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Case Report

The Thyroid Ima Artery Associated with Unilateral Absence of the Inferior Thyroid Artery: A South African Cadaveric Case Report

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Abstract

The thyroid ima artery (TIA) is an uncommon arterial variation, with reported prevalence varying substantially among anatomical studies, which primarily supplies the isthmus and inferior portion of the thyroid gland. Its variable origin and midline location in the neck make it susceptible to injury during surgical procedures like tracheostomies. During a routine cadaveric dissection, a TIA was observed in an 83-year-old white South African male, associated with an absent left inferior thyroid artery. The artery originated from the brachiocephalic trunk, measured 5.93 mm in diameter at its origin, was 18.43 mm in length, and bifurcated into two terminal branches. This case contributes to the limited anatomical literature describing the TIA in African populations and reinforces the importance of recognising this variation during anterior neck surgery. A thorough knowledge of its prevalence, location, and course can help clinicians prevent surgical complications and haemorrhage during anterior neck procedures.

Keywords: anatomical variation; thyroidea ima; thyroid gland; thyroidectomy; tracheostomy

1. Introduction

The thyroid ima artery (TIA) (also known as the arteria thyroidea ima) was first documented in 1772 by the German anatomist Johann E. Neubauer, leading to its historical name, Neubauer's thyroid artery [1–3]. The TIA is a small vessel (averaging 3–5 mm in diameter) located in the neck's midline and has a highly variable prevalence [4,5]. It may present as a single trunk or with multiple bifurcations and terminal arborisations, and its origin, diameter, arterial supply, and termination all show variation in the literature [2,6–8]. When present, the TIA generally ascends along the anterior aspect of the trachea to supply the inferior aspect of the thyroid gland and/or isthmus, thereby providing an additional, unpaired source of arterial supply [3,9,10].

The thyroid gland develops between the fourth and seventh gestational weeks. During this period, the gland forms from the endoderm on the floor of the stomodeum and descends into the neck [11]. Simultaneously, branches of the aortic arch develop to supply it [6,11]. This early vascularisation exists as a dense, rich network which, in the final week of thyroid development, gives rise to the paired superior and inferior thyroid arteries, while the remaining vessels typically regress [11]. The persistence of an embryonic arterial channel has been proposed as one explanation for the presence of the TIA, although its precise developmental basis remains unclear [11]. This embryological origin has been linked to the descent of the thyroid gland and variable arterial differentiation during the

Check for updates

Academic Editors: Athikhun Suwannakhan, Laphatrada Yurasakpong and Francesco Fornai

Received: 6 August 2026
Revised: 27 August 2026
Accepted: 15 September 2026
Published: 18 September 2026

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foetal period [3,5]. Early researchers like Faller and Schaerer [6] believed the TIA was a remnant of the thymic artery.

The reported prevalence of the TIA varies considerably among anatomical studies, reflecting differences in study design, detection methods, and target populations. Early anatomical observations illustrated this variability, ranging from Adachi's finding [12] of 0.4% (1 of 271) to higher frequencies reported in classical reference works [13]. Contemporary evidence demonstrates a similar pattern: a meta-analysis by Yurasakpong et al. [8] identified an overall prevalence of 3.8%, noting higher detection rates in foetuses and European populations, while a recent systematic review by Bartziotas et al. [9] observed prevalence estimates between 0.1% and 5.71%, with cadaveric investigations consistently yielding higher detection rates than imaging-based studies. Beyond acting as an accessory source of arterial supply to the thyroid isthmus and inferior pole [3,10], the TIA is frequently associated with unilateral or bilateral absence of the inferior thyroid artery [1,3,9,13,14]. This recurrent co-occurrence highlights the TIA's role as an alternative pathway when conventional vessels are absent, though whether this reflects a true developmental compensatory mechanism remains unestablished from current anatomical data. Furthermore, persistent TIA channels have been implicated in meeting increased vascular demands under specific physiological or pathological conditions [2], as well as serving as feeding vessels for parathyroid adenomas [15].

The origin of the TIA is also highly variable. The brachiocephalic trunk is the most frequently reported origin. However, the artery may also arise from the aortic arch, common carotid artery, subclavian artery, internal thoracic artery, thyrocervical trunk or other vessels [8,9]. Recent case reports continue to document unusual origins, including an origin directly from the aortic arch with an uncommon aortic arch branching pattern [16]. This variation in origin is clinically relevant because the TIA may arise from major vessels within the root of the neck or superior mediastinum and subsequently cross the operative field of anterior neck procedures.

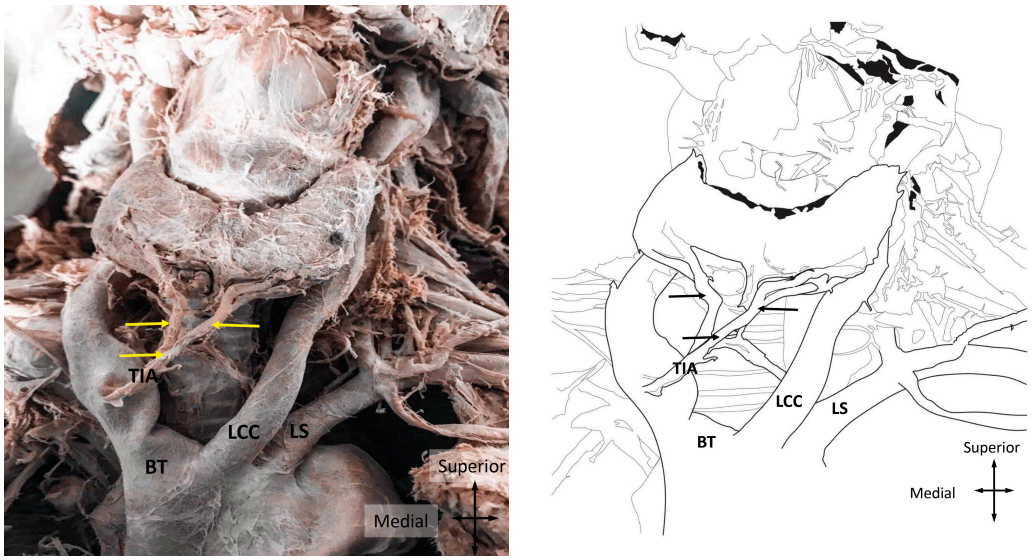
The significant increase in tracheostomies (5–15%) performed during the COVID-19 pandemic has underscored the clinical importance of understanding the TIA prevalence and course [17–19]. Due to reported cases of haemorrhage linked to the TIA during percutaneous dilatational tracheostomy [20,21], surgical teams must recognise this vascular variant to safely navigate and execute interventions across the midline of the neck and suprasternal notch.

Most published anatomical descriptions and prevalence studies of the TIA originate from European and Asian populations, whereas reports from African populations remain comparatively scarce. Although studies from African populations have documented variation in the origins of the superior and inferior thyroid arteries, direct information concerning the prevalence and anatomical characteristics of the TIA in African populations remains limited. Population-specific anatomical data is relevant and may contribute to surgical education, anatomical reference data and safer surgical practice.

2. Case Report

During routine dissection of the root of the neck, a thyroid ima artery (TIA) was noted in an 83-year-old formalin-embalmed white South African male cadaver. The TIA originated from the brachiocephalic trunk, ascended anteromedially in the midline of the neck and divided into two main branches (Figure 1a,b). The vessel exhibited a proximal diameter of 5.93 mm where it originated from the brachiocephalic trunk, with a total length of 18.43 mm to its bifurcation. Measurements were obtained using a digital Vernier calliper (accuracy $\pm$0.01 mm). Following bifurcation, the two branches coursed superiorly within

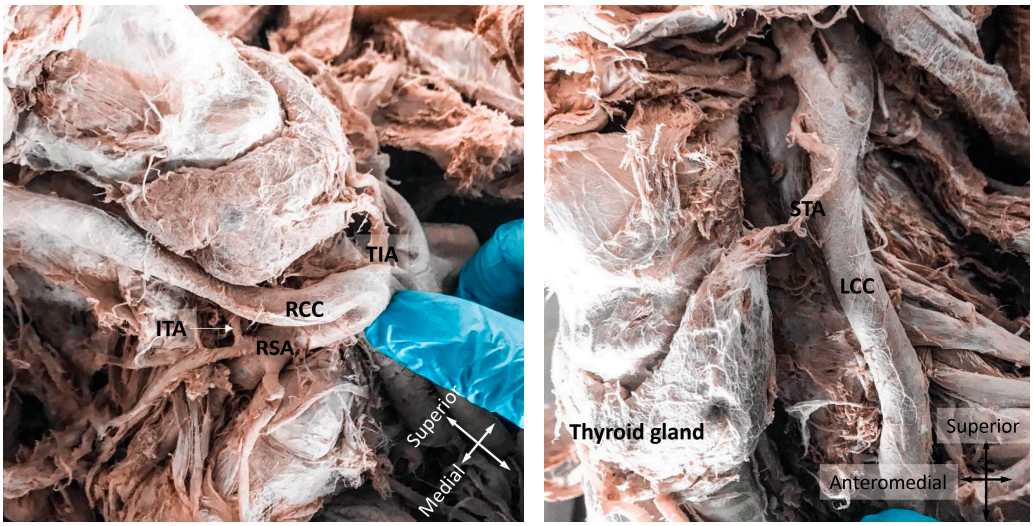
the anterior neck and were traced to their terminal distribution. The branches supplied the isthmus and both inferior poles of the thyroid gland.



(**a**) (**b**)

Figure 1. Demonstration of the origin, course and bifurcation of the TIA in (**a**) cadaveric dissection and (**b**) line diagram. LCC: left common carotid artery; BT: brachiocephalic trunk; LS: left subclavian artery; TIA: thyroid ima artery. The arrows indicate the TIA bifurcating into its left and right branches.

The arterial supply of the thyroid gland was further investigated by dissecting the origin and course of the superior and inferior thyroid arteries. Bilateral superior thyroid arteries were identified, each arising directly from the respective external carotid artery as described in standard anatomical textbooks [22,23]. Vascular asymmetry was noted, with the right inferior thyroid artery originating from the right thyrocervical trunk, in contrast to an absent left inferior thyroid artery (Figure 2a,b).



(**a**) (**b**)

Figure 2. (**a**) Right and (**b**) left views of the arterial supply to the thyroid gland. ITA: inferior thyroid artery; RSA: right subclavian artery; RCC: right common carotid artery; TIA: thyroid ima artery; STA: superior thyroid artery; LCC: left common carotid artery.

3. Discussion

The TIA is an uncommon anatomical variation in the arterial supply of the thyroid gland, with prevalence estimates varying considerably among anatomical studies according to study population and methodology [3,7]. A systematic review and meta-analysis by Yurasakpong et al. [8] estimated an overall prevalence of 3.8% among 4335 subjects, with substantial heterogeneity between studies. The prevalence was higher in European populations (5.3%) than in Asian (4.0%), American (2.2%) and African (1.6%) populations. In addition, this study reported higher prevalence in cadaveric studies (4.3%) than in imaging-based studies (3.3%), suggesting that differences in detection methods may contribute to the variation between reported estimates. More recently, Bartziotas et al. [9] reviewed 20 studies published between 2010 and 2025 and reported prevalence estimates ranging from 0.1% to 5.71%, with consistently higher detection rates in cadaveric studies than in imaging studies. The occurrence of a TIA in the present South African cadaver therefore contributes to the relatively limited anatomical evidence from African populations.

The origin of the TIA is also highly variable. Yurasakpong et al. [8] reported that the brachiocephalic trunk was the most common origin, accounting for approximately 74% of cases, followed by the right common carotid artery (9.6%) and aortic arch (7.7%), with less frequent origins from other arteries. The present TIA originated from the brachiocephalic trunk, consistent with the most frequently reported origin in the literature and recent cadaveric reports.

Chin et al. [3] reported that the TIA is typically a small vessel measuring approximately 3–5 mm in diameter. In this case, the TIA exhibited a proximal diameter of 5.93 mm at its brachiocephalic origin, exceeding standard literature ranges, and measured 18.43 mm in length, similar to the 17.8 mm documented by Lovasova et al. [24]. The relatively large calibre observed in the present case may be related to the extensive distribution of the artery, as its branches supplied both the inferior thyroid poles and the isthmus. Recent cadaveric reports demonstrate considerable branching variability; for example, Totlis et al. [25] described a TIA arising from the brachiocephalic trunk that divided into multiple anterior and posterior branches supplying the thyroid gland, parathyroid glands and infrahyoid muscles. The bifurcation observed in the present case represents another pattern within the recognised range of TIA branching morphology.

It has been suggested that the TIA provides an alternative vascular route when the inferior thyroid artery is absent [1]. Early observations by Faller and Schaerer [6] revealed that the rate of aplasia among TIA presentations ranged between 0.20 and 5.9%. In a post-mortem study, the inferior thyroid artery was absent in 4.3% of cases on the right and 9.5% on the left in females, and in 5.9% of cases on both the right and left in males [2]. The coexistence of the TIA with absence or deficiency of an inferior thyroid artery is particularly relevant to the present case: the left inferior thyroid artery was absent, while the left branch of the TIA supplied the inferior aspect of the left thyroid lobe. This anatomical relationship aligns with previous reports describing the TIA alongside unilateral or bilateral absence of the inferior thyroid arteries [9,14,26]. In the present case, the TIA provides an alternative arterial supply to a region where the conventional left inferior thyroid artery was absent. Although this may represent a compensatory arrangement, the developmental relationship between persistence of the TIA and absence of the inferior thyroid artery cannot be definitively established from a single specimen.

African data on thyroid arterial variation remain sparse. Magoma et al. [27] investigated the origins of the thyroid arteries in 50 Kenyan cadavers and found variant origins in over 25% of superior thyroid arteries and 11% of inferior thyroid arteries, though they did not report on TIA prevalence. Similarly, Tsegay et al. [28] examined 16 cadavers from North Ethiopia, noting variations in the superior thyroid artery while the inferior thyroid

artery consistently arose from the thyrocervical trunk, with no TIA identified. These studies highlight both the presence of thyroid arterial variation in African populations and the paucity of TIA-specific data. Consequently, the 1.6% African subgroup prevalence reported by Yurasakpong et al. [8] should not be interpreted as representative of the continent as a whole.

Recent non-African studies further underscore the broad clinical and morphological variability of this vessel. A 2024 cadaveric study of 84 body donors identified a TIA in 14.3% of specimens, substantially higher than the pooled ranges reported by Yurasakpong et al. [8] and Bartziotas et al. [9]. Additionally, Zaborowski et al. [16] described a TIA arising directly from the aortic arch in an 82-year-old male cadaver, in association with an unusual five-branch aortic arch. Such structural variation demonstrates that the TIA differs not only in prevalence, but also in its arterial origin, course, and relationship with surrounding structures.

The clinical significance of the TIA relates directly to its midline course along the anterior aspect of the trachea. Injury to the vessel during tracheostomy, cricothyrotomy, thyroidectomy or other anterior neck procedures can cause fatal haemorrhage [15,21]. This risk was underscored during the COVID-19 pandemic due to a marked increase in surgical and percutaneous tracheostomies [17–19,29]. In the present case, the TIA's midline position, paired bifurcation and wide distribution across the isthmus and both inferior poles demonstrate that a single variant vessel may supply an extensive area of thyroid tissue. Operating clinicians must maintain awareness of potential midline vascular variations to prevent intraoperative haemorrhage and ensure safe surgical planning in the lower anterior neck. While direct cadaveric dissection cannot yield population-level prevalence data, documenting such detailed morphometrics expands the anatomical reference base for clinical practice and surgical education.

4. Conclusions

Although the TIA is uncommon, failure to recognise its presence during anterior neck procedures, such as tracheostomy, thyroidectomy and emergency airway management, can lead to severe intraoperative haemorrhage. This case contributes valuable morphometric data to the limited anatomical literature on thyroid vascular variations in South African populations. Documenting such rare variants remains essential for enhancing surgical education and clinical safety. Larger-scale epidemiological and cadaveric studies in Southern Africa are warranted to clarify regional prevalence and further inform safe operative practice in the lower anterior neck.

Author Contributions: Both authors contributed to the dissection, measurement and material preparation. The first draft was written by K.S., while the final version was written by S.v.d.W. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: The study utilised an embalmed human cadaver from the Department of Anatomy and Histology. The cadaver was obtained through either family donation or as an unclaimed body in accordance with the South African National Health Act (Act No. 61 of 2003). No personally identifiable information was collected or accessed. The study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki (2024), ensuring the confidentiality, integrity, and ethical handling of all anatomical material. Ethical approval has been granted by the Sefako Makgatho University Research Committee (SMUREC/M/110/2021:PG; 1 July 2021).

Informed Consent Statement: The prosection was performed on an embalmed adult cadaver from the Department of Anatomy's cadaveric collection. The specimen was obtained either through voluntary body donation by the family or as an unclaimed body, in accordance with the provisions of the South African National Health Act (Act No. 61 of 2003). No identifiable personal information was accessed, collected, or recorded during the study. The use and handling of the cadaveric material complied with applicable ethical requirements and the principles outlined in the Declaration of Helsinki (2024).

Data Availability Statement: The original contributions presented in this study are included in the article. Further inquiries can be directed to the corresponding author.

Acknowledgments: The authors sincerely thank those who donated their bodies to science so that anatomical research and teaching could be performed. Results from such research can potentially increase scientific knowledge and can improve patient care. Therefore, these donors and their families deserve our highest respect. The authors would also like to thank Marinda Pretorius for her assistance in creating the line diagram and for editing the figures. Thank you for your input and assistance in elevating the visual aspect of the paper.

Conflicts of Interest: The authors declare no conflicts of interest.

Abbreviations

The following abbreviations are used in this manuscript:

TIA Thyroid ima artery

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