

Bilateral Absence of Posterior Communicating Arteries - A Case Report

Dr. Hemamalini¹, Kiran Kumar D²

¹ Assistant Professor, Department of Anatomy, JSS Medical College, Mysore – 570015, India

² Post Graduate in Anatomy, JSS Medical College, Mysore – 570015, India

Abstract: *The major arterial supply to the brain is by an arterial circle - circle of Willis situated in the interpeduncular cistern of the brain. It is formed by the anastomosis of the branches arising from the internal carotid and vertebral arteries. Posterior communicating artery is the main anastomotic channel between the carotid and vertebrobasilar circulation. During routine dissection of brain for undergraduate students in a 70years old male cadaver, we observed bilateral absence of posterior communicating arteries. Right vertebral artery was smaller than the left. Individuals with absence of posterior communicating artery/vertebral artery hypoplasia are more prone to develop stroke, migraine and cognitive dysfunction. Knowledge of variation in the posterior communicating arteries is not only important to diagnose neurological disorders but also important from surgical and angiographic point of view.*

Keywords: circle of Willis, posterior communicating artery, aplasia, hypoplasia, vertebral artery

1. Introduction

Posterior communicating artery arises from the posterolateral wall of the cerebral part of internal carotid artery. It runs posteromedially very close to the posterior clinoid process medial to the oculomotor nerve to enter the interpeduncular fossa and joins the posterior cerebral artery. During its course, it gives off 2-10 posteromedial central branches which supply the optic chiasma, optic tract, mammillary body, hypothalamus, thalamus and posterior perforating substance. The internal carotid artery gives two terminal branches – anterior and middle cerebral arteries. The two anterior cerebral arteries are connected to each other by an anterior communicating artery. The basilar artery terminates into two posterior cerebral arteries at the upper border of the pons and each posterior cerebral artery is connected to internal carotid artery through posterior communicating artery. This arterial anastomosis forms the circle of Willis at the base of the brain. There are variations in the pattern and caliber of the arteries that form the circle of Willis. According to SAGunnal, complete circle of Willis was found in 60% of cases. Incomplete circle of Willis was mostly because of absence of posterior communicating arteries. Maximum variations were seen in posterior communicating arteries like aplasia in 4% of cases, Hypoplasia in 27.33%, Fenestration in 0.66% of cases and fetal type in 18% of cases¹. Complete functional circle is very rare. The anastomosis provides alternate path for circulation under abnormal conditions such as block or sudden constriction of an artery².

2. Case Report

During routine dissection of brain for undergraduates, we observed bilateral absence of posterior communicating arteries in the circle of Willis, in a male cadaver approximately aged 70years in JSS medical college, Mysore. Right vertebral artery was smaller than the left. There was hemorrhage in the right

cerebral hemisphere in the inferior surface extending towards the occipital lobe. The internal carotid artery terminated by dividing into anterior cerebral and middle cerebral arteries. The two anterior cerebral arteries were connected to one another by anterior communicating artery. The basilar artery terminated at the upper border of the pons by dividing into right and left posterior cerebral arteries.

3. Discussion

Variations in the origin, termination and distribution of the arteries at the base of the brain are common. In most of the arterial variations the brain function may not be affected due to the collateral circulation and compensation from the arteries of the other side. Kapoor et al., reported that the typical circle of Willis was seen in 45.2% of cases and rest showed variations (54.8%) out of 1000 brain specimens. The circle was deficient in 3.2% of cases and posterior communicating artery was absent in 1% of cases³. According to Ardakani SK et al., symmetrical and circular circle of Willis was seen in 42.1% of cases. Apalsia of the right posterior communicating artery (16.6%) is more common than the left (3.3%)⁴.

According to Augenijus Vilimas et al., classical circle of Willis is however found only in 15-52% of cases. In 10% of cases there was either aplasia, hypoplasia or double posterior communicating arteries were found. He also reported the importance of posterior communicating arteries in vertebral artery hypoplasia which results in stroke. Out of 47 cases he studied, 50% were detected with absence of both posterior communicating arteries, 16.7% of cases had one posterior communicating artery, 33.3% of cases had both posterior communicating arteries. The percentage of stroke was 60% in case of bilateral absence of posterior communicating arteries, 40% in unilateral absence of posterior communicating artery

and 20% in patients having both posterior communicating arteries⁵.

A S Szarazova reported that the right hypoplastic vertebral artery occurs in 6.2% of the population, while left vertebral hypoplasia is present in 4.5% of the population⁶. Klotzsch C found a retrograde flow and significantly elevated flow velocity in the ipsilateral posterior communicating artery in all patients with a unilateral internal carotid artery block⁷. Schomer DF et al., have reported that posterior communicating arteries having less than 1mm in diameter and no visible flow in the ipsilateral posterior communicating artery had ischemic necrosis in the cerebral hemispheres in patients with internal carotid artery occlusion⁸. Jean-Marc Bugnicourt et al., reported that there is link between the presence of incomplete posterior circle of Willis and migraine, suggesting that this abnormality may contribute to migraine development⁹. Eric S Sussman et al., reported that absence of the posterior communicating arteries can result in cognitive dysfunction after carotid endarterectomy with in 24hours¹⁰.

In occlusive vascular disease of the brain collateral circulation becomes important. Collateral circulation will be more effective in the presence of a complete circle of Willis than in the one in which deficiency is present. For effective collateral circulation through circle of Willis, presence of posterior communicating arteries and anterior communicating artery is very important. If one of these arteries is absent, then collateral circulation through the circle may be impaired. As it confirms high percentage of variations in the formation of circle of Willis, all surgical procedures should be done after confirming by angiography.

References

- [1] S. A. Gunnal, M. S. Farooqui, and R. N.Wabale. Anatomical Variations of the Circulus Arteriosus in Cadaveric Human Brains. Neurology Research International Volume 2014, Article ID 687281, 16 pages.
- [2] Crossman AR. Vascular supply of the brain. In Standring S, Gray's Anatomy: The Anatomical Basis of Clinical Practice. 40th international edition. Edinburg: Elsevier Churchill Livingstone; 2008. P. 247- 252.
- [3] Kapoor K, Singh B, Dewan LI. Variations in the configuration of the circle of Willis. Anat Sci Int. 2008; 83: 96–106.
- [4] Ardakani SK, Dadmehr M, Nejat F, Ansari S, Eftekhari B, Tajik P, El Khashab M, Yazdani S, Ghodsi M, Mahjoub F, Monajemzadeh M, Nazparvar B, Abdi-Rad A. The cerebral arterial circle (circulus arteriosus cerebri): an anatomical study in fetus and infant samples. Pediatr Neurosurg. 2008; 44: 388–392.
- [5] Augenijus V, Egidijus B, Aleksandras V, Jurgita R, Renata M. Vertebral artery Hypoplasia: Importance for stroke development, the role of the posterior communicating artery, possibility for surgical and conservative treatment. Acta medica Lituanica. 2003. T. 10, Nr. 2.

- [6] A S Szarazova, Eva Bartels, Peter Turcani. Vertebral artery hypoplasia and the
- [7] posterior circulation stroke. Perspectives in Medicine. 2012; vol 1, 198-202.
- [8] Klotzsch C, Popescu O, Berlitz P. Assessment of the posterior communicating artery by transcranial color-coded duplex sonography. *Stroke*. 1996;27(3):486-9.
- [9] Schomer DF, Marks MP, Steinberg GK, Johnstone IM, Boothroyd DB, Ross MR, Pelc NJ, Enzmann DR. The anatomy of the posterior communicating artery as a risk factor for ischemic cerebral infarction. *N Engl J Med*. 1994 2;330(22):1565-70.
- [10] Jean-Marc Bugnicourt, Pierre-Yves Garcia, Johann Peltier, Bruno Bonnaire, Candice Picard, Olivier Godefroy. Incomplete Posterior Circle of Willis: A Risk Factor for Migraine? Headache; 2009 American Headache Society.
- [11] Eric S Sussman, Christopher P Kellner, Joanna L Mergeche, Samuel S Bruce, Michael M McDowell, Eric J Heyer, E Sander Connolly. Radiographic absence of the posterior communicating arteries and the prediction of cognitive dysfunction after carotid endarterectomy. *J Neurosurg* 2014;121(3):593-8.

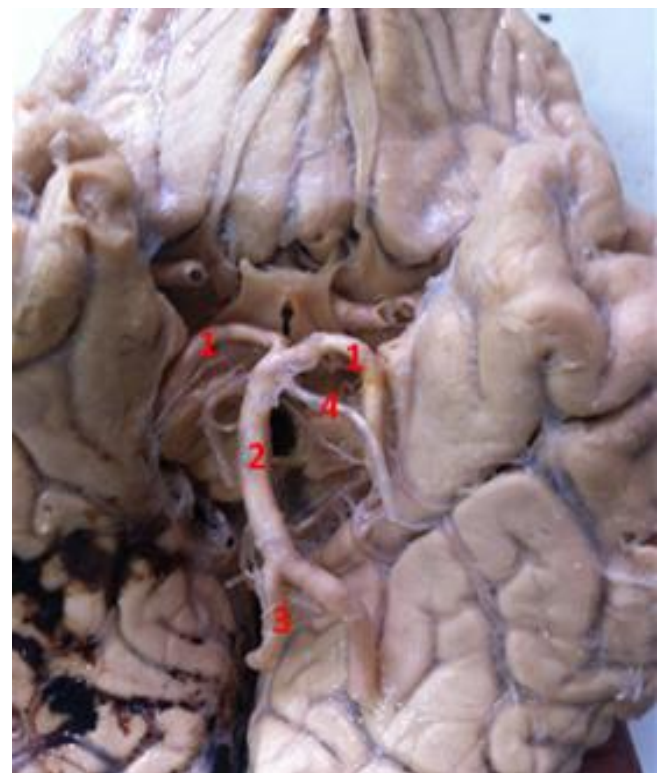


Figure 1: 1-Right and left posterior cerebral arteries, 2-Basilar artery, 3-right vertebral artery.



Figure 2: 1-Anterior communicating artery, 2-anterior cerebral artery, 3-middle cerebral artery.

