



Bilateral supernumerary clavicular heads of sternocleidomastoid muscle in a Korean female cadaver

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Abstract

Many anatomical variants on the sternocleidomastoid muscle have been reported. In this study, supernumerary clavicular heads of sternocleidomastoid muscle in a Korean female cadaver were bilaterally displayed. The observed supernumerary heads were classified as follows: one sterno-mastoid, one cleido-occipital and one cleido-mastoid on the right side, and one sterno-mastoid-occipital, four cleido-occipitals, and one cleido-mastoid on the left side. The sterno-mastoid and sterno-mastoid-occipital and the cleido-occipital made the superficial layer of the sternocleidomastoid muscle, while others made deep layer. We discussed clinical relevance and developmental basis of these muscular variations important for clinicians and anatomists.

Keywords Sternocleidomastoid · Superficial layer · Development · Variation

Introduction

The sternocleidomastoid (SCM) muscle originates in two heads: tendinous sternal head attached to the manubrium of the sternum and muscular clavicular head attached to the medial third of the clavicle. The former runs obliquely across the side of the neck while the latter heads almost at right angles upward. The SCM muscle is comprised of two layers: (1) the superficial layer has superficial sterno-mastoid, sterno-occipital and cleido-occipital parts and (2) the deep layer involves deep sterno-mastoid and cleido-mastoid parts [8, 18, 22].

The SCM muscle shows a wide range of variations [22] with up to 5 fleshy bellies and 13 heads of origin [21]. Although the supernumerary clavicular heads of SCM have been reported with incidence up to 33% [3, 12], bilateral multiple supernumerary heads of SCM muscle have been

reported only in several studies [1, 4, 7, 11–17] to the best of our knowledge. Most of these cases were found in male cadavers, only one case was observed in a female cadaver. Herein, we describe a case with large number of bilateral supernumerary clavicular heads of SCM muscle in a Korean female cadaver. It is of anatomical interest with significant surgical and clinical importance.

Case report

During a routine educational dissection, bilateral variations of SCM were observed in a 49-year-old Korean female cadaver, whose cause of death was ‘diabetic ketoacidosis’.

We found two clavicular heads on the right side and five clavicular heads on the left side. The right SCM was comprised of a typical sterno-mastoid, a cleido-occipital, and a cleido-mastoid (Fig. 1a). The cleido-occipital originated close to the sternal head, running parallel with the sternal head (Fig. 2b). The cleido-mastoid extended from the clavicle as fleshy fibers, coursed upward and posterior to the sterno-mastoid and the cleido-occipital, and inserted onto the mastoid process just behind to the superficial layer (Fig. 2a). The widest dimension at the origin of the right sternal head was 6 mm. Those of clavicular heads were 26 mm and 28 mm, respectively (Fig. 1a).

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Fig. 1 Photographs showing bilateral variations of the sternocleidomastoid muscle. Multiple clavicular heads (CH) with broad origin were seen on the right neck (a) and the left neck (b) after superficial dissection. *The sternal head of the sternocleidomastoid, SH sternohyoid, OH omohyoid

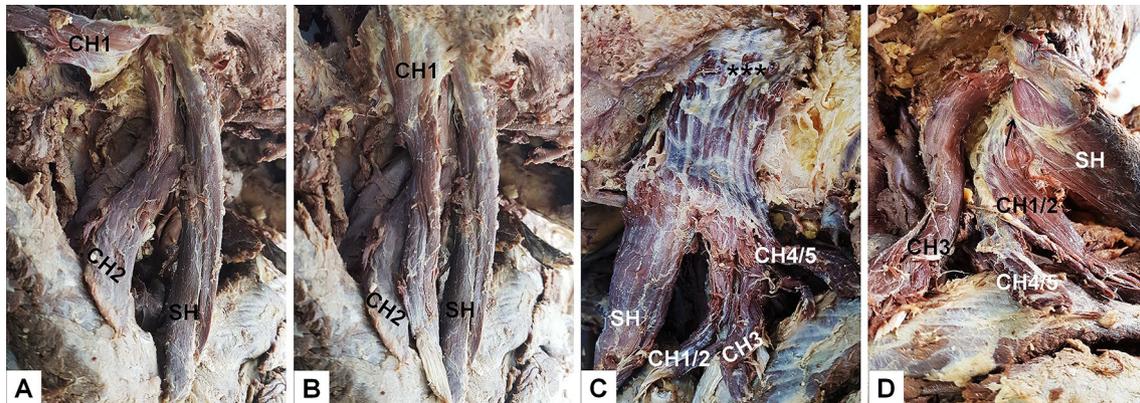
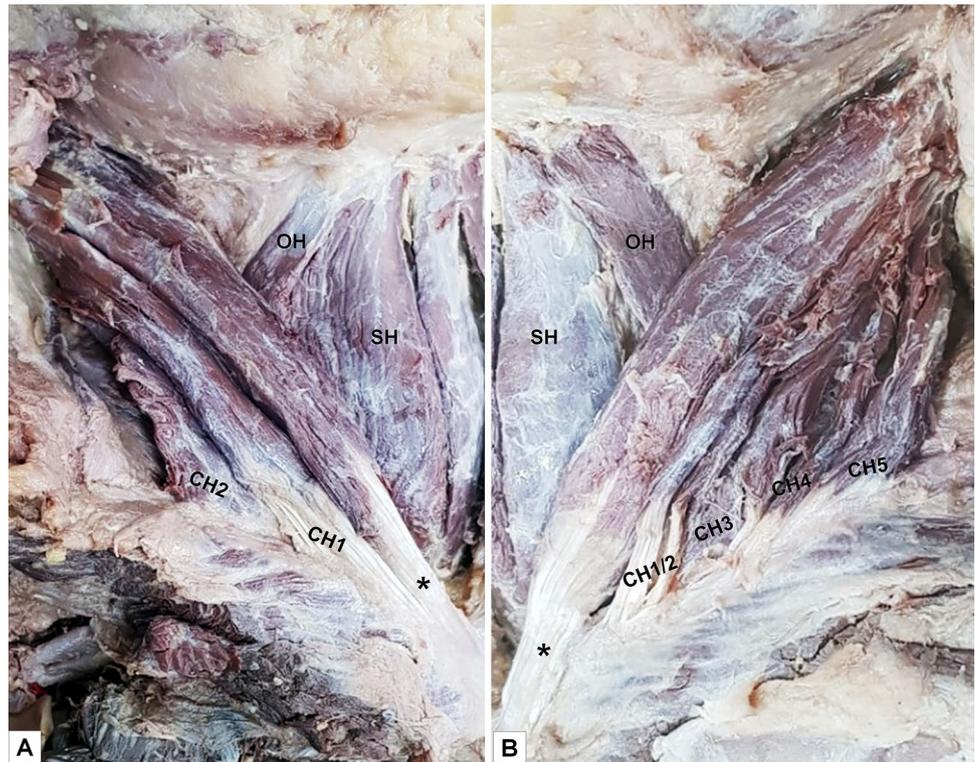


Fig. 2 Photographs showing superficial and deep layers of the sternocleidomastoid muscle. a, b A superficial clavicular head, the cleido-occipital (CH1) on the right side, was cut and reflected to reveal the insertion of the sterno-mastoid (SH) and cleido-mastoid (CH2) on the lateral neck. c, d The sternal head (a sterno-mastoid-occipital,

SH) continued with multiple clavicular heads (CH1, CH2, CH4, and CH5) to make the superficial layer on the left neck. After reflecting the superficial layer, a clavicular head (CH3) was confirmed to form the cleido-mastoid of the deep layer

On the left side, the sternal head arose from the manubrium of the sternum, and terminated at the mastoid process to the superior nuchal line because it ran together with some clavicular heads (Fig. 2c). Two medial clavicular heads (cleido-occipitals) fused with each other in the middle (Fig. 2d). The third muscle head (cleido-mastoid) took its origin from the clavicle as fleshy belly, attached to the mastoid process, and formed a deep layer (Fig. 2d).

The fourth and fifth clavicular heads, arose lateral to the cleido-mastoid and cleido-occipitals (Fig. 2c). These cleido-occipitals extended upward together. It was difficult to distinguish the bellies from each other (Fig. 2c). The widest dimension at the origin of the left sternal head was 9 mm. Those of clavicular heads were 6 mm, 2 mm, 17 mm, 4 mm, and 18 mm, respectively (Fig. 1b).

Table 1 Characteristics of references regarding bilateral variation of sternocleidomastoid muscle

References	Number of heads		Age/sex
	Right	Left	
Anil et al. [1]	SH1CH2	SH1CH2	66/male
Hurtado and Arquez [4]	SH1CH2	SH1CH3	47/male
	SH1CH2	SH1CH2	75/male
Kim et al. [7]	SH1CH3	SH2CH2	67/male
Natsis et al. [11]	SH2CH4	SH2CH4	72/male
Nayak et al. [12]	SH2CH1	SH2CH1	60/male
Özgüner et al. [13]	SH1CH2	SH1CH2	72/male
Prakash et al. [14]	SH1CH2	SH1CH2	NS/male
Raikos et al. [15]	SH1CH3	SH2CH2	76/female
Ramesh Rao et al. [16]	SH1CH2	SH1CH2	NS/male
Saha et al. [17]	SH1CH4	SH1CH3	NS/male
	SH1CH2	SH1CH2	NS/male
This case	SH1CH2	SH1CH5	49/female

NS not specified, SH sternal head, CH clavicular head

Discussion

Variations in origin of clavicular and sternal heads of the SCM have been reported previously. However, variations in the former one are more common than the latter one [3, 12, 20]. In cadaveric studies, the frequency of bilateral supernumerary heads of SCM muscle has been reported to be 11.1% (2 cases/16 cadavers) [4] or 12.5% (2 cases/18 cadavers) [17], which is quite low compared to that of single clavicular head variant. We found only 12 cases of bilateral supernumerary heads of SCM muscle (Table 1), of which only 1 case showed bilateral supernumerary sternal heads [12], only 1 case showed bilateral supernumerary sternal and clavicular heads [11]. An additional cleido-cervical head [15] which was not a part of the typical SCM muscle was also found. Others were bilateral supernumerary clavicular heads. Although two cases including the present case out of 13 reported cases were observed in females, the relationship between bilateral supernumerary variation of the SCM muscle and sex was not clearly reported. It remains to be clarified.

The clavicular head variant of SCM muscle has been reported to be subdivided into several small muscle slips [21]. This might be related to the abnormalities in the developmental course of the trapezius and SCM muscles. The trapezius and SCM muscles originated partly from the neural crest as well as partly from somites. They are derived from the occipital region just caudal to the posterior sixth branchial arch mesoderm, becoming a thick mass which then segregates into a ventral part for the developing SCM, and a dorsal part for developing trapezius muscle.

The SCM muscle progressively develops and extends from the mastoid process and occipital region dorsally to the clavicle, eventually attaching to the manubrium of the sternum and the clavicle [10, 20]. The bilateral supernumerary heads of SCM muscle might also be connected with inaccurate signaling Hox genes [9]. These genes control the mesoderm linking muscles to the posterior neck and shoulder skeleton. Accordingly, the supernumerary heads of SCM muscle can be attributed to abnormal mesodermal division at the last pharyngeal arch with or without the influence of Hox genes.

The left portion of this case might have been formed as a result of incomplete split of the SCM and trapezius muscles since both muscles arise from a common pre-muscle mass [10, 20]. Adjoining margins of the SCM and trapezius muscles have also been reported [19]. The right portion of this case could be regarded as a cleido-mastoid of classic five parts of SCM with superficial and deep parts. Regarding developmental evidence, most bilateral supernumerary clavicular heads of SCM muscles could be considered as another cleido-mastoid part [1, 11–14, 16, 17]. Only five cases [4, 7, 15], including the present case, showed superficial and deep parts of the SCM muscle, in which a sterno-mastoid-occipital or a cleido-occipital fused with sternal heads in the superficial layer.

Radiation-induced toxicity including spasm [4] and atrophy [6] of the SCM muscle has been a concern after head and neck surgery. For head and neck dissection, the SCM muscle takes a role as the landmark and a useful flap [2, 5]. Precise knowledge of variable anatomy about the SCM muscle is clinically valuable because such information helps surgeons avoid possible damage to cardinal structures such as the common carotid artery, the internal jugular vein, the accessory nerve, branches of brachial and cervical plexuses, and deep cervical lymph nodes [15]. Although supernumerary heads of SCM muscle may not cause any functional advantage or disadvantage in neck movement they might be physically interfering with invasive procedures. Such information is important to clinicians and as anatomists.

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Author contributions Oh JS and Kim CE found the case and acquired the primitive data. Kim J and Yoon SP analyzed the data and references. Oh JS and Kim CE wrote the manuscript. Oh JS, Kim J, and Yoon SP revised the manuscript. All authors approved the manuscript.

Compliance with ethical standards

Conflict of interest None declared.

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