VIA MEDICA

CASE REPORT

Folia Morphol.
Vol. 82, No. 3, pp. 735–739
DOI: 10.5603/FM.a2022.0063

ISSN 0015–5659
eISSN 1644–3284
journals.viamedica.pl

A unique variation of a four-bellied digastric muscle named "real quadrigastric muscle": a case report and literature review

B. Landzhov[1], L. Gaydarski[1], R.S. Tubbs[2], V. Kirkov[3], G.P. Georgiev[4]

[1]*Department of Anatomy, Histology and Embryology, Medical University of Sofia, Bulgaria*
[2]*Department of Neurology, Tulane University School of Medicine, New Orleans, Louisiana, United States*
[3]*Department of Health Policy and Management, Medical University of Sofia, Bulgaria*
[4]*Department of Orthopaedics and Traumatology, University Hospital Queen Giovanna – ISUL, Medical University of Sofia, Bulgaria*

[Received: 27 May 2022; Accepted: 13 June 2022; Early publication date: 8 July 2022]

From a topographical standpoint, the digastric muscle is key to the formation of several triangles of the neck, which are of the utmost clinical significance. Herein, we present a previously unrecognised variation of the digastric muscle: a quadrigastric muscle with two accessory bellies originating from the body and angle of the mandible and inserting to the intermediate tendon. Three new triangles are demarcated between the four bellies of the aberrant muscle. Detailed knowledge of variations of the digastric muscle, changing the borders and relationships of the topographic triangles, is paramount for radiologists and surgeons operating on the anterior region of the neck. (Folia Morphol 2023; 82, 3: 735–739)

Key words: neck topography, novel triangles, clinical significance

INTRODUCTION

The digastric muscle (DM) belongs to the suprahyoid muscle group. It normally comprises an anterior belly (AB), an intermediate tendon (IMT), and a posterior belly (PB). The posterior belly of the digastric muscle (PBDM) is usually marginally longer and originates from the mastoid notch of the temporal bone. It passes ventrally and inferiorly as it continues into the intermediate tendon. The anterior belly of the digastric muscle (ABDM) originates from the digastric fossa of the mandible and passes caudally and inferiorly as it inserts into the IMT, thus connecting with the PB and constituting the whole muscle. The IMT perforates the tendon of the stylohyoid muscle and attaches to the body and greater horns of the hyoid bone [19].

The AB is innervated by the mylohyoid branch of the inferior alveolar nerve, a branch of the third branch of the trigeminal nerve, the mandibular nerve. The blood supply for the AB is carried by the submental artery, a branch of the facial artery. The PB is innervated by the digastric branch of the facial nerve. Its blood supply is carried by muscle branches of the posterior auricle and occipital arteries [19]. This duality in innervation and blood supply is explained by embryological development. The ABDM, the mandibular branch of the trigeminal nerve and the facial artery are derived from the first pharyngeal arch; the PBDM, the facial nerve and the stapedial artery are derived from the second. The stapedial artery is only present during early development. Later, it obliterates and is substituted by muscle branches of the posterior

Address for correspondence to: Prof. B. Landzhov, MD, PhD, Department of Anatomy, Histology and Embryology, Medical University of Sofia, 2 Zdrave Str., 1431 Sofia, Bulgaria, tel: +35929172608, +35929172601, e-mail: landzhov_medac@abv.bg

auricular and occipital arteries [5, 18, 19]. With that in mind, it is only logical to assume that the development of the two accessory bellies is a result of division in the mesenchyme tissue of the first pharyngeal arch during the 4th week of gestation [18].

The DM is important for topographic landmarks in the neck. It is involved in the formation of several triangles, which a plethora of medical specialties such as radiologists, general surgeons, neck surgeons, endocrinologists, and maxillofacial surgeons use as landmarks in the anterior region of the neck [10, 20].

CASE REPORT

A 78-year-old male cadaver had undergone standard anatomical dissection in the dissection hall of the Department of Anatomy, Histology, and Embryology in the Medical University of Sofia for the education of medical students, as approved by the Medico-Legal Office and Local Ethics Committee. During the dissection of the cadaver's neck, a unique unilateral variation of the left DM was observed. After the deviant muscle was thoroughly cleaned of the surrounding connective tissue and its fascia had been gently peeled off, the aberrant muscle proved to have two accessory bellies. The posterior accessory belly (PAB) originated from the angle of the mandible, passed anteriorly and inferiorly and inserted on to the IMT. The anterior accessory belly (AAB) originated from the inferior margin of the body of the mandible, approximately in the middle. It passed inferiorly and nearly vertically and inserted on to the IMT. The left and right digastric muscles were measured with a standard ruler. The AB of the left DM was 35 mm long from the digastric fossa to its continuation into the IMT, and 11 mm wide. The AB of the right DM was 37 mm long from the digastric fossa to its continuation into the IMT, and 17 mm wide. The AAB was 22 mm long from the inferior margin of the mandible to the point of its insertion on to the IMT, and 9 mm wide. The PAB was 23 mm long from the angle of the mandible to its insertion on to the IMT, and 7 mm wide (Fig. 1). No variations of the PB of the left DM were noted, as it originated from the mastoid notch and continued into the IMT. Both accessory bellies were supplied with blood from the submental branch of the facial artery, and both were innervated by branches of the facial nerve.

The two accessory bellies subdivided the submandibular triangle into three smaller triangles: anterior triangle, bounded by the AB and the AAB; middle triangle, situated between the AAB and the PAB; and posterior triangle, demarcated by the PAB and the PB of the digastric muscle. In addition, owing to the presence of the two accessory bellies, the topography of the three small triangles (of Béclard [1], Lesser [see 7], and Pirogoff [17]) normally situated inside the submandibular triangle, was altered. Those three small triangles could not be observed on the left side since their boundaries were overlapped by the accessory bellies. After the right side of the neck of the same cadaver had been dissected, it was established that the right DM had two normal bellies. It was concluded that the unique abnormality of the

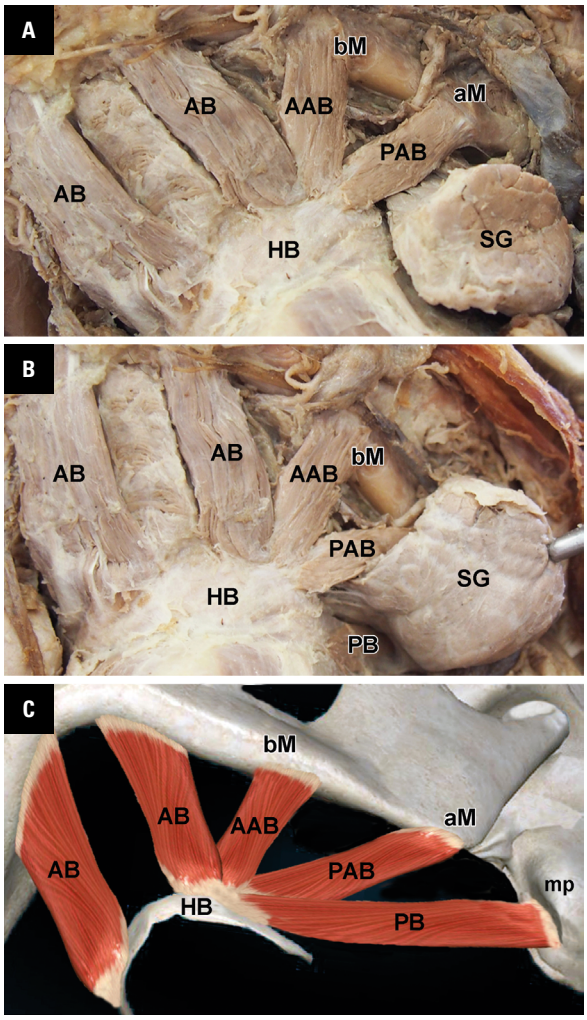

Figure 1. Anterolateral view of the neck. An unusual variation of the digastric muscle: a "real quadrigastric muscle"; **A.** Anterior triangle, bounded by the AB and the AAB; middle triangle, situated between the AAB and the PAB; **B.** Posterior triangle, demarcated by the PAB and the PB; **C.** A schematic presentation of unilateral "real quadrigastric muscle"; AB — anterior belly; PB — posterior belly; AAB — anterior accessory belly; PAB — posterior accessory belly; HB — hyoid bone; SG — submandibular gland; bM — base of mandible; aM — angle of mandible; mp — mastoid process.

quadribellied DM (two accessory bellies) was unilateral, present only on the left side of the neck. Medical records of the cadaver showed no history of surgical interventions of any kind in the region of the neck, nor were any scars observed prior to the dissection.

DISCUSSION

The ABDM is a highly variable structure with an extensive range of variations in its number, form, and points of origin and insertion. According to Lee and Yang [11] incidence rate of doubling of the ABDM is 66.7%. Kim and Loukas [9] have summarized all the more common cases of AAB, including cases of crossing the midline and inserting contralaterally, both uni- and bi-laterally, arising from the IMT, the hyoid bone, or the main AB. However, there are only a handful cases describing unique variations of the DM with two AABs. Macalister described an independent muscle originating from the body of the hyoid bone, passing alongside the medial border of the ABDM and inserting on to the symphysis of the mandible: the mentohyoid muscle. Furthermore, Macalister [12] described a hyoangularis muscle, which originated from the hyoid bone and inserted into the angle of the mandible. Natsis et al. [14] described a three-headed right ABDM. The main ABDM originated from the digastric fossa and the accessory bellies originated from the inferior margin of the mandible. Natsis et al. [14] also reported two accessory muscle bundles in the submental region, forming a triangle. Harvey et al. [4] reported a unique waving pattern of bilateral variation of the ABDM; the aberrant AB had two heads, deep and superficial. Furthermore, Harvey et al. [4] described two more accessory heads bilaterally, again superficial and deep, as the right superficial accessory head and both deep accessory heads crossed in the midline. Celik et al. [2] presented a rare case of quadrification of the ABDM. The aberrant muscle belly had four insertion points in the digastric fossa, but posteriorly the four muscle bellies united and continued into the IMT [2]. Ozgur et al. [16] described a bilateral quadrification of the DM. All four ABs originated for the digastric fossa and inserted to the hyoid bone. Moreover, Ozgur et al. [16] described two more accessory muscles situated medially to the medial ABDM. Those two aberrant muscles fused at the midline and covered the underlying mylohyoid muscle. Uzun et al. [22] reported a rare case of bilateral variation of the ABDM. Medially to the main anterior belly was an accessory belly, originating from the digastric fossa on both sides. The accessory bellies inserted to the hyoid bone via a common fibrous band [22]. With that in mind, it is apparent that the variation found in our case has never been described throughout the literature. It therefore appears to be unique.

During our extensive literature review we found several different types of classification, summarizing the variations of the ABDM in several ways. Žlábek [24] first classified the variations of the AB of the digastric muscle in terms of ontogenetic and phylogenetic development. Afterwards, Yamada [23] developed a six-types classification based on the relationships between the AABs and their points of origin and insertion. Mori [13] classified the variations of the ABDM into seven types on the basis of their points of origin and insertion, along with the presence or absence of aberrant muscle fibres. De-Ary-Pires et al. [3] classified the variations in the DM into three large categories containing different numbers of subtypes. The first category comprised five types of variations of the AB based on the number of ABs inserting to the mandible or mylohyoid, both ipsi- or contra-laterally [3]. Type 5 was the unique mentohyoid muscle described by Macalister [12]. The second category comprised variations of the IMT based on the relationship between the IMT of the DM and the tendon of the stylohyoid muscle. The third category comprised variations of the PBDM based on its point of origin [3]. Hsiao and Chang [6] studied 15 cadavers and found three with variations of the ABDM, which they classified as "unilateral type", "crossed type" and "mixed type" depending on whether the aberrant muscle fibres crossed the midline. Ozgur et al. [15] proposed a simplified classification with three types based on the origin and insertion of the ABDM: Classical type — normal digastric; digastric fossa type — ipsilateral origin and insertion; crossed type — one or more accessory bellies crosses the midline. The aberrant muscle we report as a unique muscle cannot be included in any of the abovementioned classifications.

The DM is not only anatomically important owing to its participation in vital processes such as mastication, swallowing, and phonation [19], but also of the utmost clinical significance as a paramount landmark for several clinically significant triangles on the anterior region of the neck: submental, submandibular, Béclard's, Lesser's, and Pirogoff's triangles [8, 19].

According to Tubbs et al. [21], Béclard's triangle was present in 82.4% of cases, while Lesser's

and Pirogoff's triangles were found in 88.2%. The reason for the absence of Béclard's triangle was a consequence of variations of the PBDM, while the absence of Lesser's and Pirogoff's triangles was due to the inferior passage of the hypoglossal nerve.

The fact that the bellies of the DM are used as margins of these various triangles is enough to demonstrate the clinical significance of variations in the DM; a deviation in the course or number of bellies results in complete reorganisation of the triangular spaces of the anterior neck. In our case, the topography of the submandibular triangle was completely changed because of the two accessory bellies. Instead of the three small triangles (Béclard's, Lesser's and Pirogoff's) there were three different triangles that we described as anterior, middle, and posterior accessory. As shown, the muscle is paramount for the topography of the suprahyoid region of the neck; hence, variations in the DM are of definite clinical significance, as aberrant bellies can be misinterpreted as tumour masses or metastatic lymph nodes [10]. In addition, the DM has a key role in plastic surgery for facial reconstruction [20].

CONCLUSIONS

Comprehensive knowledge of the variations of the ABDM is paramount for every medical specialism regarding the suprahyoid region of the neck because of the great topographical and clinical significance of the DM for a plethora of surgical and radiological procedures. The aim of this article was therefore to elucidate the variability of the ABDM.

Acknowledgements

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.

Conflict of interest: None declared

REFERENCES

1. Béclard PA, Knox R. Third section. Of the external muscles. In: Knox R (ed). Elements of general anatomy. MacLachlan and Stewart, Edinburgh 1830: 311–321.
2. Celik HH, Aldur MM, Ozdemir B, et al. Abnormal digastric muscle with unilateral quadrification of the anterior belly. Clin Anat. 2002; 15(1): 32–34, doi: 10.1002/ca.1088, indexed in Pubmed: 11835541.
3. De-Ary-Pires B, Ary-Pires R, Pires-Neto MA. The human digastric muscle: patterns and variations with clinical and surgical correlations. Ann Anat. 2003; 185(5): 471–479, doi: 10.1016/S0940-9602(03)80110-3, indexed in Pubmed: 14575275.
4. Harvey JA, Call Z, Peterson K, et al. Weave pattern of accessory heads to the anterior digastric muscle. Surg Radiol Anat. 2015; 37(8): 1001–1004, doi: 10.1007/s00276-014-1401-8, indexed in Pubmed: 25501489.
5. Hitier M, Zhang M, Labrousse M, et al. Persistent stapedial arteries in human: from phylogeny to surgical consequences. Surg Radiol Anat. 2013; 35(10): 883–891, doi: 10.1007/s00276-013-1127-z, indexed in Pubmed: 23640742.
6. Hsiao TH, Chang HP. Anatomical variations in the digastric muscle. Kaohsiung J Med Sci. 2019; 35(2): 83–86, doi: 10.1002/kjm2.12012, indexed in Pubmed: 30848024.
7. Jamieson GG. Head and neck operations. In: Jamieson GG (ed). Anatomy of general surgical operations, 2nd ed. Churchill Livingstone/Elsevier, Edinburgh 2006: 1–240.
8. Kikuta S, Iwanaga J, Kusukawa J, et al. Triangles of the neck: a review with clinical/surgical applications. Anat Cell Biol. 2019; 52(2): 120–127, doi: 10.5115/acb.2019.52.2.120, indexed in Pubmed: 31338227.
9. Kim SD, Loukas M. Anatomy and variations of digastric muscle. Anat Cell Biol. 2019; 52(1): 1–11, doi: 10.5115/acb.2019.52.1.1, indexed in Pubmed: 30984445.
10. Larsson SG, Lufkin RB. Anomalies of digastric muscles: CT and MR demonstration. J Comput Assist Tomogr. 1987; 11(3): 422–425, doi: 10.1097/00004728-198705000-00010, indexed in Pubmed: 3571582.
11. Lee HY, Yang HE. Anterior neck muscles. In: Tubbs RS, Shoja MM, Loukas M (eds.) Bergman's comprehensive encyclopedia of human anatomic variation, 1st ed. Wiley & Sons, Hobokken, New Jersey 2016: 228.
12. Macalister A. Additional observations on muscular anomalies in human anatomy (third series), with a catalogue of the principal muscular variations hitherto published. Trans Roy Irish Acad Sci. 1875; 25(1): 1–134.
13. Mori M. Statistics on the musculature of the Japanese. Okajimas Folia Anat Jpn. 1964; 40: 195–300, doi: 10.2535/ofaj1936.40.3_195, indexed in Pubmed: 14213705.
14. Natsis K, Piagkou M, Vrochidis P, et al. Unilateral asymmetrical anterior bellies of the digastric muscle in coexistence with accessory muscle bundles in the submental triangle: A rare case report. Morphologie. 2018; 102(337): 83–86, doi: 10.1016/j.morpho.2017.10.001, indexed in Pubmed: 29496384.
15. Ozgur Z, Govsa F, Ozgur T. The cause of the difference in the submental region: aberrant muscle bundles of the anterior belly of the digastric muscle. J Craniofac Surg. 2007; 18(4): 875–881, doi: 10.1097/scs.0b013e31806844da, indexed in Pubmed: 17667681.
16. Ozgur Z, Govsa F, Ozgur T. Bilateral quadrification of the anterior digastric muscles with variations of the median accessory digastric muscles. J Craniofac Surg. 2007; 18(4): 773–775, doi: 10.1097/scs.0b013e318068ff09, indexed in Pubmed: 17667663.
17. Pirogoff NI. Sectiones capitis, colli et columne vertebrarum triplici directioneductae. In: Pirogoff NI (ed.) Anatome topographica sectionibus per corpus humanum congelatum.

Triplice directione ductis illustrate. First Ed. Typis Jacobi Trey, St. Petersburg 1852: 1–248.
18. Sadler TW. Head and neck. In: Sadler TW (ed.) Langman's medical embryology, 10th ed. Lippincott Williams & Wilkins, Philadelphia 2006: 259–261.
19. Standring S. Head and neck. In: Standring S (ed.) Gray's Anatomy. The Anatomical Basis of Clinical Practice, 40th ed. Churchill Livingstone/Elsevier, Edinburgh 2008: 437.
20. Tan ST. Anterior belly of digastric muscle transfer: a useful technique in head and neck surgery. Head Neck. 2002; 24(10): 947–954, doi: 10.1002/hed.10150, indexed in Pubmed: 12369074.
21. Tubbs RS, Rasmussen M, Loukas M, et al. Three nearly forgotten anatomical triangles of the neck: triangles of Beclard, Lesser and Pirogoff and their potential applications in surgical dissection of the neck. Surg Radiol Anat. 2011; 33(1): 53–57, doi: 10.1007/s00276-010-0697-2, indexed in Pubmed: 20623121.
22. Uzun A, Aluclu A, Kavakli A. Bilateral accessory anterior bellies of the digastric muscle and review of the literature. Auris Nasus Larynx. 2001; 28(2): 181–183, doi: 10.1016/s0385-8146(00)00100-0, indexed in Pubmed: 11240328.
23. Yamada S. Beobachtungen über den Venter anterior des Musculus digastricus mandibulae bei japanischen Erwachsenen und Foeten. Acta Anat Nippon. 1935; 8(1): 303–347.
24. Žlábek K. Contribution à la connaissance des anomalies du ventreantérieur du digastrique de l›Homme. Arch Anat Histol Embryol. 1933; 16: 357–406.