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Replacement of the retrohepatic vena cava in segmental liver transplantation

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Abstract Reduced grafts represent an important technical development in paediatric liver transplantation. The use of a left lateral segment graft has required preservation of the native inferior vena cava to "piggy-back" the graft onto it. We report four children who underwent left lateral segment transplantation with caval replacement using the donor iliac vein because the native retrohepatic inferior vena cava was small, friable or difficult to preserve. There were no caval or hepatic vein complications post-transplant and the donor iliac vein proved to be a satisfactory interpositional graft. The technique offers the advantages of a wider retrohepatic cava avoiding venous outflow or caval obstruction, provides good tissue to suture and is well suited for the triangulation technique of the left hepatic vein.

Key words Segmental liver transplantation, vena cava replacement · Vena cava replacement, segmental liver transplantation · Liver transplantation, segmental, vena cava replacement

Introduction

Knowledge of the segmental anatomy of the liver has led to the establishment of hepatic reduction [1] as an important advance in paediatric liver transplantation and the development of split and living related liver transplantation [4, 6, 9]. The development of the "piggy-back" technique [5] has allowed the use of a left lateral segment graft (LLS; hepatic segments 2 and 3) for transplanting smaller recipients with a donor:recipient weight ratio of 10:1. The native liver has to be filleted off the retrohepatic inferior vena cava (IVC) by dividing all venous tributaries coming between the liver and the IVC. The donor left hepatic vein is anastomosed to a

Table 1 Replacement of the retrohepatic vena cava in segmental liver transplantation (*IVC* inferior vena cava, *NA-NB hep* non A-non B hepatitis, *OLT* orthotopic liver transplantation, *HAT* hepatic artery thrombosis)

No	Age (months)	Sex	Weight (kg)	Diagnosis	Native liver	Cause IVC replacement	Follow-up (Time)
1	96	M	19	Cryptogenic cirrhosis	Hard and distorted	Difficult to dissect IVC	Well (21 months)
2	1	M	2.7	Neonatal hemangio-endothelioma	Replaced by massive haemangioma	IVC very narrow	Well (18 months)
3	1	M	3.5	NA-NB hep, OLT, HAT	Left lobe graft with neonatal IVC	Retransplant	Died (2 days)
4	9	M	7.5	Extra-hepatic biliary atresia	Small compressed IVC	Distorted IVC after separation	Well (17 months)

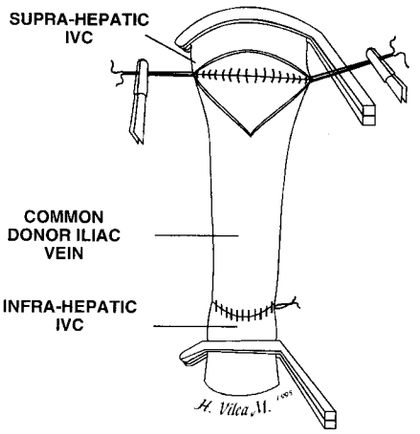

Fig. 1 Replacement of the retrohepatic vena cava in segmental liver transplantation

common orifice of the recipient hepatic veins using a "triangulating" technique to avoid venous outflow obstruction [2] and caval narrowing.

On occasion the retrohepatic IVC is small, friable or difficult to preserve, particularly in neonates, and caval replacement with the donor iliac vein graft has proved to be a satisfactory solution. We report four cases of IVC replacement in children undergoing LLS transplantation.

Patients and surgical technique

From 1989 to 1995, 117 orthotopic liver transplantations (OLT) using reduced grafts were performed in children and of these, 58 were LLS grafts. Four male children, median age 5 months (range 1–96 months) and median weight 5.5 kg (range 2.7–19 kg), under-

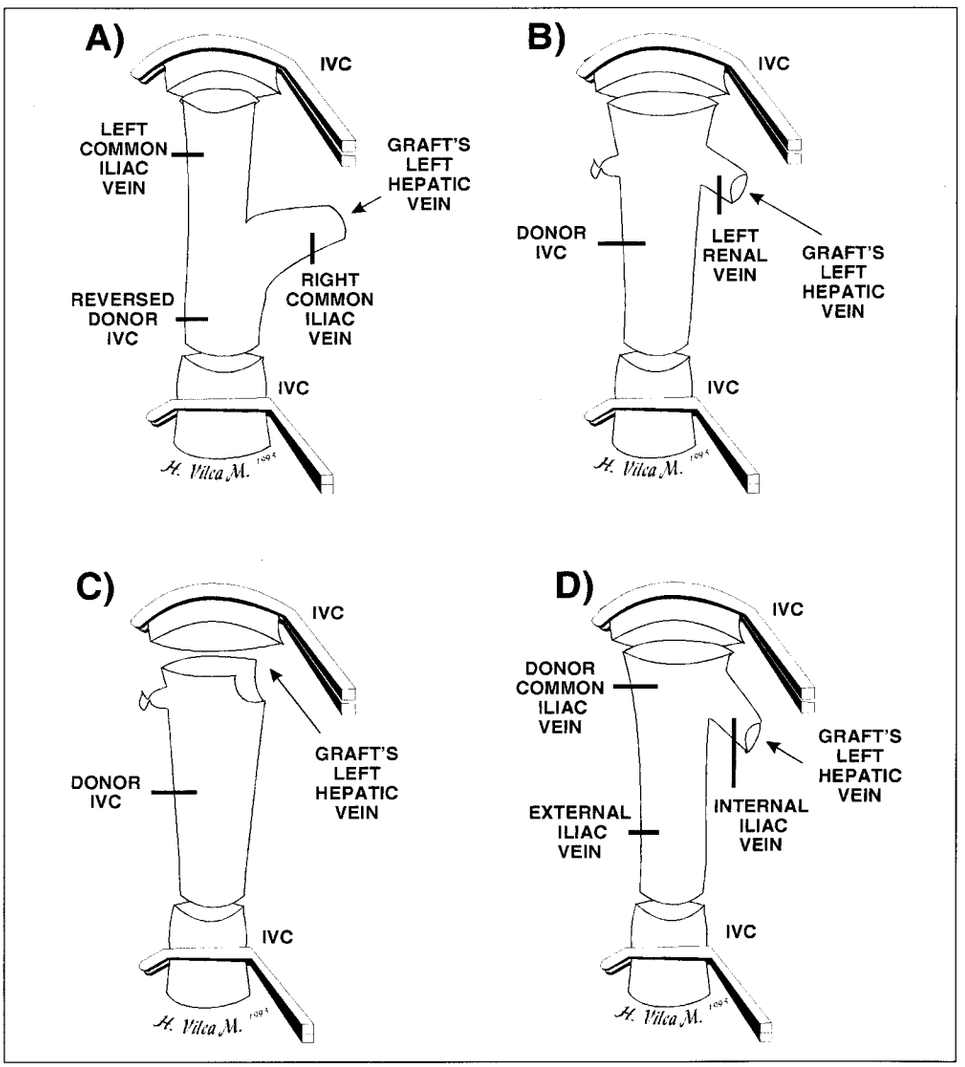

Fig. 2A–D Surgical techniques of caval replacement in liver transplantation: **A** Starzl TE, et al. 1980; **B** Tanaka K, et al. 1993; **C** Hayashi S, et al. 1995; **D** Praga Pillay S, et al. 1995

went IVC replacement during segmental liver transplantation. Their clinical features are summarized in Table 1.

In all four cases, the iliac vein from the same liver donor (median donor weight 37 kg, range 6–70 kg) had been preserved in University of Wisconsin solution and was used as an interpositional caval graft. The surgical technique was end-to-end anastomosis of the donor iliac vein to the infrahepatic vena cava with continuous 5/0 or 6/0 monofilament polypropylene suture, leaving a "growth factor" of one-third the diameter. The posterior wall of the proximal donor iliac vein was anastomosed to the posterior wall of the suprahepatic caval cuff and a V-shape was cut into the anterior wall of the proximal donor iliac vein (Fig. 1). The graft left hepatic vein was then anastomosed using a triangulation technique. Post-transplant clinical and ultrasound follow-up did not reveal any caval or hepatic vein complications after a median follow-up of 18 months. One child (case 3) died 2 days after surgery (emergency retransplant) with severe sepsis and multiorgan failure. There was no evidence of IVC thrombosis or hepatic outflow obstruction at postmortem.

Discussion

In general surgery, replacement of the IVC has been attempted both for venous occlusive disease and to repair the IVC after excision of malignant tumours using polytetrafluorethylene (PTFE) grafts, saphenous vein or Dacron. These procedures have had varying degrees of success.

Replacement of the retrohepatic vena cava for segmental liver transplantation has been reported using a variety of techniques (Fig. 2). A reversed vena cava-iliac homograft (Fig. 2A) has been used, but the patient died 20 days later with hepatic artery thrombosis [8]. Replacement with donor IVC with the renal veins attached (Fig. 2B) [10] and anastomosis of donor IVC to the segmental hepatic graft at backtable surgery (Fig. 2C) [3] have been reported in experimental split liver transplantation. Interposition of the donor iliac vein has been used before, but the technique described was to anastomose the left hepatic vein to the donor external iliac vein (Fig. 2D) [7], retaining a significant risk of twisting and subsequent outflow obstruction.

In our experience, the need for IVC replacement is limited to a small number of left lateral segment transplants with a small or friable IVC, particularly in neonates. The donor iliac vein is a satisfactory interpositional graft and is always available as it is retrieved routinely. This technique offers the advantages of a wider retrohepatic cava with less likelihood of caval or hepatic venous outflow obstruction caused by twisting or caval narrowing, it provides good tissue to suture the graft to and it allows the use of a triangulation technique of anastomosis.

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