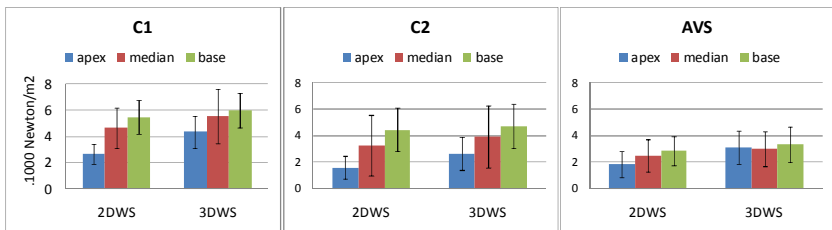


3D Evaluation of Myocardial End-Systolic Wall Stress From Cardiac Magnetic Resonance Cine Data.

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Noninvasive evaluation of left ventricular (LV) function and remodeling is essential in the management of cardiovascular diseases. LV remodeling and dysfunction occur as a response to changes in LV preload and afterload conditions. This latter determines myocardial wall stress (WS). The aim of the present study was to compare the 2D against the 3D evaluation of myocardial WS. **Methods.** Two control groups C1 (10 subjects, 24 ± 4 years) and C2 (11 subjects, 58 ± 6 years) and a group of patients with an aortic valve stenosis (AVS) (12 subjects, 80 ± 10 years) were studied. All subjects underwent a cardiac magnetic resonance (MR) exam with cine imaging on 10 to 12 short axis slices as well as an applanation tonometry to measure the end-systolic pressure (ESP). Regional 2DWS was calculated as a combination of the ESP and a geometrical factor calculated using myocardial wall thickness and LV cavity radius while the 3DWS included a thickness and radius correction based on the longitudinal LV curvature. **Results.** The 3D correction reduced the base to apex gradient in WS (figure) from 2.8 ± 1.6 to 1.6 ± 1.7 in C1, 2.9 ± 1.2 to 2.1 ± 1 in C2, 1.1 ± 0.8 to 0.2 ± 1.3 Newton. $1000/m^2$ in AVS. Moreover, the averaged 3D basal WS was 6.0 ± 1.3 for C1, 4.7 ± 1.6 for C2 and 3.3 ± 1.3 Newton. $1000/m^2$ for AVS. Differences between C1 and C2 as well as between C2 and AVS were statistically significant (t-test, $p<0.05$), whereas the only significant difference was found between C2 and AVS when considering the 2DWS. **Conclusion.** The 3D evaluation corrected for the erroneous underestimation of the apical WS induced by partial volume effect that is increased in the apical region by the important curvature of the wall. Besides 3DWS was able to characterize aging and abnormal increase in afterload caused by AVS. Its addition to clinical CMR tools would enable a better characterization LV remodeling.



Results of 2DWS and 3DW for the 3 populations and the 3 anatomical locations.