Vascular Model Repository Specifications Document

0003_H_AO_SVD

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Species	Human
Anatomy	Aorta
Disease	Single Ventricle Defect
Procedure	Aortic Reconstruction

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.

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, is not 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 the intact ventricular septum (PA/IVS), and atrioventricular canal defect (AV Canal).

Aortic Reconstruction

Aortic root reconstruction is a procedure to treat an aortic aneurysm. An aneurysm is a condition characterized by abnormal bulging or ballooning in the wall of a blood vessel. Aortic root aneurysm can be treated by reconstruction of this delicate area surgically, through aortic root reconstruction. This involves complete resection of the diseased portion of the aorta including the aortic valve. The aortic root is then replaced with an artificial tube (graft) and the aortic valve is replaced with a mechanical or biological valve. This type of aortic root reconstruction is called aortic root replacement. When a mechanical valve is chosen, lifelong anticoagulation therapy is required. When a biological valve is used, re-operation may be required, should the biological valve fail.

Valve-sparing aortic root repair is another alternate procedure for aortic root reconstruction that involves the preservation of the patient aortic valve. During this procedure, the enlarged section of the aorta is replaced with an artificial tube (graft). The patient aortic valve stays in place and is sutured to the inside of the graft. This stabilizes the aortic annulus and prevents further aortic dilatation. It also enhances the durability of the native valve function.

Clinical Data

General Patient Data

Age (yrs)	5
Sex	Female

Specific Patient Data

BSA (m^2)	0.68
CI (L/min/m^2)	2.8
P IVC MP cath	11
P SVC MP cath	11
P LPA MP cath	7
P RPA MP cath	9

Notes

Model of neo-aorta on patients who have undergone the Fontan procedure with aortic reconstruction. \nSee paper for more details. See below for information on the image data.

Image Modality:	CT
Image Type:	VTI
Image Source:	TLAB
Image Manufacturer:	SIEMENS

Publications

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

Marsden, A. L., Reddy, V. M., Shadden, S. C., Chan, F. P., Taylor, C. A., & Feinstein, J. A. (2010). A new multiparameter approach to computational simulation for Fontan assessment and redesign. Congenital Heart Disease, 5(2), 104-117. http://www.doi.org/10.1111/j.1747-0803.2010.00383.x

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