

Original article:

Study of Variations of Posterior Cerebral Circulation and its Clinical structural Relevance : Cadaveric study

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Abstract

Introduction: Cerebrovascular diseases such as stroke, aneurysms and arterio-venous malformations are very much prevalent in our country. Circle of Willis, as an anastomotic polygon at the base of the brain forms an important collateral network to maintain adequate cerebral perfusion.

Material and methods: The present work was carried out in the department of anatomy for one year duration. It included 30 human brain dissection with 15 as males and 15 as females) irrespective of the cause of death. Brains were obtained from cadavers donated to the Dissection hall of the Department of Anatomy and we collected observational information during routine dissection of medical students in standard form. Circle of Willis and its branches were completely cleared and exposed. Their formative pattern was observed.

Results : Out of the 30 specimens examined, 20 circles showed bilateral Adult type PCA in which Rt and Lt PCA were of normal measurement and diameter of PCA was more than PCoA. Similarly 2 circles showed bilateral Foetal type PCA in which PCoA arteries of right and left side were normal but diameter of PCoA was more than PCA. 15 circles showed bilateral Transitional type PCA in which diameter of PCA and PCoA were equal. Only one specimen showed adult plus transitional type PCA, Right side showed transitional Type PCA and left side showed Adult type PCA.

Conclusion: These variations can cause complications if thrombotic material present in atherosclerotic plaques of ICA gets dislodged into PCA through a PCoA which has a larger diameter.

Introduction:

Cerebrovascular diseases such as stroke, aneurysms and arterio-venous malformations are very much prevalent in our country. Circle of Willis, as an anastomotic polygon at the base of the brain forms an important collateral network to maintain adequate cerebral perfusion. Changes in the normal morphology of the circle may condition the appearance and severity of symptoms of cerebrovascular disorders, such as aneurysms, infarctions and other vascular anomalies. A possible link between abnormalities of the circle of Willis and the mentally ill patients has been observed. Brain is a highly vascular organ and obtains 15% blood supply. The Circle of Willis plays a chief role in sustaining a steady blood flow to the cerebrum. The continuance of a steady blood flow through the Circle of Willis is important to curtail the occurrences of cerebral infarcts and also to preserve perfusion during cardiac surgeries with extracorporeal circulation [1]. The Circle of Willis acts as a closed space in which fluid starts its circulation from one entry point and returns to it. The different branches of the Circle of Willis act as end arteries once they

enter the cerebral hemisphere, and no additional anastomosis is possible. Thus collateral circulation is completely dependent on the calibre of the branches of the Circle of Willis [2].

The posterior cerebral arteries are paired vessels that usually originate from the basilar artery at the level of the pontomesencephalic fissure and are joined by the posterior communicating artery to close the posterior portion of the Circle of Willis (circulus arteriosus cerebri). There is a considerable variation in the presence of the arterial segments of the circle of Willis.

With this view present work was planned to study Variations of Posterior Cerebral Circulation and its Clinical structural Relevance .

Material and methods:

The present work was carried out in the department of anatomy for one year duration. It included 30 human brain dissection with 15 as males and 15 as females) irrespective of the cause of death. Sample size was estimated on the basis of previous published data and with the help of expert statistician .

Brains were obtained from cadavers donated to the Dissection hall of the Department of Anatomy and we collected observational information during routine dissection of medical students in standard form. Circle of Willis and its branches were completely cleared and exposed. Their formative pattern was observed. The external diameters of posterior cerebral and posterior communicating artery were seen with vernier calipers at 2 different points .

Data obtained and were systematically tabulated.

Results:

The least common anomaly of the circle of Willis was the absence of one or other posterior communicating arteries. Complete absence of a posterior communicating artery on one side was found in three circles .

Out of the 30 specimens examined, 20 circles showed bilateral Adult type PCA in which Rt and Lt PCA were of normal measurement and diameter of PCA was more than PCoA. Similarly 2 circles showed bilateral Foetal type PCA in which PCoA arteries of right and left side were normal but diameter of PCoA was more than PCA. 15 circles showed bilateral Transitional type PCA in which diameter of PCA and PCoA were equal. Only one specimen showed adult plus transitional type PCA, Right side showed transitional Type PCA and left side showed Adult type PCA.

Discussion:

The cerebral blood flow is divided into an anterior circulation and a posterior circulation connected to each other in the form of a circle called Circle of Willis (CW). It is formed by the unification of the internal carotid (ICA) and vertebrobasilar systems Posteriorly, the basilar artery, formed by the left and right vertebral arteries, branches into a left and right posterior cerebral artery (PCA), forming the posterior circulation. The internal carotid system lies anteriorly and is joined to the posterior circulation by posterior communicating (PCoA) arteries. The internal carotid artery divides into anterior and middle cerebral artery. The two anterior cerebral arteries are joined to each other by an anterior communicating artery. The posterior cerebral artery before it joins the posterior communicating artery that means its proximal part is named as the pre communicating part (P1) and the distal part as the post communicating part (P2). In the adult P1 has a diameter larger than the PCoA so that the occipital lobe gets its blood supply mainly via the vertebrobasilar system whereas in the fetus the diameter of the ipsilateral precommunicating

(P1) segment of PCA is less than the diameter of PCoA, so that the blood supply to [3] the occipital lobe is mainly via the internal carotid arteries. In some persons, there is a transitional configuration in which the PCoA is equal in diameter to the P1 segment of the PCA.

Krabbe-Hartkamp [4] and Jain [5] have reported fetal type of PCA in 32% and 16.66% of their specimens respectively. An anatomic variant of the PCA, known as fetal type or fetal PCA (FPCA), has been identified by anatomic and angiographic studies in 11% to 46% of adult humans [4], fetal configuration of PCA was seen in 10% in the present study. In complete fetal-type PCA, the prospect of a collateral circulation developing between anterior and posterior cerebral circulation is impossible as PCA flow is totally dependent on the ICA and this can be responsible for a stroke. The incidence of the adult configuration was highest in the present study as compared to other studies [5]

Conclusion:

These variations can cause complications if thrombotic material present in atherosclerotic plaques of ICA gets dislodged into PCA through a PCoA which has a larger diameter.



Fig. Cadaveric dissection showing pattern of Posterior cerebral artery

References:

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