

Case report**AN INTERESTING VARIATION OF ANTERIOR CEREBRAL ARTERY: A DISSECTION BASED CASE REPORT****Das M¹, Jahan S², Pankaj P³**

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Abstract

Introduction: The microsurgical anatomy of anterior cerebral artery is of particular interest to the cerebrovascular surgeons as it supplies the areas of the motor and somatosensory cortices that represent lower limb. This communication reports yet another rare but clinically significant variation of A1 segment of anterior cerebral artery noticed during routine dissection on cerebral circulation. **Methods:** Brain was obtained from the cadaver used for dissection purpose after removal of calvaria. Meticulous dissection was done and anterior cerebral artery was cleaned and studied. **Results :** There was duplication of A1 segment of anterior cerebral artery. Diameter of one trunk was more than other. **Discussion:** The variant we found is a duplication of A1 segment and can have important clinical implications. Communicating arteries between major arteries and branching sites are most thrombosis prone sites in human vasculature.

Key words: ACA variation , duplication , A1 segment , clinical implications.

Introduction

The **anterior cerebral artery**(ACA) is the smaller terminal branch of internal carotid artery that supplies the most medial portions of frontal lobes and superior medial parietal lobe and is a part of the Circle of Willis. The left and right anterior cerebral arteries are connected by the anterior communicating artery(AComm)¹. Various variations from the normal pattern have been reported in the past. This communication reports yet another rare but clinically significant variation of A1 segment of anterior cerebral artery noticed during routine dissection on cerebral circulation.

The ACA is divided into 3 segments (smaller branches from the ACA "callosal" arteries considered as the **A4** and **A5** segments sometimes)²

- x **A1:** this part extends from the termination of internal carotid artery up to the junction with the anterior communicating artery (AComm). The anteromedial central arteries arise from this segment as well as the Acomm and pass through the medial portion of anterior perforated substance and supply the caudate nucleus and the anterior limb of the internal capsule .

- x **A2:** this segment extends from the junction with the AComm up to the origin of callosomarginal arteries. The recurrent artery of Heubner which irrigate the internal capsule, usually arises at the beginning of this segment near the AComm. 4 branches arise from this segment .
- x **A3:** Also known as the pericallosal artery this is the part distal to the origin of callosomarginal artery which extends posteriorly in the pericallosal sulcus to form the internal parietal arteries (superior, inferior) and the precuneal artery. This artery may form an anastomosis. with the posterior cerebral artery.

Material and methods

Anterior cerebral artery was observed in the brain obtained from cadaver used for routine educational dissection . Head was supported on a block and a saggital cut was given through the epicranial aponeurosis from the root of nose to external occipital protuberance. Skin, superficial fascia and epicranial aponeurosis was pulled laterally and detached from the temporal lines. Periosteum was stripped from the external surface of the vault of skull upto a level below the attachment of temporalis muscle. Calvaria was removed.

Falx cerebri was detached from crista galli, cranial nerves and important blood vessels present at the base of the brain was cut to preserve it with brain. Tentorial attachment to petrous temporal bone was divided . Spinal medulla and vertebral artery was cut and brain was carefully removed from

cavity. Blood vessels on superolateral surface and base of brain was cleaned from piamater on the external surface of which it lies.Through meticulous dissection, anterior cerebral artery was cleaned and digital photographs were taken.

Observation

In our cadaver following changes from normal pattern was observed.

- x There was duplication of A1 segment on the right side just after origin..
- x Diameter of one trunk was more than the other.
- x Thicker trunk crossed to the opposite side and joined the opposite ACA at the level of anterior communicating artery



Fig 1: Photograph illustrating duplicated A1 segment on the right side

Discussion

Variation found in our cadaver can either be a case of Duplication of A1 segment of anterior cerebral artery or a Duplicated anterior communicating artery. Duplication of anterior communicating artery is a commonly reported variation in many studies but both the communicating

arteries are usually parallel^{3,4}. The trunk of duplicated anterior communicating artery is thinner in diameter than the parent anterior cerebral artery. Duplicated anterior communicating originates a few mms after the origin of ACA^{5,6,7}.

However in the variant we found A1 segment duplicated at the origin, the trunk joining the opposite ACA was thicker than the original A1 segment and course of this variant trunk was much longer and non-parallel to the anterior communicating artery. So this is a duplication of A1 segment rather than duplication of anterior communicating artery and can have important clinical implications. Communicating arteries between major arteries and branching sites are most thrombosis prone sites in human vasculature because these sites favor stasis and are associated with disturbed laminar flow of blood. So this variant duplicated ACA can be a concealed site of thrombosis and can cause recurrent Transient ischaemic attacks (TIAs) and even stroke. If a patient with our reported variation undergoes a cerebral angiography, it may be absolutely normal because in angiography the non-visualised duplicated A1 segment in which the dye does not enter is already not there in normal anatomy and thus patient's angiography is reported normal despite having extensive thrombosis.

A1 segment of ACA is in close proximity to important structures mainly optic chiasma. Knowledge of this anatomical variation is of utmost importance for those performing debulking surgeries for resection of sellar and suprasellar tumours compressing optic chiasma to prevent vascular injury⁸. Thrombosis of anterior

communicating artery has been reported to cause recurrent TIAs. Angiographic assessment of these patients with the above mentioned variation may appear to be normal because duplicated A1 may mimic Acomm artery and the original Acomm may not be visualised at all.

Padgett described 8 stages in the development of the cerebral arteries. The first 7 stages occur during embryogenesis in the first trimester. When the embryo is approximately 40 mm in length (estimated ovulation age 52 days), circle of Willis is recognizable and the stems of all the cerebral arteries attain their adult configuration.⁹

In the final embryonic period of cerebrovascular development, the vessels branch in accordance with the developing parenchyma. This pattern of development has been termed "cerebrovascular ontogenic plasticity".¹⁰ It is postulated that anomalous arteries and vascular malformations develop during this period.

Phylogenetic comparison indicates that the cranial division of ICA in humans is homologous with olfactory artery in lower orders e.g. fish and reptiles. This vessel is seen to evolve into ACA as one ascends in phylogenetic hierarchy implying that ACA is direct continuation of ICA whereas MCA is a secondary branch of this vessel.

Primitive ICA divides into a cranial (primitive ACA) and caudal (primitive post communicating) divisions at 4-6mm stage of embryo. MCA is first recognized as multiple twigs branching from the cranial division of internal carotid artery. Coalescence of these twigs into single branch form middle cerebral artery. Persistence of a twig separate from MCA

can explain an assessor branch seen arising from proximal ACA.

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