

The unilateral cleidohyoideus accessorius muscle in human: A case report

Chakorn Vorakulpipat¹, Tawepong Arayapisit², Panjit Chunhabundit²,
Varunya Chantadul²

¹ Department of Oral and Maxillofacial Surgery, Faculty of Dentistry, Mahidol University, Bangkok, Thailand

² Department of Anatomy, Faculty of Dentistry, Mahidol University, Bangkok, Thailand

Objectives: The infrahyoid muscles are of clinical importance as they serve as anatomical landmarks especially for cervical metastases and surgery. Any variations in this region may cause misdiagnosis and complicate surgical procedures. This study aimed to present a muscular variation of the infrahyoid group, the cleidohyoideus accessorius or accessory cleidohyoid, to raise a concern about additional muscles in the neck region.

Materials and Methods: The infrahyoid region of 394 cadavers was dissected and investigated. The characteristics of the cleidohyoideus accessorius were then recorded.

Results: The unilateral cleidohyoideus accessorius was found in one of 394 Thai cadavers. The additional muscle co-originated with the right clavicular head of the sternocleidomastoid muscle and inserted at the body of the hyoid bone while other infrahyoid muscles were intact. The evolution and clinical considerations of the aberrant muscle were also included.

Conclusion: In the Thai population, the unilateral accessory cleidohyoid can be considered as a rare muscular variation; however, its clinical implications cannot be neglected. Thus, our finding can support surgeons in pre-operative planning and prevent any unfavourable outcomes.

Keywords: anatomic variation, cadaver, hyoid, neck muscle

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Introduction

The muscles of infrahyoid region originate from the sternum, the scapula, or the thyroid cartilage and attach to the hyoid bone. Their functions include stabilizing the hyoid bone when chewing, deglutition, and vocalization [1]. The variations of the infrahyoid muscles have been documented for several decades [2] with much lower prevalence [3] than those of the suprahyoid muscles [4, 5]. In 1923, Steinbach [2] classified the variations of infrahyoid muscles into 4 categories; omocleidohyoideus, cleidohyoideus, cleidohyoideus accessorius,

and cleidosternohyoideus muscles. The cleidohyoideus accessorius, or accessory cleidohyoid, is a muscle extending from the clavicle to the hyoid bone and is termed when the omohyoid muscle is intact [2]. It has been reported that the omohyoid was more frequently absent than any other infrahyoid muscles and had different forms of variations including additional bellies, atypical attachments, muscular replacement of the fascial sling, and absence of the superior or inferior bellies [3, 6, 7]. While the omohyoid muscle displays more variations than any other infrahyoid muscles [6], the information of cleidohyoideus accessorius is very limited.

Correspondence author: Varunya Chantadul

Department of Anatomy, Faculty of Dentistry, Mahidol University
6 Yothi Road, Ratchathewi District, Bangkok 10400, Thailand.

Tel. +662 200 7801 Fax. +662 200 7800 E-mail: varunya.chn@mahidol.edu

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Clinical importance of the infrahyoid muscles generally involves anatomical landmarks for cervical lymph node metastasis and surgical procedures. The omohyoid muscle has been shown to be a reliable structure for level III and IV lymph node separation [8] and brachial plexus localization through an endoscope [9]. A variation in the infrahyoid region can thus cause difficulty in clinical procedure and further lead to significant complications.

Although the cleidohyoideus accessorius have been reported from several regions of the world [3, 10, 11], whether the variation also presents in the Southeast Asian population requires an investigation. Therefore, the present study aimed to report the cleidohyoideus accessorius in Thai cadavers in conjunction with its evolutionary and clinical considerations to increase awareness of the additional muscle in the anterior neck during clinical practice.

Case report

During routine anatomical dissection from 2005 to 2021, the aberration of an infrahyoid muscle was found in a 68-year-old Thai male cadaver with no evidence of surgery or macroscopic lesion in the anterior neck. The dissection was performed by making a bilateral skin incision from the mastoid process downward and forward to the sternal end of the clavicle and continued laterally along the length of the clavicle to its acromion end. The final incision at the midline was made from the mental protuberance to the upper border of the sternum. Skin flaps and the platysma muscle were then reflected to expose the sternocleidomastoid muscle and the deep cervical fasciae. After the sternocleidomastoid was cut and reflected

and the fascial layers were removed, all infrahyoid muscles were cleaned and identified revealing the additional muscle in this region.

In the anterior neck, the additional muscle was found in the muscular triangle on the right side demarcated by the median line, the sternocleidomastoid, and the superior belly of the omohyoid. The muscle was located superficial to the sternohyoid and medial to the superior belly of the omohyoid while the caudal part was covered by the sternocleidomastoid. The superior and inferior bellies of the omohyoid muscle were in their normal form. Thus, this additional muscle could be termed cleidohyoideus accessorius (Figure 1). The muscle arose from the midclavicular region of the right clavicle along with the clavicular head of the sternocleidomastoid muscle and extended superiorly and medially to attach to the body of the hyoid bone as an aponeurosis. This muscle had a strap-like shape with a length of 9.0 cm and a width of 0.8 cm and was innervated by branches from the ansa cervicalis. Other variations, neither on the left side nor in other infrahyoid muscles, were observed.

All cadavers were donated for educational and research purposes. Our study was granted exemption from ethics approval reviewed by the Faculty of Dentistry and the Faculty of Pharmacy, Mahidol University, Institutional Review Board (MU-DT/PY-IRB), reference number: COE.No. MU-DT/PY-IRB 2020/030.3107 and was conducted in agreement with the Declaration of Helsinki (2013).

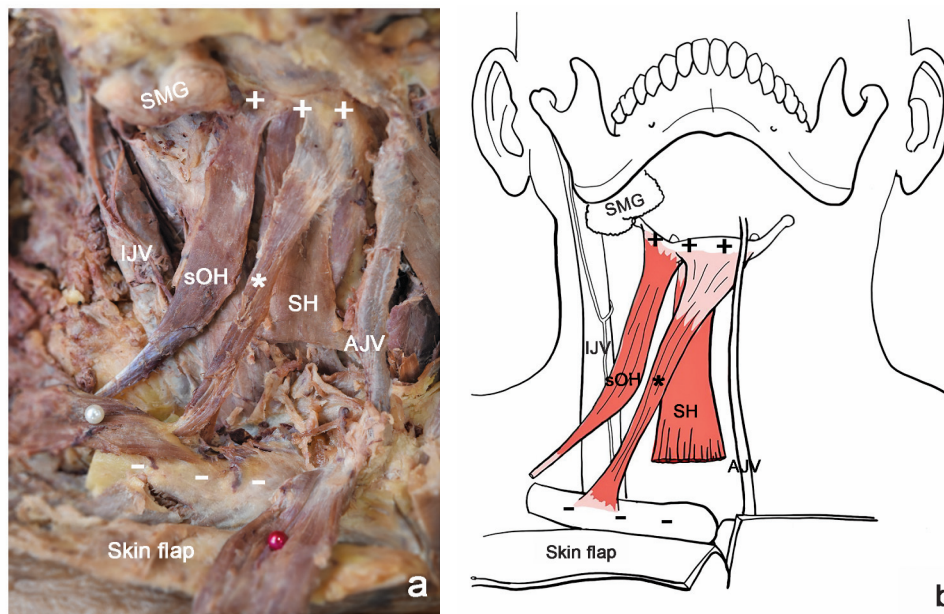


Figure 1 The cleidohyoideus accessorius muscle. (a) A photograph and (b) a schematic drawing showing the relationship between the muscle variant and other structures. The muscle was superficial to the sternohyoid and medial to the superior belly of omohyoid. Asterisk; cleidohyoideus accessorius. sOH; superior belly of omohyoid. SH; sternohyoid (cut). AJV; anterior jugular vein. IJV; internal jugular vein and ansa cervicalis. SMG; submandibular salivary gland. Minus signs; clavicle (cut). Plus signs; hyoid bone. White pin; clavicular head of the sternocleidomastoid (reflected). Red pin; sternal head of the sternocleidomastoid (reflected).

Discussion

According to Steinbach, there are two types of cleidohyoideus muscle. When the omohyoid muscle is absent, the muscle is termed the cleidohyoid muscle. Its function is probably similar to the superior belly of the omohyoid muscle. On the other hand, when the omohyoid muscle exists and other infrahyoid muscles are in their usual form, this additional muscle is termed the cleidohyoideus accessorius [2] which probably supports the sternohyoid muscle in stabilizing the hyoid bone. The additional muscle is usually found during routine cadaveric dissection [10, 11] with only one case that was observed during radical

neck dissection [12]. Currently, most of these cadaveric studies showed the bilateral form of the muscle [10, 11] while the unilateral muscle was documented less frequently. In Thailand, a previous study showed the unilateral cleidohyoideus muscle with an absence of omohyoid muscle in only one cadaver from 939 cadavers [13]. Our study thus reported another rare aberrant muscle, the unilateral cleidohyoideus accessorius, in the infrahyoid region which was found in one cadaver from 394 cadavers.

Since the cleidohyoideus accessorius is one of the variations of infrahyoid muscles, it is possible that these muscles share the same pattern of evolution. The theory based on the

tetrapod evolution has been referred to clarify the existence of the cleidohyoid muscle in human [14]. The pectoral girdle gradually changed during the evolution of tetrapods from the primitive bony fish to facilitate cranial mobility and stability during movement. As the skull became independent of the pectoral girdle, the dorsal dermal elements were progressively eliminated and cervical vertebrae developed as an axial skeleton of the neck. Consequently, the clavicle is the structure of the pectoral girdle which still exists after the evolution. In order to maintain the swallowing mechanism, the vertebrate class Aves developed the muscle connecting the pectoral girdle to the tongue skeleton (the hyoid bone), or the cleidohyoid muscle. This muscle stabilizes the larynx and facilitates swallowing in birds. In humans, these functions are performed by the well-developed infrahyoid muscles. The human cleidohyoid, and probably cleidohyoideus accessorius, muscles are thus considered as the vestigial structure of the Aves [13].

While the postulate that cleidohyoid muscle firstly developed in the birds has been widely accepted, several lines of studies have agreed that aberrations of the infrahyoid muscles are the result of regression of the episterno-cleidohyoideus sublimis (ECHS) muscle in lower vertebrates such as reptiles and amphibians [15]. This muscle originates from the sternum, clavicle, and scapula, and attaches to the hyoid bones. The progressive reduction of the ECHS muscle over the course of evolution probably led to the increase of variation of the muscle between omohyoid muscles and other infrahyoid muscles in human [15]. Therefore, it can be assumed that the cleidohyoideus accessorius muscle is the remnant of either the ECHS muscle in lower vertebrates or the cleidohyoid muscle in Aves.

During diagnostic and surgical procedures, clinicians have to be cautious of the unusual infrahyoid muscles. Identification of the omohyoid muscle along with its fascia is crucial as they direct the plane of dissection and help locate the neurovascular bundle in the carotid sheath [16]. Since the additional muscle is in close proximity to the internal jugular vein, it may cause difficulty in approaching this vessel and complications in the central venous catheter placement [17]. The contraction of the omohyoid muscle was demonstrated to change the intracerebral venous pressure during yawning [18]. As a consequence, the aberration of other muscles close to the omohyoid may also lead to these phenomena. In addition, the cleidohyoideus accessorius, when appears unilaterally, can be misinterpreted as soft tissue pathologies in radiographic examinations especially lymph nodes which show similar intensity to the muscle in computed tomography. This is of importance for lymph node group removal in neck dissection to prevent cervical metastases [8]. However, the supernumerary infrahyoid muscles can be beneficial for the reconstruction of the orofacial tissue as a myocutaneous flap after removal of malignancies [19], treatment of bowed vocal fold [20], and vocal fold atrophy [21].

Conclusion

This study reports the variation of the muscles in the anterior neck region, the unilateral cleidohyoideus accessorius which probably persists as a vestigial structure of the Aves or lower vertebrates. Although the prevalence of this muscle is considerably low in the Thai population, it can be occasionally found in clinical settings. Prior knowledge of the muscular

variation can prevent misdiagnosis or any complications from surgical procedures. Moreover, this additional muscle can be used as an alternative to restore the appearance and functions of the head and neck region.

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