

Pure laparoscopic donor right hepatectomy in a living donor with type 3a biliary variation

A case report

Young Seok Han, MD, Heontak Ha, MD, Hyung Jun Kwon, MD, Jae Min Chun, MD*

Abstract

Rationale: With refinements in the operative technique, laparoscopic surgery has become the standard practice for liver resection. In the field of living donor liver transplantation, a few centers adopted laparoscopic surgery as an alternative to conventional open donor hepatectomy, and the application of pure laparoscopic donor right hepatectomy has been limited to the donors with simple, favorable biliary anatomy.

Patient concerns: The candidate donor was a 19-year-old woman with type 3a bile duct variation.

Interventions: After confirming precise cutting points under the guidance of a radiopaque marker rubber band, the bile ducts were divided and the remnant stumps were closed with suture and clipping using Hem-o-lok, respectively.

Outcomes: The postoperative course was uneventful and she was satisfactory 6 months after surgery.

Lessons: A laparoscopic donor hepatectomy for the living donor with biliary variation was feasible. Biliary variations are commonly encountered during living donor surgery, and we think that such variations in laparoscopic donor hepatectomy need to be overcome to expand the selection criteria.

Abbreviations: IOC = intraoperative cholangiography, LDLT = living donor liver transplantation.

Keywords: biliary variation, laparoscopic donor right hepatectomy, selection criteria

1. Introduction

Despite efforts to increase the rate of deceased organ donations, living donor liver transplantation (LDLT) is performed in about 67% of total liver transplantation cases in South Korea, and donation from a lineal descendant of the recipient accounts for most such transplantations. Donor safety must be the priority during LDLT and, with refinements in the operative technique, increased surgical experience, and cautious donor selection, the major complication rates for donors remains at 1.6% to 3.2% in South Korea,^[1–3] and surgeons have focused on cosmetic issues lately.

There have been several steps to improve the cosmetic appearance of abdominal wounds in living donors.^[4] Since pure

laparoscopic right donor hepatectomy was first introduced by Soubrane et al^[5] in 2013, some transplant centers adopted it as an alternative to the conventional open donor hepatectomy. However, there is no standard technique, and strict criteria have been applied because of safety issues and difficulties in operation. In particular, donors with biliary variations were excluded from being candidates of laparoscopic donor hepatectomy.^[6,7] To expand the selection criteria for this procedure, biliary anatomic variations must be a subject to overcome. Here, we present a case of successfully performed pure laparoscopic donor right hepatectomy under viewing of 3-dimensional laparoscopy in a donor with type 3a bile duct anatomy.

2. Case report

In May 2016, a 47-year-old man was referred to our hospital because of hepatic encephalopathy. He had been diagnosed with hepatitis B-related liver cirrhosis and had an episode of hepatic encephalopathy just 2 months before admission, with conservative therapy being applied at another medical center. His ABO blood type was B⁺ and the candidate donor was his 19-year-old daughter. The laboratory tests for the donor were within normal limits, and her hepatitis viral markers (hepatitis B surface antigen and hepatitis C virus antibody) were negative. The volumetric calculation of the right hemiliver was 608 cm³ and the projected graft-to-recipient weight ratio was 0.81. Magnetic resonance cholangiopancreatography (MRCP) performed for the evaluation of bile duct anatomy revealed a type 3 bile duct (Fig. 1). After full explanation of laparoscopic donor hepatectomy and the potential risks of conversion to open laparotomy, we decided to perform the former operation.

A complete donor hepatectomy was performed under the viewing of 3-dimensional laparoscopy (Olympus). After padding

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Department of Surgery, Kyungpook National University School of Medicine, Jung-gu, Daegu, Republic of Korea.

* Correspondence: Jae Min Chun, Department of Surgery, Kyungpook National University School of Medicine, Jung-gu, Daegu, Republic of Korea (e-mail: cjmdr@knu.ac.kr).

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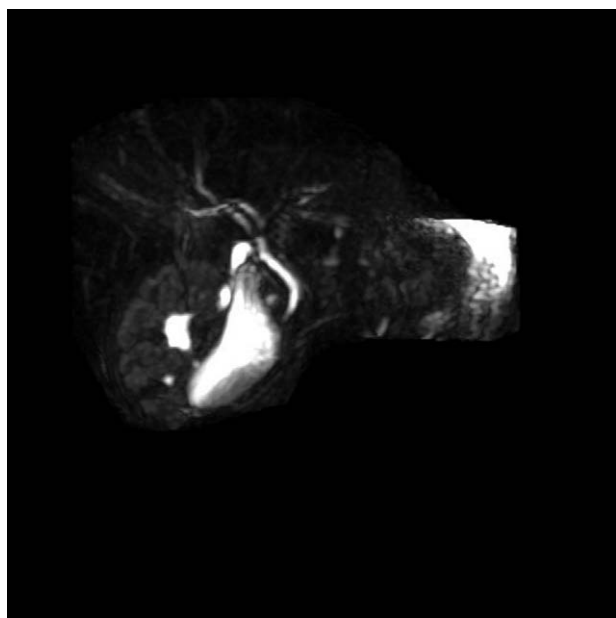


Figure 1. MRCP shows the biliary variation of the donor: type 3a. MRCP = magnetic resonance cholangiopancreatography.

bony prominences to protect against pressure injury, the donor was placed in a left decubitus position, with a small pillow under the right side of the patient's back, and the right arm rested on an elevated armrest. The operator stood at the right side of the patient and the scopist and assistant stood at the opposite side of the operator. Five trocars were used. The initial 10-mm trocar was placed above the umbilicus for a flexible laparoscope, and subsequent trocars were inserted under direct vision. A 12-mm port was placed below the right costal margin at the midclavicular line and another 5-mm port was placed 1 fist-width to the right side of the 12-mm port, which were both used by the operator. The remaining two 5-mm ports were inserted at just below the Xiphoid process and left costal margin of the midclavicular line. After full mobilization of the liver from the attached ligament with electrocautery hooks or an energy device, the vena cava ligament and the short hepatic veins were isolated and ligated using the Hem-o-lok (Weck Closure System, Research Triangle Park, NC) or metal clips, which proceeded to the groove between the right and middle hepatic vein. Thereafter, the gallbladder was freed from the liver bed and left in situ for

purpose of retraction to facilitate the exposure of hilar structures and intraoperative cholangiography (IOC). The right portal vein and right hepatic artery were dissected and encircled with vascular tapes, and then clamped temporarily to identify the transection plane demarcated on the liver surface. The liver parenchymal transection was performed using a laparoscopic cavitron ultrasonic aspirator. During the liver transection, we did not use temporary hepatic inflow occlusion or a hanging maneuver. When liver transection reached the hilar plate, caudate lobe division was followed, and then the hilar plate was encircled. To verify the optimal bile duct division point, a radiopaque rubber marker band was anchored at an adequate point and IOC was obtained via the catheter cannulated into the cystic duct. According to the classification system of Varotti et al,^[8] the bile duct was of type 3a: the right anterior bile duct opening directly into the left one (Fig. 2). After confirmation of the accurate cutting point, we divided the bile duct with scissors, and the stump of the remnant right posterior and anterior bile ducts were closed with metal clips and Hem-o-lok clips, respectively. However, the posterior duct stump was not closed completely, so we removed the metal clips and sutured it with a 6-0 absorbable monofilament (PDS II, Ethicon, Somerville, NJ) (Fig. 3). Subsequent cholangiograms showed satisfactory bile duct structure without stricture and there were no biliary leaks (Fig. 2). After completion of parenchymal transection, a 10-cm horizontal skin incision was made just above the symphysis pubis (Pfannenstiel incision) without opening the peritoneum for retrieval of the graft. Next, the right hepatic artery was ligated with Hem-o-lok clips, and the right portal and right hepatic veins were transected with unilateral linear staplers (endoTA, Covidien, Dublin, Ireland). It took 410 minutes to complete donor hepatectomy.

The donor's immediate postoperative course was uneventful and the results of laboratory test performed 6 days after surgery was as follows: aspartate aminotransferase 35 IU/L, alanine aminotransferase 36 IU/L, total bilirubin 0.38 mg/dL, alkaline phosphatase 46 IU/L, and prothrombin time-international normalized ratio 1.23. The donor was in a satisfactory condition 6 months after liver donation. The patient provided written informed consent for publication of this report.

3. Discussion

According to the annual report of KONOS in 2015, 1398 cases of liver transplantation were performed in South Korea, comprising 942 cases of LDLT and 456 cases of deceased donor liver

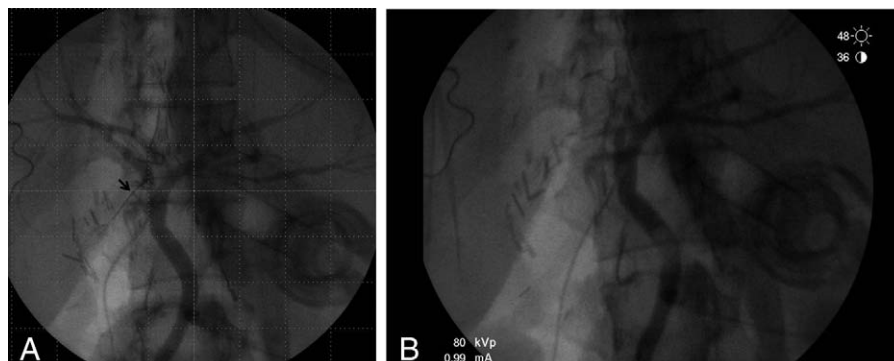


Figure 2. Intraoperative cholangiograms. (A) Before bile duct division: the right anterior bile duct opened directly into the left bile duct. A radiopaque rubber marker band was anchored at an adequate cutting point (arrow). (B) After bile duct division, the cholangiogram shows no biliary stricture or biliary leaks.

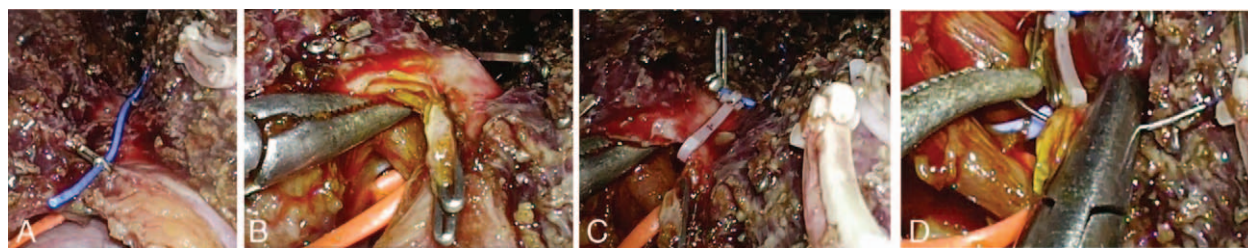


Figure 3. Steps of procedure. (A) Anchoring of a radiopaque rubber band for determining a precise cutting line; (B) application of metal clips for closure of the remnant right posterior bile duct; (C) application of Hem-o-lok clips for closure of the remnant right anterior bile duct; and (D) suturing of the remnant right posterior bile duct.

transplantation. Lineal descendants comprised 619 (66%) cases of whole living donation and 648 cases were donated under the age of 35. In addition, there were 320 cases of donation from female donors.

Donor safety is of paramount importance in performing LDLT. A recent study reported that the major complication rates (Grade \geq III) and biliary complication rates for live donors were 1.9% and 1.7% in conventional open donor hepatectomy,^[9] and these improvements resulted from refinements in the surgical technique, increases in the cumulative experience of surgical procedures, and establishment of strict criteria for donation. To minimize biliary complications in LDLT donors, several tips have been suggested. First, surgeons need to understand biliary anatomy. Second, confirmation of a precise bile duct cutting line is mandatory. Third, the tissue of the hilar plate should be preserved to prevent biliary ischemia.^[10] We followed these recommendations during this pure laparoscopic donor right hepatectomy. We performed MRCP preoperatively and checked biliary anatomy using IOC. In addition, a radiopaque marker rubber band was used to identify the precise bile duct cutting point and the hilar plate was encircled with minimal manipulation of the surrounding tissues.

The only troublesome point during the operation was a wide hilar plate. We usually use Hem-o-lok clips to close the bile duct stump in donors with a single bile duct. Here, we initially applied metal clips to the right posterior bile duct. However, closure of the remnant bile duct was incomplete because of a wide hilar plate, and needed suturing. Type 3 bile ducts have a wide hilar plate that leads to difficult remnant stump closure by simple application of clips.

As mentioned previously, a significant number of the living donors are young and female. Therefore, surgeons are concerned about cosmetic and recovery problems after conventional open donor hepatectomy, and various approaches have been attempted, from minilaparotomy to pure laparoscopic donor hepatectomy.^[4,5] In 2013, Soubrane et al^[5] first reported pure laparoscopic right hepatectomy in a living donor with a single right bile duct. Thereafter, a few studies proposed the selection criteria for laparoscopic donor right hepatectomy, and these were very strict anatomically because of possible complications after division: single hepatic artery, single portal vein, and single bile duct with long segments.^[6,7] In addition, Kwon and Joh^[7] reported over 40% biliary complication rates in patients with bile duct variations. However, biliary variations in living donors are

commonly encountered in the clinical setting and Macdonald et al^[11] reported a rate of 38% of biliary anomalies in living liver donors. Therefore, biliary variations need to be overcome to achieve pure laparoscopic donor hepatectomy successfully.

4. Conclusions

Laparoscopic donor hepatectomy for the living donor with biliary variation was feasible, and selection criteria of laparoscopic donor hepatectomy can be expanded by overcoming anatomic issues. In addition, laparoscopic donor hepatectomy for live donors with anatomic variations should be carefully advised to the families of those ready for donation since the application of this method is new and requires refinements.

References

- [1] Suh KS, Suh SW, Lee JM, et al. Recent advancements in and views on the donor operation in living donor liver transplantation: a single-center study of 886 patients over 13 years. *Liver Transpl* 2015;21:329–38.
- [2] Shin M, Song S, Kim JM, et al. Donor morbidity including biliary complications in living-donor liver transplantation: single-center analysis of 827 cases. *Transplantation* 2012;93:942–8.
- [3] Hwang S, Lee SG, Lee YJ, et al. Lessons learned from 1,000 living donor liver transplantations in a single center: how to make living donations safe. *Liver Transpl* 2006;12:920–7.
- [4] Suh SW, Lee KW, Lee JM, et al. Clinical outcomes of and patient satisfaction with different incision methods for donor hepatectomy in living donor liver transplantation. *Liver Transpl* 2015;21:72–8.
- [5] Soubrane O, Perdigo Cotta F, Scatton O. Pure laparoscopic right hepatectomy in a living donor. *Am J Transplant* 2013;13:2467–71.
- [6] Kim KH, Kang SH, Jung DH, et al. Initial outcomes of pure laparoscopic living donor right hepatectomy in an experienced adult living donor liver transplant center. *Transplantation* 2017;101:1106–10.
- [7] Kwon CHD, Joh JW. Totally laparoscopic right hepatectomy for living donors. Aseni P, Grande A, De Carlis L, editors. *Multiorgan Procurement for Transplantation. A Guide to Surgical Technique and Management*. Cham, Switzerland: Springer; 2016;239–45.
- [8] Varotti G, Gondolesi GE, Goldman J, et al. Anatomic variations in right liver living donors. *J Am Coll Surg* 2004;198:577–82.
- [9] Lee JG, Lee KW, Kwon CHD, et al. Donor safety in living donor liver transplantation: the Korean Organ Transplantation Registry (KOTRY) study. *Liver Transpl* 2017;23:999–1006.
- [10] Yuan Y, Gotoh M. Biliary complications in living liver donors. *Surg Today* 2010;40:411–7.
- [11] Macdonald DB, Haider MA, Khalili K, et al. Relationship between vascular and biliary anatomy in living liver donors. *AJR Am J Roentgenol* 2005;185:247–52.