

**Transesophageal Saline Contrast Echocardiography in Fontan Patients: Assessment of the Presence, Type and Size of Right to Left Shunting**

Adhikari, Rishi; and Roberson, David

The Heart Institute for Children, Advocate Hope Children's Hospital, Oak Lawn, IL

**Background:** Right to left shunts (R2LS) resulting in cyanosis or systemic embolization occur after Fontan procedure (F). Three types of right to left shunt exist: 1. Intracardiac shunts (ICS) due to fenestrations, baffle leaks, etc. 2. Intrapulmonary intravenous malformations (AVM). 3. Systemic to pulmonary venovenous connections (VVC).

**Aim:** Test the hypothesis that a selective saline contrast transesophageal echocardiography (SCTEE) protocol accurately determines the presence, type and semi-quantitative shunt size of R2LS in F.

**Methods:** SCTEE of 10 ml agitated saline were performed in a consecutive cohort of F patients having catheterization plus TEE for clinical indications. The protocol was as follows: Injection #1 into mid Fontan at cardiac level, if SCTEE positive in left atrium (LA) within 1 beat = ICS present. Injection #2A and 2B into right pulmonary artery and left pulmonary, if contrast present in pulmonary vein and LA after short delay = AVM present. Injection #3A and B into SVC and IVC, if SCTEE positive in LA after several heart beats = VVC present. We used 7 second cine loops. R2LS shunt size scale: 0 = absent, 1 = small, 2 = medium or large was subjectively scored according the echocardiography contrast density in the LA. SCTEE was compared to angiography (angio). Echo reviewers were blinded from angio results.

**Results:** The 29 patients had these features & diagnoses: Age = 2-38 yrs, median 15; Wt = 9-91 kg, median 44.2 kg; O<sub>2</sub> sat (FiO<sub>2</sub>) = 80-95%, median 90; Diagnoses = hypoplastic left heart (9), tricuspid atresia (8), double inlet LV (4), pulmonary atresia (3), unbalanced AV canal (2), other complex (3). Types and number of R2LS were: None = 4, ICS = 8, AVM = 1, VVC = 7, ICS+VVC = 5, ICS+AVM = 1, ICS+AVM+VVC = 1, AVM+VVC = 2. SCTEE vs angio results were the same for presence, type and size of R2LS in 79% (23/29). SCTEE vs angio results were the same for all shunts of size 0 and size 2. SCTEE was accurate in 90% (26/29), it missed 2 small VVC and 1 small ICS. Angio was accurate in 86% (25/29), it missed 3 small AVM and 1 small ICS. Neither method missed any large R2LS. Neither method had any false positives.

**Conclusions:** Selective SCTEE and angio have similar accuracy. Selective SCTEE accurately detects the presence, type and size of R2LS in F in the majority of cases. Large R2LS are not likely to be missed. False positives are unlikely. This information can be used to guide targeted angiography thereby reducing radiation exposure and angiographic contrast load.