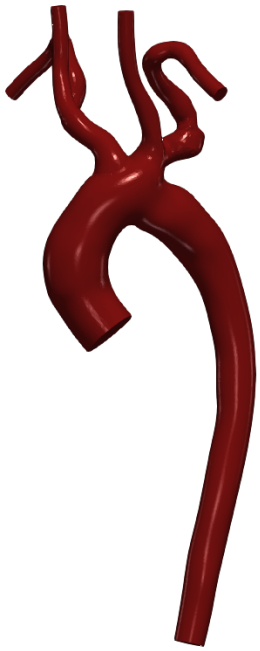
Vascular Model Repository Specifications Document



0107_0001

Species	Human
Anatomy	Aorta
Disease	Coarctation of Aorta
Procedure	End-to-Side Anastomosis

Clinical Significance and Background

Aorta

The aorta is the main and largest artery in the human body, originating from the left ventricle of the heart and extending down to the abdomen, where it splits into two smaller arteries (the common iliac arteries). The aorta distributes oxygenated blood to all parts of the body through the systemic circulation.

The aortic arch loops over the left pulmonary artery and the bifurcation of the pulmonary trunk. In addition to these blood vessels, the aortic arch crosses the left main bronchus. The aortic arch has three major branches: from proximal to distal, they are the brachiocephalic trunk, the left common carotid artery, and the left subclavian artery. The brachiocephalic trunk supplies the right side of the head and neck as well as the right arm and chest wall, while the latter two together supply the left side of the same regions.

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^2)	0.72
CI (L/min/m^2)	3.28
P sys SP cuff	112
P sys DP cuff	69

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:

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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