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A Case of Double-Branching Variant of the Right Superior Thyroid Artery

Un Caso de Variante de Doble Ramificación de la Arteria Tiroidea Superior Derecha

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SUMMARY: A case of double-branching variant of the right superior thyroid artery. The superior thyroid artery (STA) represents a crucial vascular structure in the cervical region, providing essential blood supply. Clinically, it is imperative to delineate the STA's origin and its branching architecture meticulously to mitigate the risk of hemorrhage and avert severe complications during surgical procedures. In this paper, we report a case of a female with a variant pattern of the STA: the right STA had an abnormal branching pattern, with two (anterior branch and posterior branch) Co-trunked STAs (herein named double branches of the superior thyroid artery) emanating from the anterior wall of the external carotid artery (ECA), of which the anterior branch emanated from a branch of the sternocleidomastoid muscle and a branch of the cricothyroid muscle, which ultimately distributed to the medial anterior lateral lobe of the lateral thyroid gland and the sternothyroid muscle, while the posterior branch emanated from the superior laryngeal artery, which finally branched into anterior glandular branches. The posterior branch gives rise to the superior laryngeal artery, which finally divides into the anterior glandular branch, the posterior glandular branch, and the lateral glandular branch to supply the thyroid. The left STA originates at the level of the common carotid artery (CCA) bifurcation. This article discusses the possible embryological reasons for this variation and its clinical significance, reviews the results of previous studies, and summarizes and analyzes three abnormalities of the STA: origin variation, abnormal branching pattern, and absence.

KEY WORDS: Superior thyroid artery; Branching pattern; Classification system; Anomalous origin; Surgery.

INTRODUCTION

The thyroid gland is the largest endocrine gland in the body, whose blood supply mainly derives from the superior thyroid artery (STA) and the inferior thyroid artery (ITA).The STA is the first branch of the external carotid artery (ECA), which usually originates from the anterior wall of the external carotid artery just below the level of the greater angle of the hyoid bone, and emanates from the bifurcation of the common carotid artery (CB), or the end of the common carotid artery (CCA). It runs along the lateral aspect of the thyroid cartilage through the carotid triangle, and is covered downward by the scapulohyoid muscle (omohyoid muscle), sternohyoid muscle, and sternothyroid muscle (Anand *et al*., 2022). The STA generally gives off five branches: the hypoglossal branch, the superior laryngeal artery, the sternocleidomastoid muscle branch, the cricothyroid muscle branch, and the glandular branch (which can be subdivided into anterior, posterior, and posterolateral glandular branches) to supply the thyroid gland, the larynx, the sternocleidomastoid muscle, and the tissues of other neighboring structures with blood. There is great variability in the STA's origins, branching, and adjacent anatomical structures (Poutoglidis *et al*., 2023). These variations may be involved in the establishment of the primitive cardiac and vascular system during the embryonic period or may be

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associated with some abnormality during vascular development during the embryonic period (Tzortzis *et al*., 2023), and variations in their origin and distribution may lead to medical injury and postoperative complications (Dessie, 2018; Motwani & Jhajhria, 2015). Therefore, a clear understanding of the anatomy of the STA plays an important role in some neck surgeries (Kojima *et al*., 1983; Terayama *et al*., 2006; Dessie, 2018).

In this paper, we report the pattern of variation in a female STA during routine dissection in the Anatomy Department of the Medical College of Wuhan University of Science and Technology, and discuss the possible embryological reasons for this variation and its clinical significance, reviewing the results of previous studies and summarizing and analyzing the three types of abnormalities in the STA: origin variation, abnormal branching pattern, and absence, in order to enrich the relevant data and information.

CASE REPORT

The cadaver of a 60-year-old woman (provided by the reception station, Wuhan Red Cross Society, Wuhan University of Science and Technology) was subjected to routine autopsy. A rare branching abnormality was found in her right STA: a double branching variant of the superior thyroid artery and an origin abnormality in the left STA. The woman had a history of diabetes mellitus and hypertension and died of pancreatic cancer. The authors strictly adhered to all local and international ethical guidelines and laws regarding the use of human cadaver donors in anatomical research. The Research Ethics Committee of the Medical School of Wuhan University of Science and Technology approved this research, under protocol 2024111.

Abnormal right STA branching pattern

During routine dissection, an abnormal right STA branching pattern was observed: two Co-trunked STAs (named double superior thyroid arteries in this article) emanated from the anterior wall of the ECA, of which the anterior (AB) and posterior (PB) branches had a diameter of 3.98 mm at the co-trunked point, which was located 5.83 mm above the bifurcation of the common carotid artery (Fig. 1A, B).

The AB has a diameter of 2.68 mm, and after emanation, it descends along the anterior aspect of the medial margin of the thyroid gland, and sends out a branch of the sternocleidomastoid muscle at the starting point of the AB at 10.87 mm, which distributes on the deep side of the middle part of the sternocleidomastoid muscle, with a diameter of 2.18 mm; then it sends out a branch of the cricothyroid muscle on the deep surface of the sternothyroid muscle at a

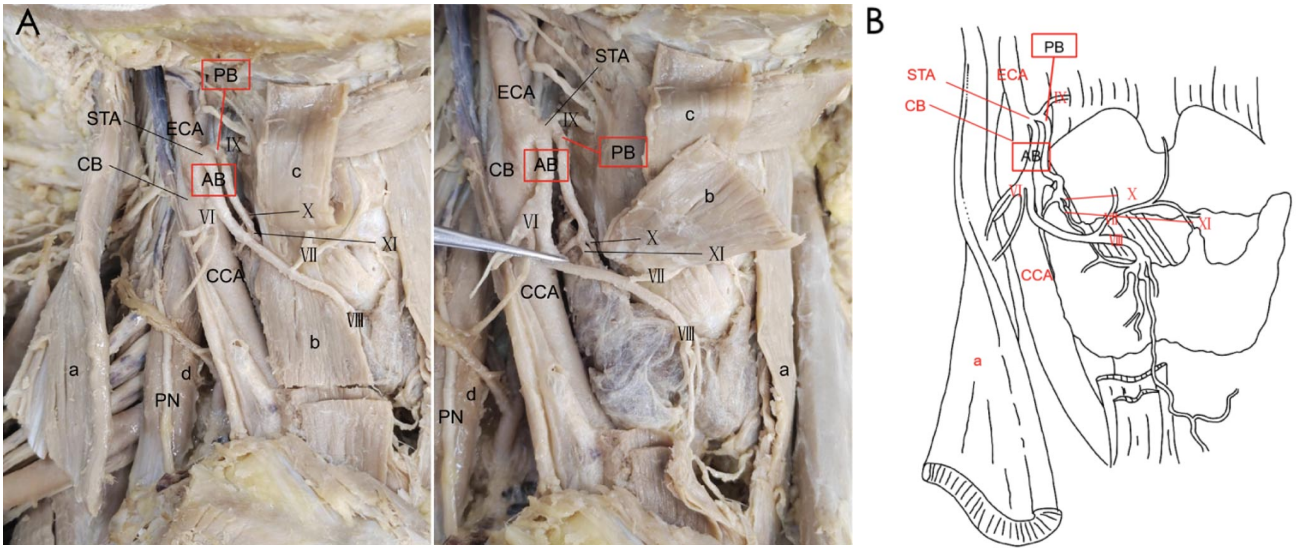

Fig. 1A. Abnormal branching of the right superior thyroid artery. STA superior thyroid artery, CCA common carotid artery, ECA external carotid artery, CB carotid bifurcation, AB anterior branch, PB posterior branch, PN phrenic nerve, VI sternocleidomastoid branch, VII cricothyroid branch, VIII anterior-medial branches, IX superior laryngeal artery, X posterior glandular branch, XI anterior glandular branch, a sternocleidomastoid muscle, b sternothyroid muscle, c sternohyoid muscle, d anterior oblique muscle.

Fig. 1B. Schema of the right superior thyroid artery. STA superior thyroid artery, CCA common carotid artery, ECA external carotid artery, CB carotid bifurcation, AB anterior branch, PB posterior branch, PN phrenic nerve, VI sternocleidomastoid branch, VII cricothyroid branch, VIII anterior-medial branches, IX superior laryngeal artery, X posterior glandular branch, XI anterior glandular branch, a sternocleidomastoid muscle, b sternothyroid muscle, c sternohyoid muscle, d anterior oblique muscle.

distance of 35.71 mm from the starting point of the anterior branch; finally, the main trunk descended along the anterior aspect of the medial margin of the lateral lobe of the thyroid gland, and divides into a number of anterior-medial branches of the nutrient side lobe. The last trunk descends anteriorly along the medial margin of the lateral lobes of the thyroid gland, dividing into several anteromedian branches that nourish the lateral lobes and the thyroid isthmus, and finally distributes to the thyroid muscle of the sternum.

The PB, with a diameter of 1.86 mm, is located in the posterior medial aspect of the AB, and is divided into four main branches: the superior laryngeal artery emanates at 2.82 mm from its origin, penetrating the thyroglossal ostium into the larynx, with a diameter of 1.21 mm; the main trunk descends to the upper pole of the thyroid gland, and emanates a posterior glandular branch at the origin of 16.91 mm, which distributes behind the lateral lobes, and then emanates a posteromedial glandular branch downward to the lateral aspect of the lateral lobes, and finally the main trunk continues as an anterior glandular branch descending close to the medial margin of the lateral lobes. The final trunk continues as the anterior glandular branch, which descends immediately adjacent to the medial margin of the lateral thyroid lobe, distributes anteriorly to the lateral lobe, and terminates in an anastomosis with the anteromedial branch at the end of the AB.

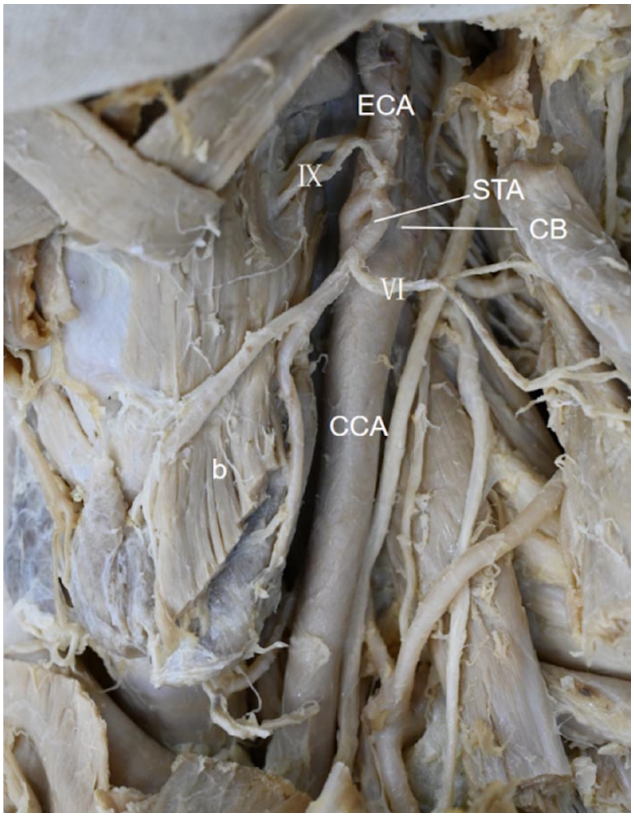

Fig. 2. Abnormal origin of the left superior thyroid artery. STA superior thyroid artery, CCA common carotid artery, ECA external carotid artery, CB carotid bifurcation, VI sternocleidomastoid branch, IX superior laryngeal artery, b sternothyroid muscle.

Abnormal origin of the left STA

The left STA originated at the level of the CB, and after emanating, it first branched out into the superior laryngeal artery, and then the main trunk branched out into the sternocleidomastoid branch and descended to the superior thyroid gland, where it branched out into the anterior glandular branch, the posterior glandular branch, and the posterolateral glandular branch. This part of the branch is normal (Fig. 2).

The vascular distribution of the superior thyroid artery and its branches is shown in Figure 3, including the anterior and posterior divisions and their major muscular and glandular branches.

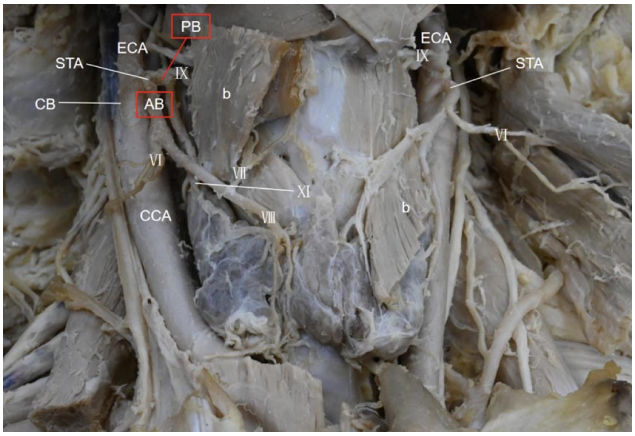

Fig. 3. Vascular distribution in thyroid area. STA superior thyroid artery, CCA common carotid artery, ECA external carotid artery, CB carotid bifurcation, AB anterior branch, PB posterior branch, VI sternocleidomastoid branch, VII cricothyroid branch, VIII anterior-medial branches, IX superior laryngeal artery, XI anterior glandular branch, b sternothyroid muscle.

DISCUSSION

Our study identified a variant pattern of the superior thyroid artery (STA) in a woman: abnormal right STA branching with two (anterior, posterior) Co-trunked STAs emanating from the anterior wall of the external carotid artery (ECA). The left STA originates at the level of the bifurcation of the common carotid artery (CB).

The anterior branch supplied the sternocleidomastoid and cricothyroid muscles and gave rise to multiple anteromedial glandular branches that anastomosed with the

anterior glandular branch of the posterior branch, while the posterior branch gave rise to the superior laryngeal artery and further divided into posterior, lateral, and anterior glandular branches supplying the thyroid gland. The left STA originated at the level of the carotidbifurcation (CB) and followed a relatively normal branching pattern. These variations are clinically significant because the STA is a key vascular structure in the carotid triangle, supplying the thyroid and parathyroid glands, larynx, trachea, esophagus, and adjacent muscles, and serves as an important landmark for identifying the external branch of the superior laryngeal nerve (EBSLN) in thyroid surgery. Intraoperative injury or inadequate ligation of the STA can result in life-threatening hemorrhage or vocal cord paralysis, underscoring the importance of detailed knowledge of STA anatomy for surgical planning and imaging diagnostics.

Variations in the origin and branching patterns of the STA are relatively uncommon but have been reported in prior studies. The STA typically originates from the ECA, though it may also arise from the common carotid artery (CCA) or the CB (Tzortzis *et al*., 2023). Classification systems by Natsis *et al*. (2011), Anagnostopoulou & Mavridis (2014), and Vázquez *et al*. (2009) describe origin variations, while Anand *et al*. (2022), Gupta *et al*. (2014), and Ozgur *et al*. (2009) provide frameworks for branching patterns. However, the co-trunked double STA observed in this case does not match any previously reported branching type. Similar complex co-trunking variants have been described for other arteries, including five-vessel co-trunks and undescribed common trunks involving the superior thyroid, superior laryngeal and lingual arteries (Motwani & Jhajhria, 2015; Bozhikova *et al*., 2024). Such rare variants highlight the need for careful preoperative evaluation and intraoperative vigilance to avoid vascular and neurological complications.

Embryologically, STA variations may arise from asymmetrical development of the aortic arches and thyroid buds or from anomalous differentiation, migration, or reorganization of primitive vessels (Tzortzis *et al*., 2023). Absence or deletion of the STA has also been reported, with compensatory hypertrophy of contralateral vessels observed in rare cases (Moriggl & Sturm, 1996; Mehta *et al*., 2010; Herrera-Núñez *et al*., 2020). Understanding both common and rare patterns of STA origin and branching is essential for surgeons performing thyroidectomy, neck dissection, tracheostomy, laryngeal operations, vascular reconstruction, and interventional procedures, as well as for interpreting radiologic studies of the neck. The present case expands the anatomical knowledge of STA variations and provides important insights into potential embryological mechanisms, thereby improving the safety and efficacy of related clinical procedures.

CONCLUSIONS

In this report, we report a case of a patient with a right STA branch variant and an abnormal left STA starting point. The right-sided branching anomaly in this case is rare, has never been reported in previous studies, and does not fall into any of the previous categories of branching patterns. This article discusses the possible embryological reasons for this variation and its clinical significance, reviews the results of previous studies and summarizes and analyzes the three types of STA abnormalities: origin variation, branching pattern abnormality, and deletion. It provides clinical knowledge of the relevant anatomy in order to improve the effectiveness and safety of the relevant procedures.

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HUANG, J.; PAN, J.; XIE, M.; ZHANG, C.; HE, Z.; LIU, D.; HE, Z.; LI, G.; LI, M. & LIU, X. Un caso de variante de doble ramificación de la arteria tiroidea superior derecha. *Int. J. Morphol., 44(3)*:851-855, 2026.

RESUMEN: Se presenta una variación anatómica de doble ramificación de la arteria tiroidea superior derecha. La arteria tiroidea superior (ATS) representa una estructura vascular crucial en la región cervical, que proporciona un suministro sanguíneo esencial. Clínicamente, es imperativo delimitar meticulosamente el origen de la ATS y su arquitectura de ramificación para mitigar el riesgo de hemorragia y evitar complicaciones graves durante los procedimientos quirúrgicos. En este artículo, informamos de un caso de una mujer con un patrón variante de la ATS: la ATS derecha tenía un patrón de ramificación anormal, con dos ATS con troncales compartidas (rama anterior y rama posterior) (aquí denominadas ramas dobles de la ATS) que emanaban de la pared anterior de la arteria carótida externa (ACE), de las cuales la rama anterior se originaba de una rama del músculo esternocleido-mastoideo y una rama del músculo cricotiroideo, que finalmente se distribuían al lóbulo anterolateral medial de la glándula tiroides lateral y al músculo esternotiroideo, mientras que la rama posterior se originaba de la arteria laríngea superior, que finalmente se ramificaba en ramas glandulares anteriores. La rama posterior da origen a la arteria laríngea superior, que finalmente se dividía en la rama glandular anterior, la rama glandular posterior y la rama glandular lateral para irrigar la tiroides. La ATS izquierda se originaba a la altura de la bifurcación de la arteria carótida común (ACC). Este artículo analiza las posibles causas embriológicas de esta variación y su relevancia clínica, revisa los resultados de estudios previos y resume

y analiza tres anomalías de la arteria tiroidea superior (ATS): variación en su origen, patrón de ramificación anómalo y ausencia.

PALABRAS CLAVE: Arteria tiroidea superior; Patrón de ramificación; Sistema de clasificación; Origen anómalo; Cirugía.

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