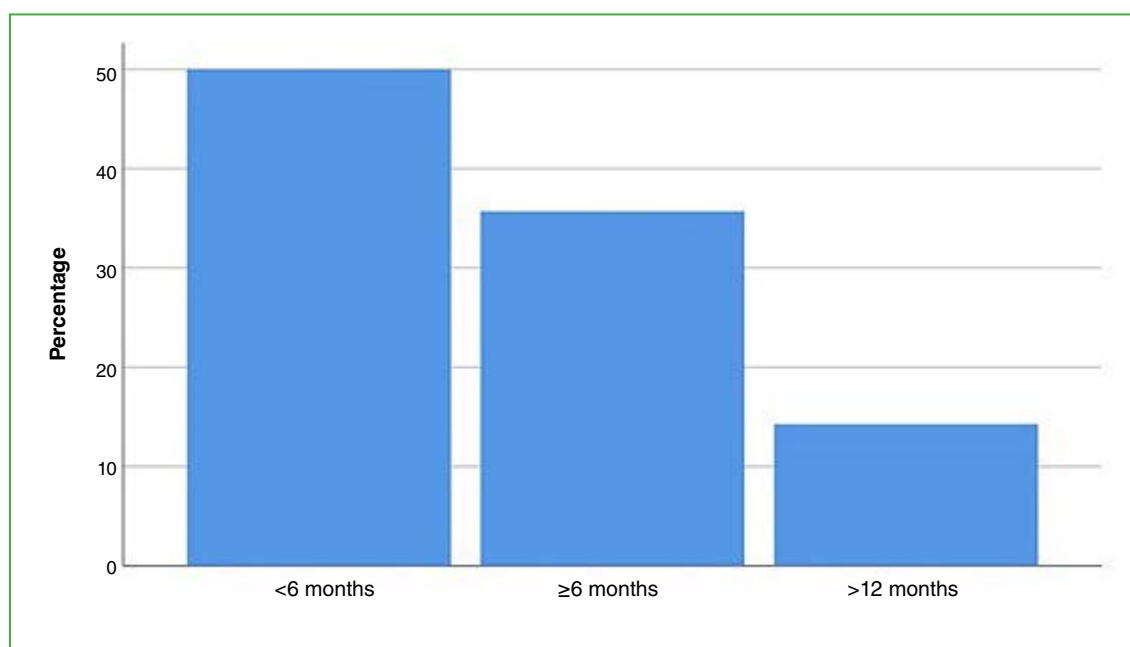


Figure 2. Distribution of prognosis according to the Tokuhashi score.

The underlying disease progressed in 28.5% of patients; three patients (21.4%) had progression of metastatic disease, and one (7.14%) sustained a pathological hip fracture due to disease progression.

The median surgical delay from diagnosis of the neurological deficit to surgery was 28 days (range, 4-90).

The most common location of metastases was the thoracic spine (50%), followed by the lumbar spine (28.6%). Two patients (14.3%) had thoracolumbar involvement, and one (7.1%) had involvement of the entire spine. No cervical or sacral metastases were detected.

Patients were assessed using the ASIA scale at the time of consultation with the spine specialist. Two (14.3%) had preserved sensation but no motor function (ASIA B); eight (57.1%) had some degree of incomplete motor impairment (ASIA C and D); and four (28.6%) had no neurological deficits at the initial assessment (ASIA E).

Regarding access to the healthcare system, three patients (21.4%) presented through the emergency department, six (42.9%) were referred from other specialties, and five (35.7%) were diagnosed directly by the spine specialist.

The documented causes of surgical delay were delays in obtaining surgical implants (100%), delayed diagnosis with an established neurological deficit (42.8%), and lack of adherence, including treatment discontinuation by the patient or failure to attend scheduled follow-up visits (21.4%). No issues related to intensive care unit bed, operating room, or anesthesiologist availability were documented. [Figure 3](#) shows an illustrative case.

Given the small sample size of this case series ($n = 14$), the statistical analysis was limited to descriptive statistics. In this context, inferential statistical methods would not be appropriate and would not yield robust conclusions.

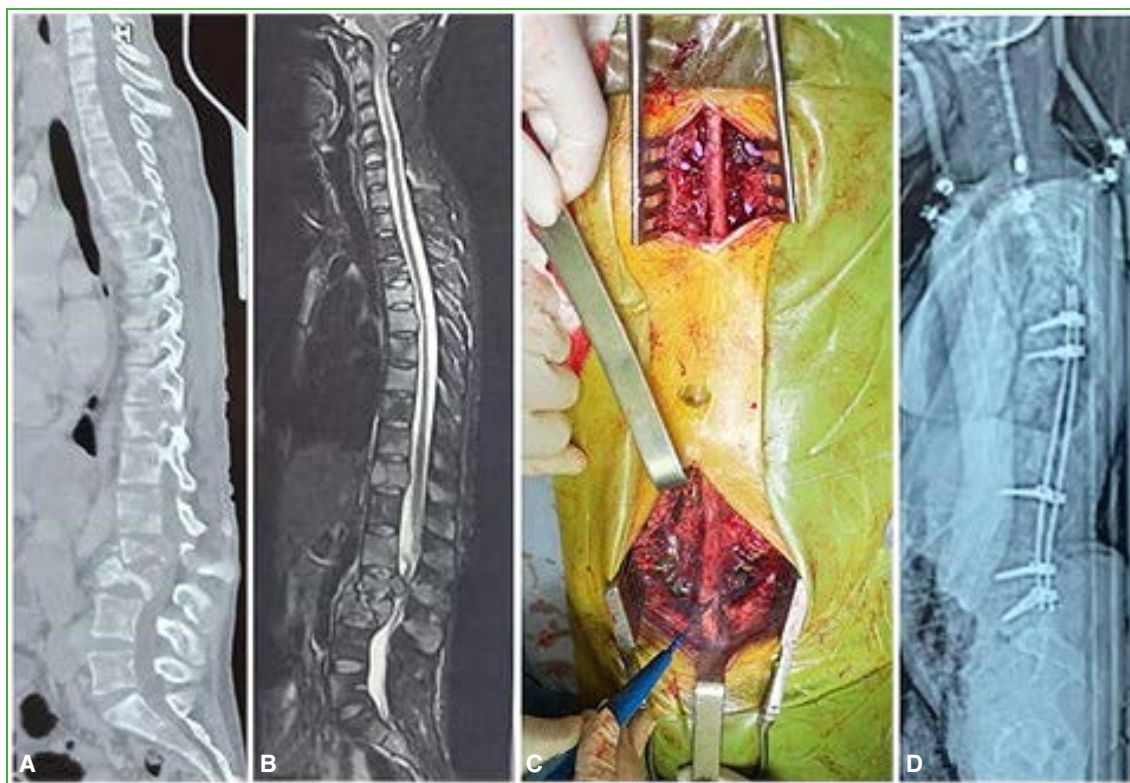


Figure 3. Representative case. A 36-year-old woman presented to the emergency department with a 2-month history of mechanical low back pain and lower extremity weakness (ASIA D). She had had multiple previous consultations, and the primary tumor was unknown. Advanced disease with multiple skeletal metastases and diffuse spinal involvement. **A and B.** Cauda equina syndrome due to L2 and L3 metastases. **C and D.** Surgical decompression with long-segment stabilization.

DISCUSSION

The “optimal” therapeutic window for early decompression in patients with vertebral metastases and neurological involvement has been estimated to be within the first 48 hours after the onset of neurological symptoms.^{9–13} However, the optimal timing of surgery remains controversial. Most of the available evidence is based on retrospective cohorts, and patients with cancer represent a clinically heterogeneous population in whom the risk-benefit balance of surgical decompression depends on multiple clinical and prognostic variables. Meyer et al. reported one of the largest cohorts to date of patients with vertebral metastases and acute neurological involvement and suggested that early surgery within 16 or even 12 hours appears to substantially increase the likelihood of functional recovery without increasing the risk of serious perioperative and postoperative complications.⁴ Based on a synthesis of data from seven retrospective studies, Bresolin et al. identified the first 48 hours as a safe and effective therapeutic window, although with a low level of certainty.¹³ In our case series, no patient underwent surgery within the first 48 hours. Delays in obtaining surgical materials within the first 48 hours (100%), delayed diagnosis (42.8%), and lack of treatment adherence (21.4%) were the predominant causes of untimely surgical delay.

In our setting, Landriel et al. published a retrospective study of patients with documented vertebral metastases and reported a mean delay of 83.5 days in surgical referral for potentially unstable or unstable lesions. The authors noted that 25% of patients had their first surgical consultation more than three months after undergoing computed tomography.¹ In our experience, all patients had sought care at emergency departments or from physicians in other specialties before their metastatic spinal disease was identified, and surgical consultation was documented only after neurological deficits had developed.

Timely diagnosis requires a high degree of clinical suspicion by physicians evaluating patients with axial spinal pain, assessment of red flags, knowledge of the clinical and epidemiological profile of patients at risk for vertebral metastases, an appropriate neurological and orthopedic examination, and sensitive and specific imaging studies, with magnetic resonance imaging playing a central role.^{1,3,4,8,13} In this context, the documented Karnofsky score likely reflects both the systemic disease burden and local vertebral involvement. Notably, all lesions were classified as at least potentially unstable according to the SINS; therefore, the functional deterioration observed in these patients may be interpreted as resulting from the interaction between advanced systemic disease and structural involvement of the spine. Based on our experience, efforts should focus on achieving an accurate diagnosis of vertebral metastatic disease and neurological involvement so that appropriate treatment can be established to minimize sequelae while keeping the risk of complications as low as possible. This also requires an effort involving not only healthcare professionals, but all stakeholders involved in the care process to facilitate early availability of the necessary surgical implants and resources.

This study has limitations that preclude generalization of its conclusions. Its retrospective, descriptive design and small sample size are its main limitations. The small sample size and heterogeneity of the primary tumors do not allow a conclusive analysis of a potential association between the spinal location of the lesions and the primary tumor. Nevertheless, this study reflects the experience of a public institution and highlights the need to establish an appropriate protocol to facilitate timely referral and specialized treatment of patients with vertebral metastases and neurological involvement.

CONCLUSIONS

Factors contributing to untimely delays in the care of patients with vertebral metastases and neurological impairment were documented in the public healthcare setting. The predominant factors were delays in obtaining surgical materials and delayed diagnosis of the complication.

Conflicts of interest: The authors declare no conflicts of interest.

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