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ISSN: 0015-5659

e-ISSN: 1644-3284

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DOI: 10.5603/fm.100840

Article type: Case report

Submitted: 2024-05-23

Accepted: 2024-06-25

Published online: 2024-07-05

CASE REPORT

Unusual anatomical variants of infrahyoid muscles — case report

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ABSTRACT

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

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

INTRODUCTION

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 hyoid bone body [8] creating medial edge of the thyroid triangle [23]. This muscle is also present in other mammals, especially apes. Several variants of the sternohyoid muscle are described in literature including presence of tendinous intersections or fusion with the contralateral muscle [8]. There is also a variant known as sternohyoideus azygos muscle which crosses the midline of the neck extending from the manubrium to the hyoid [23] and it was observed in infants with trisomy 13 [6]. Mori (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 identifying internal jugular vein and other structures located within 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 frequent than other infrahyoid muscles [29] and usually concerning superior belly [8, 15, 23, 28, 29] and morphology of the intermediate tendon [8, 26]. Originate of this muscle is variable, although majority originate from the superior margin of the scapula there are cases describing origin from superior transverse scapular ligament, acromion process or coracoid process. Omohyoid might fuse with other infrahyoid muscles [8]. Some authors suggested different development between superior and inferior bellies of the omohyoid muscle [2, 15].

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

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

In this case we describe co-occurrence of several variations of infrahyoid muscles: sternohyoid, omohyoid with presence of the levator glandulae thyroideae and small muscle bundle attached along the internal jugular vein. Also, the continuation of thyrohyoid muscle fibers with sternothyroid muscle was observed.

CASE REPORT

During routine dissection for didactic purpose and research of 57-year-old male cadaver supernumerary neck muscles and were observed. Abnormal muscular band was attached to the right cornu majus of hyoid bone passing to the contralateral side and joining to contralateral sternothyroid and sternohyoid muscle also known as sternohyoid azygos muscle (Fig. 1). Right sternohyoid muscle was absent. Some fibers of the left thyrohyoid muscle were prolonged and joined to the left sternothyroid muscle (Fig. 2). Sternohyoid azygos muscle had 81.79 mm in length and 7.17 mm in width and was innervated by branches of the ansa cervicalis arriving to left sternothyroid and sternohyoid muscles (Fig. 2). Also, we observed small muscle bundle (16.34 mm in length) originating from manubrium below the sternothyroid muscle and coursing along the left internal jugular vein (Fig. 3) and other small muscular fibers arising from the right cricothyroid muscle (16.89 mm in length) attaching to thyroid isthmus, 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 in length 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 (length of nerve branch innervating inferior belly was 58.77 mm) attaching to superior margin of the left scapula. We took samples of found abnormal muscles for histological analysis, wherein residual skeletal muscle fibers were detected (Fig. 4). No other neuromuscular or vascular abnormalities were observed in this case. We did not observe any phenotypic characteristics which would be indicative of dysmorphia in this case. There was no indications of previous surgical interventions or neoplastic lesions within the neck. Medical history of this case could not be provided.

Histological study

In this research we used supplementary histochemical techniques consistent with the guidelines proposed regarding to 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 sternohyoid azygos muscle (transverse cross-section in half of its length), small muscle fascicle found running along the internal jugular vein and muscle fascicle from cricothyroid muscle attaching to isthmus of thyroid gland (longitudinal cross-section) and also from long tendon of the left omohyoid muscle (longitudinal cross-section). All specimens were stained using Masson's trichrome method [12] for better visualization and distinction of the connective tissue and muscle fibers [14].

Findings:

1) In all specimens we confirmed occurrence of skeletal muscular fibers (Fig. 4–7),

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 fibers of connective tissue resembling 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 might be distinguished [24]. Common primordium of omohyoid and sternohyoid muscle implies more frequent occurrence of omohyoid muscle's abnormalities [15]. Development of some neck muscles became the subject of discussion. Anderson (1881) propounded separated differentiation of superior belly (as a true infrahyoid muscle) and 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 in apes [8]. Development of these muscles in mammals is conditioned by anterior-most somite myogenic program associated with Mesp1/Pax3 myogenic lineages and T-box transcription factor 1 (TBX1). TBX1 plays a key role in proper formation of branchiomeric muscles. Gene of this protein is located in 22 chromosome 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 might be observed in patients with Edwards or Down syndrome, also with muscle anomalies in other body parts [4, 6, 7]. In infants with trisomy 18 intermediate tendon of omohyoid was poorly developed and the inferior belly also received additional muscle bundles arising from clavicle or coracoid process [6]. Absent or hypoplastic superior belly of the omohyoid were found in fetuses with trisomy 13 and anencephaly [8]. Presence of the sternohyoideus azygos muscle was also observed [6, 27]. Levator glandulae thyroideae was reported in infants with 13 trisomy (Patau syndrome) [8]. In Down syndrome there was 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 were described previously [19 27, 31]. Sternohyoid azygos muscle is defined as band-like muscle crossing the midline of the neck [5, 8, 23, 31]. Besides case reports there is no data about frequency of this muscle in patients without genetic disorders. In patients with 18-trisomy (Edward's syndrome) sternohyoid azygos muscle was found in 2 of 9 cases (22,2%) (Aziz 1977) [4]. Anatomical variations of the omohyoid muscle are more frequent, about 15% and were described in the literature [29] and especially regarding superior belly [28], also absence of this muscle is the most common [5]. Some authors revealed a lack of superior belly of the omohyoid muscle but there was no histological proof whether this belly is anaplastic or hypoplastic [1, 31, 32]. Maślanka et al. (2023) described the presence of a five-headed superior belly of the omohyoid muscle [28]. Anomalous omohyoid and sternohyoid muscles might cause dysphagia with presentation of mass neck disappearing during swallowing [20–22].

Levator glandulae thyroideae is an additional muscle whose presence is considered as an anomaly or variation [8]. There are several classifications of the levator glandulae thyroideae muscle [11, 33] depending on place of insertion proposed by Mori (1964) who distinguished five types of this muscle: hypopyramidalis, thyreopyramidalis, thyreoglandularis, hyoglandularis and tracheoglandularis [26]. Eisler (1900) classified three types of this muscle basing on origin of cricothyroid, infrahyoid and inferior constrictor muscles of pharynx as follows: anterior, lateral and posterior and incorporates variation found in our case as an anterior levator glandulae thyroideae muscle [11]. According to Mori (1964) this variant might be classified as thyreoglandularis muscle which was 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 like thyroidectomy and tracheostomy are accessed through this triangle. Possible complications of these procedures include bleeding from the superior thyroid artery [18]. Presence of the levator glandulae thyroideae might also affect identifying blood vessels and residual thyroid tissue during thyroidectomy leading to surgical complications [10]. Omohyoid muscle is also a surgical landmark during resection of metastatic lymph nodes of the level III and IV in the neck localized in the vicinity of the internal jugular vein during radical oncologic surgeries. Hence, any variations of the omohyoid might increase risk of incomplete resection [30]. Omohyoid muscle is also located close to the brachial plexus and any anomaly of this muscle requires more caution during surgeries of this region [29].

Occurrence of supernumerary neck muscles also might affect blood circulation within head and neck veins leading to 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 might be observed more frequently in patients with genetic disorders. Anomalies of the omohyoid muscle or presence of the levator glandulae thyroideae have significant impact during planning 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.

Author contributions

1. Agata Mazurek — Dissection of the cadaver, measurements, description of the case, corresponding author.
2. Grzegorz Wysiadecki — literature review, linguistic correction.
3. Bożena Wójcik — histological analysis.
4. Andrzej Dubrowski — histological analysis.
5. Janusz Skrzat — content-related supervision, linguistic correction.
6. Jerzy Walocha — content-related supervision.

Acknowledgments

The authors sincerely thank those who donated their bodies to science so that anatomical research could be performed. Results from such research can potentially increase mankind’s overall knowledge that can then improve patient care. Therefore, these donors and their families deserve our highest gratitude [17].

Also, we acknowledge Jacenty Urbaniak from the Anatomy Department of the Jagiellonian University Medical College for excellent technical assistance during preparation of the figures used in this manuscript.

Conflict of interest

None of the authors declared conflict of interest.

Funding

This project was not funded by any istitution.

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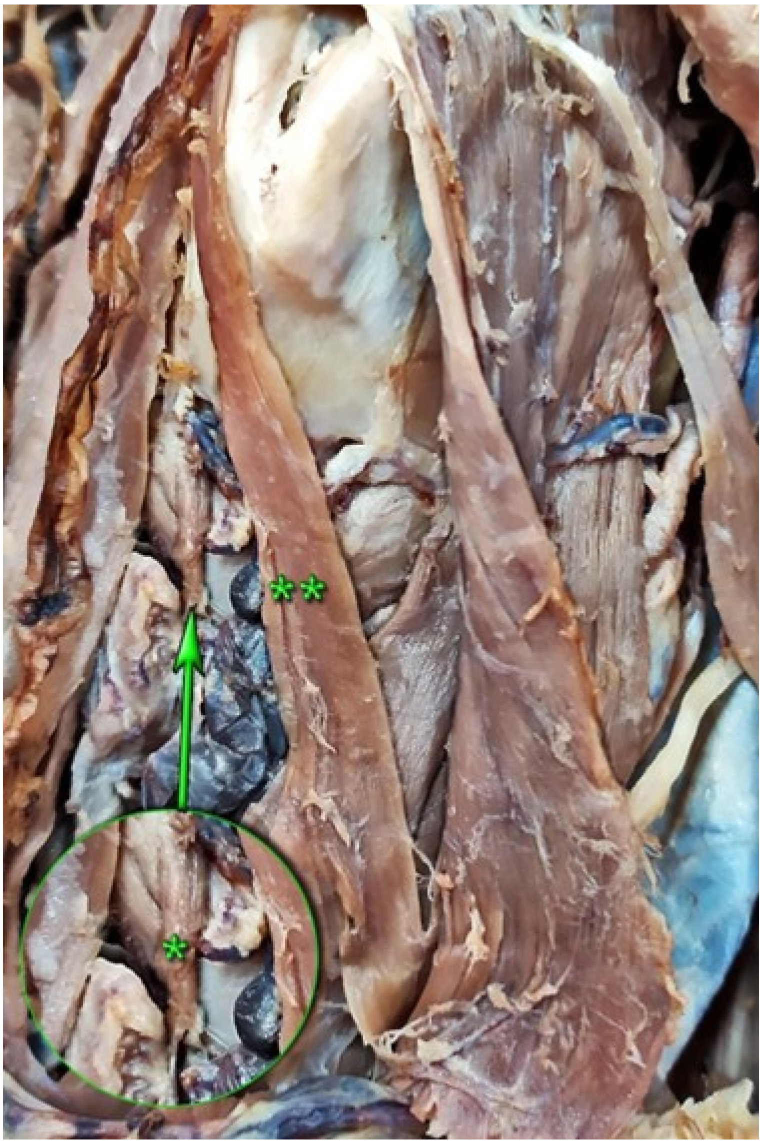

Figure 1. Anterior cervical triangle. * — anterior levator glandulae thyroideae, ** — sternohyoid azygos muscle fused with contralateral sternohyoid muscle. Sternocleidomastoid muscle is cut off and shifted.

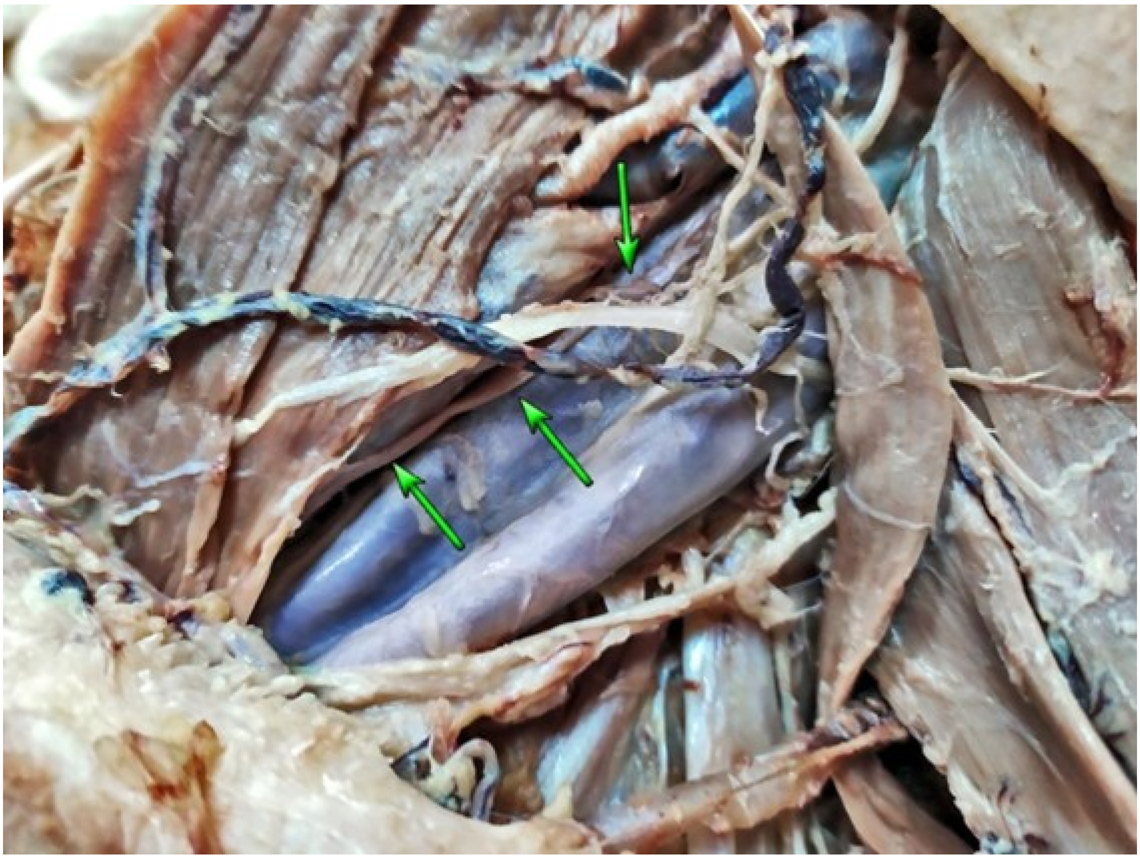

Figure 2. Muscle bundle along the left internal jugular vein (arrows).

Figure 3. Left side of the 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 the left thyroid cartilage and vascular bundle to the sternohyoid muscle, 9 — anterior jugular vein, *** — prolonged fibers of the left thyrohyoid muscle into the left sternothyroid muscle.

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

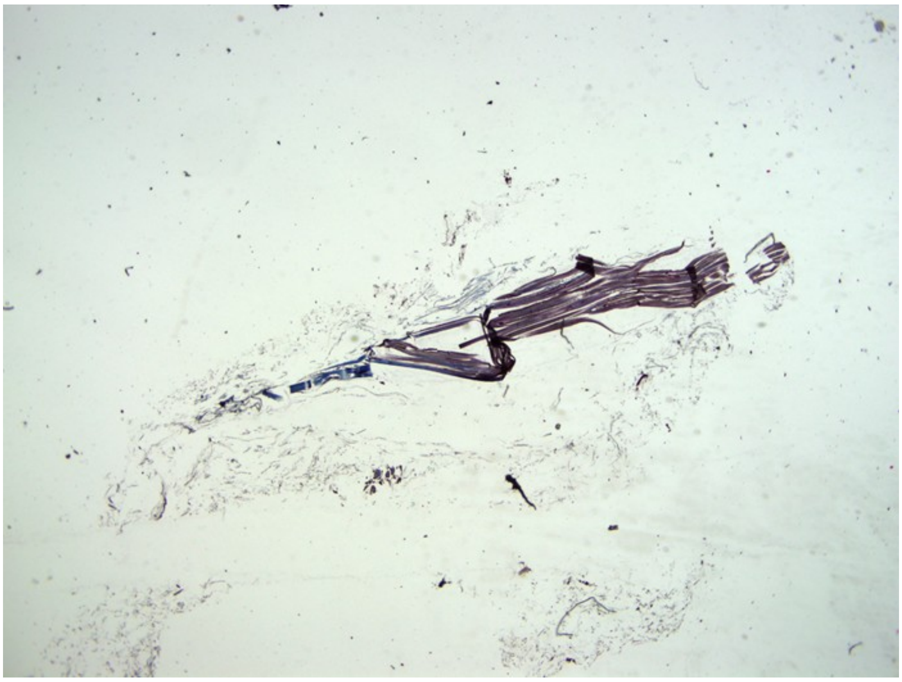

Fig. 5a

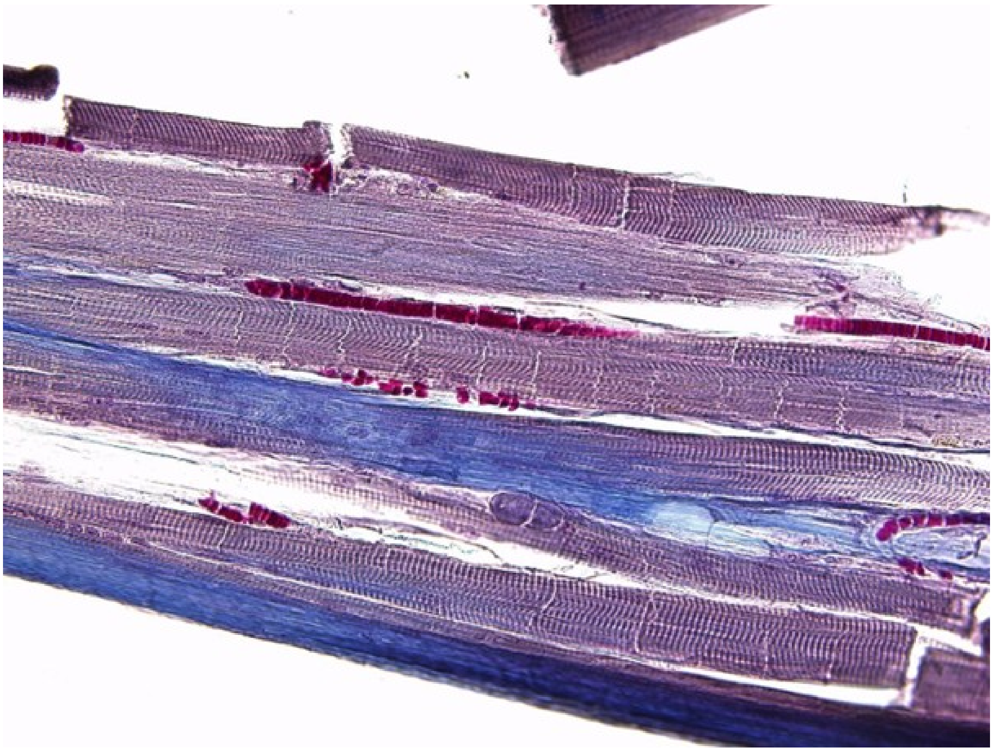

Fig. 5b

Figure 5. Anterior levator of the thyroid gland, longitudinal section. Masson's trichrome stain. Present muscle fibers. **A.** Magnification 2×, **B.** Magnification 40×.

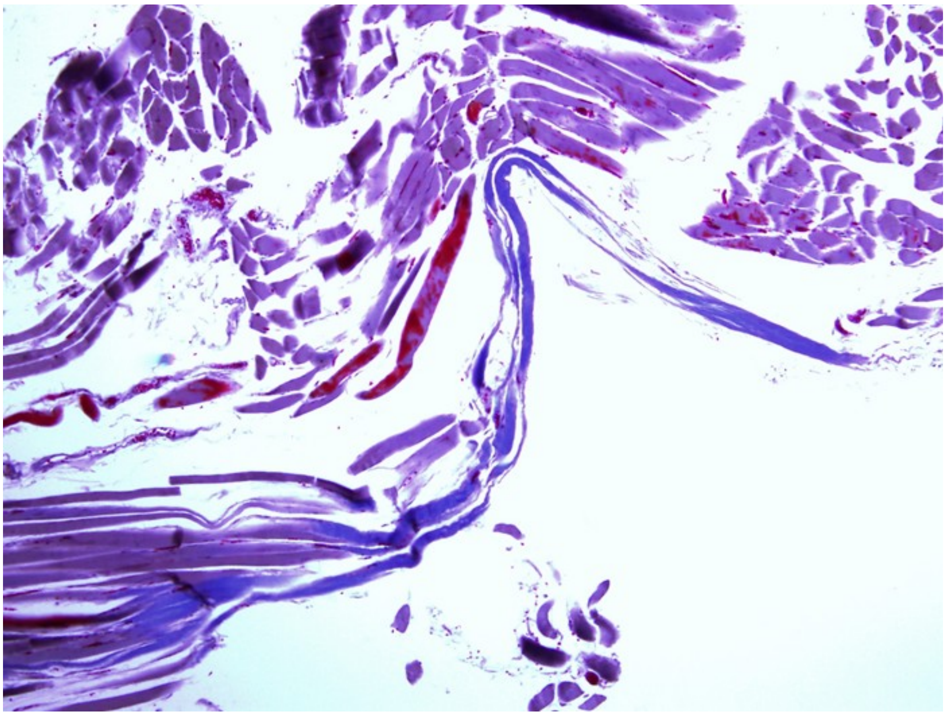

Fig. 6a

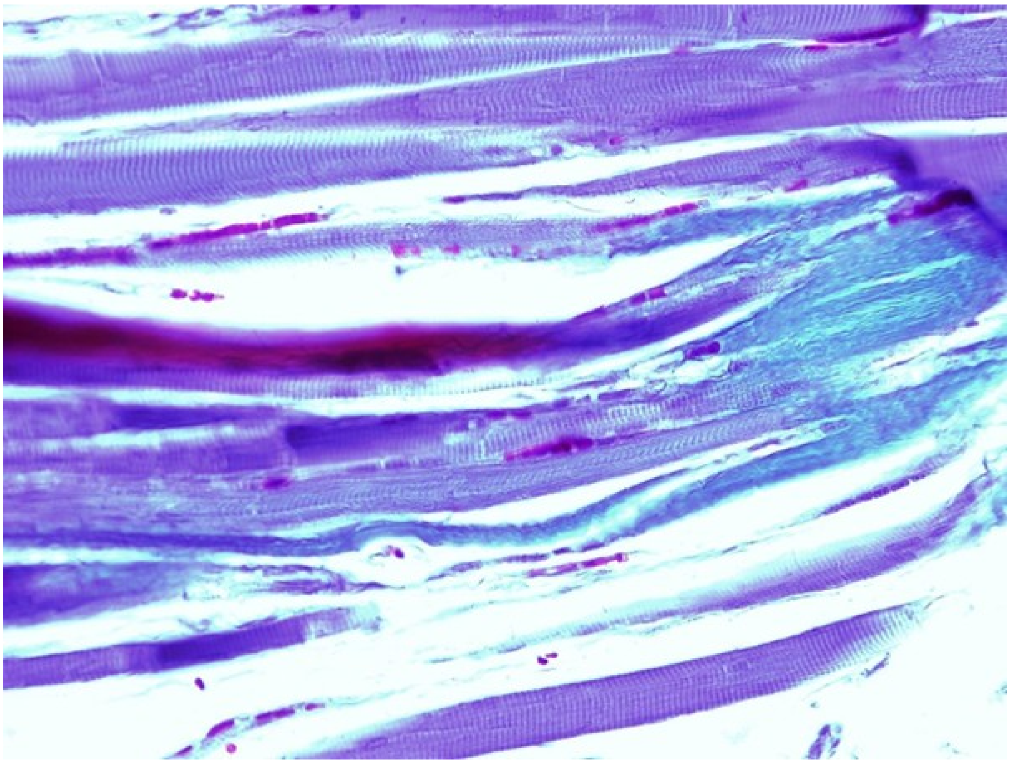

Fig 6b

Figure 6. Sternohyoid azygos muscle — transverse section, Masson's trichrome stain. Present muscle fibers. **A.** Magnification 10×, **B.** Magnification 40×.

Fig. 7a

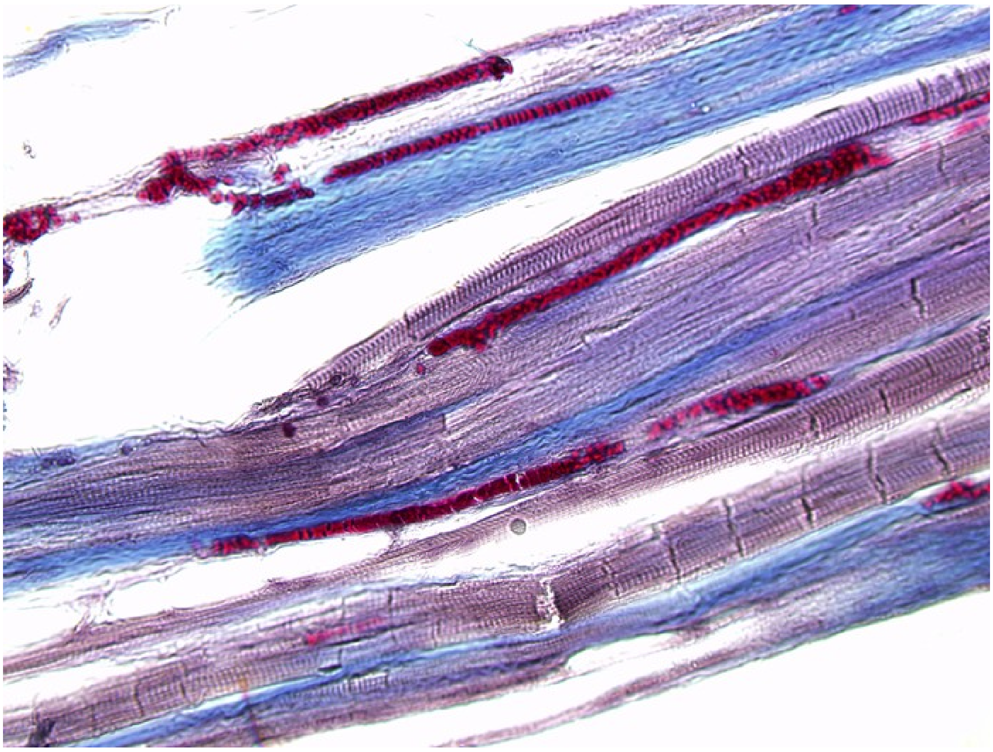

Fig. 7b

Figure 7. Muscle bundle along the left internal jugular vein, longitudinal section. Masson’s trichrome stain. Present muscle fibers. **A.** Magnification 4×. **B.** Magnification 40×.