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Rapid Flush Technique for Donor Hepatectomy: Safety and Efficacy of an Improved Method of Liver Recovery for Transplantation

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TECHNIQUES for multiple organ procurement of the heart, liver, and kidneys were first described by Starzl[1] and have been adopted throughout the world. Although this conventional technique provides usable organs in the majority of cases it has certain limitations principally due to the need for time-consuming dissection of the hepatic hilar structures. These limitations, which became critically evident in the unstable donor, have led to the evolution and refinement of this technique[2] and its eventual standardization. The final simplified version, commonly referred to as the rapid flush technique, requires no preliminary hilar dissection and allows for rapid organectomy in a bloodless field after early in situ core cooling.[3] This report describes a 2-year retrospective review of 437 donor hepatectomies comparing our experience with both the conventional and rapid flush techniques.

MATERIAL AND METHODS

Between January 1985 and December 1986, 587 consecutive donor hepatectomies were performed by the liver transplant team at the University of Pittsburgh. Donor statistic sheets and the respective recipient charts were retrospectively reviewed. Four hundred thirty-seven cases were found to have available, adequate data for analysis. Of these 437 recoveries, 157 were performed using the rapid technique and 280 organs were procured with the conventional technique. These 437 liver grafts were used in 357 primary transplants and 80 retransplantations.

Donor assessment parameters, recipient variables, indicators of graft function, and incidence of primary nonfunction were analyzed and compared with respect to the harvesting technique performed.

Donor assessment parameters included arterial blood gases and peak liver function tests (SGOT, SGPT, bilirubin, and prothrombin time). Recipient parameters included age, blood loss during transplantation, and total graft ischemia time (time from donor circulatory arrest to recipient revascularization).

Graft function was assessed by comparing peak SGPT, SGOT, and peak prothrombin time between the two groups. Finally, the incidence of primary graft failure that resulted in early retransplantation or patient death was compared.

All statistical evaluations were performed on an IBUR/PC-AT microcomputer using statistical analysis software (SPSS/PC+, SPSS, Chicago, and BMDP/PC, BMDP statistical software, Los Angeles). A t test was used for all parametric statistics and the chi-square test used for nonparametric evaluations. For all tests a P value of less than .05 was considered statistically significant.

RESULTS

Donor Assessment

Taken as a whole, there were no significant differences between the two donor populations (Table 1). Mean values for pO_2, pCO_2, and pH were essentially identical. Liver function parameters were also similar but the trend was to accept livers from somewhat less than ideal donors when the rapid technique was used. This is evidenced by the systematically higher mean values of SGOT, SGPT, and bilirubin in the rapid flush group, although statistical significance was reached for only SGOT. There was no significant difference in the mean prothrombin time.

Recipient Parameters

The two recipient populations were similar in age. The mean graft ischemia time was six

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Table 1. Donor Variables

Mean ± SD	Rapid	Conventional	P
Peak SGOT	93 ± 87	75 ± 84	.04
Peak SGPT	58 ± 72	49 ± 56	NS
Peak bilirubin	87 ± 53	82 ± 86	NS
Prothrombin time	13.3 ± 1.8	13.4 ± 2.0	NS
pO_2	134 ± 90	149 ± 94	NS
pCO_2	33 ± 12	30 ± 8	NS
pH	7.4 ± 0.1	7.4 ± 0.5	NS

hours in the conventional group and 5.6 hours when the rapid technique was used. Although this was a statistically significant difference, its biologic significance is unclear. Blood loss was recorded in blood volumes for pediatric cases and in liters for adults. There was no significant difference in total blood loss in either adult or pediatric groups. These results (Table 2), taken as a whole, illustrate little if any difference in the recipient populations receiving the liver grafts.

Graft Outcome

The grafts procured with the rapid flush technique had superior function compared to those harvested conventionally (Table 3). The peak SGOT was significantly lower in the rapid flush group and there was a strong tendency for lower peak SGPT levels as well. The mean peak prothrombin times were similar in both groups.

Most importantly, the organs procured with the rapid technique had a primary graft failure rate only 2/3 times as great as that of conventionally harvested grafts (6.4% *v* 9.6%) (Table 4).

DISCUSSION

With the increasing success of renal and extrarenal transplantation in the 1980s, the need for maximal organ use from every potential donor is obvious. The surgical principles of atraumatic dissection and in situ core cooling of the multiorgan donor have been well described and have become conventional practice.[1]

Implicit in this conventional technique, however, are the lengthy preliminary dissections of hepatic and renal hilar structures. This dissection has distinct disadvantages. During a lengthy dissection and mobilization there can be inadvertent periods of ischemia caused by temporary vascular occlusion or vasospasm. In unstable donors, this tedious approach is dangerous and may irreversibly damage an organ or preclude its use entirely. Secondly, the conventional practice can be a constant annoyance to cardiac procurement teams simply due to the waiting time imposed on them.

As experience was gained in harvesting organs from unstable donors, the rapid flush technique evolved as a technique used by the most experienced surgeons[2] and was finally standardized for routine employment.[3] The principles of the rapid technique differed from the conventional in that *no* preliminary dissec-

Table 2. Recipient Parameters

Mean ± SD	Rapid	Conventional	P
Age	17.7 ± 9.4	16.0 ± 11.6	NS
Ischemic time	5.6 ± 1.3	6.0 ± 1.4	.02
Blood loss			
Pediatric (blood volumes)	3.9 ± 2.3	4.5 ± 5	NS
Adults (L)	8.9 ± 21.1	9.6 ± 10.2	NS

Table 3. Graft Performance Variables

Mean ± SD	Rapid	Conventional	P
Peak recipient SGOT	1,396 ± 1,585	1,846 ± 2,100	.02
Peak recipient SGPT	912 ± 926	1,132 ± 1,367	.08
Peak recipient protime	18.6 ± 6.9	18.9 ± 7.4	NS

Table 4. Graft Function

	Rapid (%)	Conventional (%)	*P*
Primary function	146 (93.6)	254 (90.4)	NS
Primary failure	10 (6.4)	27 (9.6)	
Total	(100)	(100)	

tion is needed. After isolation of the great vessels and cannulation of the aorta and portal vein via the inferior mesenteric vein, the abdominal viscera are cooled and allowed to become asanguinous. Only at this point is hepatic hilar dissection begun in what is now a bloodless field. Once hepatectomy is completed the kidneys are easily removed en bloc and separated at the back table. The entire operation, including removal of the heart or heart-lungs, liver, kidney, and vascular grafts, may be completed in approximately 60 minutes.

We have previously shown[3] that this technique has been met with a high degree of acceptance by nurses, coordinators, and local surgeons with whom we have worked. More importantly, it produces organs including kidneys, livers, and hearts with excellent rates of primary function.

In this retrospective review we have compared this new rapid technique to that of the conventional. The population of donors comprising the two groups were not significantly different, although there was a trend to use slightly more compromised donors when the rapid technique was used.

Despite this trend, overall graft function, as assessed by peak transaminase elevations, was superior in the rapid flush group. Finally, the rate of primary nonfunction of hepatic grafts was reduced by the use of this new technique.

In summary, the rapid flush technique yields high quality organs, is well accepted by the transplant community, and has become the procedure of choice for organ procurement.

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