SEM IV Study Materials

AORTIC ARCHES INTRODUCTION

The **aortic arches** or **pharyngeal arch arteries** (previously referred to as **branchial arches** in human embryos) are a series of six paired embryological vascular structures which give rise to the great arteries of the neck and head. They are ventral to the dorsal aorta and arise from the aortic sac.

The aortic arches are formed sequentially within the pharyngeal arches and initially appear symmetrical on both sides of the embryo,[1] but then undergo a significant remodelling to form the final asymmetrical structure of the great arteries.

Structure:

Arches 1 and 2

The *first* and *second arches* disappear early. A remnant of the 1st arch forms part of the maxillary artery, a branch of the external carotid artery. The ventral end of the second develops into the ascending pharyngeal artery, and its dorsal end gives origin to the stapedial artery, a vessel which typically atrophies in humans but persists in some mammals. The stapedial artery passes through the ring of the stapes and divides into supraorbital, infraorbital, and mandibular branches which follow the three divisions of the trigeminal nerve. The infraorbital and mandibular branches arise from a common stem, the terminal part of which anastomoses with the external carotid artery. On the obliteration of the stapedial artery, this anastomosis enlarges and forms the internal maxillary artery; branches formerly of the stapedial artery are subsequently considered branches of the internal maxillary artery. The common stem of the infraorbital and mandibular branches passes between the two roots of the auriculotemporal nerve and becomes the middle meningeal artery; the original supraorbital branch of the stapedial is represented by the orbital twigs of the middle meningeal.

Note that the external carotid buds from the horns of the aortic sac left behind by the regression of the first two arches.

Arch 3

The *third aortic arch* constitutes the commencement of the internal carotid artery, and is therefore named the **carotid arch**. It contributes to the common carotid artery and the proximal portion of the internal carotid artery.

Arch 4

The *fourth right arch* forms the right subclavian as far as the origin of its internal mammary branch. The *fourth left arch* forms the arch of the aorta between the origin of the left carotid artery and the terminus of the ductus arteriosus.the fourth arches called systemic arch

Arch 5

The *fifth arch* either never forms or forms incompletely and then regresses.

Arch 6

The proximal part of the *sixth right arch* persists as the proximal part of the right pulmonary artery while the distal section degenerates; The *sixth left arch* gives off the left pulmonary artery and forms the ductus arteriosus; this duct remains pervious during the whole of fetal life, but then closes within the first few days after birth due to increased O_2 concentration. Oxygen concentration causes the production of bradykinin which causes the ductus to constrict occluding all flow. Within 1–3 months, the ductus is obliterated and becomes the ligamentum arteriosum.

The ductus arteriosus connects at a junction point that has a low pressure zone (commonly called Bernoulli's principle) created by the inferior curvature (inner radius) of the artery. This low pressure region allows the artery to receive (siphon) the blood flow from the pulmonary artery which is under a higher pressure. However, it is extremely likely that the major force driving flow in this artery is the markedly different arterial pressures in the pulmonary and systemic circulations due to the different arteriolar resistances.

His showed that in the early embryo the right and left arches each gives a branch to the lungs, but that later both pulmonary arteries take origin from the left arch.