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Changes of the non-invasive myocardial work in patient undergoing transcatheter aortic valve replacement: the influence of left bundle branch block

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Patients with left bundle branch block (LBBB) are known to have substantially increased afterload sensitivity. It gains particular importance in subjects with aortic stenosis: patients with pre-existing LBBB may benefit more from interventions such as transcatheter aortic valve replacement (TAVR) by an effective and rapid reduction of the left ventricular (LV) pressures.

Accordingly, our aim was to investigate the changes of LV myocardial work indices in patients undergoing TAVR by the presence of preoperative LBBB. Non-invasive myocardial work indices are novel echocardiographic parameters which adjust LV deformation to the instantaneous LV pressure, overcoming the load-sensitivity of the traditional LV functional measures.

Thirty patients undergoing TAVR were enrolled (37% female; age: 78 ± 6 years; aortic valve area [AVA]: 0.7 ± 0.3 cm²). Fourteen patients (47%; LBBB group) showed LBBB pattern on ECG, by demonstrating native LBBB (n=6; 20%) or having ventricular pacing dependency (n=8; 27%), while 16 patients had narrow QRS (53%; non-LBBB group). Prior to the procedure, subjects underwent a detailed echocardiographic investigation. Speckle-tracking analysis was performed and global longitudinal strain (GLS) was measured. LV pressure curve was estimated by adding the mean aortic valve gradient to the aortic systolic pressure. Using these measures, LV global constructive work index (CMWI) and global work efficiency (GWE) were quantified by commercially available software. A 6 months follow-up examination was also performed and at that time point we determined the aforementioned parameters.

As expected, AVA significantly improved after the procedure in the pooled study group (1.8 ± 0.4 cm²; $p < 0.001$). GLS also significantly increased (-13.2 ± 4.2 vs. -15.2 ± 3.9 %; $p < 0.01$), while CMWI only showed a tendential decrease (2422 ± 788 vs. 2166 ± 640 mmHg%; $p = \text{NS}$) at the follow-up. GLS (-10.6 ± 3.7 vs. -15.5 ± 3.4 %; $p < 0.001$), CMWI (1877 ± 679 vs. 2898 ± 529 mmHg%; $p < 0.001$), and also GWE (82 ± 9 vs. 91 ± 4 %; $p < 0.01$) was significantly lower in the LBBB-group compared to the non-LBBB patients. At the follow-up, GLS was still significantly lower in the LBBB patients (-13.2 ± 4.6 vs. -16.9 ± 2.1 %; $p < 0.01$), however, CMWI was comparable between the two groups (1956 ± 776 vs. 2350 ± 439 mmHg %, $p = \text{NS}$).

Pressure overload of the LV may affect patients with LBBB substantially more than subjects without it. TAVR causes an immediate and significant decrease in the LV afterload, which results in a more pronounced improvement in the LBBB group compared to those with no LBBB.