DISPARITIES IN OUTCOME FOR BLACK PATIENTS AFTER PEDIATRIC HEART TRANSPLANTATION

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Objective To examine the relationship of black race to graft survival after heart transplantation in children.

Study design United Network for Organ Sharing records of heart transplantation for subjects <18 years of age from 1987 to 2004 were reviewed. Analysis was performed using proportional hazards regression controlling for other potential risk factors.

Results Of the 4227 pediatric heart transplant recipients, 717 (17%) were black. The 1-year graft survival rate did not differ among groups; however, the 5-year graft survival rate was significantly lower for black recipients, 51% versus 69%, $P < .001$. The median graft survival for black recipients was 5.3 years as compared with 11.0 years for other recipients. Black recipients had a greater number of human leukocyte antigen mismatches, lower median household income, and a greater percentage with Medicaid as primary insurance, $P < .001$, $P < .001$, and $P < .001$. After adjusting for economic disparities, black race remained significantly associated with graft failure, odds ratio = 1.67 (95% CI 1.47 to 1.87), $P < .001$.

Conclusions Median graft survival after pediatric heart transplantation for black recipients is less than half that of other racial groups. These differences do not appear to be related primarily to economic disparities. *(J Pediatr 2005;147:739-43)*

A number of patient and procedure-related factors have been shown to influence survival after pediatric heart transplantation.[1] Black recipients have been reported to be at greater risk for recurrent rejection; however, recipient race has not been reported to be a risk factor for graft survival after pediatric heart transplantation in a number of single or multi-institutional reports.[1-5] Conversely, studies examining adults who undergo heart transplantation have found that black recipients have significantly poorer survival when compared with other racial groups.[6,7] Additionally, black race has been identified as a risk factor for rejection and graft loss in children after liver or kidney transplantation.[8,9] A variety of factors have been implicated in this disparity, including economic inequality and mismatching of human leukocyte antigen (HLA) loci.[7,10] In this study we analyze data from United Network for Organ Sharing (UNOS) to examine the relationship between race and graft survival. The purpose of the study was to assess the impact of recipient race on graft failure rates. In addition, we sought to explore the contribution of household income, insurance status, and HLA matching to heart transplantation outcome.

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METHODS

This study was carried out with approval from the Institutional Review Board of Children's Healthcare of Atlanta. Data for this analysis were supplied by UNOS. From 1987 to 2004 there were 4227 children, ages 17 years or younger, who underwent heart transplantation. The data set consisted of the Transplant Candidate Registration form and Transplant Recipient Registration form, and the Transplant Recipient follow-up form. The follow-up form was administered annually.

To explore the relationship of socioeconomic status and race on outcomes, the household income and insurance payer status of the recipients were examined. Using the zip code of the neighborhood in which the patient resided at the time of registration, median household income was estimated from the 2000 United States Census Bureau data.[11]

ECMO	Extracorporeal membrane oxygenation	PRA	Panel-reactive antibody
HLA	Human leukocyte antigen	UNOS	United Network for Organ Sharing

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Supported by Health Resources and Services Administration contract 231-00-0115. The content is the responsibility of the authors alone and does not necessarily reflect the views or policies of the Department of Health and Human Services, nor does mention of trade names, commercial products, or organizations imply endorsement by the U.S. Government.

Submitted for publication Mar 16, 2005; last revision received May 3, 2005; accepted Jul 14, 2005.

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0022-3476/$ - see front matter

10.1016/j.jpeds.2005.07.018

Table I. Patient characteristics

	Black recipients n = 717	Other recipients n = 3510	P value
Age at transplant in years (median)	8	3	<.001
Female sex	336 (47%)	1491 (42%)	.03
Dilated cardiomyopathy	264 (37%)	899 (26%)	<.001
Congenital heart disease	244 (34 %)	1788 (51%)	<.001
Days on waiting list (median)	29	30	.20
Mechanical ventilation*	85 (12%)	479 (14%)	.20
ECMO*	23 (3%)	121 (3%)	.75
PRA ≥20 (n = 3484)	54 (9.3%)	220 (6.9%)	.22
HLA mismatch† (n = 3018)	345 (64%)	1391 (56%)	<.001

*At time of listing.
†Mismatch of ≥5 loci.

Table II. Socioeconomic characteristics

	Black recipients	Other recipients	P value
Median household income	$33,625	$44,393	<.001
Household income <$30,000	243/647 (38%)	318/3057 (11%)	<.001
Medicaid as primary payer (n = 2823)	277 (55%)	746 (32%)	<.001

Statistical Analysis

Comparison between patient groups was performed with Student's *t* or Mann-Whitney tests for continuous variables and χ^2 or Fisher's exact test for dichotomous variables. We analyzed time to graft failure using survival analysis techniques. Graft failure was defined as death or repeat transplantation. We used the Kaplan-Meier product limit method to construct the survival curves and Cox proportional hazard regression models to examine predictors of time to graft failure. Variables with *P* value < .10 in univariate analysis were included in the multivariate model. An exploratory univariate analysis was performed to determine whether graft survival differed between recipients of white race and those other racial groups (American Indian or Alaska Native, Native Hawaiian or Pacific Islander, Asian, or mixed race) or ethnic groups (Hispanic/non-Hispanic). We found no difference in graft survival among these racial or ethnic groups. Therefore, in further analysis, black recipients were compared with the entire cohort of non-black recipients. Missing data for insurance payer status and panel reactive antibody levels were imputed. Analysis was performed with STATA 6.0 (College Station, Texas). Significance was determined at $P < .05$. All *P* values are 2-sided, and confidence intervals are 95%.

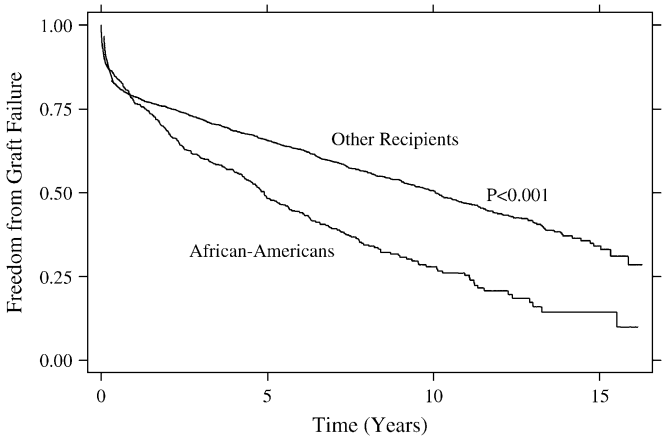

Figure. Kaplan-Meier plot of freedom from graft failure in black recipients (n = 717) and all other recipients (n = 3510).

RESULTS

During the study period 4227 heart transplants were studied. There were 4008 primary transplants and 219 repeat transplants for subjects with prior graft failure. Of the 4227 pediatric heart transplant recipients, 717 (17%) were black. The median age at transplantation for the entire cohort was 3 years. The 2 most common indications for transplantation were congenital heart disease in 2032 (48%) and dilated cardiomyopathy in 1163 (28%). The freedom from graft failure for the entire cohort was 81% at 1 year, 66% at 5 years, and 50% at 10 years.

Compared with other transplant recipients, black subjects were more likely to have dilated cardiomyopathy and less likely to have congenital heart disease (Table I). Black recipients were older at time of transplantation and were more likely to be female. Black recipients had a greater number of HLA mismatches than other recipients. Black recipients did not differ from other recipients with respect to need for pretransplantation mechanical ventilation or extracorporeal membrane oxygenation (ECMO), pretransplantation panel-reactive antibody (PRA) levels, or time on waiting list. With respect to measures of economic status, black recipients had a lower estimated median household income than all other transplant recipients, $33,625 versus $44,393, $P < .001$ (Table II). The percentage of black recipients with household income of less than $30,000 was 38% as compared with 11% of recipients of other races, $P < .001$. Black recipients were also more likely to have Medicaid as the primary payer than all other transplant recipients, 55% versus 32%, $P < .001$.

Black race was associated with a significant increase in graft failure compared with all other recipients (Figure). The 1-year graft survival rate did not differ between black recipients and other recipients, 79% versus 81%, respectively, $P = .42$. However, the 5-year graft survival rate was significantly lower among black recipients compared with other racial groups, 51% versus 69%, $P < .001$. In univariate analysis median family income of <$30,000 and Medicaid as a primary payer were associated with increased risk of graft failure (Table III). Donor-recipient race mismatch was also associated with poorer outcome