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Original Research Article

Assessing the Variations of Posterior Condylar Foramen in Dry Human Skulls: An Observational Study

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Conflict of interest: Nil

Abstract

Aim: The aim of the present study was to assess the variations of posterior condylar foramen in dry human skulls.

Methods: The present study was conducted at Anugrah Narayan Magadh Medical College, Gaya, Bihar, India and the material for this study consisted of 30 dry human skulls.

Results: Out of the 30 dried adult human skulls studied, posterior condylar canal was present in 20 skulls (66.66%) and absent in 10 (33.34%). Bilateral presence was seen in 15 skulls out of the 20 skulls and unilateral presence in 5 skulls. Out of the 5 skulls showing unilateral posterior condylar canal, 3 skulls showed its presence on the left side and 2 on the right side respectively.

Conclusion: A thorough knowledge about the variations of the posterior condylar canal and the structures passing through it is essential for any clinician or surgeon dealing in the region to avoid unwanted complications.

Keywords: Emissary Vein, Posterior Condylar Foramen, Posterior Condylar Vein, Variation, Posterolateral Approach.

Introduction

The posterior condylar canal is present in the posterior condylar fossa behind the occipital condyle. It transmits an emissary vein which connects the sigmoid sinus with veins in the sub occipital triangle. The incidence of posterior condylar canal shows racial variation from 13.3% in modern Palestinians to 70% in Peruvian crania. [1] The posterior condylar emissary vein passing through the posterior condylar canal is the largest emissary vein in the retromastoid region. These veins are valve less which allow bidirectional blood flow, thus acting as one of the mechanisms for cooling of brain. [2] It also acts as an escape route for blood in the event of unilateral or bilateral jugular venous obstruction. [3] Anthropoids show transitional stage from mammals below them to venous drainage system found in man. Simians approximate human system. Whereas Gorillas show tendency towards parietal foramen, chimpanzees show tendency towards parietal as well as condylar foramen. The posterior condylar foramen, which is the largest and the most constant (77%) of all foramina in man is not frequently seen in lower animals with only 5.6% in anthropoid crania, and not at all in other mammals. [4]

Hypoglossal canal or condylar canal in located in anterior part of the occipital condyle. There is a depression located just behind occipital condyle1and is called posterior condylar fossa. This depression located just behind occipital condyle accommodates the first cervical atlas vertebra during the atlanto-occipital joint movements. This depression or fossa may be is characterized by a foramen, also called the posterior condylar canal. [5-7] By far this posterior condylar foramen is the biggest emissary foramen of the posterior cranial fossa. Condylar canal is present behind and on lower aspect of to the jugular foramen and posterior to the hypoglossal canal. Condylar canal transmits an emissary vein to the sigmoid sinus and also nerves which supply the durameter of the posterior cranial fossah. [8,9] Emissary vein to the sigmoid sinus is also called as the posterior condylar vein that unites the veins located within the suboccipital triangle with those of the sigmoid sinus. [10,11] Meningeal branches

of the occipital artery also course through posterior condylar canal. This anatomical information is of vital significance to surgeons doing operative work on base of skull to avoid damage to the neurovascular structures. [4,12]

Posterior condylar vein, emissary vein passing through posterior condylar foramen and posterior condylar foramen both are important surgical landmark for transcondylar fossa approach (also described as supracondylar trans jugular approach). Drilling of condylar fossa is most important part of this approach. Occipital condyle and jugular tubercle can be differentiated from outside with the help of posterior condylar canal and posterior condylar vein as anatomical landmarks during this approach. Transcondylar fossa approach is most favoured approach for lesions which are in front of medulla. [7]

Recognition of posterior condylar canal helps to avoid misinterpretation in imaging investigations of tumors in the jugular area, enlarged lymph nodes and abnormal blood vessels. So the knowledge of this anatomical variant may be of crucial importance to avoid misinterpretation of radiographs, neurosurgeons during surgery of the cranial base and anatomists for its variations. The aim of the present study was to assess the variations of posterior condylar foramen in dry human skulls.

Materials and Methods

The present study was conducted at Anugrah Narayan Magadh Medical College, Gaya, Bihar, India for one year and the material for this study consisted of 30 dry human skulls. Nothing is known about antecedents regarding, community, caste, social status etc., of the specimens. Owing to the difficulty in accurate sexing of skull, no such attempt has been made. It is not unlikely that significant proportion of female skulls may have been included in this study. Skulls showing gross asymmetry or deformity particularly involving foramen magnum and occipital condyle region were rejected as unsuitable. Posterior condylar foramen is canal which is bent and it is sometimes very difficult to assess whether posterior condylar foramen is complete or not. When posterior condylar foramen was present only as pit or small blind canal, it was recorded as absent. Posterior condylar foramen was observed for its presence on one or both sides and whether it was absent on both sides.

Results

Figure 1: Posterior condylar canal absent

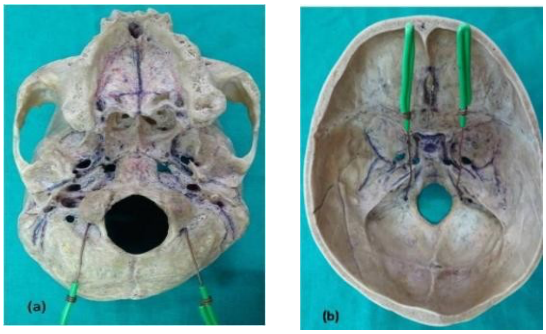

Figure 2: Bilateral posterior condylar canal (a) Exterior view (b) Interior view

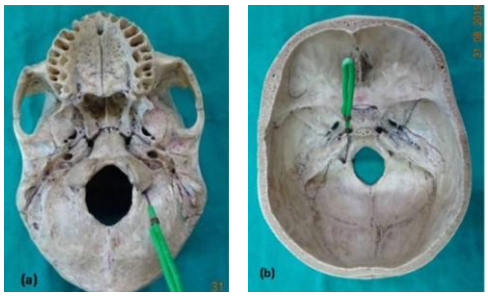

Figure 3: Left posterior condylar canal a) Exterior view (b) Interior view

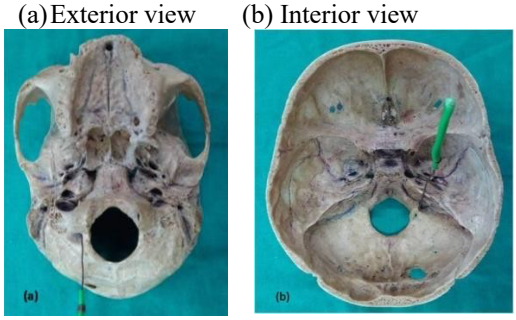

Figure 4: Right posterior condylar canal (a) Exterior view (b) Interior view

Table 1: Variants of posterior condylar canal in the 30 skulls in the present study

Posterior Condylar Canal			
Incidence (%)	Present – 20		Absent - 10
Laterality (%)	Bilateral - 15	Unilateral - 5	
		Right	Left
		2	3

Out of the 30 dried adult human skulls studied, posterior condylar canal was present in 20 skulls (66.66%) and absent in 10 (33.34%). Bilateral presence was seen in 15 skulls out of the 20 skulls and unilateral presence in 5 skulls. Out of the 5 skulls showing unilateral posterior condylar canal, 3 skulls showed its presence on the left side and 2 on the right side respectively.

Discussion

Emissary veins pass through emissary foramina present in the cranium. They connect dural venous sinuses present inside the cranium to veins present outside (extracranial veins). Some emissary veins are more commonly present while others are rarely found. Emissary veins are important clinically because infections from outside cranial cavity can spread to dural venous sinuses. For example, infection can spread from mastoid to sigmoid sinus or from paranasal sinuses to cavernous sinus. A posterior condylar emissary vein connects sigmoid sinus and veins in the sub occipital triangle via posterior condylar canal. An occipital emissary vein usually connects the confluence of sinuses with occipital vein through occipital protuberance. These emissary veins provide an alternative venous drainage when internal jugular vein is blocked or tied. [13] Occipital condyles are convex surfaces covered with hyaline cartilage. They lie at front half of the foramen magnum. Their posterior poles are separated by the diameter of foramen magnum, but their anterior poles are much closure together. Behind the condyle is a shallow fossa floored by thin bone. This fossa shows perforation by posterior condylar canal. It (posterior condylar canal) carries vein from the sigmoid sinus to the sub occipital venous plexus. [14]

In the later half of 3rd month of intrauterine life, the mastoid emissary veins, the anterior and posterior condylar emissary veins are already easily observed. They originate from the sigmoid sinus and communicate with the extracranial veins. Usually, the anterior condylar emissary veins which course through the hypoglossal canal appear first and receive venous blood from the sigmoid and marginal sinuses. Then the posterior emissary veins appear which also receive blood from the same source. At 5th month of intrauterine life, these emissary veins become larger and are seen on the posterior aspect of mastoid as mastoid emissary veins and along the foramen magnum as condylar emissary veins. At 6-7th months of intrauterine life, the condylar emissary veins connect the sigmoid sinus and/or occipital sinus with the vertebral, paravertebral and/or deep cervical veins, thereby connecting intracranial veins to extracranial venous system. [15] After birth some of the veins from the fetal circulation undergo atrophy which leads to closure of venous bony canals but can persist unilaterally in around 70% of adult human skulls.

Out of the 30 dried adult human skulls studied, posterior condylar canal was present in 20 skulls (66.66%) and absent in 10 (33.34%). Bilateral presence was seen in 15 skulls out of the 20 skulls and unilateral presence in 5 skulls. Out of the 5 skulls showing unilateral posterior condylar canal, 3 skulls showed its presence on the left side and 2 on the right side respectively. It was observed in 73.5% of skulls in the study done by Ginsberg.[3] Dimple Dev et al [16] in their study noted the posterior condylar canal in 74% of skulls. However, Vanitha et al found the posterior condylar canal in 88.09% of the skulls. [17] In the study conducted by Dimple Dev et al, the posterior condylar canal was present bilaterally in 30 % with equal incidence of 21% each on both left and right sides. The canal was absent in 26%.[16] Vanitha et al in their study observed the posterior condylar canal bilaterally in 48.8%, with unilateral presence of 15.4 % on the right side and 21.42% on the left side. The canal was absent in 11.9%.[17] In the present study, the incidence of posterior condylar canal was more on the left side with (20%) than on the right side (10%) which was similar to the study done by Vanitha et al. [17]

Neurosurgeons need to be careful during sub occipital craniotomy as occipital sinus and condylar veins serves function of collateral pathways in occlusive disease of veins. Multidetector row CT images with contrast enhancement are useful to evaluate relation between craniocervical junction veins and bony structures. [18] Condylar veins can also be used as access route to dural arteriovenous fistulas involving hypoglossal canal and transverse-sigmoid dural arteriovenous fistulas with occlusion of jugular vein. Condylar vein itself can be involved in arteriovenous fistula. [8,19] So understanding of normal anatomy and variations of posterior condylar vein and foramen are of clinical importance while considering endovascular treatment for arteriovenous fistulas of posterior cranial fossa region.

Conclusion

Posterior condylar foramen is one of the largest emissary foramen presents in human skull. It transmits posterior condylar vein, one of the major emissary veins of posterior cranial fossa region. While considering surgical or endovascular treatment of skull base diseases, knowledge of anatomical relationship and variation of posterior condylar foramen and posterior condylar vein is necessary. The occipital condylar region is an important route for surgical intervention of the dural arterio-venous malformations. Therefore, a thorough knowledge about the variations of the posterior condylar canal and the structures passing through it is essential for any clinician or surgeon dealing in the region to avoid unwanted complications.

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