Variations in Anterior Circulation of Human Brain: A Cadaveric Study

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Abstract:
Preamble: Variations in Anterior Circulation of the brain assume importance in Neuro- Surgical Interventions, particularly related to Aneurysms and Craniotomies.
Aims: Our aim was to attempt a study of such variations of Anterior Circulation of Brain.
Material and Methods: 28 brains (56 cerebral hemispheres), obtained from human cadavers at Department of Anatomy, Subharti Medical College, Meerut, India, were dissected as per protocol.
Results: In each cerebral hemisphere, the Anterior Cerebral Artery was found to originate normally, from Internal Carotid Artery, and was present as a single trunk, giving off its branches. No variations were found with reference to Anterior Communicating Artery and Recurrent Artery of Heubner.
Keywords: Anterior Cerbral Artery (ACA), Anterior Communicating Artery (AcoA), Recurrent Artery of Heubner (RAH), Internal Carotid Artery (ICA).

Introduction
Anterior Cerebral Artery (ACA) is one of the important terminal branches of Internal Carotid Artery (ICA). It contributes to the major part of Anterior Circulation of Human Brain by completing the anterior component of Circle of Willis with the help of Anterior Communicating Artery (ACoA). Territory of supply, through its central and cortical branches, includes Orbital, Frontal and Medial hemispheric portions of the Cerebrum and runs a curved course over the Corpus Callosum upto its Splenium (Gunnal et al.)1. Variations in Anterior Circulation of the Brain assume importance in Neuro-Surgical Interventions, particularly related to Aneurysms and Craniotomies.(Kedia et al., 2013)2. Hence the present descriptive study was undertaken.

Aim : The aim of the present study was to describethe variations in Anterior Circulation of Human Cadaveric Brain.

Materials and Methods
Formalin fixed Brains from twenty eight (28) Cadavers, used for routine dissections of Under graduate classes, at Department of Anatomy, Subharti Medical College, Meerut, were selected randomly for this study. The Anterior Cerebral Artery and its branches were dissected according to Cunningham’s Manual of Anatomy, Vol.33.

Observations
The Anterior Cerebral Artery started at the medial end of the lateral cerebral sulcus, as the smaller terminal branch of the Internal Carotid Artery, the larger one being Middle Cerbral Artery. Before exposing the medial surface of the cerebral
hemisphere, only a small part of ACA was visible running horizontally in an antero-medial direction to the longitudinal fissure. Here a short Anterior Communicating Artery located antero-superior to the Optic Chiasma, joined the ACAs of both sides. In all the 56 cerebral hemispheres studied, ACA was present singly and originated as a smaller terminal branch of the ICA, at the medial end of the lateral cerebral sulcus. The course of the arteries and its branches followed the Corpus Callosum, supplying the Orbital, Frontal and Medial Surfaces of each hemisphere. No anomalous origin or variations were detected.

Discussion
Studying the Anatomy of the Cerebral circulation was stimulated on the basis of a senior colleague in mid-thirties, of the corresponding author, developing a sudden paralysis of the right half of his body, after suffering an acute headache and a fainting episode. Investigations revealed that he had suffered an aneurysmal rupture of Anterior Circulation with resultant subarachnoid bleed. Researchers studying the Anterior Cerebral Circulation have noted different anomalies. Paul S and Mishra S, reported origin of the two Anterior Cerebral Arteries from a common stem in 0.5% cases\(^4\). Pai, Kulkarni and Verma reported absence of Anterior Communicating Artery in 10% cases with resultant anomalies\(^5\). Boongbird et al reported double Anterior Communicating Arteries in 12% cases and triple in 2% cases\(^6\). In our study, in all the 56 Cerebral Hemispheres, a single Anterior Cerebral Artery with a single Anterior Communicating Artery was present and originated as a small terminal branch from the Internal Carotid Artery, on either side.

Fig. 1. Figure showing origin of Anterior Cerebral Artery from Internal Carotid Artery

Fig. 2. Figure showing perforators of Anterior Cerebral Artery
Fig. 3. Figure showing participation of Anterior Cerebral Artery in formation of Circle of Willis.

Conclusion
The study of Anterior Cerebral Artery and Anterior Communicating Artery junction is important because of propensity for Aneurysms of this region. Different authors have used different means to study this region, particularly Radiological Imaging studies. Our study must be extended in consultation with Neuro-Surgeons and Radiologists, to have a comprehensive database of local population anomalies of this circulation. Such data will help in planning of neurosurgical interventions.

References

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