3D trans-thoracic echocardiography in assessment and follow up of corrected tetralogy of Fallot patients: whether it is comparable to MRI or not?

AMIRA Nour¹, MAIY El Sayed¹
¹Ain Shams University Hospital, Cairo, Egypt

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Background: Nowadays with the increasing number of repaired Fallot patients, and the chronicity of pulmonary regurgitation leading to severe right ventricle dilatation and impairment of ventricular functions, we need a method for regular follow up for the appropriate timing for intervention for pulmonary valve replacement either surgical or per-cutaneous. Cardiac MRI is the gold standard however time consuming and more expensive. 3D trans-thoracic echocardiography has recently been developed and applied for assessment of RV volumes and functions.

Aim: To evaluate right ventricle (RV) volume, ejection fraction (EF) and pulmonary valve (PV) regurgitant fraction in patients post tetralogy of Fallot (TOF) repair by 3D trans-thoracic echocardiography (3DE) in comparison with the gold standard cardiac MRI regarding its accuracy and variability and whether it can be used for annual follow up.

Methods: The study group composed of 100 patients post TOF repair with mean age group (11.66 ± 4.65), mean BSA (1.18 ± 0.36) underwent both 3D echo and CMR within 2 to 3 days. 3D echo assessment of Right ventricle end diastolic volume (RV EDV), end systolic volume (RV ESV), ejection fraction (EF), severity of pulmonary regurgitant and regurgitant fraction were carried out by two different operators using 3D echo compared with the cardiac MRI results for the same parameters done by the standard protocol according to ESC working group of cardiovascular imaging guidelines.

Results: On comparing the two groups, 3DE was comparable to the CMR in assessment of EF (52.69 ± 6.44 % by 3DE vs 51.38 ± 6.86 % by CMR) with p value (0.165) by the paired test, while the RV EDVI and RV ESVI was slightly elevated by CMR vs 3 DE (RVEDVI: 147.85 ± 40.77 ml/m², RVESVI: 72.69 ± 27.70 ml/m²) by CMR vs (RVEDVI: 136.51 ± 34.40 ml/m², RVESVI 65.12 ± 22.44 ml/m²) by 3 DE with p value (0.035), however there was statistical difference when comparing regurgitant fraction (RF) by CMR vs 3DE which was technically difficult and time consuming when calculating by 3DE as the RF was significantly higher by CMR (46.44 ± 11.27 %) vs 3DE (40.57 ± 10.50 %) with P value (0.000), our study also noted positive linear correlation between regurgitant fraction and RV EDVI (p value 0.000), and RV ESVI (p value = 0.010), and pulmonary valve annulus (p value = 0.000) respectively.

Conclusion: Three dimensional echo when compared to cardiac MRI as a method for assessment of patients with repaired TOF showed quite agreement in assessment of ejection fraction with slight difference in assessment of ventricular volumes as the accuracy of the 3DE decreases in larger volumes, however the significant difference in assessment of regurgitant fraction by 3DE makes it used as a method for serial follow up however CMR should be done as baseline.
correlation of RF and CMR parameters