for Fallot patients: Interest of a simple formula to detect invalid exams

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Purpose   Cardiac MRI (CMR) is the key exam for Fallot patients but remains tricky. The CMR report should at least mention left and right ventricle end-diastole volumes (Vl and Vr), ejection fraction (EFl and EFr) and pulmonary regurgitation (PR). Obviously, these variables are linked together by basic physiology rules and indeed $Vl \times EFl = Vr \times EFr \times (1-PR)$. We investigated the interest of using such formula as quality check during Fallot CMR exams in our center.
Methods   98 consecutive CMR examinations for Fallot (or Fallot-like) cardiopathy between 2010 and 2014 were retrospectively included. The exams failing to pass the formula (with a 10% tolerance) constituted the Invalid-group and a control group of the same size was also constituted. CMR of both groups were randomly submitted to a blinded senior observer. The inter-observer limits of agreements were compared for the different variables within both groups.
Results   (Fig. 1) 12 CMR (12%) failed to pass the validation formula. From the 24 reanalyzed CMR, only 4 failed to pass the formula (all from the Invalid-group). Two had persistent defect (VSD or ASD) which were not mentioned to the radiologist and not detected during the CMR. Two had significant artefacts in the aorta or pulmonary trunk due to sterna wires. The inter-observer disagreements for the 8 other CMR of the Invalid-group concerned the Right ventricle end-diastole volume ($P < 0.05$).
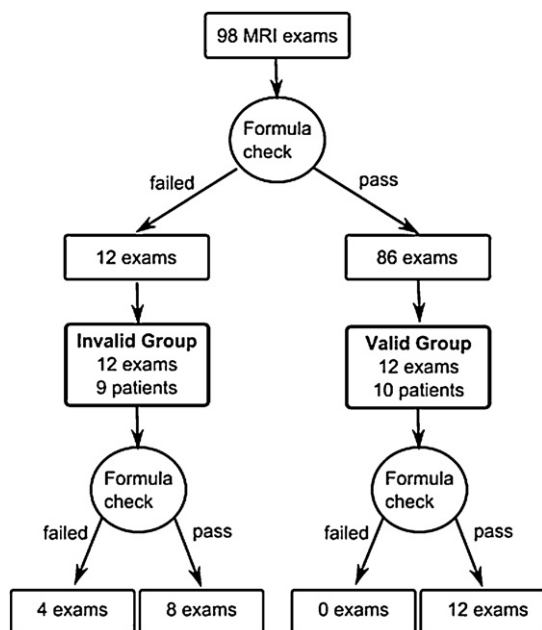
of CMR with issues. 8% of the CMR corresponded to uncertain right ventricle contours, 2% to persistent septal defects that should have been noticed during the examination and 2% to unreliable aortic or pulmonary flow due to artifacts. The formula could have permitted either to detect the anomalies or at least to conclude that the quality of the exams was impaired.
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18
Feasibility and accuracy of left ventricular volumes and ejection fraction measured by different echocardiographic methods in congenital heart diseases involving the right ventricle

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Background   In CHD with RV volumetric or barometric overload, LV shape is altered. Little is known about the accuracy in this population of left ventricular (LV) volumes and ejection fraction (EF) measurement by standard echocardiographic methods using geometrical assumption: Teicholz, biplane Simpson and real-time 3D echocardiography (RT-3DE). Three-dimensional knowledge-based reconstruction (3D-KR) derived from two-dimensional echocardiographic imaging is a novel technique that has no geometrical assumption. The aim of our study is to assess the accuracy of several echocardiographic methods for measuring LV volumes and EF compared to cardiac magnetic resonance (CMR) measurements (gold standard) in this population.
Methods   68 patients (mean age $13,3 \pm 4$ years) with Congenital Heart Diseases (CHD) involving the RV and referred for cardiac MRI, were included. Among them, 13 patients had barometric overload, 37 patients had volumetric overload, and 18 patients had mixed overload. Echocardiographic images acquisition was performed using a standard ultrasound scanner linked to a Ventripoint Medical Systems unit. Analyzed parameters were end-diastolic volume (EDV), end-systolic volume (ESV), and LVEF measured by Teicholz, Simpson's modified formula and RT-3DE (GE Vingmed QVG Auto-4D). The method of disks was used for CMR LV volumes. Intra-observer, inter-observer, and inter-technique variability was assessed using intraclass correlation coefficient (CC), Pearson's CC, coefficients of variation, and Bland-Altman analysis.
Results   Feasibility was 98% for Teicholz Method and 3D-KR, 71% for Simpson's modified formula, and 73% for RT-3DE. We found globally poor correlation and agreement for volumes and EF between the different methods and MRI. The agreement was better when RV volumes were lower than $120 \, mL/m^2$ (and thus, LV shape was less altered).
Conclusions   LV volumes and EFs cannot be measured accurately by echocardiography in patients with dilated right ventricles.
Disclosure of interest   The authors have not supplied their declaration of conflict of interest.

Fig. 1