

MRI versus Echocardiography; To Evaluate Coronary Arteries Following Arterial Switch Operation

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Objective: This study was intended to define coronary artery anatomy by MRI and make comparison to Echocardiography in patients with dextro-Transposition of the Great Arteries (d-TGA) following Arterial Switch Operation (ASO).

Background: TGA accounts for approximately 6 percent of all congenital heart disease (CHD) and occurs in nearly 5 per 10,000 births in the United States. The most prevalent form, d-TGA, is contemporarily corrected by ASO. Patients who have undergone ASO require long-term follow-up, including evaluation of the re-implanted coronary arteries. Echocardiography has previously been considered a gold-standard for evaluation of coronary arteries. However patient size, body habitus, and acoustic windows, along with inability to visualize distal coronary arteries are all limiting factors. With the evolution of Cardiac MRI, it is now possible to definitively evaluate the proximal and distal coronary arteries with volume-scanning MRI technique.

Methods: Cardiac MRI and 2-D Echocardiogram were performed on 21 patients who had undergone ASO. Studies were done between May 2009 and March 2013. Patients varied by gender and age (1.9 to 20.6 years). Echocardiogram was performed on most within 6 months of the MRI. Each patient had a complete physical exam prior to the MRI scan. The need for sedation was determined; those older than ten years of age with no cognitive defects were not sedated. MRI was performed using a 1.5T system manufactured by Phillips. An initial survey was obtained, followed by black-blood axial sequences, and volume scan of the entire heart. This technique generates ultrafast and over-contiguous images, and utilizes ECG trigger and respiratory-gated navigation. Subsequently all patients received a complete Cardiac MRI evaluation per a standard protocol. Each study was reviewed and analyzed at a 3-D work station using Phillips, TeraRecon, and Vitrea software by an MRI-trained cardiologist. Initially, the origins of the Right Coronary Artery (RCA) and Left Coronary Artery (LCA) were identified from their respective aortic sinuses. Once this was established the RCA was visualized beyond the Acute Marginal Branch with the target of the Posterior Descending Artery. The LCA was delineated through the bifurcation. The Left Anterior Descending and Circumflex arteries were visualized beyond the Diagonal, Septal, and Obtuse Marginal Branches. Image quality (IQ) 5-level score was employed (1=non-diagnostic, 5=excellent).

Results: By Echocardiogram, proximal coronary arteries were defined in 43% of patients (9 of 21), not well seen in 29% of patients (6 of 21), and not visualized in 29% (6 of 21). Using Cardiac MRI both proximal *and* distal coronary arteries were well-defined in 100% of patients (21 of 21) with the IQ score ranging from 4 to 5. To perform MRI, 12 patients required deep sedation due to young age, and none required general anesthesia. No sedation was necessary for Echocardiography.

Conclusion: This study demonstrates that Cardiac MRI, using real-time, free-breathing navigator technique is an effective and safe modality for visualizing both the proximal and distal coronary arteries following ASO. This method of MRI is time-efficient, noninvasive, involves no exposure to radiation or contrast agents, and requires no patient breath-holding. We highly recommend employing Cardiac MRI in post-operative evaluation and management of patients with d-TGA.