

## MORPHOLOGICAL AND MORPHOMETRICAL ANALYSIS OF THE VERMIAN FOSSA IN DRY ADULT SKULLS OF WESTERN UTTAR PRADESH POPULATION: AN OSTEOLOGICAL STUDY

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### ABSTRACT

**Aim:** The internal occipital crest (IOC) occasionally diverges at the lower end around the foramen magnum, giving rise to roughly triangular shaped vermian fossa. Variations occur in the vermian fossa in the form of shape and size. There is paucity of such study in the available literature, hence the present study was undertaken to evaluate the incidence, morphology and morphometry of the VF in the adult population of Western Uttar Pradesh.

**Material and method:** Adult human 30 cranial bases (vault removed) and 25 occipital bones of both the sexes, which were obtained from the osteology section of department of anatomy in LLRM Medical College, Meerut (UP), formed the basis for this study. The fossa were macroscopically examined and classified into Type 1 (triangular shape), Type 2 (quadrangular shape), and Type 3 or atypical type (fossa shape was other than the above said).

**Result:** Out of the 55 specimens the VF was observed in 40(72.7%) specimens, and was found absent in the remaining 15(27.2%) specimens. The VF was triangular shaped in 29(72.5%) specimens and quadrangular in 4(10.0%) specimens. In 7(17.5%) specimens it was having unusual morphology and considered as atypical. Among the atypical types, two specimens were having deep fossa, one was having partitioned VF, and four of them had widened VF. The average length and width of the fossa were 14.2 mm and 12.1 mm respectively.

**Conclusion:** The incidence is higher in our study as compared to the previous studies and it might be because of racial variations. Accurate knowledge of the variability of the human morphology and morphometry improves the diagnosis and therapeutic performance and also helpful in the study of the diseases that cause alterations of size and morphology of inferior vermis of cerebellum and clinician who operates intracranially or interprets radiological imaging. Hence this study is enlightening for the neuroanatomists and morphologists.

**KEYWORDS:** Internal occipital crest, Vermian fossa, Morphology, Morphometry, Foramen magnum.

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### INTRODUCTION

Vermian fossa (VF) or the middle cerebellar fossa of Verga [1] is a small depression which is situated at the lower part of the internal occipital crest on the dorsal aspect of the foramen magnum. The internal occipital crest

(IOC) occasionally diverges at the lower end around the foramen magnum, giving rise to roughly triangular shaped VF. The inferior vermis of the cerebellum lies over it [2]. Variations occur in the VF in the form of shape and size. There is paucity of such study in the available

literature, hence the present study was undertaken to evaluate the incidence, morphology and morphometry of the VF in the adult population of Western Uttar Pradesh.

**MATERIALS AND METHODS**

Adult human 30 cranial bases (vault removed) and 25 occipital bones formed the basis for this study, which were obtained from the osteology section of department of anatomy in LLRM Medical College, Meerut (UP). The skulls and occipital bones which were broken or showed pathological changes were excluded from the present study. The interior of the posterior cranial fossa were carefully examined for the presence of the VF. The fossa were macroscopically examined and classified into Type1 (triangular shape), Type 2 (quadrangular shape), and Type 3 or atypical type (fossa shape was other than the above said). Digital vernier calliper was used to measure the length and width of these fossa.

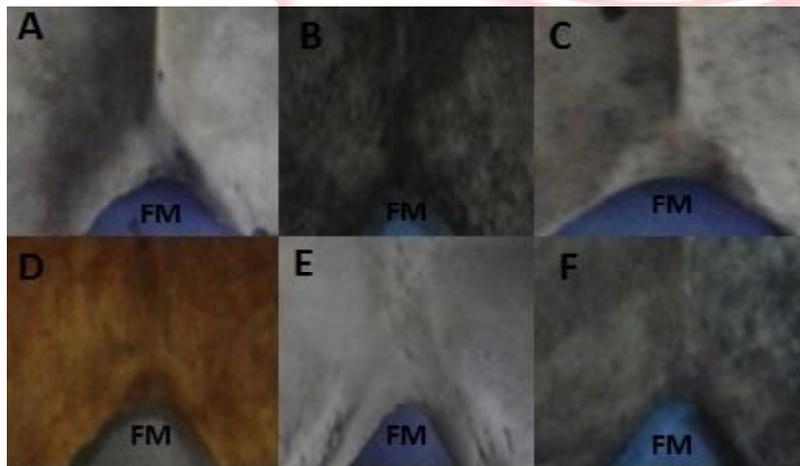
**OBSERVATIONS**

Out of the 55 specimens the VF was observed in 40(72.7%) specimens, and was found absent in the remaining 15 (27.2%) specimens (Figure 1F). The morphological distribution of VF of the present study is represented in Figure1.

The VF was triangular shaped (Type 1) in 29 (72.5%) specimens (Fig. 1A) and quadrangular (Type 2) in 4 (10.0%) specimens (Fig. 1B). In 7 (17.5%) specimens it was having unusual morphology and considered as atypical (Type 3). Among the atypical types, two specimens were having deepened fossa at the lower part (Fig. 1C), one was having partitioned VF (Fig. 1D), four of them had widened VF (Fig. 1E). The average length and width of the fossa were 14.2 mm and 12.1 mm respectively.

**DISCUSSION**

In the interior of the posterior cranial fossa a prominent internal occipital crest descends from the internal occipital protuberance and bifurcates near the foramen magnum forming the VF, the IOC provides attachment to the falx cerebelli [3], however Lang et al [4] contradicts it stating that the midline located falx cerebelli, may divided inferiorly to create a V shaped space called as the VF. This fossa lodges the inferior cerebellar vermis, which include tuber, pyramid, uvula and nodule [3]. A fairly well marked VF is found in animals like lemur and marmoset [5]. In the available literature the incidence of VF has been reported to be in the range of 4%-11.4% [6,7,8] which is very low in



**Fig. 1:** Morphological variations of VF.  
 A. Triangular (type 1), B. Quadrangular (type 2), C. Atypical (type 3, deep), D. Atypical (type 3, partition), E. Atypical (type 3, widened), F. Absent VF.  
 (VF – Vermian fossa, FM – foramen magnum)

**Table1:** comparative chart of morphological and morphometric variations of vermian fossa.

S. NO	Author	Incidence	Type1	Type2	Type3	Length	Width
1	Cireli et al(1990)	11.40%	-	2.40%	-	-	-
2	Berge et al(2001)	4.00%	-	-	-	-	-
3	Kale et al(2008)	8.22%	53.80%	30.80%	15.40%	27.8mm	18.4mm
4	Murlimanju et al(2010)	71.40%	76.00%	8.00%	16.00%	13.6mm	11.9mm
5	Present study (2014)	72.70%	72.50%	10.00%	17.50%	14.2mm	12.1mm

comparison to our study (72.7%), but it justifies the study by Murlimanju et al [9] who has reported an incidence of 71.4%. Kale et al [7] made the morphological classification of the fossa into: Type 1 (triangular), Type 2 (quadrangular) and the shapes other than these were termed as Type 3(atypical). In the present study, we observed the entirely different morphology. The incidence from our study was higher than the previous reports [6,7,8] but close to the percentage reported by Murlimanju [9]. Few authors [8,10] have named the quadrangular shaped VF as fossa occipitalis mediana. They opined that the only difference between a VF and fossa occipitalis mediana is the deepness of the fossa. The depth of the VF can provide clue about the shape of inferior cerebellar vermis. In the present study, the average length and width of the fossa were 14.2 mm and 12.1 mm respectively, which is similar to study by Murlimanju et al [9] but contradicts the study by Kale et al [7]. The present study was compared with the studies available in the literature and the same has been represented in the Table 1. We feel that this difference might be due to difference in racial and geographical distribution.

## CONCLUSION

Since the details about this bony landmark are very scarce in the literature, we believe that the present study may provide some important anatomical data. The incidence is higher in our study as compared to the previous studies and it might be because of racial variations. Accurate knowledge of the variability of the human morphology and morphometry improves the diagnosis and therapeutic performance [11]. Data like this could be of value in study of diseases that cause alterations of size and morphology of inferior vermis of cerebellum. Some studies have stressed the necessity for quantitative morphometric analysis in the study of diseases of the posterior cranial fossa [12]. The clinician who operates intracranially or interprets radiological imaging should be aware of the anatomical variations found within the posterior cranial fossa<sup>13</sup>. Hence this study is enlightening for the neuroanatomists and morphologists

**Conflicts of Interests: None**

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