

Aortic and carotid stiffening in patients after successful coarctation repair and its impact on left ventricular diastolic function

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Introduction: Arterial hypertension and accelerated arteriosclerosis are late complications even after successful coarctation (CoA) repair, which may clinically affect left ventricular (LV) function in the long-term follow-up. However, only few data exist on the occurrence of abnormal vascular bioelasticity and its effect on LV diastolic function in CoA patients with no or only mild arterial hypertension during long-term follow up. Therefore, we studied children and young adults after successful CoA repair using magnetic resonance imaging (MRI).

Methods: Fifty-two patients (18.9±10.7 years), 14.6±9.2 years after CoA repair, and 54 controls (19.0±7.9 years) underwent 3.0-Tesla MRI. The data were used to calculate distensibility and pulse wave velocity (PWV) at different aortic locations. Furthermore, in a subgroup of patients and controls common carotid artery distensibility, PWV, wall thickness and wall area were measured. LV ejection fraction (EF), volumes (LVEDV, LVESV) and mass were assessed from short axis views. Axial cine images were used to measure left atrial (LA) volumes and parameter for LA diastolic function (LAEF_{Passive}, LAEF_{Contractile}, LAEF_{Reservoir}).

Results: In patients aortic distensibility was reduced at all positions of the thoracic aorta (aortic root: 5.5±3.8 vs. 7.4±3.0 10⁻³ mmHg⁻¹, ascending aorta: 5.8±3.1 vs. 8.1±3.6 10⁻³ mmHg⁻¹, descending aorta at the isthmus: 5.6±3.0 vs. 6.8±2.3 10⁻³ mmHg⁻¹, descending aorta at the diaphragm: 6.7±2.8 vs. 8.0±2.8 10⁻³ mmHg⁻¹; p<0.05) and PWV in the aortic arch (4.7±1.8 vs. 3.8±0.8 m/s, p<0.01) was elevated. In addition, the subgroup analysis showed an increased carotid PWV, wall thickness and wall area (p<0.05). The LA volume before atrial contraction (LA-Vol_{ac}), and the minimal and maximal LA volume (LA-Vol_{min}, LA-Vol_{max}) were higher in patients (LA-Vol_{ac}: 33.2±9.8 vs. 27.4±5.9 ml/m², LA-Vol_{min}: 25.3±7.6 vs. 20.9±5.1 ml/m², LA-Vol_{max}: 48.4±11.4 vs. 43.2±8.7 ml/m²; p<0.05). LAEF_{Passive} and LAEF_{Reservoir} were reduced (LAEF_{Passive}: 31.7±8.4 vs. 36.9±6.6%, LAEF_{Reservoir}: 48.0±7.2 vs. 51.9±6.8%; p<0.01) and correlated negatively with aortic arch PWV (p<0.05). LVEF, LVEDV, LVESV and LV mass were not changed compared with controls.

Conclusions: Patients after CoA repair have reduced bioelasticity of the entire thoracic aorta and the common carotid artery as well as an abnormal carotid wall structure. The impaired aortic bioelastic function likely contributes to LV diastolic dysfunction.