ISSN 2563-7142

CASE REPORT

Superior Thyroid Artery Originating from the Ascending Pharyngeal Artery

Tata Touré[*1], Babou Ba[1], Abdoulaye Kanté[1,2], Gadji Dady Gadji[1], Fatogoma Issa Koné[3], Gaoussou Simpara[1], Sekou Kanté[2], Nouhoum Ongoïba[1,2]

Touré T, Ba B, Kanté A, et al. Superior Thyroid Artery Originating from the Ascending Pharyngeal Artery. Int J Cadaver Stud Ant Var. 2024;5(1):37-42.

Abstract

Background: The superior thyroid artery generally originates from the anterior surface of the external carotid artery. The superior thyroid artery originating from the ascending pharyngeal artery is an extremely rare anatomic variation. Nevertheless, some variations in the origin of the superior thyroid artery have been reported in the literature. Such knowledge is important during neck surgeries such as thyroidectomy and radical neck dissection. No other cases involving a superior thyroid artery arising from the ascending pharyngeal artery were found during literature review.

Case report: During a routine neck dissection of a 37-year-old male cadaver, a right superior thyroid artery originating from the right ascending pharyngeal artery was observed. The superior thyroid artery had two segments, a superior (or horizontal) segment and an inferior (or vertical) segment. The superior segment passed posterior to the linguofacial trunk. The inferior segment passed posterior to the superior laryngeal artery and an artery that went to the infrahyoid muscles. These last two arteries came directly from the external carotid artery. The superior thyroid artery terminated in two branches (one lateral and one medial) 6 mm above the superior pole of the right thyroid lobe.

Conclusion: The origin of the superior thyroid artery from the ascending pharyngeal artery is an extremely rare anatomical variation. A thorough knowledge of the variations in origin of the superior thyroid artery is decisive for head and neck surgeries..

Key Words: *Superior thyroid artery; Ascending pharyngeal artery; Thyroid gland; Anatomical variations; Neck vascular anatomical variations*

[1]*Anatomy laboratory of the Faculty of Medicine and Odontostomatology and the Faculty of Pharmacy, University of Sciences, Bamako, Mali*

[2]*Surgery Department B of the University Hospital Center of Point-G, Bamako, Mali*

[3]*Otorhinolaryngology and Head and Neck Surgery Department of the Gabriel Touré University Hospital Center, Bamako, Mali*

[*]*Corresponding author: Tata Touré, Assistant Professor, Anatomy laboratory of the Faculty of Medicine and Odontostomatology and the Faculty of Pharmacy, University of Sciences, Bamako, Mali, Email: ttbabtoure@gmail.com*

Received: February 22, 2024, Accepted: March 11, 2024, Published: April 10, 2024

ISSN 2563-7142

Introduction

The superior thyroid artery generally originates from the anterior surface of the external carotid artery, closer to its origin (Figure 1). From there, it goes first medially and anteriorly, then inferiorly, and reaches the superior pole of the corresponding lobe of the thyroid gland, where it splits into three branches: medial, lateral and posterior [1].

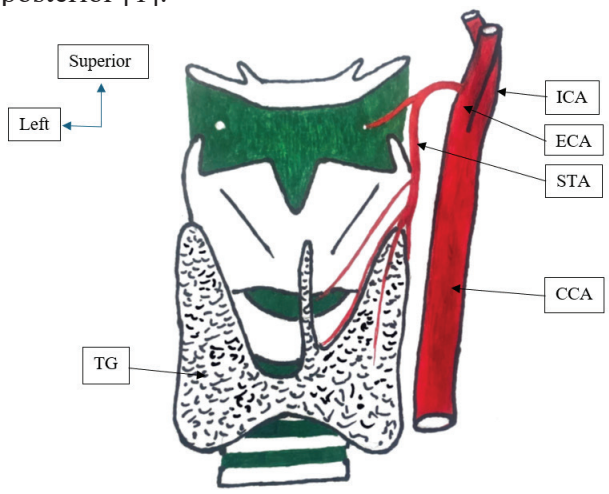

Figure 1) *Classic origin of the superior thyroid artery. CCA: Common carotid artery; ECA: External carotid artery; ICA: Internal carotid artery; STA: Superior thyroid artery; TG: Thyroid gland*

Many variations of different origins of the superior thyroid artery have been reported in the literature. The superior thyroid artery can originate from the common, external, or internal carotid arteries or originate from one of these arteries by a common trunk with the lingual artery or the lingual and facial arteries [2].

Knowledge of the anatomic variations of the superior thyroid artery are important during radiological and surgical neck procedures such as radical neck dissection, thyroidectomy, aneurysm reconstruction, cricothyroidotomy, carotid endarterectomy or cancer therapies [2-4].

No other cases involving a superior thyroid artery arising from the ascending pharyngeal artery were found during literature review.

Case Report

During routine cadaveric neck dissection, a right superior thyroid artery originating from the right ascending pharyngeal artery was observed on a 37-year-old male fresh-frozen cadaver. The ascending pharyngeal artery itself originated from the medial part of the external carotid artery. The superior thyroid artery, after its origin, presented two segments (a superior or horizontal segment and an inferior or descending segment). A branch that went to the pharynx originated at the junction of these two segments. The superior (or horizontal) segment passed posterior to the linguofacial trunk (common trunk of the lingual and facial arteries) traveling anteriorly, medially and a little inferiorly. The inferior (or descending) segment proceeded towards the superior pole of the right thyroid lobe following an oblique direction inferiorly, anteriorly, and medially. This inferior (or descending) segment passed posterior to the superior laryngeal artery and an artery that went to the infrahyoid muscles that came directly from the external carotid artery. The superior laryngeal artery originated from the medial aspect of the external carotid artery, the artery that went to the infrahyoid muscles originated from the anterior aspect of the external carotid artery. The superior thyroid artery terminated into two branches (one lateral and the other medial) 6 mm above the superior pole of the right thyroid lobe. The lateral branch ran on the posterior face of the thyroid lobe and the medial branch ran between the medial face of the thyroid lobe and the trachea (Figure 2). The cricothyroid artery originated from the medial branch.

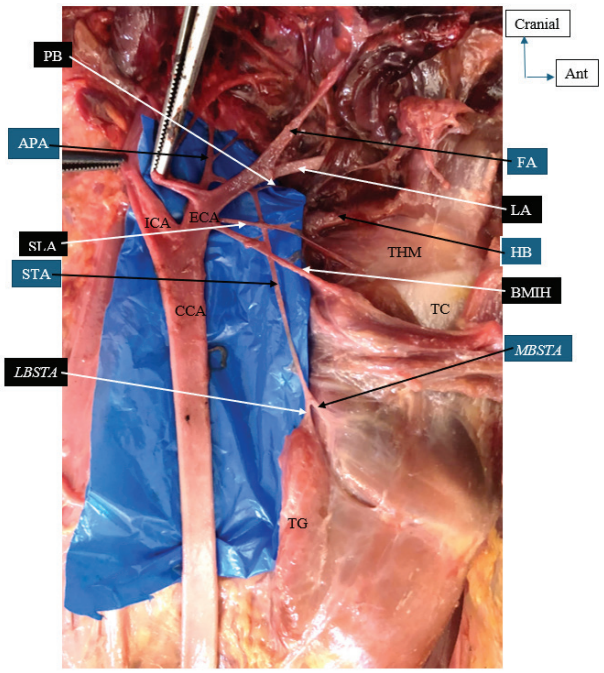

Figure 2) *Superior thyroid artery originated from the ascending pharyngeal artery.*

APA: Ascending pharyngeal artery; BIHM: Branch that went to the infrahyoid muscles; CCA: Common carotid artery; ECA: External carotid artery; FA: Facial artery; HB: Hyoid bone; ICA: Internal carotid artery; LA: Lingual artery; LBSTA: Lateral branch of superior thyroid artery; MBSTA: Medial branch of superior thyroid artery; PB: Pharyngeal branch; SLA: Superior laryngeal artery; STA: Superior thyroid artery; TC: Thyroid cartilage; TG: Thyroid gland; THM: Thyrohyoid membrane

Apart from the previously mentioned variations, no other anatomical variations were observed on the right side. The left side was also dissected and showed no anatomical variation. The cadaver, prior to their death, was asymptomatic with regards to this anomaly.

Discussion

In standard books of anatomy or surgery, the superior thyroid artery is considered to have a relatively constant origin from the anterior aspect of the external carotid artery [1,5,6]. In contrast, many variations of different origins of the superior thyroid artery have been reported in the literature [2]. It can originate from one of the other carotid arteries or from the carotid arterial tree in common with other arterial trunks [2]. Vázquez et al. [2] classified the origins of the superior thyroid artery into four types: type I (the superior thyroid artery originates from the carotid bifurcation), type II (the superior thyroid artery originates from the common carotid), type III (the superior thyroid artery originates from the external carotid artery), and type IV (the superior thyroid artery originates itself as a common trunk with one or more other branches of the carotid tree. This last type has been subdivided into two subtypes, type IVa in which the superior thyroid artery originates with the lingual artery to form the thyro-lingual trunk, and type IVb in which the superior thyroid artery originates with the lingual and facial arteries to form a thyro-linguo-facial trunk. The origin of the superior thyroid artery from the carotid bifurcation (type I) was most frequently encountered in the study of Vázquez et al. [2], Ozgur et al. [7], Natsis et al. [8] and Zümre et al. [9] with a prevalence ranging from 40% to 75%. These same authors found type II (the superior thyroid artery arises from the common carotid artery) with a prevalence of 5 to 35%. On the other hand, its origin from the external carotid artery (type III) has been most frequently noted by other authors [10-14] with a prevalence varying between 44.2 and 80.4%. Type IVa (the superior thyroid artery arises from a thyro-lingual trunk) was observed in 2.5% by Zümre et al. [9] and Ozgur et al. [7], 3% by Natsis et al. [8], 2.8% by Mata et al. [13], 0.6% by Vazquez et al. [2] and 1.2% by Dessie [14]. The origin of the superior thyroid artery from a thyro-linguo-facial trunk (type IVb) was observed in the studies of Itezerote et al. [10], Zümre et al. [9], Vazquez et al. [2] and Ogenti et al. [12] with a prevalence of 0.9%, 2.5%, 0.3% and 6.5% respectively. A rarer origin of the superior thyroid artery from the internal carotid artery via a common trunk with the occipital artery has been reported by Nilesh et al. [15]. However, a superior thyroid artery originating from the

ascending pharyngeal artery, as in the present case, was not found during our literature review. Thus, this origin variation is not included in the classification of Vázquez et al. [2].

Variations in the course of the superior thyroid artery are rarely reported in the literature. In our case report, the superior thyroid artery presented a variation in its course. It had a superior or horizontal segment that passed posterior to the linguofacial trunk and an inferior or vertical segment that passed posterior to the superior laryngeal artery and an artery that went to the infrahyoid muscles.

Embryological origin

The external carotid artery develops from the root of the third aortic arch. Its branches form annexations of arteries which develop by angiogenesis from the aortic arches. Branching development is affected by a complex process of selective regression and persistence of various segments. The signals involved in the development of the external carotid artery during angiogenesis and remodeling are not always synchronized, leading to various anatomical variations [16]. According to Jurjus et al. [17], abnormal origins of thyroid arteries may arise due to the choice of unusual pathways in the primitive vascular plexuses; the persistence of normally obliterated vessels; the disappearance of normally retained vessels; incomplete development or fusion and absorption of usually separate parts. In the present case, the origin of the superior thyroid artery from the ascending pharyngeal artery could be due to the fusion of the superior thyroid artery with the ascending pharyngeal artery during embryological development and which persisted.

Clinical implications

Identifying anatomical variations in different parts of the human body is crucial in the practice of medicine and a guide to surgical procedures [18]. Anatomical variations of the superior thyroid artery are important during a surgical and radiologic intervention of the neck. The superior thyroid artery is involved in surgical procedures such as radical neck dissection, thyroidectomy, aneurysm reconstruction, cricothyroidotomy, carotid endarterectomy, cancer therapies, interventional radiology, and plastic surgery [2-4]. During a thyroidectomy, if bleeding persists from the superior pole of the thyroid gland even after appropriate ligation of the external carotid artery, the surgeon should consider ligation of the superior thyroid artery at its origin either from the common carotid artery, or at the carotid bifurcation [19]. In this case, ligation of the external carotid artery would be sufficient to stop the bleeding, because the superior thyroid artery originated from the ascending pharyngeal artery which itself originated from the external carotid artery. Laryngeal cancer is frequently supplied by the ipsilateral or bilateral superior thyroid artery. Superselective intra-arterial chemotherapy of the superior thyroid artery for laryngeal cancer is appropriate [3]. The superior thyroid artery can also be used for angioembolization of tumors of the thyroid and parathyroid glands [20]. According to Ehrl et al. [21], the superior thyroid artery can be safely used as a receiving vessel for reconstruction of upper body defects. However, during this reconstruction using the superior thyroid artery as a recipient vessel, the surgeon may have difficulty identifying the superior thyroid artery if the latter presents variations [22]. The superior thyroid artery is considered as the first collateral branch of the external carotid artery [1]. In the present case, the first collateral branch of the external carotid artery was the artery that went to the infrahyoid muscles. The presence of this artery is an additional variation which, to our knowledge, has never been mentioned in the literature. This

variation could lead the surgeon to regard the latter as the superior thyroid artery and neglect the superior thyroid artery itself during surgical procedures such as thyroidectomy and radical dissection in the surgical treatment of malignant tumors of the neck or head. It could also be responsible for misinterpretation of radiological images such as angiography of the carotid system.

Angiologists and head and neck surgeons should be familiar with variations in the origin and course of the major arteries of the head and neck during surgical procedures involving the larynx, parathyroid glands, and thyroid gland [23].

During this dissection, the dimensions of the superior thyroid artery were not taken and its relationship with the superior laryngeal nerve was not observed, which is the major limitation of this study.

Conclusion

The origin of the superior thyroid artery from the ascending pharyngeal artery is an extremely rare anatomical variation. Knowledge of such variation is important for head and neck surgeons during certain surgical procedures such as thyroidectomy and radical neck dissection. It is also important for radiologists when interpreting radiological images such as angiography of the carotid system.

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