Development and Validation of An Individualized Prediction Calculator of Postoperative Mortality Within 6 Months After Surgical Resection for Hepatocellular Carcinoma: An International Multicenter Study

Lei LIANG1, Bing QUAN2, Yong-Kang DIAO1, Chao LI3, Ming-Da WANG3, Wan Yee LAU4, Cheng-Wu ZHANG1, Timothy M. PAWLIK5, Dong-Sheng HUANG1, Feng SHEN3, Tian YANG3

1Department of Hepatobiliary, Pancreatic and Minimal Invasive Surgery, Zhejiang Provincial People's Hospital, People's Hospital of Hangzhou Medical College, China
2Department of Clinical Medicine, Second Military Medical University (Navy Medical University), China
3Department of Hepatobiliary Surgery, Eastern Hepatobiliary Surgery Hospital, Second Military Medical University (Navy Medical University), China
4Faculty of Medicine, The Chinese University of Hong Kong, Shatin, New Territories, China
5Department of Surgery, Ohio State University, Wexner Medical Center, Columbus, OH, USA

Introduction: Evidence-based decision-making is critical to optimize the benefits and mitigate futility associated with surgery for patients with malignancies. Untreated hepatocellular carcinoma (HCC) has a median survival of only 6 months. The objective was to develop and validate an individualized patient-specific tool to predict preoperatively the benefit of surgery to provide a survival benefit of at least 6 months following resection.

Methods: Using an international multicenter database, patients who underwent curative-intent liver resection for HCC from 2008 to 2017 were identified. Using random assignment, two-thirds of patients were assigned to a training cohort with the remaining one-third assigned to the validation cohort. Independent predictors of postoperative death within 6 months after surgery for HCC were identified and used to construct a nomogram model with a corresponding online calculator. The predictive accuracy of the calculator was assessed using C-index and calibration curves.

Results: Independent factors associated with death within 6 months of surgery included age, Child-Pugh grading, portal hypertension, alpha-fetoprotein level, tumor rupture, tumor size, tumor number and gross vascular invasion. A nomogram that incorporated these factors demonstrated excellent calibration and good performance in both the training and validation cohorts (C-indexes: 0.802 and 0.798). The nomogram also performed better than four other commonly-used HCC staging systems (C-indexes: 0.800 vs. 0.542–0.748).

Conclusions: An easy-to-use online prediction calculator was able to identify patients at highest risk of death within 6 months of surgery for HCC. The proposed online calculator may help guide surgical decision-making to avoid futile surgery for patients with HCC.

Corresponding Author: Tian YANG (yangtianehbh@smmu.edu.cn)