

## A Rare Anomaly in Circle of Willis

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### ABSTRACT

Anomalies in circle of Willis are very common and complete functioning ring as classically described is found only in 85 % of population. Most anomalies however are in posterior segment. We report a case of rare anomaly of anterior segment, where anterior communicating artery was completely absent and both anterior cerebral arteries arose from right internal carotid artery. Since both the frontal lobes of cerebrum are dependent upon right internal carotid artery for vascularization, with a poor communication with its left counterpart, ischemia or stroke in an event of pathological or iatrogenic compression of right internal carotid artery can occur.

**Keywords:** Anomaly, anterior cerebral artery, Circle of Willis

### INTRODUCTION

Circle of Willis (COW) is a large arterial anastomotic ring of brain that lies in the subarachnoid space within the interpeduncular cistern. It unites the internal carotid and vertebrobasilar systems & helps in collateral circulation, slows down blood before it reaches the brain and its pulsations help in drainage of CSF in interpeduncular cistern. Considerable variations in pattern & caliber of vessels of COW are reported. Complete circular channel almost always exists but the circle is rarely functionally complete. One vessel is usually sufficiently narrowed to reduce its role as a collateral route. Cerebral and communicating arteries individually may all be absent, variably hypoplastic, double or even triple<sup>1</sup>.

We report one such case of anomalous formation of Circle of Willis, which is rare in occurrence with its embryological basis and clinico-surgical significance.

### CASE REPORT

During routine dissection carried out for purpose of medical undergraduates' teaching, anomalous circle of Willis was found in an adult male cadaver. Anterior communicating artery (ACoA) was absent and right and left anterior cerebral arteries (ACA) arose from right internal carotid artery (ICA), which was slightly larger

than left ICA. Left internal carotid artery terminated as middle cerebral artery (MCA). Both ACA, however, branched in its usual pattern (fig 1 & 2). No other anomaly was found in other vessels taking part in circle of Willis, neither was any anomaly found in heart or other large vessels in the body.

### DISCUSSION & REVIEW OF LITERATURE

After Thomas Willis first described circle of Willis in 1662, numerous anatomical variations pertaining to the formation, development and size of the principal arteries have been reported<sup>2</sup>. Cranial vessel plexuses in the embryo undergo various morphological modifications with the growth of brain and related parts. The disappearance of the vessels that normally persist or the persistence of the vessels that normally disappear or formation of new vessels due to hemodynamic factors is the probable reason for the anomalies<sup>3</sup>.

Most anomalies of COW that are described in literature are pertaining to posterior cerebral and posterior communicating arteries. The ACoA is occasionally, but rarely, absent; more often it is double (7% - 9%) or even

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triple<sup>1,4</sup>. Complete absence of ACoA with both ACA arising from ICA of same side is indeed very rare, not reported even in large series of studies by Fawcett and Blachford (700 brains), Stopford (150), Windle (200), Vassil et al (112) and Poudel (35)<sup>4,8</sup> (1-5), case reports on this anomaly is also substantially scarce<sup>9</sup>.

Although congenital defects in COW are common, they are compensated for by other departures from normal; for instance, if one ACA is hypoplastic at its origin or is absent, an enlarged ACoA supplies blood to the defective one<sup>10</sup>. In the current anomaly, however, only communication between carotid arteries of two sides was through posterior communicating arteries. In an event of vascular compression of right carotid artery, pathological or iatrogenic (aortic aneurysm or dissection surgeries), functional compromise and hence irreversible damage to neural tissue to its large territory of brain seems more likely<sup>8</sup>.

This kind of anomaly, though very rare in occurrence has a significant clinical importance and should be ruled out during preoperative preparations of patients undergoing surgery of major vessels of upper limb, head and neck or aorta and its large branches as well as before any surgical intervention of vessels involving COW. Predisposition of individuals with such anomaly to cerebral ischemia or stroke, though theoretically very probable, needs an extensive epidemiological study to comment upon.

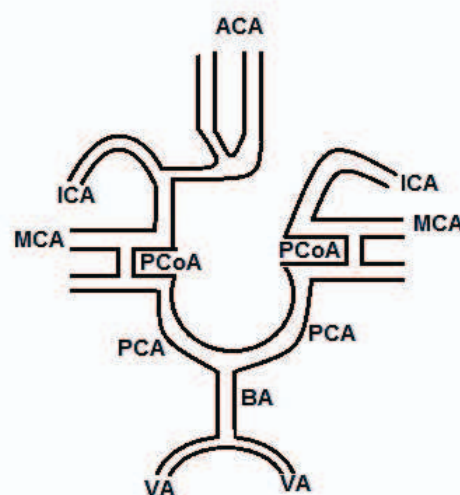
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**Figure 1: Base of brain showing aberrant circle of Willis, pointer at branch of right internal carotid artery giving rise to anterior cerebral arteries of both sides**



**Figure 2: Absent ACoA, both ACA arising from right ICA**

**ICA: Internal cerebral artery, MCA: middle cerebral artery, PCoA: posterior communicating artery, PCA: posterior cerebral artery, BA: Basilar artery, VA: vertebral artery, ACoA: anterior communicating Art & ACA: anterior cerebral artery**