ORIGINAL RESEARCH PAPER

Radio-Diagnosis

"MRI PROFILE STUDY OF ANATOMICAL VARIATION OF ACA"

KEY WORDS: ACA-Anterior Cerebral Artery, AComA-Anterior Communicating Artery, A1 segment hypoplasia, ACA Trifurcation.

Dr. Sumit Baviskar — Associate Professor, Department of Radiodiagnosis, Dr. Vasantrao Pawar Medical College Hospital & RC.

Dr. Nirbhay Deshmukh* — JR III Radiodiagnosis, Department of Radiodiagnosis, Dr. Vasantrao Pawar Medical College Hospital & RC. *Corresponding Author

Dr. Anish Subandh — JR I Radiodiagnosis, Department of Radiodiagnosis, Dr. Vasantrao Pawar Medical College Hospital & RC.

Dr. Shweta Katkar — JR III Radiodiagnosis, Department of Radiodiagnosis, Dr. Vasantrao Pawar Medical College Hospital & RC.

ABSTRACT

The anterior cerebral artery (ACA) primarily perfuses the medial regions of the cerebral hemispheres and gives off multiple cortical branches. These include the infra-orbital artery (IfO), frontopolar artery (FpA), anterior, middle, and posterior internal frontal arteries (AIFA, MIFA, PIFA), the callosomarginal artery (CmA), the paracentral lobule artery (PLA), as well as the superior and inferior internal parietal arteries (SIPA, IIPA). Considerable variability exists in these branches, which may present as duplication, absence, or differences in vessel caliber, point of origin, or course. Such anatomical variations hold significant clinical importance, particularly for neurosurgeons dealing with aneurysm repair or arteriovenous malformation (AVM) interventions, where precise knowledge of vascular patterns is essential for minimizing complications. In this study, 50 patients with cerebrovascular symptoms—including headache, transient syncope, and hemiparesis—were evaluated to assess ACA anatomy. The most frequently encountered variation was hypoplasia or complete aplasia of the A1 segment.

INTRODUCTION

The anterior cerebral artery (ACA) arises from the termination of the internal carotid artery (ICA) and supplies blood to the medial aspects of the frontal and parietal lobes, the corpus callosum, and the falx cerebri. It curves around the corpus callosum towards the splenium and is connected to its contralateral counterpart via the anterior communicating artery (AComA).

The ACA also supplies deep brain structures, including the septum pellucidum, head of the caudate nucleus, anterior portion of the putamen, and parts of the internal capsule.

For Clinical And Radiological Purposes, The ACA Is Divided Into Five Segments:

1) **A1 (pre-communicating):** From ICA to AComA
2) **A2 (post-communicating or infracallosal):** From AComA to beneath the genu
3) **A3 (precallosal):** Around the genu of the corpus callosum
4) **A4 (supracallosal):** Along the superior corpus callosum
5) **A5 (postcallosal):** Toward the splenium

Stroke is the second leading cause of death globally and a major cause of disability, especially in developed nations (WHO, 2017). In Mexico, it ranks sixth (INEGI, 2015). A significant cause of stroke is subarachnoid haemorrhage (SAH), often due to ruptured intracranial aneurysms, which most commonly occur in the ACA–AComA complex (Lu et al., 2013; Monroy-Sosa et al., 2013). Aneurysms in this region are clinically challenging due to their deep location, complex vascular structure, and hemodynamic stress. Management is further complicated by anatomical variations, which are thought to contribute to 10% of medical errors during neurovascular procedures.

Magnetic resonance angiography (MRA) is a non-invasive, reliable technique for detecting ACA anomalies such as aplasia, hypoplasia, fenestrations, and segmental variations. Due to the high variability of the anterior cerebral circulation, especially in the ACA and AComA, MRA is essential for accurate diagnosis, risk stratification, and surgical planning in cerebrovascular disease.

Aim/ Objective:

- To study different variations of Anterior cerebral artery.

MATERIALS/ METHODS

Study Design: Descriptive cross-sectional study
Source Of Data: Patients visiting the department of Radio-diagnosis at a tertiary healthcare centre.
Participant Size: 50

Inclusion Criteria

- Individuals above the age of 18 years.
- Availability of brain MRI data as part of the diagnostic workup.

Exclusion Criteria

1. Inadequate or incomplete brain MRI data, including the absence of angio sequences.
2. Patients with contraindications to MRI, such as those with non-MRI compatible implants or severe claustrophobia.

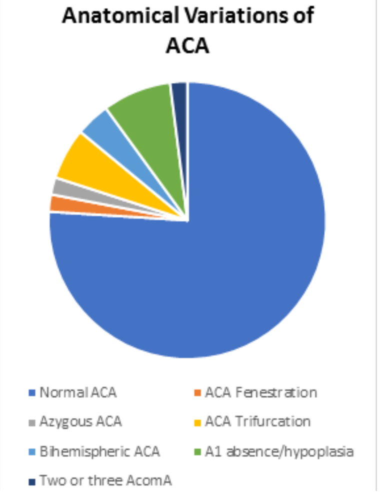
Methodology

- The study will be conducted in MRI section of Department of Radio-diagnosis of Medical College and tertiary health care center.
- After satisfying the eligibility criteria, written informed consent will be taken from all study participants.
- All these patients were screened before entry into the MRI scanning room for ferromagnetic objects, cardiac pacemakers, & aneurysm clips, etc.
- All these patients were subjected to MRI BRAIN with Siemens Magnetom Essenzaa 1.5 Tesla MRI machine & head coil.
- Appropriate sequences were acquired (T1 & T2 weighted coronal, DWI, ADC & Axial, MIP).
- The data will be collected & compiled in Microsoft excel and descriptive statistical analysis will be carried out.

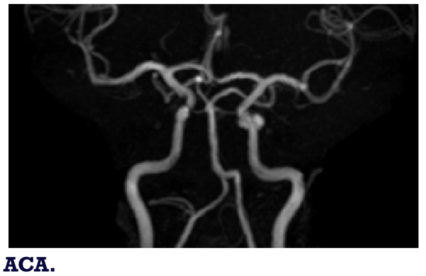
RESULTS

In this study, 50 patients with CNS complaints like headache, syncope, hemiparesis, etc. were studied.

Out of these, 38 patients (76%) had normal ACA and 12 patients (24%) had anatomical variation of ACA.



Case 1



Normal ACA.

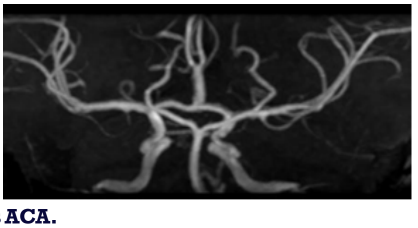
Case 2

Aplasia of right A1 segment.

Case 3

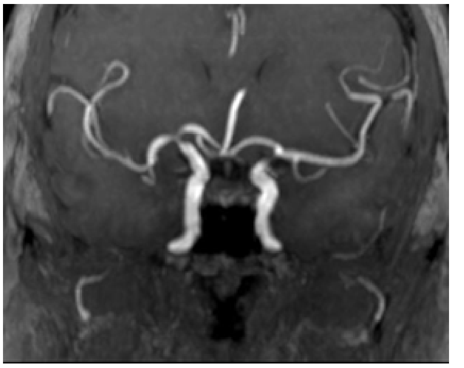
Hypoplasia of right A1 segment.

Case 4



Azygous ACA.

Case 5



Right ACA Fenestration.

CONCLUSIONS

MRA is a safe, non-invasive, and reliable modality for detecting and characterizing ACA variations and related vascular pathologies. It is particularly valuable in clinical settings for correlating anatomical variants with cerebrovascular symptoms and planning appropriate management. However, small lesions may be missed, so results should be interpreted with clinical context and, when necessary, supplemented by other imaging modalities

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