

ORIGINAL ARTICLE

Morphometric Study of Hypoglossal and Facial Nerves and its Significance in Hypoglossal-Facial Nerve Anastomosis

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Abstract:

Background: During the repairing of facial nerve injury most common nerve used is the hypoglossal nerve. **Aim and Objectives:** To measure the distance between the anatomical landmarks, facial nerve and hypoglossal nerve which will be beneficial to locate the facial nerve and hypoglossal nerve more effortlessly and will decrease the hazard of procedural problems. **Material and Methods:** Thirty specimens were dissected. Measurements of the hypoglossal and facial nerves were taken from various anatomical landmarks. Data were analyzed using Statistical Package for Social Sciences 16 version. **Results:** The mean distance of the origin of the facial nerve to the angle of mandible was 3.89 ± 0.53 cm, the mean distance of the origin of the facial nerve to the tip of mastoid process was 1.50 ± 0.40 cm, the mean distance of common carotid bifurcation to the hypoglossal nerve where it crosses the external carotid artery was 1.55 ± 0.68 cm, the mean distance of common carotid bifurcation to the hypoglossal nerve where it crosses the internal carotid artery was 2.02 ± 0.68 cm and the mean distance of hypoglossal nerve to the tip of mastoid process was 3.54 ± 0.76 cm. **Conclusion:** The results of this study will help and prevent any complication in identifying the hypoglossal nerve and facial nerve during hypoglossal-facial nerve anastomosis.

Keywords: Morphometry, Hypoglossal Nerve, Facial Nerve, Repair, Surgical Anastomosis

Introduction:

Facial Nerve (FN) after leaving the cranial cavity through the stylomastoid foramen passes through

the substance of the parotid gland and there the nerve splits into two divisions, temporofacial and cervicofacial which further divides to supply the muscles of facial expressions [1]. Hypoglossal Nerve (HN) supplies all the tongue muscles, excluding palatoglossus. The nerve exits the hypoglossal canal just medial to the internal jugular vein and internal carotid artery. Later the nerve runs straight down amongst these vein and artery then lie in front of vagus up to a point where it lies in line with the angle of the mandible. Then it goes superficially lying just below the posterior belly of digastric to appear in between the internal jugular vein and internal carotid artery. Just beyond the tip of the greater cornu of hyoid bone, it crosses both internal and external carotid arteries from lateral to medial side as well as the loop of the lingual artery. It then passes underneath the stylohyoid muscle and the tendon of digastric. Here the nerve contributes a branch that runs downwards which is called as descendens hypoglossi. This descendens hypoglossi unite with the descendens cervicalis to create a loop of a nerve called ansa cervicalis [2]. Facial paralysis is potentially distressing damage that can lead to adverse aesthetic, physiologic, and psychological effects. In order to reestablish the tone and movement of the paralyzed face, we must timely re-innervate the facial muscles [3]. For the repair of injured FN hypoglossal nerve is commonly used to do Hypoglossal-Facial Nerve

Anastomosis (HFNA) when we cannot restore the continuity of the facial nerve by grafting or repair. But it can lead to hemiglossal atrophy. So, to prevent hemiglossal atrophy various improved surgical methods are used which include, anastomosis from the divided Hypoglossal Nerve (HGN) or one of its branches which is going down to the FN. Additional methods that can prevent complications are hemi-hypoglossal-facial anastomosis and hypoglossal-facial nerve interpositional jump graft [4].

The cranial nerve gets damaged in approximately 20% of cases while doing surgical procedures of the neck, most of them involve the hypoglossal nerve as it is located superficially. One of the important causes of accidental damage is non-visualization of the hypoglossal nerve [5]. The aim of this study was to measure the distance between the anatomical landmarks, FN, and HGN which might help in locating the FN and HGN very comfortably and in addition, to decrease the hazard of procedural problems while doing hypoglossal-facial nerve anastomosis and other surgeries of the neck.

Material and Methods:

Thirty specimens were dissected. After carefully dissecting the neck following structures were located division of the common carotid artery into the external and internal carotid artery, hypoglossal nerve and origin of facial nerve from stylomastoid foramen. Following measurements of the hypoglossal and facial nerves were taken: (Figs. 1 and 2)

1. Distance of Origin of the Facial Nerve (OFN) to the Angle of the Mandible (AOM).
2. Distance of OFN to the Tip of the Mastoid Process (TMP).
3. Distance of common carotid bifurcation to HN where it crosses the External Carotid Artery (ECA)
4. Distance of common carotid bifurcation to HN where it crosses the Internal Carotid Artery (ICA).
5. Distance of HN to the TMP.

All measurements were taken in centimeters with the help of Vernier calipers. Data were analyzed using Statistical Package for Social Sciences (SPSS) 16 version.

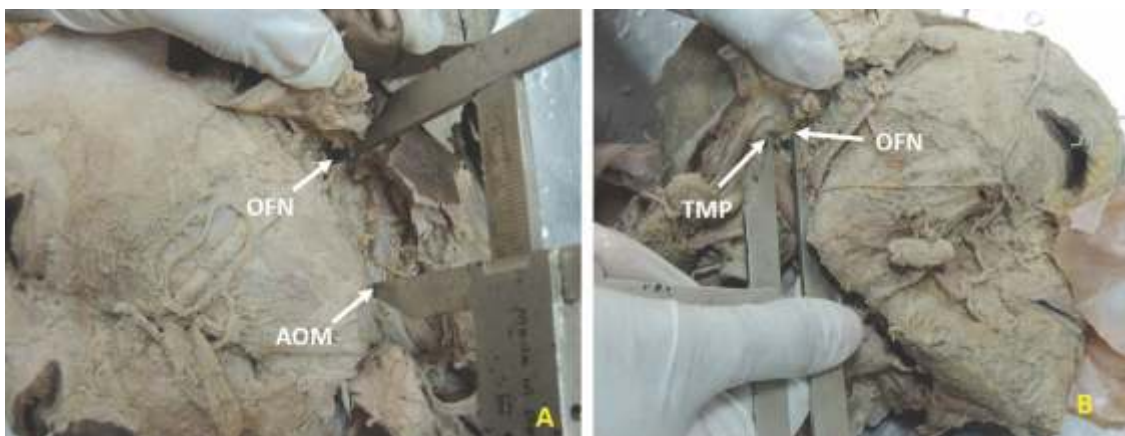


Fig. 1: Showing Measurements Done on Facial Nerve:

A. Distance of Origin of Facial Nerve (OFN) to Angle of Mandible (AOM).

B. Distance of Origin of Facial Nerve (OFN) to Tip of Mastoid Process (TMP).



Fig. 2: Showing Measurements Done on Hypoglossal Nerve:

A. Distance of Hypoglossal Nerve (HN) to Tip of Mastoid Process (TMP). B. Distance of common carotid bifurcation to Hypoglossal Nerve (HN) where it crosses the External Carotid Artery (ECA). C. Distance of common carotid bifurcation to Hypoglossal Nerve (HN) where it crosses the Internal Carotid Artery (ICA).

Table 1: Showing Measurements done on Facial and Hypoglossal nerves

Parameters	Mean ± SD
Distance of OFN to AOM	3.89 ± 0.53
Distance of OFN to TMP	1.50 ± 0.40
Distance of common carotid bifurcation to HN ECA	1.55 ± 0.68
Distance of common carotid bifurcation to HN ICA	2.02 ± 0.68
Distance of HN to TMP	3.54 ± 0.76

Results:

The mean and standard deviation of all the measurements done on the facial and hypoglossal nerve is shown in Table 1.

Discussion:

Numerous reports have revealed that it is hard to recognize and expose the FN while dissecting as it is fully covered by thick connective tissue. These FN and the HGN are situated in difficult regions.

So, the doctors should have thorough anatomical knowledge of this area to avoid procedural injury. Numerous authors have recommended that thorough anatomical information is essential to attain fruitful anastomosis [6].

Kim *et al.* reviewed the anatomy of the hypoglossal nerve in the neck. He found that the distance between the hypoglossal nerve where it crosses the

internal carotid artery to the common carotid artery branching was 2.09 cm. The distance between the HN where it crosses the external carotid artery to the common carotid artery branching was 1.53 cm [7]. These results are similar to our study results. In our study, the distance between the hypoglossal nerve where it crosses the internal carotid artery to the common carotid artery branching was 2.02 cm. The distance between the hypoglossal nerve where it crosses the external carotid artery to the common carotid artery branching was 1.55 cm. Campero and Socolovsky dissected five adult cadaver heads. They found the trunk of the facial nerve was 1.56 cm from the mastoid tip which is similar to our study. In our study the distance was 1.50 cm [8]. Seong dissected twenty-nine specimens from 15 adult cadavers. They found that the distance from the mastoid tip to the origin of FN was 0.86 cm anteriorly and 0.59 cm superiorly. The distance between the hypoglossal nerve where it crosses the internal carotid artery to the common carotid artery branching was 1.85 cm. The distance between the hypoglossal nerve where it crosses the external carotid artery to the common carotid artery branching was 1.51 cm [4]. These results are similar to our study results. In our study the distance between the hypoglossal nerve where it crosses the internal carotid artery to the common carotid artery branching was 2.02 cm. The distance between the hypoglossal nerve where it

crosses the external carotid artery to the common carotid artery branching was 1.55 cm. But in our study the distance between the stem of the facial nerve to the mastoid tip was 1.50 cm which was different from their study because we did not measure it anteriorly and superiorly.

Bademci *et al.* dissected 10 adult cadavers (20 sides) under the surgical microscope. They found that the distance between the hypoglossal nerve and the carotid branching was 1.92 cm [9]. In our study, we measured the distance at two points from the carotid bifurcation. In our study, the distance between the hypoglossal nerve where it crosses the internal carotid artery to the common carotid artery branching was 2.02 cm. The distance between the hypoglossal nerve where it crosses the external carotid artery to the common carotid artery bifurcation was 1.55 cm.

Quadros *et al.* dissected 20 hemi-faces. They found that the mean distance between the facial nerve trunk and mastoid process tip was 1.300 ± 0.089 while in our study it was 1.50 ± 0.40 [10].

Dissection of HGN is more complex, because it is situated very deep as compared to that of the FN, and the branching pattern of HGN varies a lot. Therefore, the results of this study will aid in identifying the FN and HGN and also in preventing nerve injury and it will also reduce the operation time.

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