

## Renoportal anastomosis in living donor liver transplantation

Kisaoglu A<sup>1</sup>, Demiryilmaz I<sup>1</sup>, Dandin O<sup>1</sup>, Yilmaz VT<sup>2</sup>, Aydinli B<sup>1</sup>

<sup>1</sup>Department of General Surgery

<sup>2</sup>Department of Nephrology

Medicine Faculty Hospital, University of Akdeniz, Antalya, Turkey

### Abstract

**Background:** In advanced cirrhotic patients, extensive mesenteric vein thrombosis extends the operative time, causes peri- and postoperative complications, and increases the mortality and morbidity in liver transplantation (LT). The anastomosis between the left renal vein and graft portal vein is one of the crucial options in such patients. However, especially in living donor liver transplantation (LDLT) practice, limited cases are published in the literature.

**Case report:** A thirty-seven years old female patient with hepatitis B virus (HBV) associated liver cirrhosis underwent LDLT. Her body mass index, graft weight, and graft-recipient weight ratio (GRWR) were noted 19.3 kg/m<sup>2</sup>, 990 g, and 1.9 %, respectively. During the surgical procedure, she had renoportal anastomosis (RPA) due to extensive portal vein thrombosis to provide an efficient portal inflow to the transplanted graft. No complication was observed in the early postoperative period, and the one year follow up passed without any problem.

**Conclusions:** In LT, for providing efficient portal flow to the graft, the RPAs should be considered as an option in case of extensive splanchnic vein thrombosis and large splenorenal shunt. Ensuring that graft volume is close to the recipient standard liver volume, RPA can be performed safely and effectively in LDLT as an acceptable and life-saving procedure. HIPPOKRATIA 2019, 23(3): 140-142.

**Keywords:** Liver transplantation, renoportal anastomosis, shunt, thrombosis

**Corresponding Author:** Assoc. Prof. Dandin Ozgur, Department of General Surgery, Faculty of Medicine Hospital, University of Akdeniz, Organ Transplantation Center, 07070 Antalya, Turkey, tel: +902422274400, +905333892044, fax: +902423101509, e-mail: dandinozgur@gmail.com

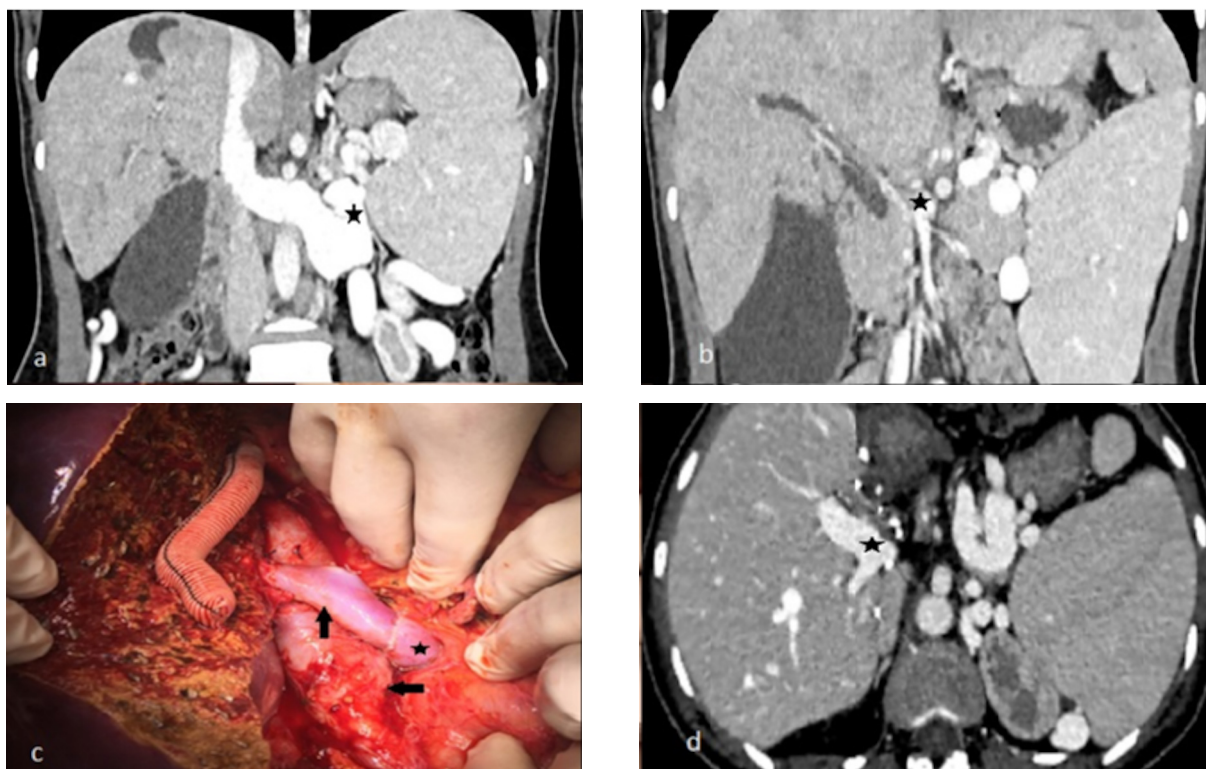
### Introduction

In advanced cirrhotic patients, extensive mesenteric vein thrombosis extends the operative time, causes peri- and postoperative complications, and increases the mortality and morbidity during liver transplantation (LT). Also, it is often accompanied by extensive collaterals or shunts, which pose a challenge to providing an efficient flow to the graft after reconstruction of the portal vein. The surgeons have limited life-saving options for this challenging condition<sup>1,2</sup>. As a rare but crucial procedure, the anastomosis between the left renal vein and graft portal vein is one of the efficient options in patients with extensive portal vein thrombosis (PVT) during LT<sup>2</sup>. The liver transplant surgeons modulate the splanchnic circulation by using this method, especially in the case of large shunts such as splenorenal, for efficient portal blood flow to the transplanted graft. However, there is a limited number of cases published in the literature regarding renoportal anastomosis (RPA) in LT practice. According to a recent review published in 2019, only 66 cases were presented from different centers. Among these patients, only five had living donor liver transplantation (LDLT)<sup>2</sup>. As a contribution to the literature, we introduce our satisfying experience with a case who underwent RPA in LDLT.

### Case Report

A thirty-seven years old female patient was operated for hepatitis B virus (HBV) associated liver cirrhosis. Her weight, height, and body mass index (BMI) were 52 kg, 164 cm, 19.3 kg/m<sup>2</sup>, respectively. The Model for End-Stage Liver Disease score was 18, and LDLT was planned for this patient. The male donor was unrelated to her, and his age and BMI were 38 years and 23.3 kg/m<sup>2</sup>, respectively. The graft weight and graft-recipient weight ratio (GRWR) were noted 990 g and 1.9 %, respectively. Preoperatively, for providing efficient portal flow, an RPA was planned due to a large (>1cm) splenorenal shunt (SRS) (Figure 1A) and Yerdel grade IV PVT (Figure 1B), causing the absence of portal flow demonstrated on triple-phase computerized tomography (CT) images. During surgical exploration, these pathologies were confirmed. After performing hepatic vein anastomosis, an end-to-end RPA was constructed by using a segment of cadaveric iliac vein graft between the portal vein of the graft and the left renal vein.

Consequently, an efficient portal flow through to the graft without the steal phenomenon was obtained (Figure 1C), which was confirmed by Doppler ultrasound. Other anastomoses were performed, and the operation was ter-



**Figure 1:** Coronal abdominal computerized tomography (CT) images showing a) a large splenorenal shunt (star) and b) Yerdel grade IV portal vein thrombosis (star). c) Perioperative photo showing the renoportal anastomosis constructed by using a segment of deceased donor iliac vein graft (horizontal arrow) between the portal vein of the graft and the left renal vein (star). The vertical arrow shows the left renal vein stump at the junction with vena cava. The synthetic vascular graft was used for providing the drainage of segments 5 and 8. d) Axial abdominal CT image demonstrating an efficient portal flow (star) in the third month after the operation.

minated after control of the bleeding and placement of the drains. The postoperative period was uneventful without complications (acute renal failure, ascites, hyperbilirubinemia, coagulopathy, etc.), and she was discharged on the 9<sup>th</sup> postoperative day. The CT demonstrated an efficient portal flow from the left renal vein to the liver and the regenerated graft in the third month after the operation (Figure 1D). The one year follow up passed without any problem such as transient or chronic renal dysfunction. The specimen reported as congenital hepatic fibrosis and mixed type cirrhosis.

### Discussion

For adequate graft perfusion and function after living or deceased donor liver transplantation (DDLT) to have enough blood flow through the portal vein is quite vital<sup>1</sup>. As a typical result of cirrhosis, PVT is observed with a rate of 2-26 % in LT<sup>3</sup>. While previously, PVT was one of the main contraindications for deceased or living donor LT<sup>4</sup>, now the surgeons can overcome this complexity by using different approaches<sup>1,5</sup>.

In the case of Yerdel<sup>3</sup> grade I and II PVT, portoportal anastomosis following portal vein resection or eversion thrombectomy may be performed for enabling the LT process<sup>6</sup>. Also, recently Golse et al<sup>7</sup> proposed that in case of partial thrombosis (Yerdel grade I) and SRS larger than

one cm in diameter if a thrombectomy is not enough for an efficient portal inflow, two approaches can be consulted: left renal vein ligation with portoportal anastomosis and RPA. However, if the PVT is complete (Yerdel grade II) and accompanied by the SRS, the RPA should be performed during surgery. In patients with Yerdel grade III PVT by using cadaveric or artificial venous grafts, the graft's portal vein may be anastomosed to the recipient's other mesenteric veins, such as a superior mesenteric vein, vein plexus of choledochal, coronary vein, middle colic vein, and mesenteric varices<sup>8-10</sup>. However, these approaches may cause challenges such as re-thrombosis and increased mortality rate<sup>2</sup>.

In patients with grade IV PVT, the LT can be performed using different techniques, including portal vein arterialization, combined liver-small bowel transplantation and, cavoportal or renoportal anastomosis<sup>1,5</sup>. Among these procedures, the RPA has been presented for obtaining an efficient portal blood flow to the transplanted graft, notably during the LDLT process in limited cases<sup>1</sup> and in terms of knowledge and experience, this approach is still at the beginning level.

Indeed, graft inflow modulations (GIM) are crucial for graft and patient survival who have Yerdel grade IV PVT with the SRS. Primarily due to the transplanted partial graft, GIM is a complex process in LDLT. Ensuring

that portal blood volume or portal vein pressure is close to the physiological ranges, GRWR higher than 0.6 % is efficient for acceptable outcomes<sup>11</sup>. Typically, the amount of blood passing through the portal vein is approximately 90 ml per 100 g tissue per min<sup>12</sup>. For this reason, the type of portal modulation should be planned according to the transplanted graft volume.

In the light of this knowledge, in the case of Yerdel grade IV PVT with the large SRS, comparing with cadaveric whole graft transplantation, LDLT requires more complex surgical management and efficient weighted graft. Francoz et al<sup>13</sup> demonstrated in their study that the patients with extensive PVT are not appropriate candidates for LDLT due to the short portal vein of the partial graft that requires additional interposition or artificial vessel graft, absence of suitable recipient's portal vein, and high mortality rate. When LT is performed with whole liver graft, after performing RPA, the blood flow of the left renal vein will be directed to the graft through the RPA, and the portal blood volume will increase slightly. Because the volume of the allograft used in the recipient is close to that of a recipient standard liver volume, this increase does not cause a severe problem.

However, GRWR is important if the RPA is performed in LDLT. It would be better to use an allograft volume close to the standard liver volume of the recipient. Donor selection is crucial in this respect. If GRWR is less than 0.8 %, performing RPA may cause portal hyper-inflow and the resulting small for size syndrome, which has a high morbidity and mortality rates. In our case, the allograft weight and GRWR were 990 g and 1.9 %, respectively (graft volume/estimated standard liver volume: 83 %). Intraoperatively, the portal vein blood flow velocity was recorded at 30-40 cm/sec by Doppler ultrasound, and portal vein pressure was calculated at 16 cmH<sub>2</sub>O during reperfusion. Additionally, no postoperative complications such as ascites, hyperbilirubinemia, coagulopathy, which are related to small for size syndrome, were observed.

In LT, for providing efficient portal flow to the graft, the RPA should be considered as an option in case of extensive splanchnic vein thrombosis and large SRS. Ensuring that graft volume is close to the recipient standard liver volume, RPA can be performed safely and effectively in LDLT as an acceptable and life-saving procedure.

#### Conflict of interest

The authors have no conflict of interest.

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#### References

1. D'Amico G, Hassan A, Diago Uso T, Hashimoto K, Aucejo FN, Fujiki M, et al. Renoportal anastomosis in liver transplantation and its impact on patient outcomes: a systematic literature review. *Transpl Int*. 2019; 32: 117-127.
2. Marubashi S, Dono K, Nagano H, Gotoh K, Takahashi H, Hashimoto K, et al. Living-donor liver transplantation with renoportal anastomosis for patients with large spontaneous splenorenal shunts. *Transplantation*. 2005; 80: 1671-1675.
3. Yerdel MA, Gunson B, Mirza D, Karayalçin K, Olliff S, Buckels J, et al. Portal vein thrombosis in adults undergoing liver transplantation: risk factors, screening, management, and outcome. *Transplantation*. 2000; 69: 1873-1881.
4. Van Thiel DH, Schade RR, Gavaler JS, Shaw BW Jr, Iwatsuki S, Starzl TE. Medical aspects of liver transplantation. *Hepatology*. 1984; 4: 79S-83S.
5. Lupascu C, Darius T, Goffette P, Lerut J. Systemic Venous Inflow to the Liver Allograft to Overcome Diffuse Splanchnic Venous Thrombosis. *Gastroenterol Res Pract*. 2015; 2015: 810851.
6. Fouzas I, Paul A, Becker C, Vernadakis S, Treckmann JW, Máthé Z, et al. Orthotopic liver transplantation in patients with portal vein thrombosis in the absence of hepatocellular carcinoma. *Transplant Proc*. 2012; 44: 2734-2736.
7. Golsse N, Bucur PO, Faitot F, Bekheit M, Pittau G, Ciaccio O, et al. Spontaneous Splenorenal Shunt in Liver Transplantation: Results of Left Renal Vein Ligation Versus Renoportal Anastomosis. *Transplantation*. 2015; 99: 2576-2585.
8. Bodini FC, Rossi S, Veronese L, Colombi D, Michieletti E. Extrahepatic Portosystemic Shunt via the Coronary Vein in Non-cirrhotic Chronic Portal Vein Thrombosis. *J Vasc Interv Radiol*. 2018; 29: 1327-1330.
9. Cherqui D, Duvoux C, Rahmouni A, Rotman N, Dhumeaux D, Julien M, et al. Orthotopic liver transplantation in the presence of partial or total portal vein thrombosis: problems in diagnosis and management. *World J Surg*. 1993; 17: 669-674.
10. Rudloff C, Scheele J. The middle colic vein: an alternative source of portal inflow in orthotopic liver transplantation complicated by portal vein thrombosis. *Clin Transplant*. 1998; 12: 538-542.
11. Macshut M, Kaido T, Yao S, Yagi S, Ito T, Kamo N, et al. Older Donor Age Is a Risk Factor for Negative Outcomes After Adult Living Donor Liver Transplantation Using Small-for-Size Grafts. *Liver Transpl*. 2019; 25: 1524-1532.
12. Sainz-Barriga M, Reyntjens K, Costa MG, Scudeller L, Rogiers X, Wouters P, et al. Prospective evaluation of intraoperative hemodynamics in liver transplantation with whole, partial and DCD grafts. *Am J Transplant*. 2010; 10: 1850-1860.
13. Francoz C, Valla D, Durand F. Portal vein thrombosis, cirrhosis, and liver transplantation. *J Hepatol*. 2012; 57: 203-212.