

11/21/90 1143

# Effect of Race Upon Organ Donation and Recipient Survival in Liver Transplantation

PRAGA PILLAY, MD, FRACS, FACS, DAVID H. VAN THIEL, MD, JUDITH S. GAVALER, PhD,  
and THOMAS E. STARZL, MD, PhD

*The effect of the race of the donor on organ donation and on the outcome of clinical liver transplantation has not been addressed previously. The aims of this study were to determine: (1) the number of organs donated by each of the major racial groups of the United States, (2) the outcome of transplantation of these organs across racial groups, and (3) the pattern of liver disease that required transplantation in each of these racial groups. A significantly higher proportion of organs were donated by white non-Hispanic Americans than either black or Hispanic Americans. There was no significant difference in survival when an organ was transplanted between black and white Americans and vice versa. Postnecrotic cirrhosis from a variety of causes was the most common indicator affecting black and white recipients, while primary biliary cirrhosis and primary sclerosing cholangitis were uncommon in the black population. While the number of organs donated by blacks was low, it was, however, proportional to the number of black recipients in this study. Reasons for the low rate of donation by the black and white Hispanic population are discussed. It is concluded that race is not a criteria to be used in selection of donors for liver transplantation. Educational programs addressing issues of organ donation and transplantation directed towards the black and Hispanic populations are recommended.*

**KEY WORDS:** donors; transplant survival; transplantation; transplants.

The rapid escalation in the number of centers performing orthotopic liver transplantation (OLTx) both in the United States and the rest of the world documents its current important place in the clinical management of irreversible advanced hepatic disease. Simultaneously, the maintenance of normal body function in individuals with severe head injuries, particularly those who are "brain dead" as determined by physicians in critical care medicine

has contributed substantially to the success of organ transplantation throughout the world by making a large number of potential organ donors available to transplant recipients.

Currently, donors for liver transplantation are matched with recipients only according to ABO blood group compatibility and body size. Nonetheless, it is well known that man as a biological species is polymorphic, with significant variation occurring within the species. Despite genetic differences in the prevalence of blood groups and HLA antigens between the various races, the effect of the race of the donor and the race of the recipient on the outcome of clinical OLTx has never been investigated.

The aims of the present study therefore were to determine: (1) the proportion of organs contributed to the liver transplantation program at the Univer-

Manuscript received February 20, 1990; revised manuscript received May 24, 1990; accepted May 31, 1990.

From the Departments of Surgery and Medicine, University Health Center of Pittsburgh, University of Pittsburgh; and The Veterans Administration Medical Center, Pittsburgh, Pennsylvania.

Supported by research grants from the Veterans Administration, Project Grant DK 29961 from the National Institutes of Health, Bethesda, Maryland, and from the NIDDK 32556.

Address for reprint requests: Dr. David Van Thiel, 5 C Falk Clinic, 3601 Fifth Avenue, Pittsburgh, Pennsylvania 15213.

sity of Pittsburgh by the three major racial groups present in the United States from 1981 to 1989; (2) if transplantation across racial groups has any effect upon the outcome; and (3) the frequency of the various liver diseases that required OLTx in individuals of different races seen at this center.

## MATERIALS AND METHODS

**Patients and Procedure.** A retrospective analysis of all adult patients undergoing their first OLTx at the Presbyterian University Hospital of the University of Pittsburgh between January 1, 1981, and December 31, 1988 was undertaken. The donor's age, sex, and race were recorded while the corresponding recipient's age, sex, race, and specific liver disease indication for liver transplantation were determined. The race of the donor was determined by what the family members considered was their racial grouping, while that of the recipient was determined by what the patients considered their racial group to be. For the purpose of this study, a transplant failure was defined as a graft failure leading to retransplantation and/or the patient's death within 60 days of the initial liver transplant. This figure was based on the fact that 85% of deaths in the transplant unit occurred within 42 days of the transplant and in order to ensure that most deaths would be included in the study, the period of 60 days was selected.

The three major racial groups included white, black and Hispanic. Minor racial groups included American Indian/Alaskan, Asian/Pacific Islander, Japanese, Arab, Southeast Asian, and Continental whites. Each of these groups of patients was excluded from the study because the small numbers of each prohibited any statistical analysis. The donor operation used at this center is standardized and has been described by Starzl et al (1). Similarly, the specifics of the recipient evaluation and selection process, the technique of liver transplantation, and the postoperative care of the patients in this series has become standardized (2, 3).

**Immunosuppression.** All recipients received comparable clinical pre- and postoperative management, particularly with respect to the type and amounts of immunosuppression used. For each case, a combination of cyclosporine and glucocorticoids or azathioprine was used as the basic immunosuppressive regimen with OKT3 (Orthoclone, Ortho Pharmaceutical Corporation, Raritan, New Jersey) being used for approximately 10 days in cases with steroid-resistant allograft rejection (3).

**Categorization.** Since August 1987 transplant patients have been stratified according to the United Network for Organ Sharing (UNOS) transplant urgency scale determined by the severity of the recipient's disease (4).

**Statistical Analysis.** The data were analyzed using chi square. A  $P$  value  $<0.05$  was considered to be significant.

## RESULTS

During the time encompassed by this study, a total of 1313 OLTx were performed in adult recip-

TABLE 1. NUMBER OF ORGANS DONATED AND FAILURE RATE BY RACIAL GROUPS BLACK VERSUS WHITE (TOTAL HISPANIC + NON-HISPANIC)

Donor	Recipient	Total 1st grafts	Failure	
			N	%
Black	Black	5	1	20
Black	White	64	9	14.1
White	White	749	124	16.6
White	Black	46	13	28.0
	Total	864	147	17.0

ients (individuals over 18 years of age). One hundred ninety of these transplant procedures represented second or third liver transplant procedures and were excluded from the analysis. Of the 1123 donor-recipient pairs, 22 were between minor racial groups other than the three major groups defined above and were excluded from the analysis. In a group of 237, the race of the donor was not recorded, and these were excluded from the analysis. There was no significant difference in recipient survival for white or black recipients when the race of the donor was unknown. Thus a total of 864 donor-recipient pairs were available within the three major racial groups for inclusion in the study.

The results of transplanting an organ from a black donor into a white recipient (both Hispanic and non-Hispanic) and *vice versa* are shown in Table 1. The total number of livers donated by blacks (69) was far less than that by whites 795 (Hispanic and non-Hispanic). Of the 51 black recipients, only 5 (10%) received an organ donated by a black, while 46 (90%) received an organ donated by a white; conversely of the 813 white recipients, 749 (92%) received an organ from a white donor while 64 (8%) received an organ from a black donor ( $P < 0.001$ ). The total number of organs donated by blacks for either black or white recipients was far less than that observed for whites and is well below their population fraction. However, the number of black donors used was proportional to the number of black recipients. A similar pattern was apparent for organs transplanted between black and non-Hispanic whites (Table 2).

A breakdown of the white population into Hispanic and non-Hispanic groups (Table 3) shows that the number of organs donated by the Hispanic group is even smaller than that donated by the black population. Thus, most donors are white non-Hispanics and both Hispanic and black recipients are most likely to receive an organ donated by a white who is non-Hispanic.

## RACE AND LIVER TRANSPLANTATION

TABLE 2. NUMBER OF ORGANS DONATED AND FAILURE RATES FOR BLACKS VS NON-HISPANIC WHITES

Donor	Recipient	Total	Failure 2nd Graft	
			N	%
Black	Black	5	1	20
Black	White (NH)	61	9	14.8
White (NH)*	White (NH)	713	113	15.8
White (NH)	Black	44	13	30
Total		823	136	16.5

\*NH = non-Hispanic.

Graft and patient survival analysis for black into total white (Hispanic) are shown in Tables 1-3. The failure rate for an organ transplanted from a black donor into a white recipient was 14.1% (14.8% in the case of a white non-Hispanic) while the failure rate for an organ obtained from a white donor and transplanted into a black was 28% (30% for white non-Hispanics). These differences were not significant. However, the fact that a higher proportion of black recipients who died (6/9 or 66%) were of a higher surgical risk than the white recipients (29/61 or 47.5%), as indicated by the UNOS scores, may explain the arithmetic, albeit not statistically significant, difference between these two groups (Table 4).

The results obtained when transplantation between a white Hispanic and a white non-Hispanic occurred are shown in Table 3. In 733 liver transplants performed in white non-Hispanic patients, 20 organs (2.7%) were obtained from white Hispanics, while in all 16 transplants performed in white Hispanics the organ was obtained from a white non-Hispanic donor. The graft survival for organs transplanted between white Hispanics and white non-Hispanics revealed a higher failure rate (8/20 or 40%) than when an organ obtained from a non-Hispanic white donor was transplanted into a white Hispanic (3/16 or 18%) ( $P = 0.016$ ). The proportion of seriously ill recipients who died was equal in these two groups, although the number of

TABLE 3. NUMBER OF ORGANS DONATED AND FAILURE RATES FOR NON-HISPANIC WHITES VS HISPANIC WHITES

Donor	Recipient	Total 1st graft	Failure	
			N	%
White (H)*	White (NH)*	20	8	40
White (H)	White (H)	0	0	0
White (NH)	White (NH)	713	113	15.8
White (NH)	White (H)	16	3	18.0

\*White (H) = white Hispanic; white (NH) = white non-Hispanic.

Hispanic recipients was very small. The number of organs transplanted between blacks and white Hispanics were too small for analysis.

The principal liver diseases for which liver transplantation was performed in each of the three major racial groups studied are shown in Table 5. Postnecrotic cirrhosis (PNC) from a variety of individual causes (chronic viral infections, alcohol, cryptogenic cirrhosis) was the single most common chronic liver disease indication for liver transplantation in all three of the major racial groups studied. Acute hepatic failure (AHF) occurred at the same rate in the black and white recipient groups. Primary biliary cirrhosis (PBC) and primary sclerosing cholangitis (PSC) were uncommon in the black population (Table 5).

The number and fraction of black patients with PBC, PSC, and PNC were significantly less than the number of white patients with the same diseases (Table 5). Since the major indications for OLTx in the white patients were PNC, PBC, AHF, and PSC in that order, the underrepresentation of blacks in these disease groups may account for the apparent disproportionate total number of OLTx performed in whites compared to blacks, but it could also be related to recently analyzed fiscal issues (5).

Because of the small numbers involved, there was no statistically significant difference in the failure rate for recipients with either PBC, PSC, or AHF among the various races. Among recipients transplanted for PNC, no differences in the failure rate was evident when the donor and recipient pairs were either matched or mismatched for race. It should be noted, however, that the number of white recipients with PNC, who were more seriously ill according to the UNOS grading scale, was greater although not statistically significantly so, than that of the black recipients with PNC. When race was considered in addition to other variables such as age, sex, and ABO blood groups, no difference in

TABLE 4. UNOS URGENCY STATUS OF RECIPIENTS DYING IN 1987 AND 1988

Donor-Recipient	Deaths	UNOS status*		Status not recorded
		1-3	4-6	
White (NH)-White (NH)	52	10	26	16
White (NH)-Black	8		6	2
Black-White (NH)	1			1
White (NH) = White (NH)	9	2	3	4

\*UNOS status began in August 1987.

TABLE 5. MAJOR HEPATIC DISEASES REQUIRING LIVER TRANSPLANTATION AND FAILURE RATE IN WHITE AND BLACK POPULATIONS

Donor-Recipient	Primary biliary cirrhosis			Primary sclerosing cholangitis			Postnecrotic cirrhosis			Acute hepatic failure		
	Total	Failure		Total	Failure		Total	Failure		Total	Failure	
		N	%		N	%		N	%		N	%
Black-Black	0	0	0	0	0	0	4	1	25	0	0	0
Black-White	10	4	40	4	0	0	28	5	18	0	0	0
White-White	133	12	9	65	4	6	261	37	14	92	12	13
White-Black	3	1	33	6	2	33	16	1	6	9	3	33
Total	146	17	12	75	6	8	309	44	14	101	15	15

outcome was found, although the number of blacks within each of these subsets was small.

### DISCUSSION

No data exist with respect to the outcome of organ donation between racial groups in clinical liver transplantation. This is related in part to the difficulty in classifying individuals in one or another racial group based solely upon their physical characteristics—commonly referred to as the “typological approach.” Our definition was determined by what the patient or the donor’s family members considered themselves to be.

It is well known that blacks donate fewer kidneys than do whites (6), but until now no information relative to other organs has been available. The data in this study demonstrate several important facts. The number of livers donated by both the black and Hispanic population is significantly less than that for the white population ( $P < 0.001$ ). Indeed only 8% of all livers donated are obtained from blacks, and even fewer (2%) are obtained from Hispanics.

A 1985 Gallup survey (7) assessing US public attitude towards organ transplantation and organ donation demonstrated that “non-White minorities were slightly less likely to be aware of organ transplantation, least likely to donate their own organs and even less likely to donate the organs of a loved one as compared to Whites” (7). The reasons for these findings have never been determined. A study investigating the attitudes of Mexican Americans (8), however, indicated that 100% of this racial group surveyed was aware of transplantation and that 85% would be willing to donate their own organs. However, only 56% were willing to donate the organs of relatives resulting in the loss of 515 eligible donors in New York, Florida, and Califor-

nia (9). The majority who refused were among the black and Hispanic populations.

The present study confirms the low rate of donation of livers among blacks and Hispanics. It also shows that transplantation across racial groups has no effect upon the transplant outcome. The importance of determining the severity of the recipient’s illness and correcting for such is also illustrated in this study. The apparent higher failure rate for organs obtained from white donors and transplanted into black recipients was due entirely to the fact that a higher proportion of the black recipients who died were more seriously ill (4–6 on UNOS scale) than were the white recipients who were transplanted in this series (Table 4). However, a difference in survival rate for transplants performed between white Hispanics and white non-Hispanics also was noted. The numbers within this group are small, however, and thus no definitive conclusion can be drawn from the data.

The genetic differences owing to race *per se* are not considered to be major, as the genetic variability within each race is greater than the variability between the races. Moreover, it has been variously estimated that black Americans have a 30–50% chance of having a white ancestor (10). Because of this fact and because of the findings in this study, the likelihood of graft failure solely as a result of the presence of a genetic difference between the race of the donor and recipient is not tenable. This conclusion is consistent with studies recently reported for renal transplantation from our center (11). Thus transplantation of organs across racial groups can be performed without fear of an additional problem occurring as a result of some inherent difference between the donor and recipient races. Our data indicate that the major problem in success of liver

## RACE AND LIVER TRANSPLANTATION

TABLE 6. DISTRIBUTION OF US POPULATION IN MILLIONS  
(TOTAL = 246 MILLION, JULY 1, 1988, MEDIAN = 32.1 YEARS)\*

	Millions	%	Projected % increased by year 2040
Total	246		24
White non-Hispanic	190	80%	11
Black	30	12%	50
White Hispanic	18	7%	30
Other	8	0.3%	

\*Compiled from Bureau of Census Handbook.

transplantation is the severity of the illness of the recipient immediately prior to the transplant.

Based upon available data, the negative views towards organ donation present in the black and Hispanic populations appears to be related to three major factors (6). First, there are religious beliefs—specifically that an intact body is thought by a large number in these two races to be important for burial. Second, there is the difficulty experienced in making a decision at a time of grief coupled with a lack of knowledge relative to a donor's wishes with respect to organ donation. Third, there is a perceived lack of trust in the providers of health care by family members of identified potential donors, eg, a misguided belief that adequate care may not be provided to an individual who carries a donor card (6).

The distribution of the three major racial groups as well as the projected increase in each population group to the year 2040 is shown in the Table 6 (12, 13). It is important to note that the American white non-Hispanic population is projected to increase by 11% and the to decline somewhat over the next 40 years. Blacks are expected to have a substantial growth rate of 50% by the year 2040. The Hispanic population is expected to increase by 30%. These figures clearly suggest that organ procurement in the future will be impaired if the present rate of donation among blacks and Hispanics is not increased.

The median age of the United States of America population at present is 32.1 years (12). This age group is often considered the ideal age for donors. This fraction is projected to decline to 48% in year 2000, then to 41% in the year 2030. This projection will also affect the ability of transplant centers to obtain organs from young donors. A very high death rate among blacks from gunshot (65.3%) and stab wounds (16.6%) is reported in some states (14). The potential for organ donation among this group of individuals has never been determined.

A determined effort on the part of health professionals is required to understand the religious beliefs of the black and Hispanic populations that adversely affect organ donation. A concerted and carefully designed educational program highlighting the benefits of organ donation directed at the black and Hispanic populations is warranted.

The number of black recipients in the transplant program was surprisingly low in comparison to the white transplant population. The pattern of diseases, particularly PBC and PSC, for which OLTx was performed resulted in a higher proportion of white recipients than black recipients. However, since chronic liver disease produced a death rate of 17.3/100,000 black males in 1986 and 14.1/100,000 in white males (15), one would have expected a higher number of black recipients. Reasons for this discrepancy have been addressed recently and probably are related primarily to socioeconomic factors (5). It is important to emphasize that the number of black donors was directly proportional to the number of black recipients. Thus, a request for more black donor organs must, of necessity, be accompanied by a corresponding increase in the number of black recipients if equity (as perceived by the black community) is to be achieved.

In conclusion, this study has highlighted the low organ donation rate for livers noted in the black and Hispanic populations. It clearly demonstrates that there is no effect on transplant survival where an organ is transplanted between the races. Thus, race is not a factor in assessing whether a given recipient might benefit from a given donor organ.

## REFERENCES

1. Starzl TE, Iwatsuki S, Esquivel CO, Todo S, Kam I, Lynch S, Gordon RD, Shaw B Jr: Refinements in the surgical technique of liver transplantation. *Semin Liver Dis* 5:349-356, 1985
2. Van Thiel DH, Schade R, Gavaler JS, Shaw BW Jr, Iwatsuki S, Starzl TE: Medical aspects of liver transplantation. *Hepatology* 4:795-835, 1984
3. Starzl TE, Iwatsuki S, Van Thiel DH, Gardiner JC, Zitelli BJ, Malatack JJ, Schade RR, Shaw BW Jr, Hakala TR, Rosenthal JT, Porter KA: Evolution of liver transplantation. *Hepatology* 2:614-636, 1982
4. Newsletter of United Network for Organ Sharing (UNOS): Update. 3 (6) 5, 1989
5. Teperman L, Scantlebury V, Tzakis A, Stascheck S, Todo S, Starzl TE: Liver transplantation in black recipients: Pittsburgh. *Transplant Proc* 21:3963-3965, 1989
6. Callender CO, Batton JA, Yeager C, Clark JE: Attitudes among Blacks toward donating kidneys for transplantation: A pilot project. *J Natl Med Assoc* 74(8):807-809, 1982

7. Gallup Survey: The US public attitudes toward organ transplants/organ donation. January 1985.
8. Johnson LW, Calianan T, Thompson T, Wilson JM, Urdameta M, Harris R: Mexican-American and Anglo-American attitudes towards organ donation. *Transplant Proc* 2015:822-823, 1988
9. Perez C, Matas A, Tellis V: Organ donation in three major cities by race/ethnicity. *Transplant Proc* 20(5):815, 1988
10. Smith A: *The Human Pedigree*. Philadelphia, JB Lippincott, 1975
11. Shapiro R, Tzakis A, Hakala T, Lopatin W, Mitchell S, Stieber A, Starzl TE: Renal transplantation in Black recipients at the University of Pittsburgh. *Transplant Proc* 21:3921-3925, 1989
12. Spencer G: Projection of the population of the United States by age, sex and race 1988 to 1080. *Current Population Reports: Population Estimates and Projections Series No. 1018*, US Department of Commerce Bureau of the Census, January 1989. p 1, 4, 32, 35, 38
13. The Hispanic Population in the United States: March 1986 and 1987. *Current Population Reports Population Characteristics, Series P-20, No. 434*. US Department of Commerce Bureau of Census, December 1988. p 1
14. *MMNR*: 38:4-6, 11, 1989. Impact of homicide on years of potential life lost in Michigan's black population. *JAMA* 261(5):686-687, 1989
15. *Monthly Vital Statistics Report*: National Center for Health Statistics 37(6):September 30, 1988