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Popova I. S., Tsyhykalo O. V., Petryshen O. I., Khodorovska A. A.

TOPOGRAPHICAL AND ANATOMICAL SPECIFICS OF THE OMOHYOID MUSCLE IN HUMAN FETUSES

Higher Educational Institution "Bukovinian State Medical University" (Chernivtsi, Ukraine)
popova_i@bsmu.edu.ua

Structures in the anterior neck region are involved in essential functional activities for the human body like voice conduction, breathing, swallowing and head movement. Omohyoid as one of the representatives of the infrahyoid muscles, is a two-bellied muscle found in the lateral and anterior neck regions on both sides, and is adjacent to the sternocleidomastoid, thyrohyoid, sternothyroid muscles and magisterial blood vessels. To investigate topographical and anatomical specifics of the omohyoid, we have studied 14 specimens of human fetuses (4-9th months of prenatal development) by the means of complex classical morphological methods (macroscopy, morpho- and anthropometry). Present study shows moderate variability of attachment points for omohyoid (including lateral and medial variants for its scapular attachments); course of muscular fibers in the middle third part (oblique or slightly straight ascending course) that impact an angle between the inferior and superior bellies below the sternocleidomastoid; asymmetry between right and left muscles within one specimen. These variations of omohyoid can influence the internal jugular vein and brachial plexus surgical accesses during neck surgeries due to their close relation. Anatomical specifics of omohyoid should be taken into consideration during infrahyoid myocutaneous flap extraction for reconstruction surgeries.

Key words: *human development, neck muscles, omohyoid, anatomical variations.*

Relationship between the publication and planned research work. This work was conducted as a part of the scientific research of the Department of Histology, Cytology and Embryology of the Higher State Educational Institution "Bukovinian State Medical University" – "Structural and functional features of tissues and organs in ontogenesis, patterns of human variant, constitutional, gender and comparative morphology" (№ of the state registration 0121U110121).

Introduction. Anterior region of the neck includes representatives of many systems of organs that make this comparatively small region crucial in maintaining basic physiological acts like breathing, swallowing, hormone production, voice formation and others. Smaller regions within anterior and lateral regions of the neck are described as triangles, inholding so-called supra- and infrahyoid muscles, demarcated by the hyoid bone. These groups of muscles participate in the movement of head and neck, some phases of chewing and create anatomical protective barrier for trachea, esophagus, thyroid and parathyroid glands and are enclosed in the neck fascia [1, 2].

Omohyoid muscle belongs to the infrahyoid group of neck muscles. It lies on both sides of the neck and is attached to the hyoid bone by its superior belly and to the superior border of the scapula by its inferior belly, respectively. Clinically, omohyoid muscle flap, especially its inferior belly, can be used in the reconstructive procedures with the need for small functional tissue like facial surgery, sphincters or vocal cords reconstructions [3, 4, 5]. Topography of the omohyoid influences the outcome of the internal jugular vein catheterization because of their adjacent positions [3]. Also there are reports of the omohyoid muscle syndrome in patients. This condition is seen as transient neck lump on swallowing and is characterized by X-shaped neck lump in the lateral region caused by the failure of the deep cervical fascia to restrict movement of the central tendon of the omohyoid muscle [6, 7]. As omohyoid muscle shows a high diversity of its anatomical configurations, placements of attachments and innervation by ansa cervicalis, we have used this muscle as an object of our morphological study. Because data on the prenatal features of one are not full and lack data on the fetal period, our work is devoted to the anatomical and topographical features of the omohyoid muscle and its adjacent structures within anterior and lateral regions of neck.

The aim of the work – to investigate the anatomical and topographical features of the omohyoid muscle during the fetal period of human prenatal development (PND).

Object and methods of research. The material was represented by 14 formalin fixed specimens of human fetuses (9 males and 5 females) 4th to 9th month (160,0-450,0 mm of parieto-heel length (PHL)) of PND. Material obtained from Chernivtsi Regional Pathologists Bureau on the basis of bilateral agreement with the Department of Histology, Cytology and Embryology. Specimens have been investigated by the means of classical morphological methods: macroscopy (under the control of a binocular microscope), morpho- and anthropometry, accompanied by consecutive photographing of the dissectioned anatomical regions. Dissection was performed in anterior and lateral neck regions. The study was performed in accordance with the provisions of the declaration of Helsinki (1995) as revised in Edinburgh (2000), ICH GCP (1996) and had been approved by the Bukovinian State Medical University Ethics Committee.

Research results and their discussion. Omohyoid muscle is seen as a thin muscular plate, arising by a broad inferior belly from the medial part of the superior portion of the scapula. In 160,0 mm of PHL fetus, the middle ⅓ of the muscle then passed below the sternocleidomastoid. Superior belly arises superiorly over the anterior edge of the sternocleidomastoid within the anterior triangle and neck. It was attached to the lower edge of the hyoid bone body. In 160,0; 250,0 mm of PHL human fetuses, deep cervical fascia has developed its distinctive subdivisions of layer: superficial, visceral and deep fascial layers, accordingly. Fascial layers cre-

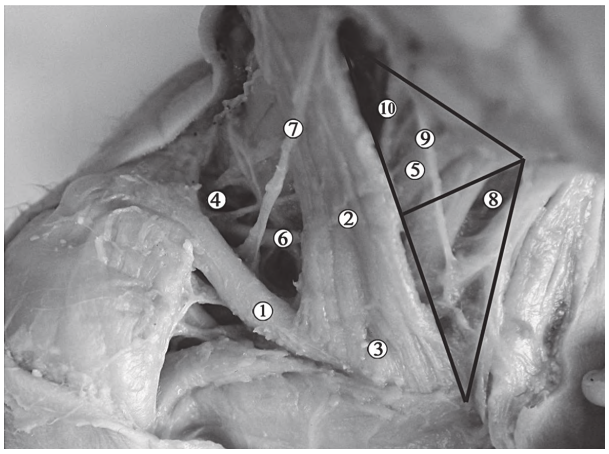

Figure 1 – Right anterior and lateral neck regions in 310,0 parieto-heel length human fetus (7th month of the prenatal development). Magn.: 4x. Marking: 1 – clavicle; 2 – sternocleidomastoid; 3 – minor supraclavicular fossa; 4 – brachial plexus; 5 – superior belly of the omohyoid; 6 – inferior belly of the omohyoid; 7 – external jugular vein; 8 – omotracheal triangle; 9 – accessory nerve; 10 – carotid triangle.

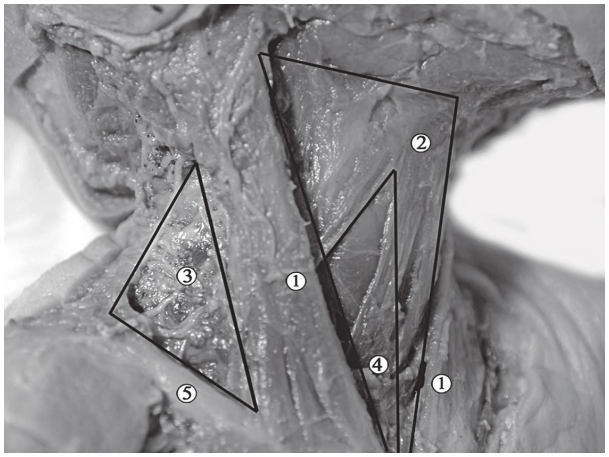

Figure 2 – Right anterior and lateral neck regions in 320,0 parieto-heel length human fetus (7th month of the prenatal development). Magn.: 2x. Marking:1 – sternocleidomastoid; 2 – right anterior neck triangle; 3 – lateral neck triangle; 4 – omotracheal triangle; 5 – clavicle.

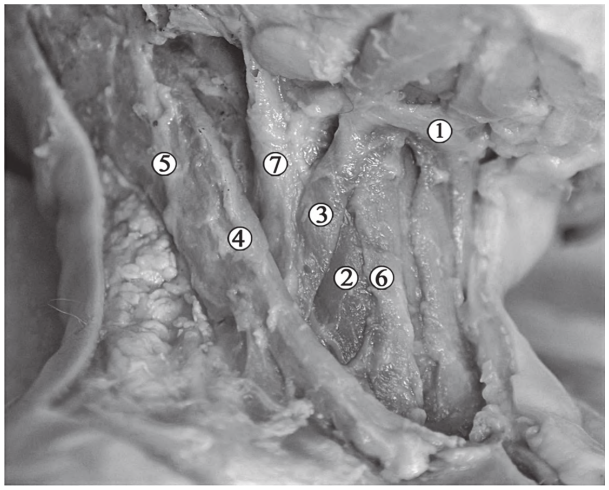

Figure 3 – Right anterior and lateral neck regions in 360,0 parieto-heel length human fetus (8th month of the prenatal development). Magn.: 2x. Marking: 1 – body of the hyoid bone; 2 – sternohyoid; 3 – superior belly of the omohyoid; 4 – sternocleidomastoid; 5 – external jugular vein; 6 – sternothyroid; 7 – common carotid artery.

ate fascial tissue spaces that can be distinguished at early stages of fetal period (160,0; 250,0 mm of PHL), as they unfold some volume of the adipose tissue. Clinically, these spaces may be possibly involved in spreading complications of inflammatory processes of the oral cavity by the means of soft tissues in the supra- and infrahyoid regions of neck.

In the human fetus of the 5th month of development (250,0 mm PHL) omohyoid was represented by a two-portion muscle with an oblique course. Inferior belly of the omohyoid started from the superior portion of scapula, laterally to the incisura, with wide fibers directed superiorly over posterior scalene muscle within the lateral triangle of neck. Superior belly of omohyoid was attached to the inferior edge of the body and larger horns of the hyoid bone. Attachment point was merging with the thyrohyoid muscle within the anterior triangle of neck.

In one case (270,0 mm PHL fetus, 6th month of PND) we didn't observe any presence of tendon in the intermediate connecting portion of the omohyoid. Instead, the inferior belly was continued by a thin portion of muscular tissue in the middle ⅓ prolonging into the superior belly, respectively. In this case omohyoid didn't show the presence of the tedious angle between the bellies (within the lateral cervical region), because of a relatively straight course.

In material of the 7th and 8th months of the PND, inferior belly of the omohyoid was found deeply in the lateral triangles of the neck **(fig. 1)**. In one case (330,0 mm of PHL fetus) we've mentioned an asymmetry of the left and right inferior bellies within one specimen that didn't impact fascial of major blood vessels topography. This case wasn't associated with any of the other infrahyoid muscle variations.

Superior belly of the omohyoid during this period of fetal development merges the posterosuperior border for the muscular triangle within the anterior region of neck. Moreover, together with sternohyoid they form a superficial layer of the ribbon muscles **(fig. 2)**. Superior belly of omohyoid, as well as sternohyoid and sternothyroid lie superficial to the lateral convex surface of the thyroid gland in fetuses. Muscular triangle **(fig. 2)** is rarely a place for the ectopic thymus findings, as the literature reports conclude.

In 9th human fetuses omohyoid arises by the means of inferior belly from the upper border of scapula near the suprascapular notch, prolonged with a common tendon. Inferior belly was innervated by the inferior root of ansa cervicalis. In one case (fetus 430,0 mm of PHL) there was no scapular attachment of inferior belly on the right side: it directly originated from the superolateral surface of the clavicle on the right side.

Superior belly of the omohyoid was attached to the lower border of the hyoid (lateral to the sternohyoid). Central tendon part of the muscle lies on the internal jugular vein. As some groups of the deep cervical lymph nodes are found along the internal jugular vein, topography of the omohyoid bellies attachment may impact surgical access for their excision, especially in case of thyroid carcinomas metastatic processes.

Superior belly of the omohyoid sometimes overlaps the attachment point of sternothyroid muscle (as seen on **fig. 3**) at a site of the hyoid bone body. Superior root of the ansa cervicalis, as the continuation of the de-

scending branch of hypoglossal nerve, reaches superior belly of the omohyoid.

Conclusions. 1. Fetal period of human prenatal development is characterized by moderate anatomical variability of omohyoid morphology (attachment, course, symmetry). The present study showed a unilateral anomalous attachment point of the inferior belly of omohyoid on the clavicle on one side (9-month fetus); absence of intermediate common tendon (6-month fetus). 2. Variation in the attachment and topography of omohyoid muscle can influence the internal jugular vein and brachial plexus anatomy during neck surgeries due to its close relation. Anatomical specifics of omohyoid should be taken into consideration during infrahyoid myocutaneous flap extraction for reconstruction surgeries.

Prospects for further research. We consider that anatomical and developmental features of the omohyoid muscles should be deeper studied on a microscopic level, including usage of immunostains.

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ТОПОГРАФО-АНАТОМІЧНІ ОСОБЛИВОСТІ ЛОПАТКОВО-ПІД'ЯЗИКОВОГО М'ЯЗА У ПЛОДІВ ЛЮДИНИ

Попова І. С., Цигикало О. В., Петришен О. І., Ходоровська А. А.

Резюме. Передня та бічні шийні ділянки вміщують низку органів та структур, які беруть участь у життєвонеобхідних функціях організму (дихання, ковтання, голосоутворення, рухи голови та шиї). Група підпід'язикових м'язів шиї розміщується нижче нижнього краю тіла під'язикової кістки у межах трикутників передньої та бічної шийних ділянок. Лопатково-під'язиковий м'яз часто використовується у якості клапотя для реконструкційних операцій, а його топографічне розташування робить його важливим орієнтиром під час доступу до внутрішньої яремної вени ти глибоких лімфатичних вузлів шиї.

Метою нашої роботи було дослідити топографо-анатомічні особливості будови та ходу волокон лопатково-під'язикового м'яза у плодів людини протягом пренатального періоду онтогенезу.

Нами досліджено 14 препаратів плодів людини (160,0-450,0 мм тім'яно-п'яткової довжини) на базі Чернівецького обласного патологоанатомічного бюро (на основі згоди щодо двосторонньої співпраці) за допомогою комплексу класичних методів морфологічного дослідження. Проводилось фотодокументування пошарового, поетапного препарування передньої та бічної шийних ділянок плодів.

В результаті проведених досліджень, виявлено атипове одностороннє місце прикріплення нижнього черевця лопатково-під'язикового м'яза у плода 430,0 мм тім'яно-п'яткової довжини безпосередньо від верхньо-бічної поверхні ключиці плода. Досліджуючи 6-місячні препарати, виявлено відсутність проміжного сухожилля у плода 270,0 мм тім'яно-п'яткової довжини, що у свою чергу вплинуло на зміну гостроти кута між верхнім та нижнім черевцем; ця частина м'яза залягала під груднинно-ключично-соскоподібним м'язом. Верхнє черевце у всіх досліджених випадках прикріплювалось до переднього краю тіла під'язикової кістки, поряд з груднинно-під'язиковим м'язом (бічніше або власне над його точкою прикріплення).

Отримані дані варіантної анатомії лопатково-під'язикового м'яза можуть бути застосовані у практичній хірургії під час висічення м'язового клапотя з реконструкційними завданнями, або під час удосконалення доступів до глибоких лімфатичних вузлів шиї (під час метастазування карцином органів шиї) чи до внутрішньої яремної вени.

Ключові слова: внутрішньоутробний розвиток людини, м'язи шиї, лопатково-під'язиковий м'яз, анатомічна мінливість.

TOPOGRAPHICAL AND ANATOMICAL SPECIFICS OF THE OMOHYOID MUSCLE IN HUMAN FETUSES

Popova I. S., Tsyhykalo O. V., Petryshen O. I., Khodorovska A. A.

Abstract. The anterior and lateral neck regions contain a list of organs and structures that are involved in vital functions of the body (breathing, swallowing, voice formation, head and neck movements). The group of infrahyoid muscles of the neck are found below the lower edge of hyoid bone body, within the triangles of the anterior and lateral cervical regions. The omohyoid muscle is often used as a flap for reconstructive surgeries, and its location makes it a landmark for accessing the internal jugular vein and deep lymphatic nodes.

The aim of our work was to investigate topographic and anatomical features of composition and course of the omohyoid in human fetuses during the prenatal period of ontogenesis. We have investigated 14 specimens of human fetuses (160,0-450,0 mm of parietal-heel length, 4-9th months of prenatal development) on the basis of the Chernivtsi Regional Pathological Bureau (based on the agreement on bilateral cooperation) using a set of classical

morphological methods of examination. Photo-documentation of consecutive dissections of anterior and lateral regions of neck was carried out.

The results of the study have revealed an atypical unilateral attachment of the inferior belly of omohyoid in 430,0 mm parietal-heel length fetus: it arised from the upper lateral surface of the clavicle. Examination of 6-month fetus revealed the absence of an intermediate tendon (270,0 mm parietal-heel length), which in turn affected the change in the angle between the superior and inferior bellies; this part of the muscle was found under the sternocleidomastoid. In all studied cases, superior belly was attached to the anterior edge of the body of hyoid bone, along with sternothyroid (lateral or actually above attachment point of last).

Variant anatomy of omohyoid can be used in practical surgery during excision a muscle flap for reconstruction tasks, or when improving access to deep lymph nodes (in case of carcinoma metastasis) or to the internal jugular vein.

Key words: human development, neck muscles, omohyoid, anatomical variations.

ORCID and contributionship:
Popova I. S.: 0000-0003-1234-3855 ABD
Tsyhykalo O. V.: 0000-0003-2302-426X AFE
Petryshen O. I.: 0000-0003-0322-0765 CDE
Khodorovska A. A.: 0000-0003-0957-111X CDE

Conflict of interest:
The authors declare no conflict of interest.

Corresponding author
Popova Iryna Serhiivna
Higher Educational Institution “Bukovinian State Medical University”
Ukraine, 58002, Chernivtsi, 2 Teatral'na ploshcha
Tel: +380507138313
E-mail: popova_i@bsmu.edu.ua

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