Original Research Paper

Volume-9 | Issue-3 | March-2019 | PRINT ISSN - 2249-555X

Anatomy

A CASE REPORT OF HYPOPLASIA OF VERTEBRAL AND POSTERIOR COMMUNICATING ARTERIES WITH THE PRESENCE OF PERSISTENT HYPOGLOSSAL ARTERY.

Dr. Pitapurapu Sasidhar M.D., Junior Resident, Dept.of Anatomy, SMC, Vijayawada, Affiliated To Dr.ntr University Of Health Sciences, Vijayawada.

Dr. Dumpala Ramarao* M.D., Junior Resident, Dept.of Anatomy, SMC, Vijayawada, Affiliated To Dr.ntr University Of Health Sciences, Vijayawada. *Corresponding Author

Dr. Chitra Ramasamy M.D., Professor and HOD, Dept.of Anatomy, SMC, Vijayawada, Affiliated To Dr.ntr University Of Health Sciences, Vijayawada.

ABSTRACT We observed a rare case of the right persistent hypoglossal artery (PHA) in the posterior cranial fossa of a deceased 54-year-old male cadaver. The large-sized PHA originating from the cervical internal carotid artery passed through the hypoglossal canal and reached the posterior cranial fossa to anastomose with the basilar artery, accompanied by the hypoglossal nerve in the hypoglossal canal . In addition, the ipsilateral vertebral artery and bilateral posterior communicating arteries were found to be hypoplastic. Here, we discuss the developmental mechanisms underlying the formation of the PHA and the spectrum of diseases related to its presence.

KEYWORDS : Cervical internal carotid artery(ICA), Basillar artery(BA), Vertebral artery(VA), Hypoglossal canal(HC), Persistent hypoglossal artery(PHA), Posterior communicating artery(PCOA)

INTRODUCTION

Several carotid-basilar artery anastomoses, such as the trigeminal, optic, and hypoglossal arteries, are present in the early developmental stage of the human embryo. Some may remain without involution as persistent carotid-basilar artery anastomoses. Persistent trigeminal artery makes up to the vast majority of persistent carotid-basilar artery anastomoses, followed by persistent hypoglossal artery (PHA), whereas the persistent optic and proatlantal intersegmental arteries occur less frequently.[1] The hypoglossal artery was first described in 1889 as incidental finding during an autopsy. Several case reports have been published describing persistent hypoglossal arteries, the estimated incidence of this anomaly being between 0.7 and 0.25%.[2] The relatively recent application of angiography has contributed to the discovery of the PHA, and its reported incidence is currently 0.027–0.26%.[3] Although PHA may be clinically silent, there are many reports of associated cerebrovascular pathologies.[4,5] The PHA normally arises from the cervical internal carotid artery (ICA) and passes through the hypoglossal canal (HC) to anastomose the basilar artery (BA). In most cases, the vertebral arteries (VA) are either hypoplastic or aplastic.[2] Given this background, we report here a case of the PHA originating from the ICA in a 54-year-old male cadaver.

CASE REPORT

During a routine dissection in the department of Anatomy, Siddhartha medical college, we identified a large PHA originating from the ICA in the right posterior cranial fossa of a 54-year-old male cadaver. The removal of brain revealed the presence of an anomalous vessel, the PHA, running from the right HC to the BA. The PHA was observed only on the right side and passed through the enlarged HC together with the hypo glossal nerve (XII) (Fig.1). The hypoplastic VA anastomosed the PHA at the opening of the HC to the cranial cavity. In the same region, the posterior inferior cerebellar artery (PICA) arose from the PHA (Fig.1). The dissection of the right cervical region showed that the PHA arose from the ICA at the level of the second cervical vertebra (Fig.2), ascending vertically along the ICA, turning to the posterior at the external cranial base, and entering the posterior cranial fossa via the right HC. In contrast, the left ICA appeared to be normal.

Examination of the cerebral vessels revealed that the BA appeared to be a continuation of the PHA (Fig.3a). The left VA anastomosed the left anterior inferior cerebellar artery (AICA) approximately 3.0 cm distal to the BA. The posterior communicating arteries (PCoAs) were present on both sides although they appeared to be hypoplastic (Fig.3b). The right VA arose anomalously from the supreme intercostal artery (SIA), whereas the left one arose from the subclavian artery (SA) (Fig.4).

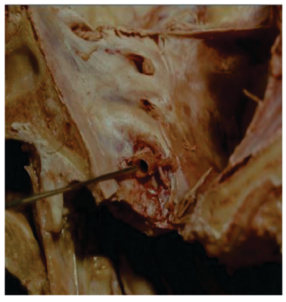

Fig 1. Photograph of the medial view of the right posterior cranial fossa. The skull was cut on the median plane, and the right half is presented here. An anomalous vessel, the persistent hypoglossal artery (PHA) was observed to pass through the hypoglossal canal (HC) together with the hypoglossal nerve (XII).

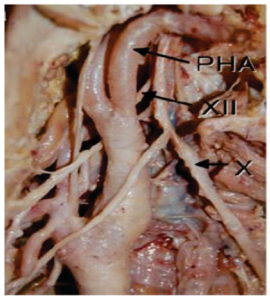

Fig.2. Photograph of the medial view of the right cervical region. The HC was opened by cutting off its inferior wall. The PHA originating from the cervical internal carotid artery (ICA) at the level of the second cervical vertebra ascended along the ICA and then turned posterior at the external cranial base.Cranial nerves X and XII.

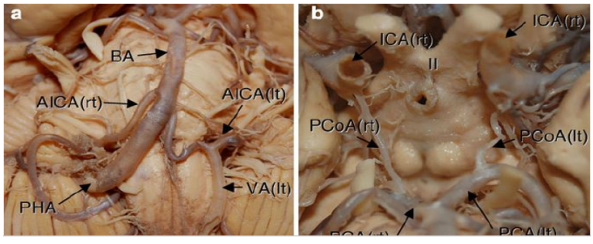

Fig. 3 a Basal view of the removed brain showing that the PHA was recognized at the ponto-cerebellar angle and appeared to be the true origin of the BA. The left VA anastomosed the anterior inferior cerebellar artery (AICA).

b Basal view of the removed brain showing that the bilateral posterior communicating arteries (PCoAs) were hypoplastic.

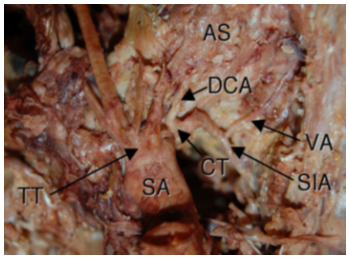

Fig.4. Photograph of the ventral view of the right lower neck. The hypoplastic right VA arose from the supreme intercostal artery (SIA) and entered the transverse foramen of the sixth cervical vertebra. II Optic chiasma, AS anterior scalene, CT

costocervical trunk, DCA deep cervical artery, SA subclavian artery,TT thyrocervical trunk

DISCUSSION

During the early stages of embryonic development, the hindbrain circulation originates from the bilateral longitudinal neural arteries that are connected in the midline to form the BA eventually. This plexus is initially supplied by three transient carotid-basilar anastomoses (trigeminal, optic, and hypoglossal arteries) and by the cervical intersegmental arteries between the hindbrain vascular plexus and anterior carotid circulation.[1] The carotid-basilar anastomoses involute concomitantly with the development of the PCoA between the 30th and 40th days of fetal life, while the first cervical intersegmental artery (the proatlantal intersegmental artery) participates in the formation of the VA. The vertical portion of the VA arises from longitudinal anastomoses between transversely running cervical intersegmental arteries and joins the first cervical intersegmental artery which represents the horizontal portion of the VA. It has been suggested that if the development of the VA is insufficient and/or the fusion between the VA and BA is inappropriate, persistent carotid-basilar artery anastomoses may persist to supply blood circulation to the hindbrain.[6] In the case described here, the right VA appeared to be hypoplastic, whereas the left VA appeared to be normal. These observations suggest that the hypoplastic VA resulted in the persistence of the hypoglossal artery.

The presence of the PHA may be completely asymptomatic, it may appear as an incidental finding in a cerebral angiogram performed for another diagnostic purpose. However, its presence has been associated with clinical implications.[7] It has been suggested that the PHA may be associated with the anomalous structure of the vessel wall, thereby exposing the basilar trunk to an unusual hemodynamic stress and predisposing the individual to the onset of aneurysms.[4] Since the origin of the PHA from the ICA forms analogous flow dynamics, such as at the carotid bulb, the development of an atherosclerotic plaque can be theoretically expected.[8] It is important to appreciate that the persistent hypoglossal and otic arteries are often associated with hypoplasia or aplasia of the vertebral and posterior communicating arteries. During cross-clamping of the carotid arteries the brainstem, cerebellum and ipsilateral cerebral hemisphere can be deprived of blood supply because of aplastic vertebral and posterior communicating arteries.[9]

In summary, we report here a rare case of the PHA in which the ipsilateral VA and bilateral PCoAs appeared to be hypoplastic. The simultaneous hypoplasia of these arteries may have reduced the competition for the territory of distribution, resulting in the persistence of the hypoglossal artery. Conversely, the PHA may have induced the hypoplastic VA and PCoAs. Although the presence of the PHA may be completely asymptomatic, it may be associated with certain clinical entities, such as aneurysm formation and atherosclerotic disease.

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