Anatomy of the Head and Neck: The Infrahyoid Musculature

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The infrahyoid musculature often gets little attention in the course of medical education. Although medical students may hear the term at some point during a lecture or come across the musculature during a dissection course, physiotherapists, for example, may not learn about these very important muscles at all and often have to get up to speed via expensive training courses. In the literature, this group of muscles also is referred to as hyoid musculature because of its direct osseous connection to the hyoid (tongue bone). All of these muscles share the same innervation, which helps simplify the learning process.

Definition

The infrahyoid (or hyoid) musculature is a group of skeletal muscles which originate caudally and insert on the os hyoideum (tongue bone), which means they are located below (inferior to) the osseous structures. Muscles located above (superior to) the os hyoideum are referred to as suprathyoid musculature, which will be the topic of a separate article.
Classification: Which Muscles Belong to this Group?

The infrahyoid musculature includes five muscles: m. omohyoideus, m. sternohyoideus, m. sternothyroideus, m. thyrohyoideus, and m. levator glandulae thyroideae.

In evolutionary terms, the muscles are assigned to the large ventral longitudinal muscle system. In medical literature, the m. omohyoideus is considered part of the immigrated trunk musculature, which has insertion on the shoulder girdle, due to its osseous origin.

Musculus omohyoideus

Via the venter inferior, the m. omohyoideus originates from the upper edge of the scapula, the margo superior scapulae, which is next to the incisura scapulae, and the respective venter superior inserts on the lateral third of the lower edge of the corpus ossis hyoidei. Its primary function is to stretch the fascia of the neck’s ventral chain; in a broader sense, it is also the vascular muscle of the vena jugularis interna, which is located below the m. omohyoideus.

Clinically, the v. jugularis interna is infiltrated with central venous catheters. Moreover, this muscle pulls the hyoid in a dorsocaudal direction and thus is involved in the process of swallowing. The muscle is innervated by the ansa cervicalis profunda of the plexus cervicalis (C1-C3).

Note: A peculiarity of this muscle is its origin. In some humans, the origin is the clavica
and not the scapula; this variation is called \textbf{musculus cleidohyoideus}. The function and innervation remain the same.

The middle neck fascia, also referred to as \textit{lamina praetrachealis}, encloses both muscle bellies (the venter superior and inferior). At the site of the intermediate tendon, the lamina grows together with the \textit{vagina carotica}, which is a firm sheath of connective tissue surrounding a vessel-nerve strand. The structures of this strand are \textit{a. carotis communis, v. jugularis interna, and n. vagus}.

\textbf{Musculus sternohyoideus}

This muscle originates at the posterior surface of the \textit{manubrium sterni}, the medial end of the clavicle, and partly from the \textit{sternoclavicular joint (SCJ)}. It inserts at the \textit{lower edge of the os hyoideum}. Muscular sternohyoideus is innervated via \textit{ansa cervicalis profunda of the plexus cervicalis (C1-C3)}, pulls the hyoid bone in a caudal direction, and fixates it when the suprahyoid muscles tenses.

\textbf{Note:} This muscle can flatten at the origin and becomes narrower and thicker in the cranial direction.

\textbf{Musculus sternothyroideus}

The \textit{m. sternothyroideus} is thicker than the \textit{m. sternohyoideus}, which is located more superficially. The \textit{m. sternothyroideus} originates from the rear of the \textit{manubrium sterni}, and its insertion site is at the \textit{linea obliqua of the cartilago thyroidea}. This means that it is located directly next to the thyroid capsule. If the \textit{m. sternothyroideus} tightens, the thyroid capsule and the larynx are moved in a caudal direction. The innervation is the same as for all other infrahyoid muscles via the \textit{ansa cervicalis profunda of the plexus cervicalis (C1-C3)}.

\textbf{Note:} It connects to the \textit{glandula thyroidea} with loose connective tissue.

\textbf{Musculus thyrohyoideus}

This muscle is the continuation of the \textit{m. sternothyroideus} and thus originates at its insertion, the \textit{linea obliqua of the cartilago thyroidea}. The insertion of the \textit{m. thyrohyoideus} is at the \textit{inner side of the lateral third of the corpus ossis hyoidei} and at the \textit{lower edge of the medial surface of the cornu majus}. This means that its insertion is lateral and distal to the \textit{m. omohyoideus}. If the \textit{m. thyrohyoideus} tenses, it closes the larynx by pulling the \textit{m. hyoid} and the cartilago thyroidea close to each other. It also is innervated by the \textit{ansa cervicalis profunda of the plexus cervicalis (C1-C3)}.

\textbf{Note:} Morphologically, the \textit{m. thyrohyoideus} represents a wide muscle plate covering and adhering to the \textit{membrana thyrohyoidea}.

\textbf{Musculus levator glandulae thyroideae}

As mentioned above, the \textit{m. levator glandulae thyroideae} is not found in every human. It is a separated part of the \textit{m. thyrohyoideus}. Its origin is at the \textit{corpus ossis hyoidei}, and its insertion site is at the \textit{isthmus glandulae thyroidea}. Innervated by \textit{ansa cervicalis profunda of the plexus cervicalis (C1-C3)}, it raises the thyroid gland.
The infrahyoid muscles pull the os hyoideum and the larynx in a caudal direction. Besides the stabilization of the larynx via the sternothyroidal muscle loop, the infrahyoid muscles have another function: They influence phonation, the formation of speech. For example, if the thyroid cartilage is tilted against the cricoid cartilage due to changes in muscle tone, then vocal cord tension also changes.

This leads to the formation of hyperfunctional dysphonia, which presents as asynchronous oscillations of the vocal cords or even a unilateral halt of the vocal cords. Changes of the muscle tone cranially of the vocal cord plane influence the resonance chamber as well as vocal sound. Furthermore, the supra- and infrahyoid musculature is a functional muscle loop, with the os hyoideum as punctum fixum.

If the masticatory muscles of the jaw joint are stabilized, supra- and infrahyoid muscles act as flexors on the cervical spine and reduce its lordosis. This means that these structures also play an important role in the cervical spine.

Because of their connection to the hyoid, all the muscles described above have an influence on the hyoid, which results in the motion of osseous structures. If soft tissues are damaged (e.g., neuronal lesions), this can lead to position and movement disorders of the os hyoideum, which can result in speech disorders. When such symptoms arise, examination of the supra and infrahyoid muscles is required.

Because of the direct connection to the jaw muscles and the cranium or the cranial base, it may also be necessary to examine the atlanto-occipital joint. Treatment may include physiotherapy or speech therapy.

**Ansa Cervicalis Profunda**
Because the infrahyoid musculature often is affected by secondary pathologies, largely as a result of neuronal lesions, it makes sense to take a closer look at the motor nerve branches innervating the muscles.

The ansa cervicalis profunda is a nerve loop of segments C1-C3, which is responsible for motor innervation of the infrahyoid muscles. Sensory innervation takes place via other structures. The ansa cervicalis profunda is formed by two stems: the radix superior and radix inferior.

The motor fibers from segment C1 form the radix superior, which runs alongside the n. hypoglossus (cranial nerve XII) and then separates into the trigonum caroticum. There, it fuses with the radix inferior, which proceeds diagonally above the v. jugularis interna. The radix inferior contains fibers of vertebral segments C2 and C3.

Vena jugularis interna

The sinus sigmoideus fuses with the v. jugularis interna shortly before the foramen jugulare. Blood from the sinus transversus and sinus cavernosus is transported in this vein. Basically, the entire blood supply of the inner skull is drained via the v. jugularis interna. It is a clinically important structure, as central venous catheters are inserted into this vein.

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