Prenatal Echocardiographic Predictors of Atrioventricular Septal Defect Postnatal Surgical Strategies

Ryan Bishop, MD[1], Betul Yilmaz Furtun, MD[1], Neil Cambronero, MD[1], Tam T Doan, MD[1], Shaine A Morris, MD, MPH[1]

[1]Section of Pediatric Cardiology, Texas Children's Hospital & Baylor College of Medicine, Houston, Texas

INTRODUCTION AND AIM

- Prenatal counseling regarding atrioventricular septal defect (AVSD) surgical outcomes in patients with **borderline small left heart structures** remains a challenge, particularly in unbalanced AVSD.
- Our aim was to create a **predictive algorithm** using fetal echocardiographic variables associated with single ventricle (SV) palliation, staged biventricular (BiV) repair, or standard BiV repair.

METHODS

- **Study Design:** Retrospective cohort study
- **Inclusion:** Fetuses with AVSD (2011-2022)
- **Exclusion**: Valve atresia, heterotaxy, great artery malposition, trisomy 13/18, diaphragmatic hernia, severe growth restriction, fetal death/comfort care
- **Data:** Fetal echo measurements collected with z-scores
  - Aortic-valve-to-pulmonary-valve annulus (AP) ratios and short-axis left-to-right-ventricular end-diastolic dimension (LVED-RVED) ratios calculated
- **Primary Outcomes:**
  - SV palliation, staged BiV repair, or standard BiV repair
- **Statistical Analysis:**
  - Univariable mixed regression analysis of fetal variables and SV palliation
  - Classification and regression tree (CART) analyses performed to construct an algorithm to predict surgical strategies

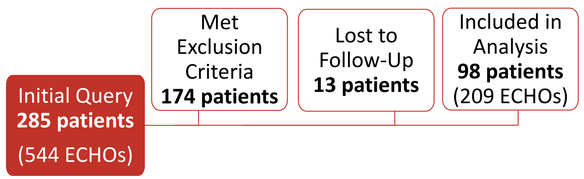


FIGURE 1. CART Model of Neonatal Outcomes Based on Fetal ECHO

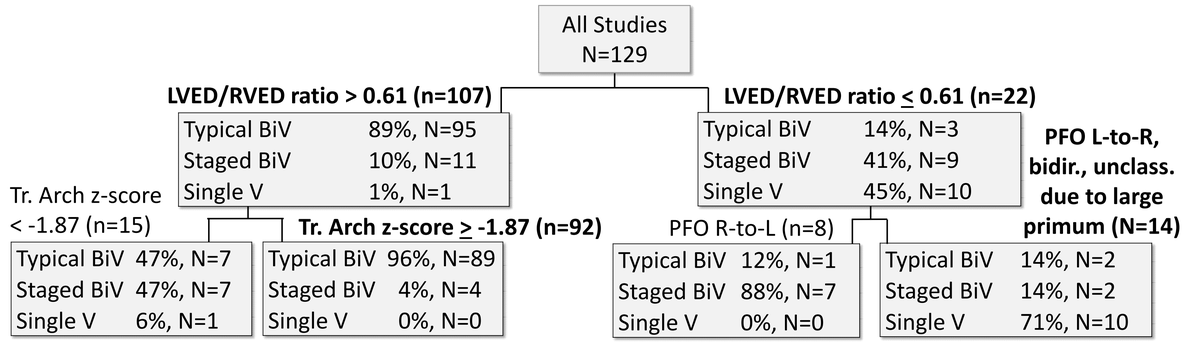
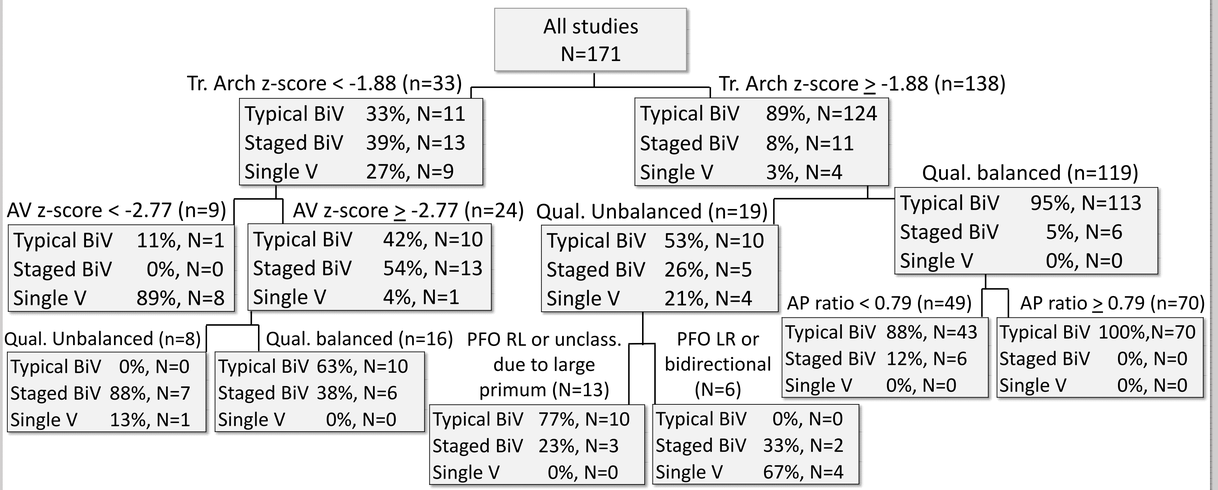


FIGURE 2. CART Model without LVED and RVED



CART MODELING RESULTS

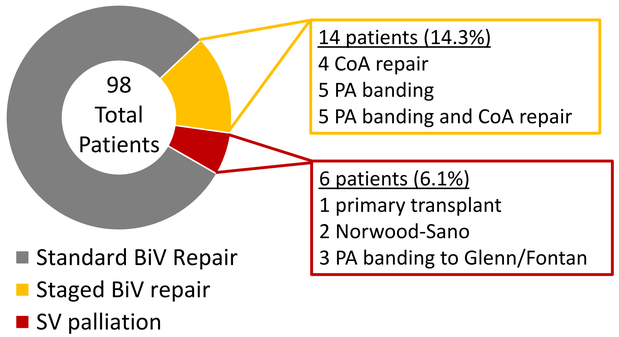
- Including **all 129 echocardiograms with complete measurements**, CART modeling identified:
  - **LVED-RVED ratio ≤ 0.61** with absence of predominantly right-to-left flow at the foramen ovale as **predictive of SV palliation (71%)**, outperforming qualitative unbalanced assessment.
  - In contrast, LVED-RVED ratio > 0.61 and transverse arch z-score > -1.87 had a **96% chance of standard BiV repair**, and a 4% chance of staged BiV repair, with no SV palliation.

RESULTS

TABLE 1: COHORT DEMOGRAPHICS

		Cohort (n=98)
Male, n (%)		47 (48%)
Race, Ethnicity, n (%)	*Black/AA, Non-H*	19 (19.3%)
	Black/AA, Hisp. or L.	1 (1.0%)
	W, Hispanic or Latino	23 (23.5%)
	W, Non-Hispanic or L.	49 (50.0%)
	Other	3 (3.1%)
	Unable to Obtain	3 (3.1%)
Trisomy 21, n (%)		75 (77%)

FIGURE 3: POSTNATAL SURGICAL STRATEGIES



CONCLUSIONS

- CART model decision trees remain a powerful tool for improving prenatal anticipatory guidance for congenital heart disease.
- Surrogate objective markers for degree of unbalance, such AP ratio, appear promising as predictors of staged BiV repair among well-balanced patients.
- Future studies should validate CART model cutoffs prospectively.

Author disclosures: SM is a consultant for Aytu BioPharma.