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Original Research Article

VARIATIONS ON ARTERIAL SUPPLY OF THYROID GLAND AND ITS CLINICAL SIGNIFICANCE IN SELECTED UNIVERSITIES OF NORTH ETHIOPIA

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ABSTRACT

Thyroid gland is the largest endocrine gland supplied by the superior, inferior thyroid arteries and occasionally by thyroid ima artery. Proper identification of thyroid gland vessels is very important in order to avoid major complications during and after neck surgeries. The objective of this study was to assess variations on arterial supply of thyroid gland and its clinical significance in human cadavers in selected universities of north Ethiopia.

A descriptive survey study design was employed to assess the variations on arterial supply of thyroid gland in human cadavers. Sixteen formalin fixed cadavers were used during routine dissection for the medical teaching. Variations in morphological character observed in the arterial supply of thyroid gland was noted, recorded and photographed.

In the present study it was observed that, the site of the origin of superior thyroid artery (STA) was evaluated as it arose from external carotid artery in 84.4%, from carotid bifurcation in 9.375% and from common carotid artery in 6.25% the cases. Regarding to the number of STA was observed that single in all specimens. In all specimens, the origin of ITA was from the thyrocervical trunk.

The anatomic characteristics and variation of the Thyroid arteries shows the most common site of origin of superior thyroid artery is from external carotid artery, whereas Inferior thyroid artery arisen from thyrocervical trunk and thyroid ima artery is not found.

KEY WORDS: Thyroid arteries, Carotid artery, Thyroid Gland.

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INTRODUCTION

The thyroid gland is the body's largest endocrine gland. It produces thyroid hormone, which controls the rate of metabolism, and calcitonin. A relatively thin isthmus unites the lobes over the trachea, usually anterior to the second and third tracheal rings. The highly vascularized thyroid gland is supplied by the superior & inferior thyroid arteries and occasionally by thyroid ema artery. These vessels lie between the fibrous capsule and the loose fascial sheath [1].

The superior thyroid arteries, descend to the superior poles of the gland, pierce the pretracheal layer of deep cervical fascia, and divide into anterior and posterior branches supplying mainly the anterosuperior aspect of the gland [1,2].

The inferior thyroid arteries, the largest branches of the thyrocervical trunks arising from the subclavian arteries, run superomedially posterior to the carotid sheaths to reach the posterior aspect of the thyroid gland and supply the posteroinferior aspect, including the inferior poles of the gland. In approximately 10% of people, a small, unpaired thyroid ima artery (L. arteria thyroidea ima) arises from the brachiocephalic trunk. However, it may arise from different arteries in the thoracic cavity [2, 3].

The diseases, which usually are related to the thyroid gland are hypothyroidism, hyperthyroidism, autoimmune thyroiditis, Graves' disease, of which hypothyroidism due to iodine deficiency is the commonest [4]. Severe iodide limitation are estimated to affect at least 800 million people world-wide. Iodide deficiency results in endemic goitre and mental retardation due to cretinism are encountered [5].

This is a severe public health problem in Ethiopia; as Ethiopia is a mountainous country, and poor soil conservation over a long period may have contributed to the leaching away of the iodine-rich soil layer and the exposing of the iodine-poor layer beneath. The highest rates of palpable and visible goiter was found in the south nation nationalities and people (SNNP) regional state (56.2%),followed by 42.0% in Oromia, 40.5% in Benshangul Gumuz,29.1% in Amhara, and 21.9% in Tigray[6].

Medical treatment in the form of iodine supplementation is not sufficient to manage thyroid disorder but it needs surgery especially in case of malignancy and when respiratory distress, dysphagia are present due to thyroid disease[7].

One of the possible complication during thyroid surgery is haemorrhage, and pneumo/ hemothorax. [8].

Anatomical variations may influence predisposition to diseases, symptomatology, clinical examination, investigation and patient management including operative surgery [9].

Accordingly, accurate knowledge of variability in human morphology is important to improve diagnostic and interventional performance especially against the background of contemporary imaging techniques such as echocardiography, magnetic resonance imaging, computerized tomography, endoscopy; open and laparoscopic surgery[10]. Hence, Knowledge of anatomical variations of thyroid gland is essential for routine surgical procedure of thyroid. Proper identification of thyroid gland vessels is very important in order to avoid major complications during and after neck surgeries.

MATERIALS AND METHODS

Institutional based descriptive cross- sectional study design was employed to assess the variations on arterial supply of the thyroid gland in human cadavers. Sixteen formalin fixed Ethiopian cadavers which were used during routine dissection for Medicine undergraduate and anatomy postgraduate in department of Human anatomy of Mekelle, Gondor and Aksum Universities were used for this study. All thyroid glands of cadavers found in dissection rooms of these universities were used. But, Thyroid gland specimens having pathological lesions, marks of previous surgery and those damaged during removal or dissection were not included in the study. The thyroid gland was observed for presence of variations in morphological features by using anatomical classification proposed by Kanata al etal, [2], and presence of any variant was noted and specimens were photographed.

Data analysis: The collected data were analysed manually and the results presented using tables, graphs, figures and percentages.

Ethical consideration: To conduct this research permission was obtain from the College of Health Sciences Ethical Review Board (IRB) of the Mekelle University. Formal letter of cooperation was written to the respective Universities.

RESULTS

During this study, the cadavers were particularly observed in the neck region for the level of origin, site of origin, number of arteries. Based on our observation here are the outcomes.

Superior thyroid artery: In the present study it is observed that, the most common site of origin of (STA) was evaluated as it arose from external carotid artery.

The level of the origin of the superior thyroid artery was above upper border of thyroid cartilage, in 68.75 %(Right 68.75%, left 62.5%) andin 31.25% (31.25%, left 37.5%) of the cases the

level of the origin was below the upper border of thyroid cartilage

There were no cases which had the origin at the same level of the upper border of the thyroid cartilage.

Table 1: Site of the origin of the superior thyroid artery (STA).

Site of origin of STA	Right side (n=16) (%)	Left side (n=16) (%)	Total (n=32) (%)
External Carotid artery	14(87.5%)	13(81.25%)	27(84.4%)
Common Carotid Bifurcation	2(12.5%)	1(6.25%)	3(9.375%)
Common Carotid Artery	0	2(12.5%)	2(6.25%)

Table 2: Level of the origin of the superior thyroid artery in relation to the upper border of thyroid cartilage.

level of origin of STA	Right side (n=16) (%)	Left side (n=16) (%)	Total (n=32) (%)
Above the level of the upper border thyroid cartilage	11(68.75%)	10(62.5%)	21(65.625%)
At the level of upper border thyroid cartilage	0	0	0
Below the upper border of thyroid cartilage	5(31.25%)	6(37.5%)	11(34.325%)

Fig. 1: Origin of the superior thyroid artery from common carotid artery bifurcation (Left side).

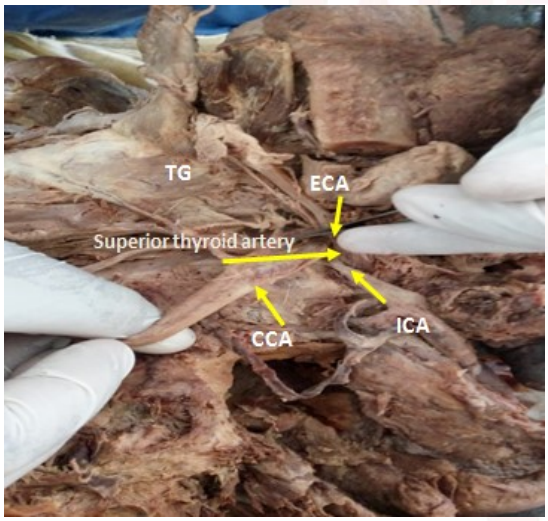


Fig. 2: Origin of the superior thyroid artery from external carotid artery (left side).

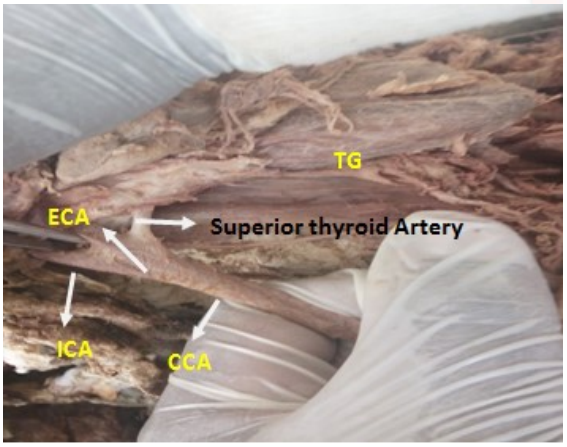
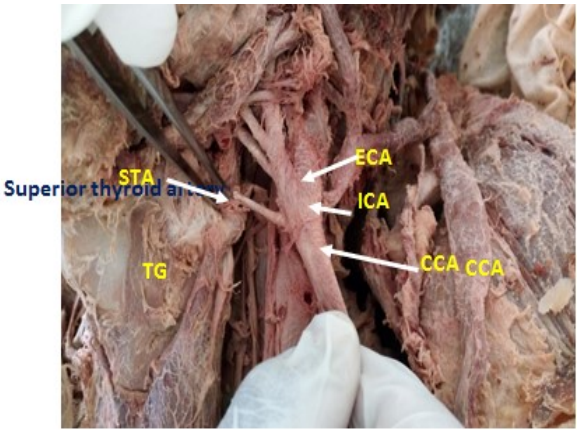


Fig. 3: Origin of the superior thyroid artery from common carotid artery (left side).



In all specimens, the ITA was arisen from the thyrocervical trunk. The level of the origin of the inferior thyroid artery from 6th to 8th tracheal ring was seen in 25 % (right 25%, left 18.5%) and from 9th to 10th tracheal ring was seen in 68.75% (62.5right %, left 75%). In 9.37% (12.5 % right, 6.25% left) the ITA started at the level of 10th to 14th tracheal rings. In all cases the ITA was single.

Table 3: Level of the origin of the inferior thyroid artery in relation to the tracheal rings.

Level of origin of ITA	Right side (n=16) (%)	Left side (n=16) (%)	Total (n=32) (%)
6th to 8th tracheal ring	4(25%)	3(18.5%)	7(21.875%)
8th to 10th tracheal ring	10(62.5%)	12(75%)	22(68.75%)
10th to 14th tracheal ring	2(12.5%)	1(6.25%)	3(9.375)

DISCUSSION

Surgeries of the thyroid gland demand a proper knowledge about the gross anatomy of the neck region and the anatomical variations of the structures located within it [11]. Failure to idnetify the proper anamtomy results serious complications some of which can be fatal. These include recurrent larynegal nerve palsy which may lead to upper airway obstruction; and hypoparathyroidism.

The superior thyroid artery (STA) commonly arises from the external carotid artery (ECA) just above the carotid bifurcation. It may also arise from the common carotid artery (CCA) or from the bifurcation of CCA. Less frequently the STA arises from subclavian artery (SCA) or as a common trunk with the lingual and facial branches of ECA. Rarely the superior thyroid artery may be absent [12].

A study conducted by Abhijeet et al.,[13], And

Hivaleela et al .,[14] shown that, superior thyroid artery arise from external carotid artery in 66.67% (60.61% right and 72.3% left), 76.21%, from common carotid bifurcation in 31.81% (36.6% right and 27.27 left), 21.43% and from common carotid artery in 1.51% (3.03%right and 0% left), 2.38% cases respectively. While in 86.36 % (87.88% right and 84.85% left) cases level of the origin was above the upper border of thyroid cartilage and in 13.64% (12.12% right and 15.15% left) cases level of the origin was at the same level of upper border of thyroid cartilage. There were no cases which had the origin below the upper border of the thyroid cartilage.

In the present study, it is observed that, the site of the origin of the superior thyroid artery (STA) was evaluated as it arose from external carotid artery in 84.4%(right 87.5%), left 81.25%) cases, from carotid bifurcation in 9.37% (right 12.5%, left 6.25%) cases and from common carotid artery in 6.25% cases (right 0%, left 12.5%).

The finding of this study is greater than that of others study when we compare the origin of STA from external carotid artery and common carotid artery and smaller when the origin is from common carotid bifurcation.

Regarding the level of the origin of the superior thyroid artery in relation to upper border of thyroid cartilage, in 68.75% (Right 68.75%, left 62.5%) level of the origin was above the upper border of thyroid cartilage and 31.25% (Right 31.25%, left 37.5%) level of the origin was below the upper border of thyroid cartilage.

There were no cases which had the origin at the same level of the upper border of the thyroid cartilage. Regarding to the number of STA, it was observed that in all specimens, the STA was single (100%). So, the present study shows it agrees with other studies.

Takkallapalli, [15] study showed that, on the right side, out of 108 cadavers , in 84.04% of males and 90.9% of females, the ITA arose from thyrocervical trunk and in 15.6% of males and 9.1% of females, the ITA originated from SCA. On the left side the ITA originated from thyrocervical trunk in 90% of males and 90.5% in females where as in 10% of males and 9.5% of females it arose from SCA.

Another study by [16] revealed that, in the majority of cases, the ITA was single. In 2.9% of males, the ITA was double and the accessory inferior thyroid artery arose from SCA.

A study conducted by Abhijeet [17] shown that, Inferior thyroid artery was found in both right and left side of the 50 cases dissected. It originated from the thyrocervical trunk in all cases (100%) on left side. On right side in 48 out of 50 sides it originated from thyrocervical trunk (96%) and in 2 cases it originated from the subclavian artery (4%).

In the present study in all specimens, the ITA was arisen from the thyrocervical trunk. The level of the origin of the inferior thyroid artery from 6^{th} to 8^{th} tracheal ring was seen in 21.87 % (right 25 %, left 18.5%) and from 8^{th} to 10^{th} tracheal ring was seen in 68.75% (right 62.5%, left 75%), 9.375% (12.5%right, 6.25% left) was originated from 10^{th} to 14^{th} tracheal rings. In all cases the ITA was single.

The origin of inferior thyroid artery varies in different populations as being described by various workers. Most commonly it arises from the thyrocervical trunk [17].

The Inferior thyroid artery (ITA) is the chief artery which supplies the posterior and inferior parts of the thyroid gland and parathyroid glands [15]. The ITA is generally larger and the more important one from the point of view of occlusion to reduce the vascularity of goiters and a route for exposure of truncal ligation of this vessel has been worked out on the cadaver and practice [18].

CONCLUSION

In the present study we have seen that, there are thyroid gland vessels variations in its origin, level and number of arteries. The anatomic characteristics and variation of the blood vessels shows the most common site of origin of superior thyroid artery is from external carotid artery, whereas Inferior thyroid artery arisen from thyrocervical trunk and all are single in number and thyroid ema artery is not found. The level of origin of superior thyroid artery in relation to upper border of thyroid cartilage found mostly above thyroid cartilage and the level of origin of inferior thyroid artery in relation to tracheal rings found mostly between 8th to 10th tracheal rings.

Conflicts of Interests: None

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