Hepatocellular Carcinoma Risk Prediction Score : A Novel artificial intelligence Model for Hepatocellular Carcinoma Risk Assessment in Hepatitis C Patients

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Topic: Nurses and Allied Health Professionals

Sub-Topic: Research project

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Background and aims:

HCC remains a major cause of mortality in chronic HCV. Practical non-invasive tools are needed to identify patients at higher likelihood of HCC to support risk-adapted surveillance. We developed and validated a machine-learning HCC Risk Profiling Score (HRPS) using routinely available baseline pre-treatment variables and compared it with FIB-4.

Method:

Retrospective NCCVH Egypt HCV cohort enriched to 4% HCC prevalence (N=133,825; HCC events n=5,353). Predictors were baseline pre-treatment variables: sex, treatment status, age, ALT, AST, albumin, total bilirubin, WBC, hemoglobin, platelets, INR, and creatinine. To reduce leakage, outcome-related fields and composite fibrosis indices (including FIB-4) were excluded from inputs, while component labs were retained. An XGBoost model with safe engineered features (ratios/log transforms) was trained using a stratified split 70/15/15 (train n=93,677; validation n=20,074; test n=20,074; test HCC n=803). Discrimination was assessed by AUROC and PR-AUC; calibration by Brier score (model). Clinical utility was assessed using top-k screening policies (top 1%, 5%, 10% predicted risk). FIB-4 was evaluated as a comparator (score-based).

Results:

In the held-out test set, HRPS achieved AUROC 0.9129, PR-AUC 0.2934, and Brier 0.0317, outperforming FIB-4 (AUROC 0.8852; PR-AUC 0.2252). For top-k policies, HRPS yielded: top 1% precision 38.8% and recall 9.7% (vs FIB-4 28.9% and 7.2%); top 5% precision 33.4% and recall 41.7% (vs 24.9% and 31.1%); top 10% precision 25.5% and recall 63.8% (vs 22.6% and 56.4%).

Conclusion:

HRPS provides a non-invasive baseline model to stratify HCV patients by likelihood of HCC using routine markers, with superior discrimination and high-risk enrichment compared with FIB-4. External validation in independent cohorts and evaluation with time-stamped follow-up are warranted.

Conflict of interest: Eslam Elmasry Employee in the National Committee for Control of Viral Hepatitis