Identification of the Time-Varying Ventricular Parameters During the Ejection Phase of the Cardiac Cycle: A Malliavin Calculus Approach

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Abstract

Physical parameters representing the energy components of the cardiac pump related to inertance, resistance, and compliance are developed. The martingale optimality principle and the Malliavin calculus are used to estimate these time-varying parameters. The methods are applied to the ejection phase of the cardiac cycle, using pressure and flow measured at the root of the aorta for the left ventricle. We find the compliance parameter to be in general agreement with data reported by others, but our resistive parameter differs considerably and has a value commensurate with the expected efficiency of the cardiac pump. The inertance parameter, not represented in models reported by others, is shown to be of significance and may contribute to differences in values of the other parameters.

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