Development of a prognostic nomogram for predicting survival after total en bloc spondylectomy in patients with malignant spinal tumors

Masafumi Kawai, Masafumi Kawai, Satoshi Kato, Noriaki Yokogawa, Takaki Shimizu, Satoru Demura

INTRODUCTION:
Total en bloc spondylectomy (TES) aims to achieve complete resection of spinal tumors and improve survival outcomes. However, due to the high technical demands and invasiveness of TES, determining surgical indications is challenging—not only for general orthopedic surgeons and physicians in other specialties who often diagnose these tumors, but also for spine surgeons who must make careful decisions. To support clinical decision-making, we developed a visual nomogram to predict postoperative survival following TES.
METHODS:
We retrospectively analyzed 140 patients with malignant spinal tumors who underwent TES between 2011 and 2023. Prognostic factors associated with survival were identified using LASSO regression analysis and then confirmed with multivariate Cox proportional hazards regression. A nomogram was constructed to visually display these prognostic factors and predict individual survival probabilities. Internal validation was performed using bootstrapping, and predictive accuracy was assessed by calculating the area under the curve (AUC), concordance index (C-statistic), and calibration plots.
RESULTS:
Frankel grade, presence of other bone metastases, frailty status, and nutritional status were identified as independent prognostic factors for survival. These variables were incorporated into the nomogram, resulting in a prediction model with a C-statistic of 0.79. The AUCs for predicting 12-, 36-, and 60-month overall survival were 0.81, 0.78, and 0.80, respectively, demonstrating good predictive performance.
DISCUSSION AND CONCLUSION:
We successfully developed and internally validated a prognostic model and nomogram to predict postoperative survival in patients with malignant spinal tumors undergoing TES. This tool may aid not only spine surgeons but also other specialists in making informed treatment decisions for these complex cases.