

Vascular Model Repository

Specifications Document



0160_H_AO_AOD

Legacy Name: BMMB_AD_2020

Model added: 11 Jan 2023

Species	Human
Anatomy	Aorta
Disease	Aortic Dissection
Procedure	Hemiarch Replacement

Clinical Significance and Background

Aorta

The largest blood vessel and the primary artery of the human body, the aorta is responsible for carrying oxygenated blood pumped from the heart to the 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 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 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, and both iliac arteries are responsible for supplying oxygenated blood to the legs and lower half of the body.

Aortic Dissection

Aortic dissection occurs when the innermost layer of the aorta begins to tear. From there, blood rushes through the initial tear and splits (dissects) the inner and middle layers of the aorta. If blood manages to penetrate the outer layer of the aorta, then the aortic dissection can become deadly. There are two types of aortic dissections: Type A and Type B. Type A aortic dissections are the most common and most dangerous of the two and involve a tear occurring in the ascending aorta while Type B aortic

dissections involve a tear occurring in the descending/lower aorta.

Hemiarch Replacement

A Hemiarch replacement is used to treat a Type A aortic dissection or an aortic aneurysm that occurs in the ascending aorta. It involves the replacement of the aortic valve as well as the replacement of the ascending aorta without replacing the arch vessels (brachiocephalic, carotid, subclavian). Often times, a Dacron graft is used to replace the ascending aorta.

Clinical Data

General Patient Data

Age (yrs)	52
Sex	Male

Specific Patient Data

CT angiographic images of the chest and abdomen were acquired on a second-generation dual-source CT scanner (Siemens, Forchheim, Germany) with retrospective ECG gating of the thorax, during the intravenous injection of 162 mL of iopamidol (Isovue 300, Bracco Diagnostics, Monroe Township, NJ, USA). A total of 1027 transverse images with a section thickness of 0.75 mm were reconstructed at 0.7 mm intervals. The final CTA dataset consisted of 512x512x1027 voxels, at a resolution of 0.63 mm x 0.63 mm x 0.70 mm.

52-year-old man with a residual Type B aortic dissection, 8 days after surgical repair (aortic root composite valve graft and hemiarch replacement) of an acute Type A aortic dissection.

Patient-specific cuff pressure measurements (109/56 mmHg).

Fraction of flow through outlets from 4D-flow data:

Brachiocephalic trunk	0.202
Left common carotid artery	0.058
Left subcl. artery (true lumen)	0.076
Left subcl. artery (false lumen)	0.059
Celiac trunk	0.126

Superior mesenteric artery	0.041
Right renal artery	0.072
Left renal artery	0.084
Right external iliac	0.109
Right internal iliac	0.045
Left external iliac	0.09
Left internal iliac	0.037

Notes

A 52-year-old man with a residual Type B aortic dissection, 8 days after surgical repair (aortic root composite valve graft and hemiarch replacement) of an acute Type A aortic dissection. Simulation results have individual .vtu files for each time step. \nSee [paper](#) for more details. See below for information on the image data.

Image Modality: CT

Image Type: VTI

Publications

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

Baumler, K., Vedula, V., Sailer, A.M. et al. Fluid-structure interaction simulations of patient-specific aortic dissection. *Biomech Model Mechanobiol* 19, 1607-1628 (2020). <https://doi.org/10.1007/s10237-020-01294-8>

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.