



Editorial: reducing blood loss in liver transplantation—the impact of surgical technique

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Liver transplantation is the standard of care for end stage liver disease, fulminant liver failure and selected liver malignancies. It is performed world-wide with acceptable morbidity and mortality. There are many parallels between transplantation surgery and abdominal oncological surgery ranging from pre-operative work up, imaging, peri-operative management and post-operative recovery, with advances in each translating to the other.

Peri-operative blood transfusion and in particular, massive blood transfusion, has been shown to be associated with increased morbidity (1), mortality (2), worse oncological outcomes (3), survival (4,5) and a significant health economic cost (6).

Many initiatives have been investigated and applied to minimize this precious resource in various clinical settings. These include pre-operative correction of anaemia and iron deficiency, auto-transfusion, donor blood usage (7), perioperative management of coagulopathy, advanced anaesthetic techniques including low CVP anaesthesia, objective intra-operative monitoring of coagulopathy (8), the intra operative use of topical haemostatic agents and the operative use of energy devices (1,9,10).

In liver transplantation, surgeons have to face the added challenge of clinical or sub-clinical portal hypertension. This burden begins at the skin incision (*caput medusae*,

recanalized paraumbilical vein) through porta hepatis dissection (porta hepatis varices, peri-choledochal vessels) and the retroperitoneal and para-caval regions where further portosystemic shunts are usually present. The vessels that form collaterals or varices tend to be anatomically thinner, more friable and have raised venous pressure within them, increasing the risk of inadvertent injury and bleeding during surgery. Obtaining haemostasis may involve surgical ligatures, stapling devices, energy sealant devices or monopolar cautery.

Liver transplantation is undertaken by highly skilled, clinically experienced and technically proficient teams whose meticulous surgical technique contribute significantly to the reduction in operative and post-operative blood loss. Surgeons would make a clinical judgement to mentally classify a vessel to be treated to be low, moderate or high-risk vessel. This decision is likely to be biased by the size of the vessel, vessel wall quality, amount of tissue around it, vicinity with a major vascular structure and difficulty in access before the vessel is treated or in the event of failure after the treatment. When dealing with portal hypertension and abnormal collateral vessels, in which the vein wall tends to be thinner and more friable, surgeons tend to avoid taking risks, even more in the setting of a long and exhaustive operation.

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Vessels with low risk of bleeding, in the interest of time, tend to be treated with monopolar or even bipolar cautery. Medium risk vessels are often treated by a sealant device or by surgical ligation. High-risk vessels are usually treated with surgical ties, sutures or staplers. Therefore, the interplay between monopolar, sealant device and surgical ligation is likely to be unique in each individual operation making it hard to assess objectively the relative efficiency of each technique.

In this issue, Lee *et al.*, objectively analyzed the use of a sealant device (LigaSureTM) versus a monopolar cautery during the recipient operation (hepatectomy and after vascular reconstruction) in the liver transplant setting in a major HPB and Liver Transplant center in South Korea (11).

From a pool of 187 patients having liver transplant in 15 months, 118 had the hepatectomy performed with monopolar and 69 with LigaSureTM, showing that the most common energy device used in the author's centre is the monopolar cautery (63.1%). The authors used a propensity score matching analysis controlling 14 variables. They were able to compare 138 patients, with 69 in each group.

There was no difference regarding intra-operative blood loss and blood transfusion, however there was significantly higher rates of postoperative bleeding (measured by re-operation) in the monopolar cautery group (18.8%) when compared to the LigaSureTM group (4.35%). The authors also found less infective complications rates in the LigaSureTM group. However, the outcomes variable (infective complication) is not clearly defined in the methodology (intra-abdominal infection, surgical site infection, lung or catheter related infection). One could speculate that the source of bleeding requiring re-operation and potential source of subsequent infective complications were the smaller vessels routinely ablated by monopolar cautery. This would support the hypothesis that the regular use of sealant energy devices on these small vessels may be the reason for the better outcome. The medium and larger vessels would be expected to be routinely sealed by energy device, surgical ligatures or stapling devices. This is particularly relevant when clamping the portal vein at the time of liver explantation, when there is an increase in the portal pressure which could lead to bleeding in areas previously sealed by the LigaSure or the monopolar cautery and the former may provide better seal.

This study published by Lee *et al.*, has shown that simple expediency of using a sealant energy device in areas where monopolar cautery is used, may have a significant effect on post-operative bleeding, return to theatre and infective

complications. Other studies addressing the use of sealant devices in liver transplantation have shown they have the potential to save hospital costs, reduce surgical time and decrease blood loss. Moreover, it has been suggested that it may also reduce staff exposure to sharp instruments (10,12). Results from a prospective trial are, however, still pending (9).

Additional areas of interest would be the impact of temporary portocaval shunts (in temporary decompressing the portal venous pressure until the cirrhotic liver is removed and the new graft re-anastomosed), use of topical haemostatic agents, the use of a haemostatic pause after revascularization and details of infective complications. While a prospective study would confirm these findings, this study strengthens the concept that a multi-modal approach is important to minimizing perioperative blood loss, even more in situations where high blood loss is expected such as liver transplantation surgery.

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