

Laparoscopic hepatic resection for completely exophytic hepatocellular carcinoma on cirrhosis

GIULIO BELLÌ, CORRADO FANTINI, ALBERTO D'AGOSTINO, ANDREA BELLÌ, and SERENA LANGELLA

Department of General and Hepato-Pancreato-Biliary Surgery, S.M. Loreto Nuovo Hospital, Via A. Vespucci, 80142 Naples, Italy

Abstract

Laparoscopic surgery is a relatively new option for the treatment of hepatocellular carcinoma (HCC) on cirrhosis. To date, there have been only a few reports of this option for this pathology in the literature, probably because of the intraoperative difficulties related to the treatment of this pathology (even at laparotomy) and because of the problems related to the minimally invasive approach (technical difficulties, complicated management of the bleeding, lack of dedicated tools, and fear of gas embolism). In this article we report four patients from our whole series (23 laparoscopic liver resections for HCC) who underwent a laparoscopic resection for completely exophytic HCC on cirrhosis, located in segment IV in two patients, and in segment III and segment V respectively, in the other two. The mean operative time was 116 min (range, 90–150 min). The Pringle maneuver was never performed. No blood transfusions were needed. No postoperative complications occurred, neither ascites, nor jaundice, nor encephalopathy. Postoperative liver function returned to the preoperative level within 3 days. Food intake started on postoperative day 2. The patients were discharged on postoperative days 5 (one patient), 6 (two patients), and 7 (one patient) after uncomplicated courses. In our opinion, limited laparoscopic liver resections could be considered, at present, to be the best option for the treatment of extremely rare protruding HCC on cirrhosis. We believe that a minimally invasive approach can minimize the postoperative morbidity rate, which is still too high in this group of patients. Our experience confirmed that nonanatomical limited resections or anatomical left lateral segmentectomies for HCC on cirrhosis are feasible and safe in the hands of surgeons trained in both open liver surgery and advanced laparoscopic surgery.

Key words Exophytic HCC · Cirrhosis · Pringle maneuver · Laparoscopic liver resection

Introduction

Laparoscopic surgery is a relatively new option for the treatment of hepatocellular carcinoma (HCC) on cirrhosis. To date there have been only a few reports of this option for this pathology in the literature,^{1–9} probably because of the intraoperative difficulties related to the treatment of this pathology (even at laparotomy) and because of the problems related to the minimally invasive approach (technical difficulties, complicated management of the bleeding, lack of dedicated tools, and fear of gas embolism).^{10,11} Nevertheless, we believe that the advantages of a laparoscopic approach are important, especially in cirrhotic patients.^{2,7,9,12}

In this article we report four patients from our whole series (23 laparoscopic liver resections for HCC)¹² who underwent a resection for completely exophytic liver mass. The tumor localizations (segments III, IV, and V) and their peculiar growth pattern, completely protruding from the liver surface (exophytic), induced us, also in accordance with the lack of feasibility of a percutaneous ablation approach, to perform a laparoscopic liver resection.

Patients and methods

Between May 2000 and December 2004, 59 laparoscopic procedures for benign and malignant hepatic diseases were performed at the Department of General and Hepato-Pancreato-Biliary Surgery, S.M. Loreto Nuovo Hospital, Naples, Italy, of which 38 (64.4%) were for HCC in cirrhotic patients. In this group, four patients were affected by a completely protruding tumor. All the patients were hepatitis C virus (HCV)-positive and affected by well-compensated (Child-Pugh class A) liver cirrhosis. They were referred to our department for HCC with a protruding growth pattern discovered during their usual follow-up. Preop-

Offprint requests to: G. Belli

Via Cimarosa 2/A, 80127, Naples, Italy

Received: October 15, 2004 / Accepted: May 31, 2005

Table 1. Characteristics of patients

Patient no.	Age	Sex	Size (cm)	Site	Cirrhosis	HCV	Esophageal varices (grade)	Surgical technique	Operative time (min)	Blood transfusion	Hospital stay (days)	ASA
1	65	F	2	IV	Yes	Yes	F1	Non-anatom	105	No	5	II
2	63	M	3.2	III	Yes	Yes	F1	Non-anatom	120	No	6	I
3	63	F	2.2	IV	Yes	Yes	F1	Non-anatom	150	No	7	II
4	66	M	3.7	V	Yes	Yes	F1	Non-anatom	90	No	6	I

**Fig. 1.** Protruding hepatocellular carcinoma (HCC) in segment IV

erative diagnosis of HCC was completed with accurate biochemical and radiological investigations, including the level of α -fetoprotein and full imaging evaluation (abdominal ultrasound [US], angio-computed tomography (CT) scan, and angio magnetic resonance imaging [MRI]). The clinical data and the types of resection in the four patients are shown in Table 1.

Case 1

The first patient was a 65-year-old woman with no previous abdominal surgery, presenting with a 2-cm protruding tumor located in segment IV (Fig. 1). She was HCV-positive and affected by well-compensated liver cirrhosis classified as Child-Pugh class A. We studied accurately the most important biochemical data, including INR,^{1,8}; albumin, 3.7 mg/dl; bilirubin, 1.7 mg/dl; and α -fetoprotein, 3.0 ng/dl. We also performed esophago-gastro-duodenoscopy (EGDS) to evaluate esophageal varices (grade, F1), and we carried out a helical-CT scan and angio-MRI (Fig. 2) to characterize the mass and its exact localization. Pulmonary function was checked by

**Fig. 2.** Angio-magnetic resonance imaging (MRI) shows exophytic HCC in segment IV

spirometry. The patient was staged as American Society of Anesthesiologists (ASA) II, according to the ASA classification. A wedge resection of segment IV was performed (Fig. 3). The margin was tumor-free (>1 cm). The operative time was 105 min. The blood loss was 250 ml. No intraoperative or perioperative blood transfusion was done. Food intake started on the second postoperative day. She was discharged home, after an uncomplicated course, on postoperative day 5.

Case 2

This patient was a 63-year-old man presenting with a 3.2-cm protruding lesion located in segment III (Fig. 4). He was HCV-positive and affected by well-compensated liver cirrhosis (Child-Pugh class A). We studied the neoplasm with Doppler US examination and through helical-CT evaluation (Fig. 5). The results of blood examinations were: INR, 1.7; albumin, 3.5 mg/dl; bilirubin, 1.7 mg/dl; and α -fetoprotein, 2.5 ng/dl. We also performed EGDS (esophageal varices, grade F1) and spirometry for evaluating pulmonary function. This patient was staged as ASA I according to the ASA

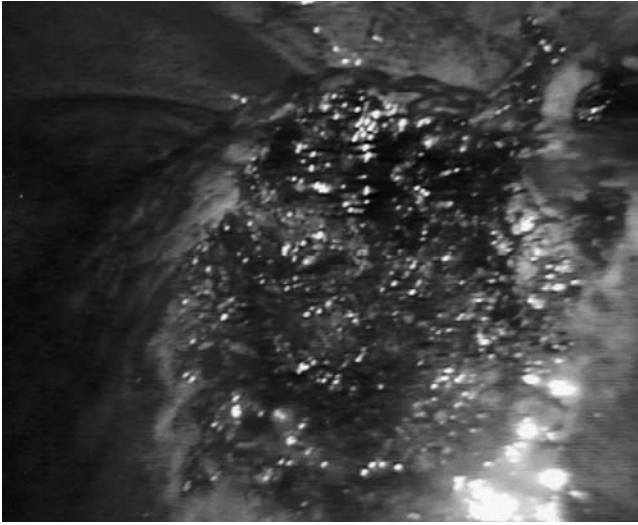


Fig. 3. Wedge resection of segment IV

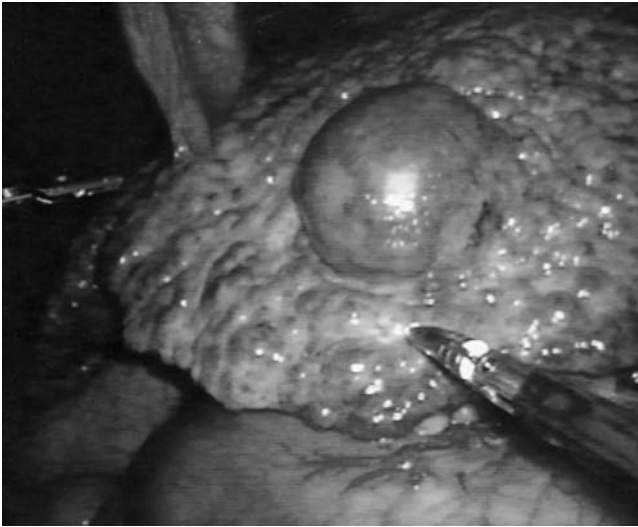


Fig. 4. Protruding HCC in segment III

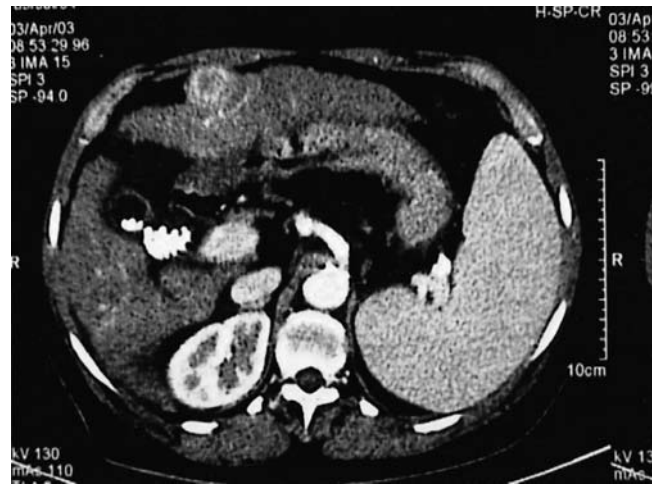


Fig. 5. Helical computed tomography (CT) of exophytic HCC in segment III

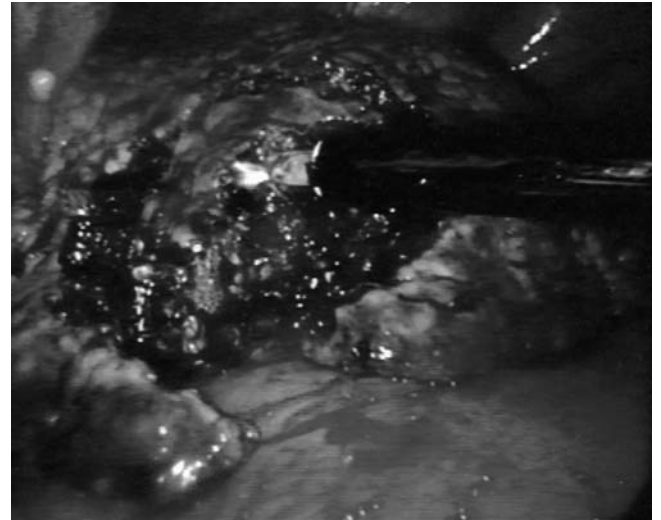


Fig. 6. Nonanatomical resection of segment III

classification. He underwent a laparoscopic non-anatomical resection of segment III (Fig. 6), without clamping of the hepatic pedicle. The surgical margin was more than 1 cm. The operative time was 120 min. No blood transfusions were necessary. Food intake started on the second postoperative day. He was discharged home on postoperative day 6, after an uncomplicated course.

Case 3

This patient was a 63-year-old woman who was HCV-positive and had severe but well-compensated liver cirrhosis (Child-Pugh class A). A control US showed a

2-cm tumor located in segment IV and protruding from inside the umbilical fissure. The biochemical data were: INR 1.2; albumin 3.5 mg/dl; bilirubin, 2.2 mg/dl; α -fetoprotein, 64.1 ng/dl; aspartate aminotransferase (AST), 171 U.I. and alanine aminotransferase (ALT), 147 U.I. EGDS provided evidence of initial esophageal varices (grade F1), while spirometry showed obstructive respiratory syndrome. A helical-CT scan was performed (Fig. 7) and contrast-enhanced harmonic sonography confirmed a 22-mm-diameter HCC in segment IV. The patient was staged as ASA II. A wedge resection of segment IV was performed. The surgical margin was more than 1 cm. The operative time was 150 min. No blood transfusions were necessary. Food



Fig. 7. Helical-CT of HCC in segment IV protruding from inside the umbilical fissure

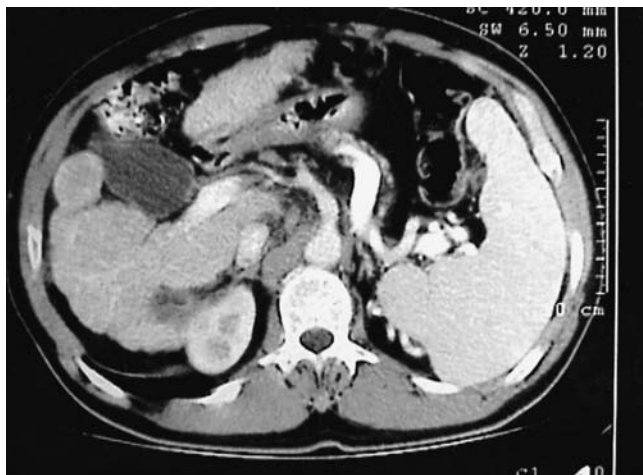


Fig. 8. Helical-CT of protruding HCC in segment V, close to the gallbladder fundus

intake started on the second postoperative day. She was discharged home on postoperative day 7, after an uncomplicated course.

Case 4

The last patient was a 66-year-old man presenting with a 3.7-cm HCC protruding from the liver surface in segment V, close to the gallbladder fundus. He was affected by compensated liver cirrhosis (classified as Child-Pugh class A), which was HCV- and hepatitis B surface antigen (HBsAg)-related. Results of his blood examinations were: INR, 1.5; albumin, 3.7 mg/dl; bilirubin, 2.1 mg/dl; and α -fetoprotein, 10.3 ng/dl. We performed EGDS to evaluate esophageal varices (grade,

F1), and we carried out US and helical-CT (Fig. 8) to study the tumor relationships to the major vascular and biliary structures. The spirometry result was normal. The patient was staged as ASA I. A wedge resection of segment V was performed. The margin was tumor-free (>1 cm). The procedure lasted 90 min. No blood transfusion was done. Food intake started on the second postoperative day. He was discharged home, after an uncomplicated course, on postoperative day 6.

Operative technique

The patients were in the “French” position, with the primary surgeon positioned between the legs with one assistant on each side. In all cases we used a Lloyd-Davis position. With an open technique (in order to preserve the umbilical vein), continuous CO₂ pneumoperitoneum was realized at a pressure lower than 12 mm Hg to prevent the risk of gas embolism. We used, as usual, a four-trocar configuration. A 12-mm port at the umbilicus housed the 30° videocamera. The other three trocars were positioned along a semicircular line, with the concavity facing the right subcostal margin, and they each also carried a 5- to 12-mm port to allow easier change of the instruments, to give the opportunity to use a harmonic scalpel with both the right and left hands and to facilitate the introduction of endo-staplers. A standard diagnostic and staging laparoscopy was performed, and the liver was examined using laparoscopic US (Aloka, Tokyo, Japan) to confirm the extension of the tumors and their relationships to the vasculature. Neither mobilization of the liver nor round-ligament transection was performed. In this way it was possible to preserve the umbilical vein, an important avenue of collateral blood flow in cirrhotic patients. The falciform ligament was sectioned to allow more comfortable management of the laparoscope and of the instruments. Once the type of resection had been decided upon, the porta hepatis was surrounded by a tape that was passed through a 16-F rubber catheter for use as a tourniquet to enable rapid and nontraumatic clamping of the pedicle, if necessary. This precaution it was only preventive; the Pringle maneuver was never performed. The area to be resected was marked by electrocautery. The hepatic resection was performed with a no-touch technique, and the parenchyma was transected using a harmonic scalpel (Ultracision; Ethicon Endosurgery, Cincinnati, OH, USA). The resected specimen was placed in a plastic bag and externalized through the enlarged periumbilical incision. An argon beam coagulator (Conmed System 7500; Conmed, Utica, NY, USA) was applied to the resection surface for ensuring hemostasis, and a fibrin glue (Tissucol; Baxter, Vienna, Austria) was spread on the parenchymal transection line for controlling biliostasis.

Results

The mean operative time was 116 min (range, 90–150 min). No complications occurred during the operations. The blood losses were more than acceptable (less than 300 ml) and no intraoperative or perioperative blood transfusions were necessary.

Food intake always started on the second postoperative day, and liver laboratory findings returned to preoperative levels within 3 days of the operations.

The patients were discharged home after uncomplicated courses and with evident satisfaction on postoperative days 5 (case 1), 6 (cases 2 and 4), and 7 (case 3).

In all the patients the surgical margins were tumor-free (>1 cm).

Until now no intrahepatic recurrences or port-site metastases have been observed.

Discussion

During the past two decades, progress in preoperative patient assessment, refinement of the indications for resection, improved surgical techniques, and the development of new surgical devices have greatly enhanced the safety of open hepatectomy in general, and even in cirrhotic patients.^{3,13–16}

The choice of treatment for hepatocellular carcinoma (HCC) is still controversial and debated. Recently, with the wide range of possibilities offered by the multimodal approach to this malignancy, the choice of surgery has received added value by the standardization of the technique,¹³ and this choice seems to have received great impulse by the new minimally invasive approaches.

However, laparoscopic liver resection has not yet gained wide acceptance among hepatic surgeons, mainly because of the difficulties encountered in dealing with possible intraoperative bleeding and with presumed technical difficulties.^{10,11}

Laparoscopic liver surgery is still a developing field; cases reported in the literature regarding benign and malignant liver lesions are still few,^{1,4,5,17,18} and the number decreases if we consider HCC developed in a previous condition of liver cirrhosis,^{5,9,12,17,19} which has been considered, until recently, a contraindication.^{4,20,21}

The advent of technological refinements in new laparoscopic instruments, experience in laparoscopic and hepatic surgery, and the application of the principles of oncologic surgery have led some groups, including ours, to expand the role of laparoscopic liver resections, with the aim of decreased postoperative pain and shortened recovery time compared with open hepatectomy, even though, until now, scientific evidence of its benefits over those of the traditional open technique has not been well shown.

Since May 2000 at our department, 23 patients have undergone laparoscopic resection for HCC on cirrhosis.¹² In this article, we describe the four patients in this series who received a liver resection for a completely exophytic liver neoplasm. This kind of HCC, with a completely protruding growth pattern (not subcapsular), is rare in the west, and is more frequently reported in Asia. We focused our attention on this group of patients because, in our opinion, they are the ones who can receive more advantages from the use of a laparoscopic approach, mostly because they are not suitable for any percutaneous ablation therapy.

However, to our knowledge, this is the first report concerning laparoscopic treatment for exophytic HCCs; this series, although small, allows us to mention some considerations.

According to our opinions, limited laparoscopic liver resections are feasible, safe and, above all, useful, even for malignancies, in selected patients with well-compensated cirrhosis.^{1,5,9,12,17,19–21} The laparoscopic approach, in fact, can minimize some intra- and postoperative complications, such as excessive bleeding and the decompensation of cirrhosis with the consequent development of jaundice, intractable ascites, and encephalopathy.^{9,12,19} Furthermore, preservation of the abdominal wall reduces the risk of parietal hernias, avoids the exposure of abdominal viscera and, most important, through the lesser destruction of wall porto-systemic shunts, may reduce the increase of portal hypertension and consequent postoperative bleeding and ascites.² Also, the intraoperative bleeding is better controlled than during an open procedure by the hemostatic effect determined by the CO₂ pneumoperitoneum.

As previously implied, we strongly suggest avoiding liver mobilization or performing any dissection of the round, falciform, and triangular ligaments, in order to preserve the increased lymphatic flow present in these structures in cirrhotic patients. Avoiding these procedures can result in improving the absorption of ascites and can minimize the need for fluid infusion.^{2,9,19}

Even the Pringle maneuver, according to our experience, must be avoided, as it can be dangerous in patients with severe portal hypertension.

In addition, in support of laparoscopy, the metabolic and immune responses to laparoscopy seem to result in a diminished stress response, with a beneficial effect on infections and tumor growth.²² The theoretical advantages mentioned before have been confirmed by the results obtained in our four patients and have induced us to propose the laparoscopic approach as a valid alternative to the conventional and standardized open liver resection, particularly in patients suffering with protruding HCC on cirrhosis.

In any event, we want to emphasize that the laparoscopic approach needs very careful attention to

the patients' inclusion criteria. In our opinion, and in accordance with other authors,^{3,5-9,21} laparoscopic resections should be performed only in patients with well-compensated cirrhosis (Child A or B < 3), having lesions of 5 cm or less, located in the left or peripheral right segments (segments II–VI of Couinaud's classification). Large tumors (deeply sited or located in the superior and posterior segments) and lesions close to the portal bifurcation or close to the suprahepatic junction should not be considered for laparoscopic resection, especially in cirrhotic patients.^{19,21} In addition, in regard to the technical aspects, all the oncologic rules should be applied as in open liver surgery ("no-touch technique", R₀ radical resection, and tumor-free resection margin).²¹

In conclusion, considering the above-mentioned inclusion criteria, we think that, in the hands of surgeons expert in both open liver surgery and advanced endoscopic liver surgery, laparoscopic liver resections, even in cirrhotic patients, are feasible and safe; this approach could be considered the gold-standard therapeutic choice for exophytic tumors of segments II–VI of the liver.

References

- Samama G, Chiche L, Brefort JL, Le Roux Y. Laparoscopic anatomical hepatic resection. Report of four left lobectomies for solid tumors. *Surg Endosc* 1998;12:76–78.
- Huscher CGS, Napolitano C, Chiodini S, Recher A, Buffa PF, Lirici MM. Hepatic resections through the laparoscopic approach. *Ann Ital Chir* 1997;6:791–797.
- Kaneko H, Takagi S, Shiba T. Laparoscopic partial hepatectomy and left lateral segmentectomy: technique and results of a clinical series. *Surgery* 1996;120:468–475.
- Marks J, Mouiel J, Katkhouda N, Gugenheim J, Fabiani P. Laparoscopic liver surgery. A report on 28 patients. *Surg Endosc* 1998;12:331–334.
- Cherqui D, Husson E, Hammoud R, Malassagne B, Stephan F, Bensaid S, et al. Laparoscopic liver resections: a feasibility study in 30 patients. *Ann Surg* 2000;232:753–762.
- Rau HG. Laparoscopic liver resections compared with conventional partial hepatectomy. A prospective analysis. *Hepato-gastroenterology* 1998;45:2333–2338.
- Lesurtel M, Cherqui D, Laurent A, Tayar C, Fagniez PL. Laparoscopic versus open left lateral hepatic lobectomy: a case-control study. *J Am Coll Surg* 2003;196:236–242.
- Morino M, Morra I, Rosso E, Miglietta C, Garrone C. Laparoscopic vs open hepatic resection. A comparative study. *Surg Endosc* 2003;17:1914–1918.
- Laurent A, Cherqui D, Lesurtel M, Brunetti F, Tayar C, Fagniez PL. Laparoscopic liver resection for subcapsular hepatocellular carcinoma complicating chronic liver disease. *Arch Surg* 2003;138:763–769.
- Cherqui D. Laparoscopic liver resection. *Br J Surg* 2003;90:644–646.
- Belli G. Laparoscopic liver surgery. (guest editorial). *HPB* 2004;6:195–196.
- Belli G, Fantini C, D'Agostino A, Belli A, Russolillo N. Laparoscopic liver resections for hepatocellular carcinoma (HCC) in cirrhotic patients. *HPB* 2004;6:236–246.
- Grazi G, Ercolani G, Pierangeli F, Del Gaudio M, Cescon M, Cavallari A, et al. Improved results of liver resection for hepatocellular carcinoma on cirrhosis give the procedure added value. *Ann Surg* 2001;234:71–78.
- Belli G, D'Agostino A, Ciciliano F, Fantini C, Russolillo N, Belli A. Liver resection for hepatic metastases: a 15-year experience. *J Hepatobiliary Pancreat Surg* 2002;9:607–613.
- Belli G, Romano G, Iannelli A, D'Agostino A, Marano I. Hepatic resection and percutaneous alcohol injection for the treatment of selected patients with more than one hepatocellular carcinoma. *Eur J Surg* 1999;165:647–651.
- Belli G, Ciciliano F, Iannelli A, D'Agostino A, Marano I. Eighty-four consecutive hepatic resections for hepatocellular carcinoma (H.C.C.). *HPB* 2000;2:228–229.
- Descottes B, Lachachi F, Sodji M, Valleix D, Durand-Fortanier S, Pech de Laclause B, et al. Early experience with laparoscopic approach for solid liver tumors: initial 16 cases. *Ann Surg* 2000;232:641–645.
- Mouiel J, Katkhouda N, Gugenheim J, Fabiani P. Laparoscopic surgery for hepatobiliary pancreatic disease: possibilities of laparoscopic liver resection. *J Hepatobiliary Pancreat Surg* 2000;7:1–8.
- Abdel-Atty MY, Farges O, Jagot P, Belghiti J. Laparoscopy extends the indications for liver resection in patients with cirrhosis. *Br J Surg* 1999;86:1397–1400.
- Ker CG, Chen HY, Juan CC, Chang WS, Tsai CY, Lo HW, et al. Laparoscopic subsegmentectomy for hepatocellular carcinoma with cirrhosis. *Hepato gastroenterology* 2000;47:1260–1263.
- Gigot JF, Glineur D, Azagra JS, Goergen M, Ceuterick M, Morino M, et al. Laparoscopic liver resection for malignant liver tumors. Preliminary results of a multicenter European study. *Ann Surg* 2002;236:90–97.
- Burpee SE, Kurian M, Murakame Y, Benevides S, Gagner M. The metabolic and immune response to laparoscopic vs open liver resection. *Surg Endosc* 2002;16:899–904.