Chapter 2

Standardizing Laparoscopic Left Lateral Sectionectomy for Hepatocellular Carcinoma

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Introduction

Laparoscopic abdominal surgery has been proven to be an effective and safe approach in various abdominal procedures. Good evidences are there in the literatures suggesting laparoscopic surgery is associated with shorter hospital stay, less pain, and non-inferior surgical outcome when compared to open surgery[1-4]. It has been regarded as the standard of care in some operations, such as cholecystectomy, fundoplication and colectomy [5-7]. However, when compared to the hollow organs, the same pace of development was not seen in laparoscopic liver resection. This is partly related to the unique liver anatomy making laparoscopic mobilization, vascular inflow/outflow control and parenchymal transection a technically challenging task. On the other hand, an incision of certain length is required for delivery of specimen and this obviates the inherent advantages of small incision in laparoscopic surgery [8-10]. Thanks to the advances of laparoscopic instruments and accumulation of experience, many complicated and risky steps during laparoscopic liver resection are made easier and safer, leading to a number of breakthroughs in laparoscopic resection for Hepatocelullar carcinoma (HCC)[11-14]. While further robust data supporting laparoscopic major hepatectomy to be the gold standard is still eagerly awaited, the benefit of laparoscopic left lateral sectionectomy for both benign and malignant diseases is far less controversial [15-17]. This chapter outlines the knowledge and techniques involved in performing a standard laparoscopic left lateral sectionectomy.

The Constant Anatomical Features of Left Lateral Section

Left lateral section is thin when compared to the right side, and it contributes 15-30% of total liver volume, making post-hepatectomy liver failure an unusual occurrence. The inter-sectional plane between left medial and left lateral section is represented by a constant surface anatomical landmark-the Falciform ligament (Diagram 1). Situated beneath the ligament, is the vertical portion of the left portal vein, which branches off to supply left medial and lateral section. The arterial inflow, biliary drainage, and portal venous branches of each segment and subsegment of the left lateral section converge intra-parenchymally within the Glissonian sheath on the left side of the falciform ligament, hence all pedicles to segment 2 and 3 will be divided by transecting along the left side of the falciform ligament. When Transection proceeds further cranially along the lateral part of falciform ligament, the left hepatic vein willbe encounteredwhere it can be readily divided.

In the Operation Theatre

After general anaesthesiacommenced, a central line can be placed for better control of central venous pressure and volume replacement; this is more important in cirrhotic patientshaving coagulopathy. Ideally the CVP should be kept less than 5cmH2O by fluid restriction during transection in order to minimize venous oozing. Fluid

replacement could be resumed once parenchymal transection is completed. Urinary catheterization and invasive blood pressure monitoring with radial arterial line should be available as per other major operations. Pneumatic device is advisable to minimize thromboembolic risk. Patient's body should be prepared and draped from nipple level to mid thigh. Hair especially those over the suprapubic area, should be removed with clipper.

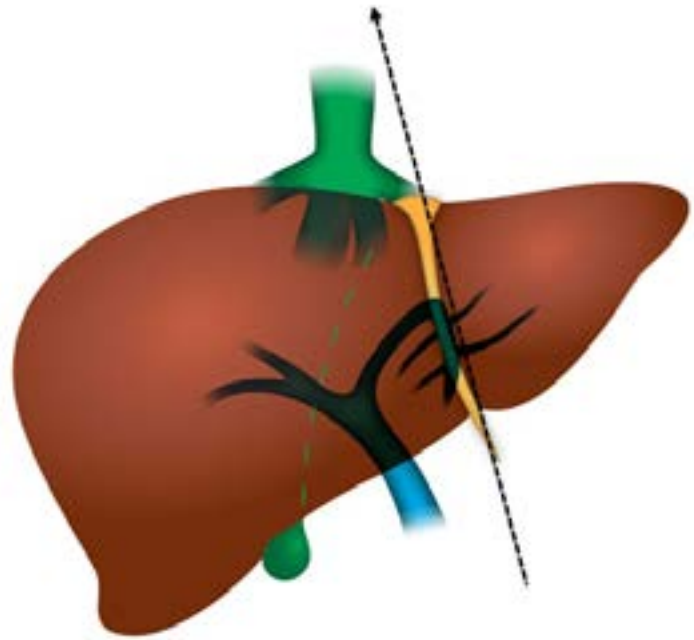

Diagram 1: Standard anatomy and line of transection in left lateral sectionectomy.

Positioning and Ports Siting

Patient should be in Lloyd-Davis position with bilateral arm abducted. The operating table should be tilted with a 30-degree Trendelenburg adjustment. At least two surgeons should be involved in the operation with the chief surgeon stood between patient's leg and the assistant surgeon stood on the side of patient facing the laparoscopic display (Diagram 2). Under normal circumstances, three ports will be required for the operation. Firstly, a 10mm port is created at the subumbilical region (this port might be placed at the supra-umbilical region instead for patients with long abdominal parachute) with open direct cut down technique. This is followed by creation of CO2 pneumoperitoneum. The intra-abdominal pressure should be maintained at 12cmH2O. A second 12mm port should be introduced at the epigastric region (but avoiding insertion into the falciform ligament) for access of ultrasound device, laparoscopic ultrasound probe, vascular stapler and optional laparoscopic Clavitron ultrasonic aspirator (CUSA). One 5 mm working port would be introduced in the right subcostal area. One optional 5 mm working port might be introduced in the lateral aspect of the right subcostal area.

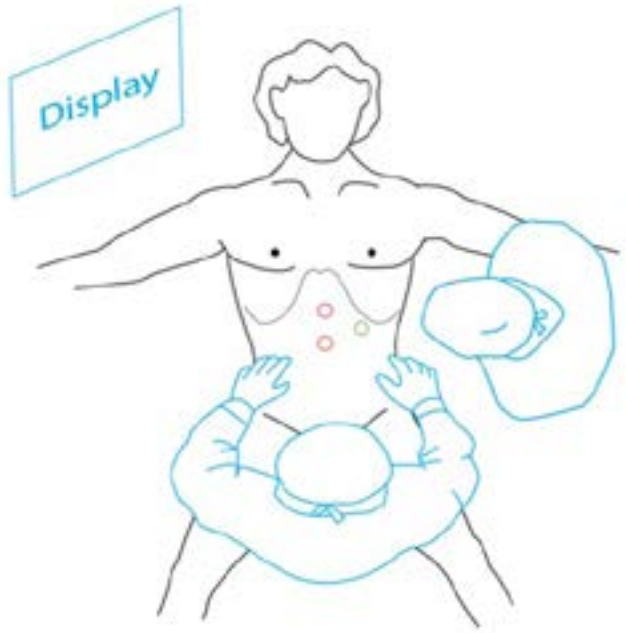

Diagram 2: Illustrating patient, surgeon and port position.

Surgical Technique

The surgeon and scrub nurse should ensure all necessary instruments are ready and functioning properly (Table 1). The operation should begin with diagnostic laparoscopy to look for any obvious peritoneal deposit. The liver surface is then inspected for the tumour location and surface anatomy. A thorough ultrasonography

of both lobes of the liver would be performed to search for additional tumor. The portal vein, hepatic vein, and hepatic artery would be assessed for possible tumor invasion. After ultrasound evaluation, the round ligament should be taken down using the ultrasonic dissector as close to abdominal wall as possible, this is to avoid redundant peritoneum that may dangle in front of the laparoscope. Liver parenchymal transection is carried out with ultrasonic dissector and CUSA along the lateral border of the falciform-round ligament complex (Figure 1). Smaller vessels or pedicles less than 5mm are safely sealed with modern energy sources. Pringle's maneuver is not usually required during transection. Larger portal structures (S2 and S3 pedicle) encountered along this transection plane will be divided using vascular stapler of cartridge height 2-3.5mm depends of situation. Towards the end of transection, left hepatic vein (LHV) would be encountered. The left triangular ligament adjacent to the left hepatic vein would be divided just wide enough for the passage of the blade of vascular stapler (Figure 2). The reason for sparing the left triangular ligament until after division of LHV is that, in case of bleeding from transection surface, the triangular ligament can act as a fulcrum of the lever system and to control the bleeding by elevating the left lateral section against the abdominal wall. Subsequently, the attachments of LLS are freed and the specimen is put into a 12cm Endocatch™ and delivered via a Pfennenstial incision, which is safeguarded by a wound protector. After delivery of the specimen, the Pfennenstial wound is temporary sealed by twisting the wound protector, pneumoperitoneum is re-established and laparoscope is reintroduced. Transection surface is meticulously examined for any bleeding. The pneumoperitoneum pressure would be lowered to 6mmHg to look for any bleeder. Monopolar or bipolar diathery coagulation, argon beam coagulation, application of metal clips, local haemostatic material such as Haemopatch and intra-corporeal suturing are all effective means for haemostasis. In case of bile leakage, metal clips and suturing could be applied. Drain is not necessary under usual circumstances. After haemostasis is secured, wound protector and ports are removed. Local anaesthetic agent is infiltrated to the preperitoneal layer and the wound should be closed in usual manner and skin should be apposed with subcuticular stitches. If the above procedures were taken place smoothly, most left lateral sectionectomy could be completed in less than 2 hours. Post-operatively, patients will be allowed to have sips of water on postoperative day 1 and resume soft diet on post-operative day 2 and discharged home on post-operative day 3.

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Table 1: Armamentarium for laparoscopic left lateral sectionectomy.

Instrument	Quantity
30-degree laparoscope	1
10mm telescope port	1
12mm working port	1
5mm port working port	1
Laparoscopic ultrasound	1
Laparoscopic CUSA	(Optional)
Thunder beat dissectors (Olympus™) /Sonosurg (Olympus™)/ Harmonic scalpels (Ethicon™)/ Sonocision (Medtronic)	1
Stapling device with 2.5-3mm cartridge	Stapler x1, cartridge x 2
Multi-firing metal clips	1 (small and medium size) (optional)
Haemolok	1(large and extra large) (optional)
Laparoscopic Argon bean coagulator	1 (optional)
12cm endo catch™	1
Wound protector	1 (optional)

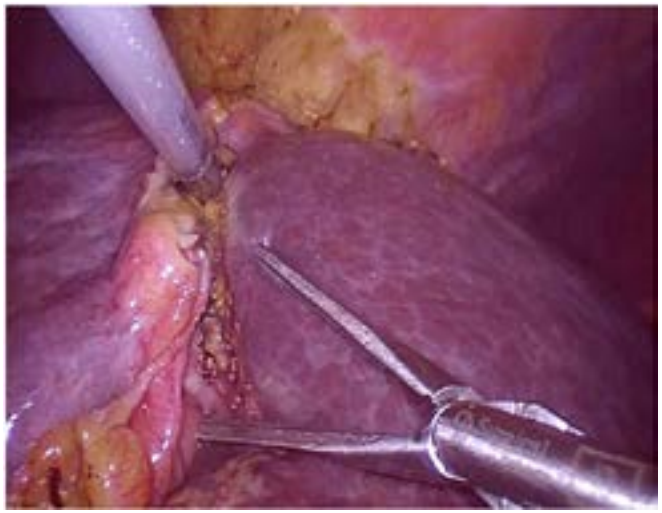

Figure 1: Dissection along the lateral border of falciform ligament.

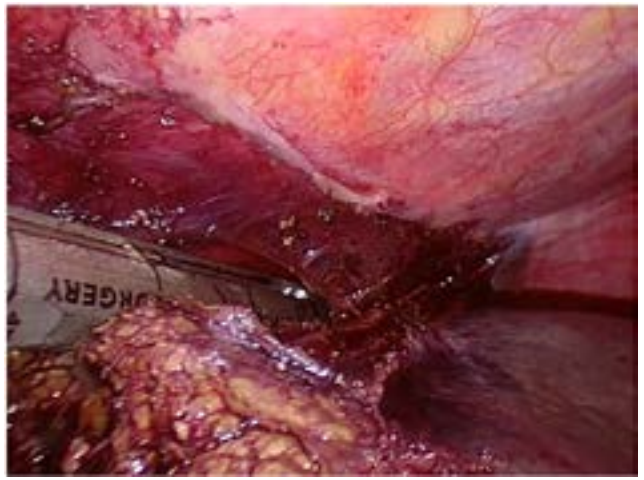

Figure 2: DDivision of left hepatic vein with vascular starrrrpler.

Discussion

Open approach of left lateral section resection has been standardized amongst all sorts of minor liver resection, it will be an ideal procedure to be performed by laparoscopic approach using smaller wounds at less obvious sites. Although experienced surgeons could perform open left lateral sectionectomy over a 5-cm midline wound, the procedure may not be easy as the assistant and the scrub nurse will have difficulties in assisting the operation through a limited exposure. Using laparoscopic approach, the operation field will be clearly seen. With the aid of current high definition video system, the magnification of the lens will allow a very meticulous dissection of the tissues

and liver parenchyma. It has been reported that laparoscopic liver resection is associated with reduced blood loss, shorter hospital stay, better post-operative pain control and similar oncological outcome [17-20]. In both First and Second International Consensus Conference on Laparoscopic Liver Resection, laparoscopic left lateral sectionectomy had been recommended as the standard practice [21,22]. However, this statement did not gain support from all the juries in Morioka consensus [21] due to the fact that most of the evidencepresentedwere from seriesof colorectal liver metastasis. We recently published a series HCC patients who received laparoscopic left lateral sectionectomy, majority of the patients had liver cirrhosis as evidenced by pathological examination [16]. The finding of less blood loss and comparable oncological outcomes suggested that, laparoscopic left lateral sectionectomy should be a superior treatment for HCC in cirrhotic patient. Classically, performing liver resection in cirrhotic patient is more difficult than those without cirrhosis in terms of haemostasis. This is explained by the presence of portal hypertension and thrombocytopenia [23]. With the use of laparoscopic approach,bleeding is slowed down or even temporarily stoppedby the intra-abdominal pressure, this allowsample time for a targeted haemostasis by means of clip application or suture plication. Laparosocpic live resection has been proven to be effective treatment in patients with liver metastasis and patients with HCC even with cirrhosis.[24].

A standardized laparoscopic left lateral sectionectomy

is agood starting point and surgical exercise for hepatobiliary surgical traineeto get familiarized with the laparoscopic environment and techniques before they embark onfurther major laparoscopic resection.

Conclusion

Laparoscopic left lateral sectionectomy is a well-recognized standard procedure in many leading hepatobiliary surgical centers around the world. As compared to open resection, its simplicity, repeatability, better surgical and comparableoncological outcome make it an ideal treatment option for HCC patients.

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