

Left ventricular preload is reduced in patients with tetralogy of Fallot and chronic pulmonary regurgitation

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Introduction

Dysfunction of the right ventricle in patients with TOF and significant pulmonary regurgitation (PR) leads to systolic dysfunction of the left ventricle (LV) due to altered ventricular interaction. In addition, abnormal diastolic function of the right ventricle (RV) affects emptying of the right atrium due to elevated RV end diastolic pressure. We wanted to measure the volumes of both atria by using cardiac magnetic resonance imaging in paediatric patients with TOF. We were specifically interested whether chronic pulmonary regurgitation affects preload of the LV.

Methods

The study subjects were 45 TOF patients with surgical repair between 1990-2003. All patients had pulmonary regurgitation. In addition, forty-four healthy volunteers were recruited. The average ages of patients and controls were 13.1 ± 3.2 vs. 14.1 ± 3.4 years (ns). The mean post-operative follow-up time of the patients was 11.8 ± 3.1 years.

For atrial and ventricular volume measurements, the end diastolic and systolic cine images were manually planimeted (Philips ViewForum workstation). The conduit flow through the atria, arterial outflow and pulmonary (PR) and aortic (AR) regurgitation volumes were assessed using a phase contrast flow measurement. The volumetric data were indexed to BSA per cardiac cycle.

Results

The PR-volume of TOF patients was 16.0 ± 11.7 exceeding 30 ml/m^2 in seven subjects. The PR of control subjects and AR in all subjects was negligible.

The ventricular preload volumes derived from the atria were significantly reduced in TOF patients. The volume from the right atrium in patients and controls was 41.1 ± 7.0 vs. 50.7 ± 6.8 ; $p=0.001$, respectively, and that from the left atrium 44.8 ± 7.3 vs. $50.3 \pm 5.7 \text{ ml/m}^2$; $p=0.002$. Due to PR, the end diastolic RV-volumes, however, were significantly higher in TOF patients (115 ± 26.5 vs. $83.6 \pm 14.8 \text{ ml/m}^2$; $p<0.0001$).

The ejection fraction of the RV was significantly reduced in TOF-patients (50.1 ± 8.6 vs. 60.0 ± 4.8 %; $p<0.0001$), whereas LV ejection fractions were preserved (61.1 ± 8.8 vs. 63.1 ± 4.7 %; ns.)

Conclusions

In TOF patients with pulmonary regurgitation, volume flow through LA is decreased. Reduction in LV preload volume might be an important factor contributing to disturbed ventricular interaction and LV dysfunction.