Narrowing of the Inferior Vena Cava following Closure of the Right Hepatic Vein Stump in a Patient undergoing Living Donor Hepatectomy

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ABSTRACT

Living donor hepatectomy is not without risks, and some complications can end up with serious morbidities if not timely diagnosed and appropriately managed. In this report, we described a very unusual but significant surgical problem in living liver donor surgery in which a significant narrowing occurred in the inferior vena cava after the closure of the stump of the right hepatic vein and inferior right hepatic vein close to the right hepatic vein together, and describe the cavoplasty technique used to repair this narrowing. To the best of our knowledge, the technique of solving this problem in living liver donors was described only once in literature, which was previously published by our team.

KEYWORDS: Living donor hepatectomy; Narrowing of vena cava inferior; Patch venoplasty

INTRODUCTION

Since the first successful liver transplantation (LT) by Starzl and colleagues in 1967, LT has become the standard therapy for many liver diseases [1]. While in western countries, most of the liver graft requirement is provided from the cadaveric organ pool, in Asian and Middle Eastern countries, a significant portion of the organ requirement is provided from the living donor pool [2]. Technical advancements in living liver donation surgery have allowed surgeons to expand their practice to provide precious life-saving solutions to patients with terminal liver diseases and deal with operative difficulties and problems encountered during surgery. Of these techniques and skills are vascular reconstruction techniques which are crucial prerequisites to performing this procedure with minimal morbidity and mortality risk to the healthy living liver donor (LLD) [3]. We describe in this report the cavoplasty technique used to correct a significant narrowing that occurred in the inferior vena cava (IVC) after clamping and transecting of the right hepatic vein (RHV) and inferior right hepatic vein (IRHV) close to the RHV together.

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CASE PRESENTATION

A 32-year-old female LLD candidate (BMI: 25.4 kg/m2, total liver volume:1015 cc, right lobe: 680 ccs, remnant liver: 33%) was admitted to our liver transplant institute to donate a part of her liver to her 55-year-old mother with chronic liver disease secondary to hepatitis C infection (BMI: 30 kg/m2, MELD-Na: 15 Child: 10/C). The potential LLDs were examined according to the evaluation algorithm applied in our institute and biochemical blood parameters were within normal limits. A right lobe living donor hepatectomy procedure was performed as previously described in our in

Figure 1: View of narrowed inferior vena cava after closing with cryopreserved venous patch (intraoperative real time imaging).

stitute [4]. After clamping and transecting of the RHV and IRHV close to the RHV together, closing its site using running 6/0 proline, and following right lobe removal, it was noted that there was a crescent shape narrowing of the IVC at the site of the RHV ostium with IVC narrowing estimated to be more than 30% of the diameter. Furthermore, it was noted by clinical assessment that the IVC is more distended and tenser distal to the narrowing side. At this point, we were convinced that the narrowing is clinically significant and proceeded with cavoplasty using a cryopreserved vein graft. An oval graft about 2x3cm was prepared, a side satinsky clamp was applied around the RHV ostium site, the previous running proline suture was removed and the vein patch was applied and sutured (Fig 1). Resolution of the narrowing was achieved and the distal distension and tension resolved clinically. The LLD received usual postoperative care and was discharged with good conditions on the 8th postoperative day without complications. Control contrast-enhanced computed tomography was obtained on the 15th postoperative and no signs of stenosis was detected in the IVC (Fig 2).

DISCUSSION

Living donor liver transplantation (LDLT) has been expanded to overcome the graft shortage and disparity between supply and demand in pediatric and adult recipients. It has been widely used worldwide and has become an effective, life-saving alternative to deceased donor liver transplantation. However, major concerns about LLD's safety, cause controversy and limit the use of LDLT to overcome organ shortages, driving the focus of the medical community to establish procedures to ensure

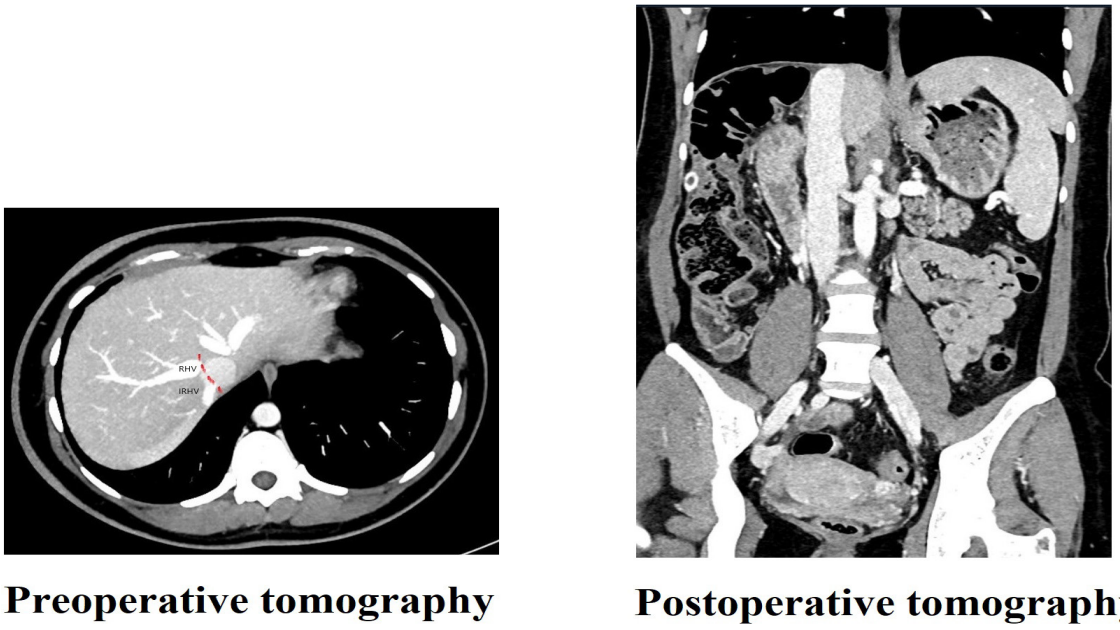

Figure 2: Control contrast-enhanced computed tomography. Left: Pretoperative time. Right: Postoperative time with no signs of stenosis in the inferior vena cava (IVC).

LLD's safety during the process of living donation and conducting safe surgery.

Although the reported mortality of LLDs is low (0.3 to 0.5 %), the reported morbidity varies from 0% to 78.3% [5-7]. Complications related to LLD can be divided into three groups as intraoperative, early postoperative, and late postoperative complications. Among the most serious intraoperative complications are the vascular and biliary complications, including hepatic artery thrombosis, remnant portal vein complications (complete or partial injury, narrowing due to short stump), hepatic venous injuries, and iatrogenic remnant bile duct injury. With technical advancements and experience in LDLT, most of the operative challenges and problems are dealt with. Of these are vascular reconstruction techniques which are known to be a crucial prerequisite to performing this procedure with minimal morbidity and mortality risk to the healthy LLDs.

Determination of the level of transection of the graft inflow and outflow vessels and bile duct is technically challenging, to achieve the balance between ensuring donor safety and providing adequate length for safe and easy anastomosis is always tricky and occasionally very challenging causing major vascular and biliary complications. These complications are serious and may occasionally lead to graft failure [8].

Clamping and transecting short and wide RHV, might lead to narrowing of the IVC which can be mild and pass unnoticed. Symptoms from significant IVC stenosis may include leg swelling; pain; varices of lower extremities; abdominal pain; and, rarely, hematochezia, and in the long-term may lead to venous ulceration and impaired renal function in suprarenal cases. The precise limits of acceptable IVC diameter loss without clinical sequela is not known, however, narrowing with up to 20% IVC diameter loss, has been reported not to compromise venous outflow from the extremities and caused no thrombosis, obstruction, or clinical symptoms [9].

There are numerous ways to repair the IVC. These include complete IVC replacement, prosthetic and autogenous patching, as well as primary lateral venorrhaphy, which are all

are available options. Primary lateral venorrhaphy of the IVC is a fast and efficient technique used to repair IVC injuries and planned and unplanned venotomies, however it is associated with the risk of IVC narrowing and eventual stenosis and/or occlusion. Available conduits and patches are cryopreserved cadaveric veins and arteries, synthetic material like polytetrafluoroethylene, and autologous veins. Prosthetic grafts and patches expose patients to an increased risk of infection while cryopreserved venous allografts are resistant to infection, thrombosis, and aneurysmal dilatation and reasonably safe reconstruction material [10-13]. Autologous peritoneal patch has been used to reconstruct the IVC [14-16], and in LT surgery it has been used in donors to reconstruct the left hepatic vein for stenosis which developed during living donor hepatectomy [17], and in recipients for right lobe hepatic venous circumferential fence reconstruction, however with higher stenosis rate compared to reconstructions performed using saphenous vein grafts [18].

The most important problem, in this case, was the transection of RHV and IRHV together to obtain a larger orifice which was the main cause of the narrowing of the IVC. Transection of the veins into a single orifice may have facilitated the implantation of the graft into the recipient, but caused an unexpected complication in the LLD. Such maneuvers should not be used to avoid risking the LLD even if the back-table reconstruction is prolonged. Transection of the veins separately is the most appropriate approach. A clinically significant loss in the IVC diameter can be solved by cavoplasty using a cryopreserved vein patch as a safe and easy solution.

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