Letter to the Editor

Development and internal validation of the Comprehensive ALPPS Preoperative Risk Assessment (CAPRA) score

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It is with great interest we read the recent study by Capobianco *et al.* (1), which reported that the Comprehensive Associating Liver Partition and Portal Vein Ligation for Staged Hepatectomy (ALPPS) Preoperative Risk Assessment (CAPRA) score had an impressive ability to predict postoperative mortality before surgery. This study had the largest number of ALPPS patients outside the ALPPS registry, which included 451 patients who underwent ALPPS at 13 centers. The model was constructed on the basis of patient characteristics, underlying disease, and procedure type before Stage 1 of ALPPS. The C statistic was 0.837 [95% confidence interval (CI): 0.789–0.885], suggesting good discriminatory capacity, which was validated by applying bootstraps and tested on selected subgroups of patients.

Compared with the traditional two-stage hepatectomy, ALPPS has higher perioperative mortality (2). Therefore, safety is always a primary concern when performing ALPPS. Patient selection is an important method for improving safety. The ALPPS Risk Score-based ALPPS registered data were previously used to improve patient selection and reduce early mortality (3). However, this model carried reporting biases and included factors between the two stages. The CAPRA score that assesses mortality risk before Stage 1 will be helpful for clinicians in determining which patients are suitable for ALPPS.

However, several aspects of this study still require discussion. The study only included patients who completed the two steps of ALPPS, whereas previous studies have shown that failure to accomplish the ALPPS was responsible for postoperative mortality (4). Therefore, the mortality rate of the 25 patients with incomplete procedures was expected to be included in the study.

In contrast to the previous model, the CAPRA score included the patients' comorbidities. Patients with severe cardiovascular disease, moderate to severe diabetes mellitus, and renal disease were included in the model. The authors assumed that comorbidities would reduce the patients' ability to overcome complications. However, they did not find a relationship between existing comorbidities and morbidity after ALPPS. The comorbidities of patients could become more serious during ALPPS. For example, major blood loss can result in deterioration of cardiovascular disease (5). Renal disease can progress to acute kidney injury during ALPPS, especially in cases of hepatocellular carcinoma with liver cirrhosis (6,7). Moreover, an analysis of 320 patients registered in an international ALPPS database revealed that 75% of the 90-day mortality was associated with post-stage liver failure (8). Therefore, we wondered whether comorbidities had a relationship with liver failure after ALPPS in this study.

One major concern of this study is its external validation. The C statistic calculated for selected subgroups showed that the CAPRA score also had overall good discrimination for primary liver tumors. However, the study included only a small number of patients with hepatocellular carcinoma, and most patients had biliary tumors. This was insufficient to represent the status of the primary cancer. In this study, 31.3% of the patients had more than one comorbidity, a higher percentage than in patients who underwent liver

resection (5,8). The higher rate of comorbidities in these patients may also have limited the external validation of this model.

Moreover, the authors concluded that partial ALPPS was helpful in reducing mortality. However, complete ALPPS has been reported to induce more rapid future liver remnant hypertrophy than partial-ALPPS-associated liver partition future liver remnant hypertrophy, especially in patients with liver cirrhosis (9). Partial ALPPS may not be effective for all patients undergoing ALPPS. Moreover, minimally invasive ALPPS, including laparoscopic and robot-assisted ALPPS, have also been used to reduce mortality (10). When physicians use the CAPRA score to assess the safety of ALPPS for patients before surgery, this score would also influence their surgical choice and prompt them to consider partial ALPPS over other minimally invasive ALPPS procedures.

Despite the limitations discussed above, this study has considerable clinical value in being one of the largest studies based on multi-institutional data. In addition, the application of this model will aid treatment decisions when applying ALPPS.

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Footnote

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Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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