

# Occipital Emissary Foramen – A Morphometric Analysis

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**Abstract:** Aim: The objectives were to find the incidence and topography and to identify the types of the occipital emissary foramen in the human skulls. Materials and Methods Used: In the present study, 60 dried adult human skulls were examined. They were analyzed for the gross incidence and position of the occipital emissary foramen. The observations were made in the squamous part of the occipital bone from the posterior margin of the foramen magnum to the external occipital protuberance. Results: From our observations, the occipital emissary foramen was found in 14 skulls. Left-sided foramen was observed in 6 cases, Right-sided foramen was found in 5 cases and the median foramen is found in 3 cases but bilateral foramen is not found in any of the skulls. Conclusion: The occipital emissary foramen conducts the occipital emissary vein. This morphology is important to neurosurgeons and plastic surgeons. Its knowledge is of importance in sub-occipital craniotomies as this foramen transmits the occipital emissary vein and will keep awareness among the surgeons to avoid excessive bleeding.

**Keywords:** Emissary vein, Foramen, Sub-occipital, Squamous, Skull

## 1. Introduction

Many studies have described about various foramen in human skull in detail but the description of occipital emissary foramen is scarce in the literature. It is commonly known that morphological differences exist between the skulls of different race[1]. The foramina conducts occipital emissary vein which connect intra-cranial venous sinuses with extra cranial veins[2]. They are valveless and so blood flows in both the directions. In cases of intra cranial tension they become an important source of blood drainage. The developed occipital emissary vein is sometimes troublesome for haemostasis if injured in sub-occipital craniotomy [3].

## 2. Materials and Methods

In this study, 60 dried adult human skulls of unknown sex were examined. The skulls were analyzed for the gross incidence and position of the occipital emissary foramen. The patency of the foramen in each case was confirmed by passing a probe. The observations were made in the squamous part of the occipital bone from the posterior margin of the foramen magnum to the external occipital protuberance. The position and number of foramina were noted. The anatomical landmarks used in the study were:

- (1) External Occipital Crest (EOC);
- (2) External Occipital Protuberance (EOP);
- (3) posterior border of Foramen Magnum (FM).

## 3. Results

The occipital emissary foramen was present in 14 skulls (23.3%) out of a total of 60 skulls. Left-sided foramen was observed in 6 cases (10%), right-sided foramen was observed in 5 cases (8.33%) and median foramen was observed in 3 cases (5%) and no bilateral foramina were observed in any of the skulls. A pin has been passed through all foramen for patency. This foramen was not present in most of our specimens. The observations of this study were compared with those of other investigators. There are few differences and similarities

## 4. Discussion

Emissary foramina are a byproduct of selection of bipedalism by extant humans[4]. The evaluation of these foramina has become an important part of diagnostic medicine but the absence of essential anatomic data on these foramina is a severe deficiency of modern anatomy textbooks. The occipital emissary foramen is present in the squamous part of the occipital bone and transmits veins which connect the confluence of sinuses with veins of the sub-occipital venous plexus[5]. Premsagar et al. (1990) reported that the foramina is more common than found by Sharma and he observed it in 7 out of 338 of the specimens. Before that Sharma et al. (1986) reported a rare finding of a single occipital emissary foramen present in the squamous portions of the occipital bone in only one skull out of 214 studied by him [6].

This foramen was later studied by a few authors and the incidence rates reported. Wysocki et al. observed this foramen in 3% of their specimens. The overall prevalence of this foramen according to Louis et al. was 7% on right and 4% on the left side [7]. Gozil et al. (1995) studied the skulls from Central Anatolia and reported the incidence of this foramen as 2.6% and reported that the foramina were closer to the foramen magnum and not to the external occipital protuberance[8]. This foramen was also studied by Hossain et al.<sup>9</sup>(2001) and their observations from 150 dry Bangladeshi skulls reported the occipital emissary foramen in 21 (14%) skulls[9]. They observed left- and right-sided foramen in 7 (4.7%) and 10 (6.7%) cases respectively. They also observed the median foramen in 4 (2.7%) cases. The fact as revealed in the present study is that the occipital emissary vein is only present in a small percentage of cases. It was also demonstrated that its location is variable as to left, right or midline. The incidence and positions of the occipital emissary foramina are important for the neurosurgeons during sub-occipital craniotomies as these will transmit the occipital emissary veins and will provide awareness to avoid unnecessary blood loss during posterior fossa surgery. These veins may be a major problem in the sitting surgical position since they can cause air embolism when injured.

S.no	Researchers	No.of. Foramens present in their studies
1.	Boyd [1930]	24/1500
2.	Sharma et al. [1986]	1/214
3.	Premsagar et al. [1990]	7/338
4.	Gozil et al. [1995]	8/300
5.	Hossain et al. [2001]	21/150
6.	Present study	14/60

## 5. Conclusion

With the increased application of magnetic resonance imaging (MRI) and computed tomography (CT), the foramina of the skull are being observed as never before in the clinical setup. The knowledge of these foramina, especially occipital emissary foramen is important because of the recent advances in neurointerventional and neurosurgical techniques. The present study was therefore undertaken with respect to its clinical relevance and the objectives of the study were to find the incidence and topography of the occipital emissary foramina in human skulls.

## References

- [1] Wysocki J, Reymond J, Skarzynski H, Wrobel B: The size of selected human skull foramina in relation to skull capacity. *Folia Morphol* 65:301–308, 2006
- [2] Standring S, ed: *Gray's Anatomy*, 39th Ed. Edinburgh: Churchill Livingstone, 2005: 281
- [3] Reis C, Deshmukh V, Zabramski JM, Crusius M, Deshmukh P, Spetzler RE, Preul MC: Anatomy of the mastoid emissary vein and venous system of the posterior neck region: Neurosurgical implications. *Neurosurgery* 61:ONS193–ONS201, 2007
- [4] D. Falk and G. C. Conroy, "The cranial venous sinus system in australopithecus afarensis," *Nature*, vol. 306, no. 5945, pp. 779–781, 1983
- [5] Premsagar IC, Lakhtakia PK, Bisaria KK: Occipital emissary foramen in Indian skulls. *J Anat* 173:187-188, 1990
- [6] Sharma PK, Malhotra VK, Tewari SP: Emissary occipital foramen. *Anat Anz* 162:297-298, 1986
- [7] Louis Jr RG, Loukas M, Wartmann CT, Tubbs RS, Apaydin N, Gupta AA, Spetzouris G, Ysique JR: Clinical anatomy of the mastoid and occipital emissary veins in a large series. *Surg Radiol Anat* 31:139–144, 2009
- [8] Gozil R, Kadioglu D, Calguner E: Occipital emissary foramen in skulls from Central Anatolia. *Acta Anatomica* 153:325-326, 1995
- [9] Hossain SMA, Rahman L, Karim M: Occipital emissary foramen in Bangladeshi skulls. *Pak J Med Sci* 17:156-158, 2001
- [10] Berge JK, Bergman RA: Variations in size and in symmetry of foramina of the human skull. *Clin Anat* 14:406-413, 2001