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CASE REPORT

Cavoportal hemitransposition for unrecognized spontaneous mesocaval shunt after liver transplantation: a case report

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Summary

Spontaneous portosystemic shunts can steal the blood away from the portal system. This may result in graft dysfunction or even loss following liver transplantation and can be sorted by shunt occlusion based on intraoperative flow measurements. Herein, we present an alternative technique with cavoportal hemitransposition performed for unrecognized spontaneous mesocaval shunt with 'portal steal' syndrome and primary graft nonfunction diagnosed first day following the transplant. This was chosen as a rescue strategy because an attempt to locate the shunt during relaparotomy was unsuccessful. As there was no improvement, emergency liver retransplantation with preservation of the cavoportal hemitransposition was performed on the fourth day after the primary transplant with good long-term outcome. We conclude that cavoportal hemitransposition during or after liver transplantation can be used to provide an adequate inflow into the donor portal vein if the shunting vessels responsible for the steal cannot be located and dealt with at surgery.

Introduction

Extensive venous collateral formation is typical in patients with liver cirrhosis and portal hypertension [1]. The collaterals may be diagnosed as large spontaneous portosystemic shunt (SPS) with the potential to steal the blood away from the portal system both prior to and after liver transplantation (OLT). This may result in a flow-steal effect compromising the inflow into the donor portal vein varying from a reduced portal vein flow velocity, complete absence of the flow or a reversed flow in its main trunk [1–5]. An unrecognized SPS during OLT have been previously reported to cause graft dysfunction which may lead to its loss and portal vein thrombosis in some cases. The preventive or treatment strategy includes restoration of portal flow by either direct shunt ligation or left renal vein ligation or renoportal anastomosis in case of spontaneous splenorenal shunting [3–5].

We describe an alternative approach of cavoportal hemitransposition (CPH) performed for an unrecognized mesocaval shunt with graft hypoperfusion diagnosed on the first day after OLT. The technique includes anastomosis between the inferior caval vein of the recipient and the portal vein of the graft and has been used during the transplant in the face of extensive portal and mesenteric vein thrombosis [6,7]. Herein, we propose its application as an option to rescue the graft if the dominant shunt cannot be identified and safely approached during surgery. To our best knowledge, the application of CPH for a SPS has not been reported so far.

Case report

A 20-year-old woman with hepatitis B-related cirrhosis, Child-Pugh C11, MELD 15 was accepted for OLT at our institution. The deceased donor OLT using the modified

piggyback technique with end-to-side cavocavostomy was performed in March 2011. The preoperative three-phase CT angiography revealed a large spontaneous mesocaval shunt in the lower abdomen (Fig. 1), which was ignored by the operating surgeons. Therefore, no intraoperative Doppler flow measurement was applied. As usually, the portal flow was only assessed visually before implantation and considered normal. The laboratory results on the first postoperative day revealed signs of primary graft nonfunction (AST 19840 IU/l, INR 6.2, arterial lactate 7.3 mmol/l)

Figure 1 CT venography showing a large spontaneous mesocaval shunt in the lower abdomen (arrow).

Figure 2 CT venography showing a patent mesocaval shunt (big arrow) and loss of flow in the portal vein (small arrow) on the first day following OLT.

accompanied by the absence of portal flow detected with Doppler ultrasound and CT angiography (Fig. 2). The patent mesocaval shunt was clearly visible strongly suggesting the 'portal steal' phenomenon with good outflow confirmed by a triphasic waveform on Doppler ultrasound of the hepatic veins of the graft. Emergent relaparotomy was performed around 30 h after the graft reperfusion at OLT. An attempt to find and locate the mesocaval shunt was unsuccessful. Therefore, a decision was made to leave the shunt intact and perform a CPH [6,7]. For this purpose, the portal vein of the recipient was ligated. The iliac vein interponate from a deceased donor was then anastomosed to the caval vein of the recipient at the level of the left renal vein in an end-to-side fashion. After that, an end-to-end anastomosis between the other end of interponate and the donor portal vein was made and the graft was reperfused. The recipient caval vein was then narrowed to around 20–25% of its lumen using a Dacron sleeve placed around it centrally to its anastomosis with the iliac vein interponate [7,8]. This was aimed to provide a hepatopetal flow into the portal vein of the graft allowing part of the flow to be diverted from the portal vein to avoid congestion of the liver. This was confirmed by both normal hepatopetal portal flow pattern in the Doppler ultrasound and CT angiography performed immediately after surgery. Despite restoration of normal flow in the portal vein of the graft, the signs of primary graft nonfunction persisted. In view of this, the patient was accepted for emergency re-OLT which was performed 4 days after the primary transplant. The surgical technique combined the same modified piggyback graft implantation with preservation of CPH that had been previously created. The iliac vein interponate was removed and a direct cavoportal anastomosis with the portal vein of the new graft was performed in an end-to-side fashion. After the reperfusion, the arterial and biliary anastomoses were typically done. The patient was extubated on the third day following re-OLT resuming full regular diet 3 days thereafter. The postoperative course was complicated by the formation of hematoma around the left lobe of the liver which needed reoperation and its removal on the 12th day following re-OLT. No complications were observed thereafter. The liver function tests normalized completely within 2 weeks after re-OLT with no signs of renal insufficiency and no edema of lower extremities observed. The ascites production decreased till less than 300 ml/day 15 days after re-OLT, when the abdominal drain was removed. Both postoperative Doppler ultrasound and CT angiography (Fig. 3) documented normal flow through the portal vein of the graft. The patient was discharged home in good general condition 21 days following re-OLT. She remains well with normal liver function and good quality of life at 20 months of follow-up at present.

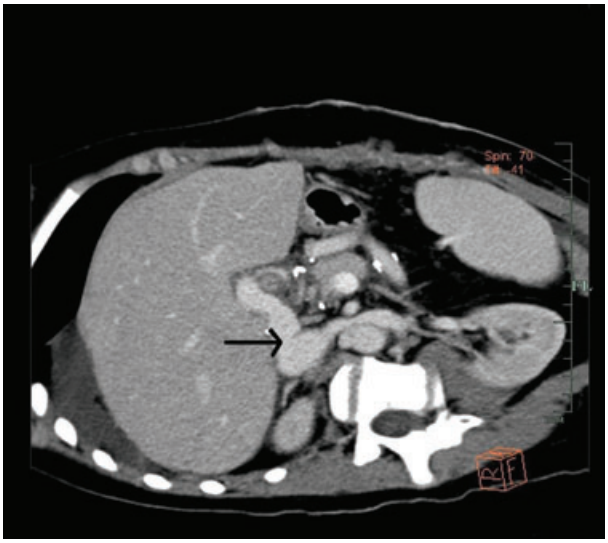

Figure 3 CT venography following re-OLT showing cavoportal hemitransposition with the donor portal vein (arrow) anastomosed to the caval vein of the recipient at the level of the left renal vein.

Discussion

The adequate hepatopetal flow in the portal vein of the graft is essential for the transplanted liver [1,2,9]. It may become significantly reduced in case of a large SPS causing so-called 'portal steal' phenomenon. Therefore, precise intraoperative assessment of portal vein flow direction, its velocity [9], and sometimes pressure [10] is mandatory. The decision to occlude the shunt should be based both on demonstration of a steal and its reversibility following a trial occlusion of the shunt [9–12]. No flow measurements were performed by the surgeons following reperfusion of the graft in our patient which created problems later on.

After whole-organ OLT with an adequate-sized graft, SPS tend to diminish and become nonfunctional because of a low resistance vascular bed of the new liver [13]. This is less true for partial living donor OLT with a small graft-to-recipient body weight ratio. In such cases, the presence of portal hypertension and high intrahepatic resistance may be more commonly seen. For this reason, routine closure of SPS during living donor OLT with small for size grafts have been recommended and applied by many authors [4,14–16]. The spontaneous closure of the shunt after whole-organ OLT may also be delayed or not occur at all leading to graft failure [1,2,5,10]. This was the case in our patient in whom we were unable to identify the shunt during emergent relaparotomy on the first day after OLT. Therefore, the decision was made to perform a CPH. This was chosen as a rescue option, even though a direct end-to-end anastomosis between the allograft and recipient portal vein remains the first choice technique in this setting. However, we were faced with the necessity to provide an adequate hepatopetal flow to the portal vein of the graft and preferred to avoid further and potentially dangerous retroperitoneal dissection looking for a shunt.

CPH remains an accepted option for patients with extensive portal and superior mesenteric vein thrombosis when no alternative collateral vein is available [6–8]. In spite of its application in our patient, graft function did not improve requiring urgent re-OLT to save the patient's life. In view of the good long-term outcome achieved following re-OLT with CPH preserved, we believe that this salvage procedure would have had a very good chance of saving the first graft provided it had been performed early enough. Percutaneous embolization of the shunt could also be a good and much less invasive alternative in this setting [17–19]. This can be done by either a transhepatic or transjugular approach and in case of postoperative complications could represent the first choice strategy in experienced centers.

SPS are not always recognized during OLT as intraoperative portal vein flow assessment is not routinely applied. This indicates that triple-phase CT angiography with vascular reconstruction prior to OLT is of particular importance in patients with liver cirrhosis. This is essential for surgical treatment planning and anticipating the need for intraoperative portal vein flow measurement. Low portal vein flow after graft implantation indicates the possibility of a SPS present necessitating a search for it. Some evidence suggest that these shunts should be routinely closed after graft reperfusion if the portal vein flow stays below 1000 ml/min, in particular if a clamping test of the shunt shows a significant difference [11,20]. In contrast, however, shunt ligation may be considered dangerous, in particular following living donor OLT, if an excessive portal vein flow has been found. This may lead to the impairment of the flow in the hepatic artery via the hepatic artery buffer response [11].

In conclusion, proper visualization of portal venous anatomy by triple-phase CT with vascular reconstruction performed prior to OLT in patients with cirrhosis is crucial. Once a large SPS is identified, intraoperative pressure and/or flow measurement in the portal vein appears mandatory for the decision-making. Cavoportal hemitransposition can be a rescue strategy to provide an adequate inflow into the donor portal vein if the shunting vessels responsible for the steal cannot be located and dealt with at surgery.

Authorship

TC: collected the data and wrote the manuscript. KZC: contributed in writing the manuscript, selected figures with imaging. MW: performed surgery, contributed in writing and revised the manuscript.

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References

1. De Carlis L, Del Favero E, Rondinara G, *et al.* The role of spontaneous portosystemic shunts in the course of orthotopic liver transplantation. *Transpl Int* 1992; **5**: 9.
2. Margarit C, Lazaro JL, Charco R, Hidalgo E, Revhaug A, Murio E. Liver transplantation in patients with splenorenal shunts: intraoperative flow measurements to indicate shunt occlusion. *Liver Transpl Surg* 1999; **5**: 35.
3. Miyamoto A, Kato T, Dono K, *et al.* Living-related liver transplantation with renoportal anastomosis for a patient with large spontaneous splenorenal collateral. *Transplantation* 2003; **75**: 1596.
4. Lee SG, Moon DB, Ahn CS, *et al.* Ligation of left renal vein for large spontaneous splenorenal shunt to prevent portal flow steal in adult living donor liver transplantation. *Transpl Int* 2007; **20**: 45.
5. Shapiro RS, Varma CV, Schwartz ME, Miller CM. Splenorenal shunt closure after liver transplantation: intraoperative Doppler assessment of portal hemodynamics. *Liver Transpl Surg* 1997; **3**: 641.
6. Tzakis AG, Kirkegaard P, Pinna AD, *et al.* Liver transplantation with cavoportal hemitransposition in the presence of diffuse portal vein thrombosis. *Transplantation* 1998; **65**: 619.
7. Azoulay D, Hargreaves GM, Castaing D, *et al.* Caval inflow to the graft: a successful way to overcome diffuse portal system thrombosis in liver transplantation. *J Am Coll Surg* 2000; **190**: 493.
8. Varma CR, Mistry BM, Glockner JF, *et al.* Cavoportal hemitransposition in liver transplantation. *Transplantation* 2001; **72**: 960.
9. Yagi S, Iida T, Hori T, *et al.* Optimal portal venous circulation for liver graft function after living-donor liver transplantation. *Transplantation* 2006; **81**: 373.
10. Cherqui D, Panis Y, Gheung P, *et al.* Spontaneous portosystemic shunts in cirrhotics: implications for orthotopic liver transplantation. *Transplant Proc* 1993; **25**: 1120.
11. Aucejo FN, Hashimoto K, Quintini C, *et al.* Triple-phase computed tomography and intraoperative flow measurements improve the management of portosystemic shunts during liver transplantation. *Liver Transpl* 2008; **14**: 96.
12. Rasmussen A, Hjortrup A, Kirkegaard P. Intraoperative measurement of graft blood flow – a necessity in liver transplantation. *Transpl Int* 1997; **10**: 74.
13. Paulsen AW, Klintmalm GB. Direct measurement of hepatic blood flow in native and transplanted organs, with accompanying systemic hemodynamics. *Hepatology* 1992; **16**: 100.
14. Fujimoto M, Moriyasu F, Nada T, *et al.* Influence of spontaneous portosystemic collateral pathways on portal hemodynamics in living-related liver transplantation in children. Doppler ultrasonographic study. *Transplantation* 1995; **60**: 41.
15. Sadamori H, Yagi T, Matsukawa H, *et al.* The outcome of living donor liver transplantation with prior spontaneous large portasystemic shunts. *Transpl Int* 2008; **21**: 156.
16. Shirouzu Y, Ohya Y, Tsukamoto Y, *et al.* How to handle a huge portosystemic shunt in adult living donor liver transplantation with a small-for-size graft: report of a case. *Surg Today* 2009; **39**: 637.
17. Vavasseur D, Duvoux C, Cherqui D, *et al.* Chronic hepatic encephalopathy due to spontaneous splenorenal shunt: successful treatment by transhepatic shunt embolization. *Cardiovasc Intervent Radiol* 1994; **17**: 298.
18. Uflacker R, Silva AO, Carneiro d'Albuquerque LA, Piske RL, Mourao GS. Chronic portosystemic encephalopathy: embolization of portosystemic shunts. *Radiology* 1987; **165**: 721.
19. Boixadena H, Tomasello A, Quiroga S, Cordoba J, Perez M, Segarra A. Successful embolization of a spontaneous mesocaval shunt using the Amplatzer Vascular Plug II. *Cardiovasc Intervent Radiol* 2010; **33**: 1044.
20. Castillo-Suescun F, Oniscu GC, Hidalgo E. Hemodynamic consequences of spontaneous splenorenal shunts in deceased donor liver transplantation. *Liver Transpl* 2011; **17**: 891.