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Hypoglossal Canal and Condylar Canal Variations: A Case Report

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ABSTRACT

The hypoglossal canal is a permanent element of the human skull (Wysocki et al. 2004). The hypoglossal canal is situated occipital bone (Sakamoto 2019). Variations can be found in this canal. Sometimes it is divided by a spicule of a bone leading to a variant as a double hypoglossal canal (Zaidi, Gupta, and Usman 2011). Knowledge of variations in anatomy is important in both surgery and anatomy.

KEYWORDS: Hypoglossal canal, variations, anatomy.

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INTRODUCTION

The hypoglossal canal (canalis nervi hypoglossi), often found in two, passes mediolaterally from the base of the condyles in the occipital bone and is located between the basal part of the occipital bone and the jugular process. In addition to the hypoglossal nerve, which arises from the hypoglossal nucleus of the preolivary sulcus, a venous plexus and often the posterior meningeal artery pass through the canal (DeGusta, Gilbert, and Turner 1999; Nikumbh et al. 2013; Paraskevas1ADE et al. 2009).

In terms of clinical anatomy, the septum's presence and the canal's separation into two are crucial. Surgical intervention to the hypoglossal canal may be considered, especially due to occipital bone fractures, emissary vein dilatations, or tumors that may occur in the surrounding area. These variations in the hypoglossal canal may create risk factors as they may affect the related surgical interventions. In addition, since the duplication of the hypoglossal canal is accepted as an epigenetic character, this variation seems to be used in anthropological studies (Sakamoto 2019).

Hypoglossal canal variations are not uncommon. These variations have been the subject of studies by many anatomists to date. In addition to the topographical and structural features of the canal, evolutionary and developmental features were also examined in the studies carried out. This canal can be divided into two with a thin piece of bone and can be found as a double hole (Kim and Naqvi 2018). Researcher named Hauser categorized the canal into five categories for his investigation based on the sorts of variance ((Kim and Naqvi 2018).

Type 1: Channel without any splits.
Type 2: A canal divided into two by a bone in its inner or outer opening or inside.
Type 3: Segmented canal with two or more bones in it.
Type 4: Channel with bridging in its inner or outer opening.
Type 5: Channel with bridging across the channel.

It is believed that the division of the canal by connective tissue or bone is usually formed by the fusion of three or four previously separated vertebrae with the base of the occipital bone. Attempts are underway to address these variations broadly (Kim and Naqvi 2018).

Hypoglossal Nerve: Hypoglossal nerve emerges from the canal called the hypoglossal canal. As the hypoglossal nerve runs downwards around the vagus nerve, the tenth pair of skulls, it curves anteriorly to pass between internal carotid artery, external carotid artery, and internal jugular vein. The hypoglossal nerve gives off branches that will innervate thyrohyoid muscle while running laterally to the lingual artery. When the nerve comes to the tongue margin, it runs along the inner edge of the venter posterior of the stylohyoid and digastric muscles. Later, the nerve gives branches on the hyoid bone between the mylohyoid muscle and hyoglossus muscle to stimulate the tongue muscles (Kanda et al. 2015; Kim and Naqvi 2018; Sanders and Mu 2013).

CASE REPORT

Four skull variations were detected during laboratory studies at Malatya Turgut Özal University Faculty of Medicine. Two cranium variations with canalis nervi hypoglossus and one cranium variation without canalis condylaris were found.

Also, the canalis condylaris was comprehensive and extensive in one of the bones. At the end of the examinations, the nervi hypoglossus was type 3a in bones. In one of the skulls, the dimensions of the canals nervi hypoglossus (type 3a) were very close to each other. Here the canal was divided in half by a septum. Both of the detected channels were located on the right side. In contrast to this variation on the right, no difference was observed in the shape and dimensions of the duct on the left (Figure I, Figure II, Table I).

DISCUSSION

The hypoglossal canal and its variation are essential for anatomists, anthropologists, forensic experts, and clinicians. We wanted to show the this variation that we detected in our study. The foramina dimensions and the variations are clinically significant, given the delicate neurovascular structures that transverse them. This canal may be divided by a bony spicule. This division of the hypoglossal canal by bony spicule separates the meningeal branch of ascending pharyngeal artery from the hypoglossal nerve. Berry and Berry studied the hypoglossal canal in a different world population and found that the frequency of such separation was noted in 7- 27.4% (Berry and Bery 1967; Nikumbh et al. 2013).

The hypoglossal canal may be divided by a bony spicule. In one study found a division of canal on the endocranial side unilaterally on the right in 8% of skulls, on the left side in 20% of skulls and bilaterally in 4% of skulls. (Hamzaoğlu et al. n.d.). Muthukumar et al. (2005) reported that the hypoglossal canal was divided into two by a bony septum in 30% of the dry skulls studied (Muthukumar et al. 2005). Nikumbh et al. identified a hypoglossal canal separated by a unilateral compartment in 3 skulls. In the study conducted by Dağtekin et al., double hypoglossal canals were detected on the cadaver in fetuses, 3 (12%) on the right and 4 (16%) on the left side. Our study detected it unilaterally and on the right side (Hamzaoğlu et al. n.d.).

The absence of canalis condylar, through which vena emissaries pass, has been reported at very high rates in the literature (Ginsberg 1994). The condylar canal and its associated emissary vein are vital landmarks during surgical interventions involving skull base surgery. The condylar canal serves to function as a bridge of communication from the intracranial to extracranial space. Variations of the condylar canal are extremely prevalent and can present as either bilateral, unilateral, or completely absent. Anatomical variations of the condylar canal pose a potential risk to surgeons and radiologists during diagnosis as it could be misinterpreted for a glomus jugular tumor and require surgical intervention when one is not needed (Lachkar et al. 2019). This canal allows for venous anastomosis between the jugular bulb and the suboccipital venous plexus. Ginsberg at al., mostly unilatarally mostly found on the left side (Ginsberg 1994).

Krause et al., (2020) found 21% bilaterally presence while unilateral was 38% of the skull (Dakshayani and Shivanal 2020). Kumar (2015), reported that the percentage of bilateral presence of the posterior condylar canal was 48.33%, left unilateral presence was 18.33%, right unilateral was 15%, and the canal was absent in 16.66% of skulls (Kumar 2015). S. Kavitha and Anand (2013) found patent foramen in 62.58% of skulls, and it was more on the right side at 69.5% and the left side at 30.4% (Kavitha and Anand 2013). Dakshayani at al., (2020) reported that found 50 skulls studied; 18 (36%) skulls showed the bilateral presence of posterior condylar canal, right unilateral in 10(20%) skulls. In our study, it was seen that it was not found bilaterally in a single skull (Dakshayani and Shivanal 2020).

CLINICAL SIGNIFICANCE

Lesions of the canal are frequently seen in the clinic (Kim and Naqvi 2018). Verma et al. stated in their study that to prevent damage to the hypoglossal canal during surgical surgery, it is very important to know the nerve variations during surgery (Verma et al. 2016).

CONCLUSION

Our case report is important in terms of showing canalis nervi hypoglossal and canals condylar variation. For this reason, the fact that surgeons know this situation during their surgery is a light for the proper treatment. Anatomists, neurologists, neurosurgeons, and researchers believe it will contribute to the literature.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

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Figure I: Measurements from the bones of variation a: Outward-inward length of canals Nervi hpoglossi b: Distance of both canalis Nervi hpoglossi to each other c: Transverse diameter of canalis Nervi hpoglossi

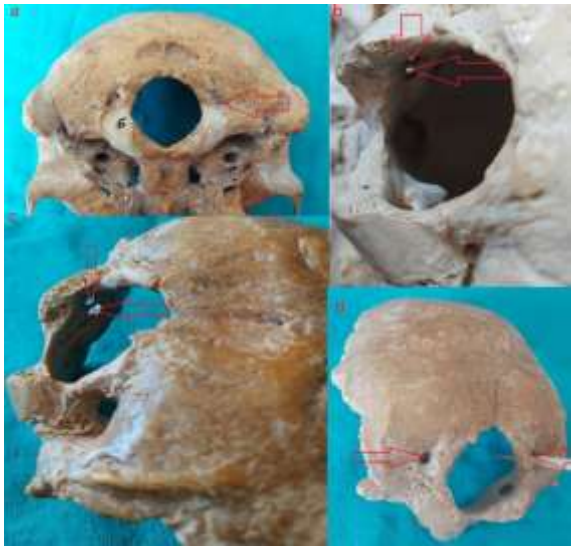

Figure II: Bones with variation detected a: Absence of Canalis condylaris, b, c: Canalis Nervi hypoglossus double type 3 on one side, d: Canalis condylaris wide

Table I. Cranium Measurements

Cranium	Anteroposterior diameter of Canalis Nervi Hypoglossi			Outward-Inward length of Canalis Nervi Hypoglossi		Distance between both channels
	Right		Left	Right	Left	35.6
I. (Figure I-a)	6.1		5.1	12.9	12.0	
II. (Double canal on the right) (Şekil I-b)	Sağ	Sol	7.2	11.3	9.7	35.9
	1,2	6,2				
III. (Double canal on the right) (Şekil I-c)	1.0	1.2	3.4	11.5	11.2	35.8
IV. (Figure I-d)	5.5		5.1	9.9	10.4	29