

## Associating Liver Partition and Portal Vein Ligation for Staged Hepatectomy (ALPPS): What Is Gained and What Is Lost?

### To the Editor:

We were interested to read the report of Schnitzbauer et al<sup>1</sup> regarding the associating liver partition and portal vein ligation for staged hepatectomy procedure in the March 2012 issue of *Annals of Surgery*. The article can be summarized as the reporting of a novel, short-interval, 2-stage, single-hospitalization hepatectomy strategy for the treatment of extensive liver metastases and other advanced hepatobiliary tumors in a cohort of 25 highly-selected patients.

When comparing short-term outcomes in the German series to our series of patients with similar extent and distribution of disease treated with standard 2-stage hepatectomy and intervening percutaneous portal vein embolization, the German series reports significant increases in morbidity rate (47% vs 68%) and mortality rate (6% 90-day mortality vs 12% in-hospital mortality).<sup>2</sup> Despite assertions to the contrary, their report does document postoperative complications related to hepatic insufficiency (ascites, persisting cholestasis, and sepsis), but these complications appear to have been compounded by additional wound, biliary, inflammatory, and infectious complications. This constellation of complications has largely been eliminated from liver surgery over the past 20 years and, therefore, its reemergence is likely related to the physiological stress of the short interval between associating liver partition and portal vein ligation for staged hepatectomy operations.

Furthermore, long-term oncological outcomes following associating liver partition and portal vein ligation for staged hepatectomy (that leaves physically manipulated liver tumors bathed in an inflammatory, immunosuppressed, and growth factor rich environment with free hepatic outflow to the pulmonary and systemic circulations for a week) are not yet available and are not reported. The oncological efficacy of this “all-touch” technique can, therefore, not be compared to the

51% 5-year overall survival rate that we have achieved with the standard 2-stage strategy.<sup>2</sup>

In the editorial of the March 2012 issue, de Santibañes and Clavien hail this procedure as “one of the most promising advances in oncological liver surgery so far” and that it “could change the face of liver surgery” based largely on the observed liver remnant hypertrophy.<sup>3</sup> Given our understanding of the atrophy-hypertrophy complex following unilateral portal vein occlusion (ligation and/or embolization), the extensive Japanese experience with portal vein embolization,<sup>4,5</sup> and our own experience indicating enhanced hypertrophy when right portal vein embolization is combined with segment 4 embolization,<sup>6</sup> we are not surprised that the patients in this report achieved rapid liver remnant hypertrophy. In fact, their reported regeneration rate of 74% of patients is similar to our previously published hypertrophy rate of 69% with percutaneous ipsilateral portal vein embolization extended to segment IV using embolic microspheres and coils.<sup>7</sup>

But the important issue with the associating liver partition and portal vein ligation for staged hepatectomy technique is not what is gained, it is what is lost. In our experience with nearly 400 portal vein embolizations, there are 3 main reasons why patients either do not proceed to hepatic resection or have poor outcomes following hepatic resection: (1) they are found to have portal hypertension at the initiation of the portal vein embolization procedure, (2) they have early progression of malignant disease, or (3) they demonstrate inadequate remnant liver hypertrophy. In each of these cases, the separation of steps in the standard 2-stage algorithm allows for appropriate selection of patients, improving the safety and oncological efficacy of the second-stage major (extended) hepatectomy. By compacting the 2-stage hepatectomy procedure into a single hospitalization with complete commitment to the second stage in these complex patients, the associating liver partition and portal vein ligation for staged hepatectomy technique blinds the surgeon and the patient from important information that is critical for decision-making.

As with any new surgical technique, we must objectively evaluate its technical feasibility, safety, and efficacy before recommending its diffusion into standard practice. On the basis of the available data, we must conclude that the associating liver partition

and portal vein ligation for staged hepatectomy technique demonstrates possible technical feasibility in the hands of expert hepatobiliary surgeons, questionable safety, no known long-term oncological efficacy, and a reasonable construction for potentiation of metastatic dissemination. Given the repeatedly proven feasibility, safety, and oncological efficacy of other multimodality strategies available for patients with this distribution of metastatic disease, we strongly caution hepatobiliary surgeons from experimenting with this technique outside of clinical trials or at least transparent registry studies endorsed by institutional review board approval.

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