

Vascular Model Repository

Specifications Document



0099_0001

Species	Human
Anatomy	Pulmonary
Disease	Congenital Heart Disease Single Ventricle Defect
Procedure	Glenn

Clinical Significance and Background

Pulmonary

The pulmonary circulation involves blood flowing from the right ventricle of the heart into the pulmonary arteries. From the pulmonary arteries, the blood then reaches the lungs, performs a gas exchange, and then continues to the pulmonary veins which then lead to the left atrium of the heart.

By definition, an artery is a blood vessel that carries blood away from the heart. This usually means arteries carry oxygenated blood to the rest of the body, but since the pulmonary arteries are transporting blood from the right side of the heart to the lungs to perform respiration, that makes the pulmonary arteries the only arteries in the body that actually carry deoxygenated blood. Similarly, the pulmonary veins, which carry blood that has been freshly oxygenated from the lungs back to the heart, are the only veins that actually carry oxygenated blood.

Congenital Heart Disease

Congenital heart disease is one or more problems with the heart's structure that exist since birth. Congenital means that you're born with the condition. Congenital heart disease in adults and children can change the way blood flows through the heart. Some types of congenital heart disease may be mild. But complex defects may cause life-threatening complications. However, advances in diagnosis and treatment continue to improve survival for those with congenital heart disease. People with congenital heart disease need lifelong medical care. Treatment may include regular checkups (watchful waiting), medications or surgery.

Single Ventricle Defect

A single ventricle defect (SVD) is a type of heart defect that a child is born with. It occurs when one of the two pumping chambers in the heart, called ventricles, isn't large enough or strong enough to work correctly. In some cases, the chamber might be missing a valve. Single ventricle defects are rare, affecting only about five out of 100,000 newborns. They are also one of the most complex heart problems, usually requiring at least one surgery. There are several types of single ventricle defects which include but are not limited to: tricuspid atresia, hypoplastic left heart syndrome (HLHS), mitral valve atresia (usually associated with HLHS), single left ventricle, double inlet left ventricle (DILV), double outlet right ventricle (DORV), pulmonary atresia with intact

ventricular septum (PA/IVS), Ebstein's anomaly, and atrioventricular canal defect (AV Canal).

Glenn

The Glenn procedure is a type of open-heart surgery. Babies who need this surgery typically have it when they're 4 - 6 months old. The Glenn procedure is done for children who are born with heart problems like hypoplastic left heart syndrome (HLHS), tricuspid atresia, and double outlet right ventricle. Depending on the heart problem, children may need the Norwood procedure before the Glenn surgery.

The Glenn procedure sends blood from the upper body directly to the lungs. This way, the single ventricle only has to pump blood to the body (and not to the lungs), so it doesn't have to work as hard.

During the Glenn procedure, the surgeon disconnects the superior vena cava (SVC) from the heart and connects it to the pulmonary artery. Now the blood from the upper part of the body flows directly into the pulmonary artery. The pulmonary artery takes the blood to the lungs. If the baby had the Norwood procedure, the surgeon will remove the shunt that was placed then.

Clinical Data

General Patient Data

Age (yrs)	4.75
Sex	Male

Specific Patient Data

CI (L/min/m ²)	3.2
P SVC MP cath	12
FS LPA MRI	0.2
FS RPA MRI	0.8

Notes

Paper patient "D". See [DOI](#) for more details. See below for information on the image data and boundary conditions associated with the model.

Image Modality: MR

Image Type: DICOM

Image Source: TLAB

Image Manufacturer: GE MEDICAL SYSTEMS

Boundary Conditions: Refer to boundary conditions in the SimVascular file.

Publications

See the following publications which include the featured model for more details:

Troianowski, G., Taylor, C. A., Feinstein, J. A., & Vignon-Clementel, I. E. (2011). Three-dimensional simulations in Glenn patients: clinically based boundary conditions, hemodynamic results and sensitivity to input data. *Journal of biomechanical engineering*, 133(11).
<http://www.doi.org/10.1115/1.4005377>

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AND/OR

N.M. Wilson, A.K. Ortiz, and A.B. Johnson, "The Vascular Model Repository: A Public Resource of Medical Imaging Data and Blood Flow Simulation Results," J. Med. Devices 7(4), 040923 (Dec 05, 2013) doi:10.1115/1.4025983.

AND/OR

Reference the official website for this data: www.vascularmodel.com

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