Long-Term Favorable Surgical Results of Laparoscopic Hepatic Resection for Hepatocellular Carcinoma in Patients with Cirrhosis: A Single-Center Experience over a 10-Year Period

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BACKGROUND: We first performed laparoscopic hepatic resection (Lap-Hx) for hepatocellular carcinoma (HCC) in 1994. Here we review the long-term surgical results of Lap-Hx for HCC in patients with cirrhosis over a 10-year period at a single institution.

STUDY DESIGN: Between January 2000 and December 2013, 99 patients with cirrhosis underwent open hepatic resection (Open-Hx) and 63 underwent Lap-Hx for primary HCC within the Milan criteria. We compared the operative outcomes and patient survival between the 2 groups.

RESULTS: There were no significant differences regarding patient background characteristics or tumor-related factors between the 2 groups. The morbidity rate of the Lap-Hx group was significantly lower than that of the Open-Hx group (26% vs 10%; $p = 0.0459$), and the complication rate of ascites was significantly lower (7% vs 0%; $p = 0.0077$). The mean duration of hospital stay of the Lap-Hx group was significantly shorter than that of the Open-Hx group (16 vs 10 days; $p = 0.0008$). There were no significant between-group differences regarding overall or disease-free survival.

CONCLUSIONS: Laparoscopic-Hx for HCC in patients with cirrhosis is associated with less morbidity and shorter hospital stays, with no compromise in patient survival. It may be time to consider changing the standard operation for primary HCC within the Milan criteria to Lap-Hx in patients with cirrhosis. (J Am Coll Surg 2014;219:1117−1123. © 2014 by the American College of Surgeons)

Hepatocellular carcinoma (HCC) is one of the most common malignancies worldwide, accounting for approximately 6% of all human cancers.[1] The mainstay of curative treatment for HCC is hepatic resection, and the surgical results of hepatic resection for HCC have significantly improved, with the mortality rate nearly reaching zero.[2] However, hepatic resection for HCC remains high risk, especially in patients with cirrhosis. As a less invasive procedure, laparoscopic hepatic resection (Lap-Hx) for HCC has gathered attention in this challenging field.[3]

We first performed Lap-Hx for HCC in patients with cirrhosis in 1994.[4] Until 2007, we selected Lap-Hx for HCC on the left lateral lobe or the peripheral ventral right lobe, and we performed liver parenchymal division through a small laparotomy after mobilization of the liver. We reported favorable short-term surgical results of Lap-Hx for HCC, with less blood loss and shorter hospital stays, with no compromise in patient survival.[5] In June 2008, pure Lap-Hx was introduced in our institution,[6] and Lap-Hx for the posterior segment, anterosuperior segment (S8), and caudate lobe was performed with the patient in the semiprone position.[7,8]

Several meta-analyses summarized the surgical results of Lap-Hx for HCC as follows: less blood loss, less frequent need for transfusion, less morbidity, a lower complication rate of ascites, a lower complication rate of liver failure,

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Abbreviations and Acronyms

HCC = hepatocellular carcinoma
Lap Hx = laparoscopic hepatic resection
ICGR-15 = indocyanine green retention rate at 15 minutes
Open-Hx = open hepatic resection

shorter hospital stays, and no compromise in prognosis. [9-13] However, long-term (ie, more than 10 years) surgical results of Lap-Hx for HCC in patients with cirrhosis have not yet been reported.

We herein present a retrospective analysis of long-term surgical results including patients' prognoses after Lap-Hx for HCC within the Milan criteria[14] (ie, ≤5 cm in diameter in single HCC or ≤3 nodules and ≤3 cm in diameter in multiple HCCs) in patients with cirrhosis, over a 10-year period at a single institution.

METHODS

Patient characteristics

We retrospectively analyzed 653 patients with HCC who underwent hepatic resections at the Department of Surgery and Science, Graduate School of Medical Sciences, Kyushu University, from January 2000 to December 2013. Among them, 162 patients who underwent curative hepatic resections for primary HCC within the Milan criteria were enrolled in this study. We divided this cohort of 162 patients into 2 groups; the open hepatic resection (Open-Hx) group (n = 99), and the Lap-Hx group (n = 63).

Surgical procedures and outcomes

Details of our surgical techniques of Open-Hx and patient selection criteria for hepatic resection for HCC have been reported.[15,16] Resection volume was decided based on the patients' indocyanine green dye retention rate at 15 minutes (ICGR-15) in both the Open-Hx and Lap-Hx groups. Patients with an ICGR-15 ≥ 35% were generally selected for limited resection.[16] From 1994 to 2007 in 25 patients (40%), Lap-Hx was done on the principle that parenchymal division would be performed under direct vision through a small laparotomy wound after mobilization of the liver under a carbon dioxide (CO_2) pneumoperitoneum. The CUSA system (Valleylab) was used to transect the liver parenchyma.

In almost all of the hepatic resections, the Pringle's maneuver, consisting of clamping the portal triad for 15 minutes and then releasing the clamp at 5-minute intervals, was applied; alternatively, hemivascular occlusion[17] was performed. From June 2008 in 38 patients (60%), pure Lap-Hx was introduced in our institution,[6] and Lap-Hx for the posterior segment, anterosuperior segment (S8), and caudate lobe was performed with the patient in the semiprone position.[7,8] In patients who underwent the Lap-Hx, bipolar scissors or a Biclamp under the VIO soft-coagulation system (ERBE Elektromedizin) fitted with a silicon tube dropping saline to the tip was used to transect the liver parenchyma. If transection of the liver parenchyma of S7, S8, or the right superior portion of S1 was needed in the Lap-Hx patients, an intracostal port with a balloon was placed under left-lung ventilation.[8] Types of hepatic resections in both the Open-Hx group and the Lap-Hx group are summarized in Table 1. There were no patients who underwent lobectomy or more for HCC within the Milan criteria in our series. The majority of operations performed were partial hepatic resections: 71 patients (71.7%) in the Open-Hx group and 36 patients (57.1%) in the Lap-Hx group.

Any death that occurred in the hospital after hepatic resection was recorded as a mortality. Complications were evaluated by Clavien's classification of surgical complications, and the complications with a score of grade II or more were defined as positive.[18]

Follow-up and treatment strategy for recurrent hepatocellular carcinoma

After discharge, all patients were examined for recurrence by ultrasonography and tumor markers such as α-fetoprotein (AFP) and des-γ-carboxy prothrombin (DCP) every month and by dynamic CT every 3

Table 1. Types of Hepatic Resection

Operative procedures	Open (n = 99)	Laparoscopic (n = 63)
Lobectomy or more		
Right liver	0	0
Left liver	0	0
Segmentectomy or more		
Left lateral	4	13
Medial	3	1
Anterior	1	0
Posterior	1	5
Subsegmentectomy or more*		
S2	0	2
S3	2	1
S5	4	1
S6	7	2
S7	2	0
S8	3	1
S5 + 6	1	1
Partials	71	36

*S, segment defined by the Couinaud's nomenclature.