ORIGINAL ARTICLE

Management of Thoracolumbar Vertebral Metastasis by Resection and Reconstruction

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Abstract

Background: ***Enhanced methods for detecting and treating original cancers, along with longer life spans, have led to a rise in the frequency of spinal metastases diagnoses.***

Objective: ***This study set intended to evaluate the functional outcome and quality of life of individuals with spinal metastases following surgical reconstruction following tumor excision.***

Patients and Methods: ***During prospective cohort research that began in March 2022 and ended in October 2024, twenty-three patients with metastases to the thoracic and lumbar spines had surgical care at Al Hussien Hospital, AL Azhar University. Patients were followed up for one year or until death occurred.***

Results: ***The range of ages ranged from 23 to 70 years, with 10 being females (43.47%) and 13 being men (56.52%). The average age was 52.12 ± 13.4 years. The average duration of survival was 14.086 ± 3.46 months, and no perioperative deaths occurred within the first month after the operation. Seventeen patients (73.91%) were able to survive for over a year, while six patients (26.08%) passed away due to various causes associated with the normal course of tumor metastasis.***

Conclusion: ***When patients with spinal metastases are carefully chosen, their treatment is meticulously planned, and surgical intervention is administered as needed, it can significantly enhance both function and quality of life.***

Keywords: Spinal metastases; Spine; Metastatic spine surgery; Outcome

1. Introduction

A significant source of mortality and morbidity, bone metastases, particularly those affecting the spine, are marked by a low quality of life for patients as a result of persistent and excruciating pain, limited mobility, pathological fractures, compression of the spinal cord, abnormal bone marrow development, and elevated blood calcium levels.[1,2]

The cervical spine accounts for fewer than 10% of all spine metastases, whereas the lumbar spine accounts for 15% to 30%. The thoracic spine accounts for 60% to 80% of these metastases.[3,2]

Surgical stabilization is usually necessary for patients who have spinal mechanical instability. Spinal instability cannot be treated with radiation or systemic treatment; therefore, surgical stabilization of an unstable spine is necessary for pain palliation, prevention of neurologic impairment, and the advancement of spinal deformities. When the Spinal Instability Neoplastic Score (SINS) rises, so does the level of functional disability and pain.[4,5]

When treating spinal metastases, a multimodal strategy is generally used, including surgery, chemotherapy, and radiation.[6]

Life expectancy, principal tumor site, and staging are the main factors that dictate surgical technique for patients with spinal metastases. As a result, we can better choose which patients to operate on and what kind of surgery to do. [7] To help with the decision-making process when choosing a treatment modality, Tokuhashi et al. created a score in the 1990s to estimate longevity. [8]

Specifically, we want to look at how well patients' quality of life, pain levels, neurological function, and ability to walk around after spinal reconstruction following removal of a tumor from the dorsolumbar spine fared.

Accepted 15 June 2025.
Available online 31 July 2025

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https://doi.org/10.21608/aimj.2025.446632

2. Patients and methods

During a prospective cohort study that began in March 2022 and ended in October 2024, twenty-three patients with metastases to the thoracic and lumbar spines had surgical care at Al Hussien Hospital. Individuals were monitored for a duration of one year or until they passed away.

Inclusion criteria:

Individuals older than 18 years old who have lumbar or thoracic spinal metastases, persistent pain that does not respond to non-operative treatments, spine instability as shown by pathologic fracture or progressive deformity, and neurological deficiency due to clinically substantial neural compression.

Exclusion criteria:

Patients less than 18 years old who have spinal metastases, primary benign and malignant tumors of the spine, and metastases to the cervical and sacral regions.

Complete patient history taking, comprehensive physical examination, neurological evaluation, and functional assessment were all part of the preoperative data collection process: Visual Analog Scale: Health status was assessed using the Estern Cooperative Oncology Group ECOG; prognosis and surgical fitness were determined using the updated Katagiri score; the ASIA impairment scale was utilized to evaluate neurological status; and lastly, the SINS was employed to evaluate instability.

Surgical data:

Table 1: Methods and type of resection performed on the subjects in our research.

TYPE OF RESECTION	NO. OF PATIENTS
INTRALESIONAL RESECTION	9
POSTERIOR FIXATION±DECOMPRESSION	3
POSTERIOR TRANSPEDICULAR CORPECTOMY & FIXATION COMBINED OPEN VERTEBROPLASTY & FIXATION	5 6

Follow-up data:

Radiological follow-up included periodic postoperative radiographs and magnetic resonance imaging (MRI) with contrast if necessary; clinical follow-up included assessments of pain, disability, and neurology at 3,6-, and 12-months intervals.

Statistical analysis:

The statistical software for the social sciences (SPSS) version 28 (IBM Corp., Armonk, NY, USA) was used for data coding and entry. In quantitative data, the means, standard deviations, medians, minimums, and maximums were used for summary, whereas in categorical data, the counts and percentages of frequencies were used. The Mann-Whitney U-test and the non-parametric Kruskal-Wallis test were used to compare quantitative variables. We utilized the non-parametric Friedman test and the Wilcoxon signed rank test to compare serial measurements within each subject. I used the Chi-square (x2) test to compare categorical data. On the other hand, when the anticipated frequency was below 5, an exact test was employed.

3. Results

According to Table 2, the mean age was 52.12 ± 13.4 years, with a range of 23-70 years. Of the total participants, 10 were females (43.47%) and 13 were men (56.52%). Table 3 shows the patient classifications based on the tumors' natural history: those with a slow growth rate (thyroid, prostate, pancreatic, multiple myeloma, and HCC) and those with a fast growth rate (adenocarcinoma, transitional cell carcinoma, and HCC). According to Table 4, ten patients (43.47%) had involvement of the lumbar spine, thirteen patients (56.52%) of the dorsal spine, and eighteen patients (82.60%) had oligometastasis, meaning three or fewer levels of metastasis, while four patients (17.39%) had multiple levels of metastases. Two patients (7.69% of the total) had grade A , two patients (7.69%) had grade B , six patients (26.086%) had grade C disease, two patients (8.69%) had grade D disease, and eleven patients (47.82%) had grade E disease, as measured by the ASIA scale. Based on the updated Katagiri score, patients were split into three categories: Table 5 shows that out of the total number of patients, 9 (or 39.13%) were classified as low risk (0 to 3), 12 (52.17%) as intermediate risk (4 to 6), and 2 (8.69%) as high risk (7 to 10).

Table 2. Distribution by Age and Gender.

		COUNT	%
AGE	<60 years	12	52.17%
	>60 years	11	47.82%
GENDER	Male	13	56.52%
	Female	10	43.47%

Table 3. Patient demographics as it relates to spinal metastases from primary tumors

		COUNT	%
1RY TUMOR DETAILS	Transitional cell carcinoma	1	4.34%
	Thyroid cancer	2	8.69%
	HCC	1	4.34%
	Prostatic cancer	1	4.34%
	Adenocarcinoma lung	2	8.69%
	Multiple Myeloma	7	30.43%
	Pancreatic carcinoma	1	4.34%
	Breast cancer	7	30.43%
	Adenocarcinoma colon	1	4.34%

Table 4. Proportion of patients categorized by the updated Katagiri score

		COUNT	%
REVISED KATAGIRI SCORE	0-3 (low risk group)	9	39.13%
	4-6 (intermediate risk group)	12	52.17%
	7-10 (high risk group)	2	8.69%

Surgical data:
Intervention:

Table 5. Patient distribution by intervention type and SINS.

		COUNT	%
TYPE OF INTERVENTION	Fixation + anterior reconstruction	20	86.95%
	Fixation only	3	13.043%
SINS	7-12 (potentially unstable)	15	65.21%
	13-18 (unstable)	8	34.78%

Complications:

Table 6. Showing incidence of complications.

		COUNT	%
COMPLICATIONS	Yes	5	21.73%
	No	18	78.26%
TYPES OF COMPLICATIONS	Dural tear	2	8.69%
	Deep infection	1	4.34%
	Neurological deficit	2	8.69%

Functional outcome and QOL:
VAS:

Table 7. VAS analysis.

	MEAN	SD	MEDIAN	MINIMUM	MAXIMUM	P VALUE
VAS (PRE)	9.15	0.87	9.00	7.00	10.00	----
1ST VAS (MONTH)	3.42	1.64	3.00	2.00	8.00	< 0.001
2ND VAS (6MONTHS)	2.07	2.26	1.00	0.00	10.00	< 0.001
3RD VAS (12 MONTHS)	0.68	1.42	0.00	0.00	6.00	< 0.001

European-Quality of life (Euro-QOL):

Table 8. Euro-QOL analysis.

	MEAN	SD	MEDIAN	MINIMUM	MAXIMUM	P VALUE
QUALITY OF LIFE (PRE)	-0.84	0.14	-0.88	-0.96	-0.53	----
1ST QOL (1 MONTH)	0.45	0.48	0.59	-0.96	0.95	< 0.001
2ND QOL (6 MONTHS)	0.61	0.52	0.86	-0.96	1.00	< 0.001
3RD QOL (12 MONTHS)	0.83	0.41	0.95	-0.77	1.00	< 0.001

Case 1:
27 years old female patient complaining of severe mechanical back pain. on examination, the patient had localized back tenderness and was non walker for 1 week with intact neurology. x-ray, CT and MRI showed pathological fracture of D8 due to lytic lesion. After staging, patient was diagnosed with lung adenocarcinoma

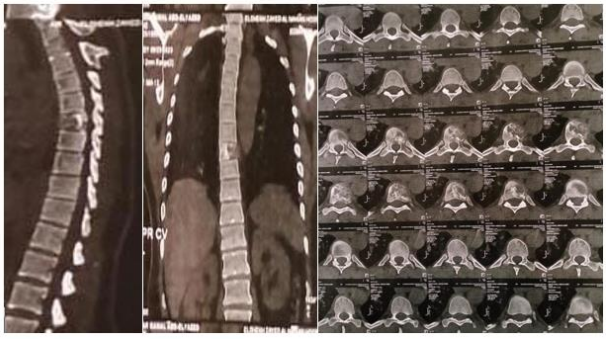

Figure 1. Case 1 CT scan of dorsal spine

Figure 2. Case 1 preoperative MRI dorsal spine

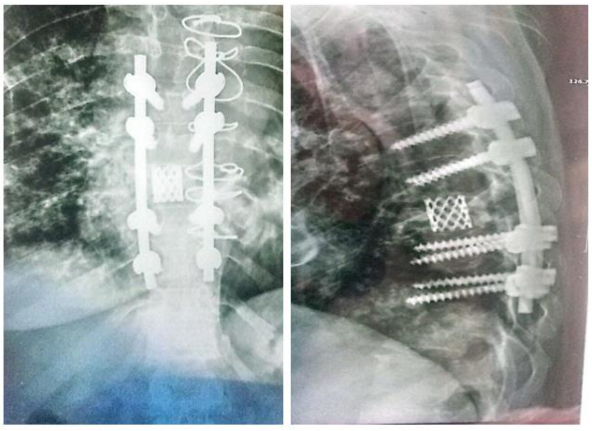

Figure 3. Case 1Post operative x ray showing Posterior fixation D6 to D10 with anterior reconstruction by pyramesh

Case 2:
73 years old male patient complaining of severe mechanical low back pain. on examination, patient had localized tenderness at low back region with intact neurology (ASIA E). Lumbar spine X ray and CT showed osteolytic lesion of L3.

Figure 4. Case 2 pre operative x ray lumbo sacral spine

Figure 5. Case 2 pre operative CT, MRI scan lumbo sacral spine

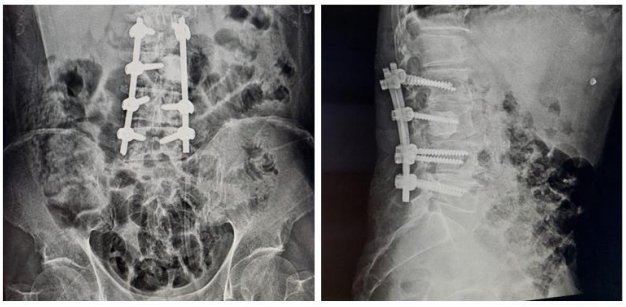

Figure 6. Case 2 post operative x ray L2 to L5 with open vertebroplasty of osteolytic lesion of L 3

4. Discussion

Multiple myeloma, lung, prostate, and breast cancer represent about 64.2% of all cancers according to Westermann et al.[9]

According to numerous studies, the majority of spine metastases occur in the dorsal region[9,10,13], but Tatsui et al.,[11] 15 percent of patients had metastases to the cervical region, 29 percent to the dorsal region, and 55.5% to the lumbar region.

Helweg et al.,[12] found that 90% of patients experienced pain as their primary symptom, whereas only 40% showed signs of neurological impairments.

The quality of life (QOL) showed a notable improvement in our study. The average Euro-QOL score was − 0.84 before the operation, and it increased to 0.45, 0.61, and 0.83 after 1, 6, and 12 months postoperatively, respectively. The improvement was statistically significant ($P < 0.001$), echoing the findings of Westermann et al.,[9], Quarishi et al.,[15,] De Reiter et al.,[16], and Quan et al. [17]

Results showed a statistically significant improvement in the mean VAS score following surgery, which persisted through all follow-up assessments. The average VAS score was 9.15 before surgery, 3.42 one month later, 2.07 six months later, and 0.68 twelve months later.

According to Westermann et al.,[9] at every postoperative follow-up appointment, there was a marked improvement in pain control, as measured by the VAS. Quality of life also improved dramatically, reaching a peak at 12 months, similar to the VAS score. Consistent with the study's findings, this pattern of gradual but steady progress peaked just before the conclusion of the research by Quan et al.[17]. Further improvement in quality of life over the long term was also noted in the study by Choi et al.[14]

According to Westermann et al., Consistent with the findings of the study by Benard et al., where the ODI increased by 70-25% by the conclusion of the follow-up period, the ODI showed improvement at each subsequent evaluation.[9]

Follow up after surgery about 70% of patients regained their ability to walk, while the number of non-walkers dropped from 10 (43.47%) to 3 (14.04%). The difference in the patient's ambulatory status before and after surgery was statistically significant (P 0.002).

Pain and ambulation were two areas where earlier surgical trials found promising results[18,19,20], however, the majority of these investigations relied on retrospective data and failed to evaluate quality of life as reported by patients.[14,15]

Concerning the neurological deficiency that persisted after surgery, 10 patients (43.4%) showed a one-grade improvement, two patients (8.69%) showed a two-grade improvement, and two patients (8.69%) showed a worsening. Before surgery, three patients had incontinence; after surgery, two of them became better.

Finding no difference in functional outcome between decompression with stabilization and corpectomy, this finding is identical to that of de Ruiter et al. [16,21]

The relatively low rate of tumor recurrence after using polymethylmethacrylate (PMMA) bone cement has led some to speculate that it may have anticancer effects.[22] Still, as pointed out by Bròdano et al.,[23], it is possible that the short survival of these patients is responsible for this consequence. Also, the average amount of time it takes to do a vertebroplasty operation in the majority of cases, according to Dong et al.,[24], compared to the corpectomy operation, which also involved inserting an extensible cage or pyramid mesh, the duration of the study was reduced.[25]

Previous research in patients with spinal metastases treated surgically has shown complication rates ranging from 20 to 36 percent; our study found a rate of 21.73%.[16, 20,26]

In terms of survival, 17 patients (73.91%) were still alive after more than a year of follow-up, while six patients (26.08%) passed away from various causes associated with the tumor

metastases' natural history. A mean of 14.086 ± 3.46 months was recorded for survival.

Westermann et al. found a significantly higher rate of mortality (44.6%) and overall 12-month survival (55.6%) compared to earlier reports (40-50%).9. The recent general improvement in the prognosis of tumor patients could be a possible reason for this finding.[27,28]

4. Conclusion

Our research shows that patients with spinal metastases can benefit from surgical intervention to enhance their quality of life, provided they are carefully chosen as patients and their care is well-planned.

Disclosure

The authors have no financial interest to declare in relation to the content of this article.

Authorship

All authors have a substantial contribution to the article

Funding

No Funds : Yes

Conflicts of interest

There are no conflicts of interest.

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