

Evaluating Surgical Outcomes of Patients with Metastatic Bone Disease Managed with Urgent Elective versus Emergent Surgical Care Pathways

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INTRODUCTION:

Metastatic bone disease (MBD) has a substantial burden on both patients and the healthcare system. Patients in a pain crisis or with an acute fracture are generally admitted via emergent care pathways whereas patients with identified high-risk bone lesions are often booked for urgent yet scheduled elective procedures. The purpose of this study is to develop a comprehensive database of all patients undergoing orthopaedic surgery for MBD and to compare the postoperative outcomes and direct healthcare costs of emergent versus electively scheduled surgical care pathways in a Canadian health care system.

METHODS: We have conducted a retrospective, multicenter cohort study of all patients presenting for surgery for MBD of the long bones or pelvis in southern Alberta, Canada between 2006 and 2021. Patients were identified by a search query of all patients with a diagnosis of metastatic cancer who underwent surgery for an impending or actual pathologic fracture. Emergent surgeries were defined by patients admitted to hospital via urgent care mechanisms and managed via unscheduled surgical bookings. Elective surgeries were defined by patients seen by an orthopaedic surgeon at least once prior to surgery and booked for a scheduled procedure. Outcomes included overall survival (OS) from the time of surgery, hospital length of stay (LOS), and 30-day hospital readmission rate. For the cost effectiveness analysis, a decision tree model of surgical care pathways was developed specifically for MBD of the femur. Probabilistic sensitivity analysis was used, with the effectiveness determined by the overall survival postoperatively between the two groups. Direct healthcare costs associated with surgery and postoperative care were estimated using micro-costing data and converted to 2021 Canadian Dollars.

RESULTS: A total of 558 patients underwent orthopaedic surgery for MBD between 2006 and 2021. There were 390 patients (69.9%) treated through emergent pathways and 168 patients (30.1%) treated through urgent, electively scheduled pathways. Lung, prostate, renal cell, and breast cancer were the most common primary malignancies and there was no significant difference in these primaries among the groups ($p=0.22$). Emergent patients were more likely to be treated for a pathologic fracture ($p<0.001$) and elective patients were more likely to be treated for an impending fracture ($p<0.001$). OS was significantly shorter in the emergent group (6.3 months, 95%CI: 5.2-7.5) compared to the elective group (16.9 months 95%CI: 12.3-24.2) [$p<0.001$]. Emergent referral was an independent poor prognostic factor of OS in addition to a diagnosis of lung cancer on multivariate analysis ($p<0.001$, $p=0.04$). LOS was significantly longer in the emergent group (14 days, 95%CI: 13-16 versus 5 days, 95%CI: 5-6 days) [$p<0.001$]. There was a significantly greater rate of 30-day hospital readmission in the emergent group (13.7% versus 7.0%) [$p=0.004$]. For the cost-effectiveness analysis, outcomes were analyzed for 379 patients who underwent surgery for MBD of the femur. The probabilistic sensitivity analysis demonstrated superior expected overall survival of the elective surgery group at 15.6 months with a corresponding lower overall surgical cost of \$20,731 per patient. However, the emergent surgery group had an overall survival of 6.3 months and an overall surgical cost of \$42,036 per patient. The results were consistent across two-way sensitivity analysis. Incremental cost effectiveness ratios were not calculated due to the superiority of elective care pathways.

DISCUSSION AND CONCLUSION:

Patients undergoing elective surgery had significantly longer OS, shorter LOS, lower rates of 30-day hospital readmission, and lower direct healthcare costs. These findings demonstrate clinical and economic value in providing elective orthopaedic care, when possible, for patients with MBD. Care delivery interventions capable of decreasing the footprint of emergent surgery through enhanced screening or follow up of patients with MBD has the potential to significantly improve clinical outcomes and decrease healthcare costs in this population. Further refinements to the economic model are ongoing and will be available for presentation.