



STUDY OF VARIATIONS IN THE HEUBNER'S ARTERY

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ABSTRACT

Background: Intracranial aneurysm is most common in anterior circulation of circle of willis. Recurrent Artery of heubner (RAH) is the first artery seen on elevating the frontal lobe to approach the aneurysm present in anterior communicating artery. In this study Recurrent Artery of heubner presence, numbers and site of origins were noted
Materials and Methods: The recurrent artery of Heubner were studied in 50 formalin fixed human brains (100 hemispheres) obtained from routine autopsies with 10x magnification. **Results:** The RAH was found in 98% of hemispheres and it was missing in 2% hemispheres Among the 98% of hemispheres, it is doubled in 10 hemispheres, out of 10 double RAH, the 6 arteries with a separate origin and 4 arteries from a common stem. The RAH originated from at the level of ACoA of the Anterior cerebral artery (ACA) in 57% of specimens, from A2 segment in 34% and from A1 segment in 7%. **Conclusion:** The knowledge of anatomical variations in heubner's artery is essential for neurosurgeons to planning the neurosurgical procedures to avoid unexpected neurological complications.

KEYWORDS: Intracranial aneurysm, Recurrent artery of heubner, anterior cerebral artery.

INTRODUCTION

In the past, many terms have been used to describe Heubner's artery. The term "Artery of Heubner" was first described by Johann Otto Leonhardt Heubner in 1872.^[1] Others named it the "telencephalic" or "arteria centralis long,"^[2] and "arteriae striatae mediales."^[3] Shellshear added the term Recurrent in 1920.^[4] The recurrent artery of heubner (RAH) is the largest of the perforating medial lenticulostriate arteries branching from anterior cerebral artery (ACA) and it doubles back on its parent ACA and passes above the carotid bifurcation and middle cerebral artery into the medial part of the sylvian fissure before entering the anterior perforated substance. According to Susan Standring (2005) surgical nomenclature divides the ACA into 3 parts. A1 - from the origin of ACA to the origin of Anterior communicating artery (ACoA). A2 - from junction with the ACoA to point of emergence of callosomarginal artery. A3 - distal to the emergence of the callosomarginal artery.^[5]

RAH is the first branch of A2 segment just after the ACoA junction, but it may also arise from A1, or at the junction of ACA - ACoA.^[6] RAH supplies the anterior striatum, anterior limb of internal capsule, nucleus accumbens, uncinate fasciculus, olfactory region, diagonal band of Broca, and anterior hypothalamus.^[7]

The anatomical variation of RAH is related to its number, presence, or absence and the point of origin from ACA is considerable clinical impact mainly from the point of the surgical procedures involving the anterior portion of the circle of Willis. The aim of this work study the anatomical anomalies of Heubner's artery and different points of origin.

MATERIALS AND METHODS

50 adult human brains (100 hemispheres) obtained from the Department of Anatomy and autopsy specimens from the Department of Forensic Medicine, Thanjavur Medical College, Thanjavur, were included in the study. Institutional ethical clearance was obtained before commencement of study. The specimens were dissected in the period from 2010 to 2013.

The specimens were removed from the cadaver as described in Cunningham's manual of practical anatomy^[8] and they were fixed in 10% formalin. The arachnoid was carefully removed from base of brain. The RAH point of origin, and its variations were evaluated and analysed with 5x, 10x magnification.

OBSERVATION AND RESULTS

In 100 hemispheres, the following parameters were analysed: frequency, incidence of doubling and site of origin. The RAH was found in 98% of specimens. The artery was single in 88% of specimens, doubled in 10%

of specimens. We had 5 hemispheres doubled on right side and 5 hemispheres doubled on left side (Fig no: 1). In doubled vessel 60% arteries originated from separate

origin and 40% arteries from common stem origin (Table no : 1).



Fig. No. 1: Double Heubner's Artery on left side.

Table no. 1: Numbers of Artery of Heubner.

S.No	Side of hemisphere	Number of arteries	Frequency	percentage
1	Right side	Single	44	88%
2		Duplication	5	10%
3		Absent	1	2%
4	Left side	Single	44	88%
5		Duplication	5	10%
6		Absent	1	2%

The RAH originated from A1 segment in 7% of hemispheres, from A2 segment in 34% of hemispheres (Fig no: 2) and from ACA-ACoA junction in 57% of

specimens. The RAH was missing in 2 hemispheres one on right side and one on left side (Fig no:3), (Table No :2).

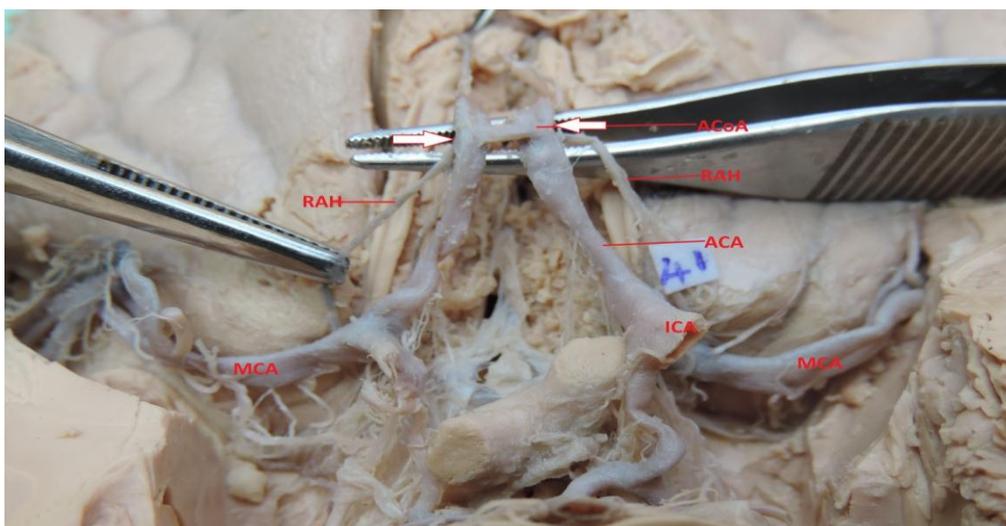


Fig. No. 2: Heubner's Artery originating at level of ACoA on both sides.

RAH: Recurrent artery of heubner, ICA: Internal carotid artery, ACA: Anterior cerebral artery, ACoA: Anterior communicating artery, MCA: Middle cerebral artery.



Pic No. 3: Heubner's Artery absent on left side.

RAH: Recurrent artery of heubner, ICA: Internal carotid artery, ACA: Anterior cerebral artery.

Table 2: Site of origin of RAH.

S.no	Site of origin	Right side	Left side	Percentage%
1	A1 segment	6%	8%	7%
2	A2 segment	30%	38%	34%
3	ACA-ACoA junction	62%	52%	57%

DISCUSSION

The greatest variation in the anatomy of the Artery of Heubner was observed in its origin. The present report confirmed that the RAH is predominantly originating from at the level of ACA-ACoA junction (57% cases). The artery arose from A2 in 34% and from A1 in 7% of cases. The RAH was missing in 2% of cases.

The study of Dunker & Harris on 28 hemispheres showed RAH arose from ACA-ACoA junction in 55% and from A1 35% of cases.^[9] The anatomical study of Lemos 1977 based on 83 formalin fixed hemispheres showed that the RAH branched from ACA-ACoA junction in 73%, from A2 in 21% and from A1 in 6% of cases. The artery was missed in 1.2% of cases.^[10] The study of Yasargil & Smith in 283 hemispheres concluded that ACA-ACoA junction most common origin of RAH(52.3%). 24.4% of RAH arose from A2 segment and 2.1% from A1 segment.^[11] Similar conclusion was shown in the study of Loukas et al on 69 formalin fixed hemispheres. The artery arose from ACA-ACoA junction in 62.3%, from A2 in 23.3% and from A1 14.3% of cases. The RAH missing in 6% of cases.^[5] The study of Uzun et al. conformed in their work based on 54 autopsy brains that the RAH commonly branched from at the junction of ACA-ACoA in 79.2%, from A2 in 14.6%, and from A1 in 6.2% of cases. The artery was missing in 6 hemispheres.^[12]

On the contrary, several authors reported the A2 segment to be the most frequent stem of the RAH. The study of Avci et al. reported RAH originated from A2 in 64%, from ACA-ACoA junction in 29% and from A1 in 6% of

cases. The artery was absent in 1.6% of cases.^[13] The microsurgical report of Zunon-Kipr'e et al. showed RAH originated from A2 in 58%, more often from A1 30%, than at the ACA-ACoA junction, in 12% of case.^[14] Perlmutter and Rhoton reported on 50 adult brains. The artery arose from A2 in 78%, from A1 in 14%, and at the level of ACoA in 8% of cases. The artery was missing in one hemisphere.^[7] Critchley^[15] and DeAlmeida^[16] described the artery arising from the anterior communicating, internal carotid, middle cerebral and anterior cerebral arteries. Gomes et al^[17] described only one RAH arising from the orbitofrontal artery. The study of Musso et al^[18] reported 0.83% of RAH arose from orbitofrontal artery. But in our study RAH originated only from ACA-ACoA, A2 or A1 segments.

The anatomical studies of the anterior part of the circle of Willis are often reporting the presence of double RAH unilaterally or bilaterally. The frequency of duplicity observed in this study was 10%, which agrees with the findings of Gomes et al, Perlmutter et al, Yasargil & Smith 1-12%. Marinkovic et al^[19] mentioned that duplicity of this artery was associated with variations or malformations in other vascular segments, including hypoplasies, fenestration of the anterior cerebral artery and aneurysm of the pericallosal artery. Perlmutter and Rhoton^[7] described contralateral duplicity when the DMSA was absent. We found neither malformations nor contralateral duplicity and only two brain had no Heubner's artery.

CONCLUSION

The RAH is commonly arising from ACA-ACoA junction or A2 segment of Anterior cerebral artery. This anterior portion of circle of willis is the place of many anatomical variations and malformations. The vessel can be absent, single, or multiple with common stem or separate stem. The awareness of these distinct anatomical and morphometric variations of the RAH is essential in planning the neurosurgical procedures in the anterior part of the circle of Willis to avoid the unexpected neurological complications.

Conflicts of interest: None.

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