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Assessment of vascular remodelling after the Fontan procedure using a novel very high resolution ultrasound method: Arterial wall thinning and venous thickening in late follow up

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Objectives and Background: The Fontan circulation is associated with an increased central venous pressure, decreased ventricular preload and increased afterload. We postulated that these central hemodynamic abnormalities would have consequences for the structural and functional properties of the peripheral arteries and veins.
Methods: We prospectively examined venous and arterial wall morphology by very-high resolution ultrasound (25-55 MHz), and function by conventional vascular ultrasound (flow-mediated dilatation, FMD) and applanation tonometry (pulse wave velocity; PWV) in 28 patients after the Fontan procedure (age 14.8±1.3 years) and 54 age-matched controls.
Results: The lumen dimension was reduced in Fontans patients compared with controls in the common carotid, brachial, radial, and femoral arteries. The common carotid, brachial, radial, ulnar, femoral and dorsal tibial artery intima-media thickness (IMT), and brachial, ulnar, and femoral artery adventitial thickness were decreased, while the cubital and dorsal tibial vein IMT was increased in Fontans. FMD, abdominal aortic stiffness and carotid-femoral PWV were similar, while carotid-radial artery PWV was increased in Fontans.
Conclusions: The Fontan circulation is associated with significant arterial and venous remodelling, presumably reflecting abnormalities of central hemodynamics. These novel data may be of clinical importance in the circulatory management as well as in the understanding of the early pathogenesis of vasculopathy in patients after the Fontan procedure.