

Vascular Model Repository

Specifications Document



0104_0001

Species	Human
Anatomy	Aorta
Disease	Coarctation of Aorta
Procedure	End-to-End 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-End 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 resection with end-to-end anastomosis. This method involves removing the narrowed area of the aorta (resection) and then connecting the two healthy parts of the aorta (anastomosis).

Clinical Data

General Patient Data

Age (yrs)	11
Sex	Female

Notes

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:

Jr. LaDisa, J. F., Dholakia, R. J., Figueroa, C. A., Vignon-Clementel, I. E., Chan, F. P., Samyn, M. M., ... & Feinstein, J. A. (2011). Computational simulations demonstrate altered wall shear stress in aortic coarctation patients treated by resection with end-to-end anastomosis. *Congenital heart disease*, 6(5), 432-443.
<http://www.doi.org/10.1111/j.1747-0803.2011.00553.x>

License

Copyright (c) Stanford University, the Regents of the University of California, Open Source Medical Software Corporation, and other parties.

All Rights Reserved.

Permission is hereby granted, free of charge, to any person obtaining a copy of this data to use the data for research and development purposes subject to the following conditions:

The above copyright notice and the README-COPYRIGHT file shall be included in all copies of any portion of this data. Whenever reasonable and possible in publications and presentations when this data is used in whole or part, please include an acknowledgement similar to the following:

"The data used herein was provided in whole or in part with Federal funds from the National Library of Medicine under Grant No. R01LM013120, and the National Heart, Lung, and Blood Institute, National Institutes of Health, Department of Health and Human Services, under Contract No. HHSN268201100035C"

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

THE DATA IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE DATA OR THE USE OR OTHER DEALINGS IN THE DATA.