

Improved visualization of coronary arteries in patients with congenital heart disease using whole-heart image navigated MR angiography

Velasco Forte M.N. (1, 2), Pushparajah K. (1, 2), Narayan S. (1, 2), Mathur S. (1, 2), Valverde I (1, 2, 3), Bell A. (2), Bellsham-Revell H. (1, 2), Razavi R. (1, 2), Henningson M. (1)
King's College London, UK (1), Department of Congenital Heart Disease, Evelina London Children's Hospital, Guy's and St Thomas NHS Foundation Trust, UK (2), Cardiovascular Pathology Unit, Institute of Biomedicine of Seville, IBIS, Virgen del Rocio University Hospital/CSIC/University of Seville, Spain (3)

Background: Whole-heart MR angiography (CMRA) is commonly used in patients with congenital heart disease (CHD) to assess morphology and structural disease. However, respiratory motion remains an impediment in a substantial amount of patients undergoing CMR. Studies in healthy subjects and cardiac patients have shown that image-based navigation (iNAV) improves respiratory motion compensation compared to conventional methods. Here, we investigated the use of iNAV with advanced respiratory gating in patients with CHD.

Methods: iNAV allowed for direct tracking of the respiratory heart motion and was generated using the bSSFP startup echoes. Gating was achieved using the diminishing variance gating (DVG) algorithm with a 50% gating efficiency. Whole-heart CMRA was acquired with 1.3mm isotropic resolution and SENSE=2. For comparison, CMRA with identical imaging parameters were acquired using conventional diaphragmatic navigator with gating window of 3 - 5 mm and 0.6 tracking factor. Use of contrast agent before whole-heart imaging acquisition and need for general anaesthesia (GA) was recorded. Scan time, visualization of coronary artery origins and distal course and imaging quality was compared between the two sequences. Image quality was scored 1-5 for each dataset.

Results: A total of 27 patients (19 males; median weight: 49 kg; range: 6.5–70; mean age: 13, 5 months–18 years) were recruited. Diagnosis are summarised in table 1. 66% scans were performed in awake patients and 33% under GA. A contrast agent was used in 51%. Scan time was significantly shorter using iNAV (mean: 6:59 ± 1:23) compared to conventional (9:17 ± 2:34, p < 0.05). Difference in visual score, using Wilcoxon sign-rank, was improved using iNAV, the difference was statistically significant (p < 0.001). The coronary arteries origin was depicted in all patients using iNav and 96% using conventional techniques. Distal course of all coronary arteries was more often visualized when using iNav (85% vs 57%). In 3.5% none of the coronary arteries could be visualized distally using respiratory navigation and in 35% they were depicted partially.

Conclusion: iNav allows for a higher success-rate and clearer depiction of the distal course of the coronary arteries in patients with CHD. Its acquisition time is shorter and image quality score was found to be equal or superior to the conventional method in all cases.

