

Supplementary Materials

Table S1. Parameters of the myocardium cell model.

a_0	Constant parameter	0.55 kN/m ²
a_1	Constant parameter	3
L_{s0}	Reference sarcomere length	1.9 μm
E_{cb}	Crossbridge stiffness	2.5 pN/nm
N_M	Number of myosin filaments per unit cross-section area	$2.5 \cdot 10^{14}/\text{m}^2$
N_{cb}	The number of myosin heads per a half of a thick filament	300
k_B	Boltzmann constant	$1.38 \cdot 10^{-23} \text{ J/K}$
T	Absolute temperature	310 K
L_p	Persistence length of titin molecule	8.4 nm
L_c	Contour length of titin in sarcomere	350 nm
h_r	Axial displacement of a crossbridge during transition from state 1 to state 2 at zero load	10 nm
f_{+}	Steady state kinetic rate at $\delta = 0$	75 s^{-1}
Δ	Constant parameter	4
δ_0	Upper limit for δ during stretch	0.4
b_{cb}	Constant parameter of the cross-bridge kinetics	1.5
c_{cb}	Constant parameter of the cross-bridge kinetics	8.5
c_{50}^0	Ca ²⁺ concentration half-saturating Tn at l_{s0} in the absence of myosin heads in 'normal' myocardium	$2 \mu\text{mol} \cdot \text{L}^{-1}$
c_{50}	Normalized Ca ²⁺ concentration half-saturating Tn at l_{s0} in the absence of myosin heads	1
α_+	Rate constant of Ca ²⁺ binding to Tn multiplied by c_{50}^0	35 s^{-1}
k_s	Constant parameter	2
k_n	Constant parameter	8
C_{Tn}	Total concentration of Tn	$70 \mu\text{mol} \cdot \text{L}^{-1}$
m	Hill parameter	3
k_{1Ca}	Rate constant of accelerated Ca ²⁺ release	15 s^{-1}
k_{2Ca}	Rate constant of deceleration of Ca ²⁺ release	200 s^{-1}
I_{Ca}^0	Normalized maximal rate of Ca ²⁺ release from SR	850 s^{-1}
c_0	Normalized Ca ²⁺ concentration at rest	0.05
k_{BC}	Reciprocal to the buffer binding constant	$1 \mu\text{mol} \cdot \text{L}^{-1}$
B_{Ca}	Total concentration of Ca ²⁺ buffer in the cytosol	$100 \mu\text{mol} \cdot \text{L}^{-1}$
γ_{1Ca}	The rate of the uptake into the sarcoplasmic reticulum	$300 \mu\text{mol} \cdot \text{L}^{-1} \cdot \text{s}^{-1}$
γ_{2Ca}	Parameter of the uptake into the sarcoplasmic reticulum	$0.1 \mu\text{mol} \cdot \text{L}^{-1}$

Table S2. LV shape approximation parameters.

r_{in}	Inner radius of the LV at its base in the near end-systolic configuration	1.73 cm
r_{out}	Outer radius of the LV at its base in the near end-systolic configuration	2.78 cm
h_{in}	Axial length of the LV cavity in the near end-systolic configuration	6.93 cm
h_{out}	Full length of the LV cavity in the near end-systolic configuration	7.68 cm
E	LV wall curvity parameter	1.1

5 Table S3. Parameters of the hemodynamic model.

V_{0LA}	Unloaded steady-state volume of relaxed left atrium	30 mL
V_{0RA}	Unloaded steady-state volume of relaxed right atrium	30 mL
V_{0RV}	Unloaded steady-state volume of relaxed right ventricle	50 mL
E_{1LA}	Passive stiffness of the left atrium	10 dyn/cm ²
E_{1RA}	Passive stiffness of the right atrium	0.41 dyn/cm ²
E_{1RV}	Passive stiffness of the right ventricle	80 dyn/cm ²
E_{2LA}	Coefficient of exponential passive elasticity of the left atrium	0.15 mL ⁻¹
E_{2RA}	Coefficient of exponential passive elasticity of the right atrium	0.15 mL ⁻¹
E_{2RV}	Coefficient of exponential passive elasticity of the right ventricle	0.025 mL ⁻¹
E_{3LA}	Active pressure coefficient for the left atrium	1.33·10 ⁴ dyn/cm ²
E_{3RA}	Active pressure coefficient for the right atrium	1·10 ⁴ dyn/cm ²
E_{3RV}	Active pressure coefficient for the right ventricle	11.3·10 ⁴ dyn/cm ²
μ_{a1}	Passive viscosity of the atria	1 s/mL
μ_{a2}	Active viscosity of the atria	1 dyn·s/cm ⁵
μ_v	Active viscosity of the right ventricle	50 dyn·s/cm ⁵
R_{iLV}	Hydraulic resistance of the mitral valve	4 dyn·s/cm ⁵
R_{oLV}	Hydraulic resistance of the aortic valve	20 dyn·s/cm ⁵
R_A	Hydraulic resistance of the systemic arteries	10 dyn·s/cm ⁵
R_{iRA}	Hydraulic resistance of the systemic veins	4 dyn·s/cm ⁵
R_{iRV}	Hydraulic resistance of the tricuspid valve	2 dyn·s/cm ⁵
R_{oRV}	Hydraulic resistance of the pulmonary valve	10 dyn·s/cm ⁵
R_{iLA}	Hydraulic resistance of the pulmonary veins	8 dyn·s/cm ⁵
R_C	Viscoelastic resistance of the walls of the large systemic vessels	60 dyn·s/cm ⁵
R_{per}	Peripheral resistance of the systemic circulation	1600 dyn·s/cm ⁵

$R_{perPulm}$	Peripheral resistance of the pulmonary circulation	230 dyn·s/cm ⁵
L_{iLV}	Inertial resistance of the mitral valve	0.5 dyn·s ² /cm ⁵
L_{oLV}	Inertial resistance of the aortic valve	0.01 dyn·s ² /cm ⁵
L_A	Inertial resistance of the flow in the systemic arteries	2.5 dyn·s ² /cm ⁵
L_{oRV}	Inertial resistance of the pulmonary valve	0.01 dyn·s ² /cm ⁵
C_{LV}	Non-sarcomeric compliance of the LV	2·10 ⁻⁵ cm ⁵ /dyn
C_{A1}	Aorta compliance	4·10 ⁻⁴ cm ⁵ /dyn
C_{A2}	Compliance of the systemic arteries	1·10 ⁻⁴ cm ⁵ /dyn
C_V	Compliance of the systemic veins	0.05 cm ⁵ /dyn
C_{APulm}	Compliance of the pulmonary arteries	3.5·10 ⁻³ cm ⁵ /dyn
C_{VPulm}	Compliance of the pulmonary veins	0.01 cm ⁵ /dyn
C_C	Coefficient that characterizes elastic component of arterial viscoelasticity	1·10 ⁻³ cm ⁵ /dyn
C_{sq}	Coefficient of the quadratic hydraulic valve resistance	1.5 dyn·s ² /cm ⁴ (mitral valve), 1 dyn·s ² /cm ⁴ (aortic valve)
$b_0, b_1, b_2, b_3, b_4, b_5$	Coefficients of the dependence of the quadratic hydraulic valve resistance on the Reynolds number	0.4614, -0.2648, 0.203, -0.066, 0.0132, -0.001

Table S4. Values of the parameters for the regulation block of the myocardium cell-model for the simulation of HCM- and DCM-associated mutations.

	'Normal' myocardium	Ile284Val (HCM)	Asp230Asn (DCM)
N_M	2.5·10 ¹⁴ m ⁻²	1.08·10 ¹⁴ /m ⁻²	2.5·10 ¹⁴ /m ⁻²
c_{50}	1	0.55	1.85
m	3	3	2
k_s	2	0.5	2

Table S5. Geometrical parameters of the normal LV and the LVs with cardiomyopathy.

Parameter	Normal	HCM	DCM
r_{in} , cm	1.73	1.5	2
r_{out} , cm	2.78	3.3	3.05
h_{in} , cm	6.93	6.85	7.25
h_{out} , cm	7.68	8.2	8



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