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U. J. Hesse
L. Defreyne
P. Pattyn
I. Kerremans
F. Berrevoet
B. de Hemptinne

Hepato-venous outflow complications following orthotopic liver transplantation with various techniques for hepato-venous reconstruction in adults and children

U. J. Hesse (✉) · L. Defreyne · P. Pattyn · I. Kerremans · F. Berrevoet · B. de Hemptinne
Department of Surgery and Radiology, University Hospital Ghent, B-9000 Ghent, Belgium

Abstract Orthotopic end-to-end cavostomy following liver transplantation was without any complications in 63 cases as compared to latero-lateral cavostomy (14.2 %) and the piggy-back technique of partial liver grafts (14.2 %). Transjugular catheterangioplasty was a practical and successful treatment for the latter, while reoperation for thrombosis in the latero-lateral anastomosis resulted in lethal pulmonary embolism.

Key words Liver transplantation · Complications · Surgical techniques

Introduction

The cavo-caval end-to-end anastomosis in orthotopic liver transplantation is less frequently associated with complications than the arterial or portol-venous anastomosis because of the large size of the anastomosis and the voluminous blood flow. However, with the increasing use of modified liver grafts such as reduced livers or partial livers as obtained from split liver transplantation, modified techniques for the anastomosis of the hepato-venous junction have recently been described [1–5]. Exceptionally, complications with these anastomoses and their treatment have been reported [4, 7]. Our own experience with these techniques regarding the incidence, clinical outcome and morphology of complications, the diagnostic approach and therapy is presented.

Patients and methods

Between May 1991 and December 1994 a total of 110 liver transplants was performed in 76 adults and 34 children. Transplantation was in 75 % ($n = 81$) of cases with a full-size liver (FS), was in 11 % ($n = 12$) of cases a reduced-size liver (RED) in which the vena cava was preserved and in 14 % ($n = 17$) of cases a partial liver (PL) graft in which only the vena hepatica was preserved for the anastomosis (three of these were from living related donors).

Three different techniques were employed to reconstruct the hepato-venous outflow. In the majority of cases ($n = 63$), an orthotopic replacement of the vena cava was performed, with end-to-end anastomosis of the donor vena cava to the recipient vena cava. The so called piggy-back[3] technique was performed in 35 cases, mainly in paediatric patients with an end-to-side hepato-caval, cavo-caval anastomosis or an end-to-end anastomosis of the recipient and the donor hepatic veins, depending on the anatomy of the graft used, i.e. reduced or partial grafts with or without preservation of the donor vena cava, respectively. A latero-lateral cavo-cavostomy [1, 2] was performed in 12 cases.

The use of veno-venous bypass, preservation time in minutes and operating time in minutes during transplantation were registered. The postoperative course and the diagnostic approach in case of complication, including the results of daily ascites production, Doppler sonography and angiography, were analysed.

For transjugular intravascular venoplasty, a number 5 French Cobracatheter was used for cannulation and an Olbert catheter with a 6- to 8-mm balloon was used for dilatation. The patients were followed for a median time of 24 months posttransplantation. For statistical analysis, a Man-Whitney U test was used to compare quantitative differences and a Chi^2 test to compare qualitative differences. Differences were significant when $P < 0.05$.

Results

Veno-venous bypass was used in 39 patients with orthotopic vena cava replacement (62 %) and only in 7 (20 %) patients in whom a piggy-back procedure was performed. When the latero-lateral anastomosis was done, the bypass was never used. The operating time and the preservation time did not differ in the subgroups (Table 1). Regarding the complications relating to graft size and technique applied, there were a total of three

Table 1 Veno-venous bypass, operation time and cold ischaemia time according to the anastomosis used

Anastomosis	Number of patients		Mean operation time (min)	Mean cold ischaemia time (min)
	With bypass	Without bypass		
Orthotopic	39	24	665	798
Piggy-back	7	28	690	875
Latero-lateral	0	12	656	852

arterial thromboses, no portal vein thromboses and three complications (3.4 %) at the hepato-venous reconstruction. The latter complications occurred significantly more frequently with the modified techniques than with orthotopic vena cava replacement ($P = 0.01$) (Table 2).

One adult patient who received a FS liver transplant in which the anastomosis was performed following the technique of Belghiti et al. [1] (latero-lateral cavo-costomy) developed, 7 days posttransplant, a partial thrombosis at the anastomosis. As diagnosed by echography and angiography, two paediatric recipients of partial liver grafts undergoing a piggy-back anastomosis developed a stenosis that could be successfully dilated in one patient at the 63rd and 145th day and in the other at the 56th and 89th day posttransplantation. In the single patient who developed a partial thrombosis in the latero-lateral cavo-cavostomy, reoperation resulted in a lethal lung embolism. Reduced-size liver transplant with preserved donor vena cava did not develop complications at the hepato-venous anastomosis, in common with the full-sized liver with orthotopically replaced vena cava.

Discussion

The orthotopic cavo-caval end-to-end cavostomy following liver transplantation was not associated with complications in this series. In contrast, one patient with a latero-lateral cavo-cavostomy and two patients with the termino-lateral piggy-back technique had to be treated for complications at the anastomosis. Certainly, each of these techniques has its particular indication, regardless of the advantage that veno-venous bypass does not have to be employed during implantation. However, complications at the reconstructed anastomoses have to be anticipated, as was recently reported [5–7]. During piggy-back anastomoses, the vena cava can be stenosed due to the manipulations, which might be treated by additional latero-lateral cavo-cavostomy [6]. The problems with the rotation of liver segments at the hepato-venous anastomoses have been described in particular with reduced-size grafts [4] and preexisting vena cava abnormalities can also cause complications at the anastomosis [7]. The piggy-back anastomosis was stenotic in the two patients who were transplanted with a partial liver graft without preserved donor vena cava, while this complication did not occur in the patients who received a transplant with preserved vena cava of the donor, most certainly due to the larger diameter of the vena cava as compared to that of the hepatic veins. The transjugular catheter angioplasty was useful in the therapy of stenosis in these cases. A similar experience was recently reported in a series using only segmental grafts from living relatives [5]. The partial thrombosis that occurred with the latero-lateral cavo-cavostomy might have been due to the siphon-like blood flow associated with this technique. To our knowledge, no such complication has been reported until now. The face-à-face cavoplasty as described by Bismuth [2] avoids the siphon forming. The preparation of the anastomosis, however, appears to be more difficult than the preparation of the latero-lateral cavo-cavostomy. This particular complication occurred in the early experience with this technique and has to be seen in the context of a learning curve. Nevertheless, its occurrence should be anticipated in order to employ appropriate therapeutic measures.

Table 2 Complications

Anastomosis	Liver size	Arterial thrombosis	Portal vein thrombosis	Hepato-venous reconstruction/ stenosis	Bleeding
Orthotopic	Full size	2	0	0	12
$n = 63$	Reduced	0	0	0	0
	Partial	0	0	0	0
Piggy back	Full size	1	0	0	1
$n = 53$	Reduced	0	0	0	2
	Partial	0	0	2	1
Latero-lateral	Full size	0	0	1	0
$n = 7$	Reduced	0	0	0	0
	Partial	0	0	0	0
Total $n = 110$		3 (3 %)	0	3* (3 %)	3* (3 %)

* $P = 0.01$ for orthotopic versus piggy-back + latero-lateral

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