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Introduction of a New Classification of the Cleidooccipital Muscle

Sandeep Silawal [1,*], Shikshya Pandey [2] and Gundula Schulze-Tanzil [1]

[1] Institute of Anatomy and Cell Biology, Paracelsus Medical University, Nuremberg, Prof. Ernst Nathan Str. 1, 90419 Nuremberg, Germany
[2] Department of Anesthesiology and Intensive Care Medicine, Kliniken des Landkreises Neumarkt i.d.OPf, Nürnberger Straße 12, 92318 Neumarkt in der Oberpfalz, Germany
* Correspondence: sandeep.silawal@pmu.ac.at

Abstract: The "cleidooccipital branches" are integral muscular branches of the sternocleidomastoid muscles (SCM), as well as the trapezius muscles, which construct the anterior and posterior borders of the posterior triangle of the neck, respectively. The term "cleidooccipital muscle", in the literature, generally describes the accessory muscle, which is proximally attached to the middle portion of the clavicle, separate from the clavicular attachment of the SCM or trapezius muscle, and crosses the posterior triangle of the neck obliquely. With proximity to either the trapezius or the SCM, the accessory cleidooccipital muscles can be divided into posterior and anterior accessory cleidooccipital muscles, respectively. At present, most of the descriptions in the literature associated with the accessory cleidooccipital muscles concern the posterior accessory cleidooccipital muscles. The anterior accessory cleidooccipital muscles are mostly recognized as a proximal clavicular-head-sided supernumerary variation of the SCM. We propose a new classification of these muscles, with nomenclatures to help researchers to differentiate the cleidooccipital branches or muscles from one another. Introducing this classification, we hope that more clarity can be achieved when addressing the so-called "cleidooccipital muscle" in the future.

Keywords: cleidooccipital; sternocleidomastoid; trapezius

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1. Introduction

During vertebrate neck development, the posterior triangle of the neck is formed after the division of a single muscle into posterior and anterior parts, leading to the development of the trapezius muscle and the sternocleidomastoid muscle (SCM), respectively [1–3]. In cases where the splitting of the muscles fails completely, there is an absence of the formation of the posterior triangle of the neck [4]. However, the separation process can also be incomplete in individuals where a separate supernumerary muscle remains in the posterior triangle of the neck. The term "cleidooccipital muscle", in the literature, generally describes this supernumerary muscle, present either unilaterally or bilaterally. This muscle is proximally attached to the middle portion of the clavicle, separate from the clavicular attachment of the SCM or trapezius muscle, and crosses the posterior triangle of the neck obliquely. It is also important to understand that "cleidooccipital branches", formed during the normal development of the neck, are integral parts of the SCM, as well as the trapezius muscles, which construct the anterior and posterior borders of the posterior triangle of the neck, respectively. As the cleidooccipital branch of the SCM is proximally attached to the sternal end of the clavicle, the branch of the trapezius muscle is inserted at the acromial end of the clavicle. The distal insertion of the cleidooccipital branches, as well as the accessory cleidooccipital muscles, is in the superior nuchal line between the mastoid process and the external occipital protuberance on the occipital bone. However, with proximity to either the trapezius or the SCM, the accessory cleidooccipital muscles can be divided into posterior and anterior accessory cleidooccipital muscles, respectively.

2. Relevant Section

Classification of the cleidooccipital muscles with their nomenclatures (Figure 1).

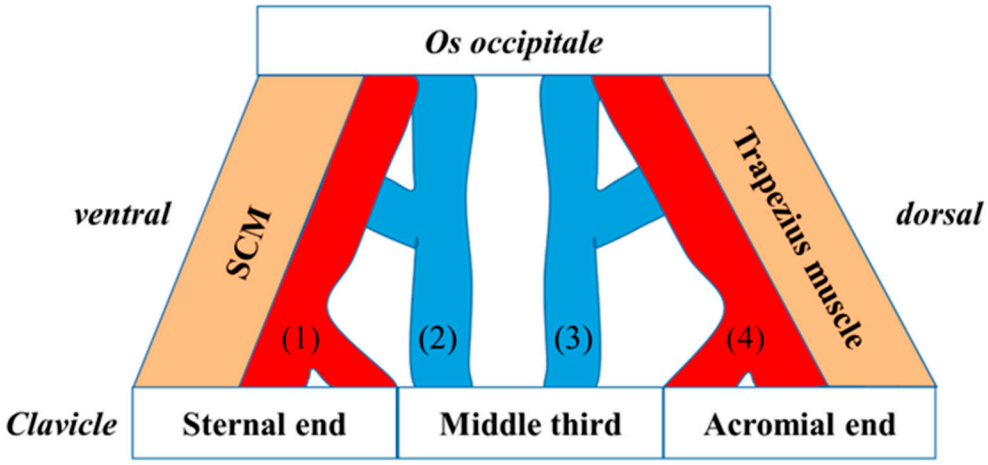

Figure 1. The schematic description of the posterior triangle of the neck with a new classification and nomenclature of the cleidooccipital muscular branches of the sternocleidomastoid muscle (SCM) or trapezius muscles, as well as the supernumerary cleidooccipital muscles. (1) Cleidooccipital branch of the SCM (*R. cleidooccipitalis musculi sternocleidomastoidii*). (2) Anterior accessory cleidooccipital muscle (*M. cleidooccipitalis accessorius anterior*). (3) Posterior accessory cleidooccipital muscle (*M. cleidooccipitalis accessorius posterior*). (4) Cleidooccipital branch of the trapezius muscle (*R. cleidooccipitalis musculi trapezii*).

(1) One of the four anatomical branches of the SCM connecting the sternal end of the clavicle to the occipital bone [5,6]. Cleidooccipital branch of the SCM (*R. cleidooccipitalis musculi sternocleidomastoidii*).

(2) An accessory muscular slip connecting the middle portion of the clavicle to the occipital bone with a close proximity or attachment to the SCM [7]. Anterior accessory cleidooccipital muscle (*M. cleidooccipitalis accessorius anterior*).

(3) An accessory muscular slip connecting the middle portion of the clavicle to the occipital bone with a close proximity or attachment to the trapezius muscle [8–11]. Posterior accessory cleidooccipital muscle (*M. cleidooccipitalis accessorius posterior*).

(4) One of the anatomical branches of the trapezius muscle connecting the acromial end of the clavicle to the occipital bone [12]. Cleidooccipital branch of the trapezius muscle (*R. cleidooccipitalis musculi trapezii*).

3. Discussion

At present, most of the descriptions in the literature associated with the accessory cleidooccipital muscles concern the posterior accessory cleidooccipital muscles [8–11]. Even though the anterior accessory cleidooccipital muscles are available for observation, these muscles are instead defined as clavicular-sided, proximal head variations of the SCM, as described in a literature review [13]. In one of the case reports, the author suggested that the additional head of the SCM could be named as a cleidooccipital muscle, as it was found to originate from the middle one third of clavicle, 1.2 cm lateral to the usual clavicular head [14]. We suggest that the same muscle and many other similar variants qualify to be nomenclated as the anterior accessory cleidooccipital muscles according to our proposed new classification. A swelling in the right posterior triangle of the neck was addressed in a case report of a 48-year old man with pain and sensory impairment on the right-hand side that radiated from the neck to the radial border of the forearm, thumb and index finger [15]. The symptoms were aggravated particularly during the movement of the head or while lifting heavy objects. The magnetic resonance imaging (MRI) showed a soft tissue in the posterior triangle of the neck, detached from the trapezius muscle midway and extending

towards the middle part of the clavicle. This muscle was termed as an accessory part of the trapezius muscle in the posterior triangle of the neck, which was surgically excised, resulting in the total relief of the symptoms of the patient. Our proposed terminology for the same muscle would define it as the posterior accessory cleidooccipital muscle.

Table 1 offers the representation of such examples, where new nomenclatures could be implemented in selected case reports in terms of our proposed new classification.

Table 1. A tabular illustration with examples of newly proposed terminologies in comparison to the already existing ones in selected case reports. SCM = sternocleidomastoid muscle.

Literature	Applied Description in the Literature	Proposed Terminology (*English*)
Rahman et al. 1994 [11]	Anomalous cleidooccipitalis muscle	Posterior accessory cleidooccipital muscle
Hug et al. 2000 [15]	Accessory part of the trapezius muscle	Posterior accessory cleidooccipital muscle
Sarikcioglu et al. 2001 [7]	Cleidooccipital muscle	Cleidooccipital branch of the SCM
Kwak et al. 2003 [8]	Cleidooccipitalis cervicalis	Posterior accessory cleidooccipital muscle
Rao et al. 2007 [16]	Additional slip in the origin of the clavicular head of SCM	Anterior accessory cleidooccipital muscle
Cherian et al. 2008 [17]	Additional third head originated from the middle third of the clavicle	Anterior accessory cleidooccipital muscle
Natsis et al. 2009 [18]	Three additional clavicular heads, four in total C1–C4	C2–C3: Cleidooccipital branch of the SCM C4: Anterior accessory cleidooccipital muscle
Mehta et al. 2012 [19]	The clavicular head of the muscle exhibited two bellies, one medial and one lateral	Lateral belly (Anterior accessory cleidooccipital muscle)
Paraskevas et al. 2013 [9]	Accessory cleidooccipitalis muscle	Posterior accessory cleidooccipital muscle
Sabnis et al. 2013 [20]	Third head of the SCM	Anterior accessory cleidooccipital muscle
Kaur et al. 2017 [14]	Additional head of SCM +cleidooccipital muscle	Anterior accessory cleidooccipital muscle
Maslowski, D.J. et al. 2019 [10]	Cleidooccipitalis cervicalis muscle	Posterior accessory cleidooccipital muscle

4. Conclusions and Future Direction

At present, different nomenclatures are used by authors for the accessory cleidooccipital muscles or the cleidooccipital branches of the SCM or the trapezius muscles. Introducing this proposed classification into the anatomical literature, we hope that more clarity could be achieved when addressing the so called "cleidooccipital muscle" in the future. Proper descriptions of these muscle variations are relevant in clinical, surgical and radiological contexts, as such variations can be encountered in daily practice. The use of a common description could optimize the description of these muscles in general.

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