Laparoscopic liver resection for hepatocellular carcinoma: a single-center experience in upper egypt

Bashir A. Fadel[a,d], Nahed A. Makhlouf[b,d], Mohamed O. Abdelmalek[b,d], Mostafa S. Abbas[c,d], Khalid S. Mohamed[c,d], Tameem M. Ibraheem[a,d]

Departments of [a]General Surgery, [b]Tropical Medicine and Gastroenterology, [c]Anesthesia and Intensive Care, [d]Faculty of Medicine, Assiut University, Assiut, Egypt

Correspondence to Nahed A. Makhlouf, MD, Professor, Department of Tropical Medicine and Gastroenterology, Faculty of Medicine, Assiut University, Assiut 71515, Egypt. Orcid ID: https://orcid.org/0000-0003-2949-4369. Fax: +20 882 354 130; e-mails: nahedmak@yahoo.com; naked.mak@aun.edu.eg

Received: 3 May 2020
Revised: 17 May 2020
Accepted: 21 May 2020
Published: 24 December 2020

The Egyptian Journal of Surgery 2020, 39:958–962

Background
Hepatocellular carcinoma (HCC) is the fifth most common cancer worldwide. Liver transplantation is an effective therapy for HCC but cannot be done in all HCC cases. Hepatic resection is the first-line therapy for HCC in compensated cirrhosis with proven cure. Laparoscopic liver resection (LLR) of HCC had a lower frequency of postoperative complications than open approach.
Aim
The aim was to determine the feasibility, safety, and outcome of LLR for HCC in a single center.
Patients and methods
This study was done on patients with HCC who underwent laparoscopic resection during 2 years. LLR was decided by the surgical team based on the location of the tumor and its size in imaging. All cases were cirrhotic Child–Pugh class A with a single focal lesion. Operative time, blood loss volume, hospital stay, and postoperative complications were reported.
Results
This study included 20 HCC cases with a mean age 55.6±9.1 years. Of them, 60% were male. The mean size of focal lesion was 3.9±0.8 cm. Wedge resection was done in 65% of cases. Left lateral anatomical resection was done in 35%. Duration of operation ranged from 70 to 120 min. Bleeding occurred in one case only and was converted to open (5%). Hospital stays ranged from 2 to 4 days. Postoperative ascites occurred in one (5%) case. No short-term mortality was seen.
Conclusion
Laparoscopic minor hepatectomy is an acceptable approach in selected cases of HCC with decreased blood loss, shorter stay in the hospital, and less complications.

Keywords:
cirrhosis, hepatocellular carcinoma, laparoscopic liver resection, outcome, postoperative decompensation

Egyptian J Surgery 39:958–962

1110-1121

Introduction

Hepatocellular carcinoma (HCC) is the fifth common cancer and the third cause of mortality related to cancer worldwide [1]. Most HCCs are found in cirrhotic patients [2]. Liver resection is regarded as a first-line curative therapy in many centers for HCC in compensated cirrhosis with normal liver function [3,4].

Patient candidacy for surgery is based on assessment of multiple parameters such as Child–Pugh class A, model for end-stage liver disease score less than 10, the presence and grade of portal hypertension (PH), sufficient residual liver volume, and the suitability to adopt a minimally invasive surgery [5]. Hepatectomy increases the occurrence of postoperative complications such as ascites, posthepatectomy liver failure (PHLF), and encephalopathy [6].

However, there is a growing concern that laparoscopic liver resection (LLR) can treat HCC on top of liver cirrhosis with less morbidity and a lower incidence of PHLF with no affection of the oncological outcomes in comparison with open surgery [7,8].

Aim

The aim was to determine the feasibility, safety, and outcome of LLR for HCC in a single center in Upper Egypt.

Patients and methods

Patients

This prospective study was done on patients with HCC who underwent laparoscopic resection during 2 years from 2017 to 2019. Surgeons at Al-Rajhi Liver Center

were qualified in open and laparoscopic procedures. Preoperative assessment was done based on age, severity of liver condition as determined by Child–Pugh class, and occurrence of clinically evident PH known by esophageal varices and/or splenomegaly. Upper endoscopy was done as a routine procedure in liver cirrhosis in our center. A surgical resection option was given by the Hepatoma Board. The decision for LLR was determined by the surgical team based on the location of the tumor and its size in imaging [computed tomography (CT) and/or MRI]. All cases had Child–Pugh class A. Cases with clinically evident PH (platelet count <100 000, splenomegaly, or ascites) were excluded. Cases with esophageal varices grade I were accepted for resection.

Preparation, surgical technique, and postoperative course

Anesthesia

All surgeries were done under general anesthesia. To improve surgical space and operating conditions, deep neuromuscular blockade was achieved by continuous rocuronium infusion of 0.6 mg/kg/h titrated to a post-tetanic count of 1–2 twitches using TOF-watch-SX for neuromuscular function monitoring. CVP was kept below 5 cm H_2O by fluid restriction during transection to decrease venous oozing.

Operative technique

Patients were placed in Lloyd-Davis position in Trendelenburg position, and the operating surgeon stood between the patient's legs, and the two assistants were positioned on the right side of the operating surgeon facing the laparoscopic display. Overall, 3–4 ports were used in all procedures. The position of the ports depended on the operation type and tumor site. Pneumoperitoneum was done with a Veress needle, and the intra-abdominal pressure was kept at 12 mm.

In left lateral sectionectomy, we used four ports (a 10-mm umbilical camera port, a 12-mm epigastric working port, a 5-mm right subcostal working port, and a 5-mm subxiphoid port for suctioning). Evaluation of tumor sites and vascular structure was done via an intraoperative ultrasonography, which has a flexible probe (BK laparoscopic ultrasound transducer). Transection lines were demarcated with electrocautery. The Pringle maneuver had not been used in any case (we did not use Pringle's maneuver in cirrhosis as possible as we can). Liver transection was done with the help of a harmonic scalpel (Ethicon Endo-Surgery Inc., Cincinnati, Ohio, USA). Hepatic vein branches were controlled with an endoclip (hemolock) (Click'aV polymer ligating clips, Grena DG, Chelsea Nottingham, United Kingdom). In left lateral sectionectomy, the round ligament was taken down after performing ultrasonography, and liver transection was carried out along the lateral border of falciform ligament.

Larger portal structures encountered during this transection plane (S2 and S3 pedicles) were controlled using endoscopic linear stapler with vascular cartridge (ECHELON FLEX ENDOPATH Staplers) or with hemolock according to their size and judgment of the surgeon.

Toward the end of transection, the left triangular ligament was divided with electrocautery, and the left hepatic vein was divided with endoscopic linear stapler with vascular cartridge (ECHELON FLEX ENDOPATH Staplers).

In cases of wedge resection, after the demarcation of the line of resection by using electrocautry, we used harmonic scalpel to resect the tumor with safety margin.

Transection surface was examined for any bleeding or bile leak, which was controlled with electrocautery, clipping, or suturing. Clamping of portal triad was not done in our case series. One or two drains were inserted according to the case. The specimen was put in a retrieval bag and removed via a Pfannenstiel incision.

We calculated operative time in minutes and the amount of blood loss. One case was converted to open laparotomy owing to occurrence of uncontrolled bleeding. After the operation and recovery from anesthesia, the patient was referred to the surgical ward or to the Intensive Care Unit (ICU).

Criteria for ICU admission were hemodynamically unstable or ventilator-dependent postoperative patients and patients who may need immediate intervention as those with uncontrolled bleeding. Only the case which was converted to open laparotomy was admitted to ICU as he was ventilator-dependent postoperatively.

Definition of postoperative ascites was accumulation of ascitic fluid in the peritoneal cavity (detected by follow-up abdominal ultrasound) after removal of surgical drains.

Pathology

The pathologist examined the resected tumor and its resection margin and searched for microvascular invasion. Margin status was considered R0 resection

when complete resection occurred and no microscopic tumor.

Follow-up protocol

The patients were clinical followed up on days 1, 3, and 7 for fever, jaundice, or bleeding. Follow-up liver function tests, including international normalized ratio, and complete blood count were also performed. Abdominal ultrasound was done after removal of surgical drains. Hospital stay was calculated.

1 month postoperatively

Clinical evaluation and laboratory evaluation, including α-fetoprotein and abdominal ultrasound, were.

3 and 6 months postoperatively

In addition to clinical evaluation and laboratory evaluation, triphasic CT abdomen was done for assessment of tumor recurrence or new lesions.

Ethics

Approval from ethics was taken from the Ethics Committee of Faculty of Medicine. Confidentiality of patient data was maintained.

Results

This study recruited 20 cases with single HCC as well as liver cirrhosis who were subjected to laparoscopic resection. The mean age was 55.6±9.1 years. Of them, 60% were male. The mean size of focal lesion was 3.9 ±0.8 cm. All cases were Child–Pugh Class A. There was no clinical significant PH (Table 1).

Table 1 Demographic and baseline data

Variables	*n* (%)
Sex	
Male	12 (60)
Female	8 (40)
Age (years)[a]	
Mean±SD	55.6±9.1
Range	40–75
Child grade	
A5	17 (85)
A6	3 (15)
Clinical significant portal hypertension	
No	20 (100)
Number of focal lesions	
Single	20 (100)
Size of focal lesion (cm)[a]	
Mean±SD	3.9±0.8
Range	3–6

[a]Data are presented in the form of number and percentage except as mean±SD or range.

Table 2 Synthetic liver function data preoperatively and postoperatively

Variables	Preoperative	Postoperative – day 3
Baseline bilirubin (mg/dl)		
Mean±SD	0.8±0.1	0.9±0.1
Range	0.7–1.0	0.8–1
Baseline albumin		
Mean±SD	33±1.5	31.7±1.2
Range	30–35	29–34
Baseline INR		
Mean±SD	0.97±0.1	1.01±0.1
Range	0.7–1.2	0.8–1.3

Data are expressed as mean±SD/range. INR, international normalized ratio.

The baseline and postoperative bilirubin, albumin, and international normalized ratio mean values are shown in Table 2. Most of our patients developed mild reduction in serum albumin in the early postoperative follow-up period.

Sites of focal lesions in CT scan are shown in Fig. 1. In 30% of cases, focal lesion was found in segment 6, whereas in 25% of cases, focal lesion was found in segment 2, and another 25% of cases in segment 3.

Operative details and postoperative course are shown in Table 3 and Fig. 2.

Wedge resection was done in 13 (65%) cases. Left lateral anatomical resection was done in seven (35%) cases. Duration of operation ranged from 70 to 120 min. Bleeding occurred in one case only and was converted to open (5%). Hospital stay ranged from 2 to 4 days. Postoperative transient ascites occurred in one (5%) case, which was improved with diuretic for 3 weeks. No short-term mortality (1 month postoperative) occurred in our case series and also up to 6-month follow-up.

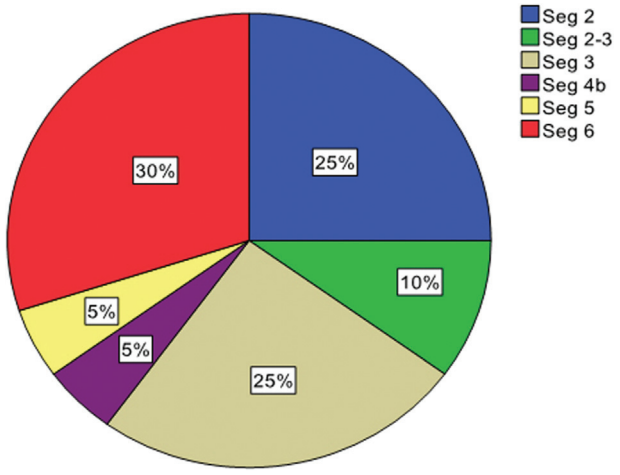
Statistical analysis

SPSS version 17 was used for statistical analyses (SPSS Statistics for Windows, Version 17.0; SPSS Inc., Chicago, Illinois, USA). Continuous variables were presented as mean and SD and range. Qualitative variables were expressed as frequency.

Discussion

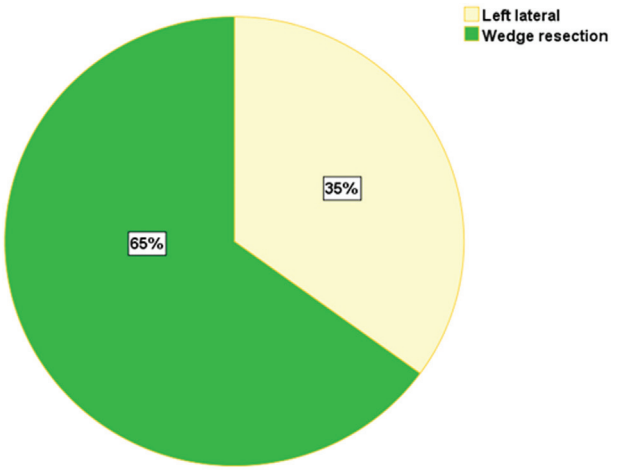
Liver transplantation is an effective curative line of therapy for HCC because it manages both the cancer and liver cirrhosis. Owing to scarcity of donors, high cost, and the burden of lifelong immunosuppression, liver transplantation cannot be done in all HCC cases

Figure 1



Site of focal lesion using triphasic computed tomography scan.

Figure 2



Type of resection.

Table 3 Operative details, postoperative course, pathology, and outcome

Variables	*n* (%)
Duration of operation (min)[a]	
Mean±SD	91±12.1
Range	70–120
Complications	
Intraoperative bleeding	1/20 (5)
Blood loss (cm)	
Median (range)	450 (50–500)
Conversion to open	1/20 (5)
Hospital stays (days)[a]	
Range	2-4
Postoperative ascites	1/20 (5)
Short-term mortality (1 month)	0
Pathology	
HCC	20 (100)
Microvascular invasion	0
Cirrhosis present	20 (100)

Data are presented in the form of number and percentage except [a]as mean±SD or range. HCC, hepatocellular carcinoma.

[9–11]. Hepatic resection is the first-line therapy for HCC in compensated cirrhosis with proven cure [3]. Hepatectomy leads to an increase in the occurrence of complications after the operation such as ascites, hepatic failure, and encephalopathy [6]. Makhlouf *et al.* [12] stated that the extent of hepatectomy has a direct relation to outcomes, with PHLF occurring in 57% of their patients with major hepatectomy.

LLR has become a widely accepted approach for HCC treatment, especially in early cirrhosis [13]. It is essential to predict the patient's liver residual volume in the preoperative phase and hepatic function after surgery before selecting the type and extent of liver resection [11]. The present study aimed to display a single-center experience in LLR and to determine the case outcomes. The study included 20 cases of Child–Pugh class A cirrhosis. each with single focal lesion (range from 3 to 6 cm). The mean age was 55.6±9.1 (range: from 40 to 70 years) and 60% were male.

Makhlouf *et al.* [12] in their study on major hepatectomy for HCC found 68% of their HCC cases were male, with mean age of 58.86±8.11 years. The mean operative time in our case series was 91±12.1 (70–120 min). Bleeding occurred in one case only and converted to open (5%). Hospital stays ranged from 2 to 4 days.

In the present study, postoperative ascites was reported only in one (5%) case. No mortality occurred. Aldrighetti *et al.* [14] stated that laparoscopic resection of HCC had a lower frequency of postoperative complications, with less blood loss than open approach [15].

Similarly, Soubrane *et al.* [16] reported an incidence of 5% of postoperative ascites with LLR. Moreover, Kanazawa *et al.* [6] reported that the frequency of ascites was significantly lower in the LLR group (3/28, 10%) than in the laparotomy (open surgery) group (18/28, 64%) ($P<0.0001$). They explained their results by the fact that, during LLR, avoidance of long abdominal incision, the decreased damage to the abdominal wall, and the decrease in liver mobilization with preservation of paraumbilical vein and round ligament were possible. These maneuvers did not disturb the lymphatic flow and venous collateral circulation and prevented the postoperative PH and the development of ascites [6,17,18]. In addition, less exposure of the abdominal viscera and decreased fluid requirements and blood transfusion during the

operation owing to less blood loss explained by the effect of CO_2 pneumoperitoneum reduce the occurrence of ascites [19].

In a meta-analysis of high quality studies comparing laparoscopic versus open surgery for HCC [20], LLR showed less morbidity and mortality, less amount of blood loss, short stay in the hospital, and a comparable duration of the operation.

Limitation of the study

Small sample size and absence of a comparison group with open surgery were the limitations.

Conclusion

Laparoscopic minor hepatectomy is an acceptable approach in selected cases of HCC with decreased blood loss, shorter stay in the hospital, and less postoperative complications.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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