
ORIGINAL ARTICLE**Supernumerary heads of sternocleidomastoid muscle and its clinical significance:
A cadaveric study**

Veeramalla Lingaswamy¹, Surekha D. Jadhav^{1*}, Sudhir E. Pawar¹

Department of Anatomy, DVVPPF's Medical College and Hospital, Opp. Govt. Milk Dairy, Vadgaon
Gupta (Vilad Ghat) Post: MIDC, Ahmednagar-414111 (Maharashtra) India

Abstract

Background: Sternocleidomastoid muscle is main muscle of neck region which is attached proximally to mastoid process and lateral half of the superior nuchal line and distally to the sternum and clavicle. It is related to numerous important neurovascular structures. A variation in its anatomy is clinically important especially for neck surgeries and catheterization of internal jugular vein. *Aim and Objectives:* To establish the incidence, number and variations of supernumerary head of sternocleidomastoid muscle in cadavers. *Material and Methods:* We studied the variations in the heads of the sternocleidomastoid muscle in the 84 cadavers (n=168, Right= 84; Left=84) which were used for undergraduate teaching in our college. Muscle was exposed by doing meticulous dissection. Proximal and distal attachments were carefully cleaned and number of supernumerary heads with their origin and insertion were noted. *Results:* Present study observed supernumerary heads of sternocleidomastoid muscle in 32.73% cadavers. In majority of cases the supernumerary heads (which may be 2, 3, 4) was found to be arising from superior surface of medial 2/3 clavicle. *Conclusion:* Detailed knowledge of this variation is crucial for head and neck surgeons, radiologist, anesthetists and clinicians dealing with this region.

Keywords: Clavicle, Mastoid process, Sternocleidomastoid, Sternum, Supernumerary heads, Superior nuchal line.

Introduction

Sternocleidomastoid (SCM) muscle is a key muscle in the neck which takes origin from two distinct heads. It has a rounded and tendinous sternal head that comes from the upper half of the anterior surface of the manubrium, and a clavicular head from the medial third of the superior surface of the clavicle [1-2].

Both heads of SCM ascend upwards, the clavicular head spirals in-back-of the sternal head and merges with the sternal head's deep surface in the middle of the neck to form a single thick, rounded belly. It is inserted superiorly into the lateral surface of the mastoid process by a strong tendon and the lateral half on the superior nuchal line by a thin aponeurosis. The mastoid process receives the

majority of the clavicular fibers, whereas the sternal fibers run more obliquely and superficially, extending to the lateral half of superior nuchal line. Due to this arrangement of fibers the direction of pull of the two heads of SCM is different. As a result, this muscle can be characterized as 'cruciate' and spiralized [3-5]. The spinal accessory nerve provides motor nerve supply, and the 2nd, 3rd, and 4th nerves provide proprioceptive innervation [1-2]. Anterior and posterior borders of the SCM act as a dividing line between anterior and posterior triangles of the neck. Minor supra-clavicular fossa is present between two heads of SCM muscle near their origin and it is a clinical landmark utilized in a variety of clinical procedures. This fossa becomes

narrow due to presence of supernumerary heads of SCM and it would be extremely difficult to locate the internal jugular vein and cannulate it [1, 2, 6].

The SCM muscle is responsible for various movements of head and neck and plays an important role in the physiology of head-neck balance. It controls and directs the head from falling backwards. Also, it contributes to the sense of equilibrium especially the clavicular head of SCM and help in forced inspiration [7-8]. Nerve point of the neck lies at the junction of the upper and middle third of the posterior border of SCM where 4 cutaneous nerves of the cervical plexus (lesser occipital, great auricular, transverse cervical, supra-clavicular nerves) and spinal accessory nerve emerge. This point is used by anesthetist to give cervical plexus block [1]. Variations of SCM anatomy may lead to narrowing of minor supra-clavicular fossa and complications may occur while doing catheterization of internal jugular vein which is present in the fossa [5]. It is used as myocutaneous flap for repair of oral cavity and facial defects, parotid surgery, protection of carotid artery. The presence of extra heads SCM muscle may alter the normal method of clavicle fracture healing and may interfere in healing of fracture along with callus formation or displacement which can lead to thoracic outlet compression [9-10]. Considering the clinical importance of SCM, we searched the literature and we came across very few detailed studies on it. Main objective of the study was to observe the incidence, number and attachments of supernumerary heads of SCM.

Material and Methods

Present study was conducted on 84 cadavers (n=168: Right- 84 and Left- 84) during routine dissection of neck region for undergraduate teaching in the Department of Anatomy, DVVPF'

s Medical College and Hospital, Ahmednagar, Maharashtra. Ethical clearance was taken from Institutional Ethics Committee (DVVPF's VIMS/IEC/2019/9A). This was an observational study which was carried in a period between 08/08/2019- 1/02/2022.

Sample size: It was calculated by using formula – $4pq/L^2 = 4 \times 0.3 \times 0.7 / 0.01 = 84$ (Where: p- Prevalence of indicator = 0.7, q- Prevalence of negative character = 1-p = 1- 0.7= 0.3, L- Margin of error = 0.01 [11]).

Cadavers showing any neck deformity and marking of incision in neck region were excluded from this study. Statistics was calculated in percentage. Ten of the dissected cadavers were female. We exposed the SCM muscle by doing meticulous dissection. Proximal and distal attachments were carefully cleaned. Then we noted number of supernumerary heads of SCM with their origin and insertion. Necessary photographs were taken.

Results

Present study observed supernumerary heads of SCM muscle in 32.73% cadavers (Table.1). Detailed prevalence of supernumerary heads of SCM muscle in female and male cadaver was given in Table 2. The supernumerary heads of SCM muscle were found to be arising from superior surface of medial 2/3 clavicle in majority of cases (Fig. 1a, 1b, 2a, 2b, 2c, 3).

In three cases, we observed that supernumerary heads were arising from sternal head (Fig. 3). In one case we observed hitch-hiking of supernumerary heads of the SCM. In this case we observed 3 clavicular and one sternal supernumerary heads of SCM which was arising from lateral side of the right sternal head of SCM (Fig. 3). It passes upwards and postero-laterally then it

fused with clavicular supernumerary head of SCM. In second case supernumerary head aroused from the medial side of sternal head which passes upwards and medially and merged with deep cervical fascia near the base of mandible (Fig. 4a). In third case, the two supernumerary heads were arising from medial and lateral sides of sternal head (Fig. 4b). The supernumerary heads which were arising from lateral side of the sternal head of SCM fused with trapezius after crossing clavicular head of SCM while the supernumerary heads arising

from medial side passes upward, laterally deep to main belly of sternal head of SCM (Fig. 4b).

In one male cadaver we observed that fibers of both heads of SCM muscles were directed laterally and posteriorly. Both heads fused with each other in middle of neck and fused fibers of SCM was merging with trapezius muscle (Fig. 4c). Also, we found that supernumerary head was arising from lateral side of trapezius which fuses with clavicular head of the SCM (Figs. 5a; 5b).

Table 1: Prevalence of supernumerary heads of sternocleidomastoid muscle

Supernumerary heads of SCM	Bilateral (No of heads)		Unilateral (No of heads)		Total	Percentage (%)
	Right	Left	Right	Left		
Three headed	12	12	6	14	44	26.19%
Four headed	-	-	3	7	10	05.95%
Six headed	-	-	1	-	01	0.59 %
Total	12	12	10	21	55	32.73%
Specimens without supernumerary heads of SCM			Right-62	Left-51	113	67.26%

Table 2: Prevalence of supernumerary heads of sternocleidomastoid muscle in female and male cadavers

Sex	Supernumerary heads of SCM	Bilateral (No of heads)		Unilateral (No of heads)		Total
		Right	Left	Right	Left	
Females	Three headed	01	01		01	03
	Four headed	-	-	-	-	-
	Six headed	-	-	-	-	-
Males	Three headed	11	11	06	13	41
	Four headed	-		03	07	10
	Six headed	-	-	01	-	01



Figure 1a and 1b: Showing three supernumerary heads of sternocleidomastoid muscle

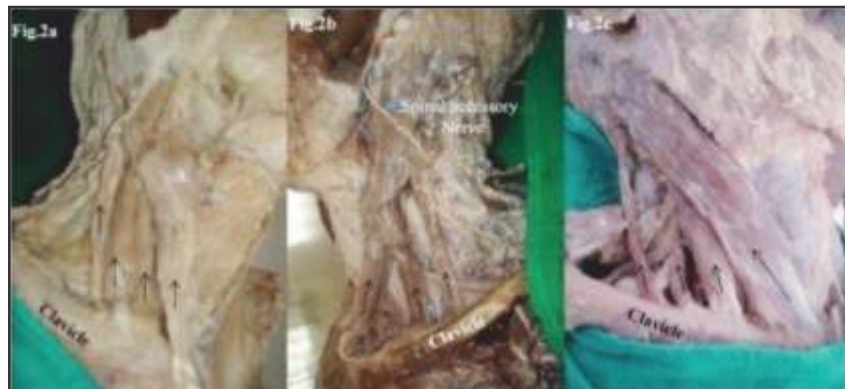


Figure 2a, 2b and 2c: Showing four supernumerary heads of sternocleidomastoid muscle



Figure 3: Showing hitch-hiking of supernumerary heads of sternocleidomastoid muscle (Six supernumerary heads of sternocleidomastoid muscle)

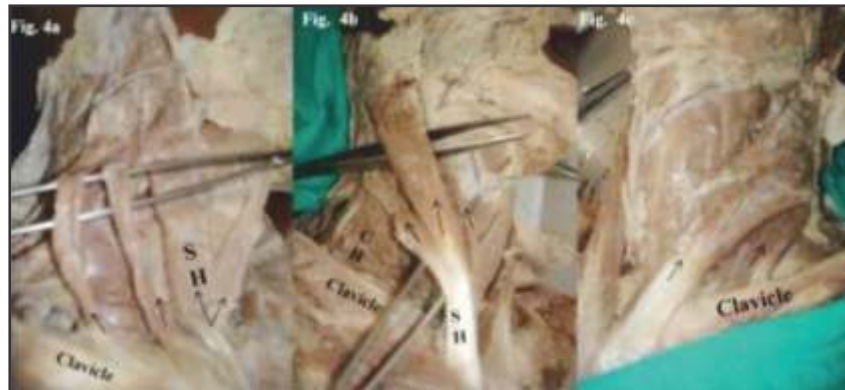


Figure 4a and 4b: Showing supernumerary heads of sternal head of sternocleidomastoid muscle
Figure 4c: Showing merging of clavicular and sternal heads of sternocleidomastoid muscle with trapezius muscle (green arrow)

SH- Sternal head, CH- Clavicular head, SCM-Sternocleidomastoid

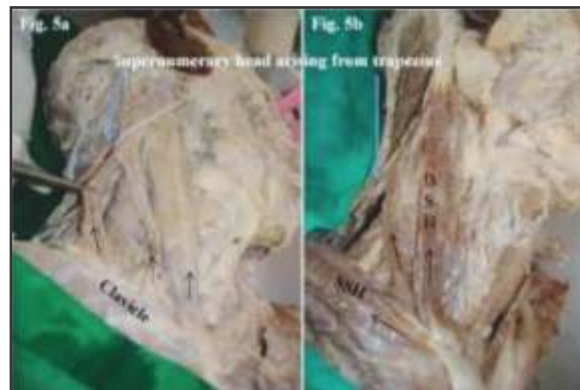


Figure 5a and 5b: Showing supernumerary head arising from trapezius muscle

SCH-supernumeraryclavicular head, CH-clavicular head, SH-sternal head, SSH-superficial sternal head, DSH-deep sternal head, Sup SH-Supernumerary sternal head

Discussion

Sternocleidomastoid muscle is also called the “quadrigeminum muscle of the neck”. Saxena *et al.* quoted that according to Le Double, in some animal species it is composed of the sterno-mastoid, the sterno-occipital, the cleido-mastoid, and the cleido-cranial occipital muscles. But in humans these four muscles forming the quadrigeminum are more or less fused. Usually, they are present in two parts-

cleidomastoid and sternomastoid which is considered as normal by many researchers [12].

Prominence of SCM is a symbol of Homo sapiens beauty. Clavicular head of SCM shows a wide range of variations. However, variations at the proximal end of the SCM muscle are rarely reported [6-7]. Few cases have been reported complete unilateral absence of SCM which occurs

due to developmental defect of muscular agenesis. Complete unilateral absence of SCM is one of the causes of congenital torticollis and it is diagnosed by USG or MRI [13-15].

Variations of SCM are observed during routine cadaveric neck dissections and surgeries. Many researchers observed a broad clavicular head which splits into multiple small muscular slips and present study also observed it (Fig. 3, Fig. 5a) [16-17]. The number of these supernumerary heads may vary and may be unilateral or bilateral. These types of variations cause the formation of supernumerary lesser supra-clavicular fosse. These supernumerary heads may not provide any functional benefit or disadvantage in neck movement, but it may cause physical interference during invasive or surgical procedures.

Embryological insight: Presence of supernumerary heads of SCM may occur due to abnormal splitting of mesoderm of 6th branchial arch and it is mediated by inaccurate signaling Hox genes which play key role in regulating the mesoderm links muscles to posterior neck and shoulder skeleton [7, 18]. Rarely, the SCM muscle may fuse with trapezius and explanation for this is that, developmentally these two muscles share the same origin and therefore may be fused with each other [19]. In one male cadaver we observed that fibers of both heads of SCM muscles were directed laterally and posteriorly and fused with each other in the middle of the neck. Then fused fibers of SCM were merging with trapezius muscle (Fig. 4c).

Saha *et al.* (2014) [19] studied the morphological study of the attachment of the SCM muscle. They

observed the incidence of supernumerary heads of the SCM muscle in 27.8% and Bergman *et al.* [20] in 33% cases [20]. Present study observed incidence of supernumerary heads of SCM in 32.73% cadavers. In 2012, Kaur *et al.* [21] reported a unique case of the SCM muscle which has six heads, two sternal and four clavicular. Present study also observed same finding in one case (Fig. 3). Natsis reported a case having five bilateral head of sternocleidomastoid two sternal and three clavicular [22].

José *et al.* observed bilateral supernumerary clavicular heads of the SCM on a human fetus [23]. Mansoor and Rathore have observed accessory mid-clavicular head of the SCM causing mild torticollis in a 27 years adult, restriction in neck movements, and pain on prolonged posturing. The patient had a limited range of neck rotation to the opposite side, along with limited extension due to the effect of the accessory clavicular head [24].

Torticollis can be caused by an extra head of SCM because it produces a physical constraint that prevents the neck from tilting and turning to the opposite side. However, until adulthood, this variance may go unnoticed. It may be confused with cervical dystonia, muscular spasm and fibromatosis colli [24].

Precise knowledge of variations of SCM is important during neck surgery, catheterization during various procedures, interpreting the CT and MRI images. Also, this is essential for physicians who are involved in the diagnosis and management of wry neck/torticollis and problems in the neck area.

Conclusion

The supernumerary heads of the SCM muscle were shown to have a wide range of variances in this study. We observed supernumerary heads of SCM muscle in 32.73% cadavers. Awareness of these variations is important for head and neck

surgeons, radiologists, vascular and orthopedic surgeons, and anesthetists who used the supraclavicular fossa for a central venous catheter that could cause pleural perforation.

References

1. Gray H, Standring S. Sternocleidomastoid (SCM). In: Standring S, Berkovitz BKB, Hackney CM, Ruskell IGL, eds. *Gray's Anatomy. The Anatomical Basis of Clinical Practice*. 39th ed. Edinburgh: Churchill & Livingstone; 2005: 536.
2. Moore KL, Dalley AF. Bones of the neck, triangles of the neck, deep structures of the neck, and lymphatics in the neck. In: Moore KL, Dalley AF, eds. *Clinically Oriented Anatomy*. 4th ed. Philadelphia: Lippincott Williams & Wilkins Company; 1999: 1000-1062.
3. Arias DK, Ferreira H. Bilateral supernumerary sternocleidomastoid heads with clinical and surgical implications. *J Chem Pharm Res* 2016; 8(5):527-37.
4. Ramesh RT, Vishnumaya G, Prakashchandra SK, Suresh R. Variation in the origin of sternocleidomastoid muscle. A case report. *Int J Morphol* 2007; 25(3):621-623.
5. Pushpa MS, Nandhini V. Unusual bilateral presence of third head of sternocleidomastoid muscle and its clinical significance – A case report. *Int J Rec Sci Res* 2014; 5(1): 5-7.
6. Raikos A, Paraskevas G, Triaridis S, Kordali P, Psillas G, Brand-Saberi B. Bilateral supernumerary sternocleidomastoid heads with critical narrowing of the minor and major supraclavicular fossae: clinical and surgical implications. *Int J Morphol* 2012; 30(3): 927-933.
7. Nayak SR, Krishnamurthy A, Kumar MSJ, Pai MM, Prabhu LV, Jetti R. A rare case of bilateral sternocleidomastoid muscle variation. *Morphol* 2006; 90:203-4.
8. Hansan T. Variations of the sternocleidomastoid a literature review. *Int J Human Anat* 2011; 1(1): 1-15.
9. Aparna G. Additional head of sternocleidomastoid muscle with 3rd supraclavicular fossa. *Int J Pharm Bio Sci* 2013; 4(3B): 586-589.
10. Arquez HF. Muscular variation in the neck region with narrowing of the minor and major supraclavicular fossa. *Int Arch Med* 2017; 10(208): 1-9.
11. Rao TB. *Research Methodology: Principles & Concepts*. 3rd ed. Pars Publication, 2010: 267.
12. Saxena A, Prasad A, Sood K. Unilateral four heads of sternocleidomastoid muscle: a rare case report. *Eur J Anat* 2013; 17(3): 186-189.
13. Koçak G, Aysun S, Akhan O. Unilateral agenesis of the sternocleidomastoid muscle. *Turk J Pediatr* 1995; 37(4):435-438.
14. Raman S, Takhtani D, Wallace EC. Congenital torticollis caused by unilateral absence of the sternocleidomastoid muscle. *Pediatr Radiol* 2009; 39(1):77-79.
15. Chawla S, Tandon A, Meena G. Unilateral Absence of Sternocleidomastoid and Ipsilateral Trapezius Presenting as Congenital Torticollis: A Case of a Rare Entity. *Cureus* 2021; 13(8): e17222.
16. Nayk, Boaro SN, Frago Neto R. A topographic variation of the sternocleidomastoid muscle in a just born children. *Int J Morphol* 2003; 21: 261-264.
17. Cherian SJ, Nayak S. A rare case of unilateral third head of sternocleidomastoid muscle. *Int J Morphol* 2008; 26(1):99-101.
18. Matsuoka T, Ahlberg PE, Kessaris N, Lannarelli P, Dennehy U, Richardson WD et al. Neural crest origins of neck and shoulder. *Nature* 2005; 436:347-55.
19. Saha A, Mandal S, Chakraborty S, Bandyopadhyay M. Morphological study of the attachment of the sternocleidomastoid muscle. *Singapore Med J* 2014; 55(1): 45-47.
20. Bergman RA, Thompson SA, Afifi AK, Saadeh FA. *Muscles*. In: *Compendium of Anatomic Variation Text, Atlas, and World Literature*. Baltimore: Urban and Schwarzenberg, 1988: 32-33.

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21. Kaur A, Sharma A, Sharma M. A case of unusual unilateral accessory clavicular head of sternocleidomastoid muscle. *North States J Anat* 2017; 2(2):25-28.
 22. Natsis K, Asouchidou I, Vasileiou M, et al. A rare case of bilateral supernumerary heads of sternocleidomastoid muscle and its clinical impact. *Folia Morphol (Warsz)* 2009; 68(1): 52-54.
 23. José Aderva Aragão, Wesley Hewesson Góes Cruz Modesto, Nilson César Menezes Santos, et al. Bilateral supernumerary clavicular head of the sternocleidomastoid muscle on a human fetus cadaver. *MOJ Anat Physiol* 2020; 7(2):27-28.
 24. Mansoor SN, Rathore FA. Accessory clavicular sternocleidomastoid causing torticollis in an adult. *Prog Rehabil Med* 2018; 3: 20180006.
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***Author for Correspondence:**

Dr. Surekha D Jadhav, Professor, Department of Anatomy, D V V P F's Medical College and Hospital, Ahmednagar, Maharashtra, Opp. Govt. Milk Dairy, Vadgaon Gupta (Vilad Ghat) Post: MIDC, Ahmednagar-414111, Maharashtra
Email: drsurekhadjadhav@gmail.com Cell: 9923373960

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