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# Outcome of Liver Transplantation Using Donors 60 to 79 Years of Age

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AS OF MARCH 31, 1994, there were 34,493 patients on the United Network for Organ Sharing (UNOS) waiting list,<sup>1</sup> up from 13,115 in December 31, 1987, an increase of 263%. Of these, 3264 awaited liver transplantation (OLT), up from 449 in 1987 (727% increase). The supply of organ donors, on the other hand, underwent a marginal increase between 1988 and 1990 (from 4085 to 4514), and has remained relatively stable since (4531 in 1991, 4521 in 1992, and 4849 in 1993). Consequently, although the need has increased dramatically, we observe with mounting concern the persistent wastage of available organs and the death of potential recipients.

Many routes have been explored in an attempt to remedy this situation, including the development of artificial organs,<sup>2</sup> utilization of living donors, even for extrarenal organs,<sup>3</sup> xenotransplantation,<sup>4,5</sup> and non-heartbeating donors.<sup>6,7</sup> However, a more immediate impact on organ shortage could be effected by changing the current donor selection criteria to include the so-called *marginal donors* (ie, obese or older living donors).

## MATERIALS AND METHODS

The case material consists of 462 adult OLT: 54 from donors between 60 and 79 years old (group I) and 408 from donors younger than 60 years (group II). All grafts were flushed with University of Wisconsin (UW) solution. Groups I and II were compared in terms of donors who were on pressors (defined as dopamine infusion >10 µg/kg/min or a continuous infusion of epinephrine or norepinephrine), pitressin, or who required cardiopulmonary resuscitation (CPR) before procurement. They were also analyzed in terms of length of stay in the intensive care unit (ICU), aspartate aminotransferase (AST), alanine aminotransferase (ALT), ischemia time, mean recipient age, and recipient UNOS status (UNOS status is a measure of severity of disease, according to UNOS candidate classification: status 1, patient may wait at home; status 2, patient may wait at home but needs medical support; status 3, patient needs to be in the hospital; status 4, patient requires life support).

Continuous data are presented as the mean ± SEM and categorical data as rates. Means were compared using a two-tailed *t* test and rates were compared using Pearson's chi-square test. Survival analysis was performed using the method of Kaplan-Meier. The significance level was set at *P* < .05.

## RESULTS

Mean donor age for group I was 65.2 ± 0.6 (range 60 to 79) vs 35.9 ± 0.7 (range 7 to 59) for group II. In group I there were 29 donors between 60 and 64, 17 between 65 and 69, and 8 between 70 and 79. There was no difference in the number of donors who were on pressors, pitressin, or who required CPR prior to procurement. The two groups were

**Table 1. Comparison of the Two Groups (Donor Age ≥60 Years and <60 Years) for Various Donor Selection Criteria**

Donor Data	Group I (n = 54)	Group II (n = 408)	Significance
Pressors (%)	35.8%	40.8%	NS
Pitressin (%)	22.6%	32.2%	NS
CPR (%)	11.3%	17.9%	NS
ICU length of stay (d)	3.1 ± 0.4	3.6 ± 0.3	NS
ALT (U/L)	36 ± 3.5	52 ± 3.3	<i>P</i> = .001
AST (U/L)	53 ± 5.5	77 ± 4.2	<i>P</i> = .001
Ischemia time (h)	12.8 ± 0.6	13.4 ± 0.2	NS
Mean recipient age (y)	53.8 ± 1.4	50.6 ± 0.6	NS
<i>Recipient UNOS status</i>			
Status 2	16.7%	14.7%	NS
Status 3	40.7%	42.9%	NS
Status 4	42.6%	42.4%	NS

CPR = cardiopulmonary resuscitation. ICU = intensive care unit. ALT = alanine aminotransferase. AST = aspartate aminotransferase. UNOS = see text.

Note. Group I donors are 60 years or older in age. Group II donors are younger than age 60 years.

also comparable when evaluated for ICU length of stay, AST, ALT, ischemia time, mean recipient age, and recipient UNOS status (Table 1).

The 2-year actuarial graft survival rate was 43% in group I and 71% in group II, a difference that is highly significant (*P* = 0.0001). The 2-year actuarial patient survival rate was 62% in group I and 78% in group II (*P* = .037). Analysis of the causes of failure in both groups showed the following:

1. Ischemic injury: 52% in group I and 22% in group II.
2. Sepsis: 16% in group I and 30.3% in group II.
3. Technical reasons: 8% in group I and 9.2% in group II.
4. Rejection: 8% in group I and 7.3% in group II.
5. Cardiovascular complications: 0% in group I and 8.3% in group II.
6. Hepatitis: 0% in group I and 5.5% in group II.

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7. Other: 16% in group I and 17.4% in group II. Although half of the failures in group I were due to ischemic injury, the overall difference across all categories did not reach statistical significance ( $P = .07$ ).

#### DISCUSSION

The evaluation of every single potential donor based on physiologic and biochemical data, instead of preset rigid criteria, allows an expansion of the organ donor pool. Patients with cardiac arrest and prolonged CPR have been found acceptable by post-CPR physiologic and biochemical criteria, and their organs have been successfully transplanted.<sup>8</sup>

The donor age deserves special mention because, when assessing for specific organ donation, chronological age is less important than the physiologic age. The liver seems, in a certain way, to be protected from aging. Its great functional reserve, regenerative capacity, and large blood supply are the key factors in delaying aging of the liver compared with other organs.<sup>9</sup> Based on a positive preliminary clinical experience,<sup>10</sup> we have been routinely using grafts from older donors.

However, our results show that, although older donor livers can be used to face the present organ shortage, they do not function as well as livers from younger donors, and their use should probably be limited to selected recipients

(ie, those in urgent need of OLT). Retransplantation should be considered early when an older donor liver fails to function promptly, considering the high number of primary nonfunctions and severe ischemic injuries in group I patients.

In conclusion, we believe that, given the current organ shortage crisis, it is mandatory to continue to use older donors. Unfortunately, we still cannot accurately identify preoperatively those grafts that are more likely to fail, and further studies will be required to answer this question.

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