Morphometric Analysis of Hypoglossal canal and its topographical relationship with adjacent structures in North Indian dry skulls

ABSTRACT

Introduction- The paired bony channel known as the hypoglossal canal (HC), situated above the occipital condyle (OC), is the conduit for the transmission of the hypoglossal nerve and meningeal branch of the ascending pharyngeal artery**.**

Aims & Objectives: To study the morphometric features of hypoglossal canal and its topographical relationship with occipital condyle & foramen magnum on exocranial surface.

Material & Methods: The present study was done on 50 adult human dry north Indian skulls available in Anatomical Museum of G.S.V.M Medical College, Kanpur. The hypoglossal canal's vertical and transverse diameters were measured. It was also noticed how far the hypoglossal canal was from the basion, opisthion, and posterior end of the occipital canal. We used a digital Vernier calliper scale to take measurements.

Results: The hypoglossal canals on the right and left had mean transverse diameters of 5.63±1.18 and 6.04±1.50 mm, respectively. The mean vertical diameter of the right and left hypoglossal canals were 5.25±0.95 & 4.93±0.73 mm. The mean distance from the right and left hypoglossal canal to the posterior ends of Occipital Condyle were 13.65±1.69 & 13.8±1.49 mm.

Conclusion: The current study provides important information regarding the morphometric aspects and its relationship with adjacent structures, which will enable effective and reliable surgical intervention in area of HC and craniovertebral junction leading to better postoperative outcome results

Keywords: Hypoglossal canal, occipital Condyle, basion, opisthion

INTRODUCTION

The anterior condylar canal, also called the hypoglossal canal, is a paired bony canal that connects the anterior 1/3rd and posterior 2/3rd of the occipital condyle, and it is adjacent to the occipital condyle. It extends from the occipital bone's jugular process to the basiocciput.[1] It is pointed forward a little and laterally.[2] With the exception of the palatoglossus, it transmits the hypoglossal nerve, which supplies all of the tongue's intrinsic and extrinsic muscles.[3] It also carries a meningeal branch of the ascending pharyngeal artery that supplies the meninges. Additionally, an emissary vein passes through it, connecting the basilar venous plexus to the internal jugular vein.

Transcondylar surgical approach, where the occipital condyle is drilled from the posterior aspect, is the favoured technique for posterolateral approaches to the foramen magnum, despite the risk to the opening of the hypoglossal canal.[1]

The goal of the current study was to determine the morphometric characteristics of the hypoglossal canal and its topographical relationship to the exocranial surface's occipital condyle and foramen magnum.

Figure 1. Hypoglossal nerve passing through hypoglossal canal

MATERIAL AND METHODS

The Study was conducted on 100 hypoglossal canals of 50 adult north Indian dry human skulls of unknown sex obtained from anthropology museum of Anatomy, GSVM Medical College, Kanpur (U.P.).

Metric parameters for extracranial hypoglossal canal (EH) taken were:

1. Vertical diameter (EH-V).
2. Transverse or Antero-posterior diameter (EH-T).
3. Distance from EH to posterior end of occipital condyle (EH-OC)
4. Distances from the EH to the basion (EH-B)
5. Distances from the EH to the opisthion (EH-O)

The Parameters were measured by using Digital Vernier Calliper Scale with a precision of 0.01 mm

INCLUSION & EXCLUSION CRITERIA

- Intact adult human dry skulls were included.
- Adult human dry skulls with any deformity & pathology were excluded in this study.

The metric parameters taken for extracranial hypoglossal canal (EH)

STATISTICAL ANALYSIS

Software named Jamovi was used to conduct the statistical analysis. For each of the parameters gathered from the skulls, descriptive statistics such as range, mean, and standard deviation were assessed. $P<0.05$ was considered statistically significant for all analyses, while $p<0.01$ was considered highly significant.

Result

The morphometric study of HC and its distance from OC & FM is shown in Table 1. The vertical diameter (mm) of HC was more on right side while transverse diameter (mm) of HC was more on left side.

The distance of external openings of HC from posterior end of OC was more on the left side while from opisthion & basion was same on both side.

Table 1: Morphometric parameters of extracranial hypoglossal canal (EH) mm

SI. No	Parameters	Right (Mean±SD)	Left (Mean±SD)	P-Values	Statistical significance	Mean
		Total(n=50)	**Total(n=50)**			
1.	EH-V	5.25±0.95	4.93±0.74	1.00	Not Significant	5.09
2.	EH-T	5.62±1.19	6.04±1.50	1.00	Not Significant	5.83
3.	EH-OC	13.67±1.69	13.80±1.49	1.00	Not Significant	13.74
4.	EH-B	16.37±1.55	16.38±1.37	1.00	Not Significant	16.37
5.	EH-O	39.3±2.23	39.4±2.30	1.00	Not Significant	39.35
3,4,5- Distance of the posterior end of OC, Basion & Opisthion from extracranial hypoglossal canal						

Discussion

With the OC inferiorly, the sphenoid portion of the clivus superomedially, and the jugular process of the occipital bone and jugular foramen laterally surrounding it, the HC is positioned anterolaterally.[2,4-6] In order to minimize harm to the hypoglossal nerve, other cranial nerves, and major blood arteries during various craniovertebral surgeries, it is essential to better understand the morphometry of the hypoglossal canal.[1]

A morphometric study of the Greek population's hypoglossal canal was carried out by Paraskevas et al. They found that the hypoglossal canal's extracranial transverse and vertical diameters are 6.15 mm and 3.91 mm, respectively.[7] Kalthur et al. conducted a morphometric analysis of hypoglossal canal in South Indian population. They found that extracranial transverse & vertical diameter of hypoglossal canal is 6.15mm & 3.91mm.[1] In present study, extracranial transverse & vertical diameter of hypoglossal canal is 5.83mm & 5.09mm.

Lyrtzis et al. conducted a study on Greek population & found that the distance of extracranial hypoglossal canal to occipital condyle is 8.17 mm.[8] Thintharua et al. conducted a study on Southeast Asia population & found that the distance of extracranial hypoglossal canal to occipital condyle is 13.70 mm.[9] Kumar et al. conducted a study on North Indian population & found that the distance of extracranial hypoglossal canal to occipital condyle is 14.42 mm.[2] Parvindokht et al. conducted a study on Iran population & found that the distance of extracranial hypoglossal canal to occipital condyle, basion & opisthion is 11.43 mm, 12.50 mm & 33.88 mm.[10] Kalthur et al. conducted a study on South India population & found that the distance of extracranial hypoglossal canal basion & opisthion is 17.35 mm & 40.9 mm.[1] In present study, distance of extracranial hypoglossal canal to occipital condyle, basion & opisthion is 13.74 mm, 16.37 mm & 39.35 mm which is almost similar to Thintharua P et al & Kumar S et al study.

Conclusion

The hypoglossal canal & its various parameters were measured, as well as how far away it was from certain anatomical landmarks. It was observed that the measurements on the left and right sides differed negligibly. It will be helpful to neurosurgeons doing various posterior cerebral fossa procedures for tumors such as hypoglossal nerve schwannoma. Transcondylar, supracondylar &

paracondylar approach of lower clivus require proper morphometry of hypoglossal canal. This data will improve understanding of microsurgical anatomy of hypoglossal canal for better patient's outcome

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