Myocardial work in patients with aortic stenosis before and short term after transcatheter aortic valve replacement

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Objective: The newly introduced noninvasive myocardial work analysis could potentially be beneficial in predicting the best timing for aortic valve replacement as well as clinical outcomes in patients with high grade aortic valve stenosis (AS), which is the leading valvular disease in the modern aging society. However, to date there is little data on the applicability of the method in the setting of extremely increased left ventricular (LV) afterload.

Purpose: In this pilot study, we aimed to apply myocardial work analysis in patients with increased LV afterload due to severe AS and to investigate the differences of myocardial work parameters in patients with different AS entities. In addition, we analyzed the early changes of myocardial work after the afterload reduction by transcatheter aortic valve replacement (TAVR).

Methods: We retrospectively studied echocardiographic data of 28 consecutive patients with severe AS before and 7 days after TAVR. Global Work Index (GWI), Global Constructive Work (GCW), Global Wasted Work (GWW) and Global Work Efficiency (GWE) were calculated using commercially available software based on noninvasive pressure-strain loops. In order to correct for underestimation of intraventricular pressure, we added the mean aortic valve pressure gradient to the peripheral systolic blood pressure used by the software.

Results. From the included patients (mean age 76±10 years) 13 were classified as having normal flow (NF) severe AS, 8 had low flow low gradient (LFLG) and 7 paradoxical low flow low gradient (PLFLG) AS. GWI and GCW were significantly lower in patients with LFLG AS compared to patients with NF or PLFLG AS (936±528 mmHg% vs. 2493±485 mmHg% vs. 1959±469 mmHg% [p<0.005] and 1132±477 mmHg% vs. 2770±507 mmHg% vs. 2189±603 mmHg%, [p<0.005], respectively). 7 days after TAVR, GCW and GWI decreased significantly in patients with NF AS. In other AS entities, a trend towards increased GWI and GCW was observed, but the difference did not reach statistical significance. GWI and GCW remained significantly lower in LFLG AS group when compared to NF and PLFLG groups (1069±378 mmHg% vs. 1919±310 mmHg% vs. 2064±842 mmHg% [p<0.005] and 1286±346 mmHg% vs. 2107±258 mmHg% vs. 2227±949 mmHg% [p<0.005]) early after TAVR. GWE and GWW did not differ between the groups and were not influenced by TAVR.

Conclusion: In this pilot study we applied the adapted myocardial work analysis in patients with increased afterload due to severe AS. We have shown that GCW and GWI are significantly higher in patients with NF AS when compared to LFLG and PLFLG AS. The differences between the groups persisted early after TAVR in spite of significant reduction of GWI and GWC in patients with NF AS. The clinical and prognostic importance of these findings are still to be investigated in a bigger cohort study.