



Neo-Suprahepatic Cava: A Case Report of a Modified Technique for Domino Liver Transplantation

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ABSTRACT

Domino liver transplantation, introduced in 1997, originally consisted of a graft from a patient with familial amyloidotic polyneuropathy used as a donor for a compatible recipient, thus increasing the pool of hepatic grafts for liver transplantation. The aim of this report was to present a modification on the technique for outflow reconstruction in domino liver transplantation first proposed by Liu et al and Cescon et al. In this description we proposed a new technique that differs from the one mentioned above by performing a neo-suprahepatic cava, constructed using only an iliac vein graft, facilitating the anastomosis as if it was a regular cadaveric liver transplant.

IN 1997 a new concept of liver transplantation, “the domino liver transplantation” was introduced.¹ In the original description a graft from a carrier of familial amyloidotic polyneuropathy (FAP) was used as “domino donor” for a compatible recipient, increasing the pool of hepatic grafts for liver transplantation. This technique was accepted worldwide; a web-based registry for those patients was created and international experience has been reported.^{2–4}

In the first proposed technique the whole inferior vena cava was left with the domino liver, performing a standard liver transplantation in the FAP carrier. Lack of portal hypertension and collateralization made it sometimes difficult to do the procedure without using veno-venous bypass. To overcome this problem, a new alternative was proposed: to perform hepatectomy on the FAP recipient of the cadaveric liver (also donor of the FAP liver), thus preserving the vena cava (ie, the “piggy-back technique”).^{5–9} The risk of this technique is the short length of the suprahepatic veins that are left in the domino liver. The length of the suprahepatic veins should enable an easy and safe anastomosis on the recipient of the domino liver. Some authors proposed different strategies to solve the outflow of the domino liver graft.^{5–8}

The aim of this report was to present a modification on the technique originally proposed by Liu et al and Cescon et al^{6–8} for outflow reconstruction. Such modification consists of performing a venous rim or circular stump and a neo-suprahepatic cava, including the 3 orifices of the hepatic vein in a single iliac vein graft from a cadaveric donor to facilitate the end-to-end anastomosis to the recipient cuff

formed by the right, middle, and left hepatic veins using the classic everting suture.

CASE REPORT

A 35-year-old male FAP patient received a cadaveric graft at Hospital Italiano (Buenos Aires, Argentina). He became a nonrelated living donor of our recipient, a 57-year-old man with alcoholic cirrhosis and liver failure, who had a past medical history remarkable for multiple episodes of spontaneous bacterial peritonitis. His weight and height at transplantation were 91 kg and 177 cm, respectively. Informed consent was obtained. Also, the nonrelated living donor liver transplantation (domino procedure) was reported to and approved by the Argentinian organ allocation and procurement organization (Instituto Nacional Central Único Coordinador de Ablación e Implante).¹⁰

Donor Surgery

Hepatectomy was performed with piggy-back technique. A right hepatic artery from the superior mesenteric artery (SMA) was found during the dissection; therefore, the hepatic artery was transected at the common hepatic artery, preserving the gastroduodenal stump for back-table reconstruction. The hepatic veins were individually transected after a German vascular clamp was placed to preserve a common cuff of the right, middle, and left hepatic veins in the FAP donor leaving 2 separate ostiums, 1 with the left and middle hepatic veins and a second 1 with the right hepatic vein.

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Back-Table Preparation of the Domino Graft

At the back-table, the right hepatic artery was anastomosed to the gastroduodenal artery with a running suture of 7/0 polypropylene.

The appearance of hepatic veins at the end of the procurement is shown in [Figure 1](#).

We first joined the right to the middle and left hepatic veins with 6/0 Prolene to facilitate the engraftment ([Fig 1](#)). Then a cadaveric iliac vein graft was brought to the bench and it was longitudinally opened ([Fig 2](#)). The length of the iliac graft was compared with the size of the common orifice of the hepatic veins and a longitudinal opening was done on the iliac graft, leaving a vascular rim of approximately 1.5 cm, as described by Cescon et al ([Fig 3](#)).

Next, the internal edge of the rim was anastomosed to the free edge of the hepatic veins using a running suture of 6/0 Prolene. Finally, the lateral edges of the venous iliac graft were sewn to turn the rim into a cylindrical structure obtaining the shape of a neo-suprahepatic vena cava ([Fig 4](#)).

Recipient Operation

The recipient hepatectomy was performed preserving the inferior vena cava, and the engraftment was carried out between the neo-cava and the common cuff of the 3 hepatic veins. The liver received portal reperfusion with a cold ischemia of 4 hours and 40 minutes. Total time for cava and portal anastomosis was 35 minutes. The donor's common hepatic artery was sewn to the recipient's hepatic artery with a gastroduodenal patch. Intraoperative doppler ultrasound showed normal inflow and outflow into all major hepatic veins throughout the neo-cava.

DISCUSSION

The original technique used for FAP liver transplantation has been modified to encourage the use of domino sequential transplants as another source of liver grafts.

The Achilles heel of the domino transplant has been reported to be the length of the inferior vena cava for both patients (donor and recipient of FAP liver). The evolution of segmental liver transplants including splits, pediatric, and cadaveric liver donor transplantation, has made surgeons

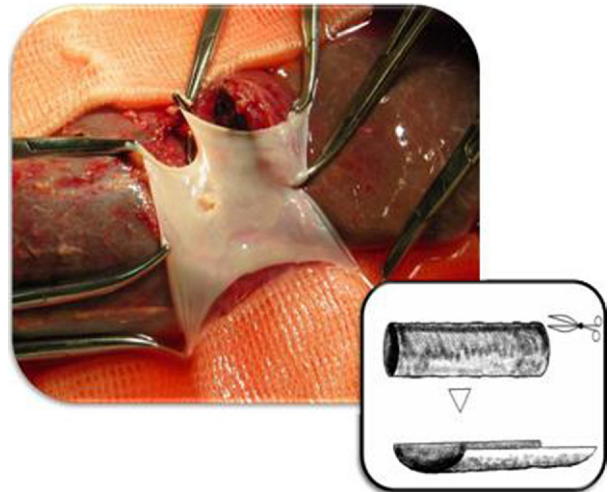


Fig 2. Performing the neo-cava, a cadaveric iliac graft is longitudinally opened.

face new and different challenges, mainly in the management of the liver outflow.^{11,12} In different reports of successful liver transplantations using FAP livers, the authors described the procurement preserving the inferior vena cava¹² and use multiple options to overcome difficult management of the liver outflow. For example, the use of a cadaveric venous graft, including the inferior vena cava and both iliac veins to anastomose the later to the liver right and middle-left hepatic veins,⁵ the use of a similar-shaped venous graft with an inverted portal vein,⁷ or the use of a venous inferior vena cava patch or rim sewn to the hepatic veins to make a wider cuff.⁶⁻⁸

In the present description we propose a new technique that differs from the technique mentioned above. We used

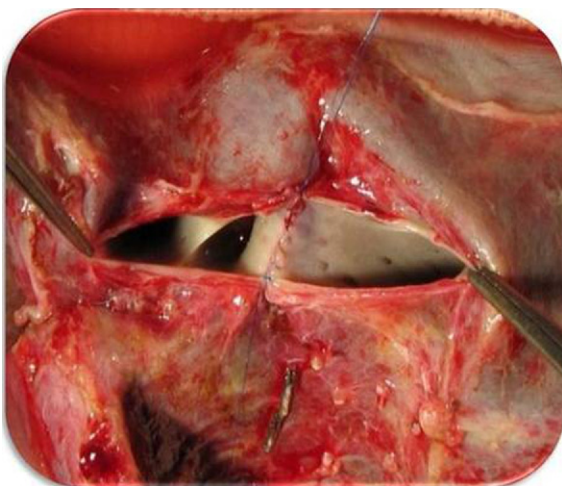


Fig 1. The ostium of the right hepatic vein is joined to the middle and left hepatic veins.

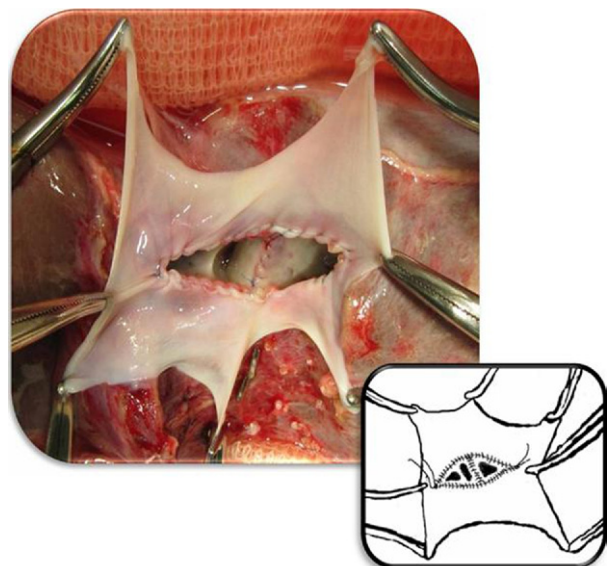


Fig 3. Construction of a venous rim.

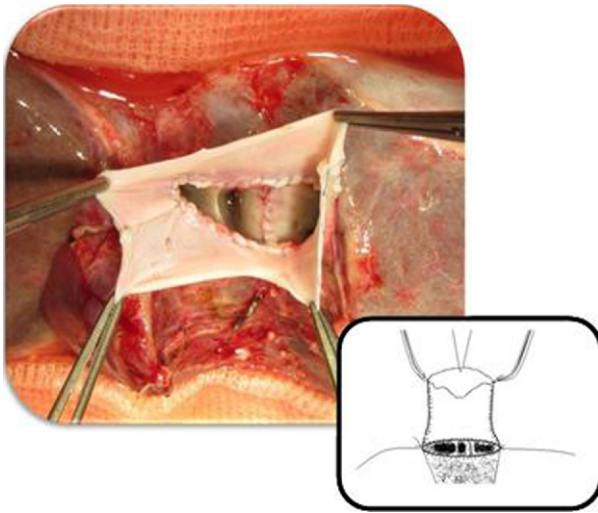


Fig 4. Converting the venous rim in a neo-cava.

a neo-suprahepatic cava, constructed using only an iliac vein graft, facilitating the anastomosis as if it was a regular cadaveric liver transplant.

An overall search of the literature shows few reports offering possibilities to help other surgeons deal with liver outflow reconstruction. Having a neo-cava would turn the outflow reconstruction of domino liver grafts into an easier procedure. In summary, this new technique might be included as part of the surgical armamentarium to avoid complications in the scenario of domino transplantation.

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REFERENCES

1. Furtado A, Tome L, Oliveira FJ, et al: Sequential liver transplantation. *Transplant Proc* 29:467, 1997
2. The Familial Amyloidotic Polyneuropathy World Transplant Registry: The Domino Liver Transplant Registry. Available at: <http://www.fapwtr.org/ram1.htm>. Accessed
3. Steen L, Holmgren G, Suhr O, et al: World-wide survey of liver transplantation in patients with familial amyloidotic polyneuropathy. *Amyloid: Int J Exp Clin Invest* 1:138, 1994
4. Herlenius G, Wilczek HE, Larsson M, et al: Familial Amyloidotic Polyneuropathy World Transplant Registry. Ten years of international experience with liver transplantation for familial amyloidotic polyneuropathy: results from the Familial Amyloidotic Polyneuropathy World Transplant Registry. *Transplantation* 77:64, 2004
5. Pacheco-Moreira LF, Oliveira M, Balbi E, et al: A new technical option for domino liver transplantation. *Liver Transpl* 9:632, 2003
6. Liu C, Loong C, Hsia C, et al: Venoplasty of hepatic venous outflow with a venous patch in domino liver transplantation. *Liver Transpl* 14:1378, 2008
7. Cerqueira A, Pacheco-Moreira L, Enne M, et al: Outflow reconstruction in domino liver transplantation with interposition of autologous portal vein graft. A new technical option in living donor domino liver transplant scenario. *Liver Transpl* 12:1298, 2006
8. Cescon M, Grazi G, Ravaioli M, et al: Modified outflow reconstruction with a venous match in domino liver transplantation. *Liver Transpl* 13:1756, 2007
9. Tzakis A, Todo S, Starlz TE: Orthotopic liver transplantation with preservation of the inferior vena cava. *Ann Surg* 210:649, 1989
10. Instituto Nacional Central Unico Coordinador de Ablacion e Implante: Argentina. Available at: <http://www.incucai.gov.ar/home.do>. Accessed
11. Sugawara Y, Makuuchi M, Imamura H, et al: Outflow reconstruction in extended right liver grafts from liver donors. *Liver Transplant* 9:306, 2003
12. Pena JR, Barroso E, Martins A, et al: Sequential whole liver transplant resected as piggy-back from FAP patients [abstract]. *Liver Transpl* 8:C-24, 2002