

Variations In The Course Of the Superior and Inferior Thyroid Arteries In Relation To the External & Recurrent Laryngeal Nerves

Rajamadhava .R¹., Kafeel Hussain .A²., Swayam Jothi S³.,
Hemanth Kommuru⁴., Sujatha N⁵

¹ Asst. Prof., Dept of Anatomy, Rangaraya Medical College, AP.

^{2,3,4,5} Dept of Anatomy, Shri Sathya Sai Medical College & Research Institute, Kancheepuram District

Abstract:

Introduction: A thorough knowledge of the thyroid anatomy and its associated anatomical variations is very important for the clinicians. The variations in the course of the vessels and nerves in the vicinity of the thyroid may prove to be a nightmare for surgeons. Therefore a detailed study on it equips the surgeon with vital information in the event of any such encounter.

Aim & Objectives: To study the variations in the course of superior and inferior thyroid artery in relation to External laryngeal nerve (ELN) and Recurrent laryngeal nerve (RLN).

Materials & Methods: The material for the present work (55 adult cadavers) was obtained from the bodies provided for dissection purpose from the Department of Anatomy, Andhra medical college Visakhapatnam, Rangaraya Medical College Kakinada, Shri Sathya Sai Medical College, Kancheepuram and also from the department of Forensic Medicine Andhra medical college Visakhapatnam.

Observations: The right RLN was found anterior (40%) & posterior (55%) to the right Inferior thyroid artery and in between its branches in 5% of the specimens. On the right side, the artery was present in all specimens. The left RLN was found anterior (20%) and posterior (70%) to the left inferior thyroid artery and in between its branches in 7.5% of the specimens. In one body, the left inferior thyroid artery was absent. Thyroidea ima artery was not found in any of the 55 dissected specimens. Left superior thyroid artery, in all the 55 was seen to be arising from the front of the external carotid artery, just below the level of greater horn of hyoid bone, the external laryngeal nerve was located immediately posterior to it, at the apex of the lateral lobe of thyroid gland. On the right side, the External Laryngeal was found posterior (80%) & anterior (15%) to the Superior thyroid artery & in between its branches in 5%.

Conclusion: The anatomy of thyroid gland and its neighboring structures highlighted in this study are of fundamental significance in the surgical treatment of various diseases and in curtailing operative errors.

KeyWords: Recurrent laryngeal nerve (RLN), External laryngeal nerve (ELN), Superior thyroid artery, Inferior thyroid artery.

I. Introduction

The thyroid gland is one of the ductless glands located in front and on the sides of the trachea opposite C5, C6, & C7 vertebra. The gland varies from H to U shape and is formed by two elongated right and left lobes connected by a median isthmus. In Thyroidectomies, while ligating the inferior thyroid arteries, inclusion of RLN into the clamp must be avoided. Injury to one RLN leads to paralysis of ipsilateral vocal cord, which comes to lie in paramedian or in adducted position producing weak voice or hoarse voice respectively. Bilateral RLN injury causes paralysis of intrinsic muscles of larynx and adduction of vocal cords and may cause death of the individual due to airway obstruction.

A thorough knowledge of the thyroid anatomy and its associated anatomical variations is thus very important for the clinicians. The variations in the course of the vessels and nerves in the vicinity of the thyroid may prove to be a nightmare for surgeons. Therefore a detailed study on it equips the surgeon with vital information in the event of any such encounter.

Aim & Objectives:

To study the variations in the course of superior and inferior thyroid arteries in relation to External and Recurrent laryngeal nerves.

II. Materials & Methods

The material for the present work (55 adult cadavers - Male 40, Female 15) was obtained from the bodies provided for dissection purpose from the Department of Anatomy, Andhra medical college Visakhapatnam, Rangaraya Medical College Kakinada, Shri Sathya Sai Medical College, Kancheepuram and also from the department of Forensic Medicine Andhra Medical College Visakhapatnam.

During midline dissection of the neck in cadavers infrahyoid groups of muscles are displaced laterally. Sternothyroids and sternohyoids are cut near their lower ends and reflected upwards, there by exposing pretracheal layer of deep fascia and fat. The fat is removed to expose the neurovascular pedicles at the superior pole containing superior thyroid artery, vein and External laryngeal nerve. The lateral lobes are pushed medial wards and inferior thyroid arteries are traced at the base of the gland.

Right and left recurrent laryngeal nerves are traced in the respective tracheal-oesophageal grooves and their relations with inferior thyroid artery are identified. The anastomosing branches of the superior and inferior thyroid arteries are identified on the medial part of the posterior surface.

Observations:

Relation of Recurrent Laryngeal Nerve to Inferior Thyroid Artery:

Right recurrent laryngeal nerve:

In all the 55 adult cadavers, it was seen to be arising from the vagus nerve at the level of right subclavian artery. It looped around the subclavian artery and ascended upwards and medially to the tracheal-oesophageal groove. On the right side, the inferior thyroid artery was related anteriorly to the nerve in 40% of the specimens (Fig: 1). In 55% the inferior thyroid artery was related posteriorly to the right RLN (Fig: 2). In 5% the inferior thyroid artery divided into branches which passed on either side of the nerve (Fig: 3) (Table -1). On the right side the artery was present in all specimens.

Left recurrent laryngeal nerve:

In all the 55 adult cadavers, it was seen to be arising from the vagus nerve, entered into the thorax in front of the arch of aorta. It hooked around the arch of aorta at the ligamentum arteriosum, ascended upwards and medially to reach the tracheal-oesophageal groove. Near the lower pole of the lateral lobe, it passed either in front or behind or between the branches of inferior thyroid artery and was closely related to medial surface of lateral lobe. On the left side of the inferior thyroid artery was related anteriorly to the nerve in 20% of the specimens. In 70% the inferior thyroid artery was related posteriorly to the left RLN (Fig: 4). In 7.5% artery divided into branches which passed on either side of the nerve. On the left side the artery was absent in 2.5% of the specimens (Table -2). In all the 55 dissected specimens inferior thyroid artery was arising from the thyrocervical trunk, ascending anterior to the medial border of scalenus anterior muscle behind the carotid sheath structures including the sympathetic trunk traversing the longus colli muscle to the lower pole of the gland.

Superior thyroid artery and its branches in relation with external laryngeal nerve:

Superior thyroid artery on the left side was constant in position. In all the 55 specimens (Table -3), it was seen to be arising from the front of the external carotid artery, just below the level of greater horn of hyoid bone, the external laryngeal nerve was located immediately posterior to it, at the apex of the lateral lobe of thyroid gland (Fig: 5a & 5b). On the right side, the External Laryngeal was found posterior (80%) (Fig: 6) & anterior (15%) (Fig: 7) to the Superior thyroid artery & in between its branches in 5% (Fig: 8). (Table -4)

In one body, the left inferior thyroid artery was absent. Thyroidea ima artery was not found in all the 55 dissected specimens. Superior, middle and inferior thyroid veins were seen in all the bodies with the former two draining into the Internal Jugular Vein and the later into brachiocephalic vein.

III. Discussion

Smith & Molay¹² (1930) indicated that nerves are entirely related functionally to the blood vessels as in the case of endocrine glands, their stimulation or ablation does not materially affect the function of the gland tissue itself. Rogers¹⁰ (1929) proposed that superior thyroid artery is distributed primarily to the septa, while inferior thyroid artery really supplies parenchyma. Smith SD et al¹³ reported a case of an anomalous right superior thyroid artery from common carotid artery. Issing PR et al⁵ (1994) also observed variation in the origin of superior thyroid artery from the common carotid artery.

In the present study it is seen arising from antero-medial aspect of external carotid artery. It descended downwards and forwards underneath the sternocleidomastoid and sternohyoid at the lateral border of thyrohyoid at the apex of thyroid gland. In all the cases it was divided into terminal branches viz. anterior and posterior. Anterior branch was in close relation with the anterior border of lateral lobes except in 1 case. In the present study where the gland was horse shoe shaped, the superior thyroid arteries were far more medial from the

anterior border of thyroid gland. Posterior branch descended on the posterior border of the gland supplying the medial and lateral surfaces and anastomosed with inferior thyroid artery.

Archuri V et al¹ (1990) reported the absence of inferior thyroid artery in 1% cases and a thyroid artery arising from the common carotid artery in 2% cases. He also reported anomalous vessels taking origin at the bifurcation of the common carotid artery. Jelev et al⁶ (2001) reported a case of absent right Inferior thyroid artery combined with an abnormal ramification of right superior thyroid artery. Bohutova et al⁴ (1990) reported a case of an inferior thyroid artery taking origin from the left vertebral artery. Reed⁹ (1943) stated that the Inferior laryngeal branch of vagus nerve passed frequently between but also variably in front or behind branches of inferior thyroid artery.

In the present study in all the 55 dissected specimens inferior thyroid artery was arising from the thyrocervical trunk. The superior laryngeal nerve was seen to be arising from the vagus nerve with in the carotid sheath passed behind the external carotid artery, running downwards & forwards to follow the further course of superior thyroid artery. It was posterior and then medial to the superior thyroid artery and divided in to external and internal laryngeal nerves. Internal laryngeal nerve pierced the thyrohyoid membrane. External laryngeal nerve descended posterior to sternothyroid, pierces the inferior constrictor muscle of pharynx to supply the cricothyroid muscle.

Berlin³ (1929) observed in dissections upon 70 cadavers that right RLN may be as much as a cm. lateral to trachea and in 42 cases on the right side, the RLN was situated in the tracheal- oesophageal groove, on the Left side the nerve was situated in 49 cases. In a similar series of 70 operations, he also concluded that the nerve was in the sulcus in 41 cases on the right side and 45 cases on the left. Schwartz's¹¹ (2002) documented that the right RLN may be non recurrent in 0.5 to 1% of individuals. Weeks and Hinton¹⁴ (1942) were in favour of extra laryngeal division of recurrent laryngeal nerve to be quite common. Armstrong and Hinton² (1951) and Morrison⁸ (1952) found that extra laryngeal division of RLN occurred in 73% & 43% cases respectively. King and Gregg⁷ (1948) encountered it in 25% of the cases. In the Present study all the bodies right RLN is seen, arising from vagus at the level of right subclavian artery. It looped around the subclavian artery and ascended upwards and medially to reach the tracheal-oesophageal groove.

Yelmaz et al¹⁵ (1993) reported a case where in the thyroidea ima artery was found to arise from brachiocephalic trunk, none of which was observed in the present study.

IV. Conclusion

The anatomy of thyroid gland and its neighbouring structures are of fundamental significance in surgical treatments of various diseases and in curtailing the operative errors. A thorough understanding and knowledge of variations of the external laryngeal nerve & recurrent laryngeal nerve to superior and inferior thyroid arteries is important to a surgeon while performing operations such as thyroidectomy, tracheostomy, radical neck dissection, removal of neck masses and other operations. The present work highlights the detailed anatomy regarding the arteries & nerves to the thyroid gland in 55 adult cadavers.

References

- [1]. Archuri V ,Fotaa I,Peco ppet al (1990):A rare thyroid vascular anomaly,a unique thyroid artery arising from the R.carotid bifurcation.Minerva chir 15;45(7)503-4
- [2]. Armstrong,W.G and Hinton J.W(1951) Multiple divisions of recurrent laryngeal nerve;an anatomical study.AMA arch surg 62;532 1951
- [3]. Berlin DD & Lahey FH(1929) Dissections of the recurrent and superior laryngeal nerves.The relation of recurrent Laryngeal nerve to the inferior Thyroid.a and relation of superior thyroid a to adductor paralysis.Surg.Gynec and Obs 49;102
- [4]. Bohutova J and Markova H (1990): Anomalous branching of the Inferior Thyroid .a from the Left Vertebral.a Cesk Radiol 44(4):263 -7
- [5]. Issing PR ,Kempf HG and Lenarz T(1994 Oct.): A clinically relevant variation of the superior thyroid a. Loaryngorhino otology 73(10);536-7
- [6]. Jelev L and Surchev L(2001 Jan): Lack of Inferior Thyroid.a Ann.Anat 183(1) 87-90
- [7]. King B.T and Gregg R.L (1948):An Anatomical reason for the various behaviours of paralysed vocal cords.Ann.otol.Rhin and laryng 57;925
- [8]. Morrison LF(1952) Recurrent laryngeal paralysis;A revised concept based on the dissection of one hundred cadavers. Ann.Otol,Rhin & Laryng 61;567
- [9]. Reed.A.F (1943) The relation of Inferior Laryngeal nerve to the Inferior Thyroid artery.Anat Rec 85:17 1943
- [10]. Rogers L(1929) The thyroid arteries are considered in relation to their surgical importance J.Anat 64:50 1929
- [11]. Schwatz's principles of surgery Chirtal (2002)
- [12]. Smith I.H and Mollay H.C(1930):The effect of nerve stimulation and nerve degeneration on the mitochondria and histology of the thyroid gland.Anat Rec 45;393,1930
- [13]. Smith SD and Benton RS(1940) A Rare origin of Superior Thyroid artery.Acta Anat (Basel)101(1);91-3
- [14]. Weeks.C and Hinton J.W(1942): Extralaryngeal division of recurrent laryngeal nerve .Its Significance in vocal cord paralysis.Ann.Surg 116;251 (1942)
- [15]. Yelmaze, Celik HH,Durgan Bet al(1993):Arteria thyroidea ima arising from brachiocephalic trunk with bilateral absence of Inferior Thyroid arteries- a case report.

Table-1: Relationship of Right RLN to inferior thyroid artery

Anterior to artery	Posterior to artery	Between the branches of artery	Artery is absent
22 bodies	30 bodies	3 bodies	Nil
40%	55%	5%	

Table-2 Relationship of Left RLN to inferior thyroid artery

Anterior to artery	Posterior to artery	Between the branches of artery	Artery is absent
11 bodies	40 bodies	4 bodies	1 body
20%	70%	7.5%	2.5%

Table 3: Relationship of left External laryngeal nerve to Left Superior Thyroid artery

Anterior to artery	Posterior to artery	Between the branches of artery	Artery is absent
-	55 bodies	-	-
-	100%	-	-

Table -4 Relationship of Right External Laryngeal nerve to Superior Thyroid artery

Anterior to artery	Posterior to artery	Between the branches of artery	Artery is absent
8 bodies	44 bodies	3 bodies	Nil
15%	80%	5%	



Fig-1: Right RLN anterior to inferior thyroid artery



Fig-2: Right RLN posterior to inferior thyroid artery



Fig-3: Right RLN between the branches of inferior thyroid artery



Fig-4: Left RLN posterior to inferior thyroid



Fig.5 Left ELN posterior to superior thyroid artery



Fig: 6 Right ELN posterior to superior thyroid artery



Fig: 7 Right ELN anterior to Superior Thyroid artery



Fig: 8: Right ELN in between the branches of Superior thyroid artery