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Transplantation of shipped donor livers

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Abstract. Between September 1988 and November 1991, 201 donor hepatectomies and transplantations were performed. Fifty-four livers (26.9 %) were harvested by other teams and shipped for transplantation; 147 livers (73.1 %) were procured by teams from our transplant center. Comparing the maximal postoperative serum-aminotransferases (s-AT), we evaluated the postischemic damage of shipped organs (AST 951 ± 931 IU/l; ALT 820 ± 666 IU/l) and nonshipped organs (AST 753 ± 1256 IU/l; ALT 636 ± 896 IU/l); this did not differ significantly. Donor-related factors, such as critical parameters (i. e., cardiac arrest, arterial hypotension, age over 50 years, or elevated preoperative s-AT), length of stay in the intensive care unit before harvesting, and cause of death showed similar patterns in both groups. The mean cold ischemia time in the group of shipped livers (12 h 10 min ± 4 h 22 min) and in the nonshipped livers (10 h 6 min ± 3 h 53 min) did not differ significantly. Five cases (2.5 %) of a primary nonfunctioning graft presenting with significantly ($P < 0.001$) elevated s-AT (AST 4944 ± 2280 IU/l; ALT 3186 ± 1918 IU/l) necessitated an early retransplantation. One organ was shipped and four organs were nonshipped, thus corresponding to their portion of all grafts. These data indicate that the transplantation of shipped livers is a safe procedure procedure, provided that procurement is done by experienced centers.

Key words: Shipped donor livers – Liver transplantation – Graft function, liver

Introduction

In kidney transplantation the use of shipped organs has become a routine procedure and its safety has been acknowledged [10]. While more than 50% of all kidneys harvested in Europe are shared among transplant centers, procurement of livers is usually done by a surgical team from the transplanting institution. During the last several years there has been an increase both in the experience gained with hepatic transplantation and in the numbers of transplanting centers, two reasons why livers that have been harvested by other teams may now be more readily accepted for transplantation than they were in the past.

We retrospectively investigated our experience with shipped donor livers and the incidence of factors generally believed to be involved in early graft function.

Methods

The records of 201 donor hepatectomies and transplantations performed in 187 recipients between September 1988 and November 1991 were reviewed. Groups were formed according to the origin of the graft, i. e., whether they were harvested and shipped for transplantation by other teams or procured by teams from our transplant center.

The postischemic damage was evaluated by assessing the postoperative peak values of serum-aminotransferases (s-AT) or the incidence of primary nonfunction (PNF) [1]. A diagnosis of PNF was not made if a graft failed due to histologically confirmed rejection or a vascular thrombosis [9].

In addition, the age of donors and recipients, the cold ischemic periods, and the preservation solutions used were compared. Donors were further divided into groups according to the length of their stay in an intensive care unit (ICU) before organ harvesting [7], their causes of death – with particular attention to polytraumatized donors [6] – and parameters considered critical in liver donation. These parameters included cardiac arrest with cardiopulmonary resuscita-

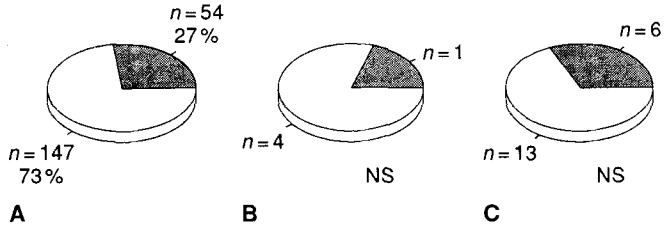

Fig. 1 A–C. Proportion of shipped (▨) and nonshipped (□) livers: **A** in relation to all those procured; **B** showing primary nonfunction; **C** presenting with peak postoperative s-AT above 2000 IU/l

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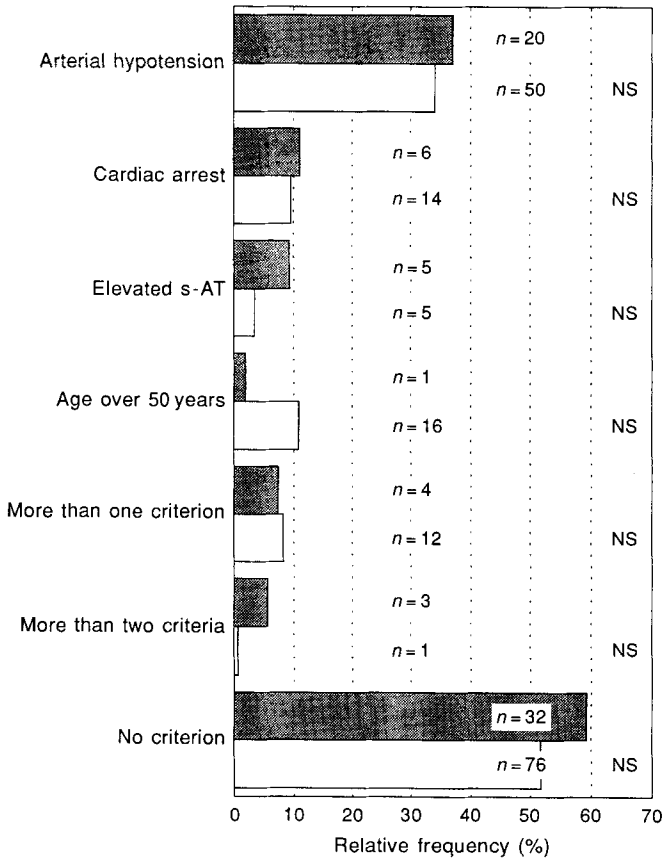

Fig. 2. Critical parameters in donors whose livers were shipped (▩) or not shipped (□)

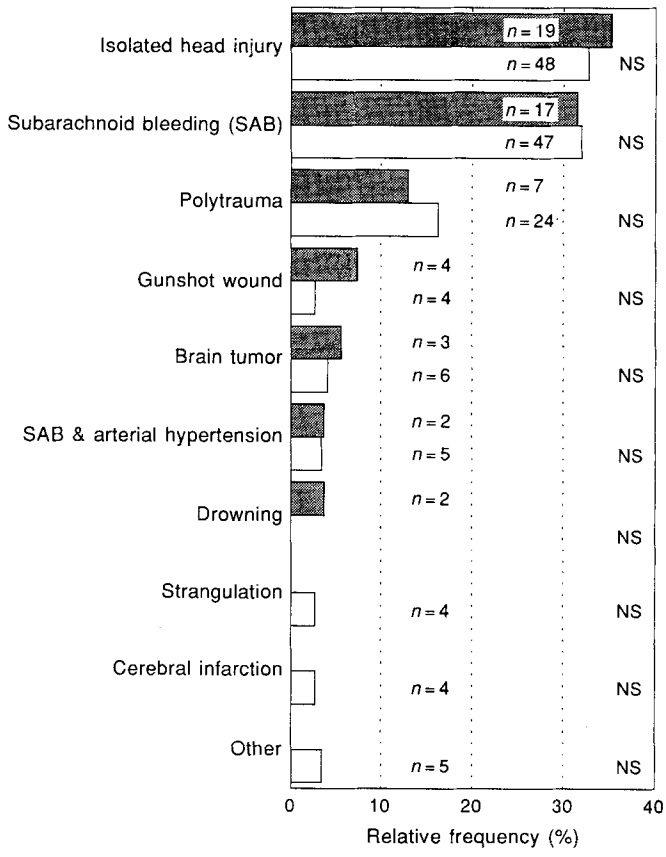

Fig. 3. Causes of death in donors whose livers were shipped (▩) or nonshipped (□)

tion (CPR), sustained arterial hypotension (MAP < 60 mm Hg for more than 20 min), elevated preoperative s-AT (> 100 IU/l), or donor age over 50 years [8].

Statistical analysis was performed using the Wilcoxon rank sum test and the chi^2-test.

Results

The organs came from 138 male (68.7%) and 63 female (31.3%) donors who were between 10 and 60 years old (mean 30.8 ± 11.9 years). Recipients were 106 male (52.7%) and 95 female (47.3%) patients between 16 and 64 years of age (mean 44.2 ± 11.2 years). Two organs had been preserved in Euro-Collins (EC) solution, the others in University of Wisconsin (UW) solution. Cold ischemia times (CIT) ranged from 4 h 20 min to 24 h 15 min (mean 10 h 39 min ± 4 h 6 min) and were 12 h 10 min ± 4 h 22 min and 10 h 6 min ± 3 h 53 min in the groups of shipped and nonshipped organs, respectively.

Fifty-four livers (26.9%) were harvested by other teams and shipped for transplantation; 147 livers (73.1%) were procured by teams from our transplant center (Fig. 1a).

There were five cases (2.5%) of PNF, all necessitating an early retransplantation between postoperative days 3 and 13 (median day 4). Peak values of s-AT (AST 4944 ± 2280 IU/l; ALT 3186 ± 1918 IU/l) were significantly ($P < 0.001$) elevated as compared to primary functioning grafts (AST 690 ± 952 IU/l; ALT 615 ± 720 IU/l). One organ was shipped and came from a donor without critical parameters. Four organs were nonshipped, three of which originally belonged to a donor with one critical parameter (Fig. 1b). In 19 recipients (9.5%) s-AT was elevated above 2000 IU/l but eventually returned to normal levels. Of these recipients, six had undergone transplantation of a shipped graft (Fig. 1c). The incidence of PNF or s-AT above 2000 IU/l after transplantation of a shipped liver was not statistically significant.

Mean postoperative peak values of s-AT and CIT were slightly higher in the group of shipped organs but did not

Table 1. Peak values of aspartate-aminotransferase (AST) and alanine-aminotransferase (ALT) until postoperative day 3, donor and recipient age, cold ischemia time (CIT), and preservation solution used for shipped and nonshipped livers. UW, University of Wisconsin solution; EC, Euro-Collins solution; NS, not significant

	Shipped livers	Nonshipped livers	*P*-value
Number	54	147	
Peak postoperative AST	951 ± 931 IU/l	753 ± 1256 IU/l	NS
Peak postoperative ALT	820 ± 666 IU/l	636 ± 896 IU/l	NS
Donor age (years)	29.9 ± 11.0	31.2 ± 12.3	NS
Recipient age (years)	43.5 ± 12.2	44.5 ± 10.9	NS
CIT	12 h 10 min ± 4 h 22 min	10 h 6 min ± 3 h 53 min	NS
Preservation solution	2 EC/52 UW	147 UW	NS

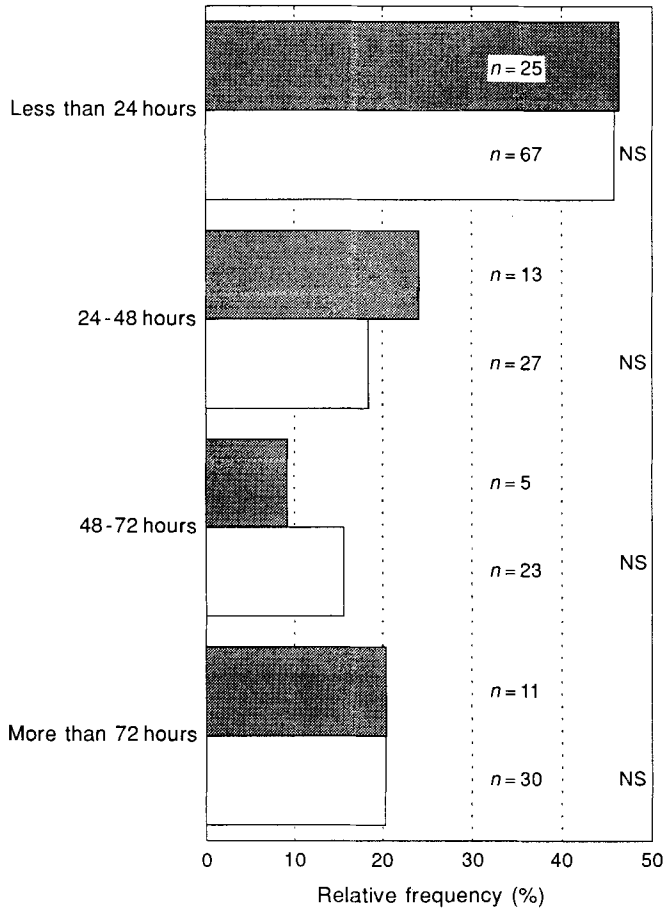

Fig. 4. Length of stay in the intensive care unit (ICU) before harvesting of grafts that were shipped (▨) or not shipped (□)

reach statistical significance (Table 1). The same was true with regard to the preservation solution used and to donor and recipient age.

Donor-related factors, such as critical parameters (Fig. 2), cause of death (Fig. 3), and length of stay in the ICU before harvesting (Fig. 4), did not differ significantly between the two groups.

Discussion

The principle finding from this study was that early graft function was not impaired when livers were harvested by other teams and shipped. Mean postoperative peak values of s-AT were only slightly more elevated than those in recipients who had received livers procured by teams from our center. The contribution of shipped livers to primary nonfunctioning grafts and to grafts from recipients who presented with peak s-AT levels of more than 2000 IU/l corresponded to their portion of all transplanted livers.

Donor-related factors, such as critical parameters, length of stay in the ICU before harvesting, and cause of death showed similar patterns for the shipped and nonshipped liver groups. The predictive role of these parameters remains uncertain as they have probably been applied too stringently in the past [3, 4]. Exclusion criteria could be applied even more liberally with the broad introduction of Belzer's UW solution [2].

The lack of objective criteria for predicting graft function accounts for the harvesting surgeon's central role since his personal impression of a liver is often decisive, especially in borderline cases when knowledge of the recipient is essential. Therefore, organ procurement by teams from the transplanting institution still seems to be desirable. Delays due to organizational requirements could not be observed. CITs were somewhat shorter in the group of nonshipped livers. Acceptance of shipped livers was more often based upon the wish of the local harvesting team to do the procurement themselves or upon the timing of the harvesting procedure by the donor coordinator. Availability of a procurement team from our institution was almost always an alternative possibility.

A study about organ donor management from a trauma center revealed that 8 (10.4%) of 77 donated livers could not be procured because of the unavailability of transplant teams [5]; in contrast, 224 kidneys were donated and all of them procured. The transplantation of shipped livers is a safe procedure, provided procurement is done by experienced centers. In light of the current organ shortage, a more ready acceptance seems to be justified.

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