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Original Article

Anatomy Section

Morphology of Vermian Fossa in South Indian Human Adult Skull Bones

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ABSTRACT

Introduction: The Vermian Fossa (VF), or middle cerebellar fossa of Verga, is a shallow depression found in the lower part of the internal occipital crest and, above it is the inferior part of the vermis of the cerebellum. The fossa is found occasionally on the dorsal aspect of the foramen magnum and it could be divided into an upper and lower part by a bony ridge of varying size.

Aim: The present study has been attempted to analyse the morphological, morphometrical and incidence of vermian fossa in 50 dry skulls of South Indian adults.

Materials and Methods: The study was conducted on 50 dry adult human skulls comprising of 32 cranial bases (with vault removed) and 18 occipital bones. The fossae were macroscopically classified as triangular (Type 1), quadrangular (Type 2) and atypical (Type 3).

Results: Incidence of VF in the present study was 72%. The VF was identified in 36 skulls, 26 cranial base and 10 occipital bones, and was found absent in the remaining 14 skulls. Type 1 (triangular) VF was present in 29(80.56%) cases and vermian fossa of Type 2 (Quadrangular) was present in four cases (11.11%). Atypical or Type 3 cases were found in three cases (8.33%). The mean length and width of the fossae were 14.6 ± 4.1 mm and 12.6 ± 3.1 mm respectively.

Conclusion: By having an accurate knowledge of the variability of the human skulls morphology and morphometry we can augment the diagnosis and therapeutic performance.

Keywords: Cranial base, Foramen magnum, Fossa of Verga, Inferior vermis, Morphometry

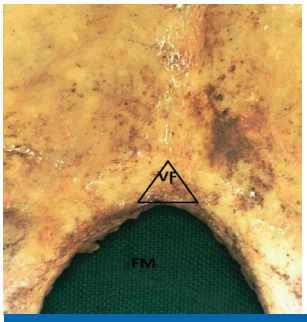
INTRODUCTION

In the inner surface of the occipital squama, there is an elevation named the internal occipital protuberance, and from it a prominent median crest, the internal occipital crest, descends to foramen magnum which forms an attachment for the falx cerebelli [1,2]. Occasionally, the internal occipital crest splits into two to enclose a shallow, triangular depression of variable size, the VF just above the foramen magnum. The inferior vermis of the cerebellum is lodged in the VF [1-4]. The VF is also called middle cerebellar fossa of Verga [5]. VF is expected to be of varying sizes and shapes. It is bound by the lips of the internal occipital crest which diverge around the foramen magnum and thus gives the fossa a slightly triangular shape. The fossa could be partitioned into an upper and a lower part by a bony ridge [3]. Berge and Bergman have reported in their study the frequency of VF, as 4 % as the least incidence [5]. Cireli E et al., reported the maximum incidence of 80% [6]. The present study aimed to analyse the morphological, morphometrical and incidence of VF in 50 dry adult South Indian skulls.

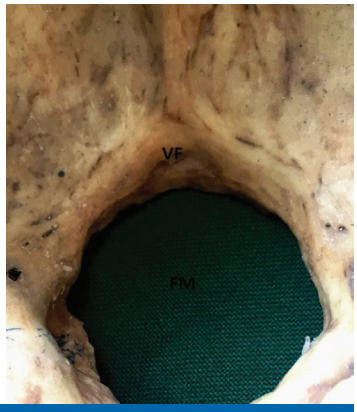
MATERIALS AND METHODS

The study was done in the Department of Anatomy of Sree Balaji Dental College, Chennai, India on 50 dry adult human skulls comprising 32 cranial bases (with vault removed) and 18 occipital bones. It was a cross-sectional study done during the period from May 2016 to July 2016. Damaged skulls and occipital bones were excluded from the study. The inner aspect of the cranial fossa posterior to the foramen magnum was examined for the presence of VF. These skulls were scrutinized and the shape and variation of VF were studied and photographed. The shapes of the VF determined were macroscopically classified as triangular- Type 1 [Table/Fig-1], quadrangular- Type [Table/Fig-2], and atypical- Type 3 [Table/Fig-3], comprised other than triangular or quadrangular. The VF was found to be absent in some skulls [Table/Fig-4].

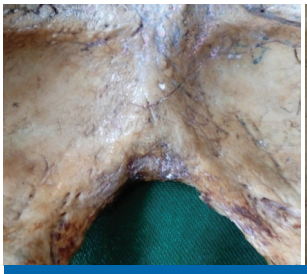
The length and width of the VF were determined with a digital Vernier caliper. The length of the fossa was measured from the superior end to the inferior part and the breadth as measured at the place where it seemed to be of maximum width.



[Table/Fig-1]: Triangular shape (Type 1) (left).
[Table/Fig-2]: Quadrangular shape (Type 2) (right).



[Table/Fig-3]: Atypical (Type 3) (left).
[Table/Fig-4]: Vermian fossa absent (right).
*Note: VF=Vermian Fossa; FM=Foramen Magnum



[Table/Fig-5]: Quadrangular with a ridge (left).
[Table/Fig-6]: Quadrangular shape with a groove (right).

STATISTICAL ANALYSIS

The data was tabulated and statistically represented as mean±Standard Deviation (SD).

RESULTS

The VF was identified in 36 skulls, 26 cranial base and 10 occipital bones, and was found absent in the remaining 14 specimen. Type 1 (triangular) VF present in 29 (80.56%) cases and VF of Type 2 (Quadrangular) was present in four cases (11.11%). Atypical or Type 3 cases were found in three cases (8.33%). Among the quadrangular type, one specimen showed the presence of a groove within the VF. Another specimen had ridges which separates the fossa [Table/Fig-1-6]. The mean length and width of the fossae were 14.6 ± 4.1 mm and 12.6 ± 3.1 mm respectively. Incidence of VF in the present study was 72%.

Descending from the internal occipital protuberance to the foramen magnum where it divides into two, the internal occipital crest gives attachment to the falx cerebelli.

DISCUSSION

The shallow fossa of varying size on dorsal aspect of foramen magnum named the VF is occupied by part of inferior vermis of cerebellum. The internal occipital crest descends from the internal occipital protuberance and divides into two halves near the foramen magnum, falx cerebelli is attached to the crest [7]. The VF is a small depression at the lower part of the internal occipital crest, over which the inferior part of the vermis of the cerebellum lies which is divided into the tuber, pyramid, uvula and nodule from the back forward.

The present study reported Type 1 (triangular) VF present in 29 (80.56%) cases and VF of Type 2 (Quadrangular) present in 4 cases (11.11%). Atypical or Type 3 was found in three cases (8.33%). Among the quadrangular type, one specimen showed the presence of a groove within the VF. Another specimen had ridges which separates the fossa. The mean length and width of the fossa were 14.6 ± 4.1 mm and 12.6 ± 3.1 mm respectively. Incidence of VF in the present study was 72%.

Berge and Bergman had reported the frequency of VF as 4% in their study, conducted on 100 skulls [3] Kale et al., reported 8.2% incidence of VF in Turkish skull. For the first time in the literature they made the morphological classification of the VF into Type 1 (triangular), Type 2 (quadrangular) and the shape other than these as Type 3 (atypical). They observed 3.84% Type 1, 30.76% Type 2 and remaining 15.38% as Type 3 [8].

Murlimanju BV et al., reported in his studies among Indian Skulls, 71.42% incidence of VF. They also observed among, 76% were of triangular shape and 8% were of quadrangular shape. Remaining 16% were classified as atypical [9].

Arvind Yadav et al., conducted similar research and found the VF in 72.7% specimen. The VF they observed was 72.5% triangular and 10% quadrangular and 17.5% atypical [10]. Ranjan RK et al., observed the fossa in 88 (80%) bones and its shape was triangular in 70.45% specimens, quadrangular in 7.95% specimen and atypical in 21.59% [11].

The incidence of VF in the present study was 72% which is similar to the previous studies in Indian population by Murlimanju BV et al., and Yadav A et al., but lower than what Ranjan RK et al., observed in 2015 [9-11].

In the present study the mean length and width of the fossae were 14.6 ± 4.1 mm and 12.6 ± 3.1 mm respectively which is comparable with the previous study in Indian population by Murlimanju BV et al., [9]. A comparative finding of VF between previous and present study is well shown in [Table/Fig-7].

Authors	Incidence	Population	Type 1	Type 2	Type 3	Height in (mm)	Width in (mm)
Berge & Bergman [3]	4%	Iowa,USA	0%	0%	0%		
Kale A et al., [8]	8.20%	North India	53.84%	30.76%	15.38%	27.80	18.40
Murlimanju et al., [9]	71.42%	Indian	76%	8%	16%	13.60	13.90
Arvind Yadav et al., [10]	72.70%	UP	72.50%	10%	17.50%	14.20	12.10
Ranjan R K et al., [11]	80%	Indian	70.45%	7.95%	21.59%	13.40	12.10
This Study	72%	South Indian	80.56%	11.11%	8.33%	14.60	12.60

[Table/Fig-7]: A comparison of incidence of vermian fossa among different studies.

These morphometric variations can be because of racial difference and it also may be influenced by smaller sample size. The anatomy of cerebellum, especially the vermis is of interest to many clinicians. It has been reported that some cases of cerebellar cortical dysplasia are associated with vermian malformation. According to Soto-Ares et al., MRI of one case of dysgenesis revealed that, global vermian hypoplasia was associated with marked cortical dysplasia [12]. In neurosurgery, the combined transventricular and supracerebellar infratentorial approach are practiced to remove the midline tumour of posterior fossa. This approach avoids unnecessary splitting of the vermis [13]. A more precise knowledge of the inconsistency of human morphology is important in medical science to improve the diagnosis and therapeutic performance [14]. An awareness of the anatomical variations which may be found in the posterior cranial fossa is imperative for the clinician who operates intracranially or interprets radiological imaging [15].The present study could be correlated by radiological and surgical data.

LIMITATION

The study was conducted only in a small sample and the observations was done by two individuals which may cause intraobservational variation which we overcame calculating the mean value.

CONCLUSION

We can augment the diagnosis and therapeutic performance by having an accurate knowledge of the variability of the human morphology and morphometry. Such data could be a valuable resource in the study of diseases that cause alterations of size and morphology of inferior vermis of cerebellum. Many recent studies have also underlined the critical importance in performing quantitative morphometric analysis in the study of diseases of the posterior cranial fossa. The surgeons and the radiologists should be aware of the variations of VF with respect to length and width and the classification of the fossa according to the shape which also can influence the shape of inferior cerebellar vermis. The present study might also help those who are involved with pathologies around the foramen magnum, like Arnold Chiari malformation. Hence, this study is enlightening for the neuroanatomists and morphologists.

ETHICAL CLEARENCE

Institutional Ethical Committee of Sree Balaji Dental College.

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