Research Article

Morphometric Analysis of Hypoglossal Canal and Jugular Foramen with its Contents by Cadaver Temporal Bone Dissection

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ABSTRACT

The aim of the study was to analyse and evaluate the distance from hypoglossal canal to jugular bulb, carotid artery, round window, roots of cranial nerves IX, X and XI by cadaver temporal bone dissection, morphometrically. The objective of study was to assess and determine morphometrically, the distance from hypoglossal canal to jugular bulb, carotid artery, round window, roots of cranial nerves IX, X and XI by cadaver temporal bone dissection via infratemporal fossa approach. The hypoglossal canal is a foramen in the occipital bone of the skull. It is hidden medially and superiorly to each occipital condyle. The hypoglossal nerve traverses the canal. The diagnoses of variety of tumours are found at the base of the skull. The hypoglossal canal can be safely and consistently reached by way of the temporal bone with preservation of hearing and cranial nerves (CN) IX to XI through infratemporal fossa. A total of 6 Human cadaver temporal bones were dissected. Infratemporal fossa Fisch type-A dissection was done. By exposing the hypoglossal canal the distance from the hypoglossal canal to the jugular bulb, carotid artery, round window, roots of cranial nerves IX, X and XI were analysed. Six temporal bones were dissected and measured. The distance from hypoglossal canal to the jugular bulb, carotid artery, round window and the roots of cranial nerves IX, X and XI was 4.9 mm, 14.7 mm, 19.2 mm and 6.8 mm respectively. The location of the hypoglossal canal is consistently situated anterior, inferior and medial to the jugular bulb. Very little has been studied of the hypoglossal canal through the infratemporal fossa approach. This can provide the surgeon the guidelines in reaching it safely thereby preserving hearing, CN IX, X and XI.

Keywords: Morphometric Analysis, infratemporal fossa approach, hypoglossal canal.

INTRODUCTION

The hypoglossal canal or anterior condylar canal is a foramen in the occipital bone of the skull, located between the occipital condyle and jugular tubercle and runs obliquely forwards (posteromedial to anterolateral) allowing the hypoglossal nerve (Cranial Nerve XII) to exit the posterior cranial fossa. It is hidden medially and superiorly to each occipital condyle. Its proximal portion is often divided by a fibrous (sometimes ossified) septum, which separates the two roots of the hypoglossal nerve (these have formed by the convergence of numerous rootlets). These roots merge within the canal as a single nerve.

The hypoglossal nerve (Cranial Nerve XII) traverses the canal. The diagnoses of variety of tumours are found at the base of the skull including large glomus jugulare neoplasms myeloma. Management of tumors of the temporal bone and base of skull is one of the most challenging problems. The close association of these tumors with the carotid artery, jugular vein and the V through XII cranial nerves made many patients inoperable in the past several years[1]. The advancement of infratemporal fossa approach, as pioneered by Fisch, allowed the excision of lateral skull base and petrous apex lesions which were previously considered unresectable. These improved approaches are classified as Fisch type A, B and C.

The hypoglossal canal can be safely and consistently reached by way of the temporal bone with preservation of hearing and IX, X, XI cranial nerves. It transmits the hypoglossal nerve (CN XII) from its point of entry near the medulla oblongata to its exit from the base of the skull near the jugular foramen. It lies in the epiphyseal junction between the basiocciput and the jugular process of the occipital bone. The hypoglossal canal is formed during the embryological stage of development in mammals, sometimes leading to the presence of more than two canals as the occipital bone is formed[2]. Study of this area aids in the diagnosis of a variety of tumours found at the base of the skull, including: large glomus jugular neoplasms, myelomas, and the occasional meningioma[3]. Studies of the hypoglossal canal revolve around the development of safe drilling techniques to conduct surgery on that area of the cranium[4].

MATERIALS AND METHODS

The study was conducted in the Department of Anatomy, Saveetha Dental College, Chennai. A total of 6 human cadavers were used and the infratemporal region in the head was dissected and displayed by Fisch type-A approach. The hypoglossal canal was then completely exposed. The distance from the hypoglossal canal to the jugular bulb, to carotid artery, to round window and to the roots of cranial nerves IX, X and XI were measured.

RESULTS

Six temporal bones were dissected and measured. The position of hypoglossal canal is consistently located anterior, inferior and medial to jugular bulb. The distance from hypoglossal canal to jugular bulb and root of CN IX to XI at the posterior cranial fossa was 4.9 mm and 6.8mm respectively. The distance from the carotid artery where it meets the jugular vein to hypoglossal canal was 14.7mm. Details of distribution of these findings were given in the table below.

Six temporal bones were dissected and measured. The distance from hypoglossal canal to the jugular bulb, carotid artery, round window and the roots of cranial nerves IX, X and XI was 4.9 mm, 14.7 mm, 19.2 mm and 6.8 mm respectively. The location of the hypoglossal canal is consistently situated anterior, inferior and medial to the jugular bulb. Details of distribution of these findings were given in the Table 1.

Table 1: Measurements of Distances from hypoglossal canal to jugular bulb, carotid artery, round window and cranial nerves IX to XI

Measurements	Cadaver numbers (Total=6)						Mean
	1	2	3	4	5	6	
Distance from hypoglossal canal to jugular bulb (mm)	4.7	4.9	4.6	5.3	4.8	5.2	**4.9**
Distance from hypoglossal canal to carotid artery (mm)	15.2	14.9	14.5	15.3	14.1	14.3	**14.7**
Distance from hypoglossal canal to round window (mm)	21.6	17.9	18.8	17.5	19.3	20.2	**19.2**
Distance from hypoglossal canal to CN-IX to XI (mm)	6.1	7.4	7.1	6.4	7.1	6.9	**6.8**

DISCUSSION

Surgical approaches to the anterior foramen magnum are often complex and lengthy procedures[5]. They may be associated with significant morbidity. The main objective when addressing pathological conditions of the hypoglossal canal is to maximize exposure of the particular area of the tumour to be resected while reducing the risk of associated morbidities. Several approaches were described to address extradural pathologies of the hypoglossal canal include the supracondylar, extended posterolateral and infratemporal fossa approaches[6-10]. Myatt and associates used a case report of a hypoglossal neurilemmoma to demonstrate the value of an extended posterolateral approach. This approach involved a suboccipital craniectomy, mastoidectomy, and removal of the lateral process of the atlas[11]. The postoperative course was complicated by a permanent unilateral right vocal cord paralysis and a transient House-Brackmann Grade II facial palsy[12].

Infratemporal fossa procedures provide wide exposure of the skull base. The main indications for these approaches are glomus jugulare lesions-lesions of the petrous apex and clivus and nasopharyngeal, sellar and parasellar lesions, particularly those extending into the infratemporal fossa, orbit, parasellar region and cavernous sinus[13-16]. The Fisch type-A approach thus provides a clear demarcation to access the hypoglossal canal which is evident from the morphometric values as the contents of hypoglossal canal and jugular foramen are fixed and stable. These morphometric values serves as a guidepost and throws light upon surgical accuracy[17-20].

CONCLUSION

Neurosurgical literature lacks detailed anatomical dissection of this approach. The hypoglossal canal can be consistently reached using the infratemporal fossa approach. Hearing and IX, X and XI cranial nerves, several vital tissues and bony structures can be preserved by this method.

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