Effect of abrupt preload reduction on left atrial and ventricular pressures in a multi-scale mathematical model of the cardiovascular system

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Methods

Computer model of one atrial and one ventricular sarcomere [1].

Simple geometrical model of the left atrium and ventricle

Adjustment of the model parameters to pig experimental data

Purpose

The time-varying elastance theory is widely applied to the left ventricle.

It is not sure if left atrial (LA) elastance is load-independent, which prevents its application.

Left atrial behavior is difficult to reproduce in silico.

Results

Maximal measured (- -) and simulated (–) pressures during preload reduction

Measured and simulated pressures during one cardiac cycle

Simulated left atrial pressure-volume loops before (- -) and after (–) preload reduction

Conclusions

This model correctly accounts for LA behavior and responds to preload reduction experiments as physiologically expected. It thus represents a valid substitute to the time-varying elastance method.


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The authors declare no competing interest.