

Position of Terminal Branches of Inferior Thyroid Arteries in Relation to Recurrent Laryngeal Nerve

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The thyroid gland is one of the largest endocrine gland. Medical treatment is not sufficient to manage thyroid disorder especially in case of malignancy and when respiratory distress, dysphagia are present due to thyroid disease. Major complication of thyroid surgery is recurrent laryngeal nerve injury. Position of terminal branches of inferior thyroid arteries in relation to recurrent laryngeal nerve varies. The artery may lie posterior or anterior to the nerve or the main trunk of the nerve or its branches intermingle with the terminal branches of the inferior thyroid artery. The variation in the relation of recurrent laryngeal nerve is important during the exposure and mobilization of the gland in the various stages of partial and complete thyroidectomy. In mobilization of the gland, the relationship of the recurrent laryngeal nerve and the inferior Thyroid artery is important while placing the ligature in the inferior thyroid artery. To improve the results of thyroidectomy a careful study of position of terminal branches of inferior thyroid arteries in relation to recurrent laryngeal nerve is required. This is a descriptive analytic type of study. It was done in the Department of Anatomy, Dhaka Medical College from July 2003 to December 2004. Fifty seven (57) postmortem human thyroid gland and ten (10) thyroid gland surgery was from BIRDEM hospital to see the relation of recurrent laryngeal nerve with inferior thyroid artery. Age of the subjects ranged from 10 to 60 years. They were divided into three groups: group I (10 – 20 years), group II (21 – 40 years), group III (41 – 60 years). Relationship of terminal branches of inferior thyroid arteries with recurrent laryngeal nerve in cadaver varies on both sides. On the right side the recurrent laryngeal nerve was found to be passed most commonly in between the arteries but on the left side it passes most commonly posterior to artery. But on both sides it passed anterior, posterior or in between the branches of artery. In living body relationship showed similar result. The main limitation of the study was small sample size in living body. However, to establish normal standard for Bangladeshi people further studies with large samples from different zone, especially in endemic zone of the country to correlate different types of anatomical variations with age, sex and metabolic state of the individuals are suggested.

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Key words: Terminal Branches of Inferior thyroid artery, recurrent laryngeal nerve, post mortem, living.

Introduction

Thyroid gland receives more blood per gram of tissue (5.5 ml/gm/min) than any other organ.¹ All blood is supplied by a number of arteries and drained by an even greater number of veins. Recurrent laryngeal nerve is intimately related with thyroid gland especially with inferior thyroid arteries. The diseases which usually affect the thyroid gland are hypothyroidism,

hyperthyroidism, autoimmune thyroiditis, Graves' disease of which hypothyroidism due to iodine deficiency is the commonest.² Medical treatment is not sufficient to manage thyroid disorder specially in case of malignancy and when respiratory distress, dysphagia are present due to thyroid disease.³

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The overall incidence of accidental unilateral recurrent laryngeal nerve injury was 4.8 percent.⁴ One of the major complication of thyroidectomy is recurrent laryngeal nerve injury.⁵ The relationship of the recurrent laryngeal nerve to the inferior thyroid arteries varies. The artery may lie posterior or anterior to the nerve or the main trunk of the nerve or its branches intermingle with the terminal branches of the inferior thyroid artery.⁶

The recurrent laryngeal nerve may lie in front, behind or between the branches of the artery.⁷ There are 28 possible variations described. For practical purposes, three major types are important. Among the 102 cadavers, the nerve passed behind the artery in a majority of cases.⁸ On the right the nerve most frequently lies between arterial branches (48%), on the left, it was usually behind the artery (64%).⁹

The incidence of permanent recurrent laryngeal nerve paralysis was 2.4%.¹⁰ Paralysis of vocal cord is a common complication of thyroidectomy. Iatrogenic injury to the recurrent laryngeal nerve or to its branches better avoided by searching, identifying and exposing the nerve itself and by following its course with care. Deep knowledge of the thyroid region and the awareness of the extremely varying course of the recurrent laryngeal nerve and the inferior thyroid artery and their relations should be taken into account by surgeons.¹¹

Methods

The study was carried out on human thyroid glands of sixty seven (67) Bangladeshi people out of this, fifty seven (57) glands were collected from unclaimed dead bodies autopsied in the morgue of the Department of Forensic Medicine, Dhaka Medical College after requisite legal formalities. Remaining ten (10) thyroid gland surgery was observed in ENT Department of BIRDEM Hospital to

see the relation of recurrent laryngeal nerve with inferior thyroid artery.

Only fresh body were chosen for collection of study materials who died within the preceding 12 to 24 hours. From each cadaver the thyroid and related neighbouring structures were collected using the following procedure. The personnel of the Department of Forensic Medicine, Dhaka Medical College were requested to give incisions carefully not to damage the isthmus or any other part of the thyroid gland particularly vessels and nerves during postmortem examination. In the neck region, the skin along with the platysma was retracted laterally and the thyroid gland and related structures (e.g. the carotid arteries, the internal jugular veins) were identified. The sternocleidomastoid muscle was cut in its middle and was better exposed. In the chest, the skin, superficial fascia, and deep fascia were retracted laterally in one flap. Then the pectoralis major muscle was cut at its origin and was retracted laterally.

Structures extending from the base of the skull up to the mediastinum which included the thyroid and parathyroid glands, tongue, parts of the pharynx, oesophagus, larynx, trachea, thymus, fibrous pericardium, great vessels of the neck, arch of aorta and its branches, hyoid bone, part of right and left bronchus were separated enmass from the body (Enayetullah, 1996).

The collecting viscera was washed gently with tap water, blood and the blood clot were removed as far as possible. Selected viscera were duly tagged with a piece of waxed cloth which bear an identifying number along with the age & sex of the victim. Then the viscera was fixed and preserved in 10% formalin solution.

The samples were divided into three different age groups (Table I). Male and female subjects are shown in table II.

Table I: Different groups of thyroid gland according to age of cadaver

Group	Age (in year)	Number of thyroid gland n=57	%
I	10 - 20	13	22.80
II	21 - 40	32	56.15
III	41 - 60	12	21.05

Table II: Groups according to sex

Sex	Cadaver	Living	Total
Male	34	3	37
Female	23	7	30

It was observed whether recurrent laryngeal nerve placed in front or behind or in between of terminal branches of inferior thyroid arteries. Position of terminal branches of inferior thyroid arteries in relation to recurrent laryngeal nerve in cadaver and in living body during thyroid surgery was observed.. When total thyroidectomy done by ENT specialist, relationship was observed in both sides, but in case of lobectomy, relationship was observed in respective side of surgery.

In operation theater ten cases of thyroid surgery was observed. Among them, 3 persons were male and female were 7 in number. Total thyroidectomy has been observed in 6 persons (Male 1 and female 5) and lobectomy has been observed in 4 persons (male 2 and female 2). Surgery was done by ENT specialist. In total thyroidectomy cases, relationship on both sides of recurrent laryngeal nerve and terminal (glandular) branches of inferior thyroid artery has been observed, but in case of lobectomy, the relationship has been observed in the respective side of surgery.

Results

Table III and figure 3 shows the Position of terminal branches of inferior thyroid arteries in relation to recurrent laryngeal nerve in cadaveric male and female. In this study one non-recurrent laryngeal nerve was found on the right side but in that case on the left side recurrent laryngeal nerve was present (figure 2). So, total number of recurrent laryngeal nerve was 53 on the right side. Among the male cadaver in 19.4% cases, the recurrent laryngeal nerve passes anterior to the arteries, 35.5% to posterior and 45.2% cases, it passes between the arteries on the right side. Among the female cadaver in 27.3% cases, the recurrent laryngeal nerve passes anterior to arteries and in another 27.3% cases it passes posterior and 45.4% cases, it passes between the arteries.

On left side, among the male cadaver, 6.3% cases, the recurrent laryngeal nerve passes anterior to the arteries in 56.3% posterior and 37.5% cases, it passes between the arteries. Among the female cadaver, 15.8% cases, the recurrent laryngeal nerve passes anterior to the arteries and another 57.9% passes posterior and 26.3% cases, it passes between the arteries.

Analysis revealed that no statistically significant variation of relation was found between recurrent laryngeal nerve and inferior thyroid arteries among the male and female cadaver ($p > 0.05$).

Table III shows the position of terminal branches of inferior thyroid arteries in relation to recurrent laryngeal nerve in the living male and female body. In case of male, three lobectomies was seen, so relationship of nerve and artery had observed in three cases on one side. No total thyroidectomy had seen in case of male. Two thyroidectomy and five lobectomy in female was observed. So relationship of nerve and artery had observed

on both side in case of two female living body. In five cases relationship of nerve and artery had observed on one side in case of female. On the right side, among the male body, in 50.0% cases, the recurrent laryngeal nerve passes anterior to inferior thyroid artery, in one case (50.0%), it passes between the inferior thyroid arteries. Among the female body, in 16.7% cases, the recurrent laryngeal nerve passes anterior to inferior thyroid artery and in 50.0% passes posterior

and in 33.3% cases, it passes between the inferior thyroid arteries.

On the left side, no recurrent laryngeal nerve passes anterior to inferior thyroid artery in both male and female living body. Only in one (100%) cases, the recurrent laryngeal nerve passes in between the inferior thyroid artery in case of male. Among the female cases, in 60.0% cases it passes posterior to inferior thyroid artery and in 40.0% passes between the inferior thyroid artery.

Table III: Position of terminal branches of inferior thyroid arteries in relation to recurrent laryngeal nerve in cadaveric male and female

Sex	Relationship of recurrent of laryngeal nerve with terminal (glandular) branches of inferior thyroid arteries											
	Right side (n=53)						Left side (n=51)					
	Anterior		Posterior		In between		Anterior		Posterior		In between	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Male	6	19.4	11	35.5	14	45.2	2	6.3	18	56.3	12	37.5
Female	6	27.3	6	27.3	10	45.4	3	15.8	11	57.9	5	26.3
Total	12	22.6	17	32.1	24	45.3	5	9.8	29	56.9	17	33.3
p value	p>0.05						p>0.05					

*p value obtained from chi square analysis

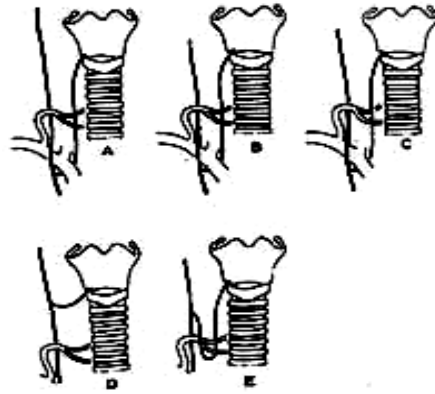


Figure 1. Possible relationship of the inferior thyroid artery to the laryngeal nerve

- A. Recurrent laryngeal nerve (n) passing anterior to the arteries (a).
 - B. Recurrent laryngeal nerve (n) passing posterior to the arteries (a).
 - C. Recurrent laryngeal nerve (n) passing in between the arteries (a).
 - D. Non-recurrent laryngeal nerve(n) passing directly to the larynx
- (From: Tzinis et.al, 1980)

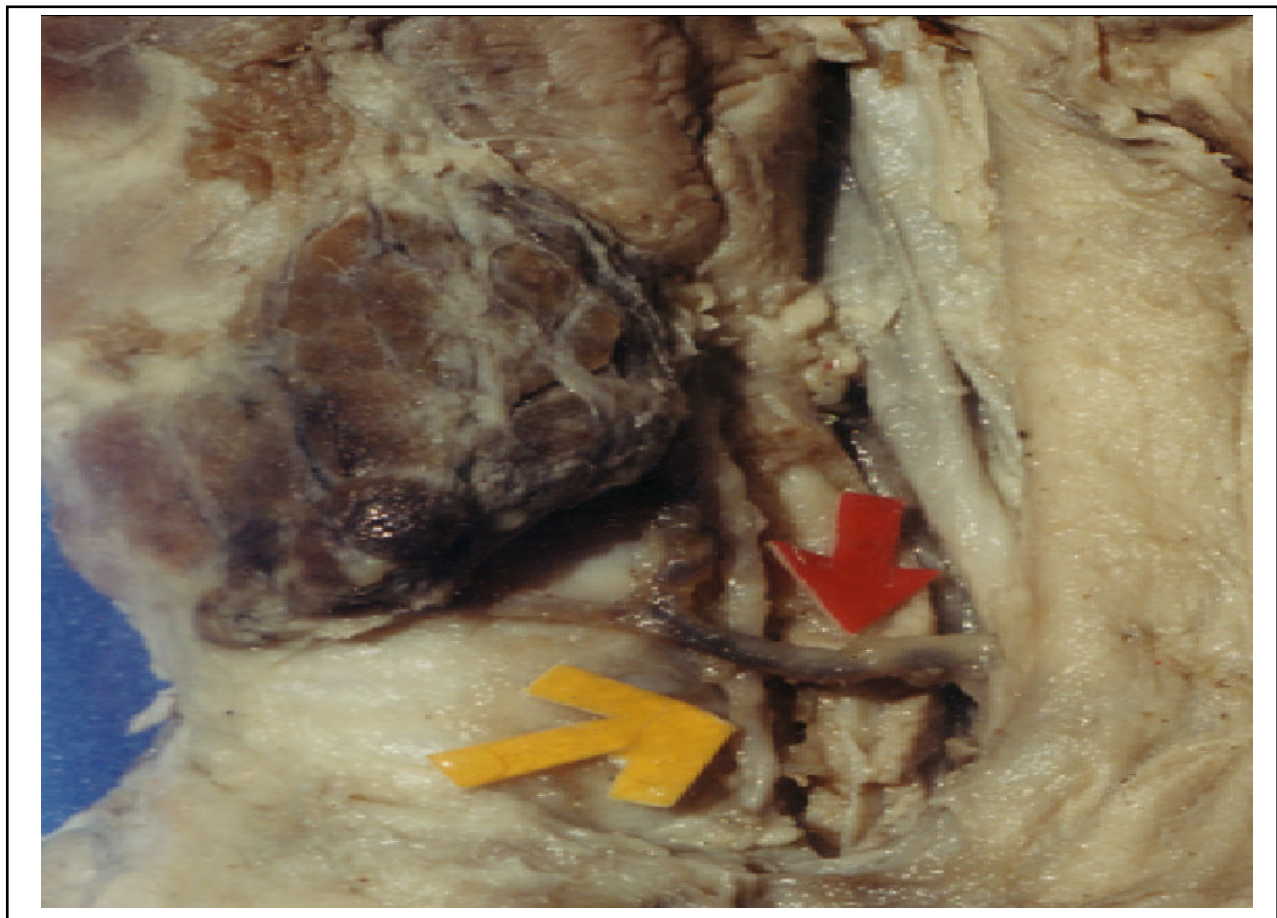


Figure 2. The thyroid gland and its related structures. Upper arrow indicates glandular branch of inferior thyroid artery of left side, which divides into two branches. Lower arrow indicates recurrent laryngeal nerve of left side. Nerve passes behind the artery.

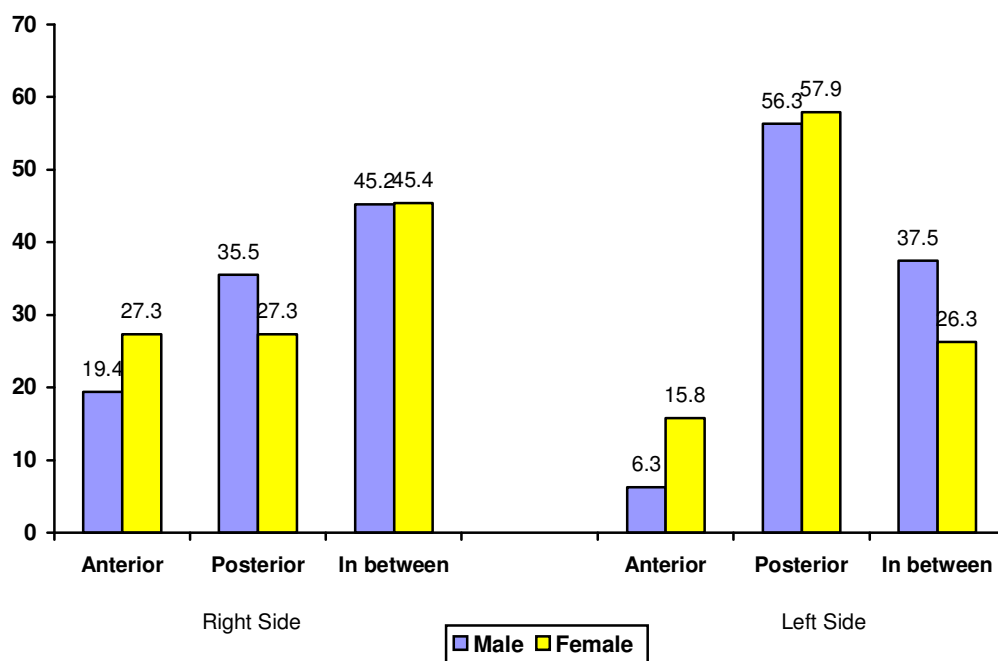


Figure 3. Position of terminal branches of inferior thyroid arteries in relation to recurrent laryngeal nerve in cadaveric male and female

Table IV: Position of terminal branches of inferior thyroid arteries in relation to recurrent laryngeal nerve in living body (n=10)

Sex	Position of terminal branches of inferior thyroid arteries in relation to recurrent laryngeal nerve in living body											
	Right side						Left side					
	Anterior		Posterior		In between		Anterior		Posterior		In between	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Male	1	50.0	0	0.0	1	50.0	0	0.0	0	0.0	1	100.0
Female	1	16.7	3	50.0	2	33.3	0	0.0	3	60.0	2	40.0
Total	2	25.0	3	37.5	3	37.5	0	0.0	3	50.0	3	50.0

Discussion

The position of terminal branches of inferior thyroid arteries in relation to recurrent laryngeal nerve varies. The artery may be posterior or anterior to the nerve or the main trunk of the nerve or its branches may be intermingled with the terminal branches of the inferior thyroid artery.¹² On the right side there are almost equal chances of finding the nerve anterior, posterior or intermingled with the branches of the artery.¹³ Aberrant nerve is more common on the right. On the left side the nerve is most likely to be posterior to the artery and least likely to be anterior.¹⁴ The present study shows that on right side among male cadaver in 19.4% cases recurrent laryngeal nerve passed anterior to the arteries, in 35.5% posterior and in 45.2% cases, it passed between the arteries. In female cadaver in 45.4% cases the nerve passed between the arteries, 27.3% cases recurrent laryngeal nerve passed anterior to arteries, another 27.3% cases it passed posterior to arteries. In this study it was also seen that on the left side, among male cadaver, recurrent laryngeal nerve mostly passed in 56.3% cases posterior to arteries, in 6.3% cases it passed anterior to the arteries and in 37.5% cases it passed between the arteries. Among the female cadaver in 15.8% cases the recurrent laryngeal nerve passed anterior to the arteries and another 57.9% cases passed posterior to the arteries and in 26.3% cases it passed between the arteries. It was revealed that no statistically significant variation of relation was found between recurrent laryngeal nerve and inferior thyroid artery among the male and female cadaver ($p > 0.05$). In this study the position of terminal branches of inferior thyroid arteries in relation to recurrent laryngeal nerve was studied during thyroid surgery among 10 patients to see whether there was any difference between cadaver and living body. The observations were more or less similar between cadaver and living body.

On the right side among male patients in 50.0% cases the recurrent laryngeal nerve passed anterior to the inferior thyroid arteries and 50.0% cases it passed in between the artery, no artery was found to pass posterior to the artery. Among female patient in 16.7% cases the recurrent laryngeal nerve passed anterior to inferior thyroid artery and in 50.0% cases passed posterior and in 33.3% cases it passed between the inferior thyroid arteries on the right side. In 100% cases the nerve passed in between the arteries in case of male. In case of female the nerve passed posteriorly in 60% cases and in 40% cases passed in between the arteries on the left side. The variation in the position, branching and relations of the recurrent laryngeal nerve is important during the exposure and mobilization of the gland in the various stages of partial and complete thyroidectomy. In mobilization of the gland, the relationship of the nerve and the artery is important while placing the ligature in the inferior thyroid artery, as far as laterally to safeguard the nerve in all cases but in case of non recurrent laryngeal nerve there is still risk of damaging the nerve when securing bleeding points on or near at a later stage of the operation.¹⁵ In order to minimize the risk of damage to the nerve and others have advocated the identification of the laryngeal nerve in all cases of thyroidectomy.¹⁶

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