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Cardiac function after repair of tetralogy of Fallot: how are the atria performing?

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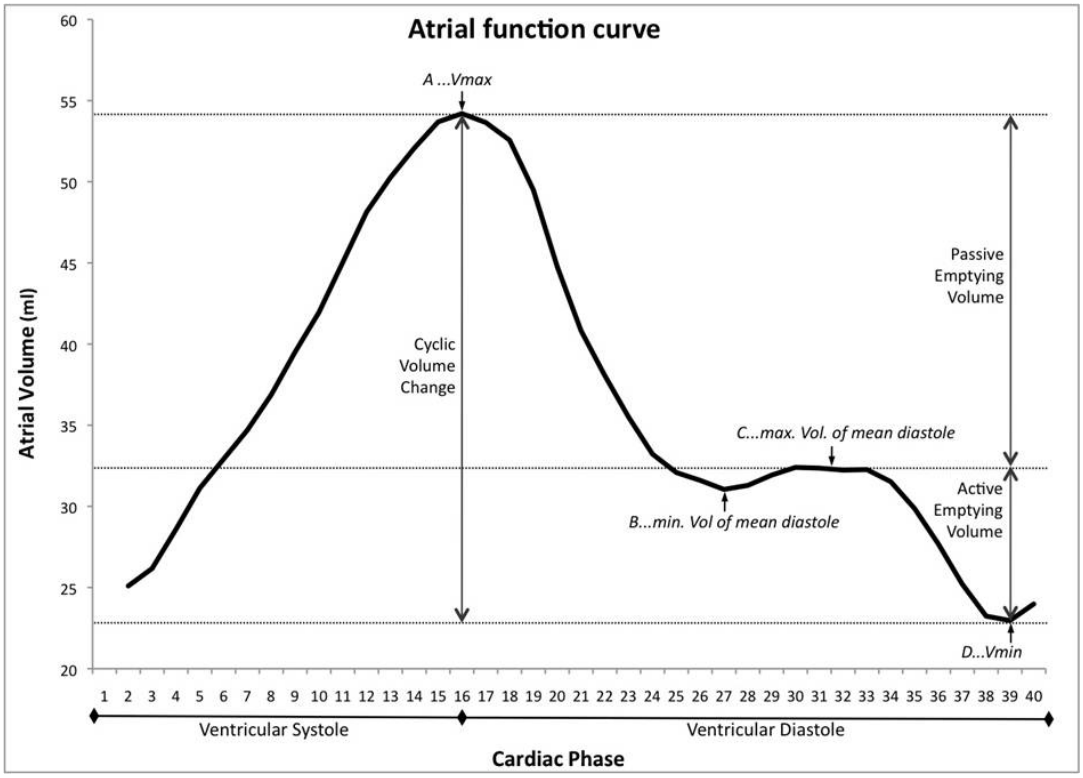
Introduction: During the cardiac cycle the atria function as reservoir, conduit and active pump and are critical for ventricular filling. Knowledge about atrial performance in children and in congenital heart disease is scarce.
We sought to evaluate right and left atrial size and function in patients with repaired tetralogy of Fallot (TOF).
Methods: Cardiovascular magnetic resonance (CMR) was performed prospectively in 12 patients after TOF repair and with significant pulmonary regurgitation. The mean age was 16.7±6.1 yrs, weight 50.9±14.9 kg. The control group consisted of 10 healthy volunteers, age 18.8 ± 6.8 yrs, weight 52.3±20.8 kg. Steady state free precession images were acquired in a short axis plane covering both atria and both ventricles. The atrial passive and active emptying volumes, atrial empting fraction, cyclic volume change, total atrial filling fraction and conduit volume were calculated from the volume/time curves obtained (figure). Phase contrast cine images were acquired perpendicularly to the inflow of both AV-valves. Blood flow profile across the AV-valves (E/A ratio) was used to depict subjects with ventricular diastolic dysfunction. Data were compared between patients and controls, as well as between patients with normal and abnormal ventricular diastolic function.



Results: In patients after TOF repair the right atrium showed an increased minimal volume at end-diastole ($p<0.01$) and increased minimal and maximal volumes during mid-diastole ($p<0.05$). Cyclic volume change ($p<0.05$), total atrial filling fraction ($p<0.01$) and passive emptying volume and fraction ($p<0.05$) were significantly decreased compared to controls. No significant difference was found for active emptying volume and fraction. In the left atrium the passive emptying fraction was the single decreased parameter ($p<0.05$) in the patient group.
Patients with a reversed E/A ratio across the tricuspid valve, representing diastolic dysfunction of the right ventricle, presented an increased conduit volume ($p<0.05$). Cyclic volume change, total atrial filling fraction, passive emptying volume and passive empting fraction were slightly decreased, without reaching statistical significance.
Conclusions: Patients after TOF repair and with significant pulmonary regurgitation present an impaired right atrial function compared to controls. Right ventricular diastolic dysfunction causes even more distinctive changes of atrial parameters.