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Thyroid ima artery (the artery of Neubauer) — how much do we know?

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The blood supply of the thyroid gland has been the subject of numerous original studies, case reports and meta-analyses. The number of surgical procedures carried out on the thyroid gland has significantly increased over the last few decades. The cadaveric report discusses the case of a thyroidea ima artery (TIA) which originated from the brachiocephalic artery before its terminal subdivision, giving off numerous branches to the infrahyoid muscles, trachea, and thyroid gland. Based on the current literature, we discuss the prevalence of TIA, its embryology, and possible clinical aspects of this variation, with special attention paid to the postoperative complications. (Folia Morphol 2025; 84, 1: 263–266)

Keywords: thyroid ima artery, artery of Neubauer, thyroid ima vein, thyroid gland, anatomical variation

INTRODUCTION

The thyroid gland is one of the best-perfused organs in the body, with a blood flow of 5 mL/g/min. The organ is mainly supplied by two paired thyroid arteries: the superior thyroid artery (STA), a branch of the external carotid, and the inferior thyroid artery (ITA), a branch of the thyrocervical trunk. Of these two, the major vessel is the ITA, which is estimated to deliver over 70% of blood to the thyroid gland is delivered by this artery. Most textbooks also mention the thyroid ima artery (TIA), named the artery of Neubauer after the name of professor Johann Ernst Neubauer, who first described it in 1772) [21].

Following the literature, it is postulated that the prevalence of TIA ranges between 1.5–12.2% and its variability is also associated with its different origin. It has been deeply studied in the fundamental meta-analysis by Yurasakpong et al. [18], based on 36 articles (including 4335 patients). They calculated the prevalence of TIA as 3.8% and studied the variation of its origin. According to them, the most frequent origin of TIA is from the brachiocephalic trunk (BCT) (74%), the right common carotid artery (9.6%), the arch of the aorta (7.7%), the right internal thoracic artery (4.8%), the left common carotid, and the left internal thoracic arteries (1.9% each) [14]. Very rarely, TIA may originate from the subclavian, pericardiophrenic, or vertebral arteries [4, 14]. The decreasing number of open surgery procedures replaced by using laparoscopic techniques requires a new look at this artery to avoid postprocedural complication, mostly severe internal bleeding.

The thyroid gland develops between the fourth and seventh gestational weeks. This period is characterized by the formation of the gland from the endoderm of the stomodeum floor, as well as its descend and simultaneous development of the branches of the aortic arch. During this time, the vessels supplying

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the thyroid gland also develop. Vascularization of the gland exists in the form of a dense, rich vascular (arterial/venous) network, which in the last week of thyroid development gives rise to pairs of STA and ITA while the rest of the vessels regress. However, sometimes the TIA, which is present throughout the developmental period, does not atrophy and persists as additional artery supplying the lower part of the gland [13].

In the current case [16], we describe the presence of a TIA which arose from the brachiocephalic trunk and supplied the isthmus and the right lobe of the thyroid gland, giving off several branches to the trachea and neighbouring fragments of the infrahyoid muscles.

CASE RAPORT

During a routine anatomical dissection of a 67-year-old female cadaver, we observed a thyroidea ima artery. It arose from the left aspect of the BCT and, after short course, it gave off its first branch, which supplied the infero-medial surface of the right lobe of the thyroid gland. Next, the artery gave off a large anterior branch to the infrahyoid muscles (mostly sternohyoid and sternothyroid), while the main trunk coursed almost in the midsagittal plane to finally divide into two terminal branches: the anterior branch to supply the isthmus and the posterior branch to supply the anterior aspect of the trachea (Fig. 1).

To improve the visibility of the artery, it was painted with red acrylic emulsion (McBinney and Smith, Forks Township, PA, USA).

The artery was gently dissected, and photographic documentation was made. All possible measurements were carried out with the help of a digital calliper (Lux-tools, Poland). They were repeated by two independent researchers.

The TIA originated from the antero-medial surface of the BCT. The distance between the origin of the BCT from the aortic arch and the origin of the TIA was 23.29 mm. Next, the artery ran upwards and obliquely under the right thyroidea ima vein. The calibre of the TIA in this fragment was 2.18 mm.

After a course of around 22.43 mm, the TIA gave off its first branch, which migrated laterally to the right. The branch ran posterior to the branches of the right thyroidea ima vein, then arched upwards and slightly anteriorly together with the aforementioned vein. After a short distance, the branch entered the infero-anterior part of the right lobe of the gland and supplied it.

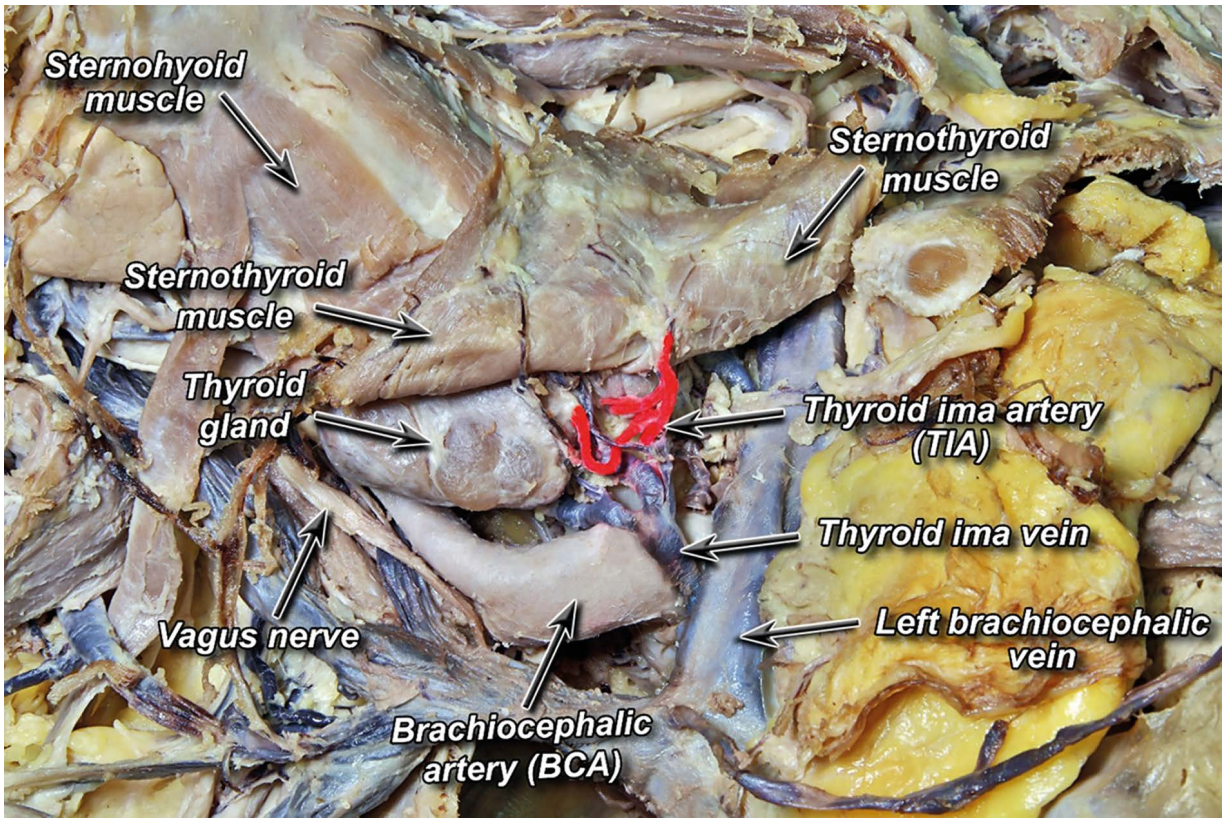

Figure 1. Artery of Neubauer arising from the brachiocephalic trunk (superior view).

Next, the TIA ran further upwards within the midsagittal plane and gave off a second branch to supply the sternohyoid and the sternothyroid muscles.

After giving off the second branch, the TIA changed its course and ran obliquely upwards and backwards. It divided into two subdivisions, which together reached the thyroid isthmus and the anterior aspect of the trachea, supplying them.

DISCUSSION

The thyroid ima artery is one of the most easily recognizable anatomical variations in the human body. Its presence significantly increases the risk of surgical approaches in the lower neck and superior mediastinum [15]. The rate of its occurrence varies between different studies, ranging from 4–10% depending on the population. It is significantly more frequent in the fetuses [12, 18]. Its higher prevalence in fetuses — 14.8% compared to adults — may result from "unstable" relation between blood vessel formation and thyroid development [12, 13].

In our case, we present the most frequent origin of TIA (from the BCT) with its detailed course and branching pattern. Its route agrees with reports of Fujimoto et al. [3]. It is similar to observations of Totlis et al. [14] regarding both the course and supply. Natsis et al. [9] observed a higher prevalence of TIA combined with a brachiocephalico-carotid trunk or associated with a right aberrant subclavian artery. These findings confirm observations made by Robinson et al. [13], who postulated a higher prevalence of TIA in case of disruption between angiogenesis and the formation of the thyroid gland.

The presence of such a large and variable vessel in the root of the neck may significantly endanger performing surgical operations in this area. Lack of proper recognition before percutaneous dilational tracheostomy, thyroidectomy, or partial resection of the thyroid gland may increase the risk of complications, such as mediastinal bleeding or postoperative ischaemia [8, 10]. The risk is especially increased in cases of primary mediastinal goitre [17, 18]. The presence of the TIA may increase the risk of intraoperative haemorrhage and can potentially cause distant complications, such as erosion of the TIA wall due to inflammation caused by a tracheostomic tube [7]. A similar risk is associated with abnormal position of the carotid arteries and the aortic arch [11], especially when accompanied by a dissecting aortic aneurysm [5].

Endovascular embolization of the thyroid arteries is a safe and effective procedure for diminishing the blood perfusion of the thyroid gland in Graves-Basedov disease [1]. Additionally, in case of emergencies, surgeons should be aware that blunt thoracic trauma causing damage to the TIA may result in a massive mediastinal haematoma. In such cases, selective embolization of the TIA may be a sufficient treatment. [17].

CONCLUSIONS

Our case presents the most frequent form of a quite rarely observed anatomical variation — the thyroid ima artery, which is a developmental remnant after the formation of the vascular network of the thyroid gland. Its presence may bring significant risk during surgical approaches to the lower neck and upper chest when injured.

ARTICLE INFORMATION AND DECLARATIONS

Ethics statement

Not applicable for this study.

Author contributions

KB and KF — dissection of the cadaver, measurements, description of the case. A. Patra, ML, J. Walocha — literature review, linguistic correction. J. Walocha, J. Wajda, A. Pasternak — content-related supervision, linguistic correction. KB, A. Pasternak, J. Walocha — writing the manuscript.

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Conflict of interest

None of the authors declared conflict of interest.

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