

Age-dependent Impact of Pre-transplant ICU Stay on Mortality in Heart Transplant Recipients

Trent Sims DO¹, Dmitry Tumin PhD², Don Hayes, Jr. MD³, Joseph D. Tobias MD^{1,2}

1. Department of Pediatric Critical Care Medicine at Nationwide Children's Hospital
2. Department of Anesthesiology & Pain Medicine at Nationwide Children's Hospital
3. Department of Pulmonary Medicine at Nationwide Children's Hospital.

Background

- Heart transplantation is definitive treatment for end-stage heart failure refractory to optimal medical management⁽¹⁾
- Prior research has shown decreased post-transplant survival in heart transplant recipients with the following risk factors⁽²⁻³⁾:
 - Mechanical ventilatory support; ECMO support; renal dialysis; and presence of infection requiring IV antimicrobial therapy
- Severe illness requiring **pre-transplant ICU stay** may also be a risk factor for diminished post-transplant survival, but this association is surprisingly inconsistent in recent studies⁽⁴⁻⁶⁾
- Adverse effect of ICU stay only evident in studies limited to infants and older adults

Objective

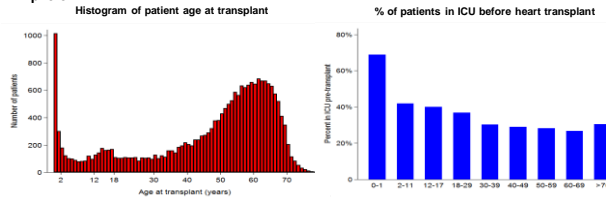
- Define ages where ICU stay predicts mortality after transplant.

Results

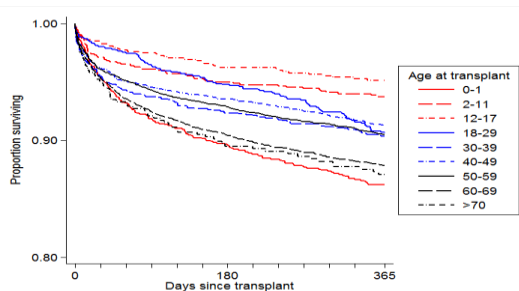
- Retrospective analysis of United Network of Organ Sharing registry, patients undergoing heart transplantation in 2006-2016
- Patients excluded if they underwent simultaneous multiple organ transplantation or retransplantation
- Nine age groups: 0-1, 2-11, 12-17, 18-29, 30-39, 40-49, 50-59, 60-69, and ≥70 years
- Primary Outcome → One year post-transplant mortality
- Cox proportional hazard regression estimate of unadjusted and adjusted hazard ratio (HR) associated with pre-transplant ICU stay in each age group.
- Covariates included gender, race, body mass index, indication for transplant, mechanical circulatory support, mechanical ventilation, renal dialysis, inotropes, bilirubin, pre-transplant infection, and graft ischemic time.

Results

- Analysis included a total of **24,207** patients
- 2179 (9%) died within 1 year of heart transplantation
- In the overall cohort, ICU stay was associated with increased hazard of 1 year mortality: **HR=1.3; 95% CI: 1.2-1.4; p<0.001**
- In age-specific univariate analysis, the HR associated with ICU stay was greatest among 1,514 infants **ages 0-1 years: HR=2.2; 95% CI: 1.5-3.2; p<0.001**
- In age-specific adjusted analysis, the highest statistically significant HR associated with ICU stay was among 2,639 adults **ages 40-49 years: HR=1.5; 95% CI: 1.1-2.1; p=0.011**

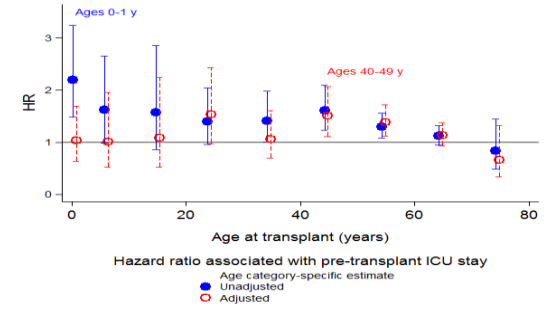


Kaplan-Meier plot of 1-year post-transplant mortality by age at transplant



Results

Adjusted hazard ratio (1-year mortality) associated with pre-transplant ICU stay



Discussion

- The association between ICU stay and survival after heart transplantation varies according to age
- On unadjusted analysis, ICU stay was most strongly associated with post-transplant survival among infants
- After adjustment, this association was strongest in early middle age.
- This may suggest opportunities for improving management of these recipients in the ICU prior to transplantation

References

- Mancini D and Naka Y. Book Chapter Cardiac Transplantation. Goldman-Cecil Medicine. 2016;82: 519-523.e1
- Lund LH, Edwards LB, Dipchand AJ, et al. The Registry of the International Society for Heart and Lung Transplantation: thirty-third adult heart transplantation report—2016. Focus theme: Primary diagnostic indications for transplant. J Heart Lung Transplant 2016;35: 1158-69.
- Rossano JW, Dipchand AJ, Edwards LB, et al. The Registry of the International Society for Heart and Lung Transplantation: nineteenth pediatric heart transplantation report—2016. Focus Theme: Primary diagnostic indications for transplant. J Heart Lung Transplant 2016;35: 1185-95.
- Stewart GC and Mehra MR. A History of Devices as an Alternative to Heart Transplantation. Heart Failure Clinics, 2014-01-01, Volume 10, Issue 1, Pages S1-S12
- Hong KN, Irbarne A, Worku B, et al. Who Is the High-Risk Recipient? Predicting Mortality After Heart Transplant Using Pretransplant Donor and Recipient Risk Factors. Ann Thorac Surg 2015;129:520-7
- Davies RR, Russo MJ, Mital S, et al. Predicting survival among high-risk pediatric cardiac transplant recipients: An analysis of the United Network for Organ Sharing database. Cardiothoracic Transplantation. J Thorac Cardiovasc Surg 2008;135:147-55