Three Dimensional Fly-Through Characterizes Coronary Ostia in Patients with Coronary Anomalies

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Introduction: Anomalous origin of the right or left coronary artery (AORCA or AOLCA) from the contralateral sinus of Valsalva is a congenital heart defect associated with exercise-induced ischemia and sudden death. This has been thought to be due to aortic enlargement in patients with an elliptical ostium. Hypothesis Fly-Through (FT) analysis in Cardiac Magnetic Resonance (CMR) characterizes abnormal coronary ostial morphology in patients with AORCA and AOLCA from the contralateral sinus of Valsalva.
Methods: We retrospectively analyzed 56 consecutive CMR coronary studies (mean age 11.6 ± 4.6 years) from January 2006 to January 2010 with the diagnosis of AORCA (n=20), AOLCA (n=7), or normal coronary origins (n=28). One postmortem heart specimen with AOLCA was imaged and analyzed with FT to validate our technique. FT analysis was used for visualization and measurement of the coronary ostia, and localization relative to the intercoronary commisure (ICC).
Results: Distinct aortic origins of the RCA and LCA were seen in all 56 studies. An elliptical orifice with a longer superior-inferior dimension was seen in all AORCA and AOLCA ostia, in contrast to the circular origin in all normal coronary origins. This was quantified in AORCA and AOLCA ostia with a long to short axis ratio of 2.5 ±0.4 compared to 1.06 ± 0.26 in controls ($p<0.001$). The locations of the ostia in AORCA and AOLCA were also significantly closer to the ICC, with the ratio of the ostial-ICC angle to the ICC-neighboring non-coronary commissural angle of 0.09 ± 0.07, compared to 0.54 ± 0.10 in controls ($p<0.001$) (A ratio of 0.5 indicates that the ostium is in the center of the sinus). Ostial morphology was confirmed in all nine patients who underwent operative repair and one patient at autopsy (Figure).
Conclusions: FT in coronary CMR identified abnormal ostial morphology and location in AORCA and AOLCA. This may be important in stratifying a patient’s risk for sudden death.

<IMAGE03>