

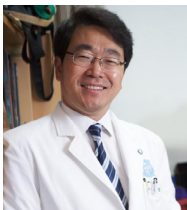
Laparoscopic liver resection for hepatocellular carcinoma in patients with cirrhosis

Jai Young Cho, Ho-Seong Han

Department of Surgery, Seoul National University Bundang Hospital, Seoul National University College of Medicine, Seoul 463-707, South Korea.

Correspondence to: Dr. Ho-Seong Han, Department of Surgery, Seoul National University Bundang Hospital, Seoul National University College of Medicine, 300 Gumi-dong, Bundang-gu, Seongnam-si, Gyeonggi-do, Seoul 463-707, South Korea. E-mail: hanhs@snuh.org

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Dr. Ho-Seong Han is a Professor of Department of Surgery, Seoul National University Bundang Hospital, Seoul National University College of Medicine. He graduated from Seoul National University College of Medicine in 1984, and finished internship and residency of Department of Surgery at Seoul National University Hospital in 1989. His field of interest is hepatobiliary surgery and laparoscopic surgery. He performed laparoscopic right posterior sectionectomy, central bisectionectomy for hepatocellular carcinoma as world-first. He has also performed laparoscopic liver resection in pediatric patient and succeeded in total laparoscopic right side donor hepatectomy as world-first. He plays an important role in many societies.

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ABSTRACT

Hepatocellular carcinoma (HCC) is a common malignant tumor and many cases occur in patients with liver cirrhosis. Although liver transplantation is the most effective treatment option, hepatectomy is still the first curative treatment option because liver transplantation is limited by the donors and high cost. In recent years, laparoscopic liver resection (LLR) has increasingly been performed in patients with liver cirrhosis, and has several advantages over open liver resection. Besides less pain and shorter hospital stay, LLR in patients with liver cirrhosis is also associated with lower incidences of postoperative liver failure and ascites because of greater preservation of collateral veins and less liver manipulation. With increasing experience, LLR for HCC located in segments 7 or 8 is now feasible, and anatomic LLR could be performed in patients with cirrhosis. Many comparative studies have shown that LLR is better than open liver resection in patients with liver cirrhosis in terms of a lower incidence of postoperative liver failure and similar patient survival. In conclusion, LLR is a promising treatment modality for HCC in patients with liver cirrhosis.

INTRODUCTION

Hepatocellular carcinoma (HCC) is the fifth most common malignant tumor, the most common primary

liver cancer,^[1] and the third most common cause of cancer-related death worldwide.^[2] Most HCCs are found in patients with liver cirrhosis, although HCC occurs in 60-90% of all patients with liver cirrhosis.^[3]



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Asian countries, especially, have a disproportionately high prevalence of HCC, mainly because chronic hepatitis B and C viruses are endemic in these countries,^[4] and are associated with high risks of liver cirrhosis and HCC.^[5]

Liver transplantation (LT) appears to be the most attractive treatment option because it treats both the cancer and the underlying disease. However, LT is limited by its high cost and the burden of lifelong immunosuppression.^[6,7] Furthermore, the scarcity of donors does not permit LT in all patients with early HCC.^[2] With recent technical advances and improvements in postoperative patient management, liver resection for HCC is now considered to be a safer procedure than it was in the past.^[8-11] Therefore, liver resection is currently regarded as the first-line treatment in many centers for HCC, especially in patients with compensated cirrhosis.^[12]

Since the first report of laparoscopic liver wedge resection, steadily increasing numbers of small case-series have demonstrated the feasibility, adequacy, and safety of laparoscopic liver resection (LLR).^[13-16] Now, LLR is commonly performed in patients with HCC and chronic liver disease.

The aim of this review was to assess the current indications, advantages, and limitations of LLR for HCC in patients with cirrhosis. We also discuss the feasibility of LLR and its oncologic outcomes relative to open surgery.

INDICATIONS

The indications for LLR have changed substantially since its introduction. In the early stages of LLR, it was limited to benign diseases. With increasing knowledge and experience of this procedure, its indications have expanded to malignant diseases, including HCC and colorectal liver metastasis.^[17] However, unlike laparoscopic cholecystectomy, laparoscopy has been limitedly used for liver resection due to the risk of air embolism and the difficulty of parenchymal dissection and bleeding control.^[18] Therefore, LLR has been frequently performed for tumors superficially located in the anterolateral segments.^[19]

For HCC located in segment 7, right posterior sectionectomy is choice of type of resection because it can preserve more functional volume of the liver than right hepatectomy. However, right posterior sectionectomy is technically more difficult and considered as major hepatectomy because it requires parenchymal dissection along the intersectional plane.^[20-23] For HCC located in segments 7 or 8

in patients with very poor hepatic reserve, non-anatomical minor liver resection such as tumorectomy is usually performed. However, it is sometimes very difficult and unexpected huge bleeding from hepatic vein could occur because the operative field is poor, intra-abdominal free space is narrow for manipulation of many instruments, and the transection line can be curved or angled.^[24] LLR for HCC in the posterosuperior segments in selected patients was reported to be as safe and feasible, and offered comparable oncologic outcomes to open liver resection. Moreover, LLR has other benefits, including reduced blood loss, fewer complications, and shorter postoperative hospital stay than open liver resection.^[25]

SELECTION OF SUITABLE PATIENTS

When considering liver resection in patients with cirrhosis, both surgical stress and the oncologic outcomes should be considered.^[13] Similar to open surgery, uncompensated cirrhosis is generally considered to be a contraindication for liver resection and hence LLR.^[26] Uncontrolled portal hypertension, including esophageal varices and low platelet count, is usually considered as a contraindication for LLR.^[27] Because patients with HCC usually have associated chronic liver disease or cirrhosis, these patients may be predisposed to hepatic failure after surgery. Therefore, it is important to preoperatively predict the patient's liver remnant volume and liver function after surgery before selecting the type and extent of liver resection. The hepatic reserve functional capacity is estimated before liver resection to facilitate patient selection and predict the safety margin of parenchymal resection in individual patients.

The Child-Turcotte-Pugh (CTP) score is a simple and the most widely used system for scoring hepatic function before liver resection. It is based on 5 easily measurable variables and, for more than 4 decades, has been considered the gold standard for selecting candidates for liver resection.^[28] However, even CTP class A patients may develop liver failure after LLR.^[29]

The model for end-stage liver disease (MELD) score was made to predict the survival of patients with severe portal hypertension and variceal bleeding who underwent transjugular intrahepatic portosystemic shunt procedure,^[30] and then has been further developed for the selection of patients who are waiting for LT.^[31] Several studies showed that the application of MELD score to predict mortality in patients who underwent liver resection, not LT worked well, and it may outperform the CTP classification in terms of predicting operative risk before liver resection.^[32] However, because MELD score was developed in

non-surgical setting, it is necessary to validate MELD score in patients undergoing liver resection.

The indocyanine green (ICG) test is one of the most commonly used liver reserved function test in Asia-Pacific region. The cut-off value of ICG retention rate at 15 min for safe major liver resection is less than 14%.^[33] However, it is unclear whether this cut-off value is also applicable to patients with liver cirrhosis.

LLR IN PATIENTS WITH CTP CLASS B OR C

Liver cirrhosis is one of risk factors for developing postoperative morbidities after hepatectomy.^[34] Severe blood loss or prolonged ascites after major hepatectomy, especially by open surgery, can occur by interruption of collateral circulation in the parietal wall and surrounding ligaments in patients with liver cirrhosis.^[35] These complications may prolong the postoperative hospital stay or cause hepatic failure in some patients. However, LLR may minimize the reduction in collateral and lymphatic flow caused by laparotomy and mobilization, and may reduce compressive mesenchymal injury, as demonstrated in previous studies of patients undergoing LLR of HCC.^[36,37] The benefits of LLR in this setting include earlier ambulation, less postoperative pain, earlier feeding, and a less postoperative complications. Other important advantages of LLR in patients with liver cirrhosis are the lower incidences of postoperative liver failure and ascites due to minimal invasiveness of LLR, which helps to preserve collateral circulation.^[13] Therefore, laparoscopic hepatectomy may be a good option in patients with cirrhosis.^[38]

Most studies consider CTP class B or C cirrhosis to contraindicate liver resection, and surgeons face a considerable challenge in treating patients with uncompensated cirrhosis. There have been a few reports describing the oncological outcomes of patients with CTP class B or C cirrhosis.^[39] A recent retrospective study of 16 patients with CTP class B or C cirrhosis who underwent LLR showed that LLR did not compromise the oncological outcomes of patients with HCC and clinically significant cirrhosis.^[40] Recently, precoagulation technique before parenchymal transection, intermittent Pringle maneuver during resection, and hybrid technique using hand port were proposed to decrease the technical difficulty of LLR in cirrhotic liver.^[41]

ANATOMICAL VERSUS NON-ANATOMICAL RESECTION

There are still many controversies, but many surgeons believe that anatomical liver resection has some

advantages compared to non-anatomical liver resection for HCC in terms of patient survival and recurrence.^[42,43] HCC recurs after resection mostly in the liver because HCC can spread along the portal branches by microscopic vascular invasion, which contributes to the poor prognosis of HCC.^[44] On this basis, anatomic resection including the whole segment according to the portal tributaries could remove small microscopic metastasis and prolong patient survival and disease free survival.^[45] Anatomical monosegmentectomy of segments 6 or 7 is extremely difficult even in open surgery.^[46] For deep seated large tumor in segments 6 or 7, laparoscopic right posterior sectionectomy will be chosen for more resection margin because segmentectomy or tumorectomy could be insufficient. For deep seated tumor near to right hepatic vein, laparoscopic extended right posterior sectionectomy (resection of right posterior section together with right hepatic vein) can be alternative treatment instead of right hemihepatectomy.^[47]

ONCOLOGIC OUTCOMES OF LLR IN PATIENTS WITH LIVER CIRRHOSIS AND ITS CHALLENGES

Several recent studies have compared the oncologic outcomes between LLR and open liver resection. These studies showed that LLR was associated with lower morbidity and mortality rates, but not 5-year overall and disease-free survival rates.^[48-50] In addition, the most up-to-date and comprehensive systematic review and meta-analysis prepared at the second international consensus conference on LLR highlighted a reduction in the rates of postoperative ascites and liver failure following LLR in cirrhotic liver.^[51,52]

Radiofrequency ablation is a compelling alternative to liver resection in patients with liver cirrhosis, especially in terms of the overall morbidities. In patients with peripherally located lesions, percutaneous ablation may carry a high risk of tumor seeding while LLR can be safely performed and may permit pathological assessment of tumor biology and of the surrounding liver parenchyma.^[53] One propensity score matching analysis showed that liver resection offered a consistent survival benefit and did not increase the incidence of major complications compared with radiofrequency ablation in patients with hepatitis B virus-related HCC and portal hypertension.^[54]

CONCLUSION

LLR has a vital role to play in the first-line treatment of HCC in selected patients with compensated cirrhosis and portal hypertension.

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Conflicts of interest

There are no conflicts of interest.

Patient consent

Not involved.

Ethics approval

Not involved.

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