

# Vascular Model Repository

## Specifications Document



0107\_0001

<b>Species</b>	Human
<b>Anatomy</b>	Aorta
<b>Disease</b>	Coarctation of Aorta
<b>Procedure</b>	End-to-Side Anastomosis

# Clinical Significance and Background

## Aorta

The largest blood vessel and the human body's primary artery, the aorta is responsible for carrying oxygenated blood pumped from the heart to rest of the body. The aorta is divided into four sections: the ascending aorta, the aortic arch, the thoracic aorta, and the abdominal aorta.

The ascending aorta starts at the left ventricle of the heart where at the root, it supplies blood to the heart muscle through the coronary arteries. From the aortic root, the ascending aorta continues to rise up until it reaches the aortic arch.

The aortic arch loops over the bifurcation of the pulmonary trunk and has three major artery branches leaving through the top: the brachiocephalic trunk, the left common carotid artery, and the left subclavian artery. The brachiocephalic trunk sends blood to the right side of the brain and right arm/neck/chest while the left common carotid artery sends blood to the left side of the brain and the left subclavian artery sends blood to the left arm/neck/chest.

After the aortic arch, the aorta begins to descend all the way to the abdomen. The section of the descending aorta that starts after the aortic arch and ends at the diaphragm is called the thoracic aorta, and it supplies blood to the chest and spinal cord.

The last section of the aorta, the abdominal aorta, starts at the diaphragm and ends just above the pelvis. This section is responsible for supplying blood to the stomach, kidneys, liver, and intestines. Past the abdominal aorta, the artery branches into two separate iliac arteries, one for each leg, which are responsible for supplying oxygenated blood to the legs and lower half of the body.

## Coarctation of Aorta

Coarctation of the aorta is a birth defect in which a part of the aorta is narrower than usual. If the narrowing is severe enough and if it is not diagnosed, the baby may have serious problems and may need surgery or other procedures soon after birth. For this reason, coarctation of the aorta is often considered a critical congenital heart defect. The narrowing of the aorta usually happens in the part of the blood vessel just after the

arteries branch off to take blood to the head and arms, near the patent ductus arteriosus, although sometimes the narrowing occurs before or after the ductus arteriosus. In some babies with coarctation, it is thought that some tissue from the wall of ductus arteriosus blends into the tissue of the aorta. When the tissue tightens and allows the ductus arteriosus to close normally after birth, this extra tissue may also tighten and narrow the aorta.

The narrowing, or coarctation, blocks normal blood flow to the body. This can back up flow into the left ventricle of the heart, making the muscles in this ventricle work harder to get blood out of the heart. Since the narrowing of the aorta is usually located after arteries branch to the upper body, coarctation in this region can lead to normal or high blood pressure and pulsing of blood in the head and arms and low blood pressure and weak pulses in the legs and lower body.

If the condition is very severe, enough blood may not be able to get through to the lower body. The extra work on the heart can cause the walls of the heart to become thicker in order to pump harder. This eventually weakens the heart muscle. If the aorta is not widened, the heart may weaken enough that it leads to heart failure. Coarctation of the aorta often occurs with other congenital heart defects.

### End-to-Side Anastomosis

Coarctation of the aorta is usually treated soon after diagnosis through surgical methods or transcatheter techniques (ballooning/stenting). One common surgical method is called end-to-side anastomosis. During end-to-side anastomosis, the narrowed segment of the aorta is not always removed. Most commonly, the narrowed segment is tied and the descending aorta is reattached through a separate incision to the underside of the aorta. In some rare instances, the narrowed region is not removed and a jump graft is used to connect the descending aorta to the aortic arch proximal to the coarctation.

## Clinical Data

### General Patient Data

Age (yrs)	4
Sex	Male

## Specific Patient Data

BSA (m <sup>2</sup> )	0.72
CI (L/min/m <sup>2</sup> )	3.28
P sys SP cuff	112
P sys DP cuff	69

## Notes

Coarctation of aorta patient with postoperative end-to-side anastomosis. 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:

LaDisa, J. F., Alberto Figueroa, C., Vignon-Clementel, I. E., Jin Kim, H., Xiao, N., Ellwein, L. M., ... & Taylor, C. A. (2011). Computational simulations for aortic coarctation: representative results from a sampling of patients.  
<http://www.doi.org/10.1115/1.4004996>

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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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