Possibilities of laparoscopic liver resection

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Abstract: The aim of this study was to report the results of our experience in liver surgery by laparoscopy. From 1989 to 1996, 30 patients (20 women, 10 men; age, 23–88 years; mean age, 53.9 years) underwent laparoscopic liver surgery at our Institute for the following pathology: 10 for biliary cysts, 7 for polycystic diseases, 8 for benign tumors, 3 for hydatid cysts, 1 for chronic abscess, and 1 for metastasis. The locations of these lesions were: 19 in the left lobe, 4 in the right lobe, and 7 in both lobes. Their average size was 8.45 cm (range, 2.5–22 cm). The largest lesions were biliary cysts; among benign tumors, the maximum diameter was 8 cm. Surgical treatment was as follows: 17 deroofings, 3 pericystectomies, 7 tumorectomies, and 3 left lobectomies. The mean operative time was 79 min (range, 45–527 min). Three of the 30 laparoscopic procedures (10%) were converted to open surgery, because of bleeding in 2 patients with polycystic disease and because it was impossible to carry out the dissection in 1 patient with liver-cell adenoma adjacent to the left portal branch. There were no deaths in this series and 6 patients showed morbidity: 2 patients with polycystic disease developed ascites and required intensive care unit recovery, 1 patient had phlebitis, 1 had infection of the urinary tract, and 2 had local septic complications. Preliminary findings show that the laparoscopic approach to liver lesions may represent safe and effective treatment in selected patients, on condition that several technical details are respected. Of fundamental importance are the surgical equipment, the presence of two experienced operators to do four-hands surgery, and the careful selection of indications, reserving laparoscopic treatment only for those lesions located in easily accessible areas, mainly in the lateral and anterior hepatic segments.

Keywords: liver surgery, laparoscopy, liver cyst, benign tumor of the liver, hydatid cyst

Introduction

Laparoscopic liver surgery represents a highly specific field whose reproducibility and development imply three considerations; it is an advanced surgery requiring hands-on experience in the laboratory and intensive clinical training; it is a highly technological surgery employing sophisticated and expensive equipment, so that only a few specialized centers may be adequately equipped; and it is a specialized surgery for which deep experience in conventional hepatobiliary surgery is required.

Several forms of laparoscopic liver surgery are carried out at different centers, but at present the results of studies at various centers are not evaluable, having been reported just as single experiences and not included in controlled trials and without long-term results. Great caution is thus mandatory in regard to present indications; so, in this article we can only suggest how to evolve from current technical feasibility to reproducibility and critical evaluation of liver laparoscopic surgery, to aid in correct clinical decision-making.

Basic principles

Patient selection

Patients affected by focal lesions of the liver have to undergo careful preoperative evaluation, keeping in mind the usual contraindications to general anesthesia: severe coagulopathies, recent myocardial infarction, unstable hemodynamic impairment, and pregnancy.

Present indications include only young patients in good general condition, without liver failure or clotting disease, affected by liver lesions (cysts, tumors, pseudotumors) that are easily and safely accessible through a laparoscopic approach. The clinical examination must include evaluation of neurologic status, the absence of liver failure signs, the presence and the
features of hepatomegaly, and easy transparietal access; previous abdominal surgery does not represent an absolute contraindication.

Excellent preoperative imaging is required, including ultrasonography, computed tomography, and/or magnetic resonance, and angiography, giving precise information about the location, extension, and pathology of the lesion. At present all experience suggests avoidance of the laparoscopic approach if preoperative assessment demonstrates invasive, deep-seated, or giant lesions, either with a close relationship to the main vascular structures or located in posterior/posterosuperior segments.

Evaluation of liver function is indispensable to exclude liver failure, which is known to have a fundamental prognostic impact in hepatic surgery. Hemostatic tests have to be evaluated in order to prevent a bleeding syndrome caused by impaired hepatic synthesis of factors I (fibrinogen), II (prothrombin), V, VII, IX, and X, whose deficit, on the whole, produces alterations in Quick time. The above-mentioned evaluations are critical because they may reveal the presence of a clinically silent disease, which, if undetected, could give rise to very severe complications. Finally, the patients must give their informed consent that, if some complication arises, conversion of the laparoscopic procedure to open surgery can proceed.

Patient preparation

Nutritional status, electrolyte balance, antibacterial prophylaxis, and personal hygiene must be optimized. In up-to-date conventional liver surgery, the need for transfusion is minimal, but the hemorrhagic risk must be still considered, and blood iso-group erythrocyte concentrates and/or frozen fresh plasma, and/or hemoderivatives (fibrinogen, anti-thrombin III) have to be collected. Two maneuvers should be used during this kind of surgery, which is fundamentally elective: (1) hemodilution, which permits limiting of perioperative blood loss; and (2) planned autologous transfusions, allowing intraoperative erythrocyte and plasma transfusions without viral and immunological risks.

All of these methods require a complete mastery of transfusional technique and constant perioperative follow-up of physiologic and biologic parameters (hemoglobin, hematocrit, and blood gases).

Patient positioning

Surgery is carried out with the patient under general anesthesia with tracheal intubation and follow-up of the physiologic parameters. Capnography is mandatory. The potential risk of a gas embolism requires the installation of an esophageal stethoscope. A nasogastric tube and bladder catheter must be placed.

The patient is placed in dorsal decubitus; the head and thorax are elevated about 20° to expose the stomach and place the intestinal loops down.

The limbs are on supports. The surgeon stands between the limbs, the assistants on both sides, and the instrument nurse on the right; the monitors are placed in front of the surgeon. This positioning gives the surgical staff a direct approach to the operative field.

A broad area of the abdominal wall is sterilized with povidone iodine solution; the operative field must be prepared in the same way as for open surgery, to which it can be converted if necessary.

Instrumentation and equipment

It is particularly important to include a 30° and/or 45° laparoscope among the usual laparoscopic instrumentation, in order to obtain a better lateral view. Also required are a high-tech video camera with a high-power xenon source (Karl Storz, Tutlingen, Germany), access trocars with universal laparoscopic cannulas to avoid time-consuming use of reducers, vascular clamps to occlude either the whole hepatic pedicle or selectively isolated branches, a fenestrated atraumatic grasper to retract various structures, and a curved dissector to separate and skeletonize vascular structures.

An indispensable instrument for exploration is laparoscopic ultrasound with color Doppler with a high-frequency orientable probe (7.5-Mhz), which is placed in direct contact with the tissues, giving high-resolution images (B and K Medical Analogic Company, Sandtopton, Denmark). In our opinion, one of the most important instruments for dissection is the ultrasonic dissector (CUSA: Vallelab, Boulder, CO, USA), which allows, as in open surgery, good exposure of intraparenchymal vascular and biliary structures while the liver parenchyma is fractured. At present, the simultaneous use of an electric coagulator may be possible.

The Nd:YAG laser has been widely used in our institution for the resection of liver metastases, its wavelength allows a deeper hemostatic layer than that achieved with the CO₂ laser or argon beam coagulator; furthermore, in comparison with electro-surgery, it produces less tissue necrosis. On the other hand, it is an expensive device and not as easy to use as the CO₂ laser.

Other instruments are being developed: the water jet dissector, the microwave coagulator, and the cryosurgical unit. Once again, the role of continuous progress in high technology is emphasized, in terms of the multidisciplinarity and the expensive instruments required to perform this specialized kind of surgery.