



# Avoiding both the surgically and oncologically futile use of ALPPS

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Associating liver partition and portal vein ligation for staged hepatectomy (ALPPS) is a novel two-stage hepatectomy that induces rapid growth of the remnant liver in primarily unresectable liver tumors by combining transection of the liver with portal vein ligation (1). Although the clinical outcomes demonstrated in the paper by Schnitzbauer *et al.* were very impressive and all the patients were able to proceed to a right trisectionectomy very shortly after the first procedure, the morbidity rate (64%) and the in-hospital mortality rate (12%) were incredibly high (1). Recently, an international registry system for this procedure has been created. This registry will gather important clinical data and can be used as a basis for establishing adequate patient selection and for improving the safety of this procedure.

Linecker *et al.* (2) provided important data on the individual surgical risk of upfront stage 1 and pre-stage 2 ALPPS procedures using the International ALPPS Registry. The strength of this study was related to its large pooled sample of 528 patients from 38 centers. As a result, this study identified the following independent predictors of futile outcomes (i.e., 90-day or in-hospital mortality) after ALPPS: age 67 years or older, biliary liver tumors, interstage occurrence of major complications, and elevated serum bilirubin or creatinine before stage 2. This prediction model may assist the patient selection process by determining whether and when to proceed with ALPPS surgery.

Although the overall findings of this study by Linecker *et al.* (2) are promising, several aspects of the study require expansion or further investigation to standardize the treatment of ALPPS surgery. First, in this study, 11 patients who did not reach the stage 2 operation were excluded.

However, to make the best prediction model for surgical risk, these patients should be included in the population of analysis. Second, liver function might be more important in predicting mortality than volume or hypertrophy. The standardized future liver remnant was significantly lower in the futile group, but it was not an independent predictor in the multivariate analysis. In this regard, the use of indocyanine green (ICG) clearance may enable quantitative assessment for determining the appropriate surgical timing. ICG is a nontoxic fluorescent dye that, after intravenous injection, is completely eliminated into bile without enterohepatic recirculation. ICG has long been in use for liver function testing in the setting of liver resection (3).

Several limitations of the present study should be acknowledged. The authors could not evaluate the distribution of the liver tumors. In fact, how many cases truly required ALPPS surgery? Ultrasound-guided parenchymal-sparing one-stage hepatectomy should be considered first to avoid dropout and the surgical risk of ALPPS. Torzilli *et al.* (4) demonstrated that one-stage hepatectomy using intraoperative ultrasonography was a feasible and effective alternative to two-stage hepatectomy in patients with bilobar multiple colorectal metastases. In addition, the partial resection and reconstruction of the hepatic vein is a useful technique for avoiding major hepatectomy (5), including ALPPS. Furthermore, this option gives us a chance for repeated liver resection. In oncological cases, we want to rule out early recurrent populations. However, a reduction in the time from diagnosis to surgery for the ALPPS procedure does not allow for evaluation of the natural history of the disease. Recently, we reported our initial experience using a

tumor Ki-67 labeling index and the maximum standardized uptake value [SUV(max)] of PET/CT before and after ALPPS (6). Although more experience is needed to arrive at valid conclusions about patient selection in ALPPS, our study may be helpful for avoiding the oncologically futile use of ALPPS.

ALPPS is an exciting new procedure; however, its morbidity is significant, and the long-term oncological outcome is still unclear. The assessment of not only surgical but also oncological risk factors for ALPPS should be necessary in selecting patients who could obtain the maximum benefit from ALPPS.

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