Modelling the Left Ventricle Mechanical performance and Ventricular Arterial Coupling: The Example of the Baroreflex

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Abstract

The human or mammalian heart Left Ventricle (LV) mechanics can be evaluated by the analysis of the LV pressure volume loop, in steady state conditions. This analysis allows the computation of the LV maximal elastance (Emax) and also the LV work and energy expenditure. It also permits the computation of the Arterial tree input impedance, determined as the Arterial tree Elastance (Ea). The Emax/Ea relation or ventriculo arterial coupling is a measure of the mechanical interaction between the LV and arterial tree and describes the mechanical performance of the circulatory system.

The main caveat of this approach is that it allows the mudulation of the circulatory system and its components, the LV and Arterial tree under steady state conditions using multiple cardiac beats. We developed an approach to calculate Emax and Ea based on single beat Elastance variation that correlates linearly with the multiple beat approach.

Using the single beat approach we could test the model with a baroreflex experiement and determine the influence of the short term changes in the LV and Arterial tree properties in Emax, Ea , ventricular arterial coupling and LV energetics.

This approach can now be applied to test acute interventions on the circulatory system, including the short term reflexes as mechano reflexes and chemoreflexes, diseases sauch as myocardial infarction and drug therapy..

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