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Variations of Posterior Condylar Canal in Dried Adult Human Skulls

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Abstract:
Background*: The posterior condylar canal which is present in the posterior condylar fossa transmits an emissary vein connecting the sigmoid sinus with veins in the suboccipital triangle. The incidence of posterior condylar canals shows a racial variation from 13.3% in Modern Palestinians to 70% in Peruvian crania. Variations in the posterior condylar canal and emissary veins are of great clinical significance.*
Objectives*: To determine the incidence and laterality of the posterior condylar canal.*
Materials and methods*: The present study was conducted in 50 dried adult human skulls in the Department of Anatomy, JNIMS, Imphal, Manipur, India.*
Results*: Out of the 50 dried adult human skulls, posterior condylar canal was seen in 31 skulls (62%) and absent in 19 skulls (38%). Posterior condylar canal was seen bilaterally in 18 (36%) out of 31 skulls and unilateral presence in 13 (26%) skulls. Out of the 13 skulls showing unilateral posterior condylar canal, 9 (18%) showed its presence on the left side and 4 (8%) on the right side.*
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: *Posterior condylar canal, posterior condylar fossa, emissary vein, variation.*

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I. 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 suboccipital 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 valveless 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] 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] The present study was conducted to determine the incidence and laterality of the posterior condylar canal because variations in the posterior condylar canal and emissary veins are of great clinical significance.

II. Materials And Methods:

The study was conducted in 50 dried adult human skulls in the Department of Anatomy, JNIMS, Imphal, Manipur. The posterior condylar foramina were identified and with the help of a probe, the patency was checked, and the presence or absence of canal were noted, and if present whether it was unilateral or bilateral, and if unilateral on which side it was present. However, age and sex of the skulls were not determined. Then the findings were noted, photographed and the overall incidence of posterior condylar canal was calculated and discussed with relevant literatures.

III. Results:

Out of the 50 dried adult human skulls studied, posterior condylar canal was present in 31 skulls (62%) and absent in 19 (38%) as shown in Fig.1. Bilateral presence was seen in 18 skulls (36%) as shown in Fig.2 out of the 31 skulls and unilateral presence in 13 skulls (26%). Out of the 13 skulls showing unilateral posterior condylar canal, 9 (18%) skulls showed its presence on the left side (Fig. 3) and 4 (8%) on the right side respectively (Fig. 4).

Fig. 1: Posterior condylar canal absent

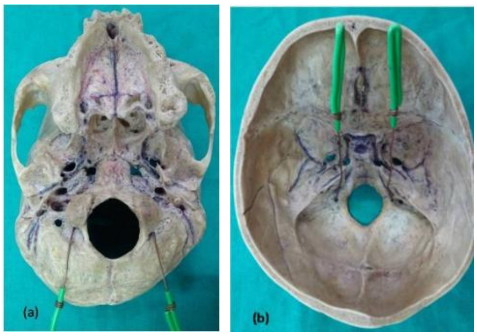

Fig. 2: Bilateral posterior condylar canal
(a) Exterior view (b) Interior view

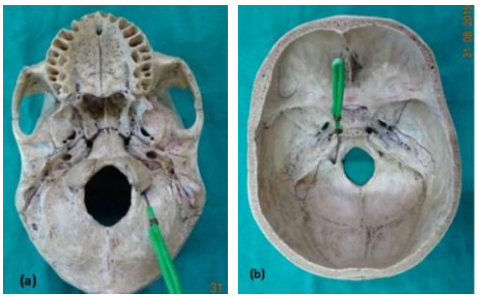

Fig. 3: Left posterior condylar canal
(a) Exterior view (b) Interior view

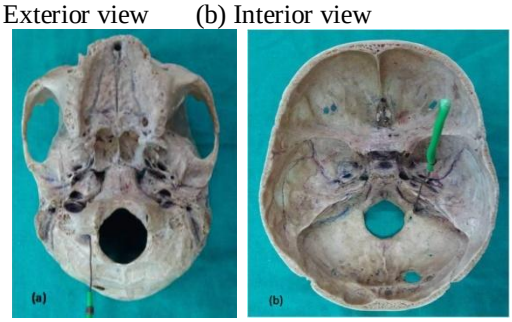

Fig. 4: Right posterior condylar canal
(a) Exterior view (b) Interior view

Table 1: Variants of posterior condylar canal in the 50 skulls in the present study (in %)

Posterior Condylar Canal			
Incidence (%)	Present - 62		Absent - 38
Laterality (%)	Bilateral - 36	Unilateral - 26	
		Right	Left
		8	18

IV. **Discussion:**

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.[5] 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.[6] Boyd in his study found that the posterior condylar canal was seen in 77% of the adult human skulls.[4] It was observed in 73.5% of skulls in the study done by Ginsberg.[3] Dimple Dev et al[7] 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.[8] In the present study the posterior condylar canal was present in 62% of the adult human skulls. A knowledge of this high incidence of the posterior condylar canal from the above studies ranging from 62-88.09% (Table 2) should be kept in mind during surgery by transcondylar approach.

The posterior condylar canal was found to be bilaterally present in 46.6% in the study conducted by Boyd with unilaterality of 16.5% on the right side and 13.8% on the left side. It was absent in 23.1%. Ginsberg in his study observed that the posterior condylar canal was bilaterally present in 55.9%. It was present on both

sides in equal incidence of 8.8%. However, the canal was absent in 26.5%.[3] 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%.[4] 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%.[7] In the present study, the incidence of posterior condylar canal was more on the left side with (18%) than on the right side (8%) which was similar to the study done by Vanitha et al. It was absent in 38% of the skulls in the present study. Schelling F in his study concluded that the straighter connection to the heart explains the right sided dominance of emissary veins which was not seen in the present study.[9] However, various parameters like the size of the canal, number and whether it was intrasinus or retrosinus were not analyzed, thus limiting the scope of the study.

Table 2: Comparison of incidence of posterior condylar canal by different workers (in %)

Study	Present	Bilateral	Right	Left	Absent
Boyd GI	77	46.6	16.5	13.8	23.1
Ginsberg	73.5	55.9	8.8	8.8	26.5
Dimple Dev et al	74	30	21	21	26
Vanitha et al	88.09	48.8	15.4	21.42	11.9
Present study	62	36	8	18	38

V. Conclusion:

A knowledge of the variants of posterior condylar canal and other variant emissary foramina is important in understanding the alternative routes of venous drainage from the brain. Posterior condylar canal can be erroneously interpreted as jugular glomus tumor in imaging studies and can result in unnecessary surgical intervention.[3] 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.

CONFLICT OF INTEREST: None.

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