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Anatomy

VARIATION IN DIAMETERS OF M1 &M2 SEGMENTS OF MCA IN NORTH INDIANS; A CADAVERIC STUDY ON 35 HUMAN BRAINS

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ABSTRACT The artery shows numerous variations and anomalies in its branching pattern, a sound knowledge of which may be helpful for neurosurgeons and clinicians.[1] The increasing use of magnification for surgical procedures in the territory of the MCA has created a need for a better understanding of its microsurgical anatomy.[2] Symmetry as such has no clinical significance, but asymmetry itself may be an indication of variability in functional ability of two sides of thebrain.[3] **Aim:** To find variation in Diameter of the M1 & M2 segments of the middle cerebral artery in normal subjects. **Material:** Fifty specimens of MCA through detailed bilateral dissection of 35 brain specimens of fresh adult Indian post-mortem cases. **Methods:** used Digital camera and diameter was recorded for both MCA segments, using ImageJ software. **Result & Conclusion:** The mean diameter of the right side was found to be more wider than that of the left side in both male and female groups.

KEYWORDS : MCAdiameter; MCAsymmetry; MCAasymmetry; MCAanomaly

INTRODUCTION

Surgicalnomenclaturedividesthevesselintofourpartsorsegments:[4,2,5]

- M1 (Sphenoidal): from the origin of MCA (termination of ICA) to genu (90° turn) of MCA; so named due to its origin and loose lateral tracking of the sphenoid bone. Although also known as the horizontal segment, this may be misleading since the segment may descend, remain flat, or extend posteriorly indifferentindividuals. The M1 segment perforates the brain with numerous antero lateral central (lateral lenticulostriate) arteries, which irrigate the basal ganglia.

- M2 (Insular): from the genu of MCA to the circular sulcus of the insula; part of the artery or its divisions that lie on and supply the insula. Extending anteriorlyon the insula, this segmentis known as theinsular segment and alsoas the Sylvian segment when the opercular segments are included. This segment of the main trunk may bifurcate or sometimes trifurcate into branches which then extend to terminate towards the cortex. Because of bi/tri-furcation, this segment is more vulnerable for variations.

M3 (*Opercular*): from the circular sulcus to the surface of the Sylvian fissure (junction of operculum & supero-lateral cerebral surface). The opercularsegmentextendslaterallytowardstheexteriorfromtheinsula to the cortex. This segment is sometimes grouped as part of M2 (Sylvian segment)

- **M4**(*Cortical*):from the surface of the Sylvian fissure, its branches extend over the supero-lateral cerebral surface. These finer terminal or cortical branches irrigate the cortex. They begin at the external aspect of the Sylvian fissure and extend distally away on the cortex of the brain.

MCA is the most complex of the major cerebralarteries owing to its anatomical and hemodynamic features. The precise patho-physiological mechanisms underlying cerebral MCA aneurysm formation remain unclear. Asymmetrical local vascular geometry and hemodynamic shear stress may play a role in aneurysm formation and progression.[6,7]

Morphology and anatomical variations of the MCA are also of significantclinical import due to the high prevalence of **intracranial aneurysms** affecting this artery.

AIM&OBJECTIVE

To examine variations in diameter of the M1 & M2 segments of the middle cerebral artery in normal subjects of different age/sex categories, in order to correlate structural features with vascular pathology Objectives.

To study and compare in normal Indian subjects of various age groups and in both sexes after Cadaveric dissection in fresh mortuary specimens for measurements of diameter by digital image analysis of dissected specimens.

MATERIALS&METHODS

Seventy specimens of MCA through detailed bilateral dissection of 35 brain specimens of fresh adult Indian post-mortem cases (both sexes) with no obvious cerebro-vascular pathology, from the Department of Forensic Medicine & Toxicology at AIIMS, New Delhi.

Digital images of each of the above mentioned dissected MCAs (n=35 x2=70) of both sides (left & right**).**

Morphometry

The specimens were individually photographed using a Digital camera and measurements (length & diameter) were recorded for both M1 and M2 segment of MCA segments, using ImageJ software.

RESULT

Fig1: MarkedarrowshowingdiameterofMCAatM1Level(Rt&Lft Sphenoidal segment)

Fig2: MarkedarrowshowingdiameterofleftM2segment

Fig3: MarkedarrowshowingdiameterofrightM2segment.

Table1: Shows Meandia Meter Of M1&M2 Segment (All Measurements Are In Mm)

Variables	N=70 Mean±SD	Range
DiameterofM1 segment	1.84±0.3	1.20-2.72
DiameterofM2 segment	1.55±0.4	0.96-2.72

We only found 61-80yr age group brain from the dissection hall of ourinstitute. Only gender related variations were observed in this case that is; diameter of M1 has no significant difference between male and female and also not significantly larger in left side than right side of M1. The mean diameter of M2 right side is more wider than left side in both male and female groups.

Table 2: Gender Variation Of Morphometry Of The MCA (all Measurements Are In mm)

Variables	Male N=17 mean±SD	Female N=17 mean±SD	Over all p value
RD1	1.79±0.9	1.85±0.1	0.663
LD1	1.84±0.1	1.86±0.1	0.916
RD2	1.84±0.3	1.86±0.4	0.916
LD2	1.29±0.2	1.20±0.2	0.354

DISCUSSION

Table3:showingthecomparisonofstudywithprevious studies According to measurements by Umanski et al.[8], the diameter of the trunk of the middlecerebral artery is bilaterally 3.0±1.3 mm. However, according to the anatomical examinations conducted by Idowu et al.[9], the diameter of the main MCA trunk amounted to 3.39–3.59 mm (mean: 3.49 mm). Even higher values were found in microanatomical examinations by Tanriover et al.[10] According to them, the main trunk diameter amounted to 3.71 mm (2.74–4.92 mm). The diameter of the upper branch was on average 2.19 mm (range: 1.36–3.52 mm) according to Tanriover et al[10], while thediameter of the lower branch was 2.26 mm (1.72–2.84 mm). A similar range of MCA width was observed in microanatomical examinations performed by Gibo et al.[2]According to Tarasow et al.[11]the MCA diameter was 2.38±0.9 mm, while with MRA it was 2.23±0.41 mm. And thesmallerdiametersof theupper branch(1.71±0.73mm) and lower branch (1.60±0.58 mm). In our own cadaveric examination the MCA diameter was lower than aforementioned reports and it was amounted to 1.84±0.3mm (range: 1.2-2.7mm), while with MRA it was 4.3±0.6 (range: 2.2-5.5mm). The observed group was also showed smaller diameter of wider and longer M2 trunk.

CONCLUSION

All 35 brain specimens were taken from cadavers belonging to the 61-80 year age group. Hence the data could only be analyzed either reference to sex and body side. Statistical analysis revealed that though the absolute values of the diameter differed somewhat on the two sides and among males and females, these differences were not significant. Themean diameter found to be on M2 right side is more wider than left side in both male and female groups which might play some role in blood pressure difference in right & left side of brain hence rightwider artery is less vulnerable to aneurysm or any cerebrovascular accidents .But more studies are to be donefor microscopic assessment of MCA so thatbetterunderstandingwillbeavailablefor ageand genderrelated variation will become crystal clear and thus their pathology will also become clear.

Disadvantages Or Limitations:

Brainspecimensavailablewerelessinnumber& specimen below 60 years were not available for obtaining the significance differences in morphometry (artery diameter) of middle cerebral artery at insular level.

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REFERENCES

1. Mehndiratta MM, Khan M, Mehndiratta P, Wasay M. Stroke in Asia: geographical variationsandtemporaltrends. *JNeurolNeurosurg*Psychiatry.2014;85(12):1308–1312.
2. GiboH,CarverCC,RhotonAL,LenkeyC,MitchellRJ.Microsurgicalanatomyofthe middle cerebral artery. *J Neurosurg*. 1981; 54: 151–169.
3. DasSK,BanerjeeTK.Stroke:IndianScenario.Circulation2008;118(25):2719–2724.
4. Griffiths PD. Vascular supply and drainage of the brain (Chap 19, Section 3: Neuroanatomy) Crossman AR (sec. ed.) In: Gray's Anatomy, The Anatomical Basis ofClinical Practice. 41st edition. Susan Standring (editor-in-chief) et al. Churchill LivingstoneElsevier;2008.p.915-938.–
5. Krayenbühl,Hugo;Yaşargil,MahmutGazi;Huber,Peter;Bosse,George(1982), CerebralAngiography,Thieme,pp.105–123,ISBN 978-0-86577-067-6
6. DasthiR,HernesniemiJ,ZNiemelaM,RinneJ,PorrasM,LeheckaM,ShenH, AlbayrakBS,LehtoH,PalPK,OliveriraSD,PerraG,RonkainenA,KoivistoT, JaaSkelainen JE: Microneuro surgical management of middle cerebralarteryb if urcationaneurysms. Surgical neurology 67 (2007) 441 – 456.
7. Sadatomo T, Yuki K, Migita K, et al: Differences between middle cerebral artery bifurcationswithnormalanatomyandthosewithaneurysms.NeurosurgRev(2013) 36:437-445.
8. UmanskyF,JuarezSM,DujovnyM,AusmanJI,DiazFG,GomesF,MirchandaniHG, Ray WJ. Microsurgical anatomy of the proximal segments of the middle cerebral artery. J Neurosurg. 1984; 61: 458–467
9. Idowu OE, Shokunbi MT, Malomo AO, Ogunbiyi JO: Size, course, distribution and anomaliesofthemiddlecerebralarteryinadultNigerians.EastAfrMedJ,2002;79: 217–20
10. Tanriover N, Kawashima M, Rhoton AL Jr, Ulm AJ, Mericle RA: Microsurgical anatomyoftheearlybranchesofthemiddlecerebralartery:morphometricanalysis and classification with angiographic correlation. J Neurosurg 98:1277–1290, 2003
11. Tarasów E, Ali AAS, Lewszuk A, Walecki J; Measurements of the middle cerebral arteryindigitalsubtractionangiographyandMRangiography,MedSciMonit,2007; 13(Suppl 1): 65-72