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BRIEF REPORT

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Hepatic vein obstruction due to hypertrophy of right split-liver adult allograft

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Abstract The increasing shortage of liver allografts has led to the development of split liver transplantation. More frequent applications have permitted the resolution of most of its technical complications. A hitherto unreported complication of split liver transplantation, hepatic vein obstruction caused by hypertrophy of a right split-liver adult allograft, is discussed. As surgical correction was impossible, the outflow obstruction was treated successfully with interventional radiology.

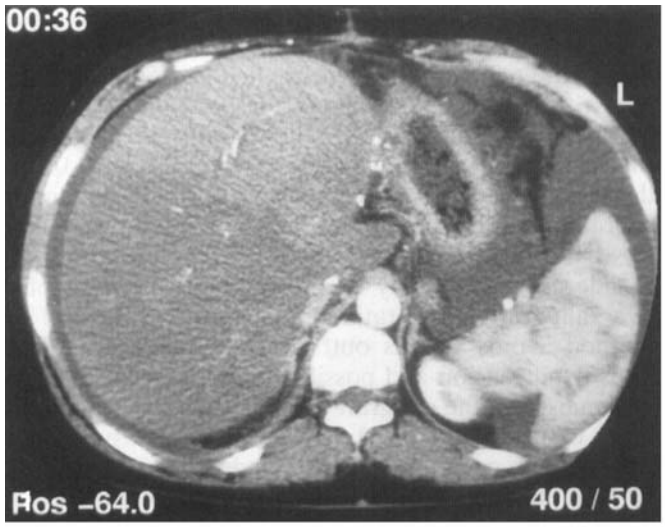
Keywords Liver transplantation · Split-liver transplantation · Hepatic vein obstruction · Interventional radiology

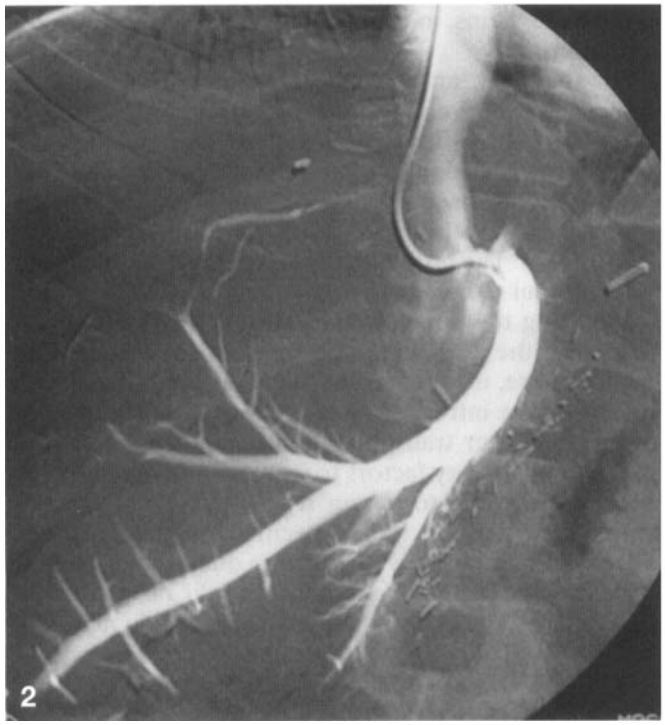
Abbreviations *D-US* Doppler-ultrasound · *IVC* Inferior vena cava · *(SP)LT* (Split-) liver transplantation

Introduction

The steadily growing success of liver transplantation (LT) and the stagnation of the number of donors resulted in the development of innovative transplantation techniques such as reduced-size and split-liver transplantation (SPLT) [2, 7, 13]. SPLT did not receive wide acceptance due to its increased organisational and technical complexity. Indeed, certain technical complications, such as arterial thrombosis, biliary (intra- and extra hepatic) problems, and bleeding originating from the section margin have been reported even in experienced centers [1, 2, 3, 13].

All these problems have been mastered by technical adaptations [2, 13]. In particular, bleeding from the section margin due to inadequate venous drainage, has been solved by the piggy-back implantation technique with the use of side-to-side anastomosis between donor- and recipient inferior vena cava (IVC) [6]. The authors present a hitherto unreported complication of split liver transplantation (SPLT); venous outflow obstruction due to the hypertrophy of the implanted right liver graft.





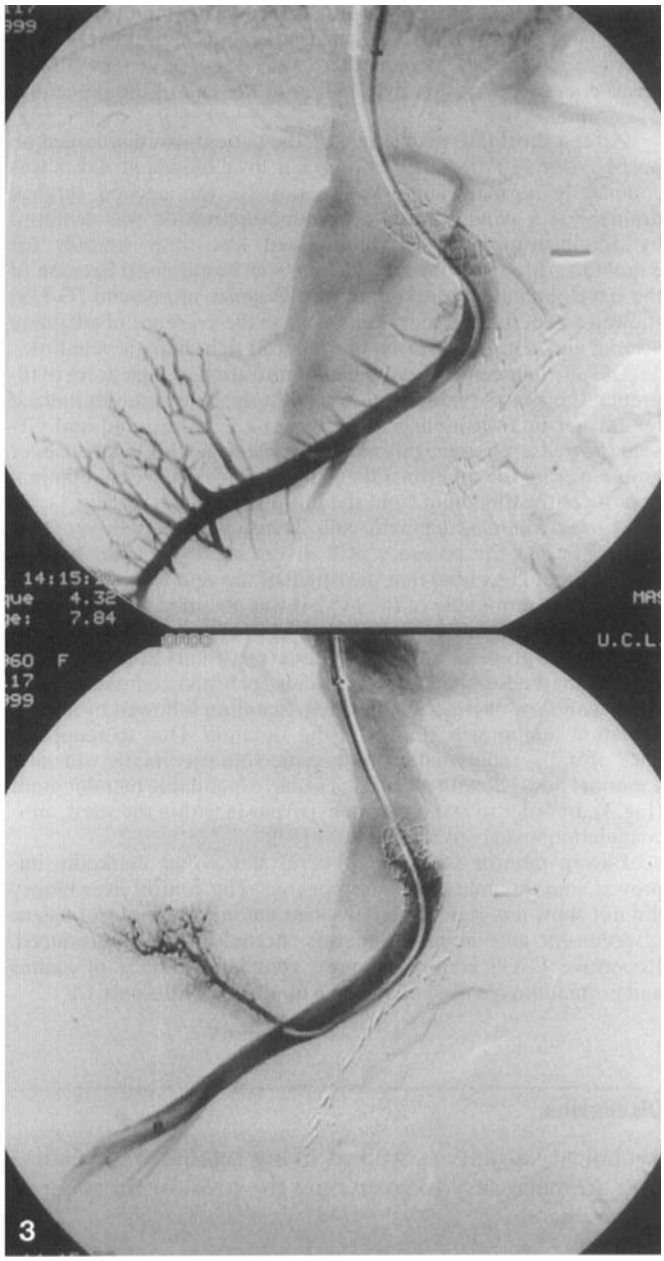


Fig. 1 CT-scan 3 months after right split liver grafting showing graft hypertrophy englobing the inferior vena cava. There is a difference in contrast material clearing between the medial and the lateral parts of the graft

Fig. 2 Transjugular hepatic venography shows a right hepatic vein stenosis due to torsion of the graft

Fig. 3 The hepatic vein stenosis was corrected by placement of a metallic expandable stent

Case report

A 38.5-year-old portuguese woman underwent transplantation on May 29, 1998 for hereditary amyloïdosis. Presence of biopsy-proven autoimmune hepatitis precluded the possibility of a domino LT. Implantation of a right split liver graft was carried out using cavo-cavostomy. No blood transfusion was necessary. Splitting was done ex-situ, guided by cholangiography and angiography. When implanting the graft using latero-lateral cavo-caval anastomosis, the supra- and infrahepatic caval cuffs were closed, using running sutures. The suture of the proximal cava cuff was far away from the ostium of the right hepatic vein. Moreover, the posterior cavotomy encompassed largely this ostium. The implantation method therefore did not interfere in the least with the venous outflow drainage of the graft. At the end of the intervention, the

right split liver filled up the natural liver fossa next to the right side of the IVC. Intraoperative flow measurements showed very good arterial and venous perfusion, there was no sign of venous outflow obstruction. Reperfusion liver biopsy at the end of the procedure was normal.

After a short intensive care stay, the patient was discharged on post-LT day 7. Percutaneous protocol liver biopsy at day 7 was completely normal. Three weeks post-LT she needed surgical drainage of a wound abscess. Immunosuppression was achieved by administration of tacrolimus and low dose steroids for 3 months. Three months post-LT, she was hospitalised because of the development of marked ascites. Doppler ultrasound (D-US) showed a hyperechogenic parenchyma in the presence of adequate arterial and venous perfusion but reduced right hepatic vein flow.

Despite paracentesis and the administration of high doses of diuretics, the ascites remained untractable, so she was rehospitalized for further investigations 5 months post-LT. Ultrasound and CT-scan showed a splenomegaly and a notable hypertrophy of the liver graft *covering* the anterior side of the IVC with unequal elimination of contrast medium from the left part of the graft (Fig. 1). D-US showed a stenosed hepatic vein. Transjugular hepatic venography confirmed the presence of a severe stenosis of this hepatic vein. It should be noted that the origin of the vein was now located at the left anterior side of the IVC; it was assumed that this was a consequence of graft hypertrophy (Fig. 2). There was no stenosis nor pressure gradient at the cavo-caval anastomosis. Liver biopsy showed marked dilatation of sinusoids (peliosis) compatible with venous outflow obstruction. Balloon dilatation followed by anticoagulation temporarily improved the situation. Due to reappearance of untractable ascites, the hepatic vein was finally widened, 7 months post-LT, with an endovascular, expandable metallic stent (Fig. 3). In order to avoid intima hyperplasia within the stent, anticoagulation was given for 3 months [10].

Eleven months later, her general status had markedly improved, and the ascites had disappeared. The control liver biopsy did not show any sign of venous obstruction. As there were signs of recurrent autoimmune hepatitis, steroids were reintroduced. Repetitive D-US controls showed complete absence of ascites and normal flow in the hepatic vein up to 37 months post-LT.

Discussion

Technical variants as well as living related transplantation are necessary to overcome the present shortage of livers [2, 7, 8, 12, 13]. With growing experience, liver splitting has become a safe intervention [2]. Both ex- and in-situ techniques can be applied to effect safe liver repartition [2, 5, 9, 13]. The use of back-table cholangiography and angiography allows safe repartition of the hilar structures between the two grafts [13]. In order to avoid stenosis at the anastomosis between donor suprahepatic (IVC) cuff and recipient hepatic vein cuff [5, 8], the piggy-back implantation technique with side-to-side cavo-cavostomy was developed for right split-liver allograft implantation in our unit in 1994. This method avoids venous outflow with the resulting venous hypertension and possible bleeding from the section margin of the allograft [6]. The right liver lobe falls in its natural bed (fossa), and this allows easy realisation of cavo-caval anastomosis under partial clamping of the recipient IVC. The posterior cavotomy of the donor IVC must, however, encompass the orifices of the hepatic veins, in order to avoid venous outflow obstruction.

In summary, an unusual complication of split-liver transplantation, venous outflow obstruction due to graft rotation, caused by major hypertrophy, is reported. Routine D-US might be helpful for the early detection of venous outflow obstruction [4]. The anatomical condition caused by this modification precluded surgical re-exploration. The problem was treated successfully by interventional radiology.

Splitting the donor liver represents the best way to maximize the available donor liver pool. With increasing expertise, most of its technical problems have been resolved. The introduction of in-situ splitting and of living related liver transplantation techniques have been major contributory factors to its recent development [9, 11], allowing one to obtain results similar to those of whole liver grafting. Some specific complications, such as venous graft outflow obstruction due to split-allograft hypertrophy, as described here, should be recognized timely in order to allow graft salvage by adequate correction.

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