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Laparoscopic liver resections in normal and cirrhotic livers: A retrospective analysis in a tertiary hepato-biliary unit

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ABSTRACT

Background: Liver surgery in patients with underlying liver disease results in higher mortality and morbidity rates compared to patients without underlying liver disease. Laparoscopy seems to have good results in patients with normal liver in terms of postoperative outcomes, but is more challenging in cirrhotic patients.

Aim of this study was to evaluate the feasibility of laparoscopic liver resection both in normal and cirrhotic livers, and secondary endpoint was to compare the surgical results.

Methods: We retrospectively evaluated 105 patients who underwent laparoscopic liver resection between November 2001 and January 2012. Candidates for laparoscopic liver resection were divided into two groups according to the presence or absence of an underlying liver disease.

Results: 105 patients (52.4% males, median age 56.1 years) were enrolled, and 37.1% had liver cirrhosis. Hepatocellular carcinoma in hepatitis C virus-related cirrhosis (89.7%) and liver metastases (57.6%) were the main indications for surgery in patients with cirrhosis and non-cirrhotic livers, respectively. None of the patients died post-operatively. Cirrhotic patients had greater blood loss (100 vs 50 ml; $p < 0.012$) and longer hospital stays (6 vs 4 days; $p < 0.031$) compared to non-cirrhotics.

Conclusions: Laparoscopic liver resections are safe and feasible procedures in both patients with cirrhotic and non-cirrhotic livers.

1. Introduction

The use of minimally invasive surgical approach is growing worldwide, and the interest in laparoscopic liver resections is progressively rising, despite the initial period of scepticism. This approach is used by teams involved in surgical oncology, hepato-biliary surgery, and liver transplantation [1]. Initially, laparoscopic liver resections were limited to small wedge resections or minor hepatectomies for lesions located in the anterior segments [2]. The development of new and better performing laparoscopic instruments, together with the improvements in anaesthesiology, and the increased experience of hepatobiliary surgeons has allowed extending the use of laparoscopy also to major hepatectomies and difficult resections. There are reports of laparoscopic liver resections performed in series of normal and cirrhotic livers [2–4]; however, a comparison between these two groups has not been made.

Liver resections in normal livers are mainly considered for the treatment of liver metastases and benign diseases. In patients with an underlying liver disease (ULD), conventional open liver surgery results in higher mortality and morbidity rates compared to patients without ULD [5–7]. The main indication in the former group of patients is hepatocellular carcinoma (HCC). The purpose of this study was to evaluate the feasibility of the laparoscopic approach and to compare the results of liver resections between patients with and without ULD.

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2. Materials and methods

Among the 949 liver resections performed between November 2001 and January 2012 at our General Surgery and Liver Transplantation Unit, 105 patients had a laparoscopic liver resection and were retrospectively analyzed.

All patients treated laparoscopically were divided into two groups according to the status of their liver parenchyma: with and without ULD. The ULD group had laparoscopically observed macroscopic cirrhosis and histologically confirmed F4 or F3 fibrosis [8].

The non-ULD group included patients with either normal liver parenchyma or who had received prior systemic chemotherapy without sinusoidal dilatation, with no significant fibrosis, and no previous history of hepatic injury.

The primary aim of this study was to evaluate whether laparoscopic liver resection was feasible both in the ULD and non-ULD groups, while the secondary end-point was to compare the surgical results (i.e. blood loss, operating time, hospital stay, etc.) between the two groups.

The patients' selection criteria and surgical indications were not modified by the choice of a laparoscopic approach instead of a conventional one. The treatment plan was discussed by a multidisciplinary team including: surgeons, hepatologists, oncologists, radiologists, pathologists, and anaesthesiologists.

All patients underwent preoperative radiological evaluation, laboratory tests, anaesthesiological evaluation, and Positron Emission Tomography only in selected cases.

Patients with benign lesions were considered for surgery mainly when a risk of haemorrhage or an increase in size was noted at computed tomography (CT) and magnetic resonance imaging (MRI). In such cases, liver resections were performed due to a small but significant suspicion of malignancy. Ablative techniques (i.e. Radio Frequency Ablation, RFA, and Percutaneous Ethanol Injection, PEI) were considered but not utilized in this series.

The inclusion criteria for patients with ULD were: compensated cirrhosis, oesophageal varices < grade 1 and platelets count > 80×10^3/L, small tumours with no major vascular invasion, and an American Society of Anesthesiologists Score (ASA) < 3 [4]. All patients were informed of the innovative nature of the procedure and provided written consent. All surgeons were experienced in hepatobiliary and advanced laparoscopic surgery (GME, RS, GV, PL).

Results were compared between the two groups defined according to the ULD/non-ULD classification.

Intraoperative complications and postoperative course were assessed and the following data were collected. Patients' baseline characteristics: age, gender, ULD, Child-Pugh score and MELD score for patients in the ULD group, previous surgery, and indications for surgery. Operative features: patients' position on the operating table, number of incisions for trocars positioning, and specimen extraction incision. Surgical results: type of resections, operative time, blood loss (volume of blood collected by the suction apparatus and the ultrasonic dissector), intra-operative transfusions, nodule size, tumour-free margin, and conversion rate. Post-operative complications: evaluated according to the Common Terminology Criteria for Adverse Events [9]. Hospital stay.

Details of extra-hepatic procedures in patients who received an associated laparoscopic extra-hepatic procedure (colorectal resection $n = 5$ and adrenalectomy $n = 2$) were not included in our analysis.

2.1. Statistical analysis

Descriptive statistics are reported as proportions for categorical data or median and interquartile ranges (IQR) for continuous variables. The chi-square test (or Fisher's exact test where applicable) or the Mann Whitney non-parametric test were used to compare groups respectively for categorical or continuous variables, and to test their association. The chi-square test for trend was used to assess the association between ULD or non-ULD and year of intervention (categorized in three periods: 2002–2008, 2009–2010, and 2011–2012). Data management and statistical analyses were performed using the SPSS version 19 statistical package (SPSS Inc., Chicago, USA).

3. Surgical technique

Intraoperative monitoring during general anaesthesia was performed by positioning a central venous catheter and a radial arterial line in major hepatectomies. Central venous pressure was maintained < 5 cm H_2O using early intraoperative fluid restriction. Patients were placed in different positions on the operating table (supine, middle left lateral, or left lateral) according to the tumour location. Umbilical open laparoscopic access was performed in all cases. In cirrhotic patients with patency of the umbilical vein related to portal hypertension, detected with preoperative radiological evaluation, the open laparoscopic access was displaced to avoid umbilical vein injury. Pneumo-peritoneum was maintained below 13 mmHg. A 30° or a 90° optical device was used in all cases (KARL STORZ GmbH & Co., Tuttlingen Postfach, Germany, OLYMPUS Europa Holding GmbH, Hamburg, Germany). Either 3, 4, or 5 trocars were used according to the tumour location. Intraoperative ultrasonography (Aloka Hitachi Medical Systems Europe Holding AG Zug, Switzerland) was performed in all cases. The Pringle manoeuvre, consisting of controlling the hepatic pedicle, was set up in all patients undergoing major hepatectomies. In all other cases, the Pringle manoeuvre was determined by the surgeon's usual procedures. Portal pedicles were identified and extra-parenchymally divided after being controlled by clips or staples in case of major hepatectomies (right or left hepatectomy) or anatomical segmentectomies (left lateral sectionectomy) [10]. The parenchymal transection was performed using either a harmonic scalpel (Ultracision Ethicon Johnson & Johnson, New Brunswick, NJ, USA) or an ultrasonic dissector (Sonosurg USU OLYMPUS Europa Holding GmbH, Hamburg, Germany). Haemostasis and biliostasis were obtained with monopolar electrocautery or harmonic scalpel, except for large intraparenchymal structures and portal pedicles that were secured with absorbable or non-absorbable clips. Hepatic veins were divided using a linear reticulating stapler. At the end of parenchymal transection, the cutting surface was scrutinized for bleeding and sealed, when necessary, with fibrin glue both in ULD and NULD. The resected liver was placed in a plastic bag and extracted from a small incision (5 cm) (periumbelical, suprapubic, or right subcostal). One or two drainages were selectively placed. A 90° optical device was used for a better visualization of the suprahepatic region in major hepatectomies and to achieve Belghiti's liver hanging manoeuvre (BLHM) in right hepatectomies with anterior approach [11].

4. Results

Among the 105 patients who underwent laparoscopic liver resection, 55 (52.4%) were males. Median age at the time of intervention was 56.1 years (IQR: 48.8–66.7 years), and male patients tended to be slightly older than female patients (median age, 57.7 vs 53.6 years, respectively, $p < 0.05$). ULD was present in 39 patients (37.1%) and normal liver parenchyma (non-ULD group) in 66 (62.9%).

Patients' characteristics are outlined in Table 1. Twenty-six patients (24.7%) had a past medical history of abdominal surgery.