

# Vascular Model Repository

## Specifications Document



0096\_0001

|                  |   |
|------------------|---|
| <b>Species</b>   | Human   |
| <b>Anatomy</b>   | Pulmonary   |
| <b>Disease</b>   | Congenital Heart Disease<br>Single Ventricle Defect |
| <b>Procedure</b> | Glenn   |

# Clinical Significance and Background

## Pulmonary

The pulmonary arteries are blood vessels that carry systemic venous blood returning to the right side of the heart through to the microcirculation of the lungs. Unlike in other organs where arteries supply oxygenated blood, the blood carried by the pulmonary arteries is deoxygenated, as it is venous blood returning to the heart. The main pulmonary arteries emerge from the right side of the heart, and then split into smaller arteries that progressively divide and become arterioles, eventually narrowing into the capillary microcirculation of the lungs where gas exchange occurs.

## 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) | 3      |
| Sex       | Female |

### Specific Patient Data

|                            |     |
|----------------------------|-----|
| CI (L/min/m <sup>2</sup> ) | 3.7 |
| P SVC MP cath              | 8   |
| FS LPA MRI                 | 0.4 |
| FS RPA MRI                 | 0.6 |

## Notes

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](http://www.vascularmodel.com)

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