Editorial Commentary

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Embryology of the ophthalmic artery

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Alternative routes of intra-arterial chemotherapy for retinoblastoma are based on the embryological and, thus, anatomical variations of the ophthalmic artery. Although the embryology of the ophthalmic artery is briefly discussed in this excellent clinical paper,[1] I would like to comment on this.

The structure of the eye is well conserved among vertebrates.[2] This implies that the vascular structure of the eye should also be well conserved among vertebrates, especially among mammals. The basic vascular supply of the eye is composed of two sources: one for the bulbar structure (retina and choroid structures) and one for the non-bulbar structure (glandular and muscular structures),[3,4] For an understanding of the embryological origins of these vessels, the bony canal, foramen, and fissure convey many messages to us. The artery supplying the bulbar structure is the ocular artery, which runs through the optic canal. The artery supplying the non-bulbar structure is the orbital artery, which runs through the superior orbital fissure (SOF). Many arterial variations of the eye come from the modifications from this basic vascular structure of the eye, by segmental or total regression, hypertrophy, and anastomosis.

Wherever the origin (branching point) of the ocular artery is, either originating from the anterior cerebral artery (A1) or distal internal carotid artery (ICA, C1-3), this ocular artery supplies the bulbar structure of the eye as long as it courses through the optic canal. Not well described in the literature except for the human eye, this artery is embryologically composed of the ventral and dorsal ophthalmic arteries supplying the retina and choroid, and is called the primitive ophthalmic artery.[5] It is known that the primitive ophthalmic artery branches off from the anterior cerebral artery in most mammals, but it also branches off from the C1/2 portion in lemur and loris, and from the C3 portion of the distal ICA in *Tupaia*, *Aotus*, *Saguinus*, and humans.[3]

Contrary to this ocular artery, the artery coursing through the SOF or lacrimal foramen is embryologically composed of the supraorbital branch of the stapedial artery, and supplies the non-bulbar structures.[3] This artery can run through both medial and lateral portions of the SOF (the latter includes the lacrimal foramen), corresponding to the deep and superficial recurrent ophthalmic arteries, respectively. The deep recurrent ophthalmic artery may anastomose with the inferolateral trunk (ILT) of the ICA (often misunderstood as dorsal ophthalmic artery).[6] The superficial recurrent ophthalmic artery may run through the lateral portion of the SOF, similar to the sphenoidal artery or through the lacrimal foramen (Hyrtl canal) similar to the lacrimal artery (meningolacrimal artery) connecting the anterior branch of the middle meningeal artery to the orbital artery.

The embryological origin of the ILT remains speculative. It could be the remnant of the primitive maxillary artery of Sabin,[7] but this primitive artery dwindles much earlier than the primitive ventral and dorsal ophthalmic arteries.[5] Thus, the anastomotic branches of the ILT are mostly composed of the stapedial artery in origin.[3] The primitive maxillary artery is better called the primitive pre-mandibular artery in consideration of its anatomical location and territories of the vascular supply – that is, the frontal pole of the prosencephalon and optic vesicle.[8]

Embryology of the ophthalmic artery is still controversial. Because the dorsal ophthalmic artery is purely intradural as observed by Padget,[5] it is better to abandon the misconception of a remnant of dorsal ophthalmic artery, which originates from the ILT, runs through the SOF, and supplies the orbit.

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