



Left and right ventricular parameters corrected with threshold-based quantification method in a normal cohort analyzed by three independent observers with various training-degree

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Abstract

While cardiac magnetic resonance (CMR) is the reference method to evaluate left and right ventricular functions, volumes and masses, there is no widely accepted method for the quantitative analysis of trabeculae and papillary muscles (TPM). The aim of this study was to investigate the effect of TPM quantification on left and right ventricular CMR values in a normal cohort and to investigate interobserver variability of threshold-based (TB) analysis by three independent observers with variant experience in CMR. At our clinic, 60 healthy volunteers (30 males, mean age 25.6 ± 4.7 years) underwent CMR scan performed on a 1.5T Philips Achieva MR machine. On short-axis cine images, endo- and epicardial contours were detected by three independent observers with variable experience in CMR (low- ca. 120, mid- > 800, high-experienced > 5000 original CMR cases). Using Conv and TB methods (Medis 7.6 QMass software Leiden, The Netherlands), we measured LV and RV ejection fractions, end-diastolic, end-systolic, stroke volumes and masses. We used TB method for quantifying TPM in ventricles using epicardial contour layers. Interobserver variability was evaluated, and the observer's experience as an impact on variability of each investigated parameters was assessed. Comparing Conv and TB quantification methods' significant difference were detected for all LV and RV parameters in case of all observers (H, M and L $p < 0.0001$). The global intraclass correlation coefficient (G-ICC) representing interobserver agreement for all investigated parameters was lower with Conv method (G-ICC_{Conv} vs. G-ICC_{TB} 0.86 vs. 0.92 $p < 0.0001$). The ICC of LV parameters was higher using TB quantification (LV-ICC_{Conv} vs. LV-ICC_{TB} 0.92 vs. 0.96 $p < 0.0001$), and for the evaluation of RV values, the TB method also had significantly higher interobserver agreement (RV-ICC_{Conv} vs. RV-ICC_{TB} 0.80 vs. 0.89 $p < 0.0001$). The TB algorithm could be a consistent method to assess LV and RV CMR values, and to measure trabeculae and papillary muscles quantitatively in various level of experience in CMR.

Keywords Cardiac magnetic resonance · Endocardium · Papillary muscles · Trabeculae · Automated thresholding · Cardiac chamber quantification

Introduction

Cardiovascular magnetic resonance (CMR) is the reference method to evaluate left (LV) and right (RV) ventricular volumes and masses [1, 2], although conventional 2D cine methods are known to cause partial volume artefacts due to the thickness of the slices.

Due to the high spatial resolution and excellent myocardial-blood contrast, CMR provide an accurate evaluation of small myocardial structures like myocardial trabeculae and papillary muscles (TPM) [3, 4]. Quantitative analysis of ventricular trabeculation and papillary muscles is controversial. There is neither generally accepted evaluation for TPM quantification, nor data available about the distribution of CMR performing laboratories regarding TPM quantification. It is difficult to compare literature data because of the diverse evaluation of TPM volumes. The majority of prior studies presented data that was either papillary muscle or trabecular mass measurement in isolation [5–8]; few studies

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