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**Objectives**

- Describe formation of aortic arches.

- Describe formation of vitelline and umblical arteries.

- Describe formation of coronary arteries.

- Correlate this knowledge to clinical conditions.

**Aortic arches**

**The pharyngeal arches:** Itis formed during the 4th - 5th weeks of development.

- Each arch receives its own cranial nerve and artery.

**The aortic arches:** It arises from the aortic sac (the most distal part of the truncus arteriosus) and terminates in the right and left dorsal aortae.

- The aortic arches are embedded in the mesenchyme of the pharyngeal arches.

**The aortic sac:** It contributes a branch to each new pharyngeal arch so it is giving rise to total of 6 pairs of arteries.

- The 5th arch is not formed or incompletely formed and then regresses.

**The dorsal aortae:** It remains paired in the region of the arches but caudal to this region they fuse to form a single vessel.

**Fate of the aortic sac:** It forms right and left horns giving rise to:

- Brachiocephalic artery

- Proximal segment of the arch of aorta respectively*.*

**Fate of the aortic arches:**

**- The 1st aortic arch:** Itdisappeared and a small portion persists to form the maxillary artery.

**- The 2nd aortic arch:** It disappeared and a

 small portions persists to form the hyoid and stapedial arteries.

**- The 3rd aortic arch:** It forms the common carotid, external carotid artery and the first part of internal carotid artery.

- The remaining part of the internal carotid is formed by the cranial portion of dorsal aorta.

**- The 4th aortic arch:** It persists on both sides but its fate is different on the right and left sides.

**- On the left side:** It forms part of the arch of the aorta (between the left common carotid and the left subclavian arteries).

**- On the right side:** It forms the most proximal segment of the right subclavian artery while the distal part is formed by a portion of the right dorsal aorta and the 7th intersegmental artery*.*

**- The 5th aortic arch:** It is never formed or incompletely formed and then regresses.

**- The 6th aortic arch:** It is known as the

 pulmonary arch, it gives an important branch that grows toward the developing lung bud*.*

**- On the right side:**

- The proximal part becomes the proximal segment of the right pulmonary artery. - The distal portion of this arch loses its connection with the dorsal aorta and disappears.

**- On the left side:** The proximal part form the left pulmonary artery and distal part persists during intrauterine life as the ductus arteriosus.

 **Other changes occurs in the aortic arches:**

**1. The dorsal aorta** between the 3rd and 4th arches is obliterated.

**2. The right dorsal aorta** between the 7th intersegmental artery and the junction with the left dorsal aorta disappears.

**3. Growth of the forebrain and elongation of the neck** pushing the heart into the thoracic cavity.

- The carotid, brachiocephalic arteries elongateandthe left subclavian artery is fixed in the arm at the origin of the left common carotid artery.

**4. The course of the recurrent laryngeal nerves becomes different:**

**- On the right side:** The distal part of 5th and 6thaortic arch disappear so the nerve hooks around the right subclavian artery.

**- On the left side:** The 6th aortic arch persists so the nerve hooks around the arch of aorta.

**Vitelline arteries**

**-** Itis a number of paired vessels supplying the yolk sac and it is gradually fuses and form the arteries in the dorsal mesentery of the gut.

**Derivatives in adult:** They are represented by the **celiac and superior mesenteric arteries.**

- The inferior mesenteric artery is derived from the umbilical arteries.

- These 3 vessels supply derivatives of the foregut, midgut and hindgut respectively.

**Umbilical arteries**

**-** Theyare paired branches of the dorsal aorta in the placenta.

- During the 4thweek each artery is connected with the dorsal branch of aorta (common iliac artery) and loses its earliest origin.

**Derivatives:**

- The proximal part of the artery persist as **internal iliac and superior vesical arteries**

- The distal parts form the **medial umbilical ligaments.**

 **Coronary arteries**

- They are derived from two sources:

**1. Angioblasts:** It is formed from the sinus venosus that are distributed over the heart surface by cell migration.

 **2. Epicardium:** Some epicardial cells undergo an epithelial to mesenchymal transition induced by the underlying myocardium.

**- The newly formed mesenchymal cells:**

 Contribute to endothelial and smooth

 muscle cells of the coronary arteries.

**- Connection of the coronary arteries to the aorta:** Itoccurs by ingrowth of arterial endothelial cells from the arteries into the aorta.

**Clinical applications**

**1. Patent ductus arteriosus:** It is one of the most frequent abnormalities.

- It is more common in pre mature.

- It may be single or with heart defects.

**2. Coarctation of the aorta:** It is congenital narrowing of the arch of aorta.

- It may be preductal or postductal (the most common type).

**3. Abnormal origin of the subclavian artery:**

- It occurs when the artery develops from distal portion of right dorsal aorta and 7th intersegmental artery.

**4. Double aortic arch:** The right dorsal aorta persist between the 7th intersegmental artery and its junction with the left dorsal aorta.

**5. Right aortic arch:** The left 4th aortic arch and left dorsal aorta are obliterated and replaced by corresponding vessels in the right side.