Original Article

Glissonian approach for pure laparoscopic donor hepatectomy

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Background: Since the technique is still being developed, pure laparoscopic donor hepatectomy (PLDH) remains controversial in terms of its safety and efficacy. In this study, we focused on the Glissonian pedicle approach, an important technique in liver surgery. Our aim was to determine whether the Glissonian pedicle approach is an appropriate method for PLDH.

Methods: We retrospectively reviewed a database of patients undergone living donor liver transplantation (LDLT) at our institution.

Results: In total, 14 patients underwent the Glissonian pedicle approach for PLDH. Of these, 10 underwent right liver grafts, and 4 underwent left liver grafts. The median operative time was 384 min (range, 280–563 min), and the median amount of bleeding was 75 mL (range, 21–1,228 mL). Conversion to open procedure occurred in one patient (7.1%). A bile leakage occurred in one patient (7.1%).

Conclusions: We found that the Glissonian approach for PLDH can be successfully performed with good operative outcomes.

Keywords: Laparoscopy; liver; donor; Glissonian; Glisson

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Introduction

Laparoscopic liver resection (LLR) is well established as a treatment method for liver disease. This method has been increasingly adopted due to a number of associated benefits, including reduced intraoperative bleeding, lesser pain and subsequently lower analgesic requirement, shorter postoperative hospital stays, and improved cosmetic outcomes (1-3). Moreover, the indications for LLR have been increasing, with major LLR becoming a standard procedure in specialized institutions (4-6). On the other hand, living donor liver transplantation (LDLT) has gained broad acceptance as a therapeutic modality. The most important principle of LDLT is both, to make sure of minimal risk and to provide rapid recovery to the healthy donor. These principles can also be achieved with pure laparoscopic donor hepatectomy (PLDH), which reduces the physical burden on patients who undergo donor hepatectomy. Nevertheless, since this technique is still in development, PLDH remains controversial in terms of its safety and efficacy (7,8). This study aimed to determine whether the Glissonian pedicle approach is an appropriate method for PLDH in terms of safety and efficacy.

Methods

We retrospectively reviewed a database of patients undergone LDLT at our institution. The study was approved by institutional ethics board (No: MH2018-555), and informed consent was taken from all the patients.

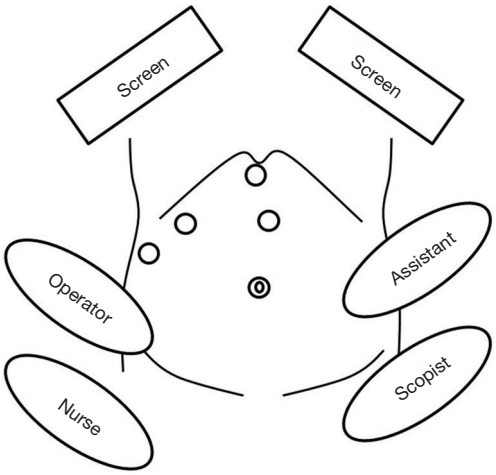

Figure 1 Surgeon and trocar positions.

Surgical procedure

Right liver graft

Donors were placed in the semi-left lateral decubitus position with the reverse Trendelenburg position. The anesthesiologist maintained a low tidal volume, low airway pressure, and low central venous pressure, all of which contributes to reducing blood loss (9). The operator stood on the patient's right side, while the operative assistant and laparoscopist stood on the left side of the patient. Five trocars were inserted, and CO_2 pneumoperitoneum was maintained at 10 mmHg (*Figure 1*).

The ligaments around the right lobe was dissected. The Glissonian branch for the caudate lobe (G1c) was divided. The hilar Glissonian pedicle was gently separated from the liver. A pair of forceps was inserted from the left edge of the root of the anterior Glissonian pedicle and put out from the dorsal side of the root of the posterior Glissonian pedicle (*Figure 2A,B,C*). The right Glissonian pedicle was temporarily clamped, resulting in revealing the demarcation line. The route of the middle hepatic vein was detected by ultrasonography.

The encircled Glissonian pedicle functioned as an important landmark during the liver parenchymal transection. The parenchymal transection was proceeded between the demarcation line, the middle hepatic vein, the right Glissonian pedicle, and the inferior vena cava (*Figure 2D*). These landmarks avoided disorientation, which is one of the disadvantages of LLR. V5 and V8 were divided, and the caudate lobe was transected. After the liver parenchyma was completely transected, the right hepatic vein was encircled.

The vessels in the right Glissonian pedicle were separated. First, the right hepatic artery was exposed and encircled. Next, the right portal vein was also exposed and encircled. Finally, the right hepatic duct was taped by removing the right hepatic artery and right portal vein from the right Glissonian pedicle.

The right hepatic artery was ligated, and then, the right hepatic duct was clipped and divided. The right hepatic artery was divided, and the right portal vein was ligated and divided. The right hepatic vein was divided using a linear stapler. At last, the right liver graft was procured from a suprapubic 9-cm incision.

Left liver graft

Patients were placed in the supine position with the reverse Trendelenburg position.

Four or five ports were placed, and all other setups were consistent with those of the right liver graft.

The left lateral section was mobilized, and the Arantius duct was divided. The hilar Glissonian pedicle was gently separated from the liver. A pair of forceps was inserted from the right edge of the root of the umbilical portion and put out from the cranial side of the divided Arantius duct (*Figure 3A,B,C*). The left Glissonian pedicle was temporarily clamped, resulting in revealing the demarcation line.

The liver parenchymal transection was performed, during which time the encircled Glissonian pedicle served as an important landmark. The parenchymal transection was proceeded between the demarcation line, the middle hepatic vein, the left Glissonian pedicle, and the Arantius plate (*Figure 3D*). These landmarks also avoided disorientation. After the parenchymal transection was finished, the left and middle hepatic vein was encircled.

The vessels in the left Glissonian pedicle were separated. First, the left hepatic artery was exposed and encircled. Next, the left portal vein was exposed, and, at the same time, branches of the Spiegel lobe were divided. The left hepatic duct was taped by removing the left hepatic artery and left portal vein from the left Glissonian pedicle.

The left hepatic artery was ligated. Subsequently, the left hepatic duct was ligated and divided. The left hepatic artery was divided, and the left portal vein was ligated and divided. The left and middle hepatic vein was divided using a stapler. At last, the left liver graft was extracted from a suprapubic 7-cm incision.

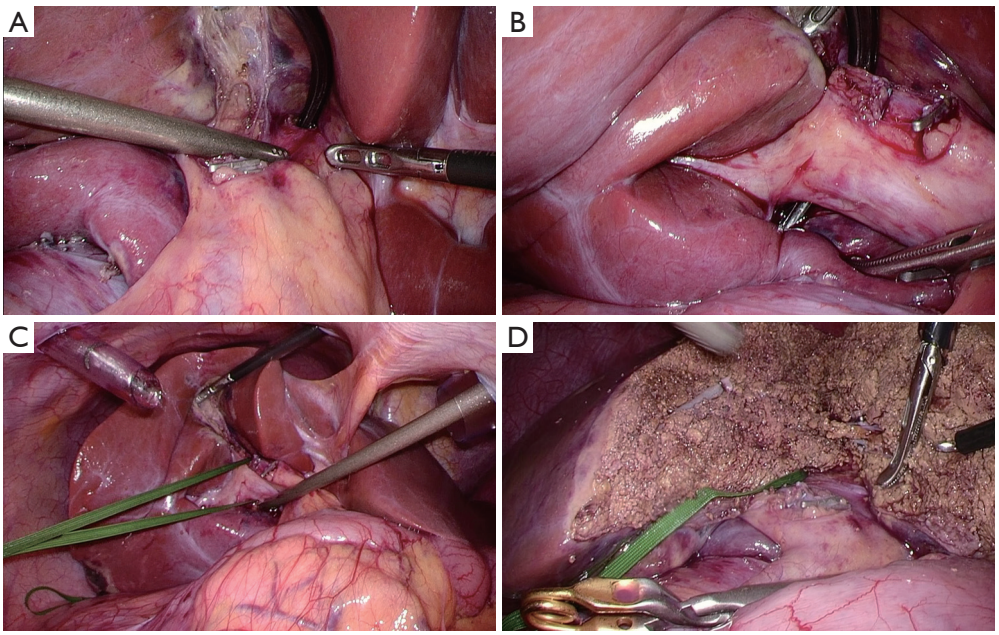

Figure 2 Glissonian approach for the right liver graft. (A) The forceps were inserted from the left edge of the root of the anterior Glissonian pedicle; (B) the forceps emerged from the dorsal side of the root of the posterior Glissonian pedicle; (C) the right Glissonian pedicle was encircled; (D) the liver parenchymal transection was proceeded between the demarcation line, the middle hepatic vein, the right Glissonian pedicle, and the inferior vena cava.

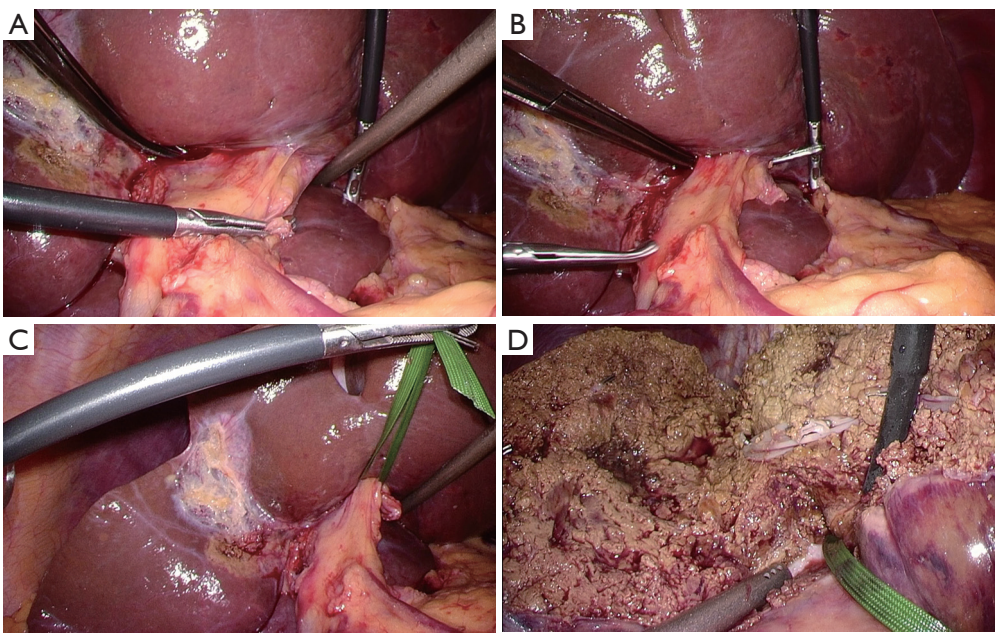

Figure 3 Glissonian approach for the left liver graft. (A) The forceps were inserted from the right edge of the root of the umbilical portion; (B) the forceps were put out from the cranial side of the divided Arantius duct; (C) the left Glissonian pedicle was encircled; (D) the liver parenchymal transection was proceeded between the demarcation line, the middle hepatic vein, the left Glissonian pedicle, and the Arantius plate.

Results

At our institution, the Glissonian pedicle approach for PLDH was introduced in November 2017, and 14 patients underwent this procedure prior to June 2019. The number of right liver grafts without middle hepatic vein was 10, and the number of left liver grafts with middle hepatic vein was 4. The median surgical time was 384 min (range, 280–563 min), and the median amount of bleeding was 75 mL (range, 21–1,228 mL). The median warm ischemic time was 5 min (range, 2–10 min). Conversion to open laparotomy occurred in one patient (7.1%). A bile leakage of Grade IIIa (according to the Clavien-Dindo classification) occurred in one patient (7.1%).

Discussion

Iwate Medical University is the only center that, to our knowledge, is using a laparoscopic Glissonian pedicle approach for donor hepatectomy. PLDH has not been widely accepted by surgical community due to concerns about both technical difficulty and safety. In other words, PLDH is a technique which is still being developed. Therefore, in order to identify the safest and most effective hepatectomy method, a variety of procedures should be considered.

The Glissonian pedicle approach, which is one method used for anatomical liver resection, was introduced by Couinaud and Takasaki (10,11). This method approaches to the portal pedicle on the hepatic hilum without parenchymal transection. Because various types of anatomical liver resections can be accomplished by this method, it is considered one of the important techniques in hepatectomy (12,13).

Few groups apply the Glissonian pedicle for open donor hepatectomy (14,15), and only our group have adopted it for PLDH (16). Despite the Glissonian pedicle approach for LLR being challenging, due to restrictions in movement associated with laparoscopic surgery, we believe that the Glissonian pedicle approach for PLDH has several advantages. Firstly, the encircled Glissonian pedicle serves as a landmark during hepatic parenchymal transection. This is an advantage because one of the major disadvantages of LLR is disorientation. The demarcation line, the middle hepatic vein, and the controlled Glissonian pedicle act as good landmarks for guide of hepatic transection. Secondly, because the Glissonian pedicle is thicker and stronger than bile ducts themselves, the Glissonian approach may avoid injuring small bile ducts running from the caudate lobe, which could lead to postoperative bile leakage. Thirdly, minimal dissection around the hepatic duct is possible by the subtraction technique, helping avoid damage to the peribiliary arterial plexus.

Additionally, we dissected the portal pedicle after liver parenchymal transection. This procedure serves a better surgical view during the hepatic hilum dissection. This is achieved because the surgical space was expanded by this step, which separates the right and left lobe. As the Glissonian pedicle dissection is relatively difficult procedure in laparoscopy due to movement restrictions, our strategy of conducting it after liver parenchymal transection might help overcome some of the disadvantages of LLR.

In conclusion, we considered that the Glissonian approach for PLDH can be successfully undergone with good surgical results. Of course, we can not compare outcomes of the Glissonian approach with those of the individual dissection approach. The choice of procedure is determined based on the operator's preference. Nevertheless, we believe that this novel technique is effective for the treatment of PLDH.

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Footnote

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Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related

to the accuracy or integrity of any part of the work are appropriately investigated and resolved. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). The study was approved by Iwate Medical University Institutional Ethics Board (No: MH2018-555), and informed consent was taken from all the patients.

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