

ANTERIOR COMMUNICATING ARTERY: A CADAVERIC STUDY

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ABSTRACT

Background: Anterior communicating artery, a short trunk connecting the anterior cerebral arteries is important in stabilizing blood flow by acting as collateral channel. The present study was conducted to note the variations in anterior communicating artery which may be one of the reason for formation of aneurysm.

Materials and Methods: Anterior communicating artery was observed for its number, course, length and variations in 50 adult embalmed cadaveric brains after injecting with latex solution.

Results: Duplication of anterior communicating artery was found in 4 specimens (8%) and it was absent in 2%. The course of ACoA was oblique in 54.2% and transverse in 45.8%. The length of ACoA was on an average of 2.82mm. The mean diameter of ACoA was 1.12mm. Fenestration of ACoA was seen in 4%. Median artery of corpus callosum was found in 1 specimen.

Conclusion: Congenital anomalies of the intracranial arteries predispose to the formation of aneurysms due to an increased haemodynamic stress. Knowing the length, course and diameter of ACoA is important as it may guide radiologists in interpretation and neurosurgeons in microsurgical procedures.

KEY WORDS: Anterior communicating artery, Aneurysm, Duplication, Fenestration.

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INTRODUCTION

Variations are inherent part of human anatomy. Interesting variations in the origin and course of arteries have long received the attention of anatomists and surgeons. Anterior communicating artery which is an important artery of circle of Willis connects the two anterior cerebral

arteries across the commencement of the longitudinal fissure.

The anterior communicating artery is significant as it gives off numerous anteromedial central branches along with anterior cerebral arteries and supply the optic chiasma, lamina terminalis, hypothalamus, para-olfactory areas, anterior

columns of the fornix and the cingulate gyrus [1]. Hence the study of the vascular anatomy of anterior communicating artery gains much importance.

Aneurysms of the anterior communicating artery are the most common circle of Willis aneurysm[1]. Aneurysm arising from anterior communicating artery produce visual field defects, endocrine dysfunction and localized frontal headache[2].

Variations of anterior communicating artery like number, diameter or course become a matter of great concern to radiologists and neurosurgeons.

MATERIALS AND METHODS

The study was conducted in 50 adult embalmed human cadaveric brains in the Institute of Anatomy, Madras Medical College, Chennai. After removing the brain following routine dissection method, latex solution was injected into the internal carotid artery to clearly visualize the arteries. Anterior communicating artery was observed for its number, course, diameter, length and for any variations like fenestrations. Measurements were taken with digital Vernier caliper and photographed.

RESULTS

On observing the anterior communicating artery, duplication was found in 4 specimens (8%) [Fig.1] and was absent in 2%. Median artery of corpus callosum was found in one specimen (2%)[Fig.2]. The course of ACoA was oblique in 54.2% and transverse in 45.8%. The length of ACoA was on an average of 2.82mm with a range of 1mm to 6mm. The mean diameter of ACoA was 1.12mm with the range of 0.74mm to 2.1mm. Fenestration of ACoA was seen in 4% [Fig.3].

Fig. 1: Duplicated ACoA.

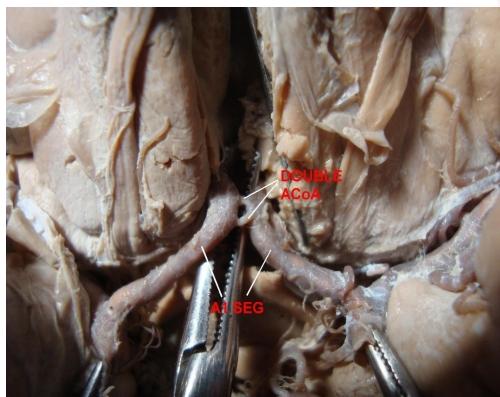


Fig. 2: Median artery of corpus callosum.

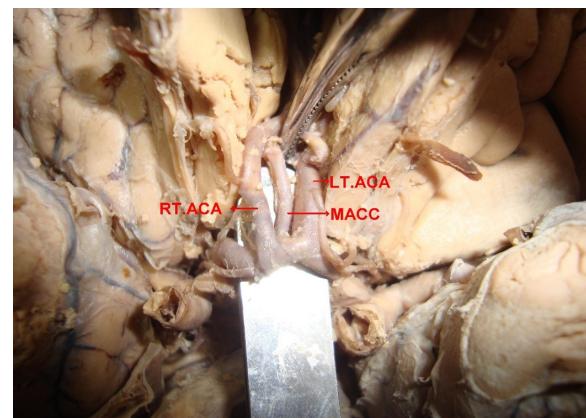
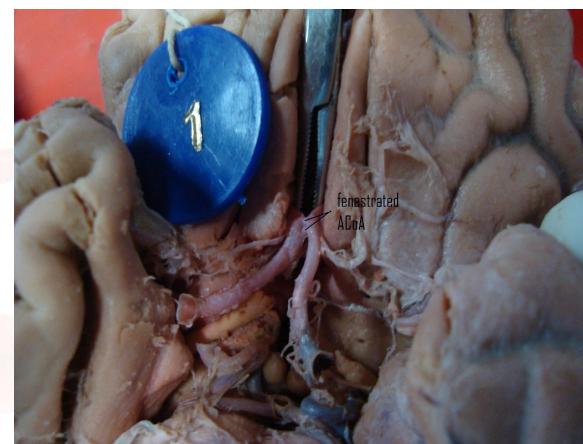


Fig. 3: Fenestrated ACoA.



DISCUSSION

Congenital anomalies of the intracranial arteries predispose to the formation of saccular aneurysms due to an increased haemodynamic stress. Anterior communicating artery aneurysms were the most complex aneurysms of the anterior circulation due to the angio architecture and flow dynamics of the ACoA region, frequent anatomical variations, deep interhemispheric location, and danger of severing the perforators with ensuing neurologic deficits [3]. Anterior communicating artery aneurysm is the most common form of intracranial aneurysm, accounting for 25-38% of total cerebral aneurysm cases[4]. Multiple aneurysms of ACoA though rare has also been reported[5].

Patients with ruptured aneurysms of the anterior communicating artery are associated with damage to deep, medial frontal areas such as septal nuclei and present with amnestic syndrome[2].

The haemodynamics of the circle is influenced by variations in the caliber of communicating

arteries of circulus arteriosus. Although a complete circular channel almost always exists, one vessel is usually sufficiently narrowed to reduce its role as a collateral route and the circle is rarely functionally complete. Cerebral and communicating arteries individually may all be absent, variably hypoplastic, double or even triple[1].

A basic understanding of the embryologic development of the ACoA region allows us to anticipate its most common congenital anomalies. By 40 days (16 to 18 mm stage), the stem of the ACA elongates medially towards its counterpart. At this stage, a midline cluster of plexiform anastomoses begins to form between the adjacent and elongating ACAs. At 44 days (20 to 24 mm stage), the channels of the midline cluster of plexiform anastomoses coalesce and form one or more ACoAs. The coalescing channels of the midline cluster of plexiform anastomoses give rise to a median ACA that originates from the ACoA[6].

Hence the ACoA may be single, double, fenestrated or plexiform. Anterior communicating artery is more often double in 7 to 9 percent or even triple, and can be absent when there was fusion between the two anterior cerebrals[7]. In 21.4% patients with aneurysms of the anterior communicating artery, vascular anomalies in the vicinity of the ACoA were reported[8]. Duplication of ACoA can have incidence upto 14%[9]. Triple ACoA was also reported[10].

Fenestration has been found to be the most common ACoA variation raising concern as this has been shown to compromise collateral flow and predispose to aneurysm formation[9]. Fenestration of the ACOA was reported in 12 out of 227 on 3D rotational angiography, 10 (83%) were associated with 1 or more aneurysms of the ACoA[11]. Plexiform ACoA was reported in 0.4%[12]. Double fenestration of the anterior communicating artery (ACoA) complex associated with an aneurysm was also reported[13]. Knowing the length, course and diameter of ACoA is important as it may guide radiologists in interpretation and neurosurgeons while doing microsurgery. The length of ACoA is usually between 2 and 3mm but may vary from 0.3 to 7mm[14]. The diameter of ACoA was 1.5mm (range 0.2mm to 3.4mm), specified by Richard

Winn[15].

ACoA may not be oriented in a strictly transverse plane. It can be oriented in an oblique or antero-posterior plane, if one ACA passes between the hemispheres behind the other, as occurs in 80% of brains. It may be curved, kinked or tortuous rather than straight[14].

Female subjects have a higher incidence of variations in the anterior communicating artery complex. Neurosurgeons should be more alert while operating females, as they have a higher frequency of anatomical abnormalities in the ACoA complex[16].

CONCLUSION

Neurosurgeons treating aneurysms should anticipate variations and this comprehensive study of the course, length, diameter, and variations of anterior communicating artery will prove to be useful to the neurosurgeons who plan for endovascular surgeries, anastomosing surgeries and also for radiologists interpreting various imaging of anterior communicating artery.

ABBREVIATIONS

ACoA – Anterior communicating artery
ACA – Anterior cerebral artery

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Conflicts of Interests: None

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