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Study on Variant Pattern of Termination of Basilar Artery in Jharkhand Population

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Abstract:
Introduction: *Basilar artery is a single trunk, formed at the pontomedullary junction, by joining two vertebral arteries. It runs in the median groove of Pons, in the subarachnoid space. It ends by dividing into right and left posterior cerebral arteries, at the upper border of pons.Aneurysms are more common at the site of termination of basilar artery and may compress the oculomotor nerve. Incidence rate of basilar artery aneurysm depends upon pattern of termination of basilar artery as shown by various studies.*
Methods: *Study on variant pattern of termination of basilar artery was done by taking 13 human brains, obtained from the cadavers used in the routine educational dissection for undergraduate students in department of Anatomy for a period of 1 and 1/2 years from March 2015 to October 2016. Dissection was done as per the Cunnigham manual. Study on different pattern of termination of basilar artery was done by gross examination of the specimen.*
Results: *Type of termination is an important factor for aneurysm formation. Bifurcation into 2 PCA is the common type of termination, as found in different studies. Trifurcation, quadifurcation, pentafurcation and nonfurcation are uncommon.Bifurcation was present in 76.92% of cases, quadrifurcation in 15.38% of cases and pentafurcation in 7.69% of cases.*
Discussion: *Increase in the branching pattern at terminal point (iequadrifurcaton, pentafurcation) increases the chances of aneurysm formation (due to weakening of tunica media). Incidence rate of basilar artery aneurysm is 3-5% of all intracranial aneurysm. Studies shows that rupture rate of small aneurysm (<10mm) is 0.05% and that of large aneurysm (>25mm) is 6%.*

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I. Introduction

The basilar artery is the major artery of the posterior circulation of brain. It is formed by joining of two vertebral arteries at the level of pontomedullary junction. It runs in the shallow median groove present on the ventral surface of Pons. It terminates at the upper border of Pons by dividing into right and left posterior cerebral artery. Aneurysms are more common at the site of termination of basilar artery and may compress the oculomotor nerve. Incidence rate of basilar artery aneurysm is 3-5% of all intracranial aneurysm.[1]There are five types of termination: [2]

Bifurcation: This is the most common pattern, in which, basilar artery terminates into two posterior cerebral arteries.
Trifurcation: It includes termination into one superior cerebellar artery and two posterior cerebral areteries.
Quadrifurcation: Basilar artery dividing into two superior cerebellar arteries and two posterior cerebral areteries
Pentafurcation: Three superior cerebellar arteries and two posterior cerebral areteries arise from the same terminal point (one side superior cerebellar artery duplicated).
Nonfurcation: Direct continuation of basilar artery into single posterior cerebral artery, either right or left. There is aplasia of one of the single posterior cerebral artery.

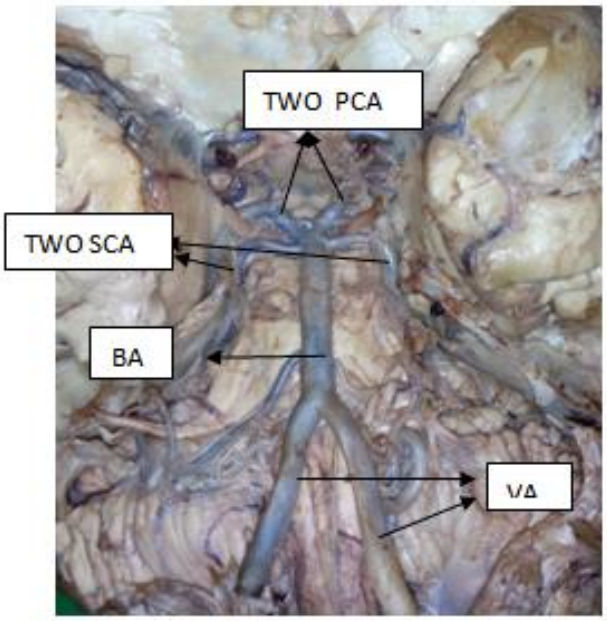


Fig-1 Showing normal variant of basilar artery.

- Terminate at the midbrain-pons junction.
- Type of termination: Bifurcation into 2 PCA.

II. Material and methods

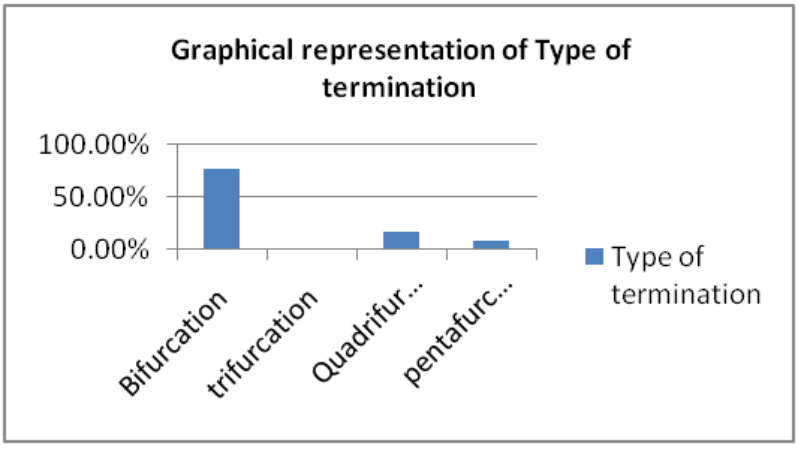
The present study entitled "study on variant pattern of termination of basilar artery in Jharkhand population" was carried out in department of Anatomy, RIMS, Ranchi by taking 13 human brains, obtained from the cadavers used in the routine educational dissection for undergraduate students in department of Anatomy for a period of 1 & 1/2 years from March 2015 to October 2016 .The brain was removed by dissection method mentioned in cunninghum manual of Practical Anatomy[3].The study was approved by scientific Review and ethical committee. . Study on different pattern of termination of basilar artery was done by gross examination of the specimen.

Inclusion criteria: Undamaged specimen of brain with intact circular arteriosus and basilar artery.

Exclusion criteria: Damaged circular arteriosus.

III. Results

The pattern of termination of basilar artery is very important because it influences the occurrence of aneurysm and atherosclerosis. There are five types of pattern are noted in literatures. In present study bifurcation was present in 76.92% of cases, quadrifurcation in 15.38% of cases and pentafurcation in 7.69% of cases.Trifurcation and nonfurcation was not seen in any specimen.



IV. Discussion

Ogengo et al (2012)[4] studied variations in termination of basilar artery in black Kenian population, in department of anatomy, university of Nairobi, kenya. They have taken 173 formalin fixed human brain. They have noted 4 types of pattern of termination.

Bifurcation: Most common pattern, found in 142 cases (82.1%). In this type, basilar artery terminates in two posterior cerebral arteries. In two cases of bifurcation posterior cerebral artery (PCA) and superior cerebellar artery (SCA) arises by common trunk. In one case there was right sided duplication of superior cerebellar artery.

Trifurcation: It includes termination into SCA and 2 PCA, in 4% of cases.

Quadrifurcation: It includes termination into 2 SCA and 2 PCA, present in 5.8% of cases.

Pentafurcation: Found in two cases .The right SCA immediately branched after origin giving a false impression of Pentafurcation.

SandhyaGunnal et al (2015)[2] conducted study "variability in basilar artery termination in human cadaveric brain" in rural medical college PIMS Loni. They had taken 170 formalin fixed human brains, for study and got following results.

Bifurcation: Basilar artery terminates in 2 PCA. This is the most common type of termination, found in 140 cases. In 3 cases PCA and SCA arises by common trunk.

Trifurcation: Basilar artery dividing into 2 PCA and 1 SCA, found in 5.29% of cases.

Quadrifurcation: basilar artery dividing into 2 PCA and 2 SCA. Found in 5.88% of cases.

Pentafurcation: 2 PCA and 3 SCA arising from the same terminal point (one side SCA duplicated), found in 3.52% of cases.

Nonfurcation: Direct continuation of basilar artery into single PCA, either right or left. There is aplasia of one of the PCA. Found in 3.52% of cases.

- In 3.52% of cases they got **aneurysm** at the site of termination.
- In two cases **fenestration** was present at the site of termination.

Bala et al (2014)[5] reported one case of trifurcation, where the SCA was arising from the P1 segment of the PCA, instead of the basilar artery on right side

These studies reveal that classical pattern of termination into 2 PCA, present only in 80% of cases. Variant pattern of termination influences the occurrence of aneurysm and atherosclerosis. These patterns are also important during surgery and intervention radiology; in order to avoid inadvertent ligation/section and misinterpretation. Aneurysm may vary from 2mm to 3cm in diameter, average 7.5cm.

Wiebers and colleagues reported zero risk of rupture of aneurysm in less than 10mm in diameter and risk of rupture 1.7% per year for aneurysm larger than 10mm.[1]

Table: 1showing different studies on variations in pattern of termination of basilar artery

Study	Bifurcation	Trifurcation	Qudrifurcation	Pentafurcation	nonfurcation
Present study	76.92%	0%	15.38%	7.69%	0%
Ogengoetal	82.1%	4%	5.8%	1.15%	0%
Gunnaletal	82.3%	5.23%	5.88%	3.52%	3.52%

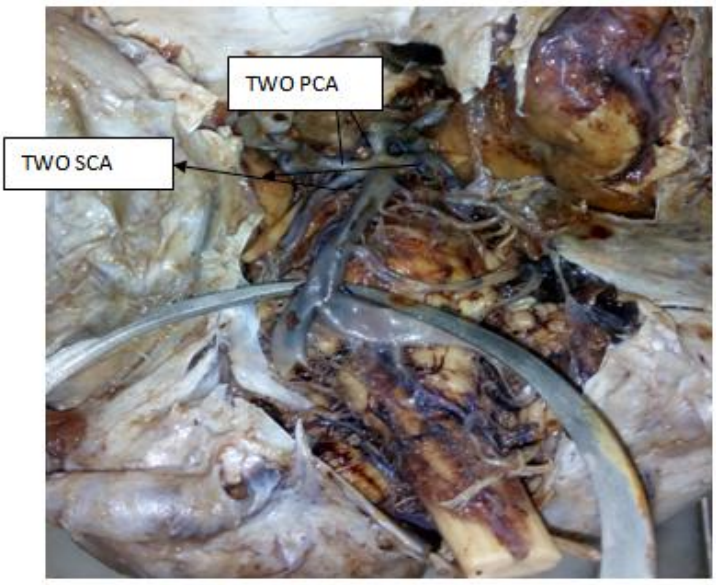


Fig 2 showing the formation, course and termination of basilar artery

- Type of termination: Qudrifurcation: 2PCA+2SCA, above midbrain-pons junction.
- Terminal point dilated

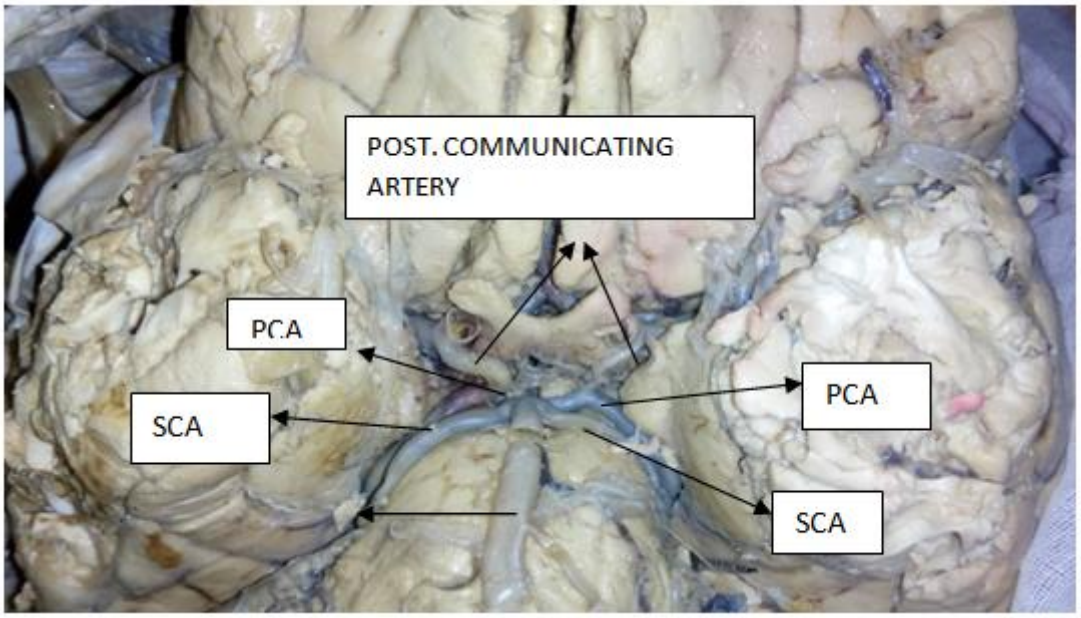


Figure 3: showing termination of basilar artery.

- Right posterior cerebral artery is fetal type i.e. diameter of right posterior communicating artery is greater than P1 segment of posterior cerebral artery.
- Type of termination is quadrifurcation i.e. into 2PCA and 2SCA.

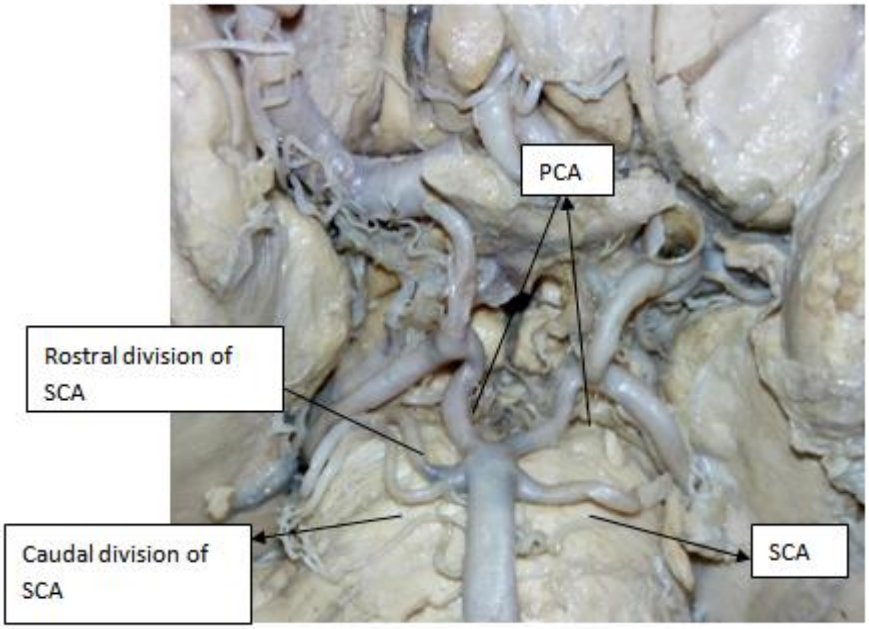


Figure 4: showing the pentafurcation of basilar artery.

- Right SCA divides soon into rostral and caudal branches, which gives the appearance of pentafurcation.

V. Conclusion

Type of termination is an important factor for aneurysm formation. Bifurcation into 2 PCA is the common type of termination, as found in different studies. Trifurcation, quadifurcation, pentafurcation and nonfurcation are uncommon findings.

Increase branching pattern at terminal point (iequadrifurcaton, pentafurcation) increases the chances of aneurysm formation (due to weakening of tunica media).

Conflicts of interest: All authors have none to declare.

Abbreviations used:

VA: Vertebral artery.

BA: Basilar artery.

SCA: Superior cerebellar artery.

PCA: Posterior cerebral artery.

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