



# An unusual origin and course of the thyroidea ima artery, with absence of inferior thyroid artery bilaterally

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## Abstract

We report an unusual origin and course of the thyroidea ima artery in a male cadaver. The ima artery originated from the right subclavian artery very close to origin of the right vertebral artery. The artery coursed anteriorly between the common carotid artery medially and internal jugular vein laterally. It then coursed obliquely, from below upwards, from lateral to medial *superficial* to common carotid artery, to reach the inferior pole of the right lobe of thyroid and branched repeatedly to supply the anteroinferior and posteroinferior aspects of both the thyroid lobes and isthmus. The superior thyroid arteries were normal. Both the inferior thyroid arteries were absent. The unusual feature of this thyroidea ima artery is its origin from the subclavian artery close to vertebral artery origin, the location being remarkably far-off from the usual near midline position, and the oblique and relatively superficial course. This report is a caveat to neck surgeons to consider such a superficially running vessel to be a thyroidea ima artery.

**Keywords** Thyroid vascular anatomy · Thyroidea ima artery · Artery of Neubauer · Blood supply of thyroid · Variations

## Introduction

The thyroid gland has a rich vascular supply as is pertinent for such an important endocrine gland. The vessels supplying it usually are the superior and inferior thyroid arteries which originate from the external carotid artery and the thyrocervical trunk, respectively. Occasionally, another artery may supply the thyroid—the arteria thyroidea ima. Classic anatomical descriptions by Gruber (1872), Pratt (1916) and Lippert and Pabst (1985) mention that ima artery may arise from the arch of aorta or the innominate artery and that it usually runs anterior to the trachea [1, 3, 6, 9]. The incidence of the ima artery varies in different reports from 0.4 to 12.2% [2, 10]. Different study series (dissection and radiological) have shown remarkably variable incidence for site of origin of the ima artery. It usually arises from the innominate artery (43.3–86.7% of ima arteries). It can also arise from the common carotid artery (2–50%) or aortic arch (0–66.7%) [8, 10]. The rarer sites of origin of ima artery are internal thoracic artery (6.6%–50%), subclavian (3.3%), inferior thyroid

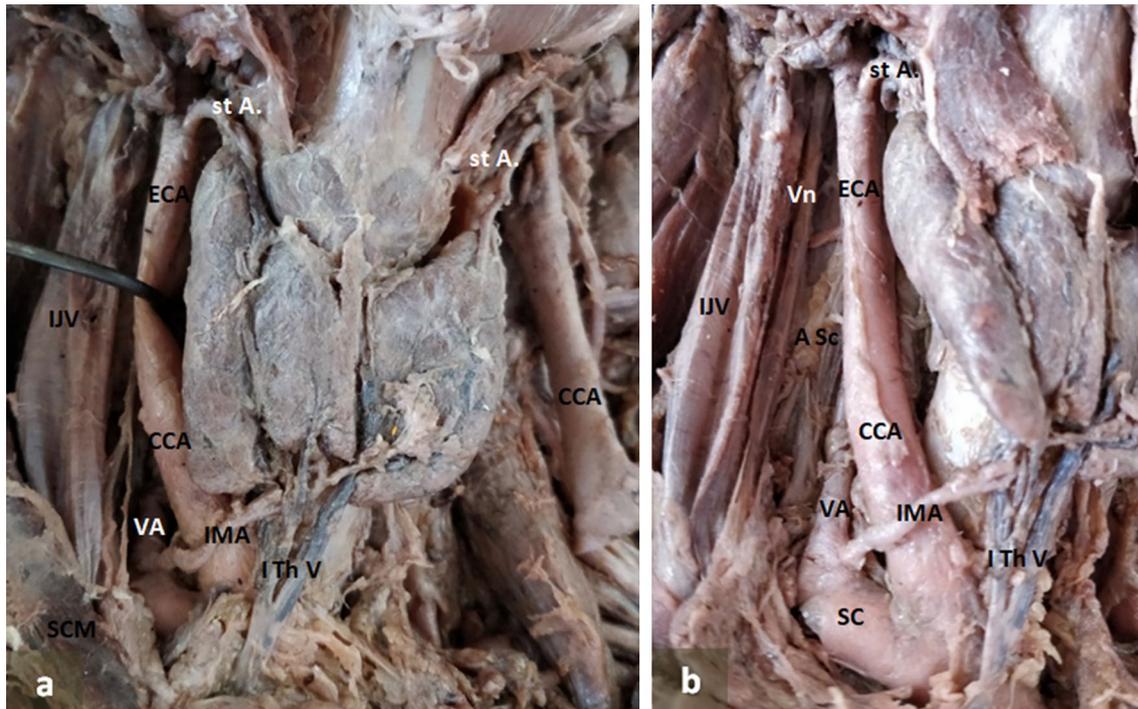
(1.1%), transverse scapular (1.1%), or pericardiophrenic or thyrocervical trunk [8, 10]. Ima artery may supplement the usual blood vessels of the thyroid or in some cases it may replace one or more thyroid arteries. The knowledge of presence of the ima artery holds an importance in neck surgeries, especially in tracheostomy owing to the relation of the ima artery anterior to the trachea and in angiography, especially in localizing parathyroid swellings [2]. In our report, we describe an unusual origin and course of the ima artery. In addition, there was the absence of inferior thyroid arteries on both sides.

## Case report

During routine academic dissection by first-year medical students, we observed an ima artery with a variant origin and course in a male cadaver donor of approximately 60 years of age, belonging to South Asian race. The ima artery originated from the subclavian artery, close to the origin of the vertebral artery (Fig. 1a, b). The vertebral artery proceeded upwards in the scaleno-vertebral triangle (Fig. 1b). The ima artery was seen to take an anterior course between the common carotid artery medially and internal jugular vein and the vagus nerve laterally. The

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**Fig. 1** Thyroid and its blood vessels. **a** Anterior view of the dissected specimen. Lower part of left common carotid artery and the whole of left internal jugular vein have been removed for deep dissection. **b** Right lateral view of the dissected neck. The sternocleidomastoid muscle has been divided and median sternotomy was done for bet-

ter exposure of the structures of the lower neck. *A Sc* anterior scalene muscle, *CCA* common carotid artery, *ECA* external carotid artery, *IJV* internal jugular vein, *IMA* arteria thyroidea ima, *I Th V* inferior thyroid vein, *SC* subclavian artery, *SCM* sternocleidomastoid muscle, *st A.* superior thyroid artery, *VA* vertebral artery, *Vn* vagus nerve

artery then traced a path medially, *superficial* to the common carotid artery to reach the lower pole of the right lobe of the thyroid (Fig. 1a). The ima artery terminated by branching repeatedly to supply the isthmus and the antero-inferior and postero-inferior aspects of the lateral lobes of thyroid (Fig. 1a). The branches coursed among the tributaries of the inferior thyroid veins (Fig. 1a). During its course from lateral to medial, it gave an esophageal branch to the cervical esophagus. There was absence of the inferior thyroid artery on the right and left side. The superior thyroid arteries on both sides arose from the external carotid artery, in accordance with the usual description (Fig. 1a). The recurrent laryngeal nerve (RLN) was seen in the tracheo-esophageal groove on both sides. The ima artery coursed much anterior to the right RLN and the left RLN. Detailed and meticulous dissection was done and all the other direct and indirect branches of the subclavian artery—that is, internal thoracic artery, ascending cervical, dorsal scapular, costocervical trunk, and superficial cervical and suprascapular arteries were identified. None of them was seen to give off inferior thyroid arteries.

## Discussion

The thyroidea ima artery (*ima* is ‘lowest’ in Latin) is also known as the thyroid artery of Neubauer after Johann Ernst Neubauer, Professor of Anatomy and Surgery at Jena, whose investigation resulted in the first description of this vessel [2]. A literature search for a definition of the thyroidea ima reveals that most authors describe the thyroidea ima as any anomalous vessel supplying the lower aspects of the thyroid gland, regardless of origin, arising from the aortic arch, brachiocephalic trunk, the common carotid, internal thoracic, pericardiophrenic, subclavian, thyrocervical trunk, the inferior thyroid or the transverse scapular artery. However, some authors comment that the ima artery is only the artery that arises from carotid arteries, arch of aorta, innominate artery or internal mammary arteries whereas the variant vessels supplying the thyroid from the subclavian arteries may be called an ‘accessory inferior thyroid artery’ [2]. This division seems arbitrary and it seems best to label any such accessory

vessel supplying the isthmus and the lower poles of thyroid gland as ima artery, regardless of origin. We judge that the present case can be best labeled as an ima artery due to the following findings—it is located on the right side, it crosses in front of the trachea (though, only few terminal branches cross the trachea), it arises from the right subclavian artery close to origin of vertebral artery (thus an indirect branch of the innominate artery), it supplies the lower parts of the thyroid lobes and isthmus, and it replaces the classic inferior thyroid arteries bilaterally. The unusual feature in this case is its location remarkably far-off from the midline, and the oblique and relatively superficial course.

The thyroid gland has a rich vascular network in its embryological period, from which many vessels disappear, with inferior thyroid artery usually remaining as the main blood supply [11]. Some vessels of the network may persist, with connections to arch of aorta, brachiocephalic or common carotid, to supplement or even replace the inferior thyroid artery (as the thyroidea ima artery) [4, 11].

Toni et al. considered ethnic and anthropological factors in the incidence of thyroidea ima and found increased incidence of thyroidea ima for people of Asian origin (10% for Asians when compared to 6% for Europeans) [7]. Our cadaver being of South Asian origin, ethnic factors may have contributed to the occurrence of ima artery. The ima artery, in this case has replaced the inferior thyroid arteries of both sides. Inferior thyroid artery is absent in around 3% of population, and in those cases, usually the superior thyroid artery or thyroidea ima artery will supply its area [10]. Yilmaz et al. has reported the absence of the inferior thyroid artery when thyroidea ima artery arising from the brachiocephalic artery was present [11]. Moriggl and Sturm reported a more atypical case, where the thyroidea ima has replaced both inferior thyroid arteries as well as the superior thyroid artery of the right side [4].

The clinical relevance of the ima artery is usually described as its location being anterior to the trachea. It makes it vulnerable for uncontrollable hemorrhage in median surgical incisions and procedures in the lower neck such as tracheostomy, as well as surgeries such as laryngeal transplantation [5, 7]. In this case, only the terminal branches of the ima artery were related to trachea. It is also to be noted that such a *superficially* and obliquely running artery in the root of the neck, as in our report, is not expected in usual dissection or surgery of the neck. So a high degree of suspicion is warranted if such an unusual artery is encountered in a procedure in the lower neck. For the thyroid surgeon, another interesting aspect is that the RLN, a vital structure in the thyroid surgeon's operative field, is at least risk in this anomaly owing to the absence of both inferior thyroid arteries (which is intimately related to the RLN) and the safe and distant location of the branches of the ima artery from

the RLN. Apart from the surgeon, knowledge of the normal anatomy and patterns of such variations is also important in parathyroid arteriographies as the thyroidea ima artery may be the blood supply of the inferior parathyroids [2].

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## Compliance with ethical standards

**Conflict of interest** The authors declare that they have no conflict of interest.

**Ethical approval** This article does not contain any studies with human participants or animals performed by any of the authors.

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