

MORPHOLOGICAL ANALYSIS AND MORPHOMETRY OF THE VERMIAN FOSSA IN DRY SKULLS

Pushpalatha M¹, Sharmadha K. L²

¹Professor, Department of Anatomy, Bangalore Medical College and Research Institute, Bangalore.

²Tutor, Department of Anatomy, Bangalore Medical College and Research Institute, Bangalore.

ABSTRACT

INTRODUCTION

Objective was to find incidents of vermian fossa in of skull in Indian population and to study its morphology and morphometrics.

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INTRODUCTION: Vermian fossa (VF) is a small depression at the lower part of the internal occipital crest, over which lies the inferior vermis of the cerebellum (Poddar and Bhagath, 2007).¹ It was reported that this fossa is of varying size and found occasionally on the dorsal aspect of the foramen magnum, has been otherwise called as the middle cerebellar fossa of Verga (Bergman et al., 1988).² It is bounded by the limbs of the internal occipital crest or ridge, which diverge around the foramen magnum giving the fossa a somewhat triangular shape. It may be divided into upper and lower parts by a ridge of bone (Bergman et al., 1988).² Kale et al. (2008)³ did the detailed evaluation of this structure in Turkish population and reported that this VF is seen in 8.22% of the cases. They studied the morphology and morphometry of VF from 158 dry bones. Berge and Bergman (2001)⁴ reported the frequency of VF as 4 % and Kale et al. (2008)³, has described that Cireli et al. had reported the frequency of VF as 11.4 %. Other than these few reports the details of VF are not available. In the present study, objectives were to find the incidence of VF in Indian population and to study its morphology and morphometry.

MATERIAL AND METHODS: The study included 20 cranial bases (vault removed) and 15 occipital bones, which were obtained from the human neuroanatomy laboratory of our institution. The inner aspects of the posterior cranial fossa were examined for the presence of the VF. The skulls and occipital bones which were found broken were excluded from the present study. The fossae were macroscopically classified as triangular (type 1) and quadrangular shapes (type 2). The fossae which were other than these shapes were included under atypical type (type 3). The length and width of these fossa were determined with the digital Vernier calliper. The data were represented as Mean±SD.

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Corresponding Author:

Dr. Pushpalatha M,
#286/5, Shriram Nivas, 11th Main,
Revenue Layout, Padmanaba Nagar, Bangalore-70.
E-mail: dr.pushpalathaaniil@yahoo.in

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RESULTS: The VF was observed in 25 specimens (71.4%) and was found absent (Figure 2F) in the remaining 10 skulls. The morphological distribution of VF of the present study is represented in Figure. 1. The VF was triangular shaped (type 1, Fig. 2A) in 19 specimens (76%) and quadrangular (type 2, Fig. 2B) in 2 (8%). In 4 (16%) specimens it was having unusual morphology and considered as atypical (type 3). Among the atypical types, one specimen was having deepened fossa at the lower part (Fig. 2C), one was having partitioned VF (Fig. 2D), two of them had widened VF (Fig. 2E). The mean length and width of the fossa were 13.6±4.4 mms and 11.9±3.3 mms respectively.

DISCUSSION: The internal surface of the squamous part of the occipital bone is divided into four deep compartments by an irregular internal occipital protuberance and by ridged sagittal and horizontal extensions from it. The two superior fossae are adapted to the occipital poles of the cerebral hemispheres; the inferior fossae are shaped to accommodate the cerebellar hemispheres. A prominent internal occipital crest descends from the protuberance and bifurcates near the foramen magnum, providing an attachment for the falx cerebelli (Standring, 2005)⁵. It was reported that this internal occipital crest may split to form the so called VF. In contrast, Lang (1991) describes that there is usually only one midline located falx cerebelli, which may be divided inferiorly to create a V shaped space called as the VF. This fossa lodges the inferior cerebellar vermis, which include tuber, pyramis, uvula and nodule (Standring, 2005)⁵. In contrast, Black (1916)⁶ has opined that the vermis is not normally in contact with the occipital bone. But most of the authors emphasized that this fossa lodges the inferior part of the vermis. East (1926)⁷ reported that, a fairly well marked VF was found in animals like lemur and marmoset, but in the macaque monkey and Cercopithecus, it was absent. Kale et al. (2008)³ identified 13 VF's, 10 out of 129 occipital bones and 3 out of 29 basicraniums, of totally 158 Turkish bones and reported the incidence of 8.22 %. For the first time in the literature, they classified the fossa into two types, type 1 (triangular), type 2 (quadrangular) and the shapes other than these they termed as atypical. In

their study, the type 1 and type 2 were observed in 7 and 4 cases, respectively. The remaining two were considered as atypical, the first atypical VF looked like a triangle but had a deeper fossa and in the other atypical case, the lateral borders were getting far away from each other. In the present study, we observed the entirely different morphology. The incidence from our study was higher than the previous reports. We feel that this difference might be because racial variations seemed to exist. In the present study, the triangular shape was observed in 19 specimens (76%), quadrangular in 2 (8%). The remaining 4 (16%) specimens were considered as atypical (type 3). Among them 2 had widened fossa, 1 had deeper fossa and the other was showing the clear partition in the lower part. The present study from Indian skulls was compared with the Turkish study by Kale et al. (2008)³ and the same is represented in Table 1.

Kale et al. (2008)³ reported that, few authors 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 depth of the fossa. It was explained that the depth of the VF can provide clue about the shape of inferior cerebellar vermis. In the present study, the mean length and width of the fossa were 13.6±4.4 mms and 11.9±3.3 mms respectively. This is different from Kale et al. (2008)³, in their study the average height and width of the VF's were found as 27.8 mm and 18.4 mm respectively. We believe that the normative data like this could be of value in study of diseases that cause alterations in size and morphology of VF. Some studies have stressed the necessity for quantitative morphometric analysis in the study of diseases of the posterior cranial fossa (Hashimoto et al., 1993).⁸

It was reported that, advancement in medicine needs a more accurate knowledge of the variation of the human morphology to improve diagnosis and therapeutic performance (Sanudo et al., 2003).⁹ The clinician who operates intracranially or interprets radiological imaging should be aware of the anatomical variations found within the posterior cranial fossa (Shoja et al., 2006).¹⁰

CONCLUSIONS: 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 study has recorded the incidence of VF as 71.4% in Indian population. This incidence is higher compared to the previous studies and it might be because of racial variations. The triangular shaped morphology was observed in majority of specimens. We believe that these data are of importance in neurosurgical literature. The study is also enlightening for the neuroanatomists and morphologists.

	Kale et al. (2008) ³	Present study (2010)
Vermian Fossa	Turkish	Indian
Incidence	8.22%	71.40%
Type 1 (triangular)	53.80%	76%
Type 2 (quadrangular)	30.80%	8%
Type 3 (atypical)	15.40%	16%
Average length	27.8 mm	13.6 mm
Average width	18.4 mm	11.9 mm

Table 1: Morphological and morphometric comparison of Vermian fossa with data from literature

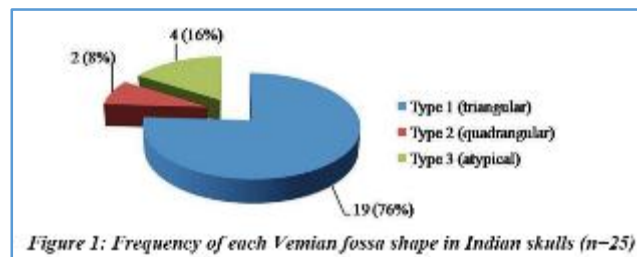


Figure 1: Frequency of each Vermian fossa shape in Indian skulls (n=25)

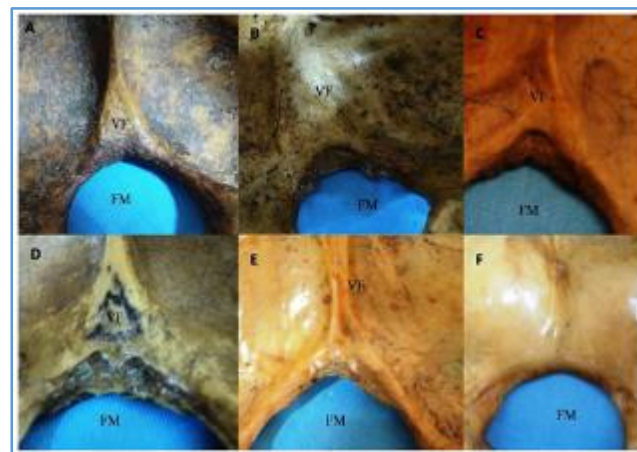


Figure 2: Morphological types of Vermian fossa (source of classification – Kale A et al., 2008), A. triangular shape (type 1), B. quadrangular shape (type 2), C. atypical, deep (type 3), D. atypical, partition (type 3), E. atypical, widened (type 3), F. absent Vermian fossa. (VF – Vermian fossa, FM – foramen magnum)

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