



Laparoscopic versus open mesohepatectomy for centrally located hepatocellular carcinoma

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Centrally located liver tumors that involve Couinaud's segment I, IV, V and VIII are surrounded by the inferior vena cava (IVC), the hepatic vein [the middle hepatic vein (MHV) or the right hepatic vein], and the first branch of the Glisson's pedicle, which need difficult surgical techniques. Extended hemihepatectomy (EH) is a standard procedure to achieve curative resection for centrally located liver tumors when the preoperative hepatic reserve is sufficient. On the other hand, mesohepatectomy (MH) was first described to treat central hepatic tumors by McBride and Wallace more than 40 years ago (1). To preserve enough remnant liver parenchyma, MH could become a reasonable option for centrally located HCC with the possibility for decreasing the risk of postoperative liver failure, because hepatocellular carcinoma (HCC) is commonly associated with cirrhosis due to chronic hepatitis B or C and alcohol abuse. In this technique, the right anterior and medial Glisson's pedicles and the MHV are usually removed with the liver parenchyma. Although this operation has been performed in medical institutions for more than 40 years, the terminology of MH is not clear at present; nearly 10 different terms have been used to describe this operation (2-4). From the viewpoint of resection for hepatic parenchyma drainage into the MHV, it is clear that one can consistently define these heterogeneous terminologies as MH (5).

A systematic review revealed that MH is safe and feasible for centrally located liver tumors and can achieve a similar postoperative outcome as EH (6). The morbidity rate, mortality rate, and overall survival rate of MH are comparable with those of EH. Moreover, compared with

EH in elderly patients, MH decreases blood loss and reduces liver failure and wound infection rates. On the other hand, bile leakage is the most common postoperative complication for MH, and the operation time of MH is theoretically longer than that of EH, requiring meticulous parenchymal transection to preserve the important vessels surrounding the lesions, as well as dissection of more liver parenchyma because of two wide resection planes. That said, MH is considered to be generally safe and effective for treating centrally located liver tumors with cirrhotic condition.

In this paper, 348 MH cases were investigated for nearly six years in a single institution, and the insights obtained from this sample size are persuasive. The authors had already reported in 2013 that the patients with centrally located HCC were divided into four subgroups based on the relation between the tumor location and the surrounding vascular structures or Glisson's pedicles (7). In this current study, the authors investigated and compared the short-term and the long-term outcomes between laparoscopic mesohepatectomy (LM) and open mesohepatectomy (OM), dividing the cases into subgroup defined by the study authors. The selection bias among patients with centrally located HCC was reduced by using a propensity matching method. Given the cross-facility differences concerning laparoscopic liver resection, it is difficult to plan a randomized controlled study to compare the surgical outcomes of laparoscopic liver resection and open liver resection. This statistical method decreases selection bias in retrospective studies and provides an objective appraisal

comparing two different surgical procedures.

Thus far, open MH has been a standard surgical procedure involving large incisions, such as the Mercedes Benz incision and the J scape incision. For such large incisions, one common postoperative complication after open MH is refractory ascites resistant to the admission of diuretic drugs. The frequency of postoperative ascites and pleural effusion after laparoscopic liver resection was lower than after open liver resection. This might be explained by reduced destruction of the collateral blood and lymphatic flow caused by laparoscopically procedure without a big incision. In the current study, the authors also revealed that the frequency of ascites, pleural effusion, and SSI after LH were lower than after OH. These results need to be addressed because the hepatic reserve of the patients indicated for MH is poor.

Meticulous surgical procedure around the hepatic hilum during hepatectomy is mandatory to avoid postoperative refractory bile leakage. The type of postoperative complications after MH may vary according to the author's classification for centrally located hepatic tumors. They claimed that in type II, because of its close adjacency to the main hepatic veins, LM in these patients was more challenging, and it was more difficult to achieve anatomic resection while securing the surgical margin. On the contrary, we presume that there are few occurrences of refractory bile leakage after LH in type II location, although such cases will still demand complex laparoscopic surgical skills.

In the surgical treatment of HCC, both overall survival and disease-free survival are essential factors. Compared with open liver resection, laparoscopic liver resection in selected patients with HCC showed similar long-term outcomes, associated with less blood loss, a shorter hospital stay, and fewer postoperative complications with propensity score matching in a multi-institutional Japanese study (8). However, this conclusion was not validated in patients with HCC undergoing LM. Anatomical liver resection in the surgical treatment for patients with HCC has been proven to yield a good impact on the DFS, and the surgical procedure of anatomical liver resection in laparoscopic liver surgery has been established due to the innovation of the laparoscopic instruments, the enrichment of preoperative and intraoperative navigation surgery, and the learning curve of the laparoscopic surgeons themselves. In this study, no significant differences were observed in both OS and DFS rates between the LM and OM group, even between the two matched groups, and the oncological prognosis was not altered by laparoscopy. Both OS and DFS rates are key

issues in the treatment of HCC, and the results in this study are original and persuasive so that LM may be one of the standard procedures for the centrally located HCC.

In laparoscopic liver surgery, the Pringle maneuver (PM) is frequently utilized during the procedure. Actually, in this study, PM was routinely utilized during liver parenchyma transection in the LM group because most of the patients enrolled in this study had liver cirrhosis, and intraoperative bleeding control was more mandatory in these patients to complete laparoscopic liver resection. As a result, patients in the LM group still had longer vascular exclusion times after propensity score matching than in the OM group. However, the time length of PM under certain hepatic reserves could have adverse effects on not only postoperative short-term outcomes but also long-term outcomes. This point might be one of the impressive insights of this paper.

Laparoscopic liver resection has become a promising procedure for various types of liver resections owing to the development of the new laparoscopic instruments, precise preoperative simulations, and intraoperative fluorescence imaging by indocyanine green. In high-volume centers for laparoscopic liver surgery, LM can be recommended as a safe and effective surgical option in select patients with centrally located HCC.

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