A Contemporary Analysis of the Safety and Efficacy of Cardiac Transplantation from Donors with Bloodstream Infections

Laura M. Piechura, MD[1,2], Morgan T. Harloff, MD[1], Mohamed Keshk, MD[1], Mitsu Ogawa, MD[1], Hari R. Mallidi, MD[1,2], Daniel E. Rinewalt, MD[1]

1. Division of Cardiac Surgery; 2. Division of Thoracic Surgery

Brigham and Women's Hospital, Boston, MA

ABSTRACT

Statement of Purpose: Consideration of cardiac allografts from donors with bloodstream infections (DBI) varies widely across institutions and providers. While often discarded due to concern for infectious complications in immunocompromised recipients, these organs may represent a possible source for addressing prolonged waitlist times. Existing evidence in the literature is from prior decades; consequently, we sought to analyze the outcomes of recipients of DBI hearts using contemporary data.

Methods: We identified first-time, adult recipients of cardiac transplants from 2010 to 2018 using the OPTN/UNOS Standard Transplant Analysis and Research Files. Patients were classified by receipt of an organ from DBI versus those from a donor with no documented bloodstream infection (control cohort). Information about culprit pathogen and antimicrobial therapy was not available in this dataset. Overall survival was compared using Kaplan-Meier log-rank analysis. Predictors of mortality were assessed using a Cox proportional-hazards model.

Results: From 2010 to 2018, 22,834 heart transplants met inclusion criteria, of which 1,982 (8.7%) involved a donor with a bloodstream infection. Recipients were comparable in terms of age, sex, race, diagnosis, history of diabetes, serum creatinine, and proportion with mechanical circulatory support devices. Donors with bloodstream infections were significantly older (29 vs. 28, p=0.01) and more likely to have diabetes (4% vs. 3%, p=0.02). DBI and control cohorts experienced equivalent length of index stay (16 vs. 56.5 days, p=0.051) and rates of rejection requiring treatment over their first year (p=0.40). Overall survival was equivalent (p=0.69) between DBI and control groups. Of note, Cox regression analysis revealed that bloodstream infection was not predictive of mortality (HR 1.00, p=0.98). Predictors of mortality included age over 60 (HR 1.3, p<0.001), black race (HR 1.2, p<0.001), BMI > 30 (HR 1.2, p<0.001), history of diabetes (HR 1.3, p<0.001), ECMO at time of transplant (HR 2.4, p<0.001), donor age (HR 1.1, p<0.001), and graft ischemia time (HR 1.1, p<0.001).

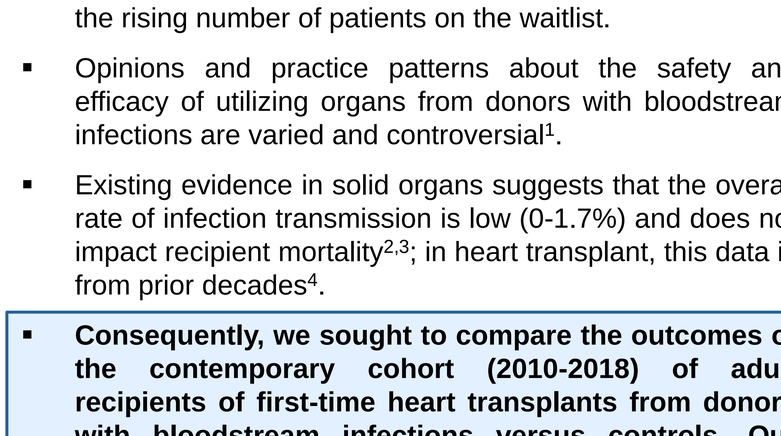
Conclusions: Adults who received first-time heart transplants from donors with bloodstream infections from 2010 to 2018 experienced survival equivalent to controls. Although clinical judgement remains paramount, our findings discourage disqualification of an allograft due to donor bloodstream infection alone.

OBJECTIVES

- Utilizing hearts from donors with documented bloodstream infections can increase the availability of transplants for the rising number of patients on the waitlist.
- Opinions and practice patterns about the safety and efficacy of utilizing organs from donors with bloodstream infections are varied and controversial[1].
- Existing evidence in solid organs suggests that the overall rate of infection transmission is low (0-1.7%) and does not impact recipient mortality[2,3]; in heart transplant, this data is from prior decades[4].
- **Consequently, we sought to compare the outcomes of the contemporary cohort (2010-2018) of adult recipients of first-time heart transplants from donors with bloodstream infections versus controls. Our primary outcome of interest was patient survival.**

METHODS

Using the United Network for Organ Sharing (UNOS) Standard Transplant Analysis and Research Files, we identified all first-time, adult heart transplants that occurred from 2010 to 2018. We excluded multi-organ transplants.



**Based on confirmed culture data when available.

RESULTS

Table 1. Recipient characteristics

Variable	DBI (n=1,982)	Control (n=20,852)	p-value
Age	47 ± 20.2	46 ± 0.8	0.17
Male sex	1,383 (70)	14,786 (71)	0.31
Race			0.97
White	1,245 (63)	13,349 (64)	
Black	430 (22)	4,395 (21)	
Hispanic	201 (10)	2,050 (10)	
Asian	72 (4)	734 (4)	
Other	34 (2)	324 (2)	
Diagnosis			0.22
Non-ischemic CM	1,148 (58)	12,164 (58)	
Ischemic CM	571 (29)	5595 (27)	
CAD	41 (2)	482 (2)	
Valvular disease	23 (1)	253 (1)	
Other	199 (10)	2,358 (11)	
BMI	26.18 ± 5.90	26.03 ± 5.96	0.29
BMI > 30	540 (27)	5,473 (26)	0.33
Diabetes	473 (24)	4,928 (24)	0.81
Creatinine, mg/dL	1.11 ± 0.52	1.13 ± 0.71	0.22
Total bilirubin, mg/dL	1.00 ± 1.73	0.98 ± 1.59	0.54

Recipients in both groups were similar. Body mass index (BMI); cardiomyopathy (CM); coronary artery disease (CAD); DBI (donors with bloodstream infections).

Table 2. Donor characteristics

Variable	DBI (n=1,982)	Control (n=20,852)	p-value
Age	29 ± 14	28 ± 14	0.0096
Male sex	1,327 (67)	14,282 (68)	0.16
Race			0.081
White	1,184 (60)	13,094 (63)	
Black	371 (19)	3,648 (17)	
Hispanic	367 (19)	3,393 (16)	
Asian	28 (1)	373 (2)	
Other	32 (2)	344 (2)	
Cause of Death			0.01
Anoxia	791 (40)	6,377 (31)	
Cerebrovascular/ Stroke	308 (16)	3,476 (17)	
Head Trauma	774 (39)	10,456 (50)	
CNS Tumor	12 (1)	108 (1)	
Other	97 (5)	434 (2)	
Diabetes	83 (4.2)	667 (3.2)	0.024
Hypertension	269 (14)	2801 (13)	0.33
Cocaine Use	358 (18)	3449 (17)	0.13
Smoking History	196 (10)	2074 (10)	0.41

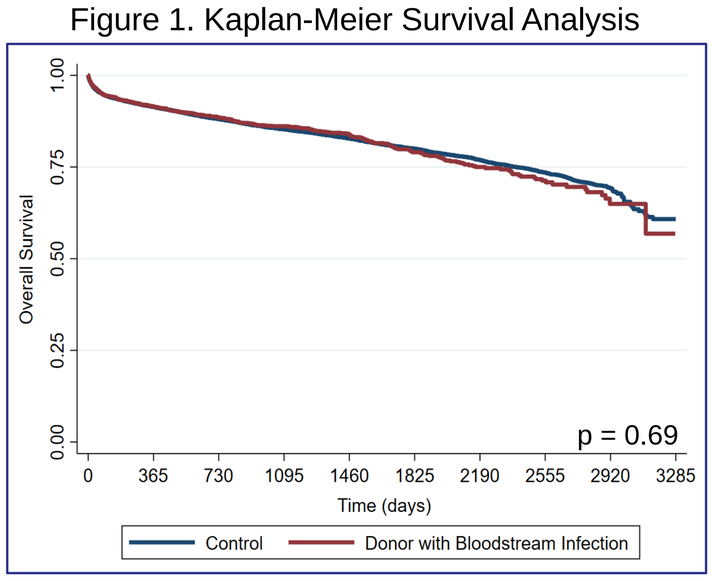
Donors with bloodstream infections (DBI) were older and more frequently had diabetes than control donors.

Table 3. Transplant-specific metrics

Variable	DBI (n=1,982)	Control (n=20,852)	p-value
Ischemic time, hours	3.2 ± 1.0	3.2 ± 1.1	0.62
Gender mismatch	529 (27)	5,752 (28)	0.39
Male recipient	294 (15)	3,128 (15)	0.79
Identical ABO compatibility	1,667 (84)	17,578 (84)	0.77
Ventilatory support	480 (25)	4,711 (23)	0.25
Inotropic support	753 (38)	7,942 (38)	0.93
IABP	124 (6)	1,175 (6)	0.25
VAD			0.89
LVAD	818 (41)	8,417 (40)	
RVAD	3 (0.1)	48 (0.2)	
BiVAD	48 (2)	505 (2)	
TAH	20 (1)	215 (1)	
ECMO	22 (1)	254 (1)	0.67

Transplant-specific metrics were similar between groups. Biventricular ventricular assist device (BiVAD); extracorporeal membrane oxygenation (ECMO); intra-aortic balloon pump (IABP); left ventricular assist device (LVAD); right ventricular assist device (RVAD).

Figure 1. Kaplan-Meier Survival Analysis



Overall survival was similar between recipients from donors with bloodstream infections and controls by Kaplan-Meier analysis (p=0.69).

Table 4. Cox regression analysis

Variable	Hazard Ratio (95% CI)	p-value
Age	0.997 (0.995-1.00)	0.067
Age > 60	1.30 (1.19 – 1.42)	< 0.001
Black race	1.18 (1.09 – 1.27)	< 0.001
BMI > 30	1.23 (1.14 – 1.32)	< 0.001
Diabetes (recipient)	1.27 (1.18 – 1.37)	< 0.001
Recipient serum creatinine	1.08 (1.06 – 1.11)	< 0.001
Recipient total bilirubin	1.06 (1.05 – 1.07)	< 0.001
IABP	1.14 (0.99 – 1.31)	0.068
ECMO	2.41 (1.90 – 3.05)	< 0.001
VAD	1.09 (1.04 – 1.14)	< 0.001
Inotropic support	0.99 (0.93 – 1.07)	0.86
Donor age	1.01 (1.01 – 1.013)	< 0.001
Diabetes (donor)	0.98 (0.90 – 1.07)	0.70
Ischemia time	1.1 (1.07 – 1.14)	< 0.001
Gender mismatch	1.08 (0.98 – 1.2)	0.11
Gender mismatch (male recipient)	0.97 (0.86 – 1.10)	0.64
Confirmed donor bloodstream infection	1.00 (0.89 – 1.12)	0.98
Donor smoking history	1.03 (0.98 – 1.09)	0.22
Donor male sex	1.08 (1.00 – 1.18)	0.057
Donor hypertension	1.01 (0.96 – 1.06)	0.067
Donor cocaine use	1.00 (0.95 – 1.04)	0.87

Confirmed donor bloodstream infection was not predictive of mortality in a Cox regression analysis (p=0.98). Notable predictors of mortality included recipient age over 60, black race, BMI > 30, recipient history of diabetes, use of ECMO at the time of transplant, donor age, and graft ischemic time.

Table 5. Post-transplant outcomes

Variable	DBI (n=1,982)	Control (n=20,852)	p-value
Transplant hospitalization, length of stay	16 (11-24)	56.5 (10-103)	0.051
Treatment for rejection within 1 year	282 (19)	3,159 (19)	0.40
Survival to 30 days	1,846 (93)	19,500 (94)	0.57
Survival to 1 year	1,449 (73)	15,659 (75)	0.055

There were no differences in length of stay, occurrence of rejection requiring treatment, and 30-day and 1-year survival between recipients of hearts from donors with bloodstream infections and control groups.

CONCLUSIONS

- Adult recipients of first-time heart transplants from donors with bloodstream infections experienced similar survival to controls.
- Clinical judgement remains paramount in decisions regarding donors with bloodstream infections, though our findings suggest that such organs should not be discarded based on bloodstream infection alone.
- This study is limited by its retrospective nature and the fact that the UNOS STAR files do not include details about infecting organisms, antibiosis, and the timing of such treatment regimens.

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