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Morphometry of Hypoglossal Canal in Central Indian Crania

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Abstract---Aim: Study of non metric cranial variants have been a field of considerable interest to research workers especially because of their racial and regional importance. Present study is undertaken to know the morphometric differences of hypoglossal canal and to draw any significant statistical conclusions. **Materials and methods:** This study is conducted on eighty central Indian dry crania of unknown sex and age. Various parameters of hypoglossal canal were measured and documented. **Results:** The intra cranial diameter ranged on right side from 5-7.5 mm with an average of 6.0 ± 3 mm. On left side, it ranged from 4.5-8mm with an average of 6.8 ± 3 mm. The extra cranial diameter ranged on right side from 5.5-8.5mm with an average of 6.4 ± 2 mm and on left side ranged from 5.5-9mm with an average of 6.2 ± 3 mm. Regarding the shape of the openings, of the eighty skulls used for this study, we found round shaped (63,78.75%), oval shaped (10,12.5%), kidney shaped (1,1.25%), tear drop shaped (4,5%), dumb bell shaped(1, 1.25%), triangle shaped(1,1.25%). Septation is observed on right side in 5 skulls (6.25%) and on left side in 8 skulls (10%). **Conclusions:** Detailed knowledge of variants of hypoglossal canal is essential for many branches of medicine in general and neurosurgeons in particular. Though the variations of the hypoglossal canal may not produce any major problems in movements of tongue, they are good enough to change the quality of words produced by the individual.

Keywords---hypoglossal canal, spicules, septation, morphometric variations.

Introduction

Anthropological and paleoanthropological studies concerned with epigenetic traits or non metrical cranial traits have been increasing in the past 10 years. Analysis of non metrical traits remains an important approach to the tracing of genetic relationships among ancient populations as they permit measurement of biological distances between populations. They can also be used for assessment of existence of parental structures within a community or as taxonomic indicators¹. Cranial foramina are the only portals to an otherwise closed cranium. Evaluation of these foramina is an important part of diagnostic medicine and would aid the clinician in his surgical approach to this complicated region². The hypoglossal canal (anterior condylar canal), which is situated anteriorly above each condyle, starts internally a little above the antero-lateral part of foramen magnum and continues antero laterally. It may be partly or wholly divided by a spicule of bone and transmits the hypoglossal nerve and a meningeal branch of ascending pharyngeal artery³. Difficulties and high rate of morbidity associated with ventral approaches dictates to use a dorsal approach to ventral processes of foramen magnum, which employs the transcondylar mode for which the knowledge and different morphometrical variations of this area has to be borne in mind⁴. Knowledge of normal and variant positions of the canals and foramina of skull base is important for neurologists, neurosurgeons, anatomists and radiologists, because of increasingly refined techniques available⁵. Considering the clinical and surgical importance of hypoglossal canal and lack of literature concerning the central Indian population, we have undertaken this study.

Materials and Methods

Eighty dry human skulls were collected from the Department of Anatomy of Ayaan Institute of Medical Sciences and the following parameters were observed:

- Intracranial and extra cranial diameter of hypoglossal canal.
- Shape of the internal opening.
- Patency of the canal.
- External hypoglossal canal distance - distance between external hypoglossal canal openings measured at both medial walls of both right and left openings.

The measurements of each parameter were taken with a vernier callipers twice and the mean of the both was taken as final measurement to nullify intra observer error.

Results

The intracranial diameter of hypoglossal canal on right side ranged from 5-7.5mm with an average of 6.0 ± 3 mm. On the left side, it ranged from 4.5-8mm with an average of 6.8 ± 3 mm. The extra cranial diameter of hypoglossal canal on right

side ranged from 5.5-8.5mm with an average of 6.4 ± 2 mm and on left side, ranged from 5.5 - 9mm with an average of 6.2 ± 3 mm. Regarding the shape of the openings, of the eighty skulls used for this study, we found the following:

	Shape	Incidence
1.	Round shape	63 (78.75%)
2.	Oval shape	10(12.5%)
3.	Kidney shape	01(1.25%)
4.	Tear drop shape	04(5%)
5.	Dumbbell shape	01(1.25%)
6.	Triangle shape	01(1.25%)

Concerning the patency of the canal, we found the following observations:
Septation:

- On right side, in 5 skulls (6.25%)
- On left side, in 8 skulls (10%)
- On both sides, in 3 skulls(3.75%)

Spicules:

- On right side, in 1(1.25%) skull.
- On left side, in 1(1.25%) skull.

The above results are tabulated as follows:

	Right %	Left %	Bothsides %
Septation	05 (6.25)	08 (10)	03 (3.75)
Spicules	01 (1.25%)	01 (1.25%)	----

Discussion

Non metrical cranial variants have been a subject of study by many pioneering workers like Todd and Tracy (1930) .Variants on racial basis also were observed by workers like Berry and Berry (1967) and are of considerable ethnic but lesser forensic interest. Cranial variants have aroused the curiosity of anatomists for many decades like Le Double (1903). However it was Wood Jones (1930), however who first proposed that the differing incidences of these minor variants which occurred in different races might be useful in anthropological studies. Laughlin and Jorgensen (1956) put this idea in practice and Berry and Berry (1967) suggested that a wide range of these statistical variants could be used to calculate a distance statistic between population samples⁶. Teixeira(1982) was the first to conduct a study on sex discrimination on the size of foramen magnum⁷.

Kaur.J (2012) found double hypoglossal canal in 12 male skulls (10.5%) and in 6 female skulls (9.1%). In the present study, however we could not observe the incidence of double hypoglossal canal. In the study undertaken on Turkish-Caucasian skulls by Kizilkanat (2006)⁸, they found the intracranial and extra cranial diameters of hypoglossal canal were 6.5 ± 1.3 mm and 6.6 ± 1 mm. In our

present study, the maximum intracranial diameter on right side is 7.5mm and on the left side it is 8 mm. Similarly the maximum extra cranial diameter on right side is 8.5mm and on left side it is 9 mm. Regarding the shape of internal opening of hypoglossal canal, we observed round shape in 63 (78.75%), oval shape in 10 (12.5%), tear drop shaped in 4 (5%) and one skull each of kidney shape , dumbbell shape and triangle shape.

Sharma.N., Garud.R (2011) observed septation pattern in 50 skulls and reported that septations in hypoglossal canal were exclusively on the endocranial aspect and were seen bilaterally in 4% and unilaterally in 20% skulls. In our study, septation is observed on right side in 5 skulls (6.25%) and on left side in 8 skulls (10%) and on both sides in 3 skulls (0.04%). Spicules were observed on right side in one skull and on left side in one skull. Though this might not produce any major problems in movements of tongue, they are good enough to change the quality of words pronounced by the individual⁹. R.D.Nikumbh, D.B.Nikumbh (2013) observed AP diameter and transverse breadth of hypoglossal canal was more in male than in females. Unilateral double hypoglossal canal was noted in 25% dry skulls and unilateral double hypoglossal canal was noted in 25%, whereas bilateral double hypoglossal canal in 3% dry skulls¹¹. Osunwoke et al (2014) found unilateral double hypoglossal canal was found in 13 skulls and bilateral double hypoglossal canal in 7 skulls¹².

The studies were tabulated as follows:

Author	Factor	Incidence	Present study
Kaur (2012)	Double hypoglossal canal	18	----
Kizilkanat (2006)	ICD ECD	7.8mm 7.6mm	7.5mm 8 mm
Sharma and Garud (2011)	Septation	12	16
R.D.Nikhumbh, D.B. Nikumbh (2013)	Unilateral and bilateral double hypoglossal canal	25% 3%	----- -----
Osunwoke et al (2014)	Unilateral and bilateral double hypoglossal canal	13 07	----- -----

Several differences may occur in human crania but there is little consistency in the occurrence of these dimorphisms. The incidence of a variant may be more in females in one sample and same may be more in males of another sample, showing that these are outward manifestations of activity of epigenetic and environmental forces. This doesn't invalidate them as anthropological tools, but if sufficient variants are used, proportion of genome represented by them is so much greater when single gene characters are used¹.

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