Anatomical Variations of the Anterior Belly of the Digastric Muscle

Variaciones Anatómicas del Vientre Anterior del Músculo Dígastrico

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SUMMARY: A routine dissection of the digastric muscle reflected that it originated by two muscle bellies namely, the anterior and posterior belly which are connected by an intermediate tendon (IT). These bellies originated from the mastoid process of the temporal bone and the digastric fossa of the mandible respectively. The digastric muscle serves as an important surgical landmark in surgical interventions involving the submental area however, accessory bellies may interfere with surgical intervention in this area. Therefore, this study aimed to document the occurrence of the anatomical variations in the anterior belly of the digastric muscle (ABDM) in a selected number of cadaveric samples. Ten bilateral adult cadaveric head and neck specimens (n = 20) were macro-dissected in order to document the morphology of the digastric muscle. The accessory bellies in the ABDM was observed in 60% of the specimens. Unilateral and bilateral variations were observed in 20% and 30% of the specimens, respectively. These accessory bellies originated in the digastric fossa, ABDM, IT and hyoid bone, and inserted into the mylohyoid raphe, mylohyoid muscle and hyoid bone. In addition, an anomalous main ABDM was observed in 10% of the specimens inserting through a transverse tendon into the hyoid bone. Variations in the digastric muscle are common especially the accessory bellies, therefore, a comprehensive understanding of these anatomical variations could be of clinical importance to the surgeons during head and neck radiological diagnosis and surgical interventions.

KEY WORDS: Digastric muscle; Anterior belly; Accessory belly; Anatomical variation.

INTRODUCTION

The digastric muscle originates as dual bellies; an anterior and posterior belly, from the inferior base of the cranium and the inferior margin of the mandible, hence called the ‘digastric’. The intermediate tendon (IT) unites these muscle bellies and curves at an angle above the hyoid bone and inserts into this bone by fascia (Harrison et al., 2009). The ABDM originates from the digastric fossa of the mandible, while the posterior belly of the digastric muscle (PBDM) originated from the mastoid notch of the temporal bone (Harrison et al.; Moore et al., 2014). Morphologic variations in the digastric muscle have been linked with the anomalous arches during its development.

As a result, the morphologic variation in the digastric musculature includes the presence of an accessory belly in the ABDM and has been the commonly documented in the literature reviewed, with various authors describing different forms, shapes and attachments of this variant muscle. Firstly, the accessory belly may originate either from the mandible, mylohyoid muscle, IT, digastric fossa, and the main anterior or opposite anterior belly (Rani et al. 2013; Quadros et al., 2013; Azedero et al., 2015). Secondly, it may insert into the midline raphe of the mylohyoid muscle, the IT, the mandible and contralateral ABDM (Aktekin et al., 2003; Reyes et al., 2007; Rani et al.). Lastly, the accessory belly may vary in its course and travel either ipsilaterally on the same side of its origin from the mandible or contralaterally crossing the mandible from its point of origin (Liquidate et al., 2007; Kyung et al., 2011; Azeredo et al., 2016).

With its pivotal role in a variety of surgical procedures involving the submental region such as submental artery flaps, rejuvenation, submental rhytidectomy and lipectomy (Zdilla et al., 2016). Knowledge of the anatomy of the digastric muscle and its variations is of importance, especially when the accessory belly could be easily misinterpreted during radiographic imaging of the submental region. Therefore, this study is aimed to document the anatomic variations of the ABDM in a selected number of adult cadaveric specimens.
MATERIAL AND METHOD

Macro-dissection of the digastric muscles was conducted bilaterally on 10 adult cadaveric head and neck specimens (n = 20). The sample size consisted of 8 males and 2 females between the age range of 33 – 84 years old, which were obtained from the Department of Clinical Anatomy, School of Laboratory Medicine and Medical Sciences, College of Health Sciences, University of KwaZulu-Natal, South Africa. Ethical clearance was obtained from the University Biomedical Research Ethics Committee (BE530/17). The skin and subcutaneous fascia overlying the anterior aspect of the neck was removed. The overlying platysma and sternocleidomastoid muscles were dissected and gently retracted superiorly exposing the underlying digastric muscles. The origin, course and insertion of the digastric muscles were documented according to Zhao et al. (2015) classification method and digital photographs of the digastric musculature were taken using a camera (Canon PowerShot SX50 HS, 12.1 Megapixel), for morphological analysis.

RESULTS

Morphological Analysis of the Digastric Muscles. In 40 % (4/10) of the specimens, the typical origin and insertion of the digastric muscle was observed. While, the remainder (60 %; 6/10) showed a morphological variance in the accessory bellies. The accessory bellies documented were both unilateral and bilateral. These bellies arose from the digastric fossa, the IT, the medial margin of the main ABDM, the mandible and hyoid bone.

i. The main anterior bellies of the digastric muscle had a typical origin from the mandible as described in the standard anatomical literature, however, it had an abnormal insertion onto the hyoid bone via a transverse tendon situated above the hyoid bone. The medial portions of these bellies were continuous distally (Fig. 1).

ii. Unilateral left accessory belly originated via a narrow tendon from the inferior margin of the mandible and coursed superficially on the left ABDM, and its fibers were inserted into the hyoid bone (Fig. 2).

iii. A Type I (unilateral) triangulated left accessory belly originated from left ABDM posteriorly and inserted into the midline of the mylohyoid raphe (Fig. 3).

iv. A Type II bilateral accessory belly; right and left belly arranged in a triangle. This muscle originated with the vertex in the IT inferiorly and inserted via a base onto the midline of the mylohyoid raphe of the mylohyoid muscle (Fig. 4).

v. The upper and lower muscle fibers crossed centrally into opposite directions, the upper muscle fibers originated from the digastric fossa superficial to the left main ABDM descended inferiorly and inserted onto the medial margin of the right ABDM. On the right side, the lower muscle fibers originated from the ABDM.
body of the hyoid bone and ascended transversely to insert into the medial margin of the left ABDM. (Fig. 5).

vi. Bilateral accessory bellies, the right and left belly originated from the respective main ABDM distally. Centrally, the anterior muscle slips originated from the internal surface of the internal surface of the mental symphysis (Fig. 6).

**DISCUSSION**

The morphological variations in the digastric muscle are common and are extensively reported in the anatomical literature, in particular, regarding the presence of the accessory belly of the ABDM. Abnormalities in the pharyngeal arches from which the digastric muscle is derived are claimed to contribute to the formation of these variations. For instance, anomalies in the neural crest cells of the 1st pharyngeal arch may cause the development of an accessory belly (Mascaro et al., 2011; Chaithra Rao et al., 2016). While, a deficiency during differentiation of the mesodermal cells may either result in a unilateral or bilateral accessory belly (Chaithra Rao et al.). As a result, bilateral accessory bellies have been frequently documented in literature (Aktekin et al.; Liquidate et al.; Mascaro et al.; Kyung et al.; Chaithra Rao et al.) and the majority of these are asymmetrical (Rani et al.; Buffoli et al., 2016; Accioly Lins et al., 2017). This study documented both unilateral and bilateral accessory belly variations.

Different anatomical descriptions and classifications suggested by various authors have reported these anatomical variations according to their origin, composition, course and location (Ozgur et al., 2007; Zhao et al., 2015). These accessory bellies originated in the digastric fossa of the mandible, the IT, the main ABDM and the hyoid bone; and may insert into the IT, the midline of the mylohyoid raphe, the hyoid bone and the mandible (Mascaro et al.; Quadros et al.; Rani et al.). Aktekin et al. reported a bilateral accessory belly originating from the IT crossing the midline to form an ‘X shape’. A similar pattern was observed by Mascaro et al., but the accessory bellies did not cross the midline. While a digastric muscle with three accessory bellies has also been reported (Kyung et al.; Nayak et al., 2017).

Reyes et al. reported a triangular shaped accessory belly that originated bilaterally from the IT and inserted into the midline of the mylohyoid raphe. A similar observation was documented in this study, unilaterally and bilaterally. A bilateral variation of the ABDM were described having three accessory bellies namely, the right, left and posterior or lower posterior accessory belly originated from either side of the digastric fossa of the mandible and IT, respectively (Kyung et al.; Raju et al., 2014). Turan-Ozdemir et al. (2004) described similar bilateral accessory bellies, however these accessory bellies originated from either
sides of the IT and the digastic fossa. Likewise, the bilateral accessory bellies documented in this study corroborated with the afore-mentioned findings documented by Turan-Ozdemir et al. This study further documented a unilateral oblique belly that originated through a tendon from the inferior margin of the mandible and travelled superficial to the ABDM and inserted distally on both right and left halves of the hyoid bone. On the other hand, an anomalous main ABDM inserted into the hyoid bone via a transverse tendon.

The digastic muscle is involved in deglutition and mastication by elevating the hyoid bone and depressing the mandible, respectively. Thus, anatomical variations in the digastic muscle may possibly alter these functions and may cause imbalance in the musculature of the anterior region of the neck, larynx and floor of the mouth especially in cases where variations occur unilaterally (Mascaro et al.). Furthermore, excess tissue in the suprahoid region may be misinterpreted as lymph nodes, tumor or metastases during radiological diagnosis (Mascaro et al.; Reyes et al.; Chaithra Rao et al.; Accioly Lins et al.).

CONCLUSION

This study provides a brief overview of a prevalence of the accessory belly of the ABDM in a selected adult population sample size. The results revealed varying formations of the accessory belly occurring either unilateral or bilateral. Therefore, these findings may be of significance to the anatomists and contributes into the knowledge of the morphological variations that exists in the digastic muscle.

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REFERENCES


