

Assessment of pressure-volume-relations in univentricular hearts - comparison of obtainment by 3D-real-time echocardiography and mini pressure-wire with conductance technology

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Objectives: Pressure-volume relations (PVR) of the heart allow assessment of systolic as well as diastolic function which may be of particular importance in single ventricle physiology. The gold standard to acquire PVR, the conductance technology (PVRCond), is rarely used in children and restricted to older age due to its catheter size and invasiveness. PVR can also be obtained by 3D-echocardiography (3DE) volume data in combination with simultaneously measured pressure data by a mini pressure-wire (PVR3DE). We sought to compare both methods in patients with univentricular hearts. **Methods:** We studied 19 patients (age 2-29 years). PVR3DE (Philips iE33; TomTec; pressure-wire: Radi, St. Jude Medical) and PVRCond (CD Leycom) were assessed under baseline conditions followed by positive inotropic stimulation with dobutamine (10 μ g/kg/min). **Results:** Both methods showed that the PVR-specific parameter End-systolic elastance (Ees) as a measure for contractility increased significantly under stimulation with dobutamine. The isovolumic relaxation time constant Tau, reflecting the early active relaxation process decreased as an expression for a positive lusitropic effect of dobutamine (fig.1). Bland-Altman-analyses (bias \pm standard deviation): Ees: 1.6 \pm 2.9 mmHg/ml, Tau: -4.6 \pm 7.8 ms. While obtaining PVR3DE was successful in all patients, correct placement and signal quality of the conductance catheter could be achieved in only 15 patients under baseline conditions (79%) and under dobutamine in 12 patients (63%).

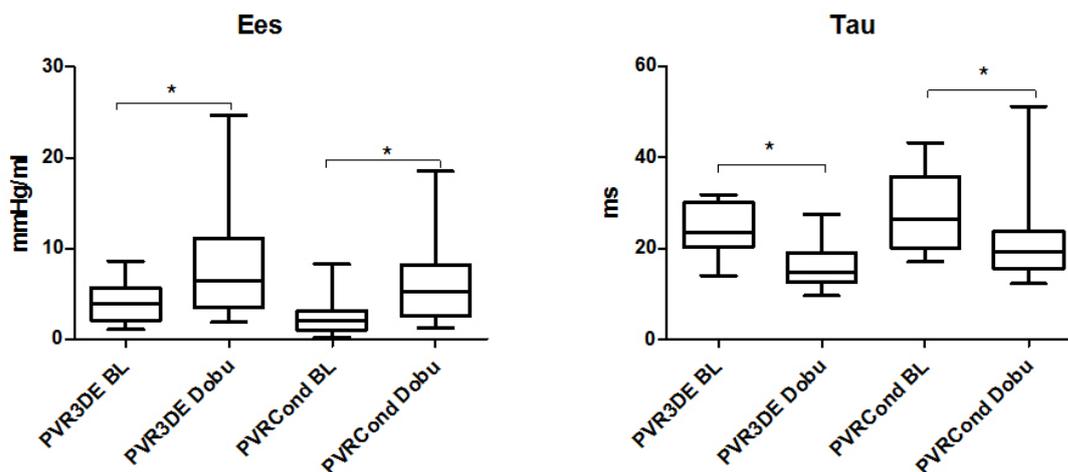


Fig.1: End-systolic elastance (Ees) und isovolumic relaxation time constant (Tau) under baseline conditions (BL) and stimulation with dobutamine (Dobu). PVR3DE= 3D-echocardiography combined with mini pressure-wire; PVRCond= Conductance technology; * = $p < 0.05$ BL compared to Dobu.

Conclusion: The changes of PVR-specific parameters under dobutamine stimulation were reflected in the same way by both methods. The absolute values for these parameters could vary between the methods, though. So methods are not interchangeable. We experienced that obtaining PVR3DE in a single ventricle was easier and more often successful than achieving correct placement and signal quality of the conductance catheter for PVRCond. Consequently, PVR obtained by 3DE and mini pressure-wire can serve as a promising and needed alternative to the conductance technology for the assessment of cardiac function in univentricular hearts.

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