Anterior Cerebral Artery (ACA)

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The anterior cerebral artery extends upward and forward from the internal carotid artery (ICA).

Segments

Anterior Cerebral Artery Segments.

Branches

1. Recurrent artery of Heubner: 80% arise from Al (one of the larger medial lenticulostriates, remainder of lentic-ulostriates may arise from this artery head of caudate, putamen, and an-terior internal capsule

- 2. Medial orbitofrontal artery
- 3. Frontopolar artery
- 4. Callosomarginal artery
- A. internal frontal branches 1. anterior 2. middle 3. posterior
- 5. Pericallosal artery

Territory

Anterior cerebral artery territory.

Supply

It supplies the frontal lobes, the parts of the brain that control logical thought, personality, and voluntary movement, especially of the legs.

Pathology

see Anterior cerebral artery infarct.

see Anterior cerebral artery aneurysm.

see Anterior cerebral artery dissection.

Anatomical Variations

The ACA, a key branch of the internal carotid artery, typically comprises segments A1 (precommunicating) and A2 (post-communicating). Variations may affect its origin, course, caliber, and symmetry, and are crucial for both neurosurgical planning and stroke management.

1. A1 Segment Variations

□ Hypoplasia or Aplasia Most common variation (seen in 2-15%)

One A1 segment is underdeveloped (hypoplastic) or absent (aplastic)

The contralateral A1 supplies both hemispheres via the anterior communicating artery (ACoA)

□ Fenestration The A1 splits into two parallel channels for a short distance

Rare, but may be associated with aneurysms

Duplication Two separate A1 segments from the same ICA

Very rare, usually incidental finding

2. Azygos ACA (Single A2 Trunk)

see Azygos anterior cerebral artery

3. Bihemispheric ACA

One dominant A2 segment extends across the midline, supplying both hemispheres

The contralateral A2 is hypoplastic or absent

Can be confused with azygos ACA but less symmetric

4. Median Artery of the Corpus Callosum

Also called persistent median artery

Arises from ACoA, runs along the corpus callosum midline

Coexists with paired A2 segments

Important variant with surgical implications

5. Triplication of A2

Three distal ACA branches arise independently from the ACoA region

Very rare

Increases the complexity of aneurysm surgery at the ACoA

Clinical Relevance

Variations are key in aneurysm surgery, stroke localization, and endovascular procedures

They influence collateral circulation and risk of bilateral infarcts

Preoperative CTA, MRA or DSA is essential for surgical planning

Description of the anterior cerebral artery and its cortical branches: Variation in presence, origin, and size

Certain aspects of the anterior cerebral artery (ACA) cortical branches tend to vary, including absent or additional arteries, variation in origin, and changes to diameter and length. Knowledge of these factors can be crucial in aneurysm and arteriovenous malformation surgery. Few studies report on these aspects and a South African study have not been completed. Therefore, the aim of this study is to report absent or additional arteries, the origin, diameter and length of ACA cortical branches in a Western Cape population.

A coloured silicone was injected into the ACA of 121 hemispheres (60 right, 61 left), consisting of 83 males and 38 females. Specimens were divided in groups younger than 34 (n=36), between 35 and 48 (n=35), older than 49 (n=40), and unknown (n=10). There were three population groups; coloured (n=72), black (n=37), white (n=10), and unknown (n=2). Any absent or additional arteries were noted, as well as the origins. External diameter and lengths were measured using a digital micrometre, string and a ruler.

The diameter and lengths indicated significant differences between right and left, sex, age and population groups. Most commonly absent (callosomarginal artery) and additional (paracentral lobule

artery) arteries were noted. Origins were similar to the literature; however, previously unreported origins and common trunks were also observed.

The aspects reported have been neglected in previous work and neurosurgeons should be aware of these variations and anomalies to avoid complications. Studies should continue to assess the cerebral vasculature since undocumented variations are still being reported ¹⁾.

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Cilliers K, Page BJ. Description of the anterior cerebral artery and its cortical branches: Variation in presence, origin, and size. Clin Neurol Neurosurg. 2016 Dec 2;152:78-83. doi: 10.1016/j.clineuro.2016.11.024. [Epub ahead of print] PubMed PMID: 27936431.

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