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Original Research Article

Morphometric Study of Basilar Artery in Cadavers of Malayali Population

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Conflict of interest: Nil

Abstract:

Background: The blood supply of the brain is quite important for understanding the process and effect of cerebrovascular accidents and other anomalies of brain function.

Method: 30 (thirty) non-pathological cadaveric brains were studied for the metrical study of the basilar artery. The diameter and length were measured with a digital vernier calliper.

Results: The mean length was 28.40 (± 4.48) and the range was 21.3–42.08. The mean diameter was 3.34 (± 0.68), and the range diameter was 2.06-4.48. Normal termination was 26 (86.6%), and variations were 4 (13.2%).

Conclusion: It is concluded that the morphometric study of the basilar artery presents variations in the length, diameter, origin, and termination. These variations will be quite helpful for the neurologists, neurosurgeons, and radiologists for proper diagnosis and surgery to avoid morbidity and mortality in neuro-vascular accidents, anomalies, and pathologies of the brain.

Keywords: Non-Pathological, Digital Vernier Calliper, Cadaveric Brain, Neuro-vascular disease.

Introduction

The basilar artery is formed by the union of vertebral arteries, and it forms an important part of the posterior circulation of the brain. Through its terminal branches (posterior cerebral artery), it contributes to the formation of the "Circle of Willis, "which is an important arterial anastomosis situated at the base of the brain, connecting the carotids and vertebro-basilar system. It has many important branches that supply the vital parts of the brain, like the cerebellum, Pons, medulla-oblongata, carotid-plexus, ventricles, and internal ear. A variation of the vertebro-basilar system is more often congenital and creates confusion for neurosurgeons and radiologists during cerebrovascular accidents and other anomalies of brain function. Hence, an attempt was made to measure the length and diameter of the basilar artery at various junctions to evaluate its normalcy, or anomaly, because the artery changes its routes to compensate for the gravity and rotation of the head at the level of the atlanto-occipital and atlanto-axial joints.

Material and Method

30 (thirty) non-pathological cadaveric brain specimens preserved in formalin in the anatomy dissection theatre of KMCT Medical College, Manassery Kozhikode, Kerala (673602) were studied.

Inclusive Criteria: Intact arteries of the circle of Willis with the brain are selected for study.

Exclusion Criteria: Damaged or pathological arteries of the circle of Willis and damaged brains were excluded from the study.

Method: The brain was removed by dissection following the Cunningham practical manual volume III[rd]. Before dissection, every specimen was washed in running tap water. The coverings (Dura, Archanoid, and Pia metre) were removed carefully, and the basilar artery and its branches were exposed to study. The length and diameter were measured by digital vernier callipers. The terminal and beginning sites of the basilar artery were visualised by using magnifying glass. The length and diameter, as well as the variation in the beginning and terminal, were noted.

The duration of the study was from June 2021 to May 2023.

Statistical analysis: Mean values and standard deviation of length and diameter of basilar artery variations in beginning and termination were studied with percentages. The statistical analysis was performed in SPSS software. The ratio of male and female cadavers was 3:1.

Observation and Results

Table 1: Metrical Study of the Basilar Artery (A) 28.40 (±4.48), length 21.3–42.08 range, (B) 3.34 (±0.68), diameter (mm) 2.06–4.48 range

Table 2: Variations of basilar artery at the level of formation: 27 (90%) at the ponto-medullary level, 2 (6.6%) above the ponto-medullary junction, and 1 (3.3%) below the ponto-medullary junction.

Table 3: Variations in the level of termination of the basilar artery: 26 (86.6%) at the ponto-mesencephalic junction, 2 (6.6%) above the ponto-mesencephalic junction, and 2 (6.6%) below the ponto-mesencephalic junction.

Table 4: Present Metrical Study was compared with previous studies, and it was observed that the present study findings were more or less in agreement with previous studies.

Figure 1: Anatomical Variability in the Origin, Length and Termination of Basilar Artery

Figure 2: Abnormal variant of basilar artery. Abnormal variant, right hypoplastic vertebral artery (Blue arrow) and curved course of basilar artery (Red arrow)

Table 1: Metrical Study of Basilar artery (No. of patients: 30)

(A) Length	Millimeter (mm)	(B) Diameter	Millimeter(mm)
Mean with SD	28.40 (± 4.48)	Mean with SD	3.34 (±0.68)
Range	21.3 – 42.08	Range	2.06-4.48

Length and diameter of the Basilar Artery of cadavers

Table 2: Variations of basilar artery at the level of formation

Sl. No	Level of formation	No. of Cadavers (30)	Percentage (%)
1	At Ponto-Medullary	27	90
2	Above the Ponto Medullary Junction	2	6.6
3	Below the Ponto-Medullary Junction	1	3.3

Variations was mainly observed at Ponto-Medullary area

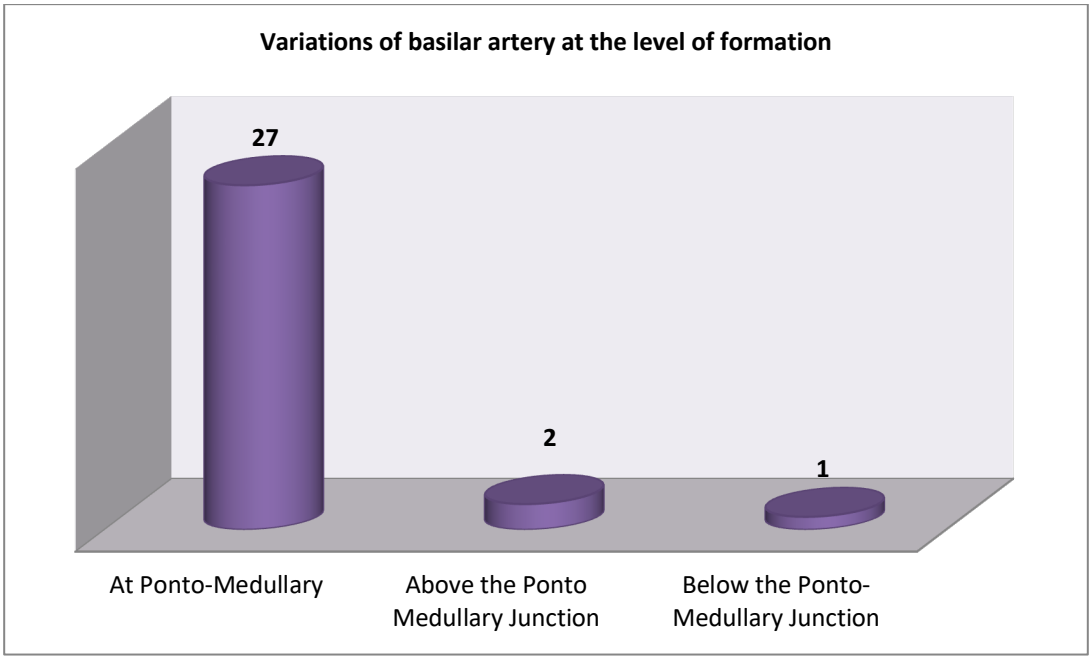

Figure 3: Variations of basilar artery at the level of formation

Table 3: Variations in the level of termination of basilar artery

Sl. No	Level of termination	No. of Cadavers	Percentage (%)
1	At Ponto-Mesencephalic Junction	26	86.6
2	Above Ponto-Mesencephalic Junction	2	6.6
3	Below Ponto-Mesencephalic Junction	2	6.6

Majority of the termination was at Ponto-mesencephallic junction

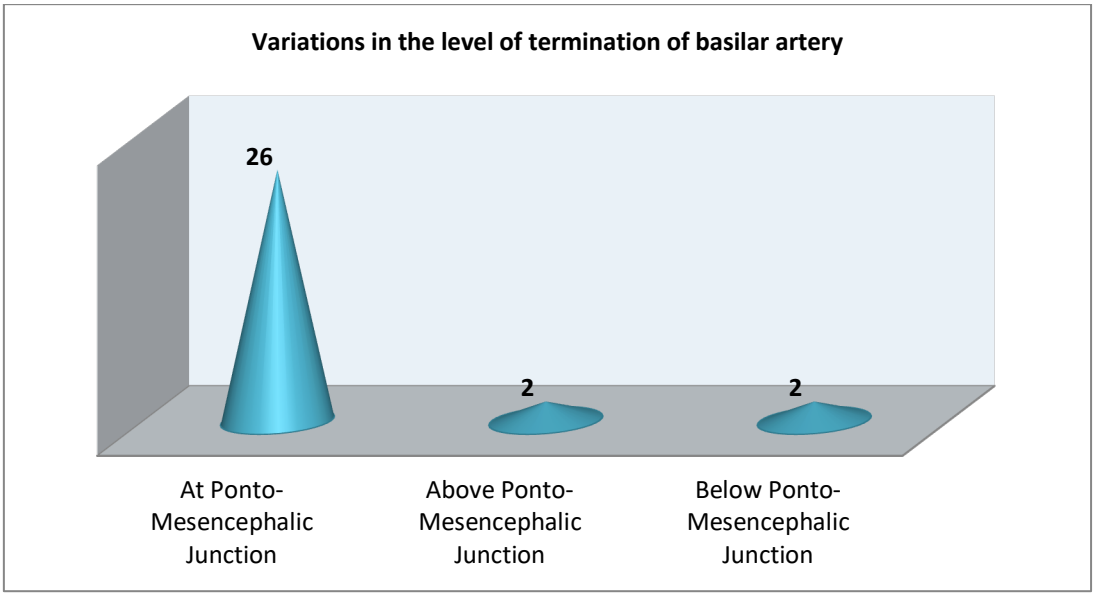

Figure 4: Variations in the level of termination of basilar artery

Table 4: Comparison of present Metrical study of basilar artery with previous workers

Worker with year	No of samples	Length range (mm)	Average length	Diameter range (mm)	Average diameter (mm)
Kamath (1981)	100	20-40	31-42	2.5-5.5	3.82
Pai BS (2007)	25	24-35	24.9	3-7	4.3
Padmavathi. etal (2011)	54	25-38	--	--	--
Mamtha. etal (2012)	20	25-37	28.5	--	--
Iqbal. S (2013)	50	18-37	30	2.8-5.1	3.9
Warikhede (2014)	40	24-36	29.9	3.0-4.0	3.53
Patel.etal (2015)	60	20.1-42.7	27.7	2.05-4.45	3.36
Satapathy&Mohapatra (2021)	38	20.2-35.2	25.58	2-3.9	3.05
Savita Budi Jagdeesh Morab(2021)	50	21.2-43.04	28.8	2.08-4.82	3.42
Present study 2023	30	21.3-42.08	28.40(±4.48)	2.06(±4.48)	3.34 (± 0.68)

Discussion

In present morphometric study of basilar artery in Malayali Cadavers, the mean length was 28.40 mm(± 4.48), and the range of length was 21.3 to 42.08mm. The mean diameter was 3.34mm (± 0.60) and range from 2.06 – 4.48mm (Table 1). Variations of the basilar artery at various levels of formation, 27 (90%) at the ponto-medullary junction, 2 (6.6%) above the ponto-medullary junction, and 1 (3.3%) below the ponto-medullary junction (Table 2). Variations were found for the level of termination of the basilar artery. 26 Basilar arteries (86.6%) terminated at the ponto-mesencephalic junction, 2 (6.6%) above the ponto-mesencephalic junction, and 2 (6.6%) below the ponto-mesencephalic junction (Table 3) (Figure 1 and 2). The present findings were correlated with previous studies, and it was observed that the present findings were more or less in agreement with previous studies [6,7,8].

The level of termination of the basilar artery determines the type of approach to be made for the treatment of aneurysms of the basilar artery and the posterior cerebral artery, so as to minimise or prevent damage to nearby important structures like the mammillary body, optic chiasma etc. Anterior inferior cerebellar artery and internal auditory artery are important branches of basilar artery and are more frequently involved in tumours like acoustic neuromas, meningiomas at the cerebello-pontine angle, and vascular lesions like arterial occlusions, aneurysms, and A-V malformations. The internal auditory artery is an end artery supplying the internal ear and nearby structures and may be damaged during surgery to treat the cerebello-pontine angle disease of the internal ear or tumours of the pyramid, resulting in deafness.

The superior cerebellar artery is the second most common site for the occurrence of aneurysm, and the oculomotor nerve is involved, resulting in Weber's syndrome and extraocular muscle paralysis. The superficial temporal artery and distal part of the superior cerebellar artery are anastomosed for stenosis of the proximal or midsection of the basilar artery [9].

It is reported that, in 11% of cases, there is a common trunk of origin for both the posterior cerebral artery and the superior cerebral artery. The posterior cerebral artery sub serves the function of vision and many ocular functions, like papillary reflexes and eye movements, Visual memory, binoculars, and visual spatial integration. It is commonly involved in malignant gliomas, astrocytomas, and cerebral angiomas.

Anastomosis of the external carotid artery and Posterior cerebral artery has been successfully performed with a saphenous vein graft for treatment of stenosis of the basilar artery [10]. A trans-sylvian pterion approach is suggested for the treatment of basilar artery aneurysms.

Posterior communicating artery aneurysm may cause cranial nerve palsies, especially the 3rd cranial nerve, resulting in Weber's syndrome. Clipping or ligation of the neck of the aneurysm has been suggested for successful treatment.

Summary and Conclusion

The present morpho-metric cadaveric study of the basilar artery is useful for neuro-physician, radiologist, and neuro-surgeon to diagnose and treat cerebral vascular disease efficiently, but this study demands further embryological, genetic, nutritional, angiological, bio-mechanical, and patho-physiological studies because the exact mechanism or causes of variations in the basilar artery is still unclear.

Limitation of study – Due to the tertiary location of the research centre, the small number of cadavers, and the lack of the latest techniques, we have limited findings and results.

This research paper has been approved by the ethical committee of KMCT Medical College, Manassery Kozhikode Kerala (673602).

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