Laparoscopic liver resection: Toward a truly minimally invasive approach

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Abstract
In the surgical treatment of hepatocellular carcinoma and colorectal liver metastasis, it is important to preserve sufficient liver volume after resection in order to avoid post-hepatectomy liver sufficiency and to increase the feasibility of repeated hepatectomy in case of intrahepatic recurrence. Parenchyma-sparing approach, which minimizes the extent of resection while obtaining sufficient surgical margins, has been developed in open hepatectomy. Although this approach can possibly have positive impacts on morbidity and mortality, it is not popular in laparoscopic approach because parenchyma-sparing resection is technically demanding especially by laparoscopy due to its intricate curved transection planes. "Small incision, big resection" is the words to caution laparoscopic surgeons against an easygoing trend to seek for a superficial minimal-invasiveness rather than substantial patient-benefits. Minimal parenchyma excision is often more important than minimal incision. Recently, several reports have shown that technical evolution and accumulation of experience allow surgeons to overcome the hurdle in laparoscopic parenchyma-sparing resection of difficult-to-access liver lesions in posterolateral segments, paracaval portion, and central liver. Laparoscopic surgeons should now seek for the possibility of laparoscopic parenchyma-sparing hepatectomy as open approach can, which we believe is beneficial for patients rather than just a small incision and lead laparoscopic hepatectomy toward a truly minimally-invasive approach.

Key words: Laparoscopy; Liver resection; Hepatectomy; Minimally-invasive; Parenchyma-sparing; Laparoscopic surgery; Hepatocellular carcinoma; Liver metastasis; Liver lesion; Colorectal carcinoma

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Core tip: In the surgical treatment of hepatocellular carcinoma and colorectal liver metastasis, it is important to preserve sufficient liver volume after resection in order to avoid post-hepatectomy liver sufficiency and to increase the feasibility of repeated hepatectomy.
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**TOWARD A TRULY MINIMALLY-INVASIVE LIVER RESECTION**

I remember the words, "small incision, big resection", in the keynote lecture by Professor Henri Bismuth at the European Association for Endoscopic Surgery meeting in 2011, which cautioned laparoscopic surgeons against an easygoing trend to seek for a superficial minimal-invasiveness of hepatectomy rather than substantial patient-benefits.

Laparoscopic hepatectomy has become popular[1-4] and is the standard of care[5] to treat lesions in the left lateral section[5] or peripheral antero-inferior segments[6,7] with better short-term outcomes compared to open hepatectomy, including less blood loss, less pain, and earlier recovery[8,9]. In addition, increasing number of laparoscopic major hepatectomy is actively performed in specialized centers all over the world[2,10], based on the recognition that such benefits may confirm the superiority of laparoscopic hepatectomy as a minimally-invasive surgical treatment compared to open hepatectomy. However, now is the time to reconsider if laparoscopy is truly minimally-invasive and advantageous for patients. Hepatectomy is different from other visceral surgery with regard to the importance of postoperative remnant organ function. Post-hepatectomy liver sufficiency is a life-threatening complication, mainly observed in hepato-cellular carcinoma (HCC) patients with cirrhosis or colorectal metastases (CLM) patients after prolonged chemotherapy. Even after successful hepatectomy, both HCC and CLM patients may develop intrahepatic recurrence and then the possibility of repeated hepatectomy depends on the liver functional reserve. As Professor Bismuth cautioned, "big resection with small incision" should not be beneficial for patients compared to "small resection with big incision".

In seeking for both sufficient surgical margins and the best remnant liver function, parenchyma-sparing hepatectomy, including mono-segmentectomy[11] and combination of minor resections[12], has been developed in open hepatectomy. On the other hand, parenchyma-sparing approach is not popular in laparoscopic hepatectomy. This is because laparoscopy has a significant limitation of forceps manipulation so that making intricate curved transection planes for parenchyma-sparing hepatectomy is much more demanding in laparoscopic approach than in open approach. In our opinion, major hepatectomy with a single and straight transection plane, such as right and left hepatectomy, is easier and more suitable for laparoscopy, compared to anatomical or non-anatomical minor resection. For this reason, large resection, which excises non-tumorous parenchyma more than required to obtain sufficient surgical margins, is often performed by laparoscopy for small-to-intermediate-sized lesions in difficult-to-access areas. Recently, several reports have shown that technical evolution and accumulation of experience allow surgeons to overcome the hurdle in laparoscopic parenchyma-sparing resection of difficult-to-access liver lesions[13] in posterosuperior segments[14,15], paracaval portion[16], and central liver[17]. We believe laparoscopic surgeons should now reconsider the importance of parenchyma-sparing hepatectomy and try to minimize the extent of resection by laparoscopy as open approach can. “Small incision, minimum resection required for oncologic principles” should lead laparoscopic hepatectomy toward a truly minimally-invasive and beneficial approach.

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