Clinical Outcomes of Surgery for Spinal Metastases: A Comparative Study

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INTRODUCTION: Breast cancer accounts for 12–17% of all spinal metastases, ranking among the most common primary tumors to spread to the spine alongside lung and prostate cancers. Patients with breast cancer differ from those with other malignancies in age, comorbidities, and baseline characteristics. This study aims to compare demographics, surgical outcomes, and survival in patients with breast cancer spinal metastases versus other cancer types.

METHODS: Using the Epic Cosmos dataset, encompassing data from 1500 hospitals and 300 million patients, we identified patients who underwent surgery for spinal metastases from breast or non-breast cancers. We created two cohorts, breast and non-breast, where the non-breast group was balanced to include equal patients from each cancer type (lung, thyroid, prostate, liver, renal, multiple myeloma). A 1:1 propensity score match was performed to control for demographics and comorbidities, with key differences noted. Outcomes included 90-day postoperative complications, analyzed using risk ratios (RR) with a significance threshold of $p < 0.05$, and 5-year Kaplan–Meier survival.

RESULTS: The study included 2,115 patients per matched cohort (98% female for breast, 34% female for other). The breast cancer cohort had significantly lower complication rates: readmission (RR 0.790, 95% CI 0.742–0.841, p<0.001), pneumonia (RR 0.589, 95% CI 0.472–0.735, p<0.001), cardiac arrest (RR 0.471, 95% CI 0.261–0.850, p=0.016), ventilator dependence (RR 0.278, 95% CI 0.103–0.747, p=0.012), acute renal failure (RR 0.585, 95% CI 0.487–0.701, p<0.001), septic shock (RR 0.461, 95% CI 0.310–0.684, p<0.001), sepsis (RR 0.635, 95% CI 0.511–0.787, p<0.001), pulmonary embolism (RR 0.788, 95% CI 0.631–0.984, p=0.040), and unplanned reintubation (RR 0.591, 95% CI 0.400–0.874, p=0.010). Other complications were not significantly different. Kaplan–Meier analysis showed 5-year survival of 71.3% in the breast cancer cohort versus 61.2% in other cancers (log-rank (LR) p<0.001). Compared individually, breast cancer survival at 5 years was higher than lung (71.3% vs. 43.5%, LR p<0.001), kidney (71.3% vs. 55.7%, LR p<0.001), and liver cancer (71.3% vs. 40.3%, LR p<0.001); not significantly different from multiple myeloma and prostate cancer; and lower than thyroid cancer (71.3% vs. 78.6%, LR p=0.006).

DISCUSSION: Patients undergoing surgery for spinal metastases from breast cancer experience fewer complications and higher survival compared to those with lung, liver, or kidney cancers. These findings support the consideration of more aggressive or durable treatments in breast cancer patients, while emphasizing the need for individualized, nuanced decision-making. Further studies comparing cancer-specific outcomes are warranted.

SIGNIFICANCE/CLINICAL RELEVANCE: Breast cancer patients demonstrate superior surgical outcomes compared with patients who have lung, liver, or kidney metastases. This knowledge can help guide clinicians in selecting more aggressive and durable treatment strategies tailored to this patient group.

IMAGES AND TABLES:

Table 1: 90-Day Postoperative Complications.
Compares complication rates, risk ratios (RR), and p-values for patients with spinal metastases from breast cancer versus a matched cohort of other malignancies.

90-Day Postoperative Complications

Matched Cohorts: Breast Cancer vs. Other Malignancies

Complication	Rate (Other)	Rate (Breast)	Risk Ratio	95% CI	p-value
Readmission	54.28%	42.88%	0.790	0.742 - 0.841	**<0.001**
Wound Disruption	6.48%	6.00%	0.927	0.734 - 1.171	0.567
Blood Transfusion	0.00%	0.00%	NA	NA - NA	>0.999
Pneumonia	9.31%	5.48%	0.589	0.472 - 0.735	**<0.001**
Surgical Site Infection	5.82%	4.96%	0.854	0.663 - 1.100	0.247
Urinary Tract Infection	11.63%	12.62%	1.085	0.923 - 1.277	0.346
Cardiac Arrest	1.61%	0.76%	0.471	0.261 - 0.850	**0.016**
Myocardial Infarction	2.13%	1.37%	0.644	0.406 - 1.024	0.079
Stroke	2.46%	1.89%	0.769	0.512 - 1.157	0.246
Ventilator Dependence	0.85%	0.24%	0.278	0.103 - 0.747	**0.012**
Acute Renal Failure	13.43%	7.85%	0.585	0.487 - 0.701	**<0.001**
Deep Vein Thrombosis	4.63%	3.74%	0.806	0.603 - 1.078	0.167
Septic Shock	3.59%	1.65%	0.461	0.310 - 0.684	**<0.001**
Sepsis	9.31%	5.91%	0.635	0.511 - 0.787	**<0.001**
Pulmonary Embolism	7.80%	6.15%	0.788	0.631 - 0.984	**0.040**
Unplanned Reintubation	3.12%	1.84%	0.591	0.400 - 0.874	**0.010**
Progressive Renal Insufficiency	10.40%	8.94%	0.859	0.714 - 1.033	0.119
Spinal Cord Injury	2.70%	2.22%	0.825	0.563 - 1.207	0.372

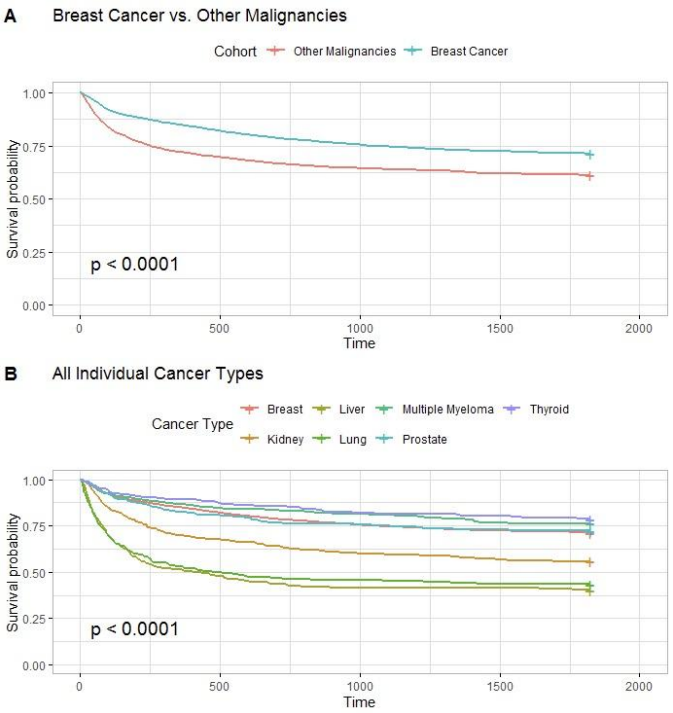

Figure 1: 5-Year Survival After Propensity Score Matching.
Kaplan-Meier curves showing (A) significantly higher 5-year survival for breast cancer patients compared to a combined cohort of other malignancies (p<0.0001), and (B) a comparison of survival among all individual cancer types (p<0.0001)