FEASIBILITY, ACCURACY AND REPRODUCIBILITY OF A FULLY AUTOMATED ALGORITHM TO MEASURE LEFT VENTRICULAR SYSTOLIC FUNCTION BY REAL-TIME VOLUME TRANSTHORACIC ECHOCARDIOGRAPHY IN PATIENTS IN SINUS RHYTHM AND ATRIAL FIBRILLATION. A COMPARISON TO MAGNETIC RESONANCE IMAGING AND 2-D BI-PLANE SIMPSON’S METHOD

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Background: Real time full volume 3-D transthoracic echocardiography (RT-VTTE) allows continuous imaging of full ventricular volumes in every heart beat. The aims were: (1) verify the feasibility, accuracy, and reproducibility of RT-VTTE to measure LV volumes and EF using an automated trabecular endocardial detection algorithm in patients with normal sinus rhythm (NSR), 2) identify the sources of discrepancy and their relative impacts on LV volumes measured by RT-VTTE and CMR, 3) assess the accuracy of RT-VTTE in patients with AF when compared to 2-D Bi-plane Simpson’s method.

Methods: RT-VTTE images were acquired using the Acuson SC2000 system (Siemens). LV EDV and ESV and EF were measured using a fully automated endocardial contour detection algorithm (Auto LVA) in NSR and AF. Investigation for sources of discrepancy between RT-VTTE and CMR volumes included using trabecular versus compacted myocardial edge for endocardial contours.

Results: 89 patients (65 in SR, 24 in AF) were included. In 36 patients with EF >50% the RT-VTTE derived volumes correlated highly with CMR values (EDV; r=0.85; ESV r=0.92; EF; r=0.86; p<0.001). The EDV, ESV, and EF were underestimated by 10.7 ± 17.5ml, 5.1 ± 6.1ml (p < 0.001), and 0.5 ± 2.5% (P<0.30). In 29 patients with EF <50%, the respective r values were 0.87, 0.92, 0.97, p≤0.001. However, the EDV, ESV, and EF were underestimated by 26.7 ± 32.8ml, 16.9 ± 24.2ml (p<0.001), and 0.2 ± 2.5% (p=0.66) respectively, p<0.001. Application of automated contour correction to detect the compacted myocardium eliminated these volume differences. In patients with AF: r=0.94, r=0.94, r=0.91 for EDV, ESV and EF, respectively.

Conclusions: RT-VTTE measurement of EDV, ESV, and EF with a fully automated trabecular endocardial contour detection algorithm is feasible, accurate, and reproducible. Furthermore, the underestimation of LV volumes when compared to CMR can be overcome by using an automated approach to detect the compacted myocardial edge instead of the trabecular endocardial border. In patients with AF, RT-VTTE can accurately measure LV volumes and EF that could not be measured with CMR.