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SPINE

COSTS ANALYSIS OF SPINAL COLUMN METASTASES SURGICAL TREATMENT

ANÁLISE DOS CUSTOS DO TRATAMENTO CIRÚRGICO DAS METÁSTASES DA COLUNA VERTEBRAL

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ABSTRACT

Introduction: End-of-life cancer treatment is associated with substantial healthcare costs. Objective: This study aimed to analyze the surgical treatment cost of spinal metastasis and epidural compression patients undergoing surgical treatment. Methods: A retrospective cost analysis of 81 patients with spinal metastasis and epidural compression undergoing surgical treatment. Cost evaluation was defined in the following categories: medications, laboratory and imaging tests, nursery, recovery room, intensive care unit, surgical procedure, and consigned material. The cost of pain improvement, functional activity, and survival was also evaluated. Results: The total cost of surgical treatment for 81 patients was $3,604,334.26, and the average value for each patient was $44,497.95. The highest costs were related to implants (41.1%), followed by hospitalization (27.3%) and surgical procedure (19.7%). Conclusion: The cost of surgical treatment for spinal metastases is one of the most expensive bone complications in cancer patients. The cost of treatment related to outcomes showed differences according to the outcome analyzed. Hospital stay, tests, drugs, and intensive care play an important role in some of the costs related to the specific outcome. ***Level of Evidence II, Retrospective Study***.

Keywords: Palliative care. Spinal Cord Compression. Hospital Costs. Costs and Cost Analysis.

RESUMO

Introdução: O tratamento do câncer em fim de vida está associado a custos substanciais em saúde. Objetivo: O objetivo do estudo foi analisar o custo do tratamento cirúrgico de pacientes com metástase espinhal e compressão peridural submetidos ao tratamento cirúrgico. Métodos: Uma análise retrospectiva de custos de 81 pacientes com metástase espinhal e compressão peridural submetidos a tratamento cirúrgico. A avaliação de custos foi definida nas seguintes categorias: medicamentos, exames laboratoriais e de imagem, enfermaria, sala de recuperação, unidade de terapia intensiva, procedimento cirúrgico e material consignado. O custo relacionado à melhora da dor, atividade funcional e sobrevida também foi avaliado. Resultados: O custo total do tratamento cirúrgico de 81 pacientes foi de R $ 3.604.334,26 e o valor médio de cada paciente foi de R $ 44.497,95. Os maiores gastos foram relacionados com implantes (41,1%), seguidos de internação (27,3%) e procedimento cirúrgico (19,7%). Conclusão: O custo do tratamento cirúrgico para metástases espinhais é um dos mais caros entre as complicações ósseas em pacientes com câncer. O custo do tratamento relacionado aos desfechos apresentou diferença de acordo com o desfecho analisado e a permanência hospitalar, exames, medicamentos e terapia intensiva tem papel importante em alguns dos custos relacionados ao desfecho específico. ***Nível de Evidência II, Estudo retrospectivo***.

Descritores: *Cuidados Paliativos. Compressão da Medula Espinal. Custos Hospitalares. Custos e Análise de Custo.*

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INTRODUCTION

The spine is the most common site of bone metastasis and, 70% of all bone metastasis are in spine,[1,2] being that epidural or vertebral metastasis is presented in 94.5% of patients, on the other hand, intradural extramedular (5-6%) or intramedullary metastasis (0.5%) are rare.[2] Spinal cord compression (SCC) is the most serious complication, affecting 20% of patients.[3] The (sites) organs with tumors most likely to cause bone metastasis are in order of incidence: prostate, breast, kidney, lung and thyroid cancer,[4,5] so, there is a large impact on healthcare resources from spinal metastasis and their complications.[6-8]

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The study was conducted at the Universidade de São Paulo, Ribeirão Preto Medical School, Department of Orthopedics and Anesthesiology.
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Surgical treatment of spinal metastasis received acceptance and began to be widely used after the report of a controlled trial by Patchell et al.,[9] showing that surgery followed by radiotherapy provided better outcome compared to radiotherapy alone in patients with a life expectancy superior to three months. This study influenced the indication for surgical treatment of spinal metastasis and adopted the threshold of life expectancy that has also influenced the decision for surgical indication. The goal of surgical treatment of spinal metastasis is pain relief, restoration or preservation of the neurological function, stabilization of spinal segment, and improvement of health-related quality of life. Surgical strategies are diverse and can include simple decompression and stabilization or spinal reconstruction that can be accomplished via anterior or posterior approach.[1,2,9]

The widespread availability of advanced imaging and the improvement of survival with the use of target therapies has contributed to increase the magnitude of the problem related to spinal metastasis.[2,10] It is expected the number of survivors that will undergo surgery will increase.[11] Surgical treatment of spinal metastasis is the most expensive procedure among skeletal events in oncologic patients, whose cost is estimated at 83,000 US$ per patient.[12] It was reported that around 27% of total cost were spent with surgery with a mean cost of 16,888 pounds per patient.[13]

Our University Hospital is a reference center for Oncology, the number of referred patients with spinal metastasis has historically grown. Thus, the motivation of the study was to perform a critical retrospective evaluation of the cost related to patients with spinal metastasis with epidural compression that underwent surgical treatment, so, the aim of the study was to evaluate the cost of surgical treatment of patients with spinal metastasis with epidural compression and the correlation of the cost with some outcomes.

METHODS

This is a cross-sectional study, approved by local HCRP – no. 8120/2017. We carried out a retrospective review of the data of 81 patients with spinal metastasis and epidural compression who underwent surgical treatment between March 2009 and August 2015 in the Department of Orthopedics and Anesthesiology from Ribeirão Preto Medical School - University of São Paulo, Brazil.

The inclusion criteria were patient's 18 years and older with a diagnosis of spinal metastasis and epidural metastasis of solid malignant tumor who underwent surgical treatment. Patient who underwent previous surgery, diagnosis of hematological malignancy and individuals with solid metastatic neoplastic disease, whose spinal compression was not confirmed after anatomopathological evaluation of the surgical material were not enrolled in the study.

To compare data of categorical variables, the chi-square test with or without correction was used, while for the comparison of central tendency measures, Student's t test for independent samples was used for means, or the test from Mann-Whitney for independent samples, to medians. In all analyzes, a significance level of 5% was considered.

The cost data were collected retrospectively using the electronic data system of University Hospital of Ribeirão Preto Medical School-USP, between March 2009 and August 2015, and took into account consumption material, equipment and human resources. The cost evaluation followed the methods proposed by Drummond et al (2005)[14] including real direct monetary costs health care, defined in the following categories: 1) medicines, 2) laboratory and imaging exams, 3) ward, 4) surgical procedure, 5) surgical material (consigned or not), 6) post-surgical recovery room and, 7) intensive care unit.

The cost were those registered in the hospital system on the day of its use by the patient and considering the real amount paid by the hospital through public bidding process. Laboratory and imaging exams: the cost of each exam performed by the patient during hospitalization period. Ward, recovery room and intensive care unit: all direct and indirect cost such as water, energy, telephone and support services (cleaning, physiotherapy, psychology) make up the value average cost of the patient day. Surgical procedure: value of the surgical hour added to the cost of anesthesia. Surgical material (consigned or not): implants for surgical procedure reimbursed by the health system (SUS). For cost corrections, Inflationary adjustments: estimated cost were expressed in Brazilian Real (BRL) from December to August 2015 and adjusted for June 2018 through the Consumer Price Index (IPCA). The discount rates were not used in the study since the costs analyzed are related to a period less than one year in all patient.[14]

Univariate sensitivity analysis was used to evaluate the most influential input parameter with the exact delimitation of the minimum and maximum values. This method is used to prove the degree of stability of the results found in the study.[14]

RESULTS

Complete required information was obtained from 81 patients, with forty-nine male (60.5%), being that the age of the patients at the time of spinal decompression surgery ranged from 18 to 91 years old (mean 56.3 years; SD 15.9); 58.24 (16.22) for male and 53.31 (15.92) for women ($p > 0.05$). The Table 1 is illustrating the distribution of primary tumors by gender and descending order. The two most frequent tumors were malignant breast cancer (28.4%) and prostate cancer (20.99%). The primary tumor site was unable to be identified in six patients (7.41%).

The performed surgical treatment in the enrolled patients was open posterior fixation using pedicle screw based system associated with decompressive laminectomy, while corpectomy was performed in patients who the anterior column reconstruction was required.

The total cost of surgical treatment of 81 patients was R$ 3,604,334.26 and the mean value for each patient was R$ 44,497.95. The cost

Table 1. Distribution (in descending order and gender) of primary tumors among the selected patients.

	Gender		Total
	Male	Female	
	n (%)	n (%)	n (%)
Primary tumor			
Breast	0 (0%)	23 (71.88%)	23 (28.4%)
Prostate	17 (34.69%)	-	17 (20.99%)
Sarcoma	5 (10.2%)	1 (3.13%)	6 (7.41%)
Occult primary tumor	5 (10.2%)	1 (3.13%)	6 (7.41%)
Rectum	3 (6.12%)	1 (3.13%)	4 (4.94%)
Oral cavity	2 (4.08%)	1 (3.13%)	3 (3.7%)
Lung	3 (6.12%)	0 (0%)	3 (3.7%)
Kidney	3 (6.12%)	0 (0%)	3 (3.7%)
Thyroid	2 (4.08%)	1 (3.13%)	3 (3.7%)
Bladder	2 (4.08%)	0 (0%)	2 (2.47%)
Cervix	0 (0%)	2 (6.25%)	2 (2.47%)
Colon	1 (2.04%)	1 (3.13%)	2 (2.47%)
Testis	2 (4.08%)	0 (0%)	2 (2.47%)
Esophagus	1 (2.04%)	0 (0%)	1 (1.23%)
Choroid plexusmelanoma	1 (2.04%)	0 (0%)	1 (1.23%)
Nasopharynx	1 (2.04%)	0 (0%)	1 (1.23%)
Sinus maxillary	1 (2.04%)	0 (0%)	1 (1.23%)
Gallbladder	0 (0%)	1 (3.13%)	1 (1.23%)
Total	49 (100%)	32 (100%)	81 (100%)

items and respective values are shown in Table 2. The largest expense was related to consigned material (implants) with a total cost of R$ 1,491,008.13 (41.1%) and mean cost of R$1,407.50 for each patient.

The distribution of the number of patients by KPS (Figure 1) level and Frankel Scale (Figure 2), with respective costs per item, is shown in Table 3 below. There was a tendency for higher cost in patients with lower KPS values, but without statistical significance ($p>0.05$). The cost of surgical treatment according to neurological deficit was lower in patients with severe neurological deficit (Frankel A and B)[15] but without statistical significance ($p>0.05$).

Sensitivity analysis showed a large range between the minimum and maximum values. (Figure 3) The total cost was more sensitive to the cost variation in the hospital ward. The variation of consigned material was 87.1%, 52.89% for intensive care unit, 24.06% for laboratory exams, 17.67% for surgical procedure, 15.51% for medicines and 5.21% for recovery room.

The cost of surgical treatment of the five most common tumor is represented on Table 4. The treatment of unknown primary tumor was the highest mainly due to the cost of the ward, that account for 36% of the total cost.

As can be seen, the average cost (R$ 73,493.31) of surgery in patients with a hidden primary site was higher when compared to the other four cancer sites.

Table 2. Distribution of costs (mean and total) with respective values of all items used in the surgery of the selected patients.

Variables	Mean Costs (R$)	Total (R$)	%
Consigned materials	18,407.51	1,491,008.13	41.4
Nursery	12,146.41	983,859.09	27.3
Surgery procedure	8,782.94	711,417.90	19.7
Exams	2,959.31	239,704.45	6.7
Intensive Care Unit	1,138.36	92,207.00	2.6
Medicines	819.22	66,356.54	1.8
Recovery room	244,21	19,781.15	0.5
Total	44,497.95	3,604,334.26	100.0

Able to carry on normal activity and to work; no special care needed.	100	Normal no complaints; no evidence of disease.
	90	Able to carry on normal activity; minor signs or symptoms of disease.
	80	Normal activity with effort; some signs or symptoms of disease.
Unable to work; able to live at home and care for most personal needs; varying amount of assistance needed.	70	Cares for self; unable to carry on normal activity or to do active work.
	60	Requires occasional assistance, but is able to care for most of his personal needs.
	50	Requires considerable assistance and frequent medical care.
Unable to care for self; requires equivalent of institutional or hospital care; disease may be progressing rapidly.	40	Disable; requires special care and assistance.
	30	Severely disabled; hospital admission is indicated although death not imminent.
	20	Very sick; hospital admission necessary; active supportive treatment necessary.
	10	Moribund; fatal processes progressing rapidly.
	0	Dead

Figure 1. Karnofsky Performance Scale.

Frankel grade	Definition
A	Complete injury, no motor or sensory function below the level of injury
B	Incomplete injury, no motor function
C	Incomplete injury, motor function useless, sensory incomplete
D	Incomplete injury, motor function useful, sensory incomplete
E	Incomplete injury, motor function normal, sensory normal

Figure 2. Frankel Classification of Spinal Cord Injury.

The cost of treatment considering the outcome related to pain improvement was higher (R$ 45,736.35) in the group of patients who showed postoperative pain improvement compared to patients with postoperative pain (R$ 44,550.84). All cost components were higher in postoperative pain improvement group except the cost of intensive care and, The cost for patients who maintained or improved functional activity (Frankel D or E) was slightly smaller than patients with impaired function (Frankel A,B and C). The difference in cost was related to hospital stay, medicines and recovery room. (Table 5)

The cost of patients with less than three months of survival was higher (R$ 13,844.54) *versus* (R$ 13,801.32) compared to patients who had longer survival (R$ 11,061.94) *versus* (R$ 7,126.41). The cost of hospital stay including ward, intensive care and medication were responsible for this difference. (Table 6)

DISCUSSION

The mean cost of surgical treatment for patients with spinal metastasis that underwent surgical treatment was R$ 44,497.95 for each patient. The largest expenses was related to implants (41.1%), followed by hospital stay (27.3%), and surgical procedure (19.7%). The other costs were smaller compared to the mentioned cost. The total cost for treatment of 81 patients was R$ 3,604,334.26. Cost estimates were obtained using micro-costing to obtain a more accurate information.

Several reports have presented the cost of surgery for spinal metastasis with epidural compression. Although there are some differences in the final value of the cost, there is an agreement that it's the most expensive treatment for skeletal event in those patients.[6,8,16,17]

The rough comparison of the cost of surgical treatment for patients in our group was lower than the value reported in other studies,[6,15] that mentioned it as the most expensive treatment among the skeletal event in patients with cancer. Hospitalization cost range widely secondary to the variability in the procedures performed, pathologies treated, and different countries.[6,15,18]

The highest percentage of the cost in our patient was related to the cost of implants, whereas in other reports the hospital stay was in charge for the highest percentage. DuBois and Donceel (2010) reported that hospital stay was 39% and it was in charge for the highest percentage of the treatment cost.[7] The costs of surgery for spinal tumor range widely and depend on a variety of factors. The identification of factors that can be modified is critical for decreasing the cost of treatment. Analysis of the cost of treatment related to outcomes showed interesting data that should be considered in treatment guidelines in order improve treatment, and resources allocation.

The cost of consignated and implants was in charge for a large amount of the total cost of the treatment considering all the group. When the cost is analyzed considering the outcomes, the

Table 3. Distribution of the number of patients by KPS level and Frankel Scale, with respective costs (mean) per item, between 2009 – 2015.

Resources	Mean Costs(R$) by KPS level						
	50 (n=8)	60 (n=26)	70 (n=30)	80 (n=12)	90 (n=3)	100 (n=1)	P Value
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (DP)	
Nursery	17.141,04 (7187,05)	11.208,61 (7126,69)	11147,97 (13922,5)	12530,44 (7905,87)	12679,2 (14962,19)	3953,98 (-)	0,05
Intensive Care Unit	1.920,22 (4462,27)	546,75 (2438,22)	1966,18 (6018,9)	154,68 (535,84)	596,08 (1032,44)	0 (-)	0,67
Medicines	1135,11 (1013,08)	577,71 (567,34)	819,87 (1486,74)	963,99 (1405,8)	1845,06 (2792)	107,77 (-)	0,38
Surgery procedure	8641,33 (1727,8)	8757,96 (2861,57)	8350,59 (3132,85)	9896,81 (2198,16)	8801,29 (5408,5)	8670,25 (-)	0,52
Recovery room	646,81 (840,82)	127,42 (338,79)	132,38 (306,42)	495,67 (780,87)	458,12 (229,17)	0 (-)	0,05
Exams	3908,06 (2118,36)	3199,32 (2279,11)	2795,47 (2604,27)	2866,63 (2423,58)	1998,5 (602,55)	641,33 (-)	0,34
Consignedmaterials	15528,88 (3587,85)	19428,58 (12363,14)	19195,72 (9972,2)	15004,37 (3869,59)	19378,58 (17497,18)	24749,42 (-)	0,64
Total	48921,45 (12376,19)	43846,34 (16143,94)	44408,19 (20570,72)	41912,59 (12754,09)	45756,82 (19058,13)	38122,75 (-)	0,84

Recursos	Mean Costs (R$) by Frankel Scale				
	A (n=12)	B (n=11)	C (n=19)	D (n=11)	E (n=28)
	média (DP)	média (DP)	média (DP)	média (DP)	média (DP)
Nursery	13.751,89 (8011,05)	9.483,56 (6925,58)	13.771,18 (8867,44)	12.678,74 (12405,18)	11.192,81 (13123,63)
IntensiveCare Unit	1.209,45 (3662,76)	2.266,92 (6690,98)	748,68 (2845,85)	156,91 (520,4)	1.314,52 (4797,15)
Medicines	1.134,67 (1532,21)	1.113,61 (1637,26)	721,85 (659,9)	537,61 (598,47)	745,07 (1435,33)
Surgery procedure	7.813,3 (2966,82)	7.804,85 (2846,55)	8.472,78 (2776,78)	9.466,92 (2848,02)	9.524,5 (2740,2)
Recovery room	333,19 (515,63)	112,61 (213,84)	427,54 (722,64)	248,9 (469,91)	131,53 (390,91)
Exams	3.354,78 (2072,01)	3.051,1 (1033,25)	3.839,9 (2684,49)	1.667,74 (1044,96)	2.663,64 (2800,63)
Consignedmaterials	14.534,17 (4430,22)	18.692,2 (9979,45)	18.314,78 (10070,88)	20.792,42 (14382,18)	19.081,66 (9667,67)
Total	42.131,43 (14111,55)	42.524,85 (13093,73)	46.296,7 (13848,25)	45.549,24 (18542,97)	44.653,74 (21089,07)

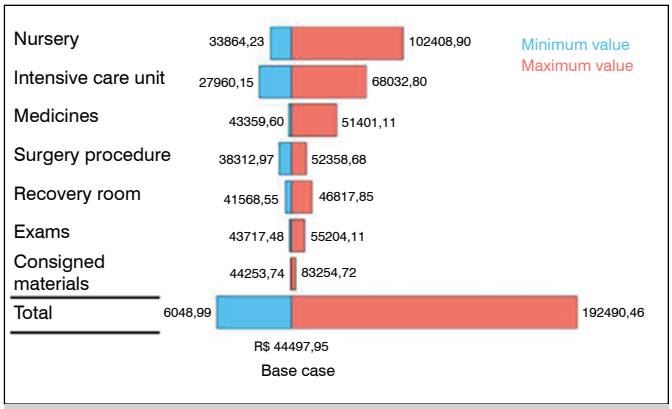

Figure 3. Sensitivity analysis showed a large range between the minimum and maximum.

consignates and implants do not have a large role as in the total cost. Considering the cost and outcome related to neurological deficit, the cost of implants was lower in patients more severe neurological deficits (Frankel A and B). This would be explained by more palliate surgery in patients with severe neurological deficit compared to patients with partial neurological deficit or normal patients that underwent more sophisticated treatment and reconstruction. Cost of consignated and implants concerning the other outcomes as pain, function, survival showed was similar and other factors as hospital stay, intensive unit care, exams was in charge for the difference in costs.

The reported cost by Barlev (2010)[6] of patients with spinal metastasis due to prostate, breast and multiple myeloma similar to our cost and showed that treatment of spinal metastasis with or without epidural compression is the most expensive event related to skeletal.[6] Hagiwara, Delea and Chung (2014)[19] also reported that surgical treatment of spinal metastasis with epidural compression was the most expensive event. Felix et al. (2011)[20] reported the mean cost of EUR 13,203.00 for patient with prostate or breast cancer and spinal cord compression in the National Health Service of Portugal.[20] Jaysekera et al. (2014) reported the cost of U$82,868.00 for patients with prostate cancer in EUA that underwent surgical treatment for spinal metastasis with epidural compression. Only 4% of the patients required surgery among 52% that had epidural metastasis.[12]

The cost of unknown primary tumors was higher compared to others metastatic tumor, mainly due hospital stay, intensive care unit, medicines and exams and, would be related to difficult and attempts to find the primary tumor site. The primary site of histologically documented carcinoma cannot be identified in 3.0 to 13.0% of patients. In epidural neoplastic metastasis, the primary tumor is unknown in 15.0 to 25.0% of patients.[21]

The cost of patients with shorter survival was higher and related to the cost with hospital stay and intensive unit care. It should also be considered that postoperative complications are concentrated in the group of patients with lower survival. This observation reinforces the need to identify the patient with a good prognosis in order to avoid a surgical procedure with lower survival expectancy and that can also increase the total cost of the treatment.

The morbidity and cost of spinal metastasis shown that early diagnosis could avoid the risks and high costs related to surgical treatment. Screening of spinal metastasis using new available imaging technology would improve quality of life of patients with spinal metastasis and reduce the overall cost avoiding surgery. It should also be considered that postoperative complications are concentrated in the group of patients with lower survival.

The evaluation of the cost of treatment allowed identification of the different components that act in the cascade of cost. The results allows to better understand flow of the cost and how we can better allocate the resources or reduce the overall cost. Considering the high cost of surgical treatment and benefits of early diagnosis that reduces cost and morbidity, protocols for early diagnosis of spinal metastasis should be stimulated. Early diagnosis and target treatment might reduce or delay serious and expensive outcomes.

Table 4. Means of cost of surgical treatment of the five most common tumor among the selected patients.

Resources	Mean Costs (R$)					
	Breast (n=23)	Prostate (n=17)	Sarcoma (n=6)	Occult primary Tumor (n=6)	Rectum (n=4)	Lung (n=3)
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Nursery	8,802.16 (6,751.85)	14,636.08 (9,388.04)	11,857.46 (5,150.85)	26,209.10 (23,943.17)	7.416,03 (4,892.92)	9.696,1 (4,522.08)
Intensive Care Unit	370.55 (1425.9)	256.62 (742.09)	3,716.59 (9,103.74)	6,233.06 (10,369.09)	905.02 (1,810.05)	0 (0)
Medicines	472.21 (526.53)	704.68 (657.29)	853.30 (1,110.74)	3,315.46 (2,687.48)	443.44 (381.15)	735.91 (442.65)
Surgery procedure	8,021.70 (2,780.35)	8,108.18 (2,324.40)	8,828.27 (4,286.67)	9,766.38 (2,089.18)	10,577.42 (2.120.63)	9,548 (1,401.16)
Recovery room	232.63 (469.27)	455.40 (690.86)	122.01 (174.76)	114.02 (231.80)	198.28 (174.79)	0 (0)
Exams	2,305.48 (1,719.42)	3,628.24 (2,796.64)	2,575.93 (1,063.43)	6,506.64 (4,023.95)	1,440.17 (1,466.58)	3,472.19 (570.96)
Consigned materials	19,880.78 (10,010.88)	18,284.85 (12,115.92)	21,406.65 (16,597.71)	21,348.66 (11,034.17)	18,015.10 (5,373.75)	18,058.90 (2,273.84)
Total	40,085.52 (12,454.57)	46,074.06 (16,394.62)	49,360.20 (19,176.88)	73,493.31 (28,488.30)	38,995.47 (8,383.85)	41,511.10 (5,901.17)

Table 5. The cost distribution according to postoperative pain outcome and functional activity outcome.

Resources	MeanCosts (R$)	
	Pain improvement	Persistant pain
	Mean (SD)	Mean (SD)
Nursery	13,072.34 (12,379.03)	12,694.51 (9,721.62)
IntensiveCare Unit	480.05 (2,282.52)	1,028.71 (3,987.35)
Medicines	906.71 (1,611.65)	762.94 (936.28)
Surgery procedure	9,219.05 (3,205.74)	8,487.95 (2,529.14)
Recovery room	244.42 (526.35)	281.08 (534.15)
Exams	3,287.22 (2,974.13)	2,786.70 (1,895.63)
Consigned materials	18,526.56 (10,090.63)	18,508.95 (10,131.71)
Total	45,736.35 (19,459.00)	44,550.84 (15,981.18)
Resources	**MeanCosts (R$)**	
	Improves deambulation	Not able to walk
	Mean (SD)	Mean (SD)
Nursery	12,025.02 (11,736.63)	14,600.98 (8,696.96)
IntensiveCare Unit	1,055.15 (3,973.04)	745.65 (2,690.82)
Medicines	697.14 (1,156.13)	1,093.24 (1,483.43)
Surgery procedure	8,839.17 (2,931.33)	8,400.93 (2,735.23)
Recovery room	232.91 (549.03)	323.90 (484.46)
Exams	2,908.86 (2,700.31)	3,318.16 (1,762.71)
Consigned materials	18,767.43 (11,330.24)	17,614.30 (7,048.87)
Total	44,525.67 (19,544.81)	46,097.16 (12,375.63)

Table 6. Costs distribution according to survival greater than or less than 3 months.

Recursos	Mean Costs (R$)	
	<3 months	≥3 months
	Mean (SD)	Mean (SD)
Nursery	13,844.54 (13,801.32)	11,061.94 (7,126.41)
Intensive Care Unit	2,453.35 (6,121.35)	140.88 (541.77)
Medicines	1,142.18 (1,572.08)	585.37 (856.53)
Surgery procedure	9,333.99 (2,847.32)	8,428.16 (2,786.71)
Recovery room	232.81 (446.40)	258.51 (554.87)
Exams	3,185.05 (2,532.89)	2,832.93 (2,247.65)
Consigned materials	18,995.79 (10,689.28)	18,028.20 (9,498.72)
Total	49,187.7 (20,121.19)	41,335.98 (13,077.85)

CONCLUSION

The mean cost of surgical treatment for patients with spinal metastasis that underwent surgical treatment was R$44,497.95 for each patient. The largest expenses was related to implants (41.1%), followed by hospital stay (27.3%), and surgical procedure (19.7%). The cost of unknown primary tumors was higher compared to others metastatic tumor as well as the cost of patients with shorter survival.

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