Section: Anatomy

Original Research Article

A MORPHOMETRICAL EVALUATION OF VERMIAN FOSSA AND INTERNAL OCCIPITAL CREST IN ADULT DRY HUMAN SKULLS AT A TERTIARY CARE CENTRE

Umeshkumar R Vasava[1], Jagdish Soni[2], Vandana B Vasava[3]

[1]Third Year Resident, Department of Anatomy, Parul Institute of Medical Sciences & Research, Parul University, Limda, Waghodia, Vadodara, Gujarat, India.
[2]Professor & Head, Department of Anatomy, Parul Institute of Medical Sciences & Research, Parul University, Limda, Waghodia, Vadodara, Gujarat, India.
[3]Second Year Resident, Department of Anatomy, Parul Institute of Medical Sciences & Research, Parul University, Limda, Waghodia, Vadodara, Gujarat, India.

Received : 19/02/2025
Received in revised form : 07/03/2025
Accepted : 30/03/2025

Keywords:
Vermian Fossa, Internal Occipital Crest.

Corresponding Author:
Dr. Umeshkumar R Vasava,
Email: drumeshkumar13@gmail.com

DOI: 10.47009/jamp.2025.7.3.54

Source of Support: Nil,
Conflict of Interest: None declared

Int J Acad Med Pharm
2025; 7 (3); 291-293

ABSTRACT

Background: The vermian fossa (also known as fossa vermiana; VF) is a small depression located along the midline of the internal surface of the squamous portion of the occipital bone. The present study was conducted for morphometrical evaluation of vermian fossa and internal occipital crest in adult dry human skulls at a tertiary care centre. **Materials and Methods:** This study evaluated 40 normal adult human cranial bases, examining- Vermian fossa: presence, shape, and dimensions, and - Internal occipital crest: shape and length. Data was recorded in Excel and analyzed statistically using SPSS software. **Result:** VF was present in 82.5 percent of the cases. Among these 33 cases, triangular, quadrangular and typical shapes were encountered in 90.91 percent, 3.03 percent and 6.06 percent of the cases respectively. Mean height and width of VF were 9.2 mm and 8.5 mm respectively. Mean length of internal occipital crest was 2.83 cm. Shape of internal occipital crest was sharp, rounded, wide and ill-defined in 55 percent, 40 percent, 2.5 percent and 2.5 percent of the patients respectively. **Conclusion:** VF is a minor indentation located at the lower section of the internal occipital crest on the dorsal side of the foramen magnum. A precise understanding of the variations in human morphology and morphometry enhances diagnostic accuracy and therapeutic effectiveness.

INTRODUCTION

The vermian fossa (also known as fossa vermiana; VF) is a small depression located along the midline of the internal surface of the squamous portion of the occipital bone. This fossa is found at the lower end of the internal occipital crest, close to the foramen magnum. At its inferior end, the internal occipital crest splits, providing an attachment point for the falx cerebelli. It is believed that the lower section of the cerebellar vermis fits between the attached edges of the falx cerebelli, which is the origin of the name "vermian fossa."[1]

In 1926, East linked an enlarged ventricular system to increased intracranial pressure caused by hydrocephaly in a four-month-old infant. These unusual associations regarding the ventricular system are largely overlooked in contemporary discussions, and references to it in standard anatomical literature are limited. Grays Anatomy (41st edition) suggests that the ventricular system "may exist," indicating its variability, which could explain the lack of detailed coverage in other anatomy texts. Nonetheless, it is crucial for anatomists and medical educators to possess comprehensive knowledge of all anatomical structures to enhance the quality of medical training. Additionally, in today's context of advanced radiological imaging, understanding skull structures is vital for diagnostic purposes. Berge and Bergman emphasized that familiarity with the dimensions and variations of skull structures can significantly assist in interpreting radiologic images, pointing out that the lack of critical anatomical information on normal variations is a significant shortcoming in modern anatomy textbooks. The ventricular system is one such structure that has received limited anatomical attention.[2-4] Hence; the present study was conducted for morphometrical evaluation of vermian fossa and internal occipital crest in adult dry human skulls at a tertiary care centre.

MATERIALS AND METHODS

The present study was conducted for assessing Vermian Fossa and Internal Occipital Crest in Adult Human Skulls. The research focused on the

ISSN (O): 2687-5365; ISSN (P): 2753-6556

evaluation of 40 normal, dry adult human cranial bases. Criteria for exclusion from the study included any skull or occipital bone damage. Additionally, bones exhibiting any type of anatomical or morphological pathological lesions were not included. The following parametric variables were assessed: - Vermian fossa: Presence (absent/present), Shape (triangular/quadrangular/atypical), and Dimensions. - Internal occipital crest: Shape (sharp/rounded/wide/ill-defined) and Length (measured from the internal occipital protuberance to the posterior margin of the foramen magnum). All findings were documented in a Microsoft Excel spreadsheet and analyzed statistically using SPSS software. Univariate analysis was done for evaluation of level of significance.

RESULTS

VF was present in 82.5 percent of the cases. Among these 33 cases, triangular, quadrangular and typical shapes were encountered in 90.91 percent, 3.03 percent and 6.06 percent of the cases respectively. Mean height and width of VF was 9.2 mm and 8.5 mm respectively. Mean length of internal occipital crest was 2.83 cm. Shape of internal occipital crest was sharp, rounded, wide and ill-defined in 55 percent, 40 percent, 2.5 percent and 2.5 percent of the patients respectively.

Table 1: Morphology occurrence and shape of VF

VF		Number	Percentage
Occurrence	Absent	7	17.5
	Present	33	82.5
Shape	Triangular	30	90.91
	Quadrangular	1	3.03
	Typical	2	6.06

Table 2: Dimensions of VF

Dimensions	Mean	SD
Height (mm)	9.2	0.5
Width (mm)	8.5	0.3

Table 3: Morphology of Internal occipital crest.

Shape of internal occipital crest	Number	Percentage
Sharp	22	55
Rounded	16	40
Wide	1	2.5
Ill-defined	1	2.5
Length (cm)	2.83	

DISCUSSION

On the inner surface of the occipital squama, there exists a raised area referred to as the internal occipital protuberance. From this point, a distinct median ridge known as the internal occipital crest extends downward toward the foramen magnum, serving as an attachment site for the falx cerebelli. In some cases, just above the foramen magnum, this crest may bifurcate, creating a shallow, triangular depression of varying dimensions called the vermian fossa, which accommodates a portion of the inferior vermis of the cerebellum. This fossa, located on the dorsal side of the foramen magnum, is also identified as the middle cerebellar fossa of Verga.[5-7] Hence; the present study was conducted for morphometrical evaluation of vermian fossa and internal occipital crest in adult dry human skulls at a tertiary care centre.

VF was present in 82.5 percent of the cases. Among these 33 cases, triangular, quadrangular and typical shapes were encountered in 90.91 percent, 3.03 percent and 6.06 percent of the cases respectively. Mean height and width of VF were 9.2 mm and 8.5 mm respectively. Mean length of internal occipital crest was 2.83 cm. Shape of internal occipital crest was sharp, rounded, wide and ill-defined in 55 percent, 40 percent, 2.5 percent and 2.5 percent of the patients respectively. Yadav A et al evaluated the incidence, morphology and morphometry of the VF in the adult population. Adult human 30 cranial bases (vault removed) and 25 occipital bones of both the sexes, which were obtained from the osteology section. The fossa was macroscopically examined and classified into Type1 (triangular shape), Type 2 (quadrangular shape), and Type 3or atypical type (fossa shape was other than the above said). 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. The incidence is higher in our study as compared to previous studies and it might be because of racial variations. Accurate knowledge of the variability of human morphology and

ISSN (O): 2687-5365; ISSN (P): 2753-6556

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.[8]

In a separate investigation by Murlimanju et al., the authors examined the occurrence of the "vermian fossa" in the skulls of the Indian population, focusing on its morphology and morphometry. The study analyzed 35 specimens, which included 20 cranial bases and 15 occipital bones. The inner surfaces of the posterior cranial fossa were scrutinized to identify the presence of the vermian fossa. The fossae were categorized macroscopically into three types: triangular (type 1), quadrangular (type 2), and atypical shapes that did not conform to the first two types (type 3). Measurements of the fossa's length and width were taken using a digital vernier caliper. The findings revealed that the fossa was present in 25 specimens, accounting for 71.4% of the total. Among these, 19 skulls (76%) exhibited a triangular shape, 2 (8%) were quadrangular, and 4 (16%) were classified as atypical (type 3). The average length and width of the fossa were recorded as 13.6 mm and 11.93 mm, respectively (± SD). The triangular form was predominant among the vermian fossae. The authors emphasized that understanding this bony landmark is crucial for neurosurgery and provides valuable insights for neuroanatomy and neuroradiology.[9] Luckrajh, Jeshika S et al investigated the incidence, morphology, and morphometry of the VF. A total of 100 dry, adult skulls of South African origin were analyzed to determine the morphological and morphometric parameters of the VF. The VF was found to be present in 62% of cases. The shape of the VF was classified as triangular (27%), quadrangular (8%), and atypical (27%). The average length of the VF was 13.78 mm, and the average width was 11.62 mm. The morphometric findings of this study correlate with that of previous studies; however, the incidence of atypical shaped VF (27%) is higher in comparison to previous studies (9.7%). The detailed anatomical description of the VF may aid in the study of diseases which cause alterations in the size and morphology of the vermis of the cerebellum as well as in transvermian approaches to tumors within the fourth ventricle.[10]

CONCLUSION

VF is a minor indentation located at the lower section of the internal occipital crest on the dorsal side of the foramen magnum. A precise understanding of the variations in human morphology and morphometry enhances diagnostic accuracy and therapeutic effectiveness.

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ISSN (O): 2687-5365; ISSN (P): 2753-6556