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Original Research Article

MORPHOMETRIC STUDY OF HYPOGLOSSAL CANAL OF OCCIPITAL BONE IN DRY SKULLS OF SOUTH INDIA

Vinay KV *[1], Swathi [2], Denia MY [3], Sachin KS [2].

[*1] Associate Professor, Department of Anatomy, K. S. Hegde Medical Academy, Nitte University, Mangaluru, Karnataka. India.

[2]Assistant Professor, Department of Anatomy, K. S. Hegde Medical Academy, Nitte University, Mangaluru, Karnataka. India.

[3] Second MBBS student, Department of Anatomy, K. S. Hegde Medical Academy, Nitte University, Mangaluru, Karnataka. India.

ABSTRACT

The hypoglossal nerve is the twelth cranial nerve cranial nerve XII which is a motor nerve supplying the muscles of tongue. At the skull base, it passes through the hypoglossal canal (HC). The HC has different shapes & dimensions. The knowledge about these dimensions of HC is very important for neurosurgeons & radiologists. The present study was done on 50 dry adult skulls. The length, diameter, distance of hypoglossal canal from occipital condyles were measured using a digital Vernier's calipers. The parameters were measured separately on right & left side, tabulated & analysed statistically. The mean length of HC was 12.55mm. The mean diameter HC at its intracranial & extracranial end was 7.5 & 7.6mm respectively. The mean distance from intracranial end of HC to anterior & posterior end of occipital condyle was 12.7 & 12.9 mm respectively. The mean distance from intracranial end of HC to inferior end of occipital condyle was 11.98 & 12.32mm on right & left side respectively which was statistically significant. The study of morphometry of HC & its location is important to anatomists, anthropologists, forensic experts & clinicians

KEY WORDS: Hypoglossal canal, occipital condyle, morphometry, Skull base, Foramina.

Address for Correspondence: Dr. Vinay Kumar. V, Associate Professor, Department of Anatomy, K.S. Hegde Medical Academy, Nitte University, Deralakatte, Mangalore, Karnataka, India. Pin-575018. Ph:+917795767676, **E-Mail:** dr7795767676@gmail.com.

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INTRODUCTION

The hypoglossal canal (HC) or anterior condylar canal is situated in the occipital bone, above the occipital condyle at its junction of anterior one-third[1]. The HC is surrounded by cortical bone & transmits hypoglossal nerve, meningeal branch of ascending pharyngeal artery & an emissary vein from the basilar plexus internally to internal jugular vein externally [1].

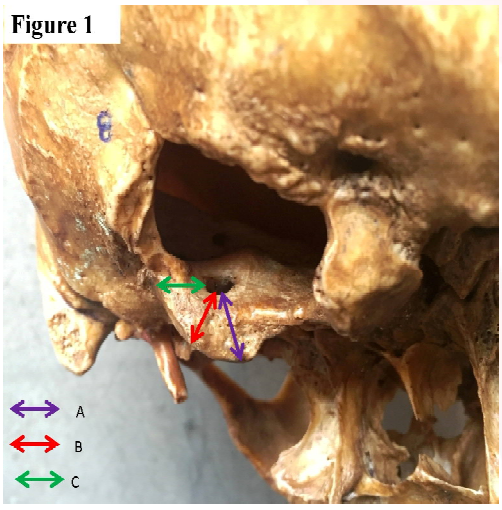
The lesions that are present anterior to craniocervical junction have posed a surgical challenge. The lesions that are located anterior to craniocervical junction are accessed through transcondylar approach [2]. A sound knowledge of the morphometry of this area can provide important benefits in determining safe surgical zones during surgical procedures such as transcondylar, supracondylar & lateral suboccipital approaches [3-5]. Knowing the precise location of the HC is important in

understanding the spatial relationships of surrounding structures & in the resection of tumors lying close to or within the canal itself. In addition, when drilling into the occipital condyle (OC) it is important for the surgeon to anticipate the possible depth & direction of the HC [6]. Thus, a preoperative morphometric analysis of HC & OC will enable the surgeon to choose the most appropriate surgical technique & approach to be employed. The aim of the present study is to measure the length of the HC, antero-posterior & transverse diameter of the intra & extracranial ends of the HC, distance of the HC from the anterior, posterior & inferior margins of the OC. Compare the above parameters between left and right sides and To determine normal anatomic database of dimensions of HC in South Indian dry adult skulls.

MATERIALS AND METHODS

Fifty adult dry skulls were collected & studied in the present study. The skulls with any bony abnormalities & those in which the HC had bony septum were excluded from the study. The following measurements were done using a digital Vernier calipers. (Figure1)

Fig. 1: Measurements taken using a digital Vernier calipers.



a. The length of HC.

b. The mean diameter of the intra & extracranial ends of the HC.

c. The distance of the intra cranial end of HC to anterior, posterior & inferior margins of OC.

All the measurements were made separately on right & left sides. The measurements were done twice & the mean of the two values were noted to minimize error. The data collected was tabulated & analysed statistically by student t test. The level of significance was set at $p < 0.05$. The data were computationally tested using SPSS for Windows, version 16.0 (SPSS Inc., Chicago, IL, USA).

RESULTS

Table: 1: Showing various parameters measured hypoglossal canal (HC) on right & left side separately.

Sl. No	Parameters	Mean (mm)	SD	P VALUE
1	Length of HC on right side (HCLR)	12.5	0.55	0.37 Not significant
2	Length of HC on left side (HCLL)	12.6	0.45	
3	Diameter of intracranial end of HC on right side (DIR)	7.47	0.39	0.38 Not significant
4	Diameter of intracranial end of HC on left side (DIL)	7.53	0.29	
5	Diameter of extracranial end of HC on Right side (DER)	7.58	0.33	0.74 Not significant
6	Diameter of extracranial end of HC on Left side (DEL)	7.6	0.25	
7	Distance from intracranial end of HC to anterior end of OC – right side (DIAR)	12.68	0.56	0.49 Not significant
8	Distance from intracranial end of HC to anterior end of OC – left side (DIAL)	12.75	0.44	
9	Distance from intracranial end of HC to inferior end of OC– right side (DIIR)	11.98	0.51	0.0002 Highly significant
10	Distance from intracranial end of HC to inferior end of OC– left side (DIIL)	12.32	0.36	
11	Distance from intracranial end of HC to posterior end of OC– right side (DIPR)	12.8	0.59	0.11 Not significant
12	Distance from intracranial end of HC to posterior end of OC – left side (DIPL)	12.98	0.51	

Table 1 shows the parameters that were measured on right & left side of the skull. On comparing the parameters on right & left side it was observed that statistically significant results were only present in mean distance from intracranial end of HC to inferior end of OC on right & left side. All the other parameters were insignificant & thus the data on left & right side were pooled together for comparing. The mean length of HC was 12.55mm (Table 2). The mean diameter HC at its intracranial & extracranial end was 7.5 & 7.6mm respectively. The mean distance from intracranial end of HC to anterior & posterior end of OC was 12.7 & 12.9 mm respectively. The mean distance from intracranial end of HC to inferior end of OC was 11.98 & 12.32mm on right & left side respectively which was statistically significant.

Table 2: Showing the parameters that were obtained after right & left parameters of HC were clubbed together.

S. No.	Parameter	Measurement
1	Mean length of HC	12.55mm
2	Mean diameter of Intracranial end of HC	7.5mm
3	Mean diameter of Extracranial end of HC	7.6mm
4	Mean distance from intracranial end of HC to anterior end of OC.	12.7mm
5	Mean distance from intracranial end of HC to posterior end of OC.	12.9mm

*The mean distance from intracranial end of HC to inferior end of OC on right & left side could not be clubbed since it showed statistically significant differences.

DISCUSSION

Microsurgical anatomy is the foundation of neurosurgery. The base of the skull especially the region of HC is involved in many pathological conditions. An indepth knowledge about the anatomy of HC is essential for many surgical interventions especially in relation to transcondylar approach. Adequate anatomical knowledge of HC & its related bony, neural & vascular structures is essential for surgery of lesions involving this area. HC is related superiorly to jugular tubercle, superolaterally to jugular foramen, laterally to sigmoid sinus & inferiorly to OC [7]. The mortality & morbidity rate may be high when surgical interventions are done without detailed knowledge of this region [8,9]. It is very important for the surgeon to anticipate the depth of HC when drilling into OC during surgical procedures [9].

In the present study, the mean length of HC was 12.55mm (Table 2) which was similar to other studies done by Muthu kumar et al., (12.6mm) but more when compared with study done by Hadley KS et al.,[10] (11.2mm), Berlis A et al., [11] (7.78mm) & Kizilkanat ED et al [12]., (9.9mm).

The mean intracranial & extracranial diameter of HC in the present study was 7.5 & 7.6 mm respectively (Table 2). These dimensions were different when compared with studies done by Muthukumar et al., [13] (7.2 & 7.9mm respectively). The study done by Berge JK etal., [14] showed a intracranial & extracranial diameter to be 4.66 & 5.51 mm respectively. The study done by Kizilkanat ED et al [12] on adult Turkish skulls noted that the mean intracranial & extracranial diameter of HC to be 6.5 & 6.6mm respectively. These diameters are much less when compared to our study which may be due to racial variations of the population studied.

In the present study, the mean distance from intracranial end of HC to anterior & posterior end of OC was 12.7 & 12.9 mm respectively which was similar to the study done by Muthukumar et al., [13] (12.6 & 12.2mm respectively) but much higher than that of study done by Kizilkanat ED et al., [12] (11.2 & 12.3mm respectively). The mean distance from intracranial end of HC to inferior end of OC on right & left side could not be clubbed since it showed statistically significant differences. The mean distance between the intracranial end of HC to inferior end of OC was 11.98 & 12.32mm on right & left side respectively. The distance on right side was similar to that of study done by Muthukumar et al., [13] (11.9mm) but very much higher as compared to study done by Kizilkanat ED et al., [12] (9.4mm).

The difference in dimensions observed between the studies are measured in millimeters & therefore these minute variations must be borne in mind during surgical interventions. The dimensions reported in this study require a careful radiological analysis of HC before craniovertebral junction surgery. Further studies with age changes in dimensions of HC may be done which will be very helpful.

CONCLUSION

The data of the present study will provide the database on the dimensions of HC. The data presented here will provide additional information on the complex morphology of dimensions of HC which will be helpful in reducing the mortality and morbidity during surgical intervention. The findings from this study will be relevant to anatomists, anthropologists & surgeons.

Conflicts of Interests: **None**

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