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Prognostication of survival in patients who underwent operative treatment of metastatic spine disease

Authors: N.R. Cools Paulino Pereira, MD[1]; S.J. Janssen, MD[1]; E. van Dijk, BSc[1]; F.J. Hornicek, Jr., MD, PhD[1]; Marco L. Ferrone, MD[2]; J.H. Schwab, MD, MS[1]

1. Orthopedic Surgery, Massachusetts General Hospital, Boston, MA, United States.
2. Orthopedic Surgery, Brigham and Women's Hospital, Boston, MA, United States.

Background: Spine metastatic disease impacts survival and quality of life in terminally ill patients. The goal of treatment is to maintain quality of life in this often palliative setting. The decision on how to treat patients with metastatic spine disease is informed by the estimated survival. Several studies identified factors associated with survival and developed algorithms to predict survival. The predictive value however, is not sufficiently accurate, creating a need for more accurate prognostication. We tested new parameters in a large cohort of patients and aimed to improve existing prognostication models.
Questions/ Purposes: Our study aim is to (1) identify patient, treatment, and laboratory factors independently associated with survival in patients undergoing surgery for metastatic spine disease and (2) to compare the accuracy of a classic algorithm with a nomogram construct and boosting algorithm in predicting 30, 90, and 365 day survival.
Patients and Methods: In this retrospective study that was approved by our Institutional Review Board, we identified 649 patients who had operative treatment for metastatic disease of the mobile spine -i.e. cervical, thoracic and lumbar spine- between 2002 and 2014 at two university medical centers. Patients with a lymphoma or multiple myeloma in the spine were also included. We excluded patients that (1) did not have primary surgery at our institution, (2) only kyphoplasty or vertebroplasty, and (3) patients treated with radiosurgery. Only the first procedure was included if patients underwent multiple procedures for metastatic spine disease (e.g. when they develop new tumors at different levels requiring operative treatment). Demographic data, laboratory values and treatment data were obtained from medical charts. A multivariate Cox Proportional Hazard Model was used to identify clinical and laboratory factors independently associated with survival.
Results: In multivariate analysis, age (Hazard Ratio [HR] 1.01, 95% Confidence Interval [CI] 1.00 – 1.02, P = 0.007), an Eastern Cooperative Oncology Group (ECOG) impairment score of 3-4 (HR 1.54, 95% CI 1.20 – 1.97, P = 0.001), primary tumors with relatively poor prognosis (HR 1.73, 95% CI 1.43 – 2.10, P < 0.001), more than 1 mobile spine metastasis (HR 1.25, 95% CI 1.00 – 1.55, P = 0.048), other bone metastases outside of the mobile spine (HR 1.20, 95% CI 0.99 – 1.45, P = 0.064), lung and/or liver metastases (HR 1.33, 95% CI 1.08 – 1.63, P = 0.008), brain metastases (HR 1.87, 95% CI 1.41 – 2.47, P < 0.001), prior systemic therapy (HR 1.65, 95% CI 1.36 – 2.00, P < 0.001), white blood cell count (HR 1.03, 95% CI 1.01 – 1.04, P = 0.001), and hemoglobin level (HR 0.94, 95% CI 0.89 – 0.99, P = 0.020) were associated with decreased survival.
Conclusions: We identified risk factors independently associated with survival in patients with spine metastases. These risk factors can be used to improve prognostication models. We are currently working on a nomogram construct and boosting algorithm to improve survival estimation.