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Anatomy

A CADAVERIC STUDY ON ANATOMICAL VARIATIONS IN POSTERIOR COMMUNICATING ARTERY

Dr.Soumya Haridas* Assistant Professor ,Department Of Anatomy, Government Medical College, Kozhikode. *Corresponding Author

Dr.Girijamony V K Former Professor and HOD ,Department of Anatomy, Government Medical col-lege, Kozhikode.

ABSTRACT

INTRODUCTION: The posterior communicating artery is the main anastomotic channel of circle of willis.It joins internal carotid artery and vertebra-basilar arterial system. The size of posterior communicating artery varies frequently.The hypoplasia or aplasia of posterior communicating artery can detrmine the prognosis of neurological diseases.

AIM: To study the variations and caliber of posterior communicating artery

MATERIALS AND METHODS: A total of 104 specimens were collected,cleaned ,dissected and fixed in formalin.Anatomical variations and caliber of posterior communicating artery were carefully recorded and photographed.

RESULTS: In the present study,the hypoplasia of posterior communicating artery was one of the frequent variations which were observed in 16.7% of the subjects followed by aplasia in 15.5% and duplication in 1% .

CONCLUSION: Awareness of these variations is important in diagnosis of neurological disorders and in neurovascular surgeries.

KEYWORDS : Posterior communicating artery, circle of willis, hypoplasia

INTRODUCTION

Circle of Willis is a large arterial anastomosis which is found at the base of brain. It unites internal carotid and vertebra-basilar systems. It lies in the subarachnoid space within the interpeduncular cistern, and surrounds the optic chiasma and infundibulum. Anteriorly, the anterior cerebral arteries, derived from the internal carotid arteries are linked by the small anterior communicating artery. Posteriorly, the two posterior cerebral arteries, formed by the division of basilar artery are joined to ipsilateral internal carotid artery by a posterior communicating artery[1]. The brain is supplied by the internal carotid arteries and also by the posterior cerebral arteries ;the posterior communicating arteries connects the two systems. This provides collaterals in the cerebral circulation so that ,if one system is blocked or narrowed, the other system can take over. Aneurysms of the posterior communicating artery are the third most common circle of willis aneurysm[2]and can lead to oculomotor nerve palsy[3].

Aims And Objectives

1. To study the variations in posterior communicating artery
2. To study the length and external diameter of posterior communicating artery

Materials And Methods

This study was performed on 21 embalmed human cadavers from department of anatomy and 83 autopsy cases of age 18 years and above from Department of Forensic Medicine, Government Medical College ,Thrissur after the approval of ethical committee. In the case of cadavers after the removal of calvaria the brain was removed in one piece. In the case of autopsy specimens, after the removal of brain in one piece, a part of the base of brain was cut to expose the arterial circle clearly and it was fixed in 10% formalin.

The specimens thus obtained were cleaned. The arachnoid matter was removed from the arteries and the areas around it to facilitate maximum exposure. The circle of Willis was dissected out carefully. The external diameters and length were measured using a vernier calliper. Variations in length, diameter, absence and branching pattern of posterior communicating artery were noted. Photographs were taken to document the variations. The results obtained were then tabulated.

RESULTS:

In the present study, in all specimens, the origin of posterior communicating artery is from internal carotid artery. Out of 104 specimens,64.4% of cases showed symmetrical posterior communicating artery.

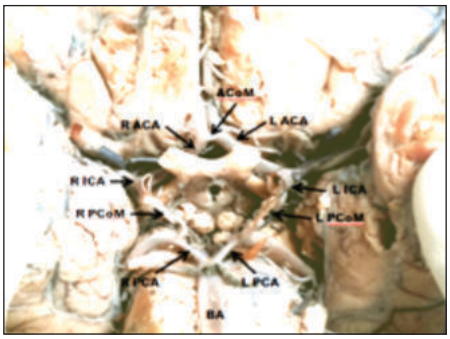

Fig 1:normal Pattern Of Circle Of Willis

[ACoM-anterior communicating artery,R ACA-right anterior cerebral artery,R ICA-right internal carotid artery,R PCoM-right posterior communicating artery,R PCA-right posterior cerebral artery,L PCA-left posterior cerebral artery,L PCoM-left posterior communicating artery,L ICA-left internal carotid artery,L ACA-left anterior cerebral artery,BA-basilar artery]

The average diameters of right and left posterior communicating arteries were 1.5mm and 1.3mm respectively. The length of right and left posterior communicating arteries were 0.96+/-0.42 cm and 1+/-0.46 cm.

The variations in posterior communicating artery were seen in 33 cases (31.7%) among the 104 specimens studied. The variations observed were grouped as:

Hypoplasia Of Posterior Communicating Artery

The communicating arteries of less than 0.5mm in diameter were considered to be hypoplastic by various authors[(4)].This definition was accepted in the present study.Hypoplastic posterior communicating artery was seen in 17 cases.

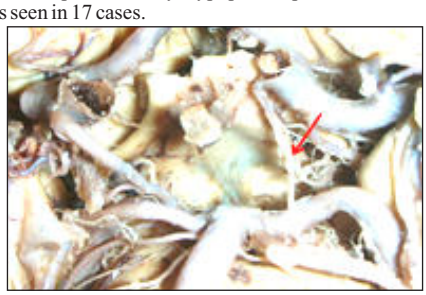

Fig 2: Hypoplastic Posterior Communicating Artery

Aplasia Of Posterior Communicating Artery

Among 104 specimens studied ,complete absence of posteri-or communicating artery was seen in 15 cases

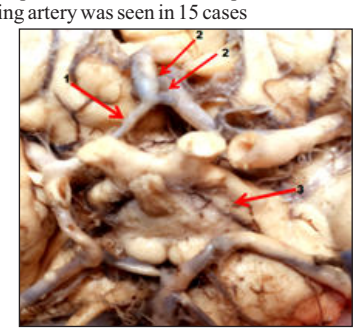

FIG 3:1. Hypoplastic A1 segment of right anterior cerebral artery2. Double anterior communicating artery3.Absent left posterior communicating artery

Duplication Of Posterior Communicating Artery

Double posterior communicating artery is seen in only 1 specimen

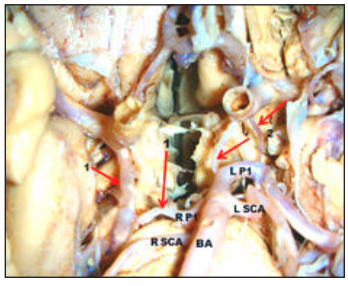

FIG 4: 1. Fetal remnant of right posterior communicating artery2. Hypo-plastic p1 segment of right posterior cerebral artery3. Double left posterior communicating artery

DISCUSSION

The circle of willis and its branches are subjected to numerous morphological variations which have been universally accepted. The posterior communicating artery is the main communicating channel of the circle of willis. It joins internal carotid artery and vertebro-basilar arterial system. In most of the variations, the brain function may not be affected due to collateral circulation and compensation of other arteries from other side.

In the present study, the average length of right and left posterior communicating arteries are 9.6+/-0.42mm and10+/-0.46 mm respectively. Bismia KK[5] has reported the average length as 10mm,Gibo et al[(6)]12mm.The present study is almost similar to the findings of Bismia KK[5] and Gibo et al[6].The average diameter of right and left posterior communicating arteries are 1.5mm and 1.3 mm respectively. Kammath S[4] as reported the diameter of posterior communicating artery as1.45mm,Gibo et al[6] as 1.4 mm. The present study is almost coincides with the findings of Kammath S [4] and Gibo et al[6].

In the present study, hypoplasia of posterior communicating artery was one of the frequent variations which were observed in 16.3% of the subjects. The communicating arteries of less than 0.5mm in diameter were considered to be hypoplastic by various authors[4].This definition was accepted in the present study.

The percentage of hypoplasia reported by various authors are:

Table 1: Comparison of percentage of hypoplasia PCom reported by various authors

Authors	Hypoplasia(%)
Iqbal S [7]	10
Kammath S[4]	10
Jain et al[8]	18
Macchi et al[9]	21
Schomer[10]	21
Present study	16.3

Thus the findings of the present study are almost similar to that of Jain et al[8] and Macchi et al[9].

The absence of posterior communicating artery was the next to be observed which was14.4%.The incidence of aplasia of posterior communicating artery by various researchers is:

Table 2:Comparison of percentage of aplasia of PCom by various authors

Authors	Aplasia(%)
Jain et al[8]	13.88
Raghavendra et al[11]	18.2
Al-Hussain et al[12]	13
Vare et al[13]	10.2
Present study	14.4

Thus the findings of the present study is almost similar to that of findings observed by Jain et al[8] and Al-Hussain et al[12].

A double posterior communicating artery on left side was noted in one case. Yasargil M G[14] reported the duplication of posterior communicating artery in 0.25% cases and Trandafilovic et al[15] reported 3.12% cases. The total duplication of posterior communicating artery was described as two distinct arteries from separate origin and without a distal arterial convergence[16].

In fig no 4,two posterior communicating arteries arise directly from internal carotid artery. The proximal one joins the basilar artery and the distal one joins the P1 segment of posterior cerebral artery. In the same figure, it was also observed that the basilar artery continues as left posterior cerebral artery and right posterior cerebral artery appears to originate from a point just below the left posterior cerebral artery. The diameter of right posterior communicating artery is larger than the right P1 segment of the posterior cerebral artery which represents the fetal remnant of the posterior communicating artery. In this case blood supply to the occipital lobe is mainly from the internal carotid artery via the posterior communicating artery.

The internal carotid artery gives first branch to eye vesicle after reaching forebrain and then divides into anterior cerebral artery, middle cerebral artery and a third branch which goes towards occipital pole representing the initial posterior cerebral artery. Afterwards during the development of brain basilar artery divides into two, the definitive posterior cerebral artery which join with the primitive posterior cerebral artery (third branch of internal carotid artery). Due to gradual increase in size of definitive posterior cerebral artery, there will be narrowing of initial posterior cerebral artery which later represents as posterior communicating artery[17]. Complete or incomplete disappearance of the initial posterior cerebral artery might result in an aplastic or hypoplastic posterior communicating artery.

CONCLUSION

In the present study, hypoplasia of posterior communicating artery is frequently observed variations while duplication is the least observed variation. The study also provides a detailed description on the morphology and morphometry of posterior communicating artery. Knowledge about these variations plays an important role in diagnosing various neurological diseases and in neurovascular surgeries.

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