Development of the Aorta

Prof. Abdulameer Al-Nuaimi

E-mail: a.al-nuaimi@sheffield.ac.uk

ab dulameerh@yahoo.com
Development of the aorta

Development of the aorta takes place during the third week of gestation. It is a complex process associated with the formation of the endocardial tube (heart tube) at day 21.

Blood islands appear bilaterally in the splanchnic mesoderm parallel and close to the midline of the embryo forming a pair of longitudinal vessels, the Dorsal Aortae. The paired dorsal aortae are connected to aortic arches that in turn arise from the aortic sac. The aortic sac is a primordial dilated vascular channel, lined by endothelial cells and located superior to the truncus arteriosus. It represents the ventral aortae of gill-bearing vertebrates. (two ventral aortae fuse to form the aortic sac which is continuous with truncus arteriosus). Dorsal aortae fuse to form the midline descending aorta.
There are six paired aortic arches, the so-called branchial arch arteries, develop between the ventral aortic sac and dorsal aortae. In addition, the dorsal aorta gives off several intersegmental arteries.
Establishment of Cardiogenic field

A. Dorsal view of a late presomite embryo (approximately 18 days) after removal of the amnion. Prospective myoblasts and hemangioblasts reside in the splanchnic mesoderm in front of the neural plate and on each side of the embryo. B. Transverse section through a similar-staged embryo to show the position of the blood islands in the splanchnic mesoderm layer. C. Cephalocaudal section through a similar-staged embryo showing the position of the pericardial cavity and cardiogenic field.
Transverse sections through embryos at different stages of development, showing formation of a single heart tube from paired primordia. **A.** Early presomite embryo (17 days). **B.** Late presomite embryo (18 days). **C.** Eightsomite stage (22 days). Fusion occurs only in the caudal region of the horseshoe-shaped tube (Fig. 12.4). The outflow tract and most of the ventricular region form by expansion and growth of the crescent portion of the horseshoe.
Early Human Embryo Arterial

- left & right dorsal aortas
- aortic arch II
- aortic arch I
- ventral aorta (aortic sac)
- Truncus arteriosus
- umbilical artery
- sinus venosus atrium ventricle bulbis cordis
- vitelline artery
Ventral (anterior)

Full set of arches develops, but not all present at the same time; (before transformation)
Aortic Sac
Dorsal Aorta
Heart

Intersegmental branches

3rd branchial arch
Gives rise to internal Carotid artery

Dorsal Aorta

Lt
Rt
truncus arteriosus
Dorsal Aorta
Heart

the midline descending aorta
Truncus Arteriosus
The aortic sac gives rise to Ascending aorta and brachiocephalic trunk
The vessels derived from each arch are as follows:

1\(^{st}\) pair: contributes to formation of the maxillary and external carotid arteries.

2\(^{nd}\) pair: contributes to formation of the stapedial arteries of the ear

3\(^{rd}\) aortic arch constitutes the commencement of the internal carotid artery and common carotid arteries. Therefore, it is named as the carotid arch.
4th arch: The left arch forms the segment of normal left aortic arch between the left common carotid and subclavian arteries.

The right fourth arch forms the proximal right subclavian artery. The distal right subclavian artery is derived from a portion of the right dorsal aorta and the right seventh intersegmental artery. The rest of the right aorta degenerates

5th arch degenerate
6th pair: The left arch contributes to the formation of the main and left pulmonary arteries and ductus arteriosus; this duct obliterates a few days after birth. The right sixth arch contributes to formation of the right pulmonary artery.
the seventh intersegmental arteries enlarge and migrate cranially to form the distal subclavian arteries. The left subclavian artery is derived entirely from the left seventh intersegmental artery, whereas the portions of the right are derived from the right fourth arch and the right dorsal aorta.
Thank You