

Original Research Article

Duplication of hypoglossal canal in North Indian human skulls

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ABSTRACT

Background: The hypoglossal canal is one among the permanent components of occipital bone of both human being and animal skull, which transmits the twelfth cranial nerve, meningeal branch of ascending pharyngeal artery and emissary veins. This is commonly known as anterior condylar canal. In some cases, this canal is divided by a bony spicule leading to a variant known as double hypoglossal canal. Such partition of hypoglossal canal predisposes the roots of twelfth cranial nerve to entrapment in the occipital bone during ossification which subsequently may leads to an alteration in the tongue movement as well as speech. The objectives of the present study were to obtain the incidence of the variant of double hypoglossal canal in north Indian population especially in Bihar and compare the incidence of such type of variation in skull of different parts of our country as well as various races of the world.

Methods: The present study was carried out on 110 undamaged dry adult human crania of unknown age and sex for any variations in the hypoglossal canal or incidence of double hypoglossal canal.

Results: We observed 15 cases (13.63%) of double hypoglossal canal in which 8 (7.27%) specimens had unilateral while 7 (6.36%) specimens had bilateral double hypoglossal canal. Double hypoglossal canal was more common in right side. In 5 cases (4.54%) unilateral bony spicules were seen.

Conclusions: The study about the hypoglossal canal and its different variation is very important to clinicians, anatomist, forensic experts as well as anthropologists too. The knowledge about the different dimensions of hypoglossal canal is also very essential for neurosurgeons and radiologist for the planning of the surgeries around the posterior cranial fossa for tumors like schwannoma of hypoglossal nerve and treatment of sleep apnea syndrome. Hence the detailed morphometric study of hypoglossal canal will be helpful for the planning of surgical intervention around the base of skull becomes easier and safer.

Keywords: Duplication, Hypoglossal nerve, Hypoglossal canal, Variations

INTRODUCTION

The human skull is the most modified part among the axial skeleton to protect the brain, special senses as well as cranial nerves. The hypoglossal canal is one among the permanent components of occipital bone of both human being and animal skull.¹ It lies above the occipital condyle at its junction of anterior one third and posterior two thirds and extends antero laterally from an inner opening a little above the lateral margin of foramen

magnum which transmits the twelfth cranial nerve (hypoglossal nerve), meningeal branch of ascending pharyngeal artery and emissary veins which connect the basilar plexus internally to the internal jugular vein externally.² This is commonly known as anterior condylar canal. In some cases, this canal is divided by a bony spicule leading to a variant known as double hypoglossal canal.^{2,3} Such partition of hypoglossal canal predisposes the roots of twelfth cranial nerve to entrapment in the occipital bone during ossification which subsequently may leads to an alteration in the tongue movement as

well as speech. In the last ten years, anthropological studies concerned with the nonmetric cranial traits have been increased and this was first studied by Jones W.⁴ Hypoglossal canal is of great clinical significance in different pathological conditions like fracture of occipital bone, any congenital defect involving posterior part of cranial base or any intra and extra cranial neoplasm.⁵⁻⁷ Present study is undertaken to know the incidence of the variant of double hypoglossal canal in north Indian population especially in Bihar to draw significant conclusion.

METHODS

The present study is a cross sectional study which has been carried out on 110 undamaged dry adult human crania, which were collected from the different students of the 1st year MBBS and Department of Anatomy and Department of Forensic Medicine and Toxicology of Indira Gandhi Institute of Medical Sciences, Patna

Medical College, Nalanda Medical College, Katihar Medical College and Lord Buddha Koshi Medical College of Bihar state of India. The age and gender of the bones used in the study is not predetermined. The skull having any damage of posterior cranial fossa were excluded. The skulls were observed carefully for any variations in the hypoglossal canal or incidence of double hypoglossal canal whether it was unilateral or bilateral. All skull was also examined closely with the help of hand lens for any other variant like bony spicules or any other accessory foramina.

RESULTS

This study observed 15 cases (13.63%) of double hypoglossal canal in which 8 (7.27%) specimens had unilateral while 7 (6.36%) specimens had bilateral double hypoglossal canal. Double hypoglossal canal was more common in right side (Table 1 and Figure 1-3). In 5 cases (4.54%) unilateral bony spicules were seen.

Table 1: Distribution of double hypoglossal canal.

Variant	Unilateral		Bilateral	Total
	Right Side	Left Side		
Double hypoglossal canal	5 (4.54%)	3 (2.73%)	7 (6.36%)	15 (13.63%)
	8 (7.27%)			



Figure 1: Unilateral double hypoglossal canal (right side).

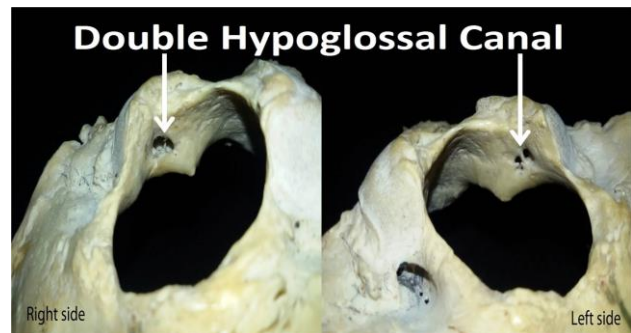


Figure 3: Bilateral double hypoglossal canal.

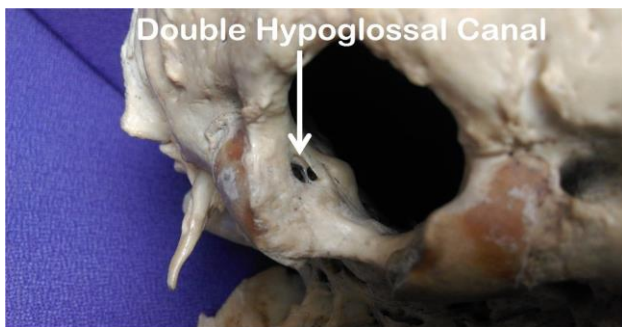


Figure 2: Unilateral double hypoglossal canal (left side).

DISCUSSION

Many studies have been carried out on different hyperostotic variants of the skull bone in the past (Table 2). In one of the study, which was conducted on 40 skulls of Uttar Pradesh State of India by Zaidi SHH et al, the incidence of double hypoglossal canal was found 12.5% which is very nearer to our findings i.e. 13.63%.³ They reported bilateral double hypoglossal canal in only 5% cases and unilateral in 7.5% cases. Kaur J et al, reported double hypoglossal canal in 10.5% cases.⁸ They also found jugular foramen bridging in 7% cases and paramastoid process in 10.5% cases. Kanda T et al studied on 590 Japanese patients by multislice computed

topography and reported double hypoglossal canal in 16.9% of cases, which is higher than our findings i.e.13.63%.⁹ They observed 2.2% cases were bilateral and double hypoglossal canal was significantly more common on left side than the right. While, study reported bilateral findings in 6.36% cases which is higher than their findings and double hypoglossal canal is more common in right side.

Osunwoke EA et al studied 79 dry crania of Nigerian origin out of which 55 belongs to male and 24 to females.¹⁰ They reported 25.31% cases of double hypoglossal canal, which is much higher than our findings. They observed double hypoglossal canal was more common in male in comparison to female. They also measured the different diameter of hypoglossal canal and observed that mean for the first external diameter (length) in males was 3.44 ± 1.03 mm while the second external diameter (width) was 2.25 ± 1.09 mm on the right side. While, in the females, it was 3.61 ± 0.99 mm for the first external diameter and 2.67 ± 1.21 mm for the second external diameter on the right side also. This was found statistically significant ($P < 0.05$). While on the left side they found the first external diameter (length) was

3.63 ± 1.33 mm and the second external diameter (width) was 2.67 ± 1.35 mm for males and in females it was 3.69 ± 1.16 mm for the first and 3.17 ± 1.97 mm for the second external diameter.

There was also a significant difference ($P < 0.05$) between the males and the females. Jacob M et al studied 60 skull bones and reported double hypoglossal canal only in 12 skulls i.e. in 20% of cases in which 4 were bilateral and in 8 were unilaterally.¹¹ Bony spur within hypoglossal canal was observed unilateral only in 2 skulls bones, while we found 5 cases (4.54%) with unilateral bony spicules. One of study conducted by Bhuller et al observed that the hypoglossal canal was divided into two canals by a small bony spicule in 28.12% of cases, which is much more higher than our findings i.e. in 4.54% of cases.¹² Mouri T studied 200 skulls of Japanese macaques and found that the side incidence of undivided hypoglossal canal was 39.5% (158/400), that of bipartite double hypoglossal canal was 51.8% (207/400) and that of tripartite double hypoglossal canal was 8.8% (35/400).¹³ In India, Raghunath M et al also reported a case of bilateral internal triplication of hypoglossal canal.¹⁴

Table 2: Incidence of double hypoglossal canal recorded by different workers.

Population	Author (year of study)	No. of specimen studied	Incidence (%)
North Indian	Tuli A et al ¹⁶	304	19.4%
North Indian	Ziaidi et al ³	40	12.5%
North Indian	Kaur J et al ⁸	100	10.5%
South Indian	Siva NRS Setty et al ¹⁷	50	2%
South Indian	Jacob M ¹¹	60	20%
Nigerian	Osunwoke EA ¹⁰	79	25.31%
Japanese	Kanda et al ⁹	590	16.9%
North Indian	In present study	110	13.63%

Singh V et al studied on 625 skulls and the bridging pattern of hypoglossal canal was observed and classified.¹⁵ The skulls having no bridging were classified as Type 1; incomplete bridging was classified as Type 2; complete endocranial bridging as Type 3; exocranial bridging as Type 4 and complete bridging throughout the canal was classified as Type 5. Type 1 category was seen in 84% of skulls, Type 2 was observed in 4.32% of cases with left side dominance. Type 3(a) category was seen in 7.68% cases and Type 3(b) in 4.16% cases. There was no skull found with Type 4 and Type 5 category.

CONCLUSION

The study about the hypoglossal canal and its different variation is very important to clinicians, anatomist, forensic experts as well as anthropologists too. The knowledge about the different dimensions of hypoglossal canal is also very essential for neurosurgeons and

radiologist for the planning of the surgeries around the posterior cranial fossa for tumors like schwannoma of hypoglossal nerve and treatment of sleep apnea syndrome. Hence, the detailed morphometric study of hypoglossal canal will be helpful for the planning of surgical intervention around the base of skull becomes easier and safer.

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