No survival benefit for patients with metastatic disease of bone treated in high-volume centers

IOWA | College of Public Health

Emma Herbach, Bradley McDowell, Benjamin J. Miller

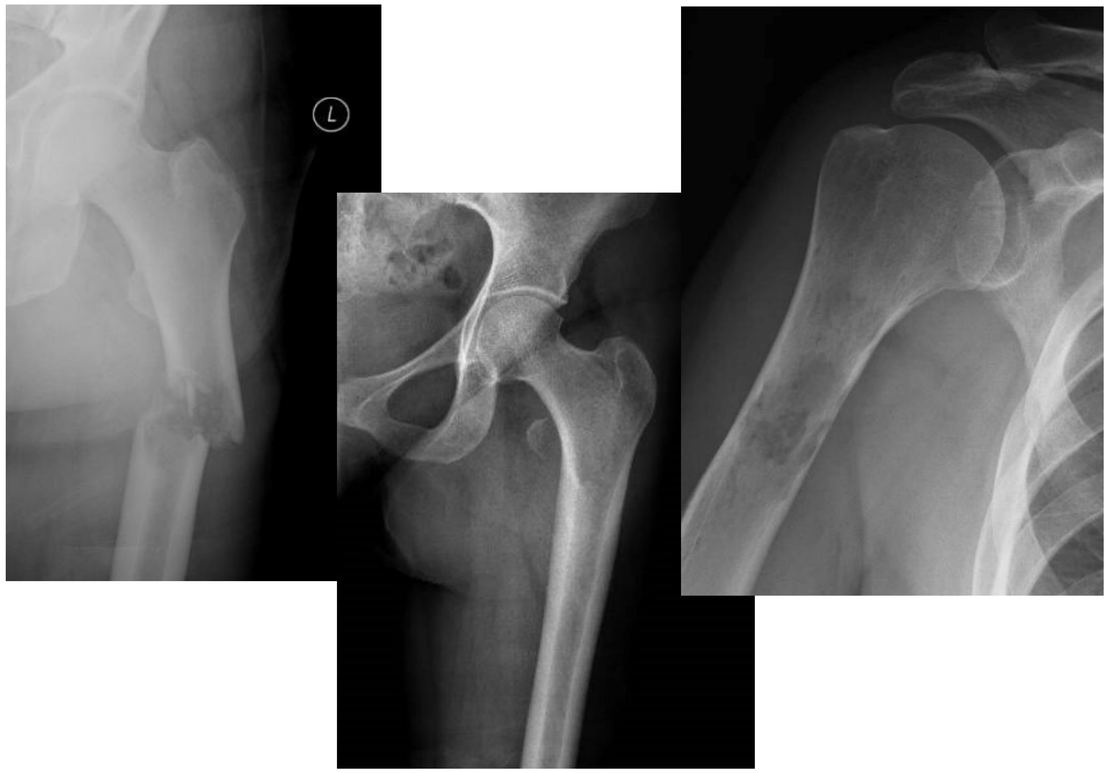
University of Iowa

Background

- Metastatic disease of bone (MDB) is a common site of cancer spread and often a source of pain and dysfunction for those affected.
- Disease involving the long bones of the extremities may require surgical intervention to prevent or treat a pathologic fracture, followed by radiation, bisphosphonates, or systemic therapy to control residual disease.
- Many cancers, including pancreatic, esophageal, and sarcoma, demonstrate a survival benefit when treated at higher volume centers.
- Our goal was to investigate the effect of hospital characteristics on the risk of death and readmission following surgical treatment of MDB.

Methods

- We queried the SEER-Medicare linked database to find 9,413 cases of extremity (femur, tibia, fibula, humerus, radius, and ulna) MDB (breast, kidney, lung, prostate, and multiple myeloma cancers) treated with bone surgery from 1992-2014.
- Cox proportional hazards regression models were used to calculate crude and adjusted hazards ratios (HRs) for each exposure and outcome.
  - Our exposures of interest were three characteristics of the hospital where each participants' qualifying bone surgery was performed: medical school affiliation, hospital volume, and Commission on Cancer (CoC) accreditation status.
  - Our outcomes of interest were 90-day mortality, 1-year mortality, and 30-day readmission.
  - Adjusted models controlled for patient, tumor, and treatment variables
- Follow-up time was calculated for each outcome as the number of days from
  - qualifying bone surgery to death from any cause or the end of the study period (90 or 365 days, respectively) for the mortality analyses.
  - discharge from the qualifying bone surgery until readmission, death from any cause (as a competing event), or 30 days after discharge (end of study period), whichever occurred first, for the readmission analysis.



Outcome	90-day mortality		1-year mortality		30-day readmission	
Hospital characteristic	Crude HR (95% CI)	Adjusted HR (95% CI)	Crude HR (95% CI)	Adjusted HR (95% CI)	Crude HR (95% CI)	Adjusted HR (95% CI)
Medical School Affiliation						
Major affiliation (vs. no affiliation)	0.86* (0.79-0.94)	0.88* (0.80-0.96)	0.91* (0.85-0.96)	0.92* (0.87-0.99)	1.10 (0.95-1.27)	1.09 (0.93-1.28)
Limited/graduate affiliation (vs. no affiliation)	0.96 (0.88-1.05)	0.95 (0.87-1.04)	0.98 (0.92-1.05)	0.99 (0.92-1.05)	0.9 (0.8-1.13)	0.95 (0.80-1.12)
Hospital volume						
Low volume (vs. high volume)	1.00 (0.93-1.07)	0.98 (0.91-1.05)	1.03 (0.98-1.08)	1.00 (0.95-1.06)	1.01 (0.88-1.14)	1.00 (0.87-1.14)
COC accreditation status						
Accredited (vs. unaccredited)	1.06 (0.99-1.13)	1.08 (1.00-1.16)	1.00 (0.96-1.06)	1.02 (0.97-1.08)	0.92 (0.81-1.04)	0.96 (0.84-1.09)

Table. Crude and adjusted HRs generated from Cox regression models. *significant at p=0.05 significance level. Models adjusted for Charlson comorbidity score, index cancer site, metastases at index cancer diagnosis, age at bone surgery, marital status at index cancer diagnosis, sex, race, ethnicity, year of bone surgery, SEER registry site, pathologic fracture, and time between index cancer diagnosis and bone surgery.

Results & Discussion

- Major medical school affiliation yielded a significantly lower risk of 90-day and one-year mortality than unaffiliated institutions before and after adjustment; there was no difference in risk of 30-day readmission for major affiliation nor in any outcome for institutions with other medical school affiliations.
  - Stratification by index cancer site revealed the significant protective effect of major medical school affiliation was driven by lung cancer patients for 90-day mortality and by lung, kidney, and multiple myeloma patients for 1-year mortality.
  - Other cancer subtypes did not demonstrate significant differences in mortality or readmission by medical school affiliation.
- Low-volume hospitals demonstrated similar 90-day mortality, 1-year mortality, and 30-day readmission to high-volume hospitals before and after adjustments.
- Patients treated at hospitals accredited by the CoC did not experience a significant difference in risk of 90-day or 1-year mortality nor 30-day readmission compared to those treated at unaccredited hospitals.

Conclusions

- We did not find evidence that increased hospital volume or CoC accreditation notably improved survival or readmission rates in patients treated surgically for MDB of the long bones.
- Patients treated at institutions with a major medical school affiliation had better 90-day and 1-year survival than those treated at hospitals that were not affiliated with a medical school.
- These results have implications in the discussion of regionalization versus access in cancer care.
  - Because MDB is a common site of metastatic disease, it will often affect patients in regions where access to a tertiary care center is difficult.
  - These results imply that surgical management of MDB at smaller regional hospitals does not compromise survival or readmissions, but we are unable to comment on functional outcomes or surgical failures.
- Orthopaedic oncologists should work on educating practitioners within their referral area on the signs of impending fracture and the indications for referral for more complex reconstructions.