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ORIGINAL COMMUNICATION

Variant Origin of the Superior Thyroid Artery in a Kenyan Population

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Variant anatomy of the superior thyroid artery is important during surgical procedures, interpretation of angiograms, and interventional radiography in the neck. Pattern of the variations shows population differences but there is no data from the Kenyan population. This study therefore investigated the variations in origin of the superior thyroid artery in a Kenyan population. Forty six necks (36 males and 10 females) from 46 cadavers of black Kenyans in Department of Human Anatomy University of Nairobi, Kenya were bilaterally dissected to expose the origin of the superior thyroid artery. Pattern of origin of the vessel was determined on both sides in males and females. It originated from the external carotid artery common carotid artery and linguo-facial trunk in 80%, 13%, and 6.5% of the cadavers respectively on the right side. All but one of the superior thyroid arteries were ventral branches. There was asymmetric origin in 6.5% of cases. Origin from the common carotid artery was associated with high carotid bifurcation. Nearly 20% of superior thyroid arteries showed variant origin. Of these, 6.5% arose from the linguo-facial trunk, much higher than in the Caucasian and Oriental populations. Origin from common carotid artery is substantially lower than prevailing figures from other populations. These findings support ethnic variations. Preoperative angiographic evaluation is recommended. Clin. Anat. 25:198–202, 2012.

Key words: variant origin; superior thyroid artery; Kenyan

INTRODUCTION

Superior thyroid artery (STA), usually the first of the three anterior branches of the external carotid artery (ECA), supplies the thyroid gland, larynx, and a wide part of the neck including the sternocleidomastoid muscle (Standring et al., 2004). It anastomoses with its fellow from the opposite side and also with other branches of ECA, especially within and around the larynx, thus providing a route for rich collateral circulation in case of carotid artery occlusion (Macchi and Catini, 1995, Jiani et al., 2009). Its variant origins include common carotid artery (CCA), carotid bifurcation (CB) and as common trunks with lingual, facial or both. In rare cases, it may arise in common with occipital or ascending pharyngeal or from internal carotid artery [ICA] (Aggarwal, 2006). These variations are important during interventional radiology and surgical procedures such as cricothyrodotomy, radical neck dissection, carotid aneurysm reconstruction, endarterectomy, tumor embolization, intra-arterial chemotherapy, and microsurgical arterial implantation, harvesting of the sternocleidomastoid osteomuscular flaps and cardiac catheterization (Hu et al., 2006, Ozgur et al., 2009, Natsis et al., 2011). Pattern and frequency of these variations shows population differences (Toni et al., 2004).

In resource limited countries where angiography is not universally available, data from dissection studies constitutes a significant source of knowledge. Such knowledge may help to achieve a bloodless surgical field during major neck dissection and to minimize postoperative complications (Ozgur et al., 2009). Furthermore, angiography and dissection often reveal disparate results (Toni et al., 2003).

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TABLE 1. Origin of the Superior Thyroid Artery on Both Sides

Side		External carotid artery	Common carotid	Lingual facial trunk	Bifurcation
Right	Male	27	6	2	1
	Female	8	0	1	1
Left	Male	29	4	2	1
	Female	9	0	1	0

Reports from African populations using either method are scarce and altogether absent from the Kenyan one. This study therefore investigated, by dissection, variant origins of the STA in an adult Kenyan population.

MATERIALS AND METHODOLOGY

Forty-six (36 male and 10 female) cadavers were obtained from the Department of Human Anatomy, University of Nairobi, Kenya. All the cadavers were of adult native black Kenyans. The cadaveric specimens that were dry and difficult to dissect and those that were macerated by students before data collection were excluded from the study. A skin incision along the impression of the anterior border of sternocleidomastoid muscle was made all from its sternal origin to the angle of the mandible bilaterally. Skin and cervical fascia were reflected, sternocleidomastoid muscle was exposed and retracted. Infrahyoid muscles were sectioned and dissected away to expose the thyroid gland. Submandibular gland, lymph nodes, connective tissue and digastric muscles were removed to expose the entire common, external and internal carotid arteries, as well as the carotid bifurcation. Branches of the ECA were identified. Arteries which entered the superior pole of the thyroid gland were identified as superior thyroid arteries. Such arteries were cleaned out and traced to their origin from the ECA, CCA, CB individually or from common trunks with other arteries which usually arise from the ECA such as lingual, facial, occipital and ascending pharyngeal. Origins of STA according to Vazquez classification were determined on both sides and recorded (Vazquez et al., 2009).

Type I - Origin from carotid bifurcation
Type II - Origin from CCA
Type III - Origin from ECA
Type IVa - Thyrolingual trunks
Type IVb - Thyrolingual facial trunks.

Photographs of representative origins were taken using a Sony® digital camera. The data collected was analyzed using SPSS® version 16.0 for Windows 7 for frequencies, side and gender differences. The student T test was used to determine the statistical

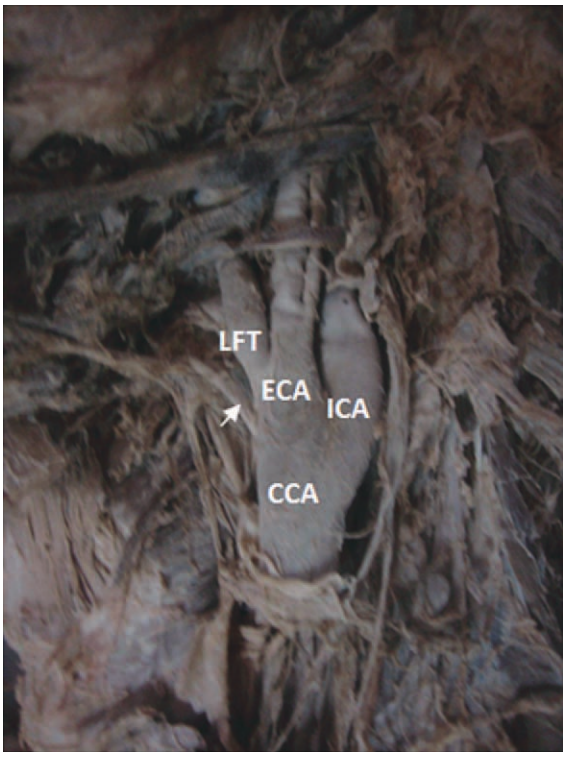

Fig. 1. Trifurcation of the Common carotid artery. The arrow shows the STA. ECA, LFT, ICA, and the STA originating from the CCA at the bifurcation. [Color figure can be viewed in the online issue, which is available at wileyonlinelibrary.com.]

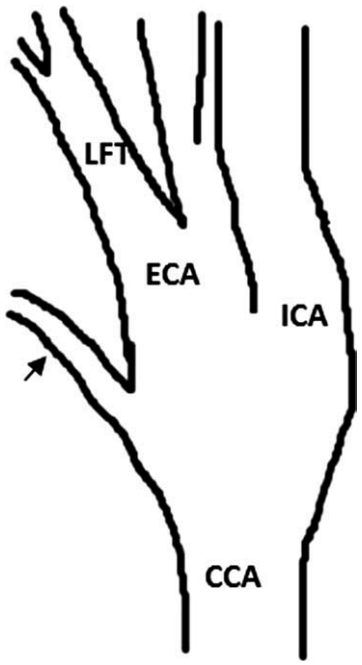

Fig. 2. An illustration showing trifurcation of the Common carotid artery. The arrow shows the STA. ECA, LFT, ICA, and the STA originating from the CCA at the bifurcation.

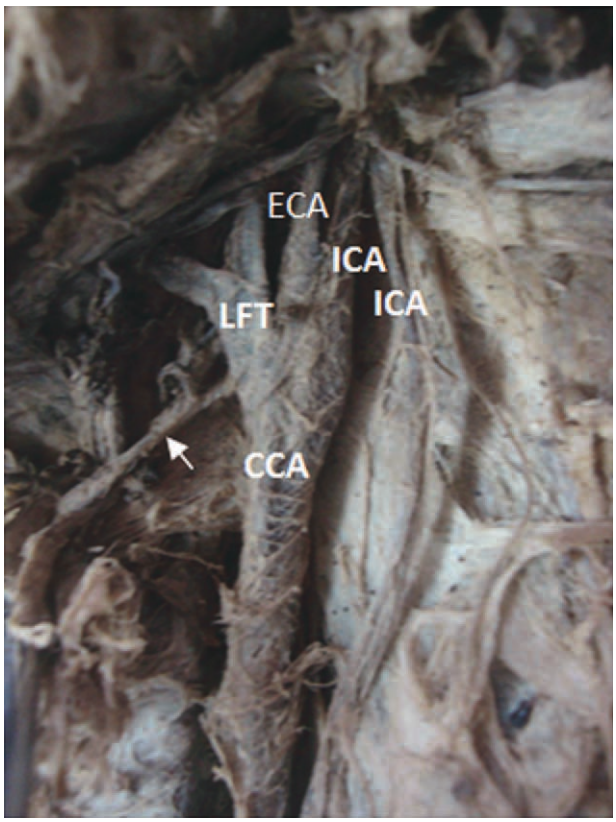

Fig. 3. Origin of the superior thyroid artery from the linguo-facial trunk. The STA (Arrowed) originating from the LFT on the left. [Color figure can be viewed in the online issue, which is available at wileyonlinelibrary.com.]

significance of bilateral and gender differences at 95% confidence interval. The data are represented in a table and macrographs.

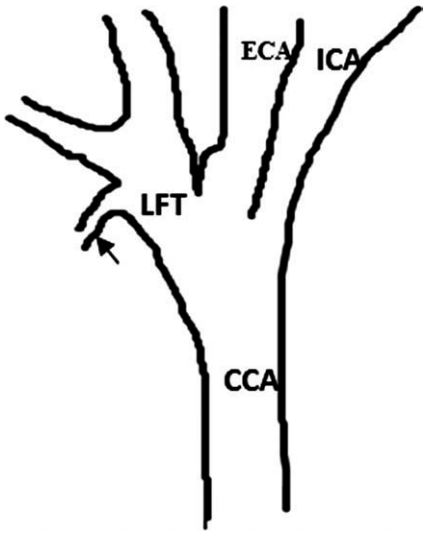

Fig. 4. An illustration showing the origin of the superior thyroid artery from the linguo-facial trunk. The STA (Arrowed) originating from the LFT on the left.

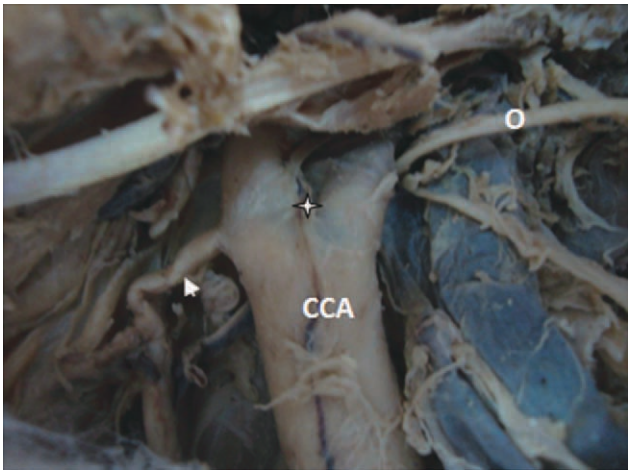

Fig. 5. Origin of the superior thyroid artery from common carotid artery. The STA (White arrow) originating from the CCA on the left at a lower level than the occipital artery (O), just below the carotid bifurcation (asterix). [Color figure can be viewed in the online issue, which is available at wileyonlinelibrary.com.]

RESULTS

The STA originated from the ECA, CCA, linguo-facial trunk (LFT) and CB in 80.4%, 10.9%, 6.5%, and 2.2% of the cadavers on the right, respectively (Table 1, Figs. 1–6). In total, twelve STA (13.1%) arose from the CCA, 2.2% at the bifurcation with the rest below the bifurcation. All the superior thyroid arteries that originated from the CCA were associated with high carotid bifurcation of the vessel.

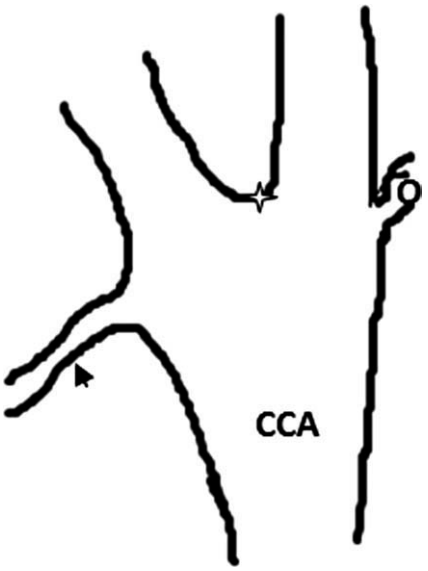

Fig. 6. An illustration showing the origin of the superior thyroid artery from common carotid artery. The STA (arrow) originating from the CCA on the left at a lower level than the occipital artery (O), just below the carotid bifurcation (asterix).

TABLE 2. Origins of the STA Based on the Vazquez Classification

Authors	Population	Number	Type I	Type II	Type III	Type IVa	Type IVb
Adachi, 1928	Japanese	200	27	13	59	2	0
Hayashi et al., 2005	Japanese	49	–	30	70	1	
Sanjeev et al., 2010	Indian	37	–	35.14	64.8	2.7	–
Delic et al., 2008	German	50	3.29	2.18	87.9	1.09	–
Ozgur et al., 2009	Turkish	20	40	35	–	–	–
Lucer et al., 2000	Croatian	40	22	47	30	–	–
Vazquez et al., 2009	UK	207	49	26.6	23	1	0.3
Natsis et al., 2011	Greek	100	49	12	39	3	–
Current study	Kenyan	46	2.2	10.9	80.4	–	6.5

There was asymmetric origin of the superior thyroid artery in three (6.5 %) cadavers. It originated from the ECA on the left and CCA on the right in two cadavers. In the third cadaver, it originated from CCA on the left and LFT on the right. In three cadavers, the CCA trifurcated into STA, ECA, and ICA (Fig. 1).

DISCUSSION

The origin of the superior thyroid artery varies from the classical description (Standring et al., 2005) in 17% and 24% of our cadavers on the left and right respectively. Variant origins of this artery in our population namely common carotid artery, carotid bifurcation and linguo-facial trunk are consistent with literature reports (Zumre et al., 2005; Anu et al., 2007; Vazquez et al., 2009) (Table 2).

The STA did not arise from the ECA in 19.6% of cases. This is at variance with classical textbook descriptions (Standring et al., 2004). It arose from ECA in 80.4% of cases higher than most of those reported but comparable to 87.9% among Germans (Delic et al., 2008). This suggests wide variations in origin of STA. These disparities could be attributed to ethnic differences.

In 13.1% of cases the artery originated from the CCA similar to Adachi's (1928) report, but much lower than that described in other series (Table 2). Notably, all these cases were males. This is in tandem with reports that more males than females have STA originating from the CCA (Toni et al., 2003, Toni et al., 2004). However, the low female sample size limits a strong inference in our population. In the 13.1% which arose from the CCA, 2.2% originated at the bifurcation while the rest originated below the bifurcation. This is at variance with reports that up to 49% of cases may originate at the bifurcation (Vazquez et al., 2009) and 25% below the bifurcation (Ozgur et al., 2009).

The superior thyroid artery in the present study originated from the linguo-facial trunk in 6.5%, higher than 2.5% reported in literature (Zumre et al., 2005, Anu et al., 2007). There was no case of thyrolingual trunk. Other series have reported it in 1–2.7% (Vazquez et al., 2009; Sanjeev et al., 2010, Budhiraja and Rastogi, 2010).

These anomalous origins of thyroid arteries may occur due to: the choice of unusual paths in the primitive vascular plexuses; the persistence of vessels normally obliterated; the disappearance of vessels normally retained; incomplete development or fusion and absorption of parts usually distinct (Jurjus et al., 1999). The wide variations reported suggest that differences in origin of STA differ between populations. Knowledge of these variations is important for surgical, diagnostic and interventional radiological procedures in the neck (Issing et al., 1994; Ozgur et al., 2009). Although uncommon in all settings, preoperative radiographic studies of neck vascular patterns are recommended in order to avoid fatal mix up of vessels for example between aberrant STA and internal carotid artery (Issing et al., 1994, Perona et al., 1999, Jeganath et al., 2001). Variations in origin of the superior thyroid artery have also been related to level of bifurcation of common carotid artery (Anu et al., 2007). In this study only 13.1% of STA originate from CCA. Previous studies have shown association of STA origin from the CCA with high bifurcation (Rao and Rao, 2009). This appears inconsistent with the recently reported high prevalence of high bifurcation of CCA in the Kenyan population (Anangwe et al., 2008).

The origin from common carotid artery is substantially lower while that from the linguo-facial trunk is higher than prevailing figures from other populations. These support ethnic variations. Preoperative angiographic evaluation is recommended.

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