

ANATOMICAL VARIATIONS IN ANTERIOR COMMUNICATING ARTERY-A
CADAVERIC STUDY

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ABSTRACT The circle of willis plays an important role in cerebral hemodynamics as a collateral anastomotic channel. There is considerable individual variations in the pattern and caliber of the vessels that make up the circle of willis. A knowledge of normal size of these vessels may also be of use to surgeons in assessing the feasibility of shunt operations and in the choice of the patients. In present study, variations in anterior communicating artery were noted. **AIM** To study the variations and calibre of anterior communicating artery **MATERIALS AND METHODS** A total of 104 specimens were collected, cleaned, dissected and fixed in formalin. Anatomical variations and caliber of anterior communicating artery were carefully recorded and photographed. **RESULTS** In the present study, the absence of anterior communicating artery was one of the frequent variations which were observed in 5.7% of the subjects followed by hypoplasia and duplication in about 3.8%. **CONCLUSION** The knowledge of the presence and clinical relevance of normal anatomic variants plays an important role in performing safe interventional, radiological and neurological procedures.

KEYWORDS : Anterior communicating artery, Circle of willis, Hypoplasia

INTRODUCTION

Circle of Willis, also referred to as Circulus Arteriosus Cerebri 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 artery¹. In case of narrowing of other arteries in circle of willis, anterior communicating artery can provide a way to supply blood to the opposite side of the circle. This can often preserve the cerebral blood supply well enough to avoid the symptoms of ischemia². Aneurysms of anterior communicating artery are most common³ and can cause visual field defects such as bitemporal hemianopsia (due to compression of optic chiasma)⁴, psychopathology and frontal lobe pathology⁵.

AIMS AND OBJECTIVES

1. To study the variations in the anatomy of circle of Willis
2. To measure the external diameters and length of anterior 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 Thirissur 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 anterior communicating artery were noted.

Photographs were taken to document the variations. The results obtained were then tabulated.

RESULTS

In the present study, the average diameter of anterior communicating artery is 1.4+/-0.5 mm. The length of anterior communicating artery shows a wide range with greatest length of about 5.4mm and smallest of about 0.8mm with a range of 2.4mm.

The variations in anterior communicating artery were seen in 14 cases

(13.4%) among the 104 specimens studied. The variations observed were grouped as:

APLASIA OF ANTERIOR COMMUNICATING ARTERY

Among 104 specimens, the complete absence of anterior communicating artery was seen in 6 specimens (fig:1). In fig:2, right and left anterior cerebral arteries join together to form a single trunk. Thus, there is absence of anterior communicating artery.

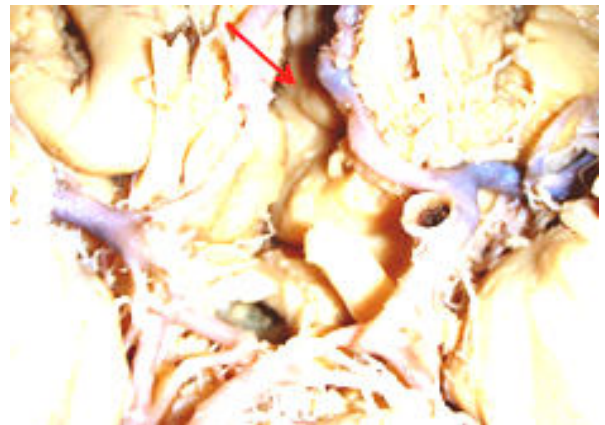


FIG.1: Absent anterior communicating artery



FIG 2: 1.Fusion of right and left anterior cerebral arteries and absent anterior communicating artery 2.Fenestration of A1 segment of left anterior cerebral artery 3.Dilated right posterior communicating artery

HYPOPLASIA OF ANTERIOR COMMUNICATING ARTERY

The communicating arteries of less than 0.5 mm in diameter were considered to be hypoplastic by various authors⁶. This definition was accepted in the present study. Hypoplastic anterior communicating artery was seen in 4 specimens.

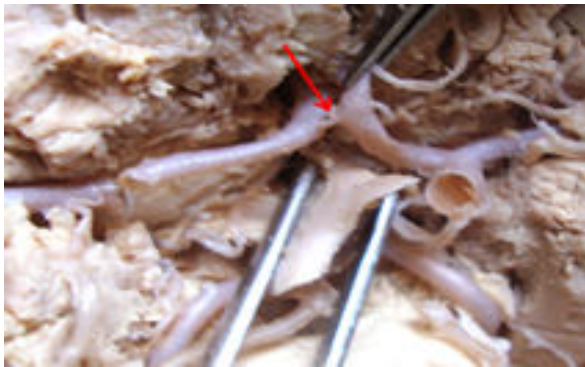


FIG.3:Hypoplastic anterior communicating artery

DUPLICATION OF ANTERIOR COMMUNICATING ARTERY

Double anterior communicating artery was seen in 4 specimens



FIG.3:Double anterior communicating artery

DISCUSSION

The circle of Willis and its branches are subjected to numerous morphological variations which have been universally accepted. The anterior communicating artery is the artery which completes circle of willis anteriorly, by connecting the two internal carotid arterial system. In most of the variations the brain function may not be affected due to the collateral circulation and compensation of other arteries from the other side.

In the present study, the average diameter of anterior communicating artery is 1.4+/- 0.5 mm. Iqbal S⁶ has reported the diameter of anterior communicating artery as 1.4mm, Perlmutter et al⁷ 1.5mm, Gunnal et al⁸ 1.7mm and Kamath S⁹ 1.9mm. The present study is almost similar to the findings of Iqbal S⁶ and Perlmutter et al⁷.

The average of the length of anterior communicating artery in the present study is 2.4 mm (range being 0.8-5.7). Kamath S⁹ has reported the length of anterior communicating artery as 2.5 mm, Iqbal S⁶ a 2.4mm and Perlmutter et al⁷ 2.6mm. The present study is almost coincides well with that of Iqbal S⁶ and Kamath S⁹.

In the present study, the absence of anterior communicating artery was one of the frequent variations which were observed in 5.7% of the subjects. In figure no:2, the A1 segments of anterior cerebral arteries of both sides were fused with absence of anterior communicating artery. Gunnal et al⁸ reported an incidence of aplastic anterior communicating artery in 8% cases and Kardile et al¹⁰ also reported 8% cases of aplasia. While Fawcett et al¹¹, Blackburn¹², Vare et al¹³, Eftikar et al¹⁴, Kapoor et al¹⁵ and Alawad et al¹⁶ have found the incidence of absent anterior communicating artery ranging from 0.14% to 2.1%.

Apart from aplasia, hypoplasia and duplication of anterior communicating artery were also observed each in 3.8% cases. The incidence of hypoplasia reported by various authors is as follows:

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

Authors	Hypoplasia(%)
Alpers et al ¹⁷	3
Iqbal S ⁶	4
Kamath S ⁹	2
Puchades-Orts et al ¹⁸	6.4
Gunnal et al ⁸	10
DeSilva ¹⁹	14
Present study	3.8

Thus the findings of present study are almost similar to the findings observed by Alpers et al¹⁷, Iqbal S⁶ and Kamath S⁹ with respect to hypoplasia of anterior communicating artery.

Duplication of anterior communicating artery was also found in 3.8% cases in present study. The incidence of double anterior communicating artery reported by various researchers is:

Table 2: Comparison of percentage of duplication of ACoM reported by various authors

Authors	Duplication (%)
Fawcett et al ¹¹	7.28
Raghavendra et al ²⁰	4.5
Vare et al ¹³	2.85
Blackburn ¹²	6.36
Jain et al ²¹	5.5
Gunnal et al ⁸	10
Perlmutter et al ⁷	30
Gomes et al ²²	43.3
Present study	3.8

There is a wide range of percentage of double anterior communicating artery between various workers. The reason may be due to the racial differences among different population.

The anterior communicating artery first appears in human embryos as a reticulated anastomosis between the two anterior cerebral arteries and later fuses to form a single trunk. During the fetal period this artery acquires greatest proportions, equal to those of anterior cerebrals. The growth achieved during the fetal periods of development explains the less incidence of its absence. On the other hand, it is far more frequent to find this vessel to be either dilated or equal in size to the anterior cerebral or plexiform or partially or completely duplicated or triplicated⁶.

CONCLUSION

The present study is conducted to document the incidence of variations in the anatomy of anterior communicating artery and to find out the external diameter and length of anterior communicating artery. The study was carried out on a sample size of 104 adult brain specimens. Each brain was removed in one piece by dissection and the circle of Willis were observed.

Out of 104 specimens studied, variations in anterior communicating artery were seen in 14 cases (13.4%). The absence of anterior communicating artery was one of the frequent variations observed in 5.7% of subjects followed by hypoplasia and duplication of anterior communicating artery each of which were observed in 3.8% cases. The knowledge of the presence and clinical relevance of normal anatomic variants plays an important role in performing safe interventional, radiological and neurological procedures.

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