

Aberrant anatomy of the hypoglossal nerve

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Abstract

Objective: Variant anatomy of the hypoglossal nerve is very rare. We report an unusual intra-operative finding of an aberrant branch of the hypoglossal nerve, encountered during a facial reanimation procedure.

Case report: A 50-year-old man was referred to the head and neck surgery department by the neurosurgeons for hypoglossal-facial nerve anastomosis to treat his facial paralysis, which had occurred following the removal of an intracranial neoplasm. During surgery, we identified an aberrant branch of the hypoglossal nerve, which took a more ventral and superior course in the carotid triangle, prior to entering the base of the tongue. Following further dissection, we found the main trunk of the 'true' hypoglossal nerve. Several interconnecting strands were seen in the proximal aspect of both the aberrant branch and the main trunk of the hypoglossal nerve. These interconnecting fibres appeared to have tethered the main trunk into an abnormal anatomical position.

Conclusion: As far as we can ascertain, this is the first report of an aberrant branch of the hypoglossal nerve. Although this variant would appear to be extremely rare, surgeons must consider all variations of this nerve during head and neck procedures, in order to minimise iatrogenic complications.

Key words: Hypoglossal Nerve; Anatomy; Abnormalities

Introduction

The anatomy of the hypoglossal nerve has been well documented in both the anatomical and surgical literature. Sound knowledge of normal anatomy and anatomical variation is essential to minimise intra- and post-operative deficits. We describe a rare anatomical variant of the hypoglossal nerve that was encountered during a hypoglossal-facial nerve anastomosis procedure. To our knowledge, this particular variant of this cranial nerve has not been previously reported in the medical literature.

Case description

A 50-year-old man was referred to the head and neck surgery department by the neurosurgeons for facial reanimation surgery to treat a facial nerve deficit, following the surgical excision of an intracranial neoplasm.

We performed a hypoglossal-facial nerve anastomosis procedure via a modified parotidectomy incision. The main trunk of the facial nerve was identified using standard landmarks. The hypoglossal nerve, however, was not initially identified at its usual anatomical location, along the medial surface of the internal jugular vein (IJV). Following further dissection along the ascending portion of the jugular vein, we

identified an unusual nerve branch, which was located in a much more superior position than expected, and which appeared to directly enter the base of the tongue. Stimulation of this nerve branch resulted in tongue contraction.

Given the anomalous course of this nerve within the right carotid triangle of the neck, it was unclear if this was the 'true' hypoglossal nerve. We therefore dissected the inferior portion of the submandibular triangle and located the hypoglossal nerve in the usual position adjacent to the digastric tendon. The 'true' hypoglossal nerve was freed of fascial attachments and traced superiorly in a retrograde fashion (toward the skull base). We discovered multiple interconnecting branches of the main trunk of the hypoglossal nerve, including the nerve branch previously identified as entering the tongue base (Figures 1 and 2). These interconnecting branches appeared to have tethered the nerve in an abnormal anatomical position.

On further dissection, it was clear that these additional nerve fibres were not attached to the sympathetic chain or vagus nerve, and that there appeared to be an aberrant supply to the tongue together with the main trunk of the hypoglossal nerve. The main trunk divided distally into the descendens hypoglossi, and appeared to have normal configuration. We

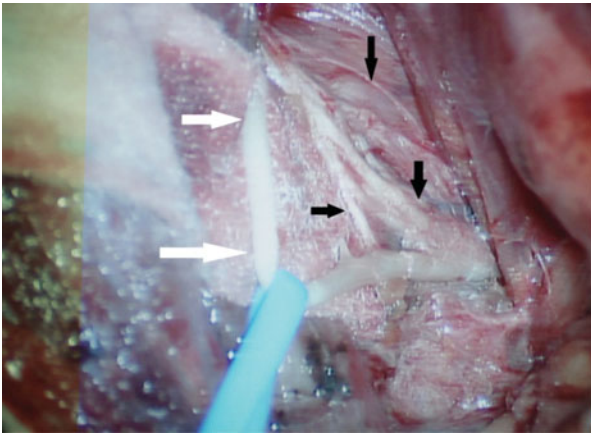


FIG. 1

Intra-operative view of the neck. The main trunk of the hypoglossal nerve is being retracted (white arrows). The aberrant hypoglossal nerve branch and interconnections between the aberrant branch and main trunk are shown (black arrows).

sharply transected the main trunk of the facial nerve at the stylomastoid foramen, and the entire distal trunk was reflected inferiorly and secured to the main trunk of the hypoglossal nerve (end-to-side anastomosis) with nylon epi-neural micro-sutures (Figure 3).

The patient's post-operative recovery was unremarkable. At the time of writing, he remained under close follow up to assess the extent of functional recovery.

Discussion

The hypoglossal nerve arises from its motor nucleus located within the medulla oblongata; it emerges from the medulla between its pyramid and olive. The nerve passes antero-laterally in the posterior cranial fossa and then exits the cranial cavity through the hypoglossal foramen. The extra-cranial route passes through the carotid and submandibular triangles of the neck. It enters the tongue by passing between the anterior border of the hyoglossus and genioglossus muscles,

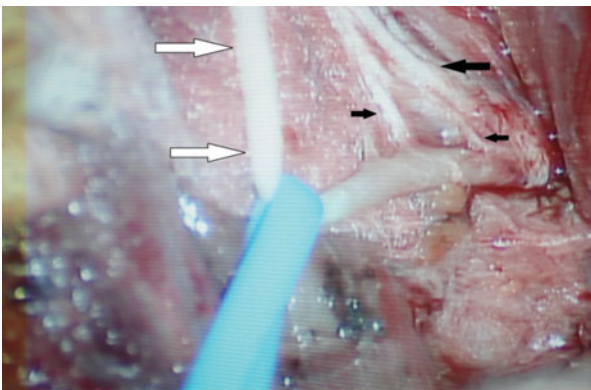


FIG. 2

Intra-operative view of the neck. The main trunk of the hypoglossal nerve is being retracted (white arrows), showing the interconnections between the aberrant branch and the main trunk of the hypoglossal nerve (black arrows).

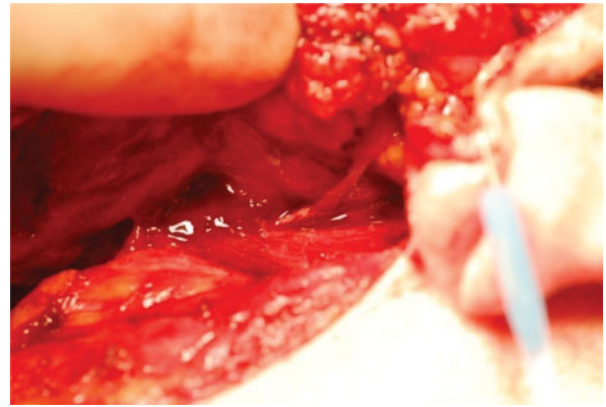


FIG. 3

Intra-operative view showing completed hypoglossal-facial nerve anastomosis.

and principally supplies motor innervation to the intrinsic tongue musculature.

The course of the infranuclear hypoglossal nerve can be divided into vertical (descending), horizontal and ascending segments. The anatomical relations of the vertical component of the hypoglossal nerve are relatively constant. However, several variations in the course of the hypoglossal nerve have been previously documented.

The nerve typically emerges from the hypoglossal canal medial to the IJV and carotid artery; however, in 8 per cent of individuals the hypoglossal nerve passes behind the IJV.¹ In addition, Nathan and Levy¹ have highlighted several variations in the relationship of the occipital artery and the hypoglossal nerve. Bergman and colleagues² have also reported variations, and these include atypical exit of the hypoglossal nerve from the posterior surface of the medulla oblongata and the formation of an annulus around the vertebral artery by its rootlets.

Anatomical variation in the course of the hypoglossal nerve in the neck has been well documented during carotid endarterectomy operations, and may account for unexpected nerve dysfunction following such procedures.^{3,4} The variations documented include a very low-lying hypoglossal nerve (level of the carotid bifurcation), the adherence of the hypoglossal nerve to the posterior surface of the facial vein, and fusion of the hypoglossal and vagus nerve trunks (via fibrous adhesions).^{3,4}

To our knowledge, a double hypoglossal nerve in the neck, as observed in our patient, has not been previously described in the medical literature.

Cadaveric studies have demonstrated that the hypoglossal nerve enters the supero-medial part of the hypoglossal canal usually as two bundles, which then change course abruptly to an antero-superior direction, and unite as one trunk before exiting the hypoglossal canal.⁵ It could be postulated that in our patient the two bundles failed to converge and subsequently continued as separate nerves along an anomalous course to reach the tongue.

Interestingly, anatomical investigations of the course and intracranial relations of the hypoglossal nerves have demonstrated that in 1–3 per cent of cases the hypoglossal canal has a bony septum throughout its entire length that completely divides it into two separate canals. In 15–28 per cent of cases, the canal is divided in two by a small bony spicule, either at the inner or outer orifice of the canal.^{5,6} However, most nerve bundles would appear to follow a diagonal course until they unite just before exiting the outer orifice of the canal.

- **Variant anatomy of the hypoglossal nerve is extremely rare**
- **We encountered a rare anatomical variant during a hypoglossal-facial nerve anastomosis procedure**
- **This is the first report of a ‘double’ hypoglossal nerve**
- **Surgeons must consider all variations of the hypoglossal nerve during head and neck procedures to minimise iatrogenic complications**

It would seem plausible that the presence of a double hypoglossal canal may alter the trajectory of the nerve fascicles entering the orifice, and the subsequent course of the nerve through the canal. This may, in turn, prevent the convergence of the nerve fascicles into a single nerve towards the periphery of the canal, and the potential formation of a double hypoglossal nerve.

Although the variant we describe would appear to be extremely rare, surgeons must consider all variations of

the hypoglossal nerve during head and neck procedures in order to minimise iatrogenic complications. The clinical significance of this variant in our patient remains unclear. However, in the context of a facial reanimation procedure the dual ipsilateral innervations to the tongue may be potentially advantageous, and may help reduce the loss of tongue function post-operatively.

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Mr S Islam takes responsibility for the integrity of the content of the paper

Competing interests: None declared
