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Original Article

Morphometric Study of Basilar Artery in Cadaveric Study

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Abstract

Background: Basilar artery is one of the import arteries of posterior part of the brain. It is clinically related to stroke, migraine aneurysm, and atherosclerotic changes as age advances.

Materials and Methods: Fifty cadaveric brain specimens were studied for basilar artery. The origin and insertion were noted. The diameter and length of the artery was measured with digital Vernier caliper.

Results: Mean length was 28.82 (SD±3.62) and range was 21.2–43.04. The mean diameter was 3.42 (SD±0.78), range was 2.08–4.82. Normal origin of artery was 45 (90%) and variations in the formation were 5 (10%). Normal insertion was 43 (86%) and variations were 7 (14%).

Conclusion: This morphometric study indicates the variations in the length and diameter, variations in the origin, and termination. As this artery correlated clinically with cerebrovascular disease these morpho –metric findings will enable the nuerophysician, radiologist for proper diagnose and neurosurgeon to operate without any fatal outcome.

Key words: Cadaveric specimen, Cerebrovascular diseases, Digital Vernier caliper, Hand magnifying glass

INTRODUCTION

Blood supply of brain is quite important for understanding the process and effect of cerebrovascular accidents atherosclerosis, stroke, and other anomalies of brain functions. Basilar artery is one of the main arteries that supply the posterior portion of brain, the area supplied by basilar artery is also called posterior cerebral circulation.[1,2] Basilar artery is formed by the union of the right and left vertebral arteries at the lower border of pons or mid-medullary level.[3] Then, it courses upward along. Basilar groove on the anterior surface of the pons and it ends at the upper border of pons by bifurcating into two posterior cerebral arteries. The posterior cerebral artery, branch of basilar artery, completes an arterial polygon called the "circle of Willis" which is the principal arterial anastomotic trunk of the brain. Normally little blood flows around this circle, if one major vessel occluded the communicating arteries may allow critically important anastomotic flow and prevent neurological damage.[4] The most frequent and severe atherosclerotic change occur in the upper and lower part of basilar artery and the first part of posterior cerebral artery. The proximal and mid-basilar arteries are the most common site of stenosis and most often cause infarction in the pons. Aneurysm of basilar artery and near the arterial circle and they can rapture or leak causing subarachnoid hemorrhage.[5] Basilar artery-related clinical condition such as post-circulation stroke, migraine, aneurysm, and atherosclerotic changes is very common.

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MATERIALS AND METHODS

Fifty cadaveric brain specimens preserved in formalin in the Anatomy Department of S. Nijalingappa Medical College, Bagalkot – 587101, Karnataka, were studied.

Inclusive Criteria

Intact arteries of circle of Willis with brain are selected for study.

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Exclusion Criteria

Damaged arteries of circle of Willis and damaged brain were excluded from the study.

Method

Brain was removed by dissection method following Cunningham practice manual volume III[rd]. Before dissection, every specimen was washed in running tap water. The coverings (dura, arachnoid, and piameter) were removed carefully and basilar artery and its branches were exposed to study. The length and diameter were measured by digital Vernier calipers. The terminal and beginning sites of basilar artery were visualized using magnifying hand glass. The length and diameter, variation in beginning, and terminal were noted.

Duration of study was June 2015–July 2018.

Statistical Analysis

Mean values and standard deviation of length and diameter of basilar artery variations in beginning and termination were studied with percentage; 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 basilar artery length mean with SD 28.82 (SD±3.62). Range was between 21.2 and 43.04, diameter mean with SD 3.42 (SD±0.78), range between 2.08 and 4.82

Table-2: Variations at the level of formation of basilar artery – 45 (90%) at pontomedullary junction, 3 (6%) above the pontomedullary junction, and 2 (4%) below the pontomedullary junction

Table-3: Variations at the level of termination of basilar artery – 43 (86%) at pontomesencephalic junction, 4 (8%) above the pontomesencephalic junction, and 3 (6%) below the pontomesencephalic junction.

Table-4: Present metrical study is compared with the previous studies.

DISCUSSION

The present morphometric study of basilar artery in North Karnataka population – mean length was 28.82 (SD±3.62), range was between 21.2 and 43.4, mean diameter was 3.42 (SD±0.78), range was between 2.08 and 4.82 [Table 1]. Variation at the level of formation of basilar artery was 45 (90%) at pontomedullary junction, 3 (6%) above the pontomedullary junction, and 2 (4%) below the pontomedullary junction [Table 2]. Variations at the level of termination were 43 (86%) at pontomesencephalic junction, 4 (8%) above the pontomesencephalic junction, 3 (6%) below the pontomesencephalic junction [Table 3]. These findings are more or less in agreement with the previous studies.[6-8]

The level of termination of basilar artery determines the type of approach to be made for the treatment of aneurysm of basilar apex and involvement of post-cerebral artery,

Table 1: Metrical study of basilar artery (total: 50)

Length	(mm)	Diameter	(mm)
Mean with SD	28.82 (±43.04)	Mean with SD	3.42 (±0.78)
Range	21.2–43.04	Range	2.08–4.82

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

Level of formation	No. of cadavers	Percentage (%)
At pontomedullary	45	90
Above the pontomedullary junction	3	06
Below the pontomedullary junction	2	04

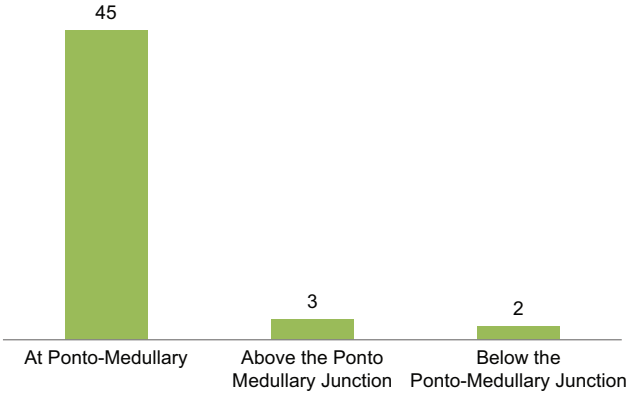

Table 3: Variations at the level of termination of basilar artery

Level of termination	No. of cadavers	Percentage
At pontomesencephalic junction	43	86
Above pontomesencephalic junction	4	08
Below pontomesencephalic junction	3	06

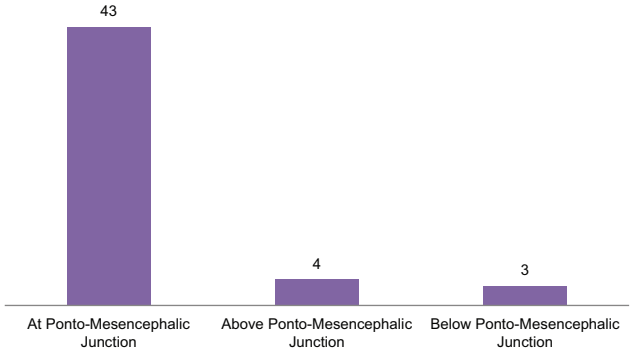

Table 4: Comparison of present metrical study of basilar artery with previous workers

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 (2007)	25	24–35	24.9	3–7	4.3
Padmavathi *et al.* (2011)	54	25–38	--	--	--
Mamtha *et al.*(2012)	20	25–37	28.5	--	--
Iqbal (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 *et al.*(2015)	60	20.1–42.7	27.7	2.05–4.45	3.36
Satapathy and Mohapatra (2021)	38	20.2–35.2	25.58	2–3.9	3.05
Present study (2021)	50	21.2–43.04	28.8	2.08–4.82	3.42

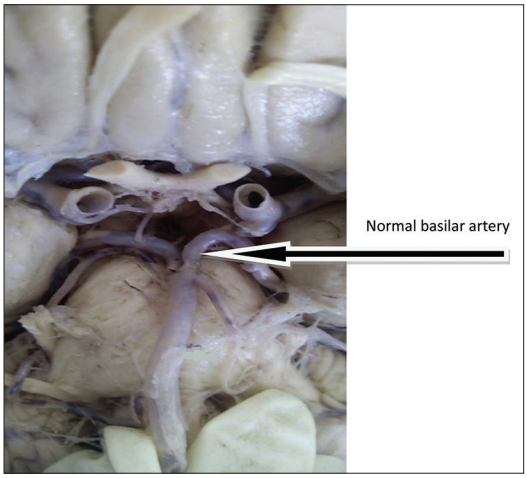

Figure 1: Normal basilar artery

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

so as to minimize or prevent the damages to the nearby important structures such as mammillary body and optic chiasma.

Anterior inferior cerebellar artery and auditory artery are very important branches of basilar artery and are more frequently involved in tumors such as acoustic neuromas, meningiomas at the cerebellopontine angle, vascular lesions such as arterial occlusions, aneurysms, and A-V malformations.

Internal auditory artery is an end artery supplying internal ear and nearby structures and may be damaged during operation done at the C-P angle disease of the internal ear, tumors of pyramid resulting in deafness.

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

It is reported that, in 11% of cases, a common trunk of origin of both post-cerebral artery and superior cerebral artery. Post-cerebral artery subserves the function of vision and many ocular functions such as papillary reflexes eye movements, visual memory, binocular, and visual spatial integration. It is commonly involved in malignant gliomas, astrocytomas, and cerebral angiomas.

Anastomosis of external carotid artery and post-cerebral artery is been successfully performed with a saphenous artery vein graft for the treatment of stenosis of basilar artery.[10] Trans-Sylvian pterion approach is suggested for the treatment of basilar apex aneurysms. Posterior communicating artery aneurysm may cause cranial nerves palsies especially 3rd cranial nerve resulting in Weber's syndrome clipping or ligation of the neck of aneurysm has been suggested for successful treatment.

CONCLUSION

The present morphometric cadaveric study of basilar artery is useful for neurophysician, radiologist, and neurosurgeon to diagnose and treat the cerebra vascular disease efficiently but this demands further embryological, genetic, nutritional, angiological, biomechanical, and pathophysiological studies because exact mechanism or causes of variations in the basilar artery are still unclear.

This research paper is approved by ethical committee of S. Nijalingappa Medical College, Bagalkot-587101, Karnataka.

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