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RESEARCH ARTICLE

VENA OBELIONICA *ALIAS* OCCIPITAL EMISSARY FORAMINA- AN OSTEOLOGICAL STUDY IN NORTH INDIAN POPULATION

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ABSTRACT

The occipital emissary foramen or vena obelionica is occasionally present as a solitary foramen in the squamous part of occipital bone at external occipital protuberance. It transmits occipital emissary vein which connects occipital sinus with the sub occipital venous plexus. Variations occur with regard to number and location. The aim of the present study was to ascertain the aforesaid parameters in North Indian population and compare it with the data available in the literature. One hundred and sixteen dry adult human skulls and occipital bones with intact foramen magnum of both sexes with unknown age group were obtained from in the neuroanatomy section of the of anatomy department, LLRM Medical College Meerut, and surrounding medical colleges Uttar Pradesh, India. The occipital emissary foramen was present in 29/116 (25%) skulls. In (7.7%) skulls the foramina was located on EOC. In (6 %) it was located on the right side, (10.3%) on left side and in (8.6%) it was median in position. Bilateral foramina were observed in (1.7%). The occipital emissary vein if present becomes significant in procedure like sub-occipital craniotomy where it becomes susceptible to injury.

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INTRODUCTION

The emissary foramina are present in mastoid, parietal and frontal regions of skull and transmit emissary veins. The emissary veins connect intracranial venous sinuses with extra cranial veins of the scalp and act as outlet veins of neurocranium. Usually the blood flow in these veins is away from the brain and slows, but the blood flow can occur in any direction since they are valve less (**Singh and Raibagkar, 2011**). However in case of raised intracranial pressure, these veins become an important source of drainage of blood (**Reis *et al.*, 2007**). The occipital emissary foramen is occasionally present as a solitary foramen in the squamous part of occipital bone at external occipital protuberance (**Williams, 1989**). It transmits occipital emissary vein which connects confluence of the sinuses to an occipital vein (**Hollinshead, 1967**). In recent studies it has been found to more often near the FM (foramen magnum) than the EOP (External Occipital Protuberance) (**Premsagar *et al.*, 1990; Gozil *et al.*, 1995; Hossain *et al.*, 2001**).The occipital emissary vein if present becomes significant in procedure like sub-occipital craniotomy where it becomes susceptible to injury. Thus an accurate knowledge about the location and incidence of the occipital emissary foramen is important for the surgeons.

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The aim of the present study is therefore to evaluate the incidence and location of the occipital emissary foramen in north Indian population.

MATERIALS AND METHODS

For the basis of the study one hundred and sixteen dry adult human skulls and occipital bones with intact foramen magnum of both sexes with unknown age group, were obtained from neuroanatomy section of the department of anatomy, LLRM Medical College Meerut, Uttar Pradesh, India and surrounding medical colleges. The skulls and occipital bones which were broken or showed pathological changes were excluded from the present study. The squamous part of occipital bone was examined carefully with the help of magnifying glass for the incidence, number and position of the emissary foramen. The patency of foramen was confirmed by passing a probe (wire) through the foramen.

RESULTS

The occipital emissary foramen was present in 29/116 (25%) skulls and absent in 75%. In 9/116 (7.7%) skulls the foramina was located on EOC (External occipital crest). In 7/116 skulls (6%) it was located on the right side, in 12/116 skulls (10.3%) on left side and in (8.6%) 10/116 skulls it was median in position. Bilateral foramina was observed in 2/116 skulls (1.7%).

DISCUSSION

The occipital emissary foramen or vena obelionica has been described by several authors (**Williams, 1989; Hollinshead, 1967**). It occurs at very low frequency throughout the hominid record and the classical one occurs near the inions (**Falk, 1986**). Variations occur with regard to number and location .These foramina are considered to be an epigenetic adaptation to an upright posture, responsible for delivering blood from brain to the vertebral veins. The incidence of occipital emissary foramen in our study is 25%, this is higher in comparison to the incidence reported in the available literature (Table 1). In our study, in 6.8% specimens the foramina was observed near the EOP (Fig.1A), this is in accordance with the earliest study done by (Boyd, 1930) although the incidence reported is very less (1.6%). In remaining all the specimens these foramina were located close to the posterior margin of FM, which justifies the studies done by previous authors (Gozil *et al.,*1995; Hossain *et al.,* 2001; Singhal and Ravindranath, 2013; Murlimanju *et al.,* 2011).

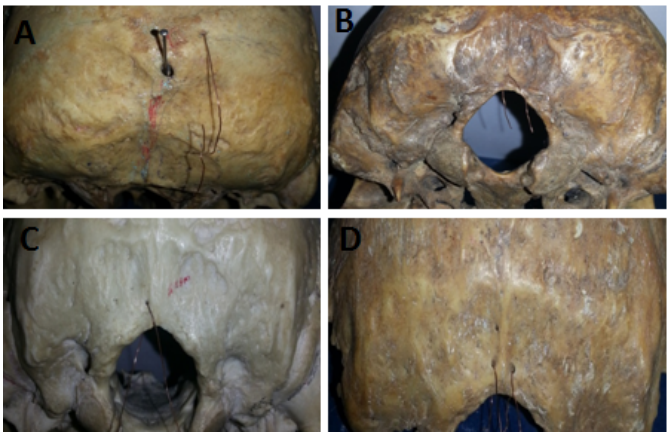

Fig. 1. Locations of occipital emissary foramina: A- median, close to EOP and right to EOP, B- median on EOC near FM, C- left of EOC near FM, D- bilateral near FM

The occipital emissary foramen connects confluence of sinuses with the occipital vein if located at or close to EOP, and if it lies close to FM it connects marginal sinuses to the occipital vein. Regarding the location of the occipital emissary foramen a predilection for left side was observed (10.34%) in comparison to right side (6.03%) in our study, and all of them were close to the posterior margin of FM (Fig.1C). This is similar to the study done by (**Murlimanju *et al.,* 2011**) although the incidence is much lower (6.4%) and (5.1%) respectively. But in contrast to the studies by **Louis *et al.,* 2009 and Hossain *et al.*, 2001** who have reported a right sided dominance. **Ganpathy *et al.*, 2013** has reported an equal incidence on right and left side (6%).The occipital emissary foramina had a median location in 8.62% (10/116) specimens, which is in agreement with the studies of previous authors (**Hossain *et al.*, 2001; Murlimanju *et al.,* 2011**) although the incidence reported is low. Among these 9/116 (7.7%) were located on the EOC and close to posterior margin of FM (Fig.1B), and in one skull (0.8%), it was located close to the EOP (Fig.1A). The site of this emissary foramen corresponds to the site of the occipital sinus present in the attached margin of falx cerebelli so that it probably connects the occipital sinus with the suboccipital venous plexus (**Premsagar *et al.*, 1990**).

Table 1. Comparative study of occipital emissary foramina incidence

S.No.	Author	Solitary foramen	Bilateral foramen
1	Boyd *et al.* (1930)	1.6%	Nil
2	Sharma *et al.* (1986)	0.46%	Nil
3	Premsagar *et al.* (1990)	2.07%	Nil
4	Gozil *et al.* (1995)	2.6%	Nil
5	Hossain *et al.* (2001)	14%	Nil
6	Wysocki *et al.* (2006)	3%	Nil
7	Murlimanju *et al.* (2011)	14.1%	Nil
8	Singhal *et al.* (2013)	9.05%	1.39%
9	Ganpathy *et al.* (2013)	14%	Nil
10	Present study (2014)	25%	1.72%

In our study bilateral foramina was observed in 2 specimens (Fig.1D), which is close to the study by Singhal and Ravindranath, 2013 who has reported it to be present in 3 specimens. Other than this, all the other previous studies have reported only solitary foramina. This finding is significant as it implies that there may be two occipital emissary veins connecting occipital vein to the occipital sinus or marginal sinuses. These veins serve to link the vertebral venous plexus with intracranial sinuses above and vertebral, brachiocephalic, and intercostal veins below. Due to such rich venous connections, chances of spread of intracranial infections extra cranially or vice versa may be accentuated (**Singhal and Ravindranath, 2013**). In our study the incidence of occipital emissary foramina is higher compared to previous studies, multiple emissary foramina were also present, this may be because of racial variation and geographical distribution. In the pathologies involving the posterior cranial fossa sub occipital exposure is a usual procedure. These procedures always include the posterior edge of foramen magnum which is either removed en bloc or piecemeal and then replaced (Park, 2006). Duramater is tightly adherent to the skull and since it cannot be stripped easily at this location and may lead to massive bleeding from the bone or underlying dura or the sinus during the surgical procedure. Hence the knowledge of location of foramina and the calibre of transmitted emissary veins becomes essential prior to surgery to avoid inadvertent intraoperative bleeding.

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