Spine Decompression in Metastatic Cord Compression; An outcome of 100 cases.

Journal:	*Asian Spine Journal*
Manuscript ID	ASJ-2022-0356
Manuscript Type:	Original article
Keywords:	spine, decompression, metastasis

Abstract:

Study design: Prospective observational sutdy

Purpose: To determine whether decompression with or without stabilisation in metastatic spinal cord compression achieves good pain relief, improve neurological function and overall quality of life assessment.

Overview of literature: Even though management of metastatic spinal disease by decompression and adjuvant radiation is described in literature, there is little evidence in the literature with regards to the extend to which the quality of life of such patients can improve following decompression of spine.

Methods: Patients with metastatic vertebral lesions were evaluated in a comprehensive cancer care hospital. Patients with SINS[1] score more than 7 were counseled for spinal decompression. 100 patients who met the inclusion criteria and consented for surgery was followed up for a period of 2 years. Frankel grading, ECOG[2] performance status, KPI[3] and ODI[4] score were documented preoperatively, post operatively and at final follow up. Patients underwent decompression, with or without stabilization, with or without cement augmentation..

Results: Preoperatively, 46% had Frankel grade C, 41% had grade D. There was a significant improvement, postoperatively with 47% to grade D, 35% to grade E ($p<0.001$). The preoperative ECOG median score was 3, and the postoperative median score was 2, with a p-value of <0.001. KPI preoperative median score was 50% compared to the post-surgery of 70% median score ($p<0.001$). Preoperatively ODI score of 46 patients had moderately disabled, followed by 30 with severe disability. Postoperatively, at last follow up, only 34 patients had a minimal disability, and 39 patients had moderately disabled($p<0.001$).

Conclusion: Spinal decompression surgeries in metastatic cancer patients results in markedly increased neurological outcomes, good pain relief and improved quality of life.

Keywords: metastasis, spine decompression, quality of life

Abbreviations: 1. SINS – Spinal instability severity score, 2. ECOG – Eastern cooperative oncology group, 3. KPI – Karnosky performace index, 4. ODI -Oswestry Disability Index.

Manuscript

Introduction

One of the most common locations for tumour metastasis is the spine, and there is an increase in the prevalence of spinal metastases cases.[1–3]. About 30% to 80% of cancer patients who have died had evidence of spinal metastases on autopsy.[4,5] Spinal metastasis leading to pathological vertebral fractures causing spinal cord compression may cause severe neurological deterioration results in poor quality of life.

Surgical decompression and stabilisation are integral components of treating metastatic spinal disease[6-8]. Depending on the location and the extent of the diseases, spine metastasis can cause functional disabilities and severe pain. Spinal metastasis cases have been treated with en-bloc resections, but unfortunately, they have resulted in substantial patient morbidity and poor long term local control[9–11]. With the advances in adjuvant chemotherapy, immunotherapy and radiation therapy, there has been a significant increase in the life expectancy of patients with spinal metastatic bone disease. As a result, quality of life of a cancer patient has come into the foray when compared to the earlier palliative goals[12]. Research studies have shown that circumferential decompression followed by radiation therapy may improve neurological function, but whether and to which extent these therapies could improve quality of life is undetermined [1,13-14]. Numerous research has evaluated the prognostic elements that can have an effect on survival, however, research focusing on elements that can have an impact on the quality of life, like, the ability to walk, are limited[15].Our main aim was to assess the outcomes in such cases in terms of pain relief, neurological function and overall quality of life.

Materials and Methods

It was a prospective observational study. Around 183 spinal vertebral lesions were evaluated in a single tertiary cancer centre by the same orthopaedic team from September 2012 to October 2020.

Inclusion criteria were

1) symptomatic vertebral metastasis confirmed by magnetic resonance imaging, with known or unknown primary cancer, with or without neurological deficits,

2) preoperative spinal instability neoplastic score(SINS)[16] score seven and above [having potentially unstable or unstable spine respectively],

3) life expectancy more than three months.

Exclusion criteria were 1) any of clinical or radiological suspicion or evidence of infection,

2) patients who were unfit for surgical intervention with ASA class 5 and 6,

3) Hematological malignancies, bone marrow tumours, intradural metastatic tumours and bleeding disorders were excluded.

Of these patients, 52 patients who were diagnosed to have multiple myeloma was excluded from the study. 13 patients had a life expectancy of fewer than three months. 118 patients met the inclusion criteria and was thoroughly counseled for surgery. 10 patients refused surgery owing to social and financial reasons. All patients gave written informed consent for participating in the study as well as for the treatment in their own native language. Study approval was obtained from our institutional review board. Preoperatively Frankel grading[17], Eastern cooperative oncology group [ECOG] performance status[18], Karnofsky Performance Index (KPI)[19], Oswestry Disability Index (ODI)[20] were recorded. Postoperatively same scores were used to assess at regular follow-up and at final follow-up.

All thoracic, lumbar, sacrum and six cervical lesions were decompressed through a standard midline posterior approach. It involved standard laminectomy and decompression of the spinal cord along with the removal of epidural soft tissue or osseous fragments found to be compressing the cord. If required, stabilisation with polyaxial pedicle fixation through standard transpedicular approach or augmentation using bone cement or both was done. In the cervical spine, four patients were approached through standard anteriorly and treated with corpectomy and stabilisation using anterior plate with cage system.

Rehabilitation protocol was tailor made of each patient. Most patients was ambulated within the first post operative week using walker and brace. Wherever possible, static exercises were intitated before discharge and was continued till week 8 followed by dynamic core exercises. All patients were followed at two weeks, 6 weeks, 3 months, 6 months,12 months, 18 months and 2 years. All patients were followed up for a total period of 2 years. 8 patients who were lost of follow up was later excluded from the study.

Data Analysis was done using SPSS (version 21.0; IBM). Between preoperative and postoperative group comparison of data were done using Wilcoxon signed-rank test and categorical data analysed using Chi-square test/Fisher exact test. Oswestry score was collected in three-time points were analysed using fried man's test. Kaplan Meir analysis was used to observe the survival distribution of patients. The duration of survival was considered to be the time between the date of the operation and death or the latest follow-up examination. The log-rank test was used to find the difference in survival of different factors or groups. $P<0.05$ is considered statistically significant.

Results

Table 1 shows patient demographic data. Out of 100 patients, there were 57 men and 43 women, and the mean age was 55 years (range, 15 to 95 years). The most common primary tumor was cancer of the lung followed by breast [Table 2]. The site of epidural compression was in the thoracic spine in 57 patients, in lumbar spine in 33 and in cervical spine in 10 patients.

15 patients underwent decompression only while 67 patients underwent decompression and stablilzation. Cement augmentation was carried out in 9 patients.

SINS scoring classified 82% of patients as unstable, and 18% as potentially unstable spine. Preoperative neurological deficits assesssed by Frankel grading showed a majority of forty-six patients (46%) with grade C and forty-one patients with grade D (41%) deficits. There was a significant improvement in neurological outcome postoperatively with forty-seven patients (47%) improving to grade D and thirty-five patients (35%) to grade E ($p<0.001$) [Table 3].

ECOG performance score evaluation showed statistical significance ($p<0.001$) between pre and post-surgery assessments. The preoperative median score was 3, and the postoperative median score was 2. In the pre-assessment majority of our patients (57%) had ECOG 3 score, followed by 31% with an ECOG score of 2, but in post-surgery, only 10 % had an ECOG score of 3, and 48% had an ECOG score of 2 [Table 4].

Significant increase in KPI scores was evidenced in these patients after surgical management.. Preoperative evaluation showed 35 patients had a performance status score of 50%, which improved to 60% in the postoperative evaluation. The preoperative median was 50% compared to the post-surgery median of 70%. There was a 20% change observed from the pre and post-surgery KPI along with the p-value <0.001 [Table 5].

The relation between KPI and Frankel grading were statistically significant ($p<0.001$) in both pre and post-surgery comparisons. Frankel grading showed a significant increase to Grade E, in which 14.29% patients had KPI score of 70%, which improved to 54.29% having 80% [Table 6]

Improvement of ODI score was statistically significant (p value<0.001) at every followup. Post hoc analyses were done using Wilcoxon signed-rank test, and statistical significance was observed between the groups. Preoperatively 46 patients had moderately disability, followed by 30 patients with severe disability. At final follow up, only 34 patients had minimal disability, and 39 patients with moderately disability. Preoperative and two weeks postoperative ODI median score in the preoperative period and at 2 week follow up was two, which had improved to a median of one (p-value <0.001)

In survival analysis with Kaplan mier estimate [Figure 4], it was observed that the mean survival time was 11 months, and the median survival time was six months with a 95% confidence interval (4.148-7.852).

Discussion

Cancer is one of the leading causes of death worldwide, according to World Health Organization, accounting for nearly 10 million deaths in 2020 [21]. The thoracic spine is the most commonly affected area [up to 60% to 80%][22]. Majority of patients in our cohort was found to thoracic compression. The most common type of cancer worldwide is lung cancer, and non-small-cell lung cancer (NSCLC) accounts for 80% to 85% of all lung cancer [23]. Most common primary site of cancer was lung [n=22] in our study.

To assess the spinal instability, Spine Instability Neoplastic Score(SINS) was used[16]. According to Fourney DR et al., study there was high reliability of intraclass correlation coefficients for interobserver and intraobserver observations for SINS scoring [24].

Surgical procedures for the treatment of metastatic spine fixations has evolved, making decompression of the cord more effective, leading to improved functional outcomes[25]. Surgery is generally to be considered in patients with a life expectancy >3 months [26]. En bloc surgery for spinal metastases has been tried before. Li et al. reported that aggressive surgeries for treatment of spinal metastases are very risky due to excessive bleeding, healthy tissue contamination, etc., leading to the deterioration of the immune system causing infection, speed the metastatic process, and even lead to direct death, but their results also showed that the debulking of tumor and the en bloc resections were equally effective in the salvage of neurologic function [27].

There are many quality-of-life assessments that have been reported for cancer patients and spinal tumours [28,29]. One of the most important outcome measures is the ability to walk according to Radesetal [29]. The Oswestry

Disability Index(ODI) often remains a valid and vigorous measure and the gold standard to estimate the quality of life and also quantify disability in patients with back problems[20]. In their literature review, Michael G. Fehlings et al. [30] reported improvement in ODI postoperatively, our results support the fact that decompression improves the ODI and thereby improving the quality of life outcomes.

ECOG and KPI are equally proven prognostic factors for overall performance status for patients with metastatic spine disease[31,32].

Longo Metal et al., evidenced that patients with ECOG more than 2 have a greater risk of hardware failure[34].

A retrospective study from Younsi A et al.[35] have analysed that preoperative median KPI is 30% and postoperative is 40% showing a 10% change. In our study, there was a better improvement in postoperative KPI median.

Our results show that 64% of patients improved neurologically by at least one Frankel grade postoperatively. In a similar study by Younsi A et al.[35], 26% maintained the same Frankel grade postoperatively. Less than half (46%) of patients were preoperatively categorised into Frankel grade C, and we observed improvements in the Frankel grading and they became ambulatory following spinal decompression surgery. Previous studies have reported postoperative improvements in Frankel grade of 40% - 89%[36 -44], and our data reiterates these findings. Tateiwaetal et al. reported that even in cases with preoperative Frankel grade operated with an interval time longer than 48 hours, have become ambulatory postoperatively [36].

The current study has certain limitations. Bone quality and stability of the implant may directly contribute to the post operative outcomes of such patients. Age, gender, pathology of primary lesion can be different factors that may affect the bone quality. For this reason we have avoided grouping hematological First, different types and severity of cancers were included given the complexity of such cases. Second, single and multilevel vertebral lesions were compared to evaluate the outcome and survivorship. This may influence the interpretation of the results from the study. Nonetheless, given the paucity of the data in the current literature, our study was undertaken.

Conclusion

Our study has found that spinal decompression surgeries in metastatic cancer patients result in markedly increased neurological outcomes and good pain relief. Quality of life is an important factor in terminally ill patients but has been unfortunately neglected hence we suggest that surgical decompression be offered to all symptomatic patients with metastatic spine disease.

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Table 1: Patient demographic data and Surgery data

Characterstics	Patients,N(%)
GENDER	
Male	57(57%)
Female	43(43%)
SINS SCORE	
Unstable	82 (82%)
Potentially Unstable	18 (18%)
SURGERY TYPE	
Decompression	15(15%)
Decompression & Stabilization	76(76%)
Decompression & Augmentation	6(6%)
Decompression, Stabilisation & Augmentation	3(3%)

Table no:2 – showing number (n) of cancer patients.

CANCER	NO: (n)
Carcinoma Lung	22
Carcinoma Breast	19
Carcinoma Prostate	12
Carcinoma Thyroid	11
Renal Cell Carcinoma	6
Carcinoma Cervix	5
Carcinoma Stomach	4
Hepatocellular Carcinoma	3
Carcinoma Rectum	2
Ewings Sarcoma	2
Carcinoma Bladder	2
Endometrial Carcinoma	2
Paraganglioma	2
Synovial Sarcoma	2
Carcinoma Tonsil	1
Cholangeo Carcinoma	1
Carcinoma Pancreas	1
Carcinoma Larynx	1
Osteosarcoma	1
Periampulari Carcinoma	1

Table 3: Frankel Grading between preoperative and post operative patients.

FRANKEL GRADE	PRE OPERATIVE n(%)	POST OPERATIVE n(%)
A	6 (6%)	5 (5%)
B	7 (7%)	5 (5%)
C	46(46%)	8 (8%)
D	41(41%)	47 (47%)
E	0(0%)	35 (35%)

Table 4: ECOG score between preoperative and post operative patients.

ECOG SCORE	PRE OPERATIVE n(%)	POST OPERATIVE n(%)
0	0	5 (5%)
1	1(1%)	30 (30%)
2	31 (31%)	48 (48%)
3	57 (57%)	10 (10%)
4	11 (11%)	7 (7%)

Table 5: Karnofsky Performance Status between preoperative and postoperative patients.

KARNOFSKY SCORE (%)	PREOPERATIVE (n)	POSTOPERATIVE (n)
20	4	2
30	2	1
40	13	4
50	35	12
60	24	30
70	20	16
80	2	23
90	0	11
100	0	1

TABLE 6: Relation between Karnofsky Performance Status and Frankel grading

		PREOPERATIVE FRANKEL GRADING n(%)				
		A	B	C	D	E
PRE OPERATIVE KARNOFSKY SCORE	20%	2 (33.33%)	2 (28.57%)	0	0	0
	30%	1 (16.67%)	1 (14.29%)	0	0	0
	40%	3 (50%)	3 (42.86%)	5 (10.87%)	1 (2.44%)	0
	50%	0	1 (14.29%)	33 (71.74%)	1 (2.44%)	0
	60%	0	0	4 (8.70%)	19 (46.34%)	0
	70%	0	0	2 (4.35%)	18 (43.90%)	0
	80%	0	0	0	2 (4.88%)	0
TOTAL		6	7	46	41	0
		POSTOPERATIVE FRANKEL GRADING n(%)				
		A	B	C	D	E
POST OPERATIVE KARNOFSKY SCORE	20%	2 (40%)	0	0	0	0
	30%	1 (20%)	0	0	0	0
	40%	1 (20%)	3 (60%)	0	0	0
	50%	1 (20%)	2 (40%)	6 (75%)	3 (6.67%)	0
	60%	0	0	2 (25%)	28 (62.22%)	0
	70%	0	0	0	9 (20%)	5 (14.29%)
	80%	0	0	0	4 (8.89%)	19 (54.29%)
	90%	0	0	0	1 (2.22%)	10 (28.57%)
	100%	0	0	0	0	1 (2.86%)
TOTAL		5	5	8	45	35

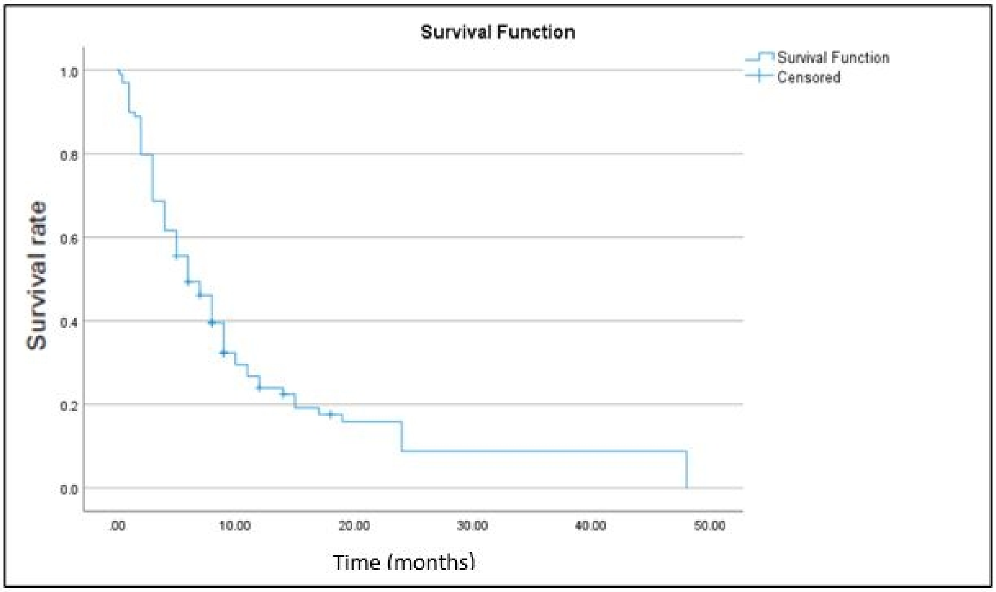

Figure 1: Kaplan Mier graph showing survival of patients

161x96mm (96 x 96 DPI)