IMAGE FOCUS

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# Seven-year clinical and mechanical follow-up of a Tetralogy of Fallot patient with severe pulmonary regurgitation

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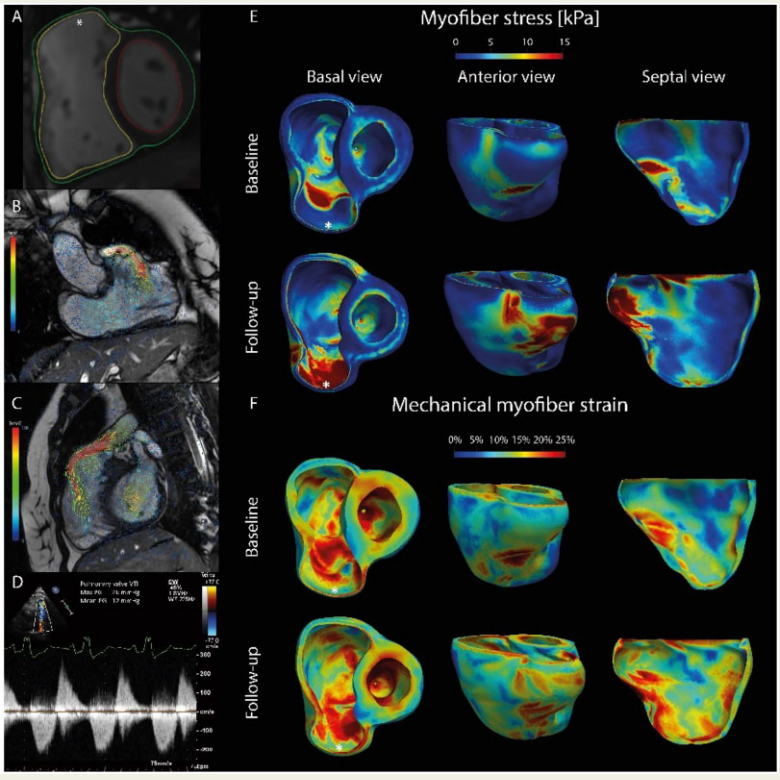


A 25-year asymptomatic female with surgically repaired Tetralogy of Fallot (TOF) and pulmonary regurgitation (PR) was followed for seven years with serial echocardiography, cardiovascular magnetic resonance, and exercise testing. During follow-up (FU), the patient remained asymptomatic. Exercise capacity was 91% and 134% of predicted load, respectively and N-terminal pro-brain natriuretic peptide was slightly elevated (baseline 29 and FU 45 pmol/L).

Left ventricle ejection fraction remained stable (59 and 65%, respectively). Right ventricular (RV) end-diastolic volume increased from 136 to 150 ml/m$^2$ (*Panel A*), RV ejection fraction decreased from 49% to 42%. PR was severe (baseline 42% and FU 46%) and directed to the anterior RV-free wall (*Panels B* and *C*, Supplementary data online). There was no significant pulmonary valve stenosis (*Panel D*) and RV diastolic pressure was low (estimated as 3 mmHg).

Using short-axis steady-state free precession images, a patient-specific geometry was created to which fibre orientation and passive material properties were assigned. After applying the RV diastolic pressure to the computer model, local mechanical wall stress and strain were calculated during passive filling (*Panels E and F*). During FU, average RV-free wall stress increased from 3.2 to 4.7 kPa. Baseline wall stress and increase in wall stress during FU were highest in the anterior part of the basal and mid-ventricular free wall. Average local mechanical myofibre diastolic strain of the RV-free wall increased slightly from 12% to 14%, indicating ventricular wall stretch and/or growth.

Parts of RV-free wall regions that were directly impacted by the PR are associated with higher wall stresses and strains, suggesting at least partly direct mechanical impact of PR on the ventricular wall. Whether monitoring of wall stress and strain changes over time helps clinicians to optimize the timing of pulmonary valve replacement in TOF patients, should be further studied.