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Laparoscopic ICG-guided stapled left lateral sectionectomy for HCC on hemochromatosis

Maria Sole Mattei, Elena Belloni, Leonardo Antonio Montemurro, Ernesto Puce, Paolo Ciano, Matteo Di Carlo, Michele Benedetti, Marco Catarci*

Introduction

Liver cancer is globally the fifth most common cancer and the fourth most common cause of cancer-related death.[1] Hepatocellular carcinoma (HCC) accounts for about 90% of liver cancers and is associated with a 10%–15% 5-year overall survival rate, mostly because of a late diagnosis. However, 5-year overall survival rate reaches 50%–70% when the disease is diagnosed at an early stage and patients can be submitted to curative treatments such as ablation, liver resection (LR), and liver transplantation.[2–4]

Hemochromatosis (HH), a hereditary autosomal recessive disorder that occurs in approximately 1 in 200–250 individuals, has been associated with liver cirrhosis (CL) and HCC. Mutations in the gene (HFE) located in the short arm of chromosome 6 lead to excess iron absorption. Excess of iron, in its non-transferrin-bound form, is readily uptaken by cardiomyocytes, pancreatic islet cells, and hepatocytes, leading to cellular injury.[5] The risk for HCC development in patients with HH was estimated to be over 200-fold in several early publications from Brisbane[6] and Dusseldorf[7] based on the evidence that its incidence in these cohorts was approximately 8%–10%.

Surgery remains a mainstay of HCC treatment also in cirrhotic patients. The last decades saw an extension of tumor burden-related indications for LR. Currently, the European Association for Study of the Liver guidelines, recommend LR, in case of a resectable solitary nodule without macrovascular invasion and extrahepatic spread, regardless of its size[8]; the American Association for the Study of Liver Diseases guidelines advocate LR in patients with Child-Pugh A cirrhosis and resectable T1 or T2 HCC (solitary tumor of less than 5 cm with or without vascular invasion or multifocal tumor of less than 5 cm).[9]

The extent of surgery and the volume of the future liver remnant can be estimated by calculating the volumes of the removed and remnant parts, as a fraction of the total liver volume. A remnant liver volume of approximately 25%–30% of the total liver volume in non-cirrhotic patients (40% in case of cirrhosis) is required before any major hepatectomy to minimize the risk of postoperative liver failure.

In this context of liver parenchymal preservation, new technologies have come to help the surgeon.

The use of indocyanine green (ICG) fluorescence is well assessed in hepatobiliary surgery. ICG clearance and retention tests are crucial for determining precise liver function before liver surgery[10] and its use has been recently suggested to highlight primary and secondary hepatic tumors. This is essential to enhance the precision of anatomical guided surgery and to obtain free resection margins, especially during minimally invasive surgery. The ability of ICG fluorescence to identify HCC nodules is affected by the presence of cirrhosis that alters its metabolism and it varies according to tumor depth.[11] Therefore, it is very important to associate fluorescence with a second instrument such as intraoperative ultrasound.

Case report

In this video [online], we present the case of a 76-year-old man, with a 10-year history of cirrhosis on a HH, CHILD score A, and MELD 10. The diagnosis of S2 and S3 liver mass detected during US surveillance prompted admission for surgery. We performed a preoperative enhanced TC scan that confirmed the presence of a 4 cm liver mass, highly suspicious for a HCC located in segments S2 and S3 with the involvement of the left hepatic vein and sparing of the main portal pedicle. ICG (12 mg diluted in 10 mL water) was intravenously administered 6 hours before surgery.

An ICG-guided laparoscopic S2–S3 left lateral sectionectomy was performed. The patient was placed supine with legs apart. The operator was standing between the legs with an assistant both sides. A five trocars approach was used. Exploration of the abdominal cavity confirms a macronodular cirrhotic liver with no ascites and no evidence of peritoneal seedings. The exact location of the tumor is confirmed by ICG near-infrared narrow band imaging and intraoperative ultrasound. Round and falciform ligament are divided using an ultrasonic device and clips in order to control enlarged perihepatic veins. Further dissection

General Surgery Unit, Sandro Pertini Hospital, ASL Roma 2, Italy

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*Corresponding Author: Address: Direttore U.O.C. Chirurgia Generale - Ospedale "Sandro Pertini" – ASL Roma 2, Via dei Monti Tiburtini, 385; 00157 Roma, Italy. E-mail: marco.catarci@aslroma2.it (M. Catarci).

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is aimed at the isolation of the left hepatic vein, but this is hampered by a dense perihepatic fibrosis surrounding the entire left anatomical lobe that does not allow sufficient exposure. This finding is particularly clear when attempting to perform a posterior approach to the inferior vena cava and the hepatic vein confluence. Therefore, direct transparenchymal approach is performed using an ultrasonic device, bipolar forceps, and hemostatic clips to control portal-biliary branches.

Due to the dense liver fibrosis, the portal pedicle to S2 and S3 is controlled by two linear vascular stapling. Once the left anatomic lobe is sufficiently mobilized in order to allow its caudal retraction, the dissection is aimed again to the left hepatic vein, which is controlled and divided by a linear vascular stapler.

A bleeding coming from the confluence of the left subdiaphragmatic vein in the left hepatic vein is controlled by the placement of a 3/0 polipropilene U stich with extracorporeal knotting. Further bleeding control on the raw resection surface is achieved through a thrombin gel matrix and argon beam coagulation. The specimen is inserted in a retrieval bag. The procedure is ended by placement of a hemostatic patch on the resection surface and a Jackson-Pratt drain.

Postoperative course was uneventful, with no blood transfusions. The patient was discharged on postoperative day 5. Final pathology was pT2 G2 HCC with a 1 cm satellite nodule and clear resection margins.

Discussion

Despite an initial period of skepticism,[12] minimally invasive liver surgery has been increasing worldwide, and more difficult operations are being performed laparoscopically. In recent years, indications for laparoscopic liver resection (LLR) have expanded to include malignant tumors and their unfavorable locations like the posterosuperior segments and close to major vessels.[13–16] Laparoscopic surgery in patients with CL is still considered challenging, because of specific complications associated to liver disease, such as portal hypertension, coagulopathy, renal failure, and increased intra-abdominal pressure. However, recent studies have shown that LLR is associated with reduced operative stress and postoperative complications,[17,18] including significantly less intraoperative blood loss, shorter hospital stay, and less postoperative morbidity, without affecting the oncological result.[19] LLR is safe, feasible, and particularly effective for parenchyma-sparing procedures, such as those needed in patients with cirrhosis. Its main advantages are reduced surgical trauma and lower impact on fluid management and patient mobilization.[20,21] The widespread use of laparoscopy in liver surgery favored the use of new technologies to increase parenchyma-sparing surgery and overcome the difficulties of LR in a cirrhotic parenchyma. ICG fluorescence is currently an additional tool to perform fluorescence-guided LRs, that may be particularly helpful to obtain parenchymal resections respecting the anatomic paradigm. Although the use of the minimally invasive approach reduces the perioperative complications rates, these remain high (morbidity 14%–33%; mortality 3%–5%), showing that intraoperative blood loss and transfusion are important predictors of adverse outcomes particularly in cirrhotic patients.[22–24] Among several methods to reduce blood loss and intraoperative blood transfusions, a linear vascular stapler is commonly used for vascular division and due to its safety, simple use, shortening of the surgical duration with similar or improved outcomes compared with traditional suture techniques.[25,26] Vascular staplers have been used in liver surgery for the control of the hepatic veins and glissonian pedicles prior to parenchymal transection, thus reducing perioperative blood loss and minimizing the requirement for blood transfusions. In addition, this decreases the need for portal triad clamping and possible liver ischemic reperfusion injury.[27] A recent international multicenter study on 1,190 laparoscopic left lateral sectionectomies[28] identified three thresholds related to the HCC diameter (40, 70, and 100 mm) significantly related to progressive longer operative time and higher rates of open conversion, blood transfusion(s), major morbidity, and readmission. Accordingly, apart from the fibrous consistency of the liver parenchyma due to HH, the case presented here represents a good indication for the laparoscopic approach in a low volume center.[29] Actually, during the last decades, LLR have been mostly handled and improved by hepatic and laparoscopic surgeons, especially in high-volume centers.[30,31] The next step in the democratization process of laparoscopy is the spread of LLR beyond these centers. Although this dissemination is normal in eastern countries,[29] it is still a matter of debate in western countries, due to a lack of data concerning the development of LLR in low volume centers.[32] Additional research in this field is required to identify patients that could be operated on safely in these centers.

Conclusion

LLR is a safe procedure also in cirrhotic patients. Preoperative evaluation, choosing the appropriate operative approach and surgical techniques to minimize intraoperative bleeding, and reduce the postoperative complications are of paramount importance to improve the outcomes. This objective can be achieved with the help of new technologies: ICG for parenchyma-sparing surgery and the use of vascular staplers for the control of glissonian pedicles.

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