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DEVELOPMENT AND VALIDATION OF A RISK STRATIFICATION MODEL FOR POST-HEPATECTOMY DISTANT METASTASIS IN HEPATOCELLULAR CARCINOMA: A MULTI-CENTER STUDY

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Background : Despite advances in surgical techniques for hepatocellular carcinoma (HCC), the occurrence of distant metastasis following curative hepatectomy remains a significant challenge that substantially impacts patient survival. Currently, there is a lack of reliable tools to identify patients at high risk for post-operative distant metastasis, limiting the ability to implement targeted surveillance and early intervention strategies.

Methods : A comprehensive analysis of 2,705 HCC patients who underwent hepatectomy across multiple institutions between 2013 and 2020 was conducted. Using statistical modeling, we integrated clinicopathological variables to identify key predictors of distant metastasis. A novel risk prediction nomogram was developed and validated through rigorous statistical methods, including concordance index calculation and calibration curve analysis. Risk stratification was performed by categorizing patients into three distinct risk groups based on calculated nomogram scores.

Results : Among the study cohort, 342 patients (22.7%) developed distant metastasis as their initial recurrence pattern. Eight independent risks emerged from our analysis: preoperative tumor rupture, tumor diameter exceeding 5 cm, multinodular disease, presence of satellite lesions, macro- and microvascular invasion, surgical margin status, and perioperative blood product administration. The constructed nomogram exhibited exceptional discriminatory ability (C-index >0.85) in predicting distant metastasis risk. Long-term survival analysis revealed striking differences among risk groups, with 5-year overall survival rates of 9.1%, 41.1%, and 90.8% for patients with distant metastasis, intrahepatic recurrence, and no recurrence, respectively (P<0.001).

Conclusions : This validated risk stratification model provides clinicians with a practical tool for identifying HCC patients at elevated risk for distant metastasis, enabling personalized surveillance protocols and timely therapeutic interventions.

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