Laparoscopic left lateral bisegmentectomy for hepatocellular carcinoma: moving from peripheral to anatomical

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Context
The use of the laparoscopic approach for liver resections became popular worldwide and is now of increasing popularity in Egypt. The growing experience in laparoscopic liver resections has made it more applicable in cirrhotic livers with hepatocellular carcinoma.
Aim
The aim of this study was to assess the feasibility and safety of laparoscopic left lateral liver resections in a tertiary centre in Egypt.
Patients and methods
A retrospective analysis of laparoscopic liver resections was undertaken in patients with preoperative diagnoses of a hepatocellular carcinoma with compensated cirrhosis. Surgical technique included CO_2 pneumoperitoneum and liver transection with a harmonic scalpel and laparoscopic Habib 4X sealer without portal triad clamping or hepatic vein control. Portal pedicles and large hepatic veins were stapled. Resected specimens were placed in a bag and removed through a separate incision, without fragmentation. Nonparametric data were presented as medians (range), and categorical data as frequency and proportion (%). *P* value less than 0.05 was considered statistically significant. Statistical analyses were performed using the IBM SPSS software, version 23.
Results
From August 2008 to February 2016, 38 liver resections were included. Eleven patients with a diagnosis of HCC were planned for laparoscopic left lateral resection. The mean tumour size was 5.6±2.1 cm. There were five conversions to laparotomy: two cases because of bleeding, one because of stapler failure, one because of accessibility failure, and one because of failure to extract the specimen. Mean blood loss was 150±75 ml. Mean surgical time was 160±40 min. There were no deaths. Complications occurred in two patients: only one patient developed postoperative ascites and the other developed bile leak.
Conclusion
Laparoscopic left lateral bisegmentectomy is feasible and safe in selected patients with adequate training and preparation.

Keywords:
hepatocellular carcinoma, laparoscopic, liver resection, surgery

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Introduction

This study tries to assess the feasibility and safety of laparoscopic Lt. lateral liver resections in a tertiary centre in Egypt. Liver resection is a well-established therapeutic option in the treatment of both benign and malignant hepatic lesions. In the era of minimally invasive surgery, laparoscopic liver resection (LLR) has rapidly been evolved with increased interest and practice since the first publication in 1991 [1]. Thereafter, LLR has been mounted from wedge resections and minor hepatectomies into anatomical and major resections. As in all less invasive procedures, LLR has the advantage of shorter hospital stay, earlier recovery, and rapid return to work. Nonetheless, LLR is a very demanding procedure necessitating a high level of experience in both laparoscopic and liver surgery, as well as a sophisticated laparoscopic setup [2].

After the introduction of LLR in the treatment of hepatocellular carcinoma (HCC), several

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studies have reported that LLR is associated with similar disease-free survival and overall survival rates to open liver resection in patients with HCC [2–6].

Patients and methods

This study included a retrospective cohort analysis of 38 patients with HCC who underwent LLR. This study highlights the progression of our learning curve from nonanatomical wedge resection to more formal anatomical resection starting from August 2008 to February 2016 at the Department of Surgery, National Liver Institute, Menoufia University, Egypt. Retrospective analysis of their data was done over the next 6 months. The study was approved by the National Liver Institute Ethical Committee. Informed consent was taken from all patients. Data were extracted from our database system as follows: demographic date, underlying liver status and the aetiology of liver disease. The liver status was assessed by Child–Turcotte–Pugh and Model of End-Stage Liver Disease scores. The tumour characteristics were extracted, especially size, number, segmental location, satellites, vascular invasion, regional lymph nodes, tumour stage, preoperative management, comorbidities, imaging studies and serum tumour markers.

Operative data were recorded, including the extent of LLR (wedge, nonanatomical and left lateral bisegmentectomy), vascular occlusion if performed (Pringle manoeuvre), the volume of blood loss and blood transfusion, total operating time and open conversion rate. Postoperative data were collected, including hospital stay and in-hospital mortality (30-day mortality). The postoperative complications were recorded. Histopathology data were collected to confirm tumour size and tumour characteristics.

Follow-up data were collected for at least 6 months postoperatively. A follow-up computed tomography scan and α-fetoprotein measurements protocol were performed at 3, 6 and 12 months. The follow-up data included the patient's clinical status, recurrence and its treatment, and death and its cause.

Surgical technique of laparoscopic left lateral bisegmentectomy

The laparoscopic approach adopted in this study was a multiport technique. The patient was placed supine and general anaesthesia was introduced. A supraumbilical approach (either closed or open) was done for pneumoperitoneum and laparoscopy insertion. The second port was introduced in the left midclavicular line through which the abdomen was explored and the liver examined by an intraoperative laparoscopic ultrasound (a laparoscopic probe of BK Medical; Ethicon Endosurgery, New York, USA). Demarcation of the transaction line on the liver surface was done as guided by intraoperative laparoscopic ultrasound using an electrocautery. Pringle manoeuvre was used only in some cases. The hepatic parenchyma transection was then performed with various devices including the Harmonic Scalpel (Ethicon Endosurgery, New York, USA) or Lap. Habib 4X Sealer (AngioDynamics, New York, USA) depending on the individual's surgical experience or preference. Large pedicles (vascular and biliary) were controlled either by clipping or staplers. The resected specimen was enclosed in a plastic bag and removed through a small incision. Hemostasis of the transection line is then performed using bipolar electrocautery, argon beam coagulation, as well as Surgicel application (Fig. 1).

Statistical analysis

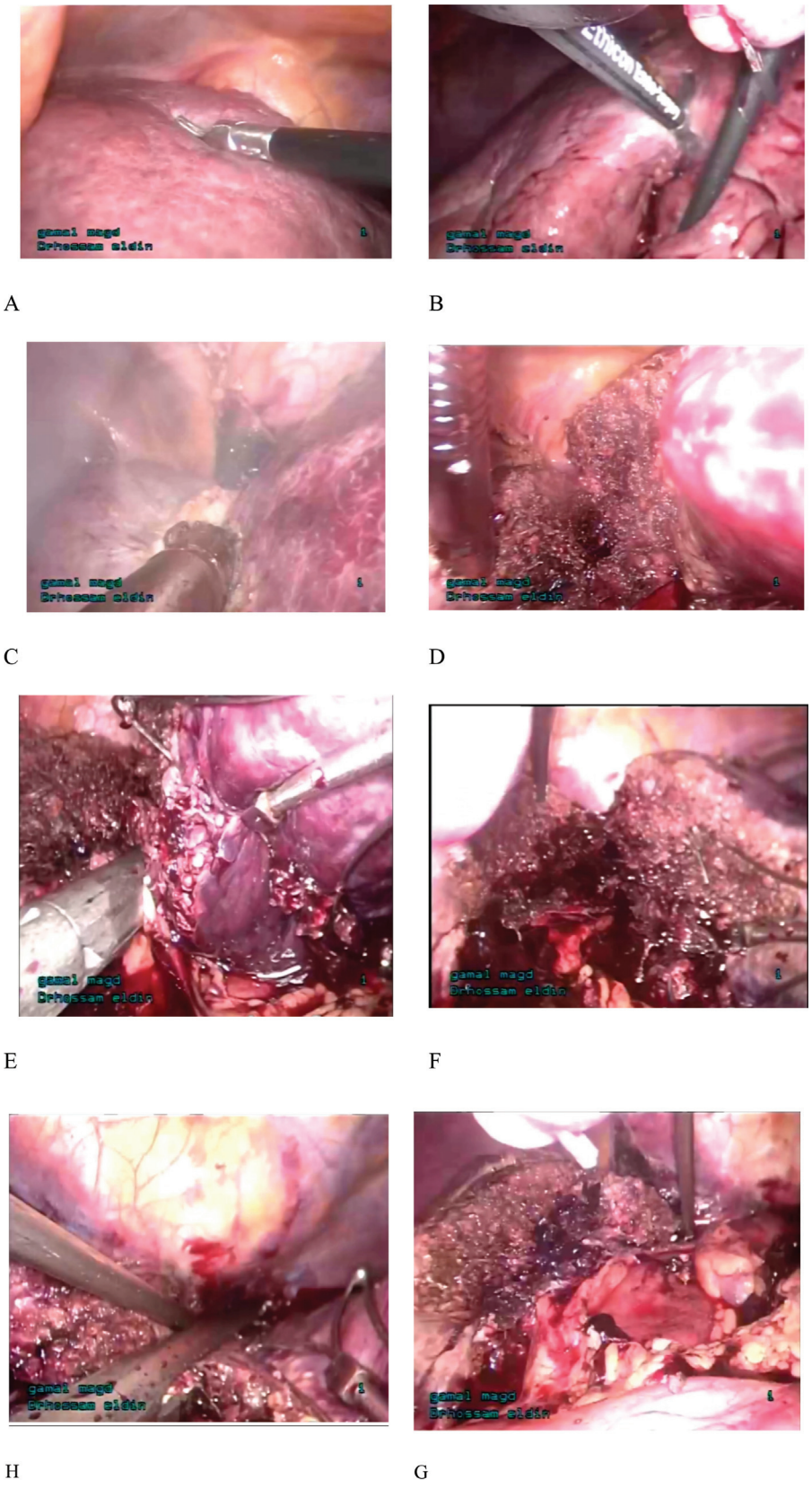
Nonparametric data were presented as medians (range), and categorical data as frequency and proportion (%). P value less than 0.05 was considered statistically significant. Statistical analyses were performed using the IBM SPSS software, version 23 (IBM Inc., Armonk, New York, USA).

Results

Thirty-eight patients underwent LLR, divided into two periods. From August 2008 to February 2016, 27 patients underwent nonanatomical resections (these focal lesions were peripherally located at segments III, IVb, V, VI and VII), and they were compared with another 11 patients who underwent laparoscopic left lateral bisegmentectomy (LLLBS), starting in February 2013 to the end of February 2016 (Fig. 2). This period division of patients was aimed for accurate comparison of our results of LLR and thus conveying the status of our learning curve and experience.

According to our HCC multidisciplinary committee, the selection criteria for laparoscopic resection were compensated cirrhosis (Child–Turcotte–Pugh class A, no signs of portal hypertension and Model of End-Stage Liver Disease score <9), single lesion and absence of a contraindication to laparoscopy. The exclusion criteria were multiple or bilobar HCC, decompensated cirrhosis and extrahepatic disease. The type and extent of laparoscopic resection were determined according to the anatomical location of

Figure 1

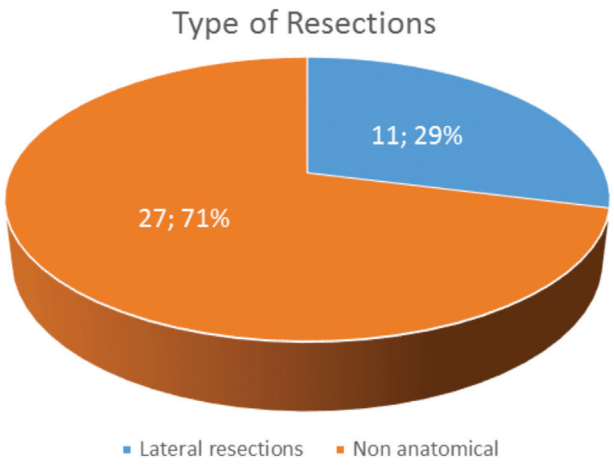


Technical steps of LLLBS. (a) A mass in S-II confirmed by ILUS. (b) The transection line is demarcated. (c) The line is burned by lap. Habib 4X. (d) The line is cut by Harmonic Scalpel. (e) The pedicle is divided using stapler. (f) After division of the inflow structures. (g) Cutting line after hemostasis. (h) Division of the LHV using stapler.

HCC, quality and volume of the remaining liver parenchyma, and the scheduled resection plan.

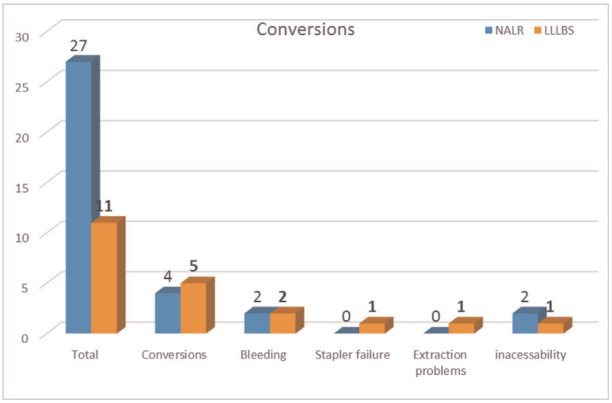
The demographic and operative data of the nonanatomical laparoscopic liver resection (NALLR)

Figure 2



Types of resections in both groups

Figure 3



Comparison of both groups for operative complications and conversions

Table 1 The operative and clinical characteristics of patients

	NALLR	LLLBS
No (%)	27 (71%)	11 (29%)
Age	53.2±4.5	52.5±3.5
Male	22 (81.48%)	9 (81.8%)
Female	5 (18.52%)	2 (18.2%)
Tumour size (cm)	3.1±2.4	5.6±2.1 cm
Operative time (min)*	120±20	160±40
Blood loss (ml)*	75±50	150±75
Blood transfusion (unit)	<1	2
Hospital stay (days)*	4±1	6±2

LLLBS, laparoscopic left lateral bisegmentectomy; NALLR, nonanatomical laparoscopic liver resection. *Statistically significant results.

versus LLLBS is demonstrated in Table 1. There was a statistically significant difference as regards operative time, blood loss and hospital stay.

Conversion to open technique was resorted to in five patients in group of LLLBS due to intraoperative bleeding in three patients, one of them due to stapler failure, fourth conversion was due to extraction difficulty because of a large left lateral segment size and the fifth conversion in this group was due to difficulty in the access of the superior part because of the large size of the tumour. On the other hand, four patients were converted into open resection in the NALLR group (Fig. 3). The causes of these conversions were operative bleeding with the failure of laparoscopic control in two patients and the difficulty of accessibility of the mass in segment VII in another two cases. However, most of these conversions occurred at the beginning of our experience. There was no statistical difference between the two groups. The overall conversion rate was statistically significant between both groups ($P<0.05$).

Postoperative outcome

The median hospital stay was comparable for both groups (Table 1), ranging from 3 to 10 days. Two patients in each group developed postoperative complications with an overall complication rate of 10.52%. In the LLLBS group, one patient developed significant ascites and the other had bile leak that was originating from the left duct stump and was treated by ERCP and stent. In the NALR group, two patients developed significant ascites postoperatively; those patients had operative bleeding and conversion. Another patient developed gastric fistula because of an overlooked iatrogenic radiofrequency injury. This was followed by peritonitis, sepsis and liver failure. There were no biliary complications in this group.

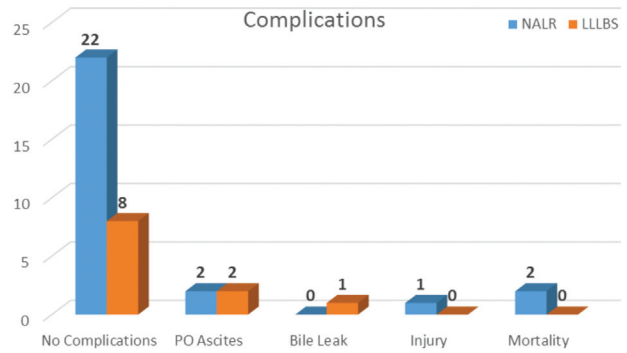
No patients died in the LLLBS group. However, two patients died in the NALLR group (Fig. 4). The first mortality was due to liver failure complicating the intraoperative bleeding and conversion, whereas the second had a gastric injury and uncontrolled septicaemia. The overall operative mortality rate was 5.26%. The 6-month tumour-free survival was 94.7%.

Discussion

Laparoscopic surgery has gained global acceptance over the past 20 years. The advantages of laparoscopic surgery in terms of surgical stress, abdominal wall trauma, respiratory complications, hospital stay, immunologic status and overall surgical-act-related morbidity [7] have been studied and demonstrated [1].

Laparoscopic minor liver resections are considered to be safe and reproducible techniques that were even superior to the open approach in recent meta-analyses gathering the results of retrospective comparisons [2–4]. A common

Figure 4



Post-operative complications in both groups. LLLBS, laparoscopic left lateral bisegmentectomy; NALLR, nonanatomical laparoscopic liver resection

indication for LLR is a solitary liver metastasis from colorectal cancer, but it may also be used for HCC and for benign liver tumours or cysts [8].

The evolution of our experience in laparoscopic resection occurred over 7 years. However, the evolution of LLLBS occurred over a 3-year period, and most of the conversion occurred in our early experience aiming for more patient safety. One study of 55 patients reported that there was no difference in the overall patient survival rate or disease-free survival rate between LLR and open resection. In five studies [2–5,8] that compared LLR with open resection in patients with malignant tumours, there were no statistically significant differences in the extent of the resection margins. Four of six nonrandomized comparative studies reported that the postoperative hospital stay was significantly shorter after LLR (mean stay: 4–15 days) than after open liver resection (mean stay: 8–22 days) [2–5,8]. All of the studies reported the rate of conversion to laparotomy, which ranged from 0% (0/30) to 15% (2/13). In LLR, blood transfusion was necessary during in 0–13% of patients. Postoperative complications included chest infection in 15% (2/13), liver failure in 8% (1/13), ascites in 8% (1/13), atelectasis of the left lower pulmonary lobe in 8% (1/13) and biliary leak in 5% (1/21) of patients. The potential adverse effects included death due to uncontrollable haemorrhage, bile leakage, gas embolism, deep-vein thrombosis and infection [9].

From the beginning of our experience, any incident that might compromise patient safety led to prompt conversion to open technique. Accordingly, there was urgent conversion of nine patients to an open approach. The complexity of the procedure may partially explain the high conversion rate in the LLLBS group, giving first priority to the issue of the patient's safety.

Finally, according to the learning curve exhibited by our team, we believe that preliminary experience, especially in the last five cases, may also improve these results with improvement of learning curves. However, there are adequate data that analyzed laparoscopic versus open left lateral sectionectomies for other indications and showed the superiority of the laparoscopic approach in terms of blood loss, postoperative pain, hospital stay and cost, with no significant difference in overall morbidity [8–12].

Conclusion

With development of experience in hepatic and laparoscopic surgery, the laparoscopic approach for liver resection is safe and feasible for selected patients with HCC in compensated liver cirrhosis.

Acknowledgements

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Nil.

Conflicts of interest

There are no conflicts of interest.

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