

PATIENTS WITH SPINAL METASTASIS SUBMITTED TO NEUROLOGICAL DECOMPRESSION AND STABILIZATION

PACIENTES COM METÁSTASES NA COLUNA VERTEBRAL SUBMETIDOS À DESCOMPRESSÃO NEUROLÓGICA E ESTABILIZAÇÃO

PACIENTES CON METÁSTASIS ESPINAL SOMETIDOS A DESCOMPRESIÓN NEUROLÓGICA Y ESTABILIZACIÓN

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ABSTRACT

Objective: To analyze retrospectively the surgical outcomes of a group of patients with bone metastases and multiple myeloma in the spine, which underwent neurological decompression and arthrodesis using pedicle screws, by isolated posterior approach, to check whether the operated patients present clinical improvement regarding the pain and neurological deficit compared to the preoperative period. **Methods:** This is a retrospective, cross-sectional study of case series, that analyzed data from medical records of patients with bone metastases in the spine who underwent surgical treatment between January 2007 and February 2011. **Results:** Of the 42 patients in the sample, according to the Kolmogorov-Smirnov test ($p=0.000$) there was improvement in pain with respect to the preoperative, with 33 patients (78.6%) reporting improvement and only 9 (21.4%) maintaining the initial pain complaints. Of the 25 patients available for evaluation of neurological improvement (\neq Frankel E) 9 patients (36%) had some kind of improvement postoperatively, and no operated patient presented neurological worsening, indicating statistical significance according to the Kolmogorov-Smirnov test ($p = 0.000$). It was also observed statistical correlation ($p=0.042$) between Frankel functional score postoperatively and pain relief, using the chi-square test. **Conclusions:** Surgical treatment for patients with spinal metastasis through arthrodesis with pedicle instrumentation and decompression may have significant clinical benefits, especially as regards the improvement in pain symptoms and improved neurological function.

Keywords: Spine; Neoplasm metastasis; Prognosis; Surgery; Mortality; Spinal cord compression; Spinal fusion.

RESUMO

Objetivo: Analisar retrospectivamente os resultados cirúrgicos de um grupo de pacientes com diagnóstico de metástases óssea e mieloma múltiplo na coluna vertebral, submetidos à descompressão neurológica e artrodesse com instrumentação, utilizando parafusos pediculares por via posterior isolada, para verificar se os pacientes operados apresentam melhora clínica quanto à dor e ao déficit neurológico com relação ao pré-operatório. **Métodos:** Trata-se de um estudo retrospectivo, transversal do tipo série de casos, no qual foram analisados os dados dos prontuários dos pacientes portadores de metástase óssea na coluna vertebral, submetidos a tratamento cirúrgico, entre janeiro de 2007 e fevereiro de 2011. **Resultados:** Dos 42 pacientes da amostra, de acordo com teste de Kolmogorov-Smirnov ($p = 0,000$), houve melhora do quadro de dor com relação ao pré-operatório, com 33 pacientes (78,6%) relatando melhora e apenas 9 deles (21,4%) mantendo as queixas algicas iniciais. Dos 25 pacientes disponíveis para avaliação de melhora neurológica (\neq Frankel E) 9 pacientes (36%) apresentaram algum tipo de melhora no pós-operatório e nenhum paciente operado apresentou piora neurológica, indicando significância estatística de acordo com teste de Kolmogorov-Smirnov ($p = 0,000$). Observou-se também correlação estatística ($p = 0,042$) entre o escore funcional de Frankel no pós-operatório e a melhora da dor, usando o teste do qui-quadrado. **Conclusões:** O tratamento cirúrgico para os pacientes com metástases da coluna vertebral, por meio de artrodesse com instrumentação pedicular e descompressão, pode trazer benefícios clínicos significativos, principalmente no que diz respeito a melhora do quadro algico e melhora da função neurológica.

Descritores: Coluna vertebral; Metástase neoplásica; Prognóstico; Cirurgia; Mortalidade; Compressão da medula espinhal; Fusão vertebral.

RESUMEN

Objetivo: Evaluar retrospectivamente los resultados quirúrgicos de pacientes con metástasis ósea y mieloma múltiple en la columna vertebral, sometidos a descompresión neurológica y artrodesis con instrumentación con tornillos pediculares solamente por acceso posterior, para verificar si los pacientes muestran mejoría clínica con respecto al dolor y el déficit neurológico en relación con el período preoperatorio. **Métodos:** Se trata de un estudio transversal, retrospectivo, de serie de casos en el que se analizaron los datos de las historias clínicas de los pacientes con metástasis ósea en la columna vertebral, sometidos a cirugía entre enero de 2007 y febrero de 2011. **Resultados:** De los 42 pacientes de la muestra, de acuerdo con la prueba de Kolmogorov-Smirnov ($p = 0,000$), hubo una mejoría en el dolor con respecto al preoperatorio, con 33 pacientes (78,6%) reportando mejoría y sólo 9 de ellos (21,4%) manteniendo las quejas iniciales de dolor. De los 25 pacientes disponibles para evaluación de mejoría neurológica (\neq Frankel E) 9 pacientes (36%) tuvieron algún tipo de mejora en el postoperatorio y ningún paciente operado presentó empeoramiento neurológico, lo que indica la significación estadística de acuerdo con la prueba de Kolmogorov-Smirnov ($p = 0,000$). También se observó correlación estadística ($p = 0,042$) entre la puntuación funcional de Frankel después de la operación y el alivio del dolor, mediante la prueba de chi-cuadrado. **Conclusiones:** El tratamiento quirúrgico de los pacientes con metástasis en la columna vertebral por medio de artrodesis con instrumentación pedicular y descompresión puede tener beneficios clínicos significativos, sobre todo en lo que se refiere la mejora de los síntomas de dolor y mejora de la función neurológica.

Descriptores: Columna vertebral; Metástasis de la neoplasia; Pronóstico; Cirugía; Mortalidad; Compresión de la médula espinal; Fusión vertebral.

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INTRODUCTION

Metastatic tumors are the most common malignant bone lesions, occurring 40 times more often than all other primary malignant bone tumors combined.¹ The main primary sites include the breasts, lungs, prostate, kidneys, gastrointestinal system, and the thyroid gland. Multiple myeloma is a plasma cell dyscrasia, in which bone lesions are common in functioning bone marrow sites, such as the vertebral bodies. It is the most common malignant neoplastic skeletal lesion.¹ Recent advances in chemotherapy, radiotherapy, and other oncological treatments have significantly improved the survival of many patients with these lesions. With improved survival rates, previously silent spine metastases are becoming clinically apparent and significantly impairing the quality of life of these patients. Metastatic disease affects the spine in 50% to 80% of patients, most frequently affecting the vertebral bodies of the lumbar spine, followed by the thoracic, cervical, and sacral regions.¹ Approximately 10% of cancer patients are diagnosed with symptomatic vertebral metastasis during the course of the disease and up to 50% of these patients require treatment of spine metastases because of neurological deficit or pain.² It is estimated, from studies performed on cadavers, that the frequency of vertebral lesions in patients who die from malignant neoplasia ranges from 30% to 90%.³

Currently, there are various ways of addressing spine metastases, taking into account the degree of spinal involvement, the presence of neurological deficit, immunocompetence and the clinical conditions of the patient, the number of metastases to other organs, the number of metastases to the appendicular skeleton, and the primary tumor type. There are several studies that have attempted using prognostic scores to determine the best type of therapeutic approach, including wide excision of the lesion, marginal or intralesional excision, palliative surgery, and non-surgical treatment.⁴

The main objectives of surgical treatment are pain control, maintenance of spinal stability, and the preservation of neurological function. Therefore, surgery is reserved for patients with neurological compromise, radioresistant tumors, vertebral instability, and non-treatable mechanical pain.^{1,2}

The objective of this study is to retrospectively analyze the surgical outcomes of a group of patients diagnosed with bone metastases and multiple myeloma of the spine, who underwent isolated posterior approach medullary decompression surgery associated with fusion with pedicle screw instrumentation. This is a surgical procedure of intermediate complexity with rapid recovery, a low expected rate of complications, mainly serious complications in the short term, but with a long-term risk of recurrence and local complications. We will evaluate whether the patients who underwent surgery experienced pain relief and neurological changes as compared to the preoperative period and we will also evaluate short- and long-term surgical complications and survival time.

MATERIAL AND METHODS

We retrospectively evaluated all 42 patients with bone metastases and multiple myeloma of the spine who underwent surgery during the period between January 2007 and February 2011. The study was approved by the Institutional Review Board.

The variables evaluated in the study were: sex, age, primary tumor type, pre- and postoperative Frankel ability scores, short- and long-term surgical complications (whether present or not and description of the type), postoperative pain assessment (improved or not improved), survival time, satisfaction with the procedure.

We evaluated medical records, conducted routine outpatient consultations, and made telephone calls to each living patient to get answers to the following two questions: "Were you satisfied with the surgical procedure performed?" and "Would you undergo the same surgery again to treat the same problem?"

The patients underwent posterior approach vertebral fusion with pedicular instrumentation of one or two levels above and below the affected vertebra, associated with localized decompressive laminectomy with little or no involvement of the lesion of the vertebral body,

but performing, when necessary, partial posterolateral approach resections of lesions of significant mass effect. All the patients with radiosensitive tumors underwent local adjuvant radiotherapy 20 to 30 days following surgery.

A significance level of 5% and a confidence level of 95% were used for analysis of the variables collected and the statistical tests. SPSS version 17.0 was the software used.

Descriptions of frequency and averages were used to evaluate the demographic and epidemiological data.

The Kolmogorov-Smirnov test was used to test the null hypothesis that there was no postoperative pain relief or of the Frankel functional ability score.

The chi-squared test was used to analyze the correlation between the variables of pain relief and Frankel functional ability score, short- and long-term surgical complications and type of tumor, and complication rate and level of satisfaction with the procedure.

Fisher's exact test was used to evaluate the relationship between the postoperative Frankel scale and post-surgical complications.

The ANOVA was used to evaluate the correlation between the variable of time of survival and type of primary tumor.

RESULTS

Of the patients evaluated, 17 (40.5%) were male and 25 (59.5%) were female. At the time of surgery, more than half of the patients (54.8%) were between 31 and 60 years of age. A total of 17 (40.5%) were 61 years of age or older. Only 2 patients (4.8%) were younger than 30 years of age. The youngest patient at the time of surgery was 11 years old, the oldest was 81, and the average age was 55.33 years. Excluding the outlier factor (the 11-year-old patient), the average age was 56.4 years. (Table 1) The most common primary tumors among the patients studied were of the breast, occurring in 12 (28.6%), of the prostate in 7 (16.7%), and multiple myeloma in 6 (14.3%). Of the 42 patients, four (9.5%) had had no prior diagnosis.

The most frequently occurring preoperative Frankel functional ability score was E, in 17 patients (40.5%), but most of the patients who underwent surgical treatment had some type of change (59.5%). None of the patients had a Frankel score of A.

For the analysis of improvement using the Frankel functional scale, the patients with a preoperative Frankel score of E were excluded since they had no motor or sensory deficits and the goal of surgery in these cases was not to improve the neurological profile, but rather to improve pain and spinal stabilization. Thus, 24 patients were available for an evaluation of neurological improvement. Of these patients, 36% (9 patients) showed some type of postoperative improvement. None of the patients who underwent surgery worsened from a neurological perspective. According to the Kolmogorov-Smirnov test, the null hypothesis that there was no improvement in the functional ability score should be rejected, i.e., it can be considered that there was some type of improvement ($p=0.000$).

According to the Kolmogorov-Smirnov test, of the 42 patients from the sample that were analyzed, the pain profile showed an improvement over the preoperative values ($p=0.000$), with 33 patients (78.6%) reporting improvement and only 9 of them (21.4%) maintaining their initial complaints of pain.

We observed a statistically significant correlation ($p=0.042$) between the postoperative Frankel functional score and pain relief using the chi-squared test. It can be seen in the table that the worst results in relation to pain occurred in patients whose neurological profiles did not improve.

Surgical complications were separated into short- and long-terms categories, with 11 patients (26.2%) presenting some sort of short-term surgical complication. (Figure 1) There were a total of 17 short-term complications among these patients, some of whom experienced more than one complication. The most frequently observed complication was deep infection, occurring five times (29.4% of the complications in 11.9% of the patients). Another complication was perioperative bleeding (patients who needed

Table 1. Description of the patients.

Sex	Age at time of surgery	Primary tumor	Frankel_pre	Frankel_post
Female	42	Breast	B	D
Female	40	Esophagus	D	E
Female	68	Breast	E	E
Female	42	Cervix	C	C
Male	73	Prostate	C	C
Female	52	Breast	C	C
Male	37	Gastric	E	E
Male	81	Prostate	C	C
Male	71	Multiple myeloma	C	C
Male	75	Unknown	C	C
Male	73	Prostate	E	E
Female	41	Breast	D	D
Female	66	Unknown	E	E
Female	53	Breast	E	E
Male	58	Unknown	E	E
Female	69	Multiple myeloma	E	E
Male	74	Prostate	B	C
Female	42	Multiple myeloma	E	E
Male	11	Kidney	C	E
Female	40	Multiple myeloma	C	C
Female	51	Unknown	E	E
Male	52	Kidney	E	E
Male	72	Prostate	C	C
Female	68	Breast	E	E
Female	59	Breast	D	D
Female	48	Breast	E	E
Female	67	Breast	C	C
Female	52	Breast	E	E
Male	61	Lung	E	E
Female	45	Lung	B	C
Male	74	Prostate	C	D
Female	44	Uterus	C	B
Female	60	Multiple myeloma	D	D
Male	25	Histiocytoma	E	E
Male	64	Larynx	D	D
Female	65	Uterus	D	D
Female	43	Breast	C	D
Female	58	Multiple myeloma	B	B
Male	45	Chondrosarcoma	D	E
Female	51	Cervix	E	E
Male	69	Prostate	B	B
Female	43	Breast	E	E

blood transfusions for hemodynamic stabilization in the peri- and immediate postoperative periods), occurring four times (23.5% of the complications in 9.5% of the patients), and superficial infection three times (17.6% of the complications in 7.1% of the patients). One of the patients who was bleeding (2.3% of the sample) died during the early postoperative period as a result of sustained shock. There was no correlation between the rate of complications and the type of primary tumor, either in the short term ($p=0.126$) or in the long term ($p=0.958$).

In relation to long-term surgical complications, 8 (19.0%) of the 42 patients had some type of complication. (Figure 2) The most frequent among the eight patients affected was residual pain, occurring in five of them, followed by deep infection, which occurred four times, and the loosening of the osteosynthesis material, three times. (Table 2) Some patients experienced more than one complication. According to the Fisher's exact test, no relationship exists between the postoperative Frankel functional scale score and postsurgical complications ($p=1.000$).

Half of the patients had died and half were still living at the cutoff date, 07/31/2012. Of the 21 patients who had died, six had a survival time of up to six months (28.6%), one patient had a survival time between 6 and 12 months (4.8%), and 14 survived longer than 12 months (66.7%). (Table 3) The shortest patient survival time was 2 days and the longest was 48 months. The average survival time among the deceased was 20.76 months. The average survival time of the patients who were still living on 07/31/2012 was 35.86 months. According to the ANOVA results, the variables of survival time and type of primary tumor are independent ($p=0.954$).

The satisfaction with the surgical procedure questionnaire was answered by 21 patients (living patients), with 19 (90.5%) who were satisfied and who would undergo the surgery again. There was no correlation between the occurrence of complications and the degree of satisfaction with the procedure as analyzed using the chi-squared test.

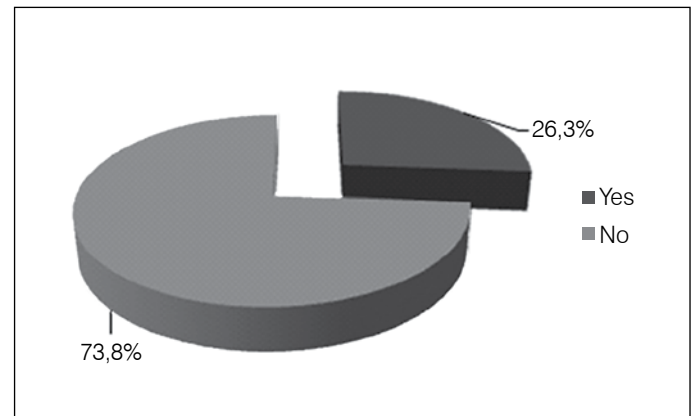


Figure 1. Short-term surgical complications.

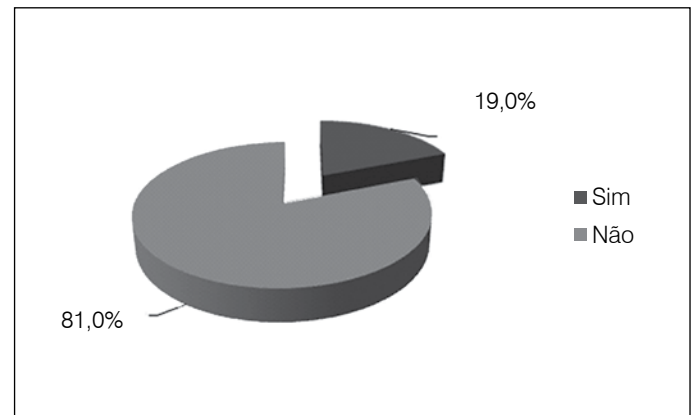


Figure 2. Long-term surgical complications.

Table 2. Long-term surgical complications.

	Frequency	%
Pain	5	35.7%
Deep infection	4	28.6%
Loosening of the synthesis	3	21.4%
Fracture T6 and L1	1	7.1%
Pathological fracture above the 1s fusion	1	7.1%
Total	14	100.0%

Table 3. Survival rate.

	Frequency	%
Up to 6 months	6	28.6
6 to 12 months	1	4.8
More than 12 months	14	66.7
Total	21	100.0

DISCUSSION

Choosing a treatment for patients with spine metastases is usually a challenge for the spine surgeon because there are several factors that must be taken into account before thinking about a surgical approach, such as life expectancy, the risks inherent in the surgical procedure, the possibility of some functional improvement or lack thereof, and the stage of malignancy of the primary tumor. Published studies have shown the difficulty in standardizing patient treatment and several scores aimed at guiding a clinical decision as to the best treatment method, whether surgical, radiotherapeutic, or conservative, have been created, but there is still controversy around which modality of treatment is the most suitable for these patients.²⁻⁴

The main objective of this study was to analyze the surgical outcomes of patients with spine metastasis, with an emphasis on pain relief and improved neurological symptoms, using a treatment technique that is less complex than large tumor resections. Several studies have reported improved quality of life following surgical treatment of patients with spine metastases, with more than 80% of the patients satisfied or very satisfied.^{5,6} In this study, we observed pain relief of 78.6% in the total patient sample and, among those still living, we confirmed that 90.5% were satisfied with their decision to operate and would undergo the procedure again to treat the same problem, in agreement with the literature.

Most of the patients with metastatic spine lesions were assessed as Frankel E (40.5%) on the Frankel functional scale. Excluding these patients, there was a functional improvement in nine (36%) of the 25 patients with neurological deficit, showing that patients who underwent surgical decompression and stabilization had significant improvement in relation to the Frankel functional scale. In this study, we did not observe worsening of neurological symptoms in any patient and we observed some level of improvement in a third of them, in

line with the literature.^{2,4,5,7} An interesting fact observed in the study was the correlation between pain relief and improved neurological symptoms, with pain relief in all patients who experienced neurological improvement and the absence of pain relief in the patients who experienced no change in the neurological lesion.

The most prevalent primary tumors that metastasize to the spine are breast, lung, kidney, prostate, thyroid, melanoma, multiple myeloma, lymphoma, and colorectal cancer.^{1,5-7} According to various authors, the type of primary tumor is highly relevant to the choice of treatment and the survival of the patient.³⁻⁵ In general, the most aggressive tumors, such as lung, liver, colorectal, and pancreas, have shorter survival times, while slower-growing tumors, like breast, prostate, thyroid, carcinoid tumors, and multiple myeloma have longer survival times.⁶⁻¹¹ Breast, prostate, and multiple myeloma were the most prevalent primary tumors in this study, totaling 59.6%. No statistical significance was observed (p=0.954) between the primary tumor type and patient survival. We believe that this lack of correlation is due to the small sample and the greater proportion of patients with slow-growing tumors.

According to the literature, the rate of surgical complications is from 20 to 30% and should be taken into account when choosing a treatment.¹¹⁻¹⁴ The highest complication rates and the most serious complications apply mainly to larger operations, including vertebrectomies and large resections, which are associated with increased morbidity as compared to simpler procedures.^{4,5,6,7,11,12,14} In our study, we observed a rate of short-term surgical complications of 26.2%, most of them minor, with only one early death. The most often encountered complication in the series was infection of the surgical site in 47% of the more complex cases, which is in agreement with that observed in the literature.^{5,7,15}

This study proposes that treatment of intermediate complexity be applied uniformly to all patients, regardless of tumor type, with a high rate of satisfaction (90.5%), good pain relief (78.6%), and some neurological recovery in about a third of the patients. This fact leads to questions about the need to perform more complex procedures, given that the reduced postoperative rehabilitation time is critical in patients with limited survival.

Hosono et al.⁶ retrospectively reviewed a large series of patients with spine metastases and concluded that “a large prospective study of consecutive patients is essential to track possible prognostic factors in patients with spine metastases”. This type of study can help to make more appropriate decisions about the scope of surgery to be recommended.

CONCLUSION

With this study, we conclude that surgical treatment for patients with spine metastases, using fusion with pedicular instrumentation and decompression, can bring significant clinical benefits, especially as regards pain relief and improved neurological symptoms.

All the authors declare that there are no potential conflicts of interest regarding this article.

CONTRIBUTIONS OF THE AUTHORS: Each author made significant individual contributions to the development of the manuscript. JAN and BPCF were the principle contributors to the writing of the article. They conducted the bibliographical research, the review of the manuscript, and contributed to the intellectual concept of the study. JAN, BPCF, RDAM, and CES performed the surgeries, monitored the patients, gathered the clinical data, and evaluated the data from the statistical analysis.

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