Original Article

Short-term outcomes after spinal surgery for metastatic breast cancer: A single-center analysis

ABSTRACT

Background: Advances in detection and breast cancer treatment lead to higher survival rates, with more patients living with spine metastases. Those surgeries are palliative; however, they can improve the quality of life (QOL).

Objective: The aim of this study is to report pain and neurological function outcomes after surgery for spinal metastatic disease of breast cancer patients of a single institution. Complications were recorded.

Materials and Methods: A retrospective, single-center, single-arm study was performed. Consecutive patients who underwent spinal surgery were included. We analyzed demographic, surgical, histopathological, and clinical data.

Results: Seventeen women were included. Three patients (17.6%) did not present pre- and postoperative pain (n = 3), 6 (35.3%) had pain in both situations, and 8 (47.1%) were pain-free postoperatively (P = 0.013). Ten (58.8%) patients had preoperative deficits: 3 (30%) did not improve and 7 (70%) improved after surgery. Six cases (35.2%) did not present preoperative deficits and did not get worse (n = 6). The Frankel classification after the following time showed that 11 patients (64.7%) remained stable after surgery and 5 patients (29.4%) got better. A single patient (5.6%) had deterioration of strength. Two patients (11.7%) had intraoperative complications.

Conclusions: Pain was significantly improved by surgery, with also a possibly positive effect on functionality. Considering the low complication rates, surgery is still a useful tool in the management of spinal metastases in breast cancer patients and may be related to better QOL.

Keywords: Breast cancer, metastasis, spine surgery

INTRODUCTION

Breast cancer is a worldwide concerning condition due to its elevated morbidity and mortality rates. Around the globe, it is estimated around 2.26 million cases in 2020,[1] and it is the most common cancer in women (nonmelanoma skin cancer excluded), also being the main cause of cancer-related death in this population.[2,3] Men can also be affected, representing approximately 1% of all breast cancer cases.[4]

In Brazil, according to the National Cancer Institute (Instituto Nacional de Câncer, INCA), breast cancer is the second most common cancer among women in all regions, just behind nonmelanoma skin cancer.[5] In that country, it was estimated, for the year of 2023, 73.610 new cases, representing an incidence of 41.89 cases of 100,000 women.[5]

This cancer is genetically and phenotypically heterogeneous, with usually a slow-growing behavior. However, through cumulative mutations over time, some of these tumors may develop the capacity to metastasize, greatly increasing their

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aggressiveness and risk of death.[6] Bones are a frequent site for metastases,[3] being found in approximately 69% of patients with advanced disease, along with lungs, liver, and brain. Pelvis, ribs, and femur are possible sites of bone dissemination; nevertheless, breast tumors metastasize more to the spine (2/3 of bone metastasis cases discovered after the primary tumor diagnosis).[7,8] In this location, the tumor growth and bone destruction lead to pain and neurological deficits, impacting negatively the quality of life (QOL).[9] Advancements in detection and treatment of breast cancer led to longer survival and consequently greater number of patients living with spine metastasis.[9]

The local treatment of breast cancer spinal metastases usually involved radiation therapy.[10] Modern radiation therapy modalities (e.g., spinal stereotactic radiosurgery [SSRS]), capable of delivering a high radiation dose to a well-defined volume while sparing adjacent organs, have demonstrated high local control rates, without the need for surgery.[11-14] However, surgery still plays a role in cases of mechanical instability and for the timely treatment of spinal cord compression. Furthermore, separation surgery is a described procedure in preparation for SSRS in cases with critical epidural tumor compression to the spinal cord.[11-16]

Throughout literature, some studies have shown evidence that surgery may be related to an improved postoperative QOL through reduction of pain and recovery or maintenance of neurological function.[17-19] In our study, we reported pain and neurological function outcomes and complications related to open surgery for the treatment of breast cancer spinal metastases at a tertiary hospital of a large city in Brazil. Demographical and clinicopathological data are also described. Based on our and other study findings, our goal was to discuss current indications for open surgery from a developing country perspective.

MATERIALS AND METHODS

Ethics

Appropriate local Ethics Committee approval was obtained under the Number 5.155.453 (CEP UNICAMP). Patients have signed a consent form before all surgical procedures, and their anonymity was maintained appropriately.

Study design

This is a retrospective, observational, single-arm, single-center study. Patients who had metastatic cancer to the spine and underwent open surgical procedures from April 2013 to August 2021 in our institution were identified.

Data were collected from physical and electronic patients' charts from the medical archiving sector of a tertiary hospital in Campinas, Brazil. Demographical, clinical, surgical, and histopathological data were registered and tabulated.

Our primary goal was to evaluate neurological function and pain at the immediate preoperative period and at the last clinical assessment. The pre- and postoperative Frankel Scale values were used to quantify and compare functional outcomes. Pain records were often subjective, and the use of a measurement tool (e.g., Visual Analogic Scale) was not consistently used. For this reason, we opted to use categorical values to describe pain and to report postoperative outcomes, such as maintenance, worsening, and improvement of pain. The statistical analysis was made by software R, V.4.2.0 (Statistics Department of the University of Auckland, Auckland, New Zealand). Descriptive analysis was presented as absolute and relative values. The McNemar test was used for comparative analyses.

RESULTS

Seventeen patients were found, all women. No patients were excluded from the analysis. The mean age was 51.8 years (range = 28–76). The mean follow-up time was 10.68 months, and one of the patients underwent two surgeries at different segments (cervical and thoracic) for an overall number of procedures of 18. Descriptive analysis is shown in Table 1.

Surgeries consisted of decompression (n = 44.44%) [Figure 1], fusion (n = 11.11%) [Figure 2], or a combination of both (n = 44.44%) and were all performed by the same surgeon (AFJ). In all cases, under general anesthesia, patients were positioned prone. For cervical or upper thoracic lesions, the

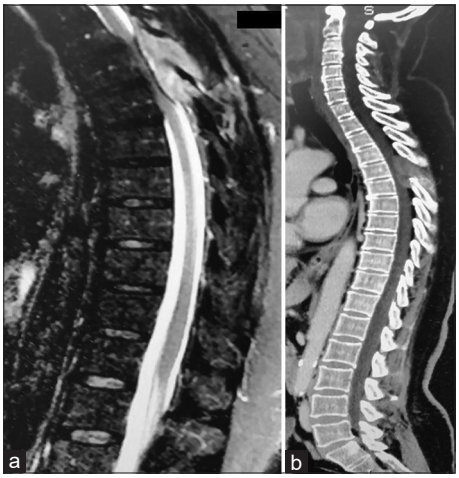

Figure 1: (a and b) Patient with posterior elements metastasis treated with decompression only

head was fixed using a three-pin Mayfield headholder. A skin incision was planned over the level of interest with the aid of fluoroscopy. Subcutaneous and subfascial paravertebral muscle dissections were carried out using the bovie until the vertebral posterior elements were sufficiently exposed. Decompression was achieved by a wide laminectomy was performed using Kerrison Rongeurs of multiple sizes. Fusion was achieved by the placement of pedicle titanium screws connected through rods with or without a cross-linking piece.

Table 1: Descriptive data on demographic, clinical, pathological, and surgical variables

Variable	*n* (%)	Variable	*n* (%)
Diagnosis		Type of procedure	
Adenocarcinoma	4 (23.5)	Instrumentation alone	2 (11.1)
Nonspecified	3 (17.6)	Decompression alone	8 (44.4)
IDC	10 (58.8)	Instrumentation/ decompression	8 (44.4)
Estrogen receptor		Intraoperative complication	
No	5 (45.5)	No	16 (88.9)
Yes	6 (54.5)	Yes	2 (11.1)
Progesterone receptor		CSF leak	1 (5.6)
No	6 (50.0)	Intense bleeding	1 (5.6)
Yes	6 (50.0)	Postoperative pain	
Karnofsky		No	11 (61.1)
70–80	16 (94.1)	Yes	7 (38.9)
90–100	1 (5.9)	Survival outcome	
Extraspinal metastases		Death	1 (5.9)
Hepatic	1 (5.9)	Loss of follow-up	16 (94.1)
Hepatic; ovarian	1 (5.9)	Affected vertebral levels	
Bone	3 (17.6)	Cervical	2 (11.8)
Pulmonary and pleural	1 (5.9)	Cervical and thoracic	1 (5.88)
Pulmonary and kidney	1 (5.9)	Lumbar	2 (11.8)
Pulmonary and bone	1 (5.9)	Thoracic	12 (70.6)
No	9 (52.9)	Number of comorbidities	
Pain		1	5 (29.4)
No	3 (17.6)	2	2 (11.8)
Yes	14 (82.4)	3	2 (11.8)
Axial pain		4	1 (5.9)
No	4 (23.5)	None	7 (41.2)
Yes	13 (76.5)	Comorbidities	
Radicular pain		Obesity	2 (11.8)
No	12 (70.6)	Hypertension	5 (29.4)
Yes	5 (29.4)	Dyslipidemia	1 (5.9)
Motor deficit		Hypothyroidism	3 (11.8)
No	7 (41.2)	Current/past smoking	4 (23.5)
Yes	10 (58.8)	Diabetes	1 (5.9)
Sensory deficit		Cardiopathy	1 (5.9)
No	6 (35.3)	Osteoporosis/osteopenia	1 (5.9)
Yes	11 (64.7)	Deficit development	
Sphincter deficit		Maintenance*	9 (52.9)
No	15 (88.2)	Improved	7 (41.2)
Yes	2 (11.8)	Worsened	1 (5.9)

*Six cases (35.3%) without preoperative deficits. CSF - Cerebrospinal fluid; IDC - Invasive ductal carcinoma

The construct length was variable, although a tendency could be seen according to the spine segment to be instrumented – thoracic segments tended to receive short constructs, whereas lumbar or transition segments' constructs were longer. Three (17.6%) patients received Conventional external beam radiation therapy (cEBRT) as adjuvant local treatment, 2 (11.8%) patients received chemotherapy as adjuvant treatment and 2 (11.8%) patients received both methods as adjuvant treatment.

Regarding pain control, 3 patients (17.6%) did not present pain in pre- and postoperative periods. In the remaining 14 cases, 6 (35.3%) presented the same level of pain in both situations, and 8 (47.1%) presented significant improvement at the first postoperative outpatient clinic visit ($P = 0.013$).

On the overall neurological function (including motor, sensitive, and sphincter functions) outcome analyses, 3 (17.6%) cases were stable, 7 (41.1%) improved, and 6 (35.2%) did not present previous deficit and remained neurologically intact in the postoperative period. The Frankel classification at last encounter showed that 11 patients (64.7%) remained stable after surgery and 5 patients (29.4%) improved. A single patient (5.6%) had deterioration of strength [Table 2].

Two patients had intraoperative complication (dural tearing with cerebrospinal fluid [CSF] leakage, which was promptly repaired at the same procedure and excessive bleeding). The patient with CSF leak underwent a decompression and the one with excessive bleeding underwent both decompression and fusion procedures. One patient had postoperative clinical complications (deep vein thrombosis and pulmonary embolism). None of the cases presenting with complications had worsened neurological deficit postoperatively [Table 3].

DISCUSSION

Modern and effective diagnostic and treatment modalities led to an increasing prevalence of cancer, including breast malignant neoplasms. The increased survival is

Table 2: Comparison of pre- and postoperative Frankel Scale

	Frankel Scale					Total patients
	A	B	C	D	E	
Preoperative	-	2	3	5	7	17
Postoperative						
A	-	-	-	-	-	-
B	-	1	-	-	-	1
C	-	1	2	1	-	4
D	-	-	-	1	-	1
E	-	-	1	3	7	11

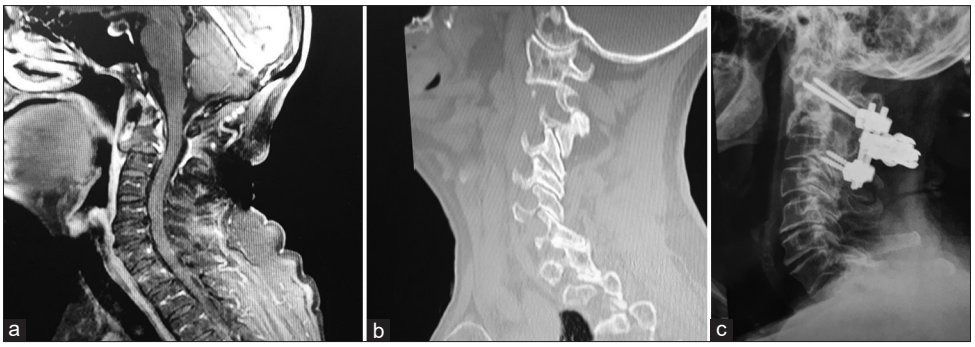

Figure 2: A 70-year-old patient presenting subluxation C1–2 and untreatable pain. (a) T1-weighted MRI showing C2 affected by tumor, with canal stenosis, (b) CT scan showing facet luxation of C1–C2. C1–C3 instrumentation, (c) 1-year control X-ray. The patient was pain-free

Table 3: Relation between surgery, deficits, and complications

Id number	Sex, age	Diagnosis	Preoperative pain	Preoperative deficit	Surgery	Intraoperative complication	PO complication	Postoperative pain	Postoperative deficit
1	Female, 76	Adenocarcinoma	Yes	Yes	Decompression	CSF leak	No	No	Maintenance
2	Female, 54	IDC	Yes	Yes	Decompression	No	No	Yes	Maintenance
3	Female, 49	IDC	Yes	No	Decompression	No	No	Yes	Improved
4	Female, 56	IDC	Yes	Yes	Decompression	No	No	No	Worsened
5	Female, 51	Adenocarcinoma	No	Yes	Decompression	No	No	No	Maintenance
6	Female, 52	IDC	Yes	Yes	Decompression	No	No	No	Improved
7	Female, 55	IDC	Yes	Yes	Decompression + fusion	No	No	No	Improved
8	Female, 28	IDC	Yes	Yes	Decompression + fusion	No	No	No	Improved
9	Female, 71	IDC	Yes	No	Fusion	No	No	Yes	Maintenance*
10	Female, 46	IDC	No	No	Decompression	No	No	No	Maintenance*
11	Female, 54	IDC	No	Yes	Decompression + fusion	No	DVT + PE	No	Improved
12	Female, 56	Nonspecified	Yes	Yes	Decompression + fusion	No	No	Yes	Improved
13	Female, 38	Adenocarcinoma	Yes	No	Decompression + fusion	No	No	Yes	Maintenance*
14	Female, 52	Nonspecified	Yes	No	Decompression + fusion	No	No	No	Maintenance*
15	Female, 68	Nonspecified	Yes	Yes	Decompression	No	No	Yes	Improved
16	Female, 33	Adenocarcinoma	Yes	No	Decompression + fusion	No	No	No	Maintenance*
17	Female, 41	IDC	Yes	No	Fusion	No	No	No	Maintenance*
			Yes	No	Decompression + fusion	Excessive bleeding (1500 mL)	No	Yes	Maintenance*

*No pre- and postoperative deficits. CSF - Cerebrospinal fluid; DVT - Deep venous thrombosis; IDC - Invasive ductal carcinoma; PE - Pulmonary embolism; PO - Postoperative

accompanied by a higher number of people living with distant metastases. Breast cancer usually metastasizes to the bones, and the spine is a frequently affected site.[3,7] The tumor destroys the bone, making it more prone to pathological fractures, and its spread through the epidural space directly compresses adjacent soft tissues, such as nerve roots and spinal cord. These lesions may be asymptomatic or present with pain and neurological compromise, causing a severe negative impact in patients' QOL.[20,21] The spine metastasis treatment requires a multidisciplinary team, including surgeons, radiologists, radiation oncologists, oncologists, and pain specialists,[22] and despite the efforts and the multiple treatment methods for spine metastasis, these remain palliative procedures and aimed at alleviating suffering.[8,11,23,24]

Breast cancer presents with varying degrees of radiosensitivity. In many of these cases, radiation therapy leads to long-term, high local control rates and also relieves pain.[12,16,25,26] Nevertheless, the development of SSRS facilitated the treatment of radioresistant tumors by delivering a very high radiation dose to a well-defined

volume, while sparing adjacent organs from ionizing damage, like radiation-induced myelopathy. Following the growth of radiation therapy, surgery progressively lost space in the therapeutic armamentarium for these lesions.

Currently, surgery may be required to create a space between the spinal cord and the compressing epidural tumor (separation surgery), avoiding excessive radiation dose at the spinal cord interface with the tumor.[13,14,22,23] Furthermore, cases with spinal instability (usually associated with neurological dysfunction and refractory pain) caused by the tumor or its treatment are managed with fusion. This standard protocol is reflected in our sample by its small size. Our institution is a large public hospital associated with a gynecologic cancer center, that both provide multi-modality treatment and follow-up to breast cancer patients covering a wide territory. Surprisingly, only a very small percentage of our cases required surgery. Excellent surveillance assessment, with early detection of spinal metastases, and effective radiation treatment are possible explanations to this phenomenon. SSRS is still an expensive and not easily available treatment modality for many places, being restricted to more developed regions.[22] In our series, no cases had separation surgery as SSRS is not available in our institution. Most of our patients received adjuvant local cEBRT. Conventional radiotherapy also has its advantages, such as its safety and effectiveness, providing a good relief of the symptoms with local tumor control, especially for radiosensitive tumors, being nowadays the most common form of radiation therapy.[11,22]

Other indications for surgical treatment are neural decompression, in cases of progressive neurological symptoms related to the compression of the spinal cord, and/or hardware fixation, whenever there is spinal instability, which also may be associated with spinal cord compression and require associated decompression. Pain may also be an indication if compromising and refractory to less invasive treatments.[11,15,27,28] Therefore, the ultimate goal of surgery is to preserve or improve QOL, as previously described.[12,13]

In accordance with Patchell *et al*.'s findings,[11,24] our research also showed a significant benefit of surgical treatment for regaining or maintenance of neurological function. Another study has shown that surgery was 1.3 times more inclined to provide maintenance of ambulation and twice inclined to restoration of ambulation, besides the improvement in 90% of pain in surgery cases, in comparison to 70% of those receiving only treatment with radiation.[11,12] Of note, almost half of our patients presented a significant improvement of pain after surgery ($P = 0.013$). Additionally, 17.6% did not present pain before or after surgery. Nevertheless, the recommendation for surgery must consider the risks related to the patient and the procedure itself.[11] Cancer patients are often frail due to the disease and its treatment and may be prone to a higher incidence of postoperative complications. Only one of our cases had medical complications, which were successfully managed with medication only. Some authors recommend a survival of, at least, 3 months to recommend surgery.[3,11,14,27]

In our series, only two cases had intraoperative complications. The morbidity of surgery may correlate with the extension of the procedure and presence of preoperative RT.[11,13,14] For that matter, minimally invasive spinal surgery is becoming more popular by providing surgical benefits with less tissue disruption, which hastens recovery and timing to radiation and systemic therapy.[11] Furthermore, it provides less time of hospital admission and lower open-wound time, decreasing infection rates.[14] Given budget constraints in the public health system (at which our hospital belongs to), our cases received open surgery. Therefore, despite noncurative, surgery is still of high importance if well indicated.[1,24] It brings improvement of pain and neurological function[21] with low complication rates, as we could observe here. The limitations of our study included the small cohort, the retrospective nature, the absence of a control group, and the lack of an objective and consistent tool for pain assessment.

CONCLUSION

We demonstrated a significant relationship between the surgical procedures and mid-term improvement of pain, also suggesting a tendency towards the maintenance or improvement of neurological status, which can be ultimately associated with the improvement of the QOL. Its safety was corroborated by the low intra and post-operative complication rates. Therefore, we conclude that open surgery for decompression or spine stabilization may still be an important component in treatment of breast cancer metastatic lesions to the spine, especially in resource-limited locations.

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Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Wilkinson L, Gathani T. Understanding breast cancer as a global health concern. Br J Radiol 2022;95:1130.
2. Kashyap D, Pal D, Sharma R, Garg VK, Goel N, Koundal D, *et al.*

Global increase in breast cancer incidence: Risk factors and preventive measures. Biomed Res Int 2022.
3. Pontes MD, Pires BP, Albuquerque FP, Herrero CF. Assessment of the posterior approach for surgical treatment of spinal metastatic breast cancer. Acta Ortop Bras 2020;28:22-5.
4. Gucalp A, Traina TA, Eisner JR, Parker JS, Selitsky SR, Park BH, *et al*. Male breast cancer: A disease distinct from female breast cancer. Breast Cancer Res Treat 2019;173:37-48.
5. Migowski A. National Cancer Institute. Data and numbers about breast cancer: anual report of 2022. Available from: https://www.inca.gov.br/mama. [Last accessed on 2022 Nov 17].
6. van Denderen BJ, Thompson EW. Cancer: The to and fro of tumour spread. Nature 2013;493:487-8.
7. Bechara AH, Junior AC, Neto MI, Veiga IG, Pasqualini W, Tebet MA, *et al*. Correlation of Tokuhashi and Tomita scores with the prognosis in metastatic breast cancer. Coluna Columna 2017;16:231-5.
8. Sciubba DM, Goodwin CR, Yurter A, Ju D, Gokaslan ZL, Fisher C, *et al*. A systematic review of clinical outcomes and prognostic factors for patients undergoing surgery for spinal metastases secondary to breast cancer. Global Spine J 2016;6:482-96.
9. Hinojosa-Gonzalez DE, Roblesgil-Medrano A, Villarreal-Espinosa JB, Tellez-Garcia E, Bueno-Gutierrez LC, Rodriguez-Barreda JR, *et al*. Minimally invasive versus open surgery for spinal metastasis: A systematic review and meta-analysis. Asian Spine J 2022;16:583-97.
10. Lipton A. Management of bone metastases in breast cancer. Curr Treat Options Oncol 2005;6:161-71.
11. Conti A, Acker G, Kluge A, Loebel F, Kreimeier A, Budach V, *et al*. Decision making in patients with metastatic spine. The role of minimally invasive treatment modalities. Front Oncol 2019;9:915.
12. Klimo *P* Jr., Thompson CJ, Kestle JR, Schmidt MH. A meta-analysis of surgery versus conventional radiotherapy for the treatment of metastatic spinal epidural disease. Neuro Oncol 2005;7:64-76.
13. Ibrahim A, Crockard A, Antonietti P, Boriani S, Bünger C, Gasbarrini A, *et al*. Does spinal surgery improve the quality of life for those with extradural (spinal) osseous metastases? An international multicenter prospective observational study of 223 patients. Invited submission from the joint section meeting on disorders of the spine and peripheral nerves, March 2007. J Neurosurg Spine 2008;8:271-8.
14. Kumar N, Malhotra R, Zaw AS, Maharajan K, Naresh N, Kumar A, *et al*. Evolution in treatment strategy for metastatic spine disease: Presently evolving modalities. Eur J Surg Oncol 2017;43:1784-801.
15. Barzilai O, Fisher CG, Bilsky MH. State of the art treatment of spinal metastatic disease. Neurosurgery 2018;82:757-69.
16. Kurisunkal V, Gulia A, Gupta S. Principles of management of spine metastasis. Indian J Orthop 2020;54:181-93.
17. Zhao C, Zhang Z, Zhong N, Fan T, Gao X, Wu Z, *et al*. Outcomes and prognostic factors for surgically treated patients with breast cancer spine metastases. J Bone Oncol 2018;12:38-43.
18. Başdelioğlu K. Features of spinal metastases: A retrospective view. Int J Spine Surg 2021;15:119-29.
19. Anwar SL, Avanti WS, Dwianingsih EK, Cahyono R, Suwardjo S. Risk factors, patterns, and distribution of bone metastases and skeletal-related events in high-risk breast cancer patients. Asian Pac J Cancer Prev 2022;23:4109-17.
20. Yang L, Wang F, Zhang H, Yang XG, Zhang HR, Li JK, *et al*. Patient characteristics following surgery for spinal metastases: A multicenter retrospective study. Orthop Surg 2019;11:1039-47.
21. Westermann L, Eysel P, Luge H, Olivier A, Oikonomidis S, Baschera D, *et al*. Quality of life and functional outcomes after surgery for spinal metastases: Results of a cohort study. Technol Health Care 2020;28:303-14.
22. Zhang HR, Li JK, Yang XG, Qiao RQ, Hu YC. Conventional radiotherapy and stereotactic radiosurgery in the management of metastatic spine disease. Technol Cancer Res Treat 2020;19.
23. Siegel GW, Biermann JS, Calinescu AA, Spratt DE, Szerlip NJ. Surgical approach to bone metastases. Curr Osteoporos Rep 2018;16:512-8.
24. Patchell RA, Tibbs PA, Regine WF, Payne R, Saris S, Kryscio RJ, *et al*. Direct decompressive surgical resection in the treatment of spinal cord compression caused by metastatic cancer: A randomised trial. Lancet 2005;366:643-8.
25. Osborn VW, Lee A, Yamada Y. Stereotactic body radiation therapy for spinal malignancies. Technol Cancer Res Treat 24 2018;17.
26. Sohn S, Chung CK. The role of stereotactic radiosurgery in metastasis to the spine. J Korean Neurosurg Soc 2012;51:1-7.
27. Kobayashi K, Ando K, Nakashima H, Sato K, Kanemura T, Yoshihara H, *et al*. Prognostic factors in the new Katagiri scoring system after palliative surgery for spinal metastasis. Spine (Phila Pa 1976) 2020;45:E813-9.
28. Joaquim AF, Powers A, Laufer I, Bilsky MH. An update in the management of spinal metastases. Arq Neuropsiquiatr 2015;73:795-802.