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CASE REPORT

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Unusual anatomical variants of infrahyoid muscles — a case report

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Anatomical anomalies of neck muscles are rarely observed, and usually comprise variations of digastric and omohyoid muscles. Neck muscle abnormalities are sometimes correlated with embryological development and are observed in individuals with aneuploidies such as Edwards' syndrome (18-trisomy) or Down's syndrome (21-trisomy). Some infrahyoid muscles are important landmarks during surgery, and therefore the anatomical variations of these muscles are related to a higher risk of surgical complications. Below, we present a rare case of infrahyoid muscle anomalies found during routine dissection of a male cadaver. Redundant muscle bellies of sternohyoid muscle (sternohyoid azygos muscle), the presence of levator glandulae thyroideae and also one hypoplastic superior belly of the omohyoid muscle were observed. The presence of muscle fibres within the found structures was confirmed using Masson's trichrome staining method. (Folia Morphol 2025; 84, 1: 267–275)

Keywords: omohyoid muscle, sternohyoid muscle, neck muscles, infrahyoid muscle, levator glandulae thyroideae

INTRODUCTION

The sternohyoid muscle is a muscle within the anterior cervical triangle which extends from the manubrium, medial end of the clavicle and posterior sternoclavicular ligament to the inferior margin of the corpus of the hyoid bone [8], creating the medial edge of the thyroid triangle [23]. This muscle is also present in other mammals, especially apes. Several variants of the sternohyoid muscle have been described in the literature, including the presence of tendinous intersections or fusion with the contralateral muscle [8]. There is also a variant known as the sternohyoideus azygos muscle which crosses the midline of the neck extending from the manubrium to the hyoid [23] and has been observed in infants with trisomy 13 [6]. Mori in 1964 distinguished four types of the sternohyoid muscle with regard to its origin [26].

The omohyoid muscle is an important landmark within the neck: it divides anterior and posterior cervical triangles [15] and its presence helps to identify the internal jugular vein and other structures located within the carotid triangle [18]. It consists of two bellies, superior and inferior, linked by an intermediate tendon. There are many reported variations of this muscle, more than is the case with other infrahyoid muscles [29] and usually concerning the superior belly [8, 15, 23, 28, 29]

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and morphology of the intermediate tendon [8, 26]. The origin of this muscle varies: although the majority originate from the superior margin of the scapula, there have been cases describing origin from the superior transverse scapular ligament, acromion process or coracoid process. The omohyoid might fuse with other infrahyoid muscles [8]. Some authors have suggested differences in development between the superior and inferior bellies of the omohyoid muscle [2, 15].

The levator glandulae thyroideae is considered to be an accessory muscle. It is observed infrequently with many variations [23, 26]. It originates from the hyoid bone or thyroid cartilage and inserts into the capsule of the thyroid gland [8]. Regarding its origin, Mori classified levator glandulae thyroideae into five types [26]. Some authors define this structure as the fibromusculoglandar band [10].

Embryological development of infrahyoid muscles plays a prominent role in their anatomical variations. In aneuploidies such as Down's syndrome and Edwards' syndrome, numerous variations of neck muscles have been observed [7]. Some authors have distinguished genes the mutations of which might be correlated with anomalies of the neck muscles [16].

Our case report describes the co-occurrence of several variations of infrahyoid muscles: sternohyoid, omohyoid with presence of the levator glandulae thyroideae, and a small muscle bundle attached along the internal jugular vein. We also describe continuation of thyrohyoid muscle fibres with sternothyroid muscle.

Figure 1. Anterior cervical triangle. *Anterior levator glandulae thyroideae; **Sternohyoid azygos muscle fused with contralateral sternohyoid muscle. Sternocleidomastoid muscle is cut off and shifted.

CASE REPORT

During routine dissection for didactic purposes and research of a 57-year-old male cadaver, supernumerary neck muscles were observed. An abnormal muscular band was attached to the right cornu majus of the hyoid bone passing to the contralateral side and joining to the contralateral sternothyroid and sternohyoid muscle also known as the sternohyoideus azygos muscle (Fig. 1). Right sternohyoid muscle was absent. Some fibres of the left thyrohyoid muscle were prolonged and joined to the left sternothyroid muscle (Fig. 2). The sternohyoid azygos muscle was 81.79 mm long and 7.17 mm wide and was innervated by branches of the ansa cervicalis arriving to left sternothyroid and sternohyoid muscles (Fig. 2). Also, we observed a small muscle bundle (16.34 mm long) originating from the manubrium below the sternothyroid muscle and coursing along the left internal jugular vein (Fig. 3) and other small muscular fibres arising from the right cricothyroid muscle (16.89 mm long) attaching to the thyroid isthmus. These are known as levator glandulae thyroideae (Fig. 1). Pyramidalis lobe of the thyroid gland was absent. Also, we observed hypoplasia of the superior belly of the left omohyoid muscle macroscopically seen as one long tendon (42.35 mm long and 2.11 mm in diameter in half of its length) attaching to the hyoid bone, with normal inferior belly innervated by the left ansa cervicalis (the nerve branch innervating inferior belly was 58.77 mm long) attaching to the superior margin of the left scapula. We excised samples of the abnormal muscles for histological analysis, wherein residual skeletal muscle fibres were detected (Fig. 4). No other neuromuscular or vascular abnormalities were observed. We did not observe any phenotypic characteristics which would be indicative of dysmorphia. There were no indications of previous surgical interventions or neoplastic lesions within the neck. No medical history of this case could be provided.

Figure 2. Muscle bundle along left internal jugular vein (arrows).

Figure 3. Left side of neck — anterior and omoclavicular triangles: 1 — sternohyoid muscle; 2 — thyrohyoid muscle; 3 — sternothyroid muscle; 4 — omohyoid muscle — inferior belly; 5 — superior thyroid artery; 6 — sternocleidomastoid muscle (cut off and shifted); 7 — internal jugular vein; 8 — linea obliqua of left thyroid cartilage and vascular bundle to sternohyoid muscle; 9 — anterior jugular vein. ***Prolonged fibres of left thyrohyoid muscle into left sternothyroid muscle.

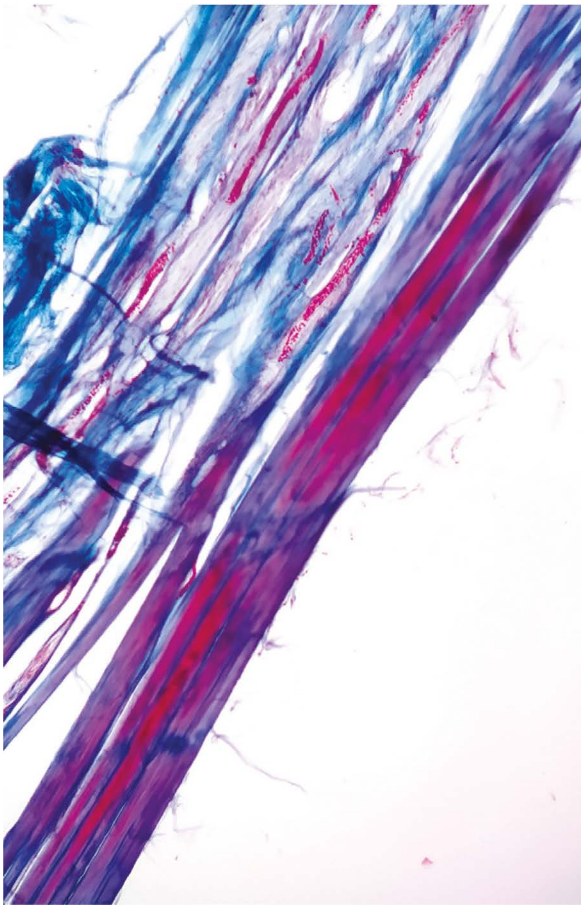

Figure 4. Long tendon of left omohyoid muscle, longitudinal section. Masson's trichrome stain. Magnification: 10×.

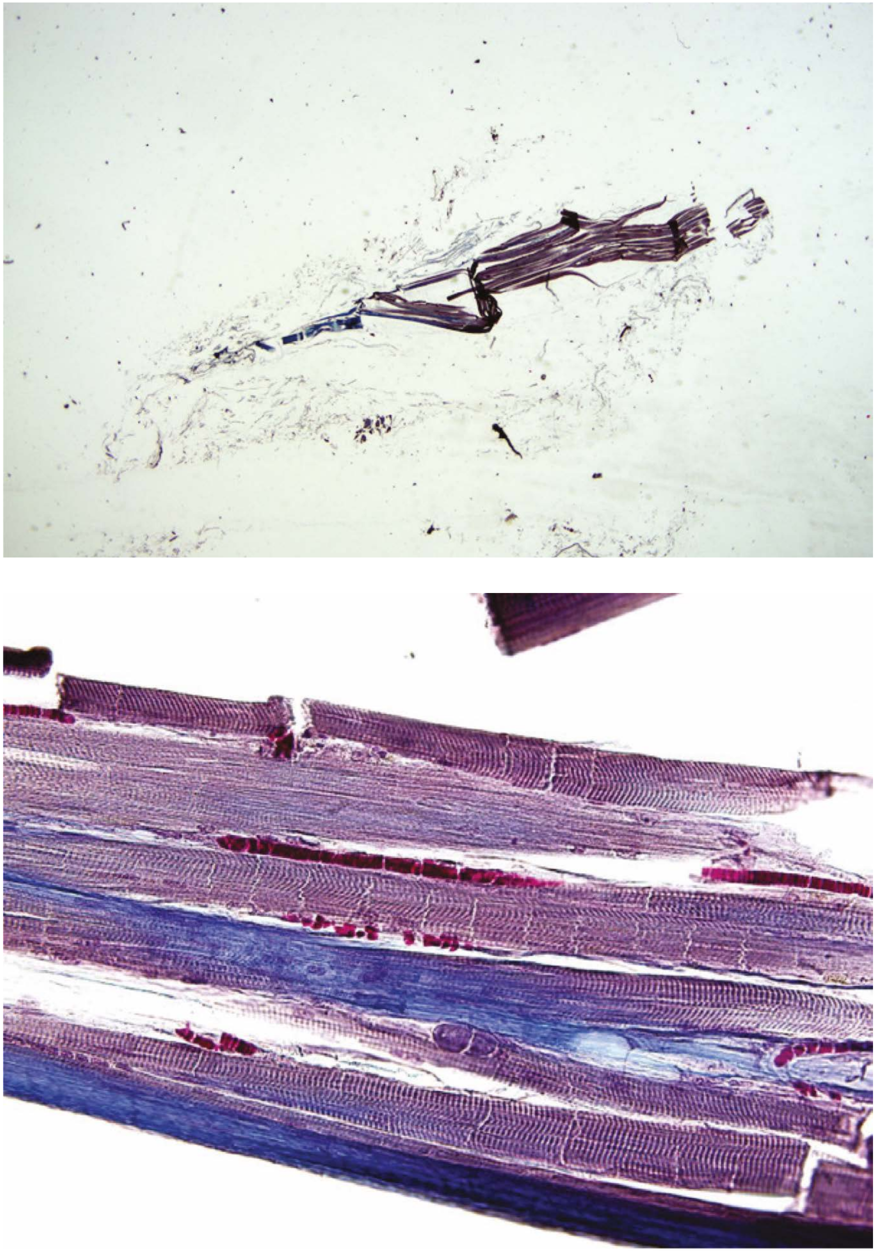

Figure 5. Anterior levator of thyroid gland, longitudinal section. Masson's trichrome stain. Proven muscle fibres presence. **A.** Magnification: 2×; **B.** Magnification: 40×.

HISTOLOGICAL STUDY

For this research, we used supplementary histochemical techniques consistent with the guidelines proposed regarding the checklist for reporting anatomical variations [34]. Specimens taken for histological examination were fixed in 10% buffered formalin and processed based on classic histological techniques [13]. Samples were taken from the sternohyoid azygos muscle (transverse cross-section in half of its length), the small muscle fascicle found running along the internal jugular vein, and the muscle fascicle from the cricothyroid muscle attaching to the isthmus of the thyroid gland (longitudinal cross-section), and also from the long tendon of the left omohyoid muscle (longitudinal cross--section). All specimens were stained using Masson's trichrome method [12] for better visualisation and to distinguish between the connective tissue and muscle fibres [14].

Findings:

1. In all specimens, we confirmed occurrence of skeletal muscular fibres (Figs. 4–7);

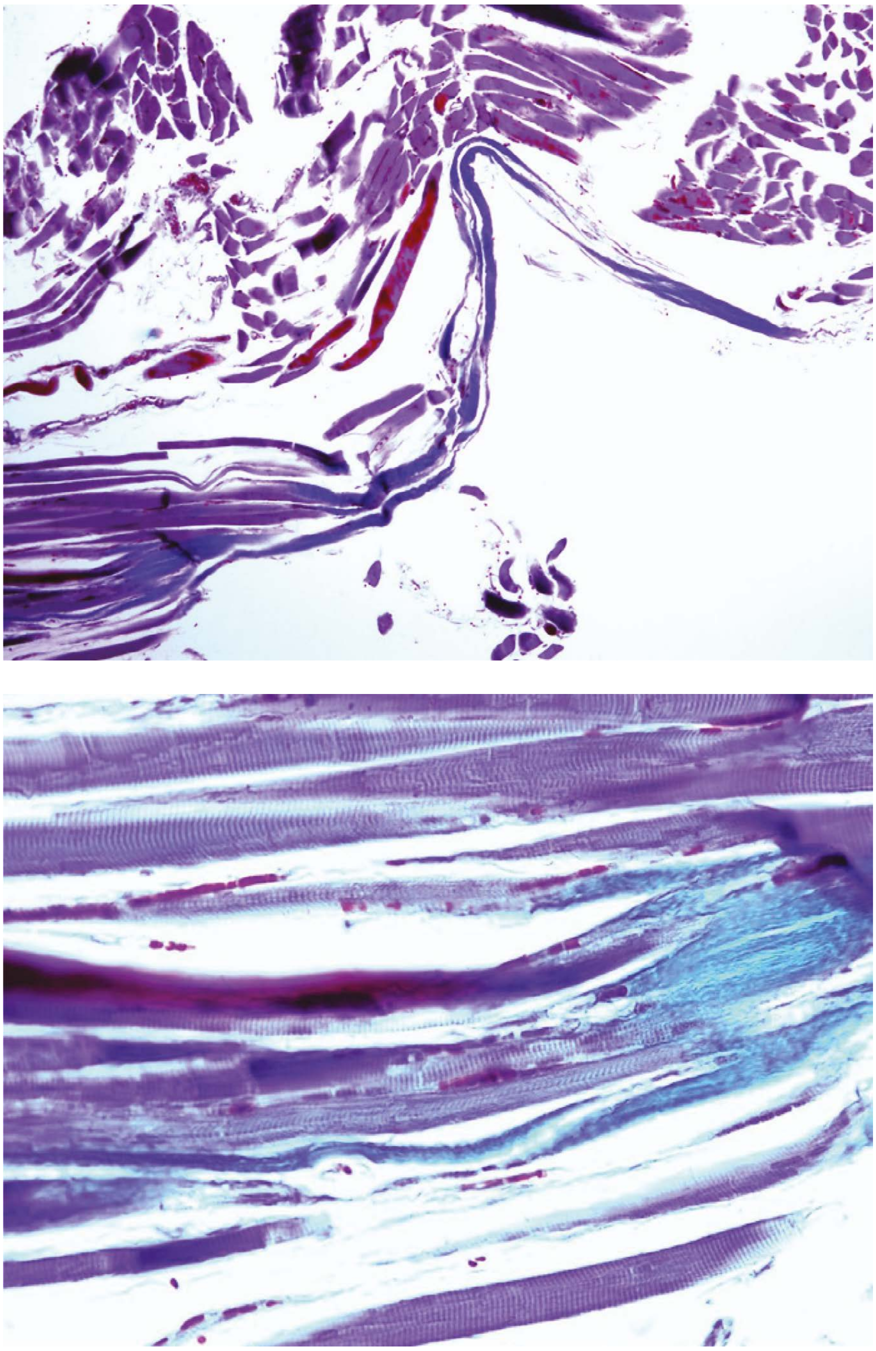

Figure 6. Sternohyoid azygos muscle — transverse section, Masson's trichrome stain. Proven muscle fibres presence. **A.** Magnification: 10×; **B.** Magnification: 40×.

2. In the longitudinal cross-section of the tendon of the omohyoid muscle, we found vestigial superior belly of the omohyoid muscle (Fig. 4);
3. In the longitudinal cross-section of muscle fascicle fixed along the left internal jugular vein, we also observed fibres of connective tissue resembling a small tendon (Fig. 7a).

DISCUSSION

Infrahyoid muscles are formed from myoblasts from cervical myotomes, unlike the other neck muscles developing from mesenchyme in branchial arches [25]. Differentiation of neck muscles is considered to begin in a 9 mm embryo, and at this phase infrahyoid muscles may be distinguished [24]. The common primordium

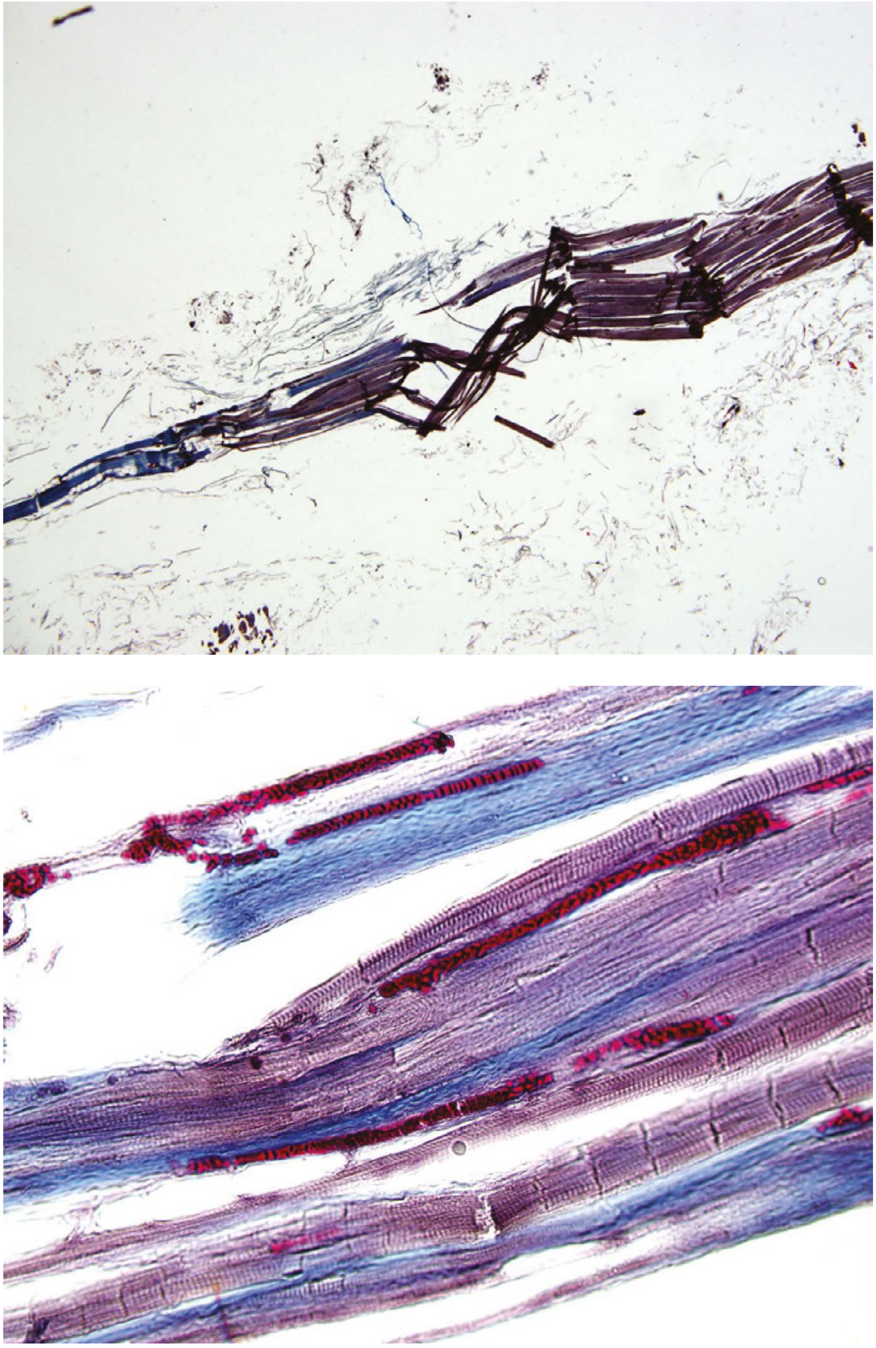

Figure 7. Muscle bundle along left internal jugular vein, longitudinal section. Masson's trichrome stain. Proven muscle fibres presence. **A.** Magnification: 4×; **B.** Magnification: 40×.

of omohyoid and sternohyoid muscle implies more frequent occurrence of omohyoid muscle abnormalities [15]. The development of some neck muscles has long been the subject of discussion. Anderson (1881) propounded separated differentiation of the superior belly (as a true infrahyoid muscle) from the inferior belly (common embryological origin with subclavian muscle) of the omohyoid muscle in relation to observed duplication of both bellies of this muscle [2].

Neck muscles similar morphologically and embryologically to humans are also observed in other mammals, especially apes [8]. The development of these muscles in mammals is conditioned by an anterior-most somite myogenic programme associated with Mesp1/Pax3 myogenic lineages and T-box transcription factor 1 (TBX1). TBX1 plays a key role in the proper formation of branchiomeric muscles. Gene of this protein is located in chromosome

22 and underlies del22q11.2 (also known as DiGeorge syndrome). Mutants with Tbx1-null phenotype presented bilateral severe hypoplasia of infrahyoid muscles [16].

Abnormalities of neck muscles may be observed in patients with Edwards' or Down's syndromes, along with muscle anomalies in other body parts [4, 6, 7]. In infants with trisomy 18, the intermediate tendon of omohyoid has been shown to be poorly developed and the inferior belly to also receive additional muscle bundles arising from the clavicle or coracoid process [6]. Absent or hypoplastic superior belly of the omohyoid has been found in foetuses with trisomy 13 and anencephaly [8]. The presence of the sternohyoideus azygos muscle has also been observed [6, 27]. Levator glandulae thyroideae has been reported in infants with 13 trisomy 13 (Patau syndrome) [8]. In Down's syndrome there has been observed supernumerary muscles such as an accessory anterior digastric belly, petropharyngeus and occipito-scapular muscles [7].

Some rare anatomical variants of omohyoid and sternohyoid muscles found in this case have been described previously [19, 27, 31]. The sternohyoid azygos muscle is defined as a band-like muscle crossing the midline of the neck [5, 8, 23, 31]. Beyond case reports, there is no data regarding the frequency of this muscle in patients without genetic disorders. In patients with 18-trisomy (Edwards' syndrome) sternohyoid azygos muscle was found by Aziz in 2/9 cases (22.2%) [4]. Anatomical variations of the omohyoid muscle are more frequent,(c.15%) as described in the literature [29] and especially regarding the superior belly [28]. Also the absence of this muscle is very common [5]. Some authors have revealed a lack of superior belly of the omohyoid muscle, but there was no histological proof as to whether this belly was anaplastic or hypoplastic [1, 31, 32]. Maślanka et al. in 2023 described the presence of a five-headed superior belly of the omohyoid muscle [28]. Anomalous omohyoid and sternohyoid muscles can cause dysphagia, with a presentation of mass neck disappearing during swallowing [20–22].

Levator glandulae thyroideae is an additional muscle the presence of which is considered as an anomaly or variation [8]. There are several classifications of the levator glandulae thyroideae muscle [11, 33] depending on the place of insertion as proposed by Mori when distinguishing five types of this muscle: hypopyramidalis, thyreopyramidalis, thyreoglandularis, hyoglandularis, and tracheoglandularis [26]. Eisler et al. in 1900 classified three types of this muscle based on the origin of cricothyroid, infrahyoid and inferior constrictor muscles of pharynx as follows: anterior, lateral, and posterior. This classification incorporates a variation found in our case as an anterior levator glandulae thyroideae muscle [11]. According to Mori, this variant might be classified as the thyreoglandularis muscle which is the most common type of the levator glandulae thyroideae (54.7%) [26].

Omohyoid and sternohyoid muscles are landmarks within the muscular triangle wherein superior thyroid artery and ansa cervicalis are found. Surgeries such as thyroidectomy and tracheostomy are accessed through this triangle. Possible complications of these procedures include bleeding from the superior thyroid artery [18]. The presence of the levator glandulae thyroideae might also affect identification of blood vessels and residual thyroid tissue during thyroidectomy, leading to surgical complications [10]. The omohyoid muscle is also a surgical landmark during resection of metastatic lymph nodes of levels III and IV in the neck localised in the vicinity of the internal jugular vein during radical oncological surgery. Hence, any variations of the omohyoid might increase the risk of incomplete resection [30]. The omohyoid muscle is also located close to the brachial plexus, and any anomaly of this muscle requires more caution during surgery in this region [29].

The occurrence of supernumerary neck muscles also might affect blood circulation within head and neck veins, leading to an increased risk of Meniere's Disease due to chronic cerebrospinal venous insufficiency [3, 9].

CONCLUSIONS

Anatomical variations of the infrahyoid muscles are very often correlated with their embryological development, and may be observed more frequently in patients with genetic disorders. Anomalies of the omohyoid muscle or the presence of the levator glandulae thyroideae have a significant impact on the planning of surgeries in the neck. Therefore, correct identification of these variants is crucial for avoiding iatrogenic complications.

ARTICLE INFORMATION AND DECLARATIONS

Ethics statement

Not applicable for this study.

Authors' contributions

AM: dissection of cadaver, measurements, description of case, corresponding author; GW: literature review, linguistic correction; BW, AD: histological analysis; JS: content-related supervision, linguistic correction; JW: content-related supervision.

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Conflicts of interest

None of the authors declare a conflict of interest.

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