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Abstract 2800: Non-Invasive Quantification of Complete Left-Ventricular Pressure-Volume Loops in Patients with Cardiac Overload

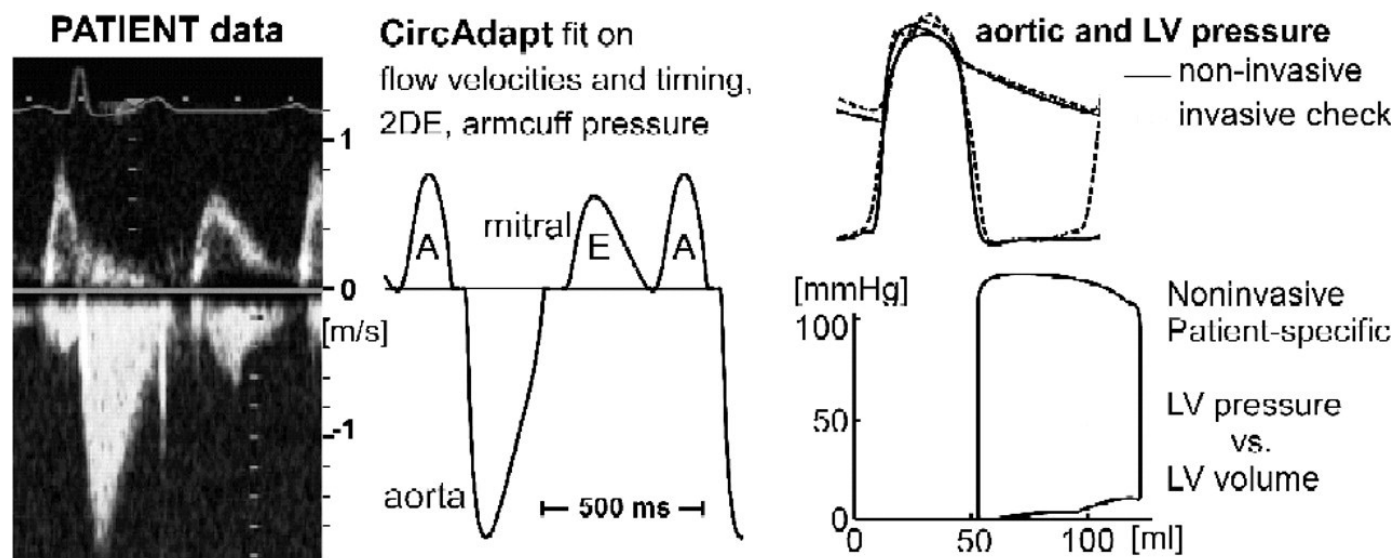
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Abstract

Pressure-volume relations of the left ventricle (LV) allow comprehensive assessment of systolic and diastolic LV function. Non-invasive assessment of LV function is currently based on, but limited to, Doppler echocardiography or MRI. LV pressure recordings are generally lacking because they require invasive diagnostic techniques. In 11 patients with and without cardiac overload (4 hypertension, 3 mitral regurgitation, 4 control), we made patient-specific fits of whole circulation hemodynamics using CircAdapt modeling (Am J Physiol, 2005). To this aim, we identified a novel smart combination of measured 2-dimensional- (2DE) and Doppler echocardiographic parameters, and armcuff-measured blood pressure. Peak systolic (range 115–161 mmHg) and end-diastolic LV pressures (range 4 –18 mmHg) agreed within $\pm 8\%$ and $\pm 15\%$ (sd) with the invasively measured pressures during cardiac catheterization in the same patients, respectively, showing the reliability of CircAdapt. With CircAdapt, systolic and diastolic myofiber stress could also be obtained (55 ± 14 kPa and 2.7 ± 1.2 kPa, respectively).

Conclusion: Patient-specific modeling using the CircAdapt computer model provides accurate, completely non-invasive bedside assessment of LV pressure and volume tracings, i.e. complete non-invasive LV pressure-volume loops, allowing comprehensive systolic and also diastolic assessment of cardiac function. In addition, myocardial tissue mechanics can be calculated, which are considered triggers of cardiac remodeling.



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