Section: Anatomy

Original Research Article

MORPHOLOGICAL ANALYSIS OF BASILAR ARTERY AND IT'S VARIATIONS

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ABSTRACT

Background: The basilar artery plays a crucial role in the posterior component of the circle of Willis, supplying blood to the posterior cranial fossa. The present study was undertaken for morphological analysis of basilar artery and it's variations. **Materials and Methods:** A total of 25 male cadavers and 25 female cadavers were enrolled in the present study. Complete details of the cadavers were obtained from their Performa. A thorough dissection of the cadavers was performed, following standard dissection manual procedures to remove the brains. Measurements of the basilar artery (BA) were taken using vernier calipers with a precision of 0.1mm, recording: Length of BA and Diameter of BA. Additionally, the angle of formation of the BA was measured using a protractor. The following details were also documented: Level of BA formation and termination. All the results were subjected to analysis using SPSS software. **Result:** A total of 50 cadavers were evaluated. Level of formation of basilar artery was at pontomedullary junction, above pontomedullary junction and below pontomedullary junction in 82 percent, 14 percent and 4 percent of the cadavers respectively. Level of termination of basilar artery was at Ponto-mesencephalic junction, above Ponto-mesencephalic junction and below Ponto-mesencephalic junction in 80 percent, 12 percent and 8 percent of the cadavers respectively. **Conclusion:** The basilar artery is formed by the union of right and left vertebral arteries at the junction of medulla with pons. After its formation it runs in the basilar sulcus to the upper border of pons. Knowledge of vascular variations will increase the success of the surgical procedures and radiological procedures used in the treatment of vertebro -basilar cerebrovascular pathology.

INTRODUCTION

The basilar artery plays a crucial role in the posterior component of the circle of Willis, supplying blood to the posterior cranial fossa. Formed by the fusion of the two vertebral arteries, it ascends along the pons and provides arterial supply to vital structures, including the brainstem, cerebellum, and posterior cerebral arteries. Dysfunction or pathology of the basilar artery can lead to a range of clinical manifestations, including altered consciousness, cranial nerve deficits, cerebellar dysfunction, and motor and sensory impairments.[1,2]

Variations in the basilar artery's distribution have been documented, including persistent carotid-basilar artery anastomoses. These anomalies occur in less than 0.5% of cases, according to cadaveric studies. The most common types of these anastomoses are: Persistent trigeminal artery, Persistent hypoglossal artery, Persistent primitive optic artery and Persistent primitive pro-atlantal intersegmental artery. These variations are rare but important to recognize in neuroanatomical and clinical contexts.[3-5] Vertebral artery injury is a rare but potentially catastrophic complication of spinal surgery. To avoid damaging the vertebrobasilar system, extreme caution is necessary, as bleeding can be severe and uncontrollable. Vertebral artery injury can result in permanent neurological damage or death in up to 10% of cases.[6]

To manage bleeding, tamponade is often sufficient, but endovascular embolization may be necessary to treat pseudoaneurysms. Given the relatively high prevalence of vertebral artery variants, preoperative imaging with computed tomography angiography (CTA) is recommended: When a variant artery is suspected and in cases of traumatic cervical spine subluxations. This allows for better planning and minimizes the risk of vertebral artery injury during surgery.[6] Hence; the present study was undertaken

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for morphological analysis of basilar artery and it's variations.

MATERIALS AND METHODS

A total of 25 male cadavers and 25 female cadavers were enrolled in the present study. Complete details of the cadavers were obtained from their Performa. A thorough dissection of the cadavers was performed, following standard dissection manual procedures to remove the brains. To prepare the brains for examination, excess preservatives were rinsed off with water. To preserve the delicate blood vessels, the arachnoid mater was carefully and gently removed from the base of the brain. Measurements of the basilar artery (BA) were taken using vernier calipers with a precision of 0.1mm, recording: Length of BA and Diameter of BA. Additionally, the angle of formation of the BA was measured using a protractor. The following details were also documented: Level of BA formation and termination. All the results were subjected to analysis using SPSS software.

RESULTS

A total of 50 cadavers were evaluated. The level of formation of basilar artery was at pontomedullary junction, above pontomedullary junction and below pontomedullary junction in 82 percent, 14 percent and 4 percent of the cadavers respectively. The level of termination of basilar artery was at Ponto-mesencephalic junction, above Ponto-mesencephalic junction and below Ponto-mesencephalic junction in 80 percent, 12 percent and 8 percent of the cadavers respectively.

Table 1: Variation in the level of formation of basilar artery

Level of formation	Number	Percentage
At pontomedullary junction	41	82
Above pontomedullary junction	7	14
Below pontomedullary junction	2	4
Total	50	100

Table 2: Variation in the level of termination of basilar artery

Level of termination	Number	Percentage
At Ponto-mesencephalic junction	40	80
Above Ponto-mesencephalic junction	6	12
Below Ponto-mesencephalic junction	4	8
Total	50	100

DISCUSSION

The basilar artery is formed by the fusion of the right and left vertebral arteries at the pons' inferior margin. It then divides into the right and left posterior cerebral arteries (PCAs). The basilar artery's branches include: Anterior inferior cerebellar arteries (AICAs), Superior cerebellar artery (SCA), Labyrinthine arteries and Peri-median and pontine branches The PCA is divided into three angiographic segments: Origin to posterior communicating artery, Posterior communicating artery to midbrain's posterior aspect and Midbrain's posterior aspect to arteries supplying temporal, parietal, and occipital lobes. It's worth noting that there's significant variability in the anatomy of these arteries.[7-9] Hence; the present study was undertaken for morphological analysis of basilar artery and it's variations.

A total of 50 cadavers were evaluated. Level of formation of basilar artery was at pontomedullary junction, above pontomedullary junction and below pontomedullary junction in 82 percent, 14 percent and 4 percent of the cadavers respectively. The level of termination of basilar artery was at Ponto-mesencephalic junction, above Ponto-mesencephalic junction and below Ponto-mesencephalic junction in 80 percent, 12 percent and 8 percent of the cadavers respectively.

Kumar APV assessed variation in the anatomy of basilar artery in local population. The average length of BA is 26.7 mm (with the range of 17.4 mm to 45mm) and the mean diameter is 3.8 mm (with the range of 2.1mm to 5.2 mm). The mean angle of formation is 58.6° (with the range between 45° to 70°). In 80% of the specimens the level of formation is normal i.e. at the pontomedullary junction. The position of termination is normal in 75% of specimens i.e. at the pons midbrain junction.[9] Satapathy BC et al provided a baseline database regarding length, mid-length diameter, level of origin, and level of termination of BA. Thirty-eight formalin-fixed brains were obtained from cadavers dissected for undergraduate studies. The external length and the average external diameter of BA were measured by a digital Vernier caliper. Variation in origin and termination of BA was noted using magnifying glass. The length and diameter of the BA were 25.58 ± 3.57 mm and 3.05 ± 0.41 mm, respectively. The origin and termination of BA was normal in most cases.

In two cases, the origin was above the pontomedullary junction, and in one case, it was below. In two cases, the termination was above the pontomesencephalic junction, and in one case, it was below. There was no gender predisposition in length and diameter of the basilar artery. The baseline data established in this study regarding length, diameter, level of origin and level of termination of basilar artery will help neurosurgeons and interventional radiologists to diagnose as well as plan and execute

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various vascular procedures such as shunting for the treatment of aneurysms and stenosis in the blood vessels of the posterior cranial fossa.[10] Mamatha H et al performed a study on 20 brain specimens used for routine dissections at the Anatomy Department, Kasturba Medical College, in order to examine the morphology of BAs in the brain. In most specimens, the position of the termination of BA was normal, although variations were present in the mode of termination. In one specimen, the BA is terminated by dividing into two superior cerebellar arteries. The posterior cerebral arteries (PCAs) arose from ICAs on both sides in this specimen, and a communicating branch was present between the terminal point of the BA and PCA on the left. In another specimen, unilateral variation was seen, with the PCA arising from the ICA on the right and a posterior communicating artery arising from the PCA, connecting it with the BA. The anatomy on the left side was normal. They highlighted the morphological aspects of the BA, the knowledge of which would help neurosurgeons safely diagnose, as well as plan and execute vascular bypass and shunting procedures for the treatment of stenosis, aneurysms and arteriovenous malformations in the posterior cranial fossa.[11]

CONCLUSION

The basilar artery is formed by the union of right and left vertebral arteries at the junction of medulla with pons. After its formation it runs in the basilar sulcus to the upper border of pons. Knowledge of vascular variations will increase the success of the surgical procedures and radiological procedures used in the treatment of vertebro -basilar cerebrovascular pathology.

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