



Non-invasive strategies to predict post-hepatectomy liver failure

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The ability to predict outcome in patients with cirrhosis remains a challenge for clinicians, particularly when intervention or operative management is required. The outcomes may be unpredictable and for individual patients, there is an imperative to be able to counsel them appropriately. A range of predictive scores have been generated and modified in order to facilitate these aims.

In this current report, the authors report on the use of two well-established and validated prognostic models, the first, aspartate aminotransferase (AST) to platelet ratio index (APRI) and the second, albumin-bilirubin (ALBI) grade based on a multivariable model (MVM) (1). This model serves as a preoperative predictor for post-hepatectomy liver failure (PHLF). PHLF is a serious complication following liver resection and represents a major cause of death. The following preoperative predictors are important to assess safety of surgery: patient's medical background, performance status, underlying liver function including synthetic function and bilirubin, presence of cirrhosis and portal hypertension (2). Child-Pugh and Model for End Stage Liver Disease (MELD) score are useful to assess the severity of liver disease and risk associated with surgery (3). Imaging pre-surgery are used to evaluate the anatomy to guide the extent of liver resection and the most appropriate technique. The size of the remnant liver left is important to provide enough functional capacity to support the physiological role. The decision to proceed with surgery is made by a multidisciplinary team (MDT) that involves surgeons, anaesthetists, hepatologists and radiologists (4).

APRI and ALBI scores are non-invasive methods used in the context of liver disease and they are useful in the preoperative assessment of synthetic function and evidence of fibrosis (5). The ALBI score was created through the integration of the components of the Child-Pugh score into a MVM. It was initially used as an indicator of hepatic function in patients with hepatocellular carcinoma (HCC) (6). The ALBI score is a significant prognostic factor associated with survival in patients with intermediate-stage HCC who are undergoing transarterial chemoembolization (TACE) (7).

In the context of hepatectomy, these scores are used in conjunction with a comprehensive patient's evaluation including imaging, patient's overall fitness and medical background. APRI is a serum biomarker calculated based on AST level and platelet count. It is used to assess the degree of liver fibrosis and severity of liver disease.

A higher score suggests more advanced hepatic fibrosis and have implications on postoperative outcome. ALBI is a score calculated using serum albumin and bilirubin using the following formula: $\log_{10} \text{bilirubin } (\mu\text{mol/L}) \times 0.66 + \text{albumin } (\text{g/L}) \times -0.085$. A higher score might indicate an impaired liver function and potential increased PHLF risk (8).

ALBI and APRI scores have the ability to predict pregnancy outcomes in women with chronic liver disease (CLD). In fact, preconception ALBI and APRI can better prognosticate the likelihood of proceeding beyond 37 weeks gestation compared to preconception MELD score (9).

Indocyanine green (ICG) is a fluorescent dye injected intravenously that is used to assess blood flow and it is a

dynamic liver function test. The ability of ICG clearance reflects how the liver can remove substances from the bloodstream. A potential risk factor for PHLF is impaired liver function that can be demonstrated by lower ICG clearance. ICG can be used during the operation for a real-time assessment of liver perfusion and guide the operator (10).

Albumin is a globular protein produced in the endoplasmic reticulum of hepatocytes and continuously released in the bloodstream with a half-life of 19–20 days. It is soluble in water and has a role in maintaining fluid distribution balancing osmotic pressure. It binds to different molecules as fatty acids and hormones and transports them throughout the body. The production can rapidly increase or decrease depending on different physiological conditions. Albumin-Indocyanine Green Evaluation (ALICE) score is calculated based on preoperative serum albumin level and ICG retention test at 15 min (ICG-R15). ICG-R15 evaluates hepatic blood flow and functional hepatocytes, and it is used to assess hepatic functional reserve in patients with underlying liver disease (11).

This paper introduces a MVM that combines APRI and ALBI scores to predict PHLF instead of using ICG and ALICE which are more costly, time consuming and sometimes invasive. It describes a large cohort of patients 12,056 from the American national surgery quality improvement program (NSQIP) database with a validation cohort of 2,525 patients from ten institutions and 620 of them were compared with different MVMs. Twenty-one years (between 2000 and 2021) of liver resections and 90-day follow-up were considered. This large cohort showed that APRI + ALBI score increases and reflects an increased risk for PHLF. APRI + ALBI score was compared to models based on ALICE, ICG-R15, ICG-plasma disappearance rate (PDR) and fibrosis-4 index (FIB-4) in 620 patients. Even if not significant, APRI + ALBI score showed a superiority in predictive potential compared to ICG and FIB-4 index. This model incorporates tumour type and planned extent of resection. A dedicated smartphone application has been designed to easily calculate this multivariable prediction model PHLF. A recent study, on patients with hepatic alveolar echinococcosis, showed that ICG and ALICE grade were predictors for severe PHLF and postoperative mortality. Higher ICG-R15 and ALICE grades were related to higher PHLF incidence and mortality compared to those patients with lower levels (12).

This impressive cohort of patients is providing a substantial dataset for the purpose of prognosticating the risk of PHLF in patients undergoing liver resection based

on scores and multivariate model. The combined use of APRI + ALBI score is deemed easily accessible and cost-effective. However, the overall patient's pre-operative assessment remains pivotal including factors as performance status, imaging and contemplation of ICG.

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Footnote

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