Supplementary material

September 2019

1 Numerical values of OpenModelica-based Simulator for the Cardiovascular and Respiratory Physiology of a Neonate.

Table 1: *hemodynamic* values of the simulator

Comparment	**Parameter description**	**Parameter name**	parameter values	
			Neonate	infant
All	Initial total blood volume	VTOTAL	310	685
Atria and ventricles	Heart rate	HR	130	129
All intrathoracic	Average intrathoracic pressure	PTH	-3	-3,25
Left atrium	Resistance to forward flow	RLAIN	5,0005e-07	1,25013e-06
	Mitral Resistance	MR	1,25013e-07	1,25013e-06
	Mitral valve resistance	MVR	1,25013e-07	1,25013e-06
	Diastolic elastance	ELAMIN	3,5	0,733
	Maximum systolic elastance	ELAMAX	3,72	1,99
	Unstressed volume	VLAU	0,25	1
	initial volume	V0LAU	3,46601	6,9955
Left ventricle	Aortic valve resistance	AVR	4,16708e-07	4,69e-07
	Intrathoracic artery resistance	IAR	4,16708e-07	4,68797e-07
	Diastolic elastance	ELVMIN	2,63	0,55
	Maximum systolic elastance	ELVMAX	53,1	28,4
	Unstressed volume	VLVU	0,5	2
	initial volume	V0LVU	4,86548	16,043
Intrathoracic arteries	Elastance	EITHA	5,51517e-10	9,66577e-10
	Unstressed volume	VITHAU	9,16	18,2
	initial volume	V0ITHAU	12,1673	25,0263
Extrathoracic arteries	Blood flow inertia	LETHA	2,E+05	26664
	Resistance	RETHA	5,0005e-09	6,25063e-08
	Elastance	EETHA	1,29321e-09	2,48365e-09
	Unstressed volume	VETHAU	24,2	48,1
	initial volume	V0ETHAU	30,6887	64,3086
Peripheral vessels	Resistance	RSP	1,78589e-09	3,75038e-09
Extrathoracic veins	Resistance (to forward flow)	RETHV	3,57179e-08	4,16708e-08
	Elastance	EETHV	3,00026e-08	8,17063e-08
	Unstressed volume	VETHVU	65,4	130
	initial volume	V0ETHVU	101,3751	223,475
Intrathoracic veins	Elastance	EITHV	1,50013e-08	7,58406e-08
	Unstressed volume	VITHVU	77,8	155
	initial volume	V0ITHVU	99,7110325	228,569
Right atrium	Resistance to forward flow	RRAIN	5,0005e-07	1,25013e-06
	Tricuspid valve resistance	TVR	1,25013e-07	1,25013e-06
	Tricuspid resistance	TR	1,25013e-07	1,25013e-06
	Diastolic elastance	ERAMIN	2,6	0,317
	Maximum systolic elastance	ERAMAX	10,1	0,63
	Unstressed volume	VRAU	0,25	1,5
	initial volume	V0RAU	3,030605	22,3065
Right ventricle	Pulmonary artery resistance	PAR	4,16708e-07	1,25013e-06
	Pulmonar valve resistance	PVR	4,16708e-07	1,25013e-06
	Diastolic elastance	ERVMIN	2,62	0,348
	Maximum systolic elastance	ERVMAX	34,4	2,09
	Unstressed volume	VRVU	0,33	3
	initial volume	V0RVU	2,759605	17,9118
Pulmonary arteries	Elastance	EPA	6,88132e-10	5,90601e-09
	Unstressed volume	VPAU	3,27	6,5
	initial volume	V0PAU	4,81283	21,6176
Peripheral vessels	Resistance	RPP	8,82441e-09	3,40943e-08
Pulmonary veins	Elastance	EPV	1,56263e-08	3,0367e-08
	Unstressed volume	VPVU	22,9	45,5
	initial volume	V0PVU	47,1283	76,3464

Table 2: Values for *uptake* $[O_2]$ of simulation

Parameter	Parameter description	Parameter value
γ	Diffusion efficiency of respiratory membrane	1
P_{50}	Partial pressure of $[O_2]$ at 50% saturation	26.6 $mmHg$
$[Hb]$	Concentration of Hb in blood	12 $g\ Hb/dl$

Under normal conditions hemoglobin $[Hb]$ concentrations for a newborn are around $14 - 24\ g/dl$ and for a child around $11 - 16\ g/dl$. For the case study of the child we take a value of $17\ g/dl$ and for the newborn we take a value of $17\ g/dl$.

1.1 Values for the aortic stenosis simulation

Table 3: Values for *uptake* $[O_2]$ simulation

Compartment	Parameter description	Parameter name	Parameter value
Left ventricle	Aortic valve resistance	AVR	9,38e-09
	Intrathoracic artery resistance	IAR	9,38e-09
	Diastolic elastance	ELVMIN	1,5
	Unstressed volume	VLVU	0

1.2 Values for the congenital heart disease simulation

Table 4: Values for simulation based on parametric and structural changes

Part of circulation	Comparment	Parameter escription	Parameter name	Descripción
Disease	Part of circulation	Parameter desccription	parameter name	parametr value
Patent ductus arteriosus	Left ventricle	Maximum systolic elastance	ELVMAX	106
		Diastolic elastance	ELVMIN	1,75
	Patent ductus arteriosus	Resistance	RDA	1,50015e-08
		Inertia	LDA	2,40E+05
Tetralogy of Fallot	Right ventricle	Maximum systolic elastance	ERVMAX	51,6
		Diastolic elastance	ERVMIN	1,75
		Outflow resistance	RRV	2,08354e-09
	Ventricular septal defect	Resistance	RVSD	1,50015e-08
	Overriding aorta	Resistance	ROA	1,50015e-07
Coarctation of the aorta	Left ventricle	Resistance	RLV	2,08354e-08
	Patent ductus arteriosus	Resistance	RDA	8,33417e-09
		Inertia	LDA	2,40E+05
	Foramen ovale	Resistance	RFO	1,50015e-08
	Right ventricle	Maximum systolic elastance	ERVMAX	114
		Diastolic elastance	ERVMIN	1,31
Transposition of the great arteries	Transposition of the pulmonary artery	Resistance	RTPA	1,50015e-08
	Transposition of the aorta	Resistance	RTA	1,50015e-07
	Ventricular septal defect	Resistance	RVSD	7,50075e-08
	Foramen ovale	Resistance	RFO	1,50015e-08
	Right ventricle	Maximum systolic elastance	ERVMAX	85,9
		Diastolic elastance	ERVMIN	1,31