

# The Impact of Sarcopenia on Survival in Surgically Treated Patients with Metastatic Bone Disease

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**INTRODUCTION:** Sarcopenia, or loss of muscle mass, is a diagnosis that has been gaining interest in outcomes research and has been correlated with survival in hip fractures, sarcoma, and metastatic disease of the spine. However, this has not been evaluated in the extremely common setting of surgical management of extremity metastatic disease. The purpose of this study is to quantify the absence or presence of sarcopenia, as measured by the psoas lumbar (L4) vertebral index<sup>1</sup> on CT scan and correlate this with surgical complications and overall survival following surgery to address a pathologic fracture of the lower extremity. Knowledge of this correlation could result in a tool to better estimate patient risk and survival to inform surgical decision making.

**METHODS:** This retrospective cohort study included patients surgically treated for biopsy proven metastatic bone disease or myeloma between 2011 and 2020. Patient demographics, imaging findings, and survival outcomes were collected. Psoas Lumbar Vertebral index (PLVI) were calculated by dividing the mean psoas cross sectional area (CSA) by their L4 CSA. Patients were split into low (sarcopenic) and high PLVI group using median PLVI as the cutoff (0.78 cm<sup>2</sup>). Additionally, patients were also split into another two PLVI groups, 1 standard deviation (SD) above and below the mean. Sarcopenia and survival were analyzed using Kaplan Meier curves and log-rank tests.

**RESULTS:** Ninety-six patients with a mean age of 66.25 (+/- 10.11) years were included. Median PLVI was 0.78 cm<sup>2</sup> (IQR: 0.6178, 0.9521). There was a difference in mean PLVI based on gender (p< 0.001) and age (p=0.002) with female and older patients having a lower PLVI (Table 1). Overall survival did not differ between high and low PLVI groups. However, survival differed significantly (p=0.024) among PLVI subgroups based on 1 standard deviation from the mean, with a disadvantage toward those patients 1 SD below the mean (Figure 1).

**DISCUSSION AND CONCLUSION:** Patients with PLVI values 1 SD below the mean are at significantly increased risk of mortality when undergoing surgical treatment of extremity metastases. This is in contrast to the high versus low PLVI groups where there was no statistical difference in mortality. This can be explained by the logic that patients are more likely to be tightly clustered around the cutoff value which may escape statistical and clinical significance. By making a clearer delineation using values 1 SD above and below the mean, we are better able to make comparisons between more distinct patient PLVIs. This information is critical to surgical decision making and patient counseling.

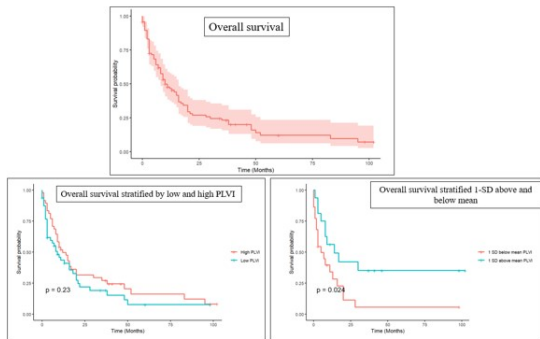


Figure 1: Kaplan Meier plot showing overall survival, survival of high vs low PLVI, and survival of patients 1-SD above and below mean PLVI.

	High PLVI (N=48)	Low PLVI (N=48)	Total (N=96)	p value
<b>Age (Mean, SD)</b>	63.04 (10.33)	69.46 (8.88)	66.25 (10.11)	0.002
<b>Sex</b>				< 0.001
Female	9 (18.8%)	31 (64.6%)	40 (41.7%)	
Male	39 (81.2%)	17 (35.4%)	56 (58.3%)	
<b>Race</b>				0.7
African American	2 (4.2%)	4 (8.3%)	6 (6.2%)	
Caucasian	45 (93.8%)	43 (89.6%)	88 (91.7%)	
Other	1 (2.1%)	1 (2.1%)	2 (2.1%)	
<b>BMI (Mean, SD)</b>	30.21 (7.37)	28.46 (6.28)	29.33 (6.84)	0.214
Extraosseous	33 (45.6%)	41 (85.4%)	74 (77.1%)	0.052
<b>Location</b>				0.231
Femur	42 (87.5%)	35 (72.9%)	77 (80.2%)	
Humerus	1 (2.1%)	1 (2.1%)	2 (2.1%)	
Pelvis	5 (10.4%)	10 (20.8%)	15 (15.6%)	
Tibia/Fibula	0 (0.0%)	2 (4.2%)	2 (2.1%)	
<b>Surgery Indication</b>				0.354
Fracture	23 (50.0%)	28 (59.6%)	51 (54.8%)	
Prophylactic	23 (50.0%)	19 (40.4%)	42 (45.2%)	
Other	2	1	3	
<b>Surgery Type</b>				0.695
Amputation	25 (52.1%)	25 (52.1%)	50 (52.1%)	
IM Nail	20 (41.7%)	17 (35.4%)	37 (38.5%)	
Other	1 (2.1%)	3 (6.2%)	4 (4.2%)	
Plates/Screws	2 (4.2%)	3 (6.2%)	5 (5.2%)	
<b>Mean Estimated Blood Loss (cc)</b>	388.23 (402.51)	548.32 (708.27)	469.20 (580.02)	0.2
<b>Length of Stay</b>	7.00 (5.93)	8.19 (7.25)	7.59 (6.62)	0.382
<b>Discharge Disposition</b>				0.511
Acute Rehabilitation	0 (0.0%)	2 (4.2%)	2 (2.1%)	
Home	27 (56.2%)	21 (43.8%)	48 (50.0%)	
Hospice	0 (0.0%)	3 (6.2%)	3 (3.1%)	
Nursing home	2 (4.2%)	2 (4.2%)	4 (4.2%)	
SNF	17 (35.4%)	17 (35.4%)	34 (35.4%)	
Unknown	2 (4.2%)	3 (6.2%)	5 (5.2%)	
<b>30-day Readmission</b>	10 (20.8%)	11 (22.9%)	21 (21.9%)	0.805
<b>Reoperation</b>	6 (12.5%)	9 (18.8%)	15 (16.0%)	0.335
<b>Mortality</b>	39 (81.2%)	38 (79.2%)	77 (80.2%)	0.798

Table 1: Demographics and patient characteristics of patients in study