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Laparoscopic Liver Mobilization: Tricks of the Trade to Avoid Complications

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Abstract: Laparoscopic liver resection is gaining popularity because of the availability of new laparoscopic instruments and advanced techniques. Laparoscopic liver mobilization is not only necessary for pure laparoscopic liver resection but also for laparoscopy-assisted hepatectomy. Laparoscopy-assisted hepatectomy significantly reduces the length of the laparotomy incision, and it is a good educational transition to the more advanced laparoscopic liver resection. Laparoscopic liver mobilization is a simple and easy procedure if surgeons know what challenges to expect. Here, the technique of liver mobilization is summarized, along with those challenges.

Key Words: liver mobilization, laparoscopic surgery, laparoscopic hepatectomy

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Significant advancements in laparoscopic instruments and surgical techniques have expanded the indications for laparoscopic hepatectomy (LH) over the last 2 decades.[1–5] However, although several surgical procedures have been replaced by laparoscopic techniques, LH is still a relatively unfamiliar procedure primarily owing to its risk of intraoperative bleeding; this drawback prevents the laparoscopic technique from becoming a standard procedure for hepatectomy.[1,6,7]

Conventional hepatectomy uniformly requires a large incision, such as a J-shape thoracoabdominal incision, even for a small partial hepatectomy, depending on tumor location. This invasive large incision is primarily required for liver mobilization. However, if liver mobilization can be completed by laparoscopy, the incision required for liver transection can be as small as a 10-cm midline incision for most major hepatectomies. This is the concept underlying laparoscopy-assisted hepatectomy (LAH). LAH significantly reduces the length of the incision and the incidence of wound complications. For most hepatobiliary surgeons, liver transection by a small laparotomy is safer or, at least, a procedure with which they are more comfortable. Therefore, LAH is a good learning transition for hepatobiliary surgeons who plan to start performing LH. In this article, the details of the operative technique for laparoscopic liver mobilization are reported along with demonstrations by means of videos (Supplemental Digital Content 1, http://links.lww.com/SLE/A106, Supplemental Digital Content 2, http://links.lww.com/SLE/A107). This should aid the widespread acceptance of laparoscopic liver resection as a standard procedure.

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METHODS

Tricks of the Trade: "Medial-to-Lateral Approach"

We strongly recommend laterally dissecting the coronary and triangular ligaments, after identifying the suprahepatic inferior vena cava (IVC) (Fig. 1). This provides better exposure of vessels, and prevents bleeding complications. If you start the dissection from the lateral aspect of the triangular ligament, an injury can occur to a diaphragm vessel or its collateral to the liver surface (Video 1, Supplemental Digital Content 1, http://links.lww.com/SLE/A106), which can be prominent in some cirrhotic patients. Such an injury can be difficult to control.

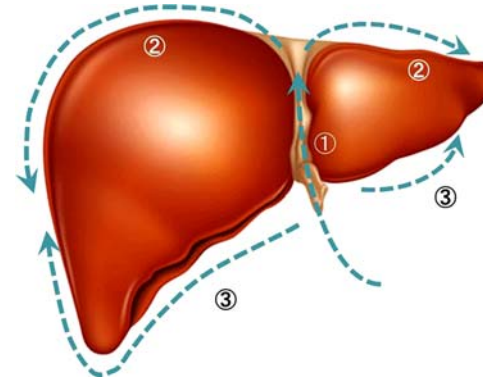

FIGURE 1. Medial-to-lateral approach. Dissecting cranial ligamentous attachment after identifying inferior vena cava and hepatic veins provides better exposure and prevents bleeding complications. 1, Dissection of falciform ligament to expose IVC. 2, Medial-to-lateral approach for cranial dissection of the liver. 3, Caudal and posterior dissection of the liver to expose IVC.

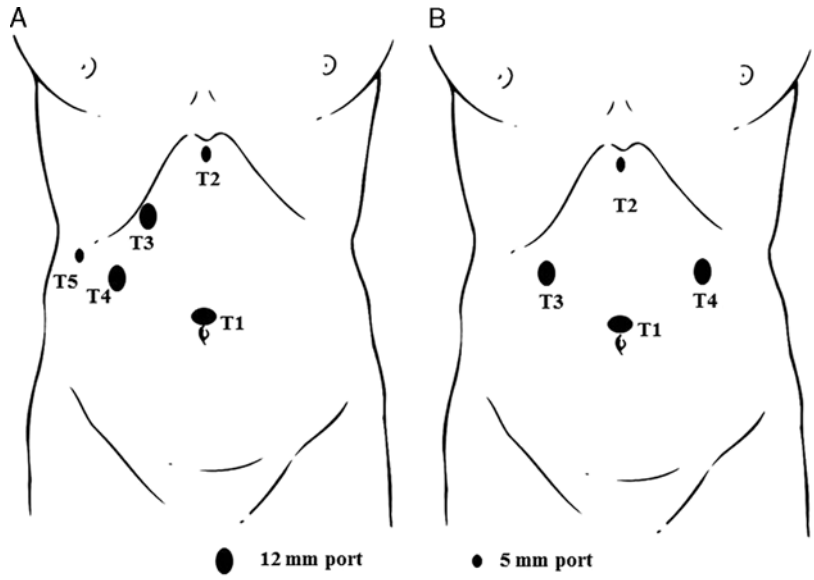

FIGURE 2. Port placement. These are typical port placements for (A) right liver mobilization and (B) left liver mobilization. T1–5 indicates Trocar number 1–5.

Patient Positioning/Port Placement

Under general anesthesia, the patient is placed in the supine position with legs open. For right liver mobilization, the patient's right side should be raised slightly for liver rotation. Table rotation is required to help further liver rotation, and the angle should be modified during operation, as needed. Pneumoperitoneum is established through a supraumbilical 12-mm port inserted using the open-entry technique. The other ports are placed as shown in Figure 2. The key here is to place the port at the epigastrium (T2) at the high position, as shown. The surgeon should use this port for the "medial-to-lateral" dissection of the cranial attachment of the liver.

Right Liver Mobilization (Video 1, Supplemental Digital Content 1, http://links.lww.com/SLE/A106)

The bed should be adjusted initially to place the patient in a supine position with the surgeon standing between the patient's legs. After dissection of the ligamentum teres and falciform ligament, the liver is gently pushed downward using an Endo-paddle (Covidien, Mansfield, MA, UK). The coronary ligament is divided until the suprahepatic IVC and right hepatic vein are exposed. The right coronary ligament and the right triangular ligament are divided laterally (medial-to-lateral approach). Care must be taken to securely divide the collateral vessels that are found in the right triangular ligament, especially in cirrhotic patients.

Next, the bed is rotated toward the patient's left so that the patient is in the left lateral position; this rotation helps liver rotation. The right liver is gently rotated to the left using the Endo-paddle or Snake retractor. The surgeon uses lateral ports (T4 and T5) to begin retroperitoneal dissection. After the dissection line is connected to the previous cranial dissection, the bare area of the liver is safely mobilized without injuring the right hepatic vein or IVC. Once the retrohepatic IVC is identified, mobilization should be performed from the hilar area toward the diaphragm (inferior-to-superior approach). Short hepatic veins are securely dissected using an energy device such as Ligasure (Covidien) or Harmonic (Ethicon Endo-Surgery, Cincinnati, OH) or surgical clips, depending on their size. Dissection at the level of the right adrenal gland should be performed carefully. After completion of right lobe mobilization, the right side of the retrohepatic IVC is exposed.

Left Liver Mobilization (Video 2, Supplemental Digital Content 2, http://links.lww.com/SLE/A107)

The surgeon stands on the patient's right side. The mobilization begins with division of the ligamentum teres and falciform ligament using a Harmonic device. The liver is gently pushed downward using an Endo-paddle. The coronary ligament is divided. After clear visualization of the IVC and left hepatic vein, the left triangular ligaments are dissected laterally (medial-to-lateral approach), and the lateral segment is completely mobilized. Vessels run across the triangular ligament, so it should be carefully dissected. The liver is retracted medially, and the lesser omentum is divided along the Arantius duct, with care being taken of replaced left hepatic artery. The Arantius duct can also be divided, which provides extra rotation of the left liver.

Mobilization of the caudate lobe can be added, if necessary. A laparoscopic blunt dissector, such as a Kittner or Cherry dissector, is used to elevate the Spiegel lobe medially and cranially. The short hepatic veins are securely ligated and divided using a Ligasure or Harmonic device and/or surgical clips, depending on the size of the veins.

RESULTS

Between 2006 and 2013, a total of 194 laparoscopic hepatectomies were performed in our facility: 80 right liver, 20 left liver, and 12 caudate lobe mobilizations. Complications during mobilization included 2 intraoperative bleeding events at the right hepatic vein and collateral veins in the right triangular ligament. In the most recent cases, the mean procedure time for laparoscopic mobilization was

68 minutes (range: 51 to 77 min) for the right liver and 22 minutes (range: 13 to 30 min) for the left liver.

DISCUSSION

Liver mobilization involves dissection of ligamentous attachments between the liver, retroperitoneum, diaphragm, IVC, and other organs such as the stomach and adrenal glands. Mobilization from the IVC requires careful division of short hepatic veins and the right inferior hepatic vein. Vessel injury requires conversion to laparotomy and can also cause major bleeding-related mortality.

The key feature of laparoscopic liver mobilization is dissection of the cranial ligamentous attachment using a medial-to-lateral approach to avoid injuries to the IVC and hepatic veins as well as potential collateral vessels at the lateral edges of the triangular ligament. Achieving careful ligation of short hepatic veins with sealing devices and/or clips under clear vision is essential for liver mobilization. Surgeons need to effectively utilize gravity and retraction to provide a clear view and avoid blind procedures. Keeping these points in mind ensures that laparoscopic mobilization of the liver becomes a simple and safe procedure. Moreover, after acquisition of adequate experience, laparoscopic liver mobilization provides better visualization and a more precise procedure than does open surgery.

Here, the technique and short-term results of laparoscopic liver mobilization were described. Laparoscopic liver mobilization is a safe and simple procedure, which can be beneficial for all hepatobiliary surgeons.

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