An object-oriented computational model to study cardiopulmonary hemodynamic interactions in humans

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Highlights

We introduced a comprehensive model of cardiopulmonary interactions (CPIs). The model is implemented in an object-oriented modeling language (OOML) which has not yet been used to study CPIs before. OOML has significant advantages in modeling of complex interconnected systems. The model includes a cardiovascular system which was built up based on work that can be found in literature, extended by non-linear models of veins and capillaries. For the respiratory system, we developed and parameterized non-linear characteristics of model components based on the Mead's parallel structure. The hemodynamic interaction was realized via a physical connection between two systems (pleural and interstitial pressures). Baseline simulation proved that the assigned parameters are consistent for a healthy human. Reasonable comparisons between simulation results and animal or clinical data demonstrated model usability in the quantitative prediction and study of CPIs