The Effect of ACE Inhibitors on AV Valve Regurgitation Among Patients with Single Ventricles

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Background

Angiotensin converting enzyme inhibitors (ACE-I) have been shown to effect myocardium remodeling and afterload reduction in adults but have shown little long term benefit in single ventricle patients[1]. However, there is little information on their utility in the specific subgroup that has atrioventricular valve regurgitation (AVVR)[1]. Single ventricle pathology alters the normal cardiac physiology by having a single ventricle function for both systemic and pulmonary vascular flow. Consequently, this causes greater stresses on atrioventricular (AV) valves than normal, where often only one AV valve is formed or is functional[2] (tricuspid with hypoplastic left, mitral with hypoplastic right and common AV valves with atrioventricular canal defects). Early development of AVVR is a risk factor for worse morbidity and mortality[2, 5]. These patients are particularly fragile between first and second stage palliative surgeries (see Figure 1), known as the interstage period. Echocardiography is useful to quantify and trend AVVR based on multiple indices[3, 4]. We hypothesized that due to the afterload reducing effects of ACE-I there would be a decrease in AVVR during the interstage period of single ventricle palliation.

Stages of Surgical Repair for Single Ventricle Hearts

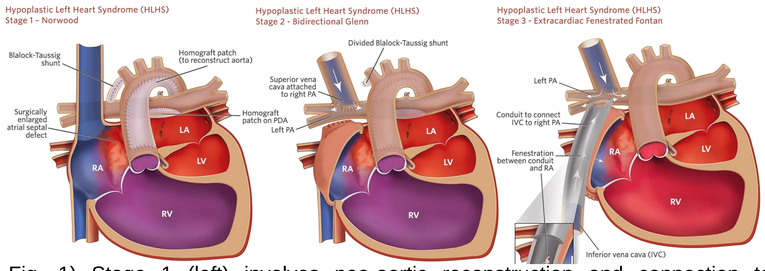

Fig. 1) Stage 1 (left) involves neo-aortic reconstruction and connection to pulmonary arteries with BT shunt. Stage 2 (middle) BT shunt removed, SVC is redirected into PA. Stage 3 (right) IVC connected to PA with conduit or baffle. Abbreviations: BT Blalock-Taussig, PA pulmonary artery, SVC superior vena cava, IVC inferior vena cava,. *Adapted from: www.chop.edu/treatments/staged-reconstruction-heart-surgery

Objectives

Using our database of echocardiograms to trend AVVR during the interstage period, we hope to identify if the use of ACE-I improves AVVR in pediatric single ventricle patients. This will help to establish a data driven standard of care for future single ventricle patients.

Materials & Methods

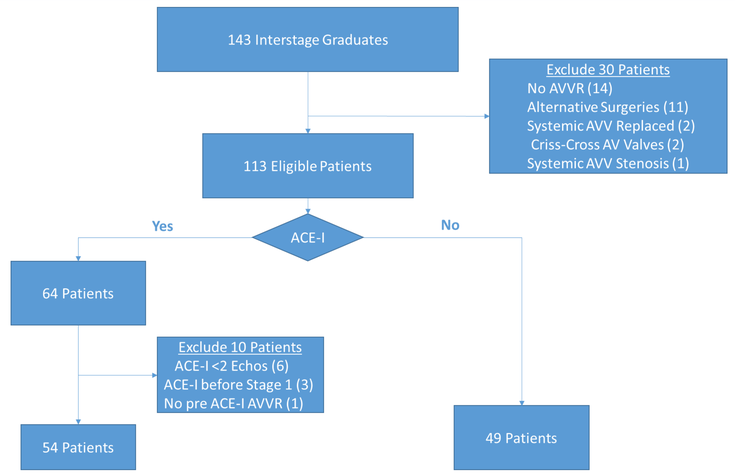

Fig. 2) Inclusion criteria required single ventricle physiology, AVVR, multiple echos and age <18. Exclusion criteria of experimental and control groups as above.

- IRB approved Safe at Home database access
- Echo review to identify patients with AVVR (2500+ Echos)
- Create Single Ventricle Echo Database in Microsoft Excel
- Surgical/Procedure Reports for interstage timeline
- Medication review to identify ACE-I use >2 Echos in interstage
- Analysis of pre and post ACE-I AVVR to determine effect

Results

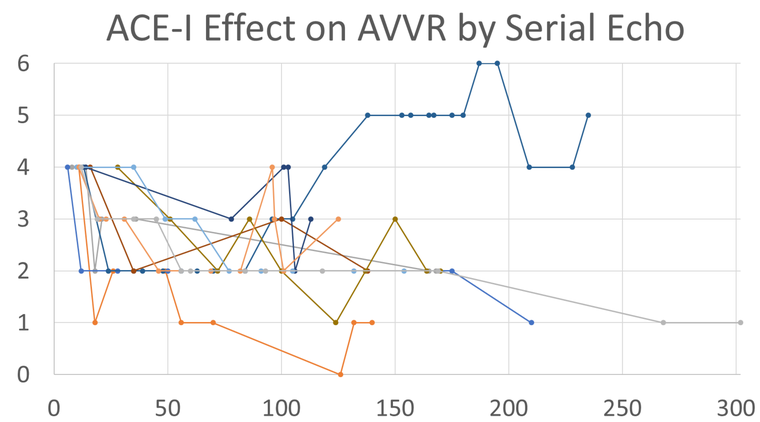

Fig. 3) Patients within the ACE-I group with moderate AVVR before ACE-I treatment followed through the duration of medical therapy or stage 2 surgery (whichever came first). Nine of ten showed reduction of AVVR with ACE-I use.

Results (Continued)

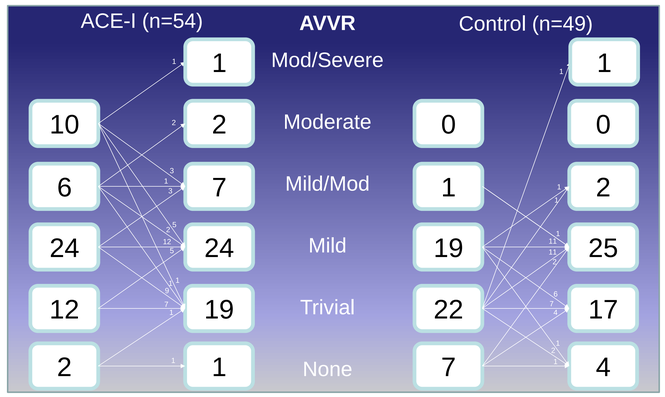

Fig. 4) Progression of AVVR in both ACE-I and Control groups throughout the interstage period. ACE-I patients improved from moderate, mild/mod and mild AVVR (90%, 50% and 37.5%) compared to (n/a, 0% and 36.8%) in the control group respectively.

Conclusions

Our retrospective analysis indicates that ACE-I improve AVVR severity compared to patients that did not receive these medications. Our data suggest that more severe AVVR was more likely to be treated with ACE-I and more likely to improve with ACE-I treatment than the control group. This agrees with studies that have shown that surgical intervention with early onset AVVR improved survival[5], and may substantiate the need for early medical intervention of higher grade AVVR.

Limitations in our study include a small sample size, subjective bias between various readers of echocardiograms, and inconsistent reporting of quantifiable indicators of AVVR. We believe that these limitations can be overcome with further studies to standardize reporting and collaborate between multiple centers to increase the sample size and power of the study. Ultimately, a prospective randomized trial should be done to measure the true effects of ACE-I on AVVR in single ventricle patients.

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