Surg Endosc (2011) 25:3930–3933
DOI 10.1007/s00464-011-1812-0

Intrahepatic Glissonian approach for pure laparoscopic right hemihepatectomy

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Received: 15 February 2011 / Accepted: 2 June 2011 / Published online: 22 June 2011

Abstract
Aim To present a video of laparoscopic right hepatectomy using Glissonian technique. A new strategy for liver transection is presented. Liver is divided in three parts. The posterior part, containing short hepatic veins, is divided with stapler before liver transection. Anterior part is fully divided with harmonic scalpel, and the middle part, containing hepatic veins from segments 5 and 8, is the last part to be transected.
Patient and method A 41-year-old woman with right-sided hepatolithiasis and choledocholithiasis was referred for surgical treatment. Patient was positioned in left lateral position. Four trocars were used. Operation began with division of liver ligaments, right liver mobilization, and exposure of the retrohepatic vena cava. Cholecystectomy was performed, followed by intrahepatic access to the right Glissonian pedicle (containing arterial, portal, and bile duct branches of segments 5–8). Two small incisions were performed around hilar plate according to specific anatomic landmarks. A vascular clamp was introduced into those incisions, resulting in ischemic delineation of right liver. Clamp was replaced by a vascular stapler, and stapler was fired. Liver parenchyma was divided by harmonic scalpel combined with vascular stapler. The specimen was extracted through suprapubic incision. Intraoperative cholangiography confirmed a 2-cm common bile duct stone which was immediately removed by endoscopy (endoscopic retrograde cholangiopancreatography, ERCP). Falciform ligament was sutured to maintain the liver in its original anatomical position, avoiding hepatic vein kinking, and abdominal cavity was drained.
Results Operative time was 180 min, with blood loss estimated at 50 ml, without need for transfusion. Postoperative recovery was uneventfully, and patient was discharged on the fourth postoperative day.
Conclusion Laparoscopic intrahepatic Glissonian approach is feasible and is a useful technique for rapid and safe control of the right liver pedicle, facilitating laparoscopic right hemihepatectomy. The special strategy described may help laparoscopic surgeons to safely perform this challenging procedure.

Keywords Liver · Laparoscopy · Technique · Glissonian · Right hepatectomy

Laparoscopic liver resection is one of the most complex procedures in hepatobiliary surgery. In the last two decades, experience with advanced techniques has increased the indications for laparoscopic liver resection. Comparative studies have suggested that laparoscopy is associated with less bleeding, fewer complications, and better quality of life than open liver surgery [1]. We have recently described a laparoscopic technique for intrahepatic Glissonian approach, which, based on small incisions and following specific anatomical landmarks, allows straightforward control of Glissonian pedicles without hilar dissection for both right and left liver [2, 3]. This video demonstrates technical aspects of a pure laparoscopic right hemihepatectomy using intrahepatic Glissonian technique.

Electronic supplementary material The online version of this article (doi:10.1007/s00464-011-1812-0) contains supplementary material, which is available to authorized users.

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Patient and method

A 41-year-old woman with right-sided hepatolithiasis and choledocholithiasis was referred for surgical treatment. Patient was positioned in the left lateral position with the surgeon standing between patient legs. Four trocars were used. Operation began with division of liver ligaments, right liver mobilization, and exposure of the retrohepatic vena cava. Cholecystectomy was performed, followed by intrahepatic access to the right Glissonian pedicle (containing arterial, portal, and bile duct branches of segments 5–8). Two small incisions were performed around hilar plate, according to specific anatomic landmarks. A laparoscopic vascular clamp was introduced into those incisions, resulting in ischemic delineation of right liver. The insertion of the vascular clamp can sometimes be hazardous, and one should be aware that the clamp should slide smoothly inside the liver parenchyma. If some resistance is felt, the clamp is not at the right place and should be repositioned. The liver tissue around the Glissonian pedicle is often soft and permits easy introduction of the clamp. The clamp should be inserted at a minimum distance from the hilar bifurcation in order not to damage common bile duct.

After ascertaining correct positioning of the vascular clamp, it is replaced by a vascular stapler. At this point it is very important to check that the correct ischemic delineation of the liver is obtained. If so, the stapler is fired. Liver parenchyma was then divided with harmonic scalpel combined with vascular stapler. The specimen was extracted through suprapubic incision. Intraoperative cholangiography confirmed integrity of biliary tree and a 2-cm common bile duct stone, which was immediately removed by endoscopy (ERCP). Falciform ligament was sutured to maintain the liver in its original anatomical position, avoiding hepatic vein kinking, and abdominal cavity was drained.

Results

Operative time was 180 min, with blood loss estimated at 50 ml, without need for transfusion. Postoperative recovery

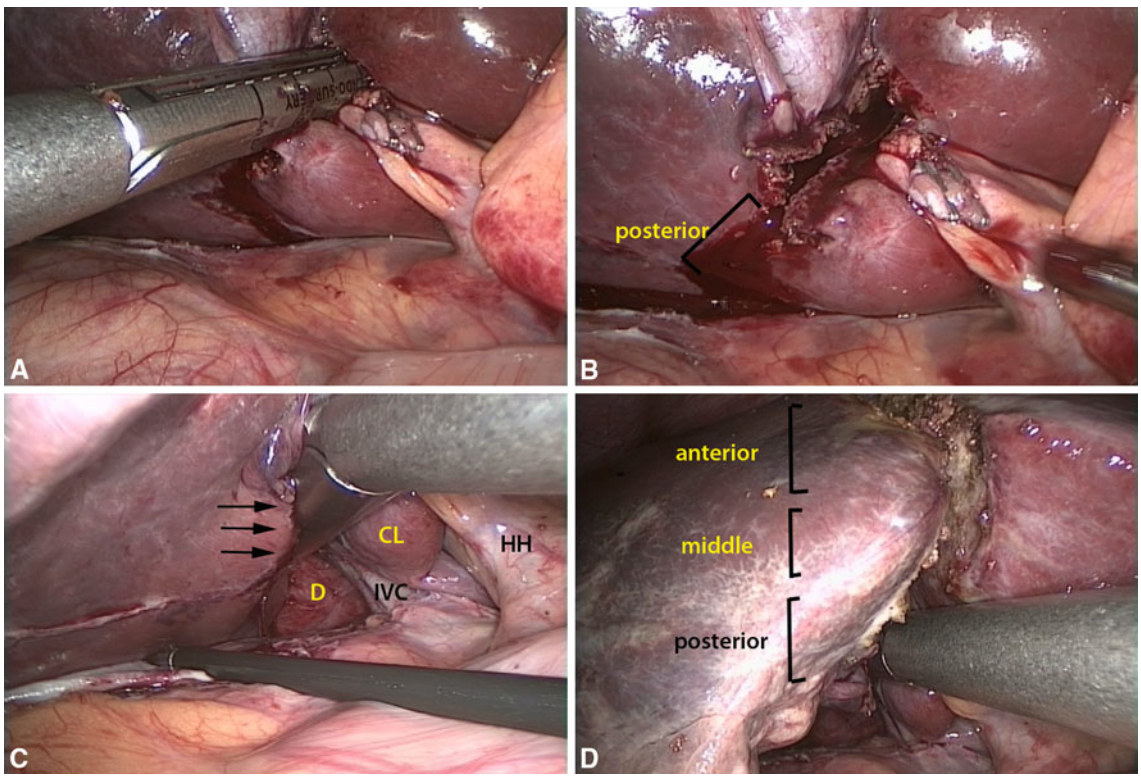

Fig. 1 Surgical strategy during laparoscopic right hepatectomy. **A** Intraoperative view: right Glissonian pedicle is divided with vascular endoscopic stapler. **B** Intraoperative view after division of right pedicle. Posterior portion of the liver is shown. **C** Intraoperative view. Posterior part of the liver, including the right part of the caudate lobe (*CL*) and short hepatic veins (*arrows*) are divided with stapler. The stapler is introduced through the cavity originated by the pedicle stapling, towards the diaphragm (**D**), parallel to the retrohepatic inferior vena cava (*IVC*). Stapler is inserted towards diaphragm (**D**); *HH* hepatic hilum. **D** Intraoperative view. The line of transection can be divided into three different parts: anterior, middle, and posterior. The posterior part contains branches of hepatic veins draining towards retrohepatic inferior vena cava and can be secured with stapler

was uneventfully and patient was discharged on the fourth postoperative day.

Discussion

Several studies have demonstrated that laparoscopic liver resection is safe and feasible, and it has become a routine approach in many centers. Moreover, laparoscopic left lateral sectionectomy (bisegmentectomy 2–3) is now considered a gold standard [4]. Laparoscopic major hepatectomy, especially right hemihepatectomy, remains a challenging procedure in spite of a recent increase in the number of reports.

Laparoscopic right hemihepatectomy needs mobilization of the liver, major vascular dissection, and parenchymal transection, and each step can result in bleeding or intraoperative complications. Based on our previous experience with major laparoscopic resections, to minimize some complications, we changed our strategy. Right liver mobilization is now performed with gentle retraction, and the right hepatic vein is not dissected prior to liver division, except in cases where the tumor makes contact with this structure. Mobilization of the right liver is done until the lateral aspect of the inferior vena cava at the level of the right hepatic vein. Short hepatic veins are no longer divided.

For vascular control, we use our previously published technique of laparoscopic intrahepatic Glissonian approach [2]. Using two small incisions we are able to gain rapid control of the right main Glissonian pedicle, which is divided with endoscopic vascular stapler (Fig. 1A). Immediately after division of the right pedicle, the posterior portion of the liver (Fig. 1B), including the right part of the caudate lobe and short hepatic veins, is divided with stapler. The stapler is introduced through the cavity originated by the pedicle stapling, towards the diaphragm, parallel to the retrohepatic vena cava (Fig. 1C). This simple maneuver avoids bleeding from posterior hepatic veins and allows upward traction of the right lobe, facilitating division of the liver parenchyma. The line of transection can be divided into three different parts: anterior, middle,

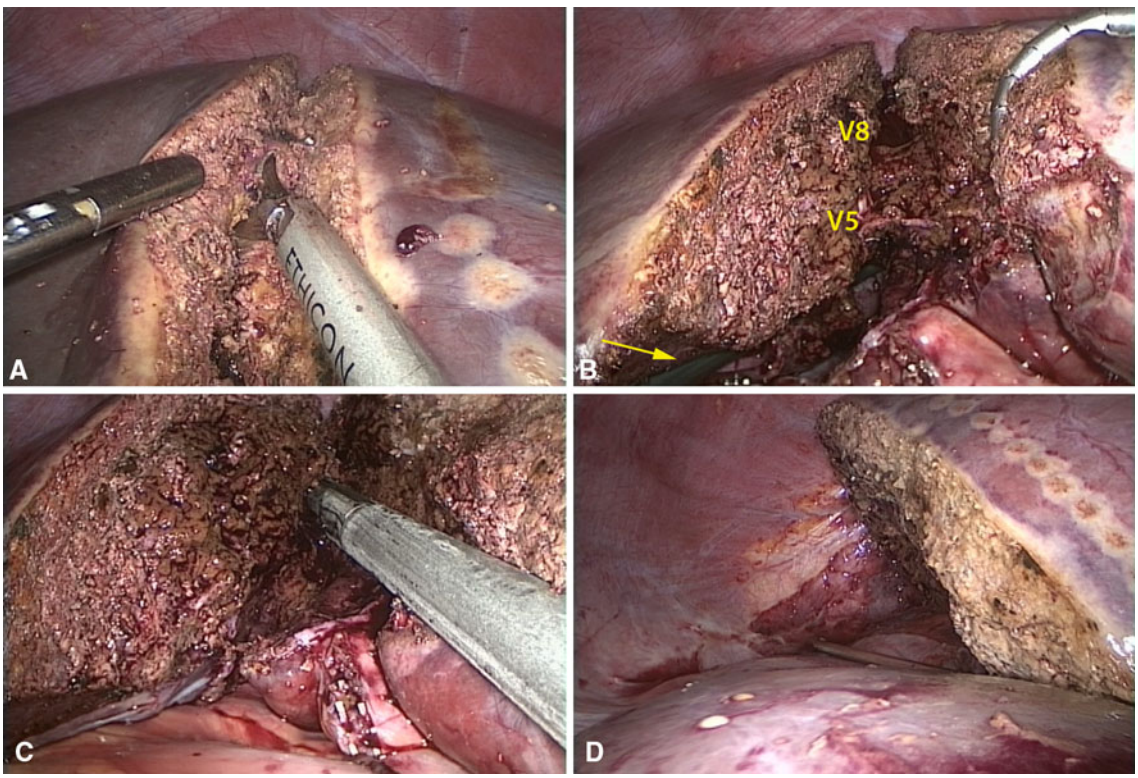

Fig. 2 Liver transection during laparoscopic right hepatectomy. **A** Intraoperative view: anterior part contains small vessels and is safely divided with harmonic scalpel following ischemic demarcation. If the size and location of the tumor permits, we began liver division about 0.5 cm inside ischemic area to decrease bleeding. **B** Intraoperative view after division of anterior and posterior part. The middle part is usually the last part to be transected because it usually contains hepatic veins from segments 5 (V5) and 8 (V8). Upward traction of the right lobe is done with laparoscopic atraumatic instrument (*arrow*). **C** Intraoperative view. Middle part of the liver is transected with stapler. Previous division of anterior and posterior liver substance facilitates introduction of the stapler, making this part of the procedure less hazardous. **D** Intraoperative view after completion of liver transection. Described strategy permits a bloodless liver transection

and posterior (Fig. 1D). Anterior part contains small vessels and is safely divided with harmonic scalpel following ischemic demarcation. If the size and location of the tumor permit, we began liver division about 0.5 cm inside ischemic area to decrease bleeding (Fig. 2A). The posterior part contains branches of hepatic veins draining towards retrohepatic inferior vena cava and can be secured with stapler (Fig. 1D). The middle part is usually the last part to be transected, because it usually contains hepatic veins from segments 5 and 8 (Fig. 2B). Previous division of anterior and posterior liver substance facilitates introduction of the stapler, making this part of the procedure less hazardous (Fig. 2C).

Right hepatic vein is then divided at the end of the procedure. This strategy permits a bloodless liver transection (Fig. 2D). After specimen removal, falciform ligament is sutured to the abdominal wall. This simple step avoids rotation of the liver remnant to the right and possible kinking of the remaining hepatic veins.

Laparoscopic Glissonian approach is gaining popularity because it may reduce the time of operation and avoids dangerous and tedious laparoscopic dissection of liver hilum [2, 3, 5, 6]. It is feasible in several circumstances even in cirrhotic patients [6, 7].

We performed our first major laparoscopic liver resection, a right hepatectomy, in 2007, and the technique used was complete dissection of the hepatic hilum. Several cases followed this initial experience, but the time for dissection of the hepatic hilum was steady between 60 and 90 min. Because of this, we rapidly changed our approach towards Glissonian technique. The main reason was because we have been using intrahepatic Glissonian approach as our standard since 2001 in open cases [7–9]. After initial experience with more than 500 open liver resections, we observed that operative time was dramatically reduced whereas blood loss and resection margins were comparable (data no published). Postoperative liver functions were significantly lower because this technique precludes use of the Pringle maneuver. With its use in laparoscopic liver resection we observe the same phenomenon with a decrease of pedicle control to 5–7 min. Moreover, using this new maneuver described herein (Figs. 1, 2) we observed an additional and significant reduction in blood loss.

Conclusions

Laparoscopic intrahepatic Glissonian approach is feasible and is a useful technique for rapid and safe control of the right liver pedicle, facilitating laparoscopic right hemihepatectomy. Special strategy and tips may help laparoscopic surgeons to safely perform this challenging procedure.

Disclosures Authors Machado, Surjan, and Makdissi have no conflicts of interest or financial ties to disclose.

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