Development Of A Preoperative Metastatic Spinal Tumor Frailty Index (MSTFI) Using A Nationwide Database and its Association With Inpatient Morbidity, Mortality, and Length of Stay

C. Rory Goodwin MD PhD; Rafael De la Garza-Ramos BA; Amit Jain BS; Nancy A Abu-Bonsrah BS; Charles Fisher MD; Chetan Bettegowda MD, PhD; Daniel M. Sciubba BS, MD

Johns Hopkins University School of Medicine, Department of Neurosurgery

JOHNS HOPKINS MEDICINE

Learning Objectives

By the conclusion of this session, participants should be able to: 1) Identify factors that are associated with morbidity, mortality and length of stay among patients with metastatic spine tumors

Introduction

"Frailty", a state of decreased homeostatic reserve, may be estimated based on the presence of preoperative comorbidities. The aim of this study was to develop a preoperative metastatic spinal tumor frailty index (MSTFI) which could predict morbidity, mortality, and length of stay.

Methods

A large inpatient hospitalization database was searched from 2002-2011 to identify 4,583 patients with spinal metastasis from breast (21.1%), lung (34.1%), thyroid (3.8%), renal (19.9%) and prostate (21.1%) cancer who underwent surgery. A multiple logistic regression model identified nine independent parameters that were used to construct the MSTFI: anemia, congestive heart failure, chronic lung disease, coagulopathy, electrolyte abnormalities, pulmonary circulation disorders, renal failure, malnutrition, and pathologic fractures. Patients with 0 comorbidities were categorized as "not frail," 1 as "mildly frail," 2 as "moderately frail," and =3 as "severely frail."

Results

The overall perioperative complication rate was 19.3% and in-patient mortality was 3.0%. Compared to patients without frailty, patients with mild (odds ratio (OR) 2.12; 95% CI, 1.74 – 2.59), moderate (OR 3.81; 95% CI, 3.05 – 4.76), and severe frailty (OR 8.11; 95% CI, 6.34 – 10.38) had significantly increased odds of complication development. Likewise, patients with mild (OR 2.73; 95% CI, 1.64 – 4.52), moderate (OR 4.10; 95% Ci, 2.39 – 7.04), and severe frailty (OR 6.34; 95% CI, 3.61 – 11.1) were more likely to die during their hospital stay. Length of stay also increased significantly by MSTFI (p<0.001).
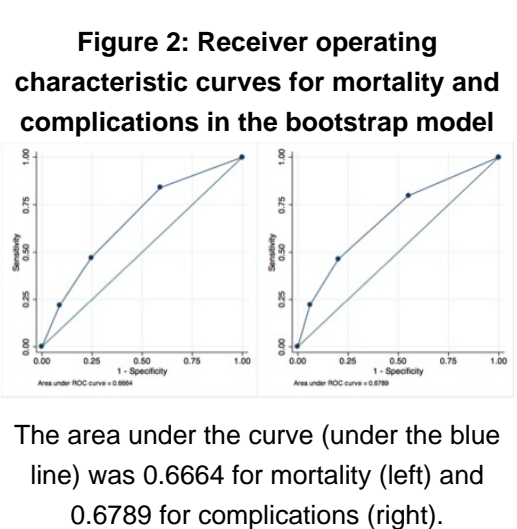
Figure 2: Receiver operating characteristic curves for mortality and complications in the bootstrap model

The area under the curve (under the blue line) was 0.6664 for mortality (left) and 0.6789 for complications (right).

Figure 1: Mortality rates (A), complication rates (B), and length of stay (C) after surgery for metastatic spinal tumors based on the MSTFI.
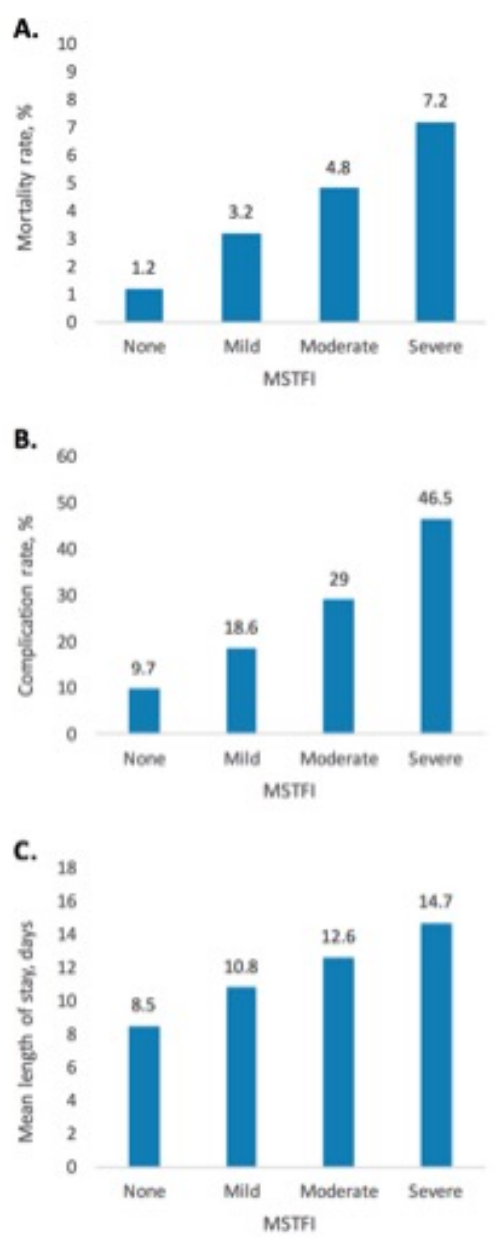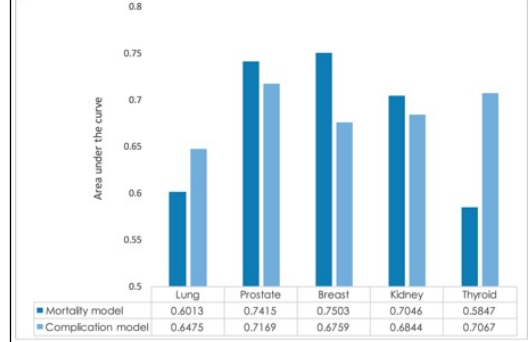

Figure 3: Areas under the curve for the ROC curves stratified by tumor location.

Conclusions

In surgically treated patients with spinal metastasis, certain preoperative comorbidities may significantly increase the risk of major complications and mortality.

References

1. Wong DA, Fornasier VL, MacNab I. Spinal metastases: the obvious, the occult, and the impostors. Spine (Phila Pa 1976). 1990;15: 1-4.
2. Maccauro G, Spinelli MS, Mauro S, Perisano C, Graci C, Rosa MA. Physiopathology of spine metastasis. Int J Surg Oncol. 2011;2011: 107969.
3. Simmons ED, Zheng Y. Vertebral tumors: surgical versus nonsurgical treatment. Clin Orthop Relat Res. 2006;443: 233-247.
4. Harrington KD. Anterior decompression and stabilization of the spine as a treatment for vertebral collapse and spinal cord compression from metastatic malignancy. Clin Orthop Relat Res. 1988: 177-197.
5. Kato S, Murakami H, Demura S, et al. Spinal metastasectomy of renal cell carcinoma: A 16-year single center experience with a minimum 3-year follow-up. J Surg Oncol. 2016.
6. Petteys RJ, Spitz SM, Rhee J, et al. Tokuhashi score is predictive of survival in a cohort of patients undergoing surgery for renal cell carcinoma spinal metastases. Eur Spine J. 2015;24: 2142-2149.
7. De la Garza-Ramos R, Kerezoudis P, Bydon A, et al. Complications in Metastatic Spinal Tumor Surgery. World Spinal Column J. 2016;7: 20-24.
8. Lau D, Leach MR, Than KD, Ziewacz J, La Marca F, Park P. Independent predictors of complication following surgery for spinal metastasis. Eur Spine J. 2013;22: 1402-1407.
9. Fedarko NS. The biology of aging and frailty. Clin Geriatr Med. 2011;27: 27-37.
10. Rockwood K, Mitnitski A. Frailty in relation to