Waitlist and Post Transplantation Outcomes in Patients with Blood Group O during Continuous Flow Left Ventricular Assist Device Support

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Disclosures

— None

Purpose

Large-scale analysis of the United Network for Organ Sharing (UNOS) database to assess whether blood group O is associated with AEs, waitlist mortality or delisting for clinical deterioration and post heart transplant survival

Introduction

– The durability, efficacy, and adverse event profile of Continuous Flow Left Ventricular Assist Devices (CF LVAD) have improved over time [1,2]

– In absence of LVAD, prolonged mortality and delisting are more prevalent if wait times are longer especially in patients with blood group O compared to other blood groups [3]

– There is a paucity of studies that have evaluated waitlist outcomes in blood group O patients bridged with CF LVADs, including

  • specific major device related adverse events (AEs)

  • waitlist survival

  • post-transplantation survival

Methods

- Type: Retrospective cohort study
- Data source: UNOS/OPTN database: adult patients receiving lung transplant from January 2006 to March 2020
- Primary outcome measure: Removal from transplant waitlist due to death or for being too sick for transplant
- Secondary outcome measure: Post-transplant survival, LVAD related complications
- Statistical methods:
  - Multivariable Cox regression analysis was performed using transplant waitlist removal and post-transplant death as the terminal event
  - Univariable logistic regression models were created to evaluate blood group O and LVAD related adverse events
  - Kaplan Meier curves were derived

Results

- Total n=8,981 patients with CF LVAD were listed during study's time period with 4,315 patients had blood group O and 4,666 had non-O blood group

- Blood group O had longer waitlist times (413 days, IQR: 102-576; non-O 250 days, IQR 39-323 days, $p<0.0001$)

- Blood group O had a higher likelihood of device infections (OR: 1.39, 95% CI 1.19-1.63, $p<0.001$) and life-threatening ventricular arrhythmias (OR: 2.21, 95% CI 1.44-3.41, $p<0.001$)

- There was no statistically significant difference in likelihood of death or removal from transplant list during wait time (HR 0.96, 95% CI 0.85-1.09, $P=0.551$)

- There was no difference in post-transplant survival between two groups (HR 0.96, 95% CI 0.86-1.09, $p=0.563$)

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Table 1: Baseline Characteristics

Variable	Entire cohort* N=8,981	O blood group* N=4,315	Non-O blood group* N=4,666	p-value
Age at listing (Years)	52.99 ± 12.02	52.84 ± 11.97	53.12 ± 12.07	0.270
Gender (Male)	7,131 (79.40%)	4,315 (78.33%)	4,666 (80.39%)	0.016
BMI at listing (Kg/m^2)	28.83 ± 5.00	28.94 ± 4.91	28.73 ± 5.09	0.053
DM	2,927 (32.66%)	1,385 (32.16%)	1,542 (33.11%)	0.339
On ventilator at listing	195 (2.17%)	100 (2.04%)	95 (2.31%)	0.360
On inotropes at listing	808 (9.00%)	408 (9.45%)	400 (8.57%)	0.144
UNOS status 1A (New Status 1-3)	2,594 (28.88%)	1,133 (26.26%)	1,461 (31.31%)	<0.001
UNOS status 1B (New Status 4)	5,657 (62.99%)	2,814 (65.21%)	2,843 (60.93%)	<0.001
Creatinine at listing (mg/dl)	1.22 ± 0.66	1.24 ± 0.78	1.22 ± 0.53	0.396
Diagnosis at listing				
Ischemic Cardiomyopathy	3,253 (36.22%)	1,445 (33.49%)	1,808 (38.75%)	<0.001
Idiopathic cardiomyopathy	3.668 (40.84%)	1,826 (42.32%)	1,842 (39.48%)	0.006
Race				
Caucasian	5,698 (63.45%)	2,584 (59.88%)	3,114 (66.74%)	<0.001
African American	2,351 (26.18%)	1,238 (28.69%)	1,113 (23.85%)	<0.001

* Value (Mean ± SD or percentage)

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Table 2: Odds ratios for univariable logistic regression analysis for adverse events by blood group O compared to other blood groups

LVAD complication	O Blood Group	Non-O blood group	Odds Ratio	p-value	95% Confidence Interval
Pump thrombosis (B1)	121 (2.80%)	125 (2.68%)	1.04	0.716	0.81 – 1.35
Device infection (B2)	375 (8.69%)	299 (6.41%)	1.39	<0.001	1.19 – 1.63
Device malfunction (B3)	118 (2.73%)	101 (2.16%)	1.27	0.081	0.97 – 1.66
Life threatening ventricular arrhythmias (B4)	63 (1.46%)	31 (0.66%)	2.21	<0.001	1.44 – 3.41

Table 3: Results of multivariable Cox Regression model for removal from waitlist due to mortality or being too sick for transplant as endpoint of interest

Variable	Hazard Ratio	P-value	95% CI
Blood Group O	0.96	0.551	0.85 – 1.09
Age at listing (Years)	1.03	<0.001	1.02 - 1.03
Gender (Male)	0.76	<0.001	0.66 – 0.88
BMI at listing (Kg/m^2)	1.01	0.053	1.00 – 1.02
DM	1.18	0.01	1.04 – 1.34
On ventilator at listing	1.51	0.003	1.16 – 1.98
On inotropes at listing	1.55	<0.001	1.29 – 1.86
UNOS status 1A	1.31	0.009	1.07 – 1.61
UNOS status 1B	0.73	0.001	0.61 – 0.88
Creatinine at listing (mg/dl)	1.11	<0.001	1.08 – 1.14
Diagnosis			
Ischemic Cardiomyopathy	0.99	0.895	0.84 – 1.17
Idiopathic cardiomyopathy	0.88	0.132	0.75 – 1.04
Race			
African American	1.16	0.216	0.92 – 1.48
Caucasian	1.33	0.011	1.07 – 1.67
UNOS Region			
Region1	0.66	0.010	0.48 – 0.90
Region2	1.12	0.236	0.93 – 1.34
Region3	1.50	<0.001	1.23 – 1.82
Region9	0.68	0.002	0.54 – 0.87

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Table 4: Results of multivariable Cox Regression model for post-transplant all-cause mortality as endpoint of interest

| Variable	Hazard Ratio	p-value	95% CI
Blood Group O	0.96	0.563	0.86 - 1.09
Age at transplant	1.00	0.168	1.00 - 1.01
Male gender	1.03	0.709	0.88 – 1.20
PA pressures at time of transplant	1.00	0.430	0.99 - 1.00
BMI at transplant	1.02	0.003	1.01 – 1.03
Diabetes Mellitus	1.29	<0.001	1.13 – 1.46
On ventilator at transplant	1.66	0.054	0.99 – 2.78
In inotropes at transplant	1.07	0.600	0.84 – 1.36
Status 1A	0.85	0.159	0.67 – 1.07
Status 1B	0.80	0.045	0.64 – 0.96
Serum Creatinine	1.12	0.002	1.04 – 1.20
Ischemic cardiomyopathy	1.09	0.326	0.92 – 1.29
Idiopathic cardiomyopathy	0.96	0.632	0.81 – 1.13
Race			
Caucasian	1.16	0.200	0.93 – 1.44
African American	1.24	0.079	0.97 – 1.59

Table 4:Results of multivariable Cox Regression model for post-transplant all-cause mortality as endpoint of interest-continued

Variable	Hazard Ratio	p-value	95% CI
UNOS region			
Region 1	0.75	0.111	0.52 – 1.07
Region 2	1.16	0.109	0.97 – 1.38
Region 4	1.31	0.008	1.07 – 1.60
Region 5	0.85	0.183	0.67 – 1.08
Region 6	0.59	0.004	0.42 – 0.85
Region 11	1.23	0.023	1.03 - 1.46

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Figure 1:Odds ratio plots for each adverse event by blood group O and non-O blood group patients

Odds Ratio plots for adverse events
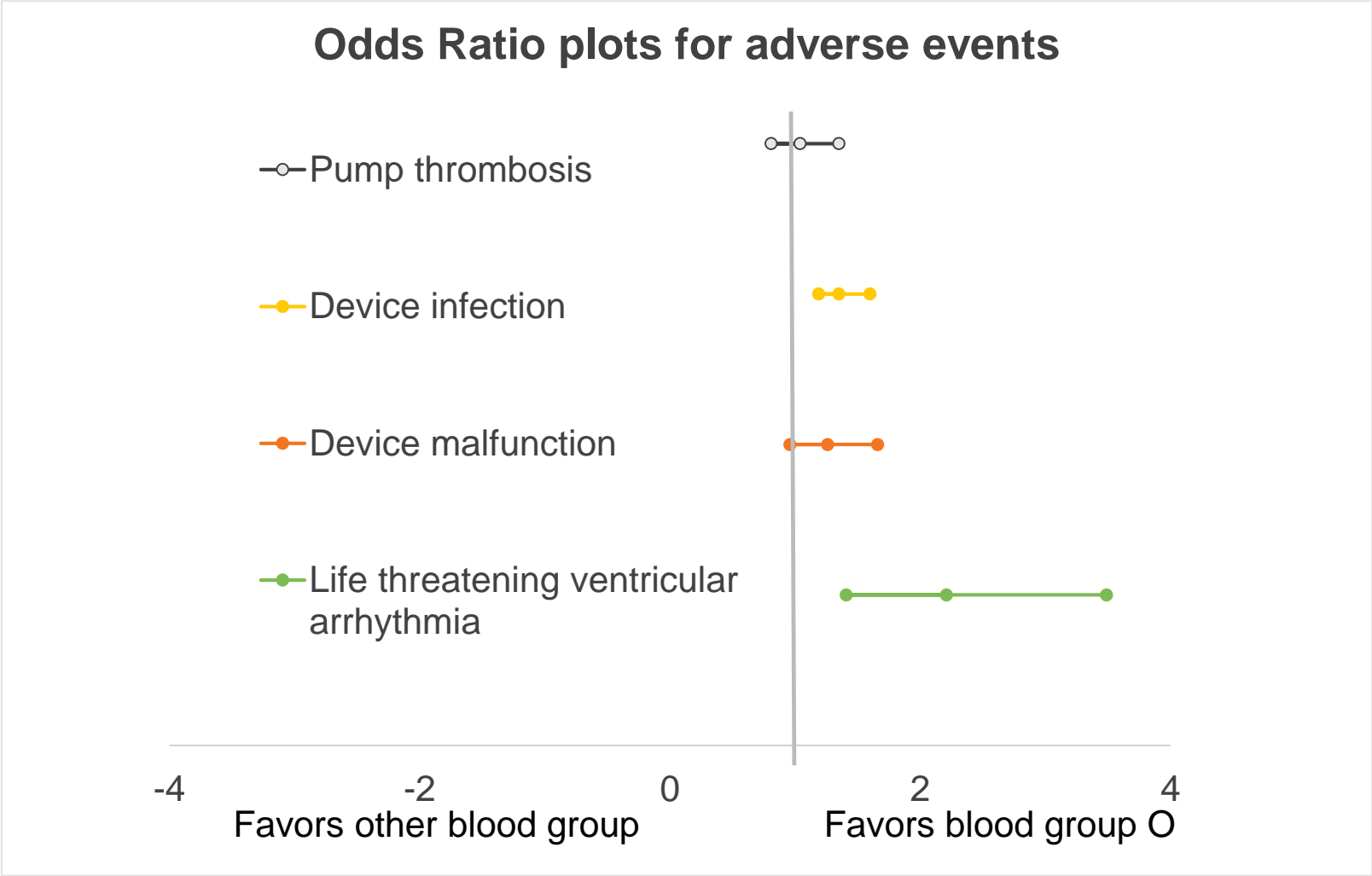
Figure 2:Kaplan Meier curves for waitlist mortality or removal

Kaplan-Meier curves for waitlist mortality by blood group

Number at risk						
Non-O	4461	994	358	145	57	23	11
Blood group O	4115	1637	726	324	137	57	27
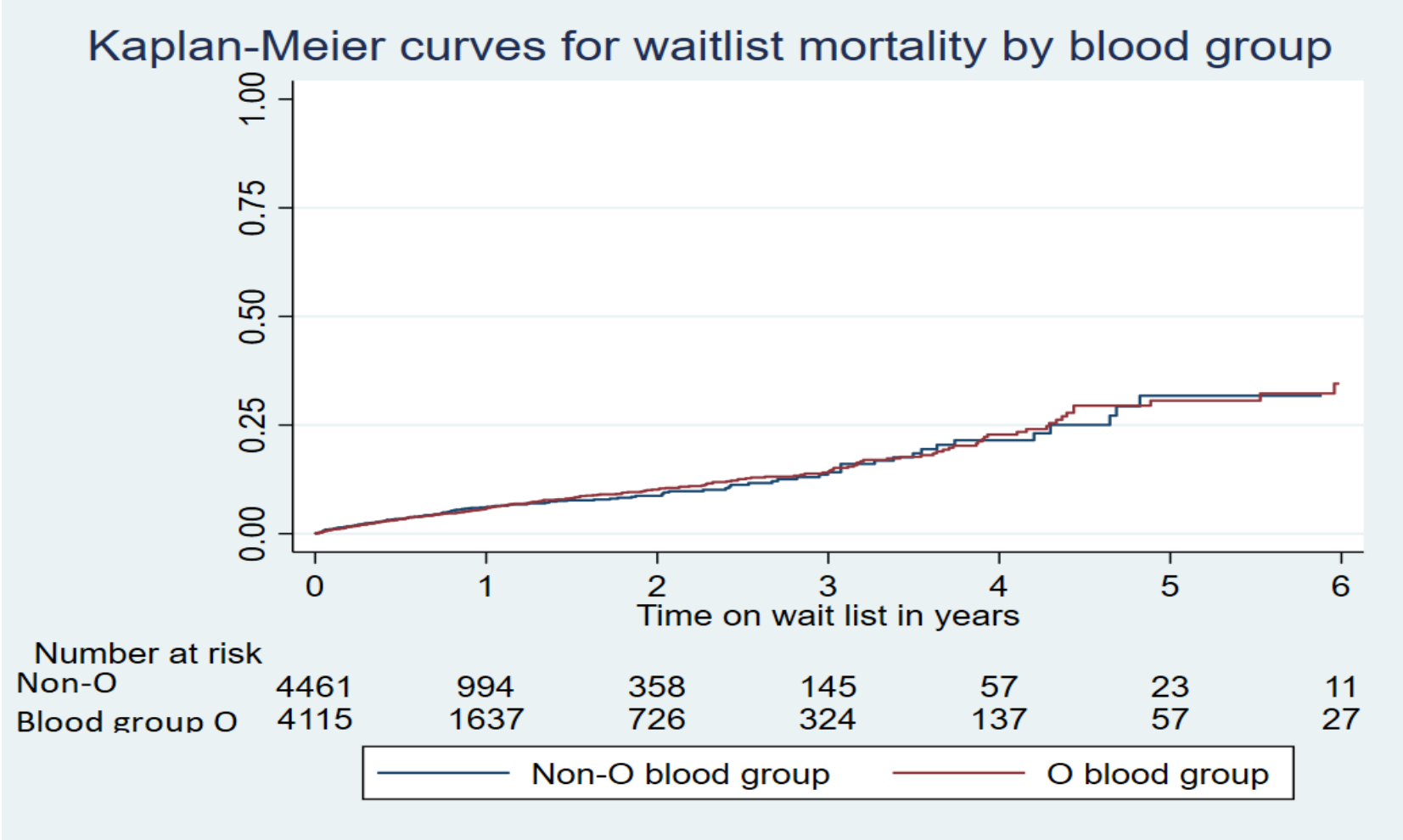
Figure 3: Kaplan Meier curves for post-transplant survival

Kaplan-Meier post transplant survival estimates by blood group

Number at risk						
Non-O	3247	1894	1148	564	210	40
Blood Group O	2359	1370	821	411	137	28

Non-O blood group — O blood group
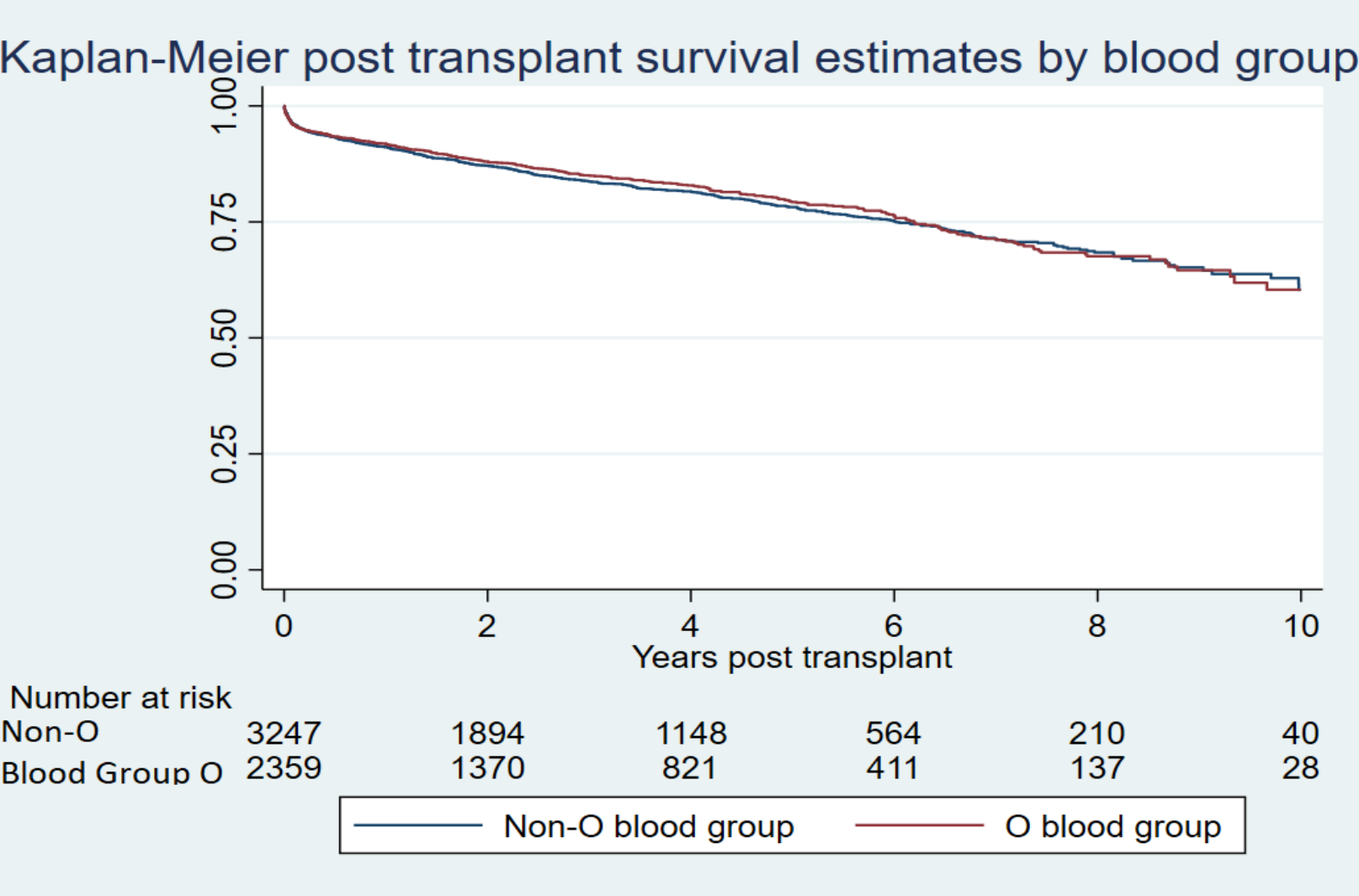
Discussion

– Reason for increased risk of device related complications with Blood group O is unclear however prolonged wait time could be a plausible reason

– Seems like CF LVAD seem to have protective effect on waitlist mortality/removal and post-transplant survival as patients without LVADs have worse outcomes [3]

– There is still significant impact of UNOS region on outcomes of patients regardless of their blood groups

– Providers should be vigilant to look for LVAD related complications in Blood group O patients

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Limitations

– Limitations of retrospective study and large database

– Type of device was not included in analysis. Heartmate 2, 3 and Heartware, the most commonly used CF LVADs have different complication profiles

Conclusion

– type O blood patients on CF-LVAD therapy awaiting heart transplant are more likely to develop driveline infections and life-threatening ventricular arrhythmias compared to non-O patients. These complications do not confer worse waitlist mortality or delisting

References

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