Editorial

# Associating liver partition and portal vein ligation for staged hepatectomy (ALPPS) and its further developments in the last decade

**Wan Yee Lau**

Faculty of Medicine, The Chinese University of Hong Kong, Hong Kong, China

*Correspondence to:* Professor Wan Yee Lau, MD, FRCS, Hon FRACS. Faculty of Medicine, The Chinese University of Hong Kong, Prince of Wales Hospital, Shatin, New Territories, Hong Kong, China. Email: josephlau@cuhk.edu.hk.

Submitted May 03, 2019. Accepted for publication May 10, 2019.
doi: 10.21037/hbsn.2019.05.01
**View this article at:** http://dx.doi.org/10.21037/hbsn.2019.05.01

The Editor-in-Chief of *Hepatobiliary Surgery and Nutrition* invited me to write an Editorial on the article entitled "10th Anniversary of ALPPS-Lessons Learned and quo Vadis" by Lang *et al.* which was published in the 2019 January issue of *Annals of Surgery* (1). This article was coauthored by 15 world-renowned experts in associating liver partition and portal vein ligation for staged hepatectomy (ALPPS) who met during the 12th Biennial Congress of the European-African Hepato-Pancreato-Biliary Association in Mainz, Germany from 23 to 26 May, 2017. The aim of the meeting and the subsequently published article was to make "the most updated inventory of what has been achieved, and what remains unclear in ALPPS".

This article should be read by all clinicians who are interested in ALPPS. The article began by tracing how ALPPS was accidentally performed by Professor Schlitt in 2007, how the concept rapidly spread and became widely adopted with the establishment of an International Registry (2). The article then went on to discuss the important knowledge of anatomy, essential diagnostic tools in assessment of liver volume and function, and the underlying mechanisms of liver growth in ALPPS. Then the technical modifications, interphase complications in determining ALPPS outcomes, and the use of ALPPS in fibrotic/cirrhotic livers, colorectal liver metastasis and perihilar cholangiocarcinoma were discussed. Finally, there was a short comparison between ALPPS with the conventional two-stage hepatectomy (TSH) and portal vein embolization (PVE).

While this article is well-written in most aspects, there are certain topics in ALPPS which I think the authors should discuss in more details. I fully understand that there is a limitation to number of words that can be put into a single article.

The first successful ALPPS carried out in Mainland China was reported in 2013 and I was asked to write a commentary to accompany the publication of that article (3). ALPPS was soon accepted by many centers in China and the main indication was for a large hepatocellular carcinoma (HCC) arising from a background of chronic hepatitis B liver. The wait for the future liver remnant (FLR) to grow to adequate size for a normal liver after PVE usually takes 6 to 8 weeks. The rate of liver growth in the FLR is known to be related to the degree of fibrosis/cirrhosis after PVE (4). The long waiting time for phase 2 tumor resection after PVE often led to progression of HCC and inoperability. It was soon found out that the wait for adequate FLR growth after stage 1 ALPPS can also be too long in some patients with cirrhosis, especially those patients with clinical evidence of portal hypertension (splenomegaly, pancytopenia, esophageal varies). Unfortunately, failure of these patients who were unable to proceed to stage 2 ALPPS was under-reported. It would be nice to have a report on these failure cases to correlate the degree of cirrhosis with the rate of hypertrophy of the liver in the FLR to guide future patients who should not be considered for ALPPS.

A minor criticism on the article by Lang *et al.* is the relatively brief description on the technical modifications of ALPPS. It is good that the authors introduced the terms tourniquet ALPPS, radiofrequency and microwave ALPPS, mini-ALPPS and laparoscopic ALPPS, with the attempt to reach to a "consensus" in terminology. However,

this is unlikely to become successful as modifications had been made with different aims which include: (I) to improve surgical results to make the operation safer; (II) to expand surgical indications so that ALPPS can benefit more patients, including modifications to preserve the right liver (segments 5, 6, 7, 8), central liver (segments 4, 5, 8), left liver (segments 2, 3, 4), double *in situ* split for staged mesohepatectomy (to preserve segments 2, 3, 6, 7) and monosegment ALPPS. The approaches include the use of percutaneous, laparoscopic, robotic or open, and the techniques include using tourniquet, radiofrequency, microwave and/or PVE; (III) to use the minimally invasive approach to make ALPPS less invasive; and (IV) to carry out salvage (or rescue) ALPPS after failed PVE (5). Some of these modifications have made the conventional ALPPS more complex, although there have also been other attempts to make the procedures less complex. Further studies need to be carried out to establish the roles of these modifications.

Finally, the article by Lang *et al.* only used a short paragraph to discuss ALPPS to compare with conventional TSH or with PVE. This is especially disappointing when this paragraph included the only randomized controlled trial available to compare ALPPS with TSH (the LIGRO Trial) (6). I would like to point out that there are other high-level evidence-based medicines in the form of systematic reviews and meta-analyses to compare ALPPS versus TSH (7,8), and in the form of a randomized comparative study to compare ALPPS with PVE (9).

There are increasing evidences to show that in selected patients, ALPPS can be carried out with low mortality and morbidity rates. The rapid induction of liver growth rate in the FLR makes ALPPS a very attractive treatment option.

## Acknowledgments

None.

## Footnote

*Conflicts of Interest:* The author has no conflicts of interest to declare.

## References

1. Lang H, de Santibañes E, Schlitt HJ, et al. 10th Anniversary of ALPPS-Lessons Learned and quo Vadis. Ann Surg 2019;269:114-9.
2. Schadde E, Ardiles V, Robles-Campos R, et al. Early survival and safety of ALPPS: first report of the International ALPPS Registry. Ann Surg 2014;260:829-36; discussion 836-8.
3. Lau WY, Lau SHY. Comments on associating liver partition and portal vein ligation for staged hepatectomy. Chin J Dig Surg 2013;12:481-4.
4. van Lienden KP, van den Esschert JW, de Graaf W, et al. Portal vein embolization before liver resection: a systematic review. Cardiovasc Intervent Radiol 2013;36:25-34.
5. Lau WY, Lai EC. Modifications of ALPPS - from complex to more complex or from complex to less complex operations. Hepatobiliary Pancreat Dis Int 2017;16:346-52.
6. Sandström P, Røsok BI, Sparrelid E, et al. ALPPS Improves Resectability Compared With Conventional Two-stage Hepatectomy in Patients With Advanced Colorectal Liver Metastasis: Results From a Scandinavian Multicenter Randomized Controlled Trial (LIGRO Trial). Ann Surg 2018;267:833-40.
7. Liu Y, Yang Y, Gu S, et al. A systematic review and meta-analysis of associating liver partition and portal vein ligation for staged hepatectomy (ALPPS) versus traditional staged hepatectomy. Medicine (Baltimore) 2019;98:e15229.
8. Moris D, Ronnekleiv-Kelly S, Kostakis ID, et al. Operative Results and Oncologic Outcomes of Associating Liver Partition and Portal Vein Ligation for Staged Hepatectomy (ALPPS) Versus Two-Stage Hepatectomy (TSH) in Patients with Unresectable Colorectal Liver Metastases: A Systematic Review and Meta-Analysis. World J Surg 2018;42:806-15.
9. Jiao LR, Fajardo Puerta AB, Gall TMH, et al. Rapid Induction of Liver Regeneration for Major Hepatectomy (REBIRTH): A Randomized Controlled Trial of Portal Vein Embolisation versus ALPPS Assisted with Radiofrequency. Cancers (Basel) 2019. doi: 10.3390/cancers11030302.

**Cite this article as:** Lau WY. Associating liver partition and portal vein ligation for staged hepatectomy (ALPPS) and its further developments in the last decade. HepatoBiliary Surg Nutr 2019;8(3):258-259. doi: 10.21037/hbsn.2019.05.01

 