Post-Operative AKI as a Predictor of Diastolic Dysfunction After Pediatric Heart Transplant

Faizeen Zafar, MBBS[1]; Chet Villa, MD[1]; Huaiyu Zang, PhD[1]; Nicholas Ollberding, PhD[1]; Danielle E Soranno, MD[2]; Tanya Perry, DO[1]; Katja M Gist, DO, MSc[1].
[1]Cincinnati Children's Hospital Medical Center
[2]Riley Children's Health

Background

- **Acute kidney injury (AKI) is a common complication** following pediatric heart transplant – Incidence varies from **30-60%.**

- **Animal studies** (murine model) have demonstrated **diastolic dysfunction following an AKI episode**; this is yet to be explored in a clinical setting.

- We **hypothesized** that **post-op AKI in heart transplant recipients is associated with diastolic dysfunction** in the post-transplant period.

Methods

- Retrospective single center study

- **Included:** Heart transplants at CCHMC **up to 21 years age** from 2010-2023

- **Excluded:** Multi-organ or repeat heart transplants

- **Exposure:** Post-op AKI; defined and staged per the KDIGO criteria

- **Primary outcome**: Diastolic function was assessed using **right ventricular end-diastolic pressure (RVEDP)** and **pulmonary capillary wedge pressure (PCWP)** obtained from routine cardiac catheterizations in the 1st post-transplant year

- A mixed effects regression model with an autoregressive correlation structure was used to compare hemodynamics between groups

Results

- **N = 102** patients

- **Median age at transplant:** 3 years (IQR 0-13 years)

- **Incidence of post-op AKI:**
  - Any AKI: 33 patients
  - Stage 2/3 AKI: 18 patients

Variable	AKI (n=33)	No AKI (n=69)
Age, years; median (IQR)	9 (1-14)	2 (0-13)
Female sex; n (%)	11 (33)	30 (43%)
Pre-transplant diagnosis; n (%)*		
Congenital heart disease	24 (73%)	31 (45%)
Cardiomyopathy	9 (27%)	38 (55%)
Days on waitlist; median (IQR)*	52 (14-161)	48 (18-121)
Previous VAD support; n (%)	9 (27)	24 (73)
Previous ventilator support; n (%)	7 (54)	6 (46)
Baseline eGFR (creatinine), mL/min/1.73m²; median (IQR)*	104 (86-125)	121 (99-148))
Ischemia time, minutes; median (IQR)*	253 (227-289)	228 (196-262)

*Significantly different between AKI and no AKI groups

Results

- **AKI was more common in patients with congenital heart disease** (24/55; 44%) than cardiomyopathy (9/47;19%) **(p = 0.008).**

- **Mean RVEDP and PCWP were 1 mmHg higher in patients with AKI than those without AKI** (RVEDP 95% CI 0.5-1.7, p=0.008; PCWP 95% CI 0.3-1.7, **p=0.008**) after adjusting for pre-transplant cardiac diagnosis, ischemia time >4h, and time since heart transplant.
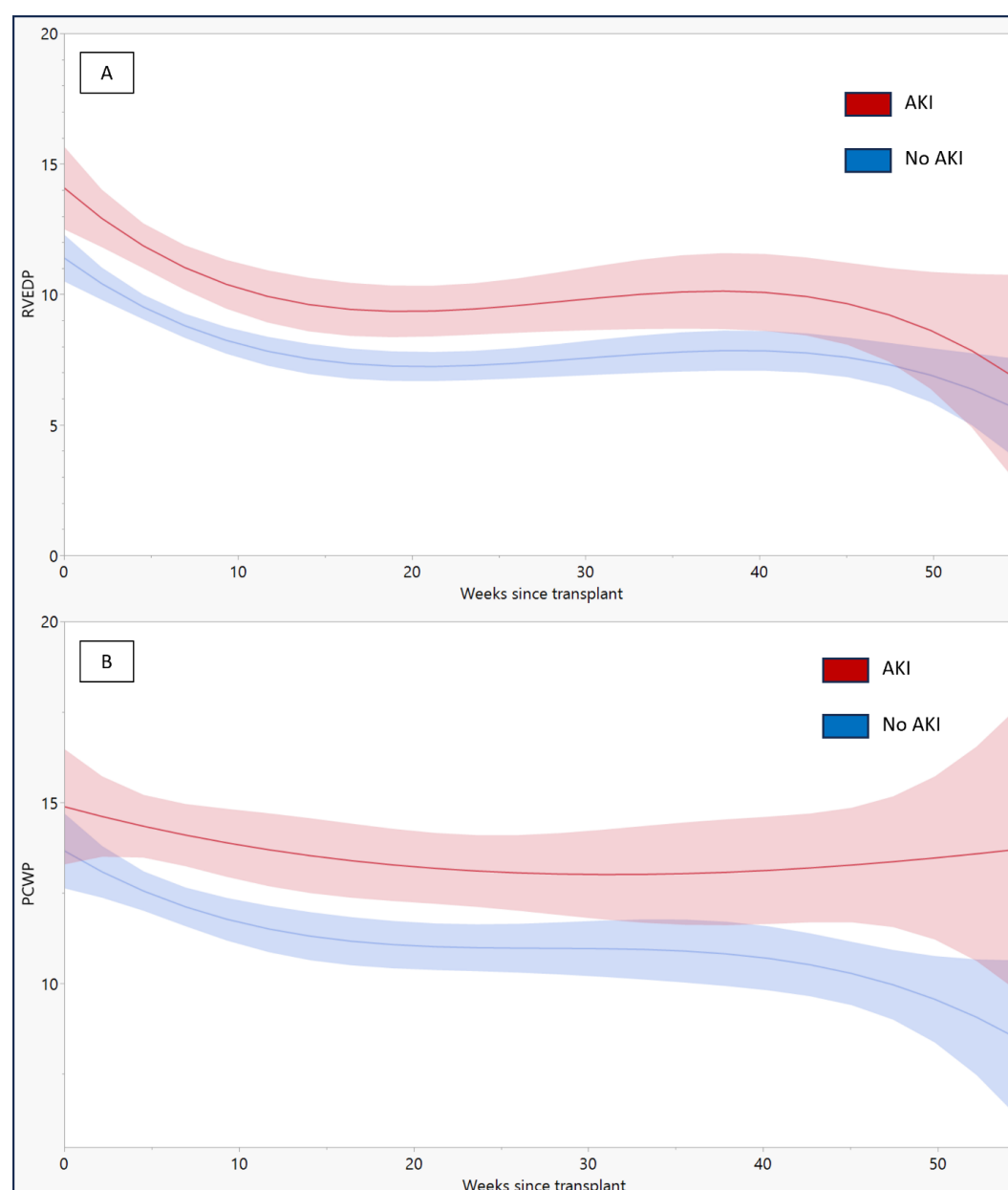
Figure 1: Visualization of hemodynamic trends after pediatric heart transplant in patients with and without AKI. Panel A depicts trends in right ventricular end-diastolic pressure (RVEDP), and Panel B shows trends in pulmonary capillary wedge pressure (PCWP), with the post-transplant period plotted on the x-axis in weeks. LOESS (locally estimated scatterplot smoothing) lines illustrate the trend of RVEDP and PCWP over time. Shaded areas represent 95% confidence intervals.

Conclusions

- This is **the first clinical study** to explore the association between AKI and diastolic dysfunction.

- **AKI was independently associated with higher RVEDP and PCWP** in the 1st year after heart transplant in our pediatric and young adult cohort.

- Therefore, **AKI may serve as a predictor of prolonged diastolic dysfunction** in this patient population.