



Original Article

Anatomical Variation of Recurrent Laryngeal Nerve with Inferior Thyroid Artery: A Cross Sectional Study in Bangladeshi People

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Abstract

Background: Recurrent laryngeal nerve is varied anatomically with inferior thyroid artery. **Objective:** The purpose of the present study was to observe the anatomical variation of recurrent laryngeal nerve with inferior thyroid artery among Bangladeshi people. **Methodology:** This comparative cross-sectional study was conducted in the Department of Otolaryngology and Head-Neck surgery at Sylhet MAG Osmani Medical College Hospital, Sylhet, Bangladesh from January 2004 to December 2004 for a period of one (01) year. Patients whose recurrent laryngeal nerve was identified during thyroidectomy due to various pathological conditions of thyroid gland were selected as group I. Again, the dead body which were undergone dissection were designated as group II. All the patients whose recurrent laryngeal nerve and inferior thyroid artery were identified during total, near total, sub-total, hemithyroidectomised or lobectomised were included in this study. **Result:** A total number of 32 patients were recruited for this study. On the left side nerve was found anteriorly in 2(10.53%), in between in 4(21.05%) and posteriorly in 13(68.42%). On the right side-nerve was found anteriorly in 7(30.43%), in between in 6(26.09%) and posteriorly in 10(43.48%). In this series nerve was seen posterior relation more than other two relations and anterior relation more on right side whereas posterior relation on left side, anterior relation more than in between relation on right side but reverse on left side. In group II On the left side nerve was found anteriorly in 2(6.25%), in between in 6(18.75%) and posteriorly in 24(75%). On the right side-nerve was found anteriorly in 8(25%), in between in 9(28.12%), and posteriorly in 10(46.88%). **Conclusion:** In conclusion each recurrent laryngeal nerve lies posterior to the inferior thyroid artery in the majority of the occasions whereas the nerve lies anterior to the branches of the inferior thyroid artery less commonly except right side of both study group. [*Journal of Science Foundation, January 2020;18(1):7-12*]

Keywords: Recurrent laryngeal nerve; anatomical variation; inferior thyroid artery

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Introduction

Permanent paralysis of recurrent laryngeal nerve is extremely rare if the nerve has been identified during thyroid surgery (Krukowski 2000). Identification and preservation of the recurrent laryngeal nerve is of major concern in surgery of thyroid gland (Siddique 1994). The inferior thyroid artery serves as an important surgical landmark for the identification of recurrent laryngeal nerve (Hisham and Lukman, 2002). The nerve will either pass immediately superficial to the artery, deep to it or between its two terminal branches (Maran and Wilson, 1993). Left recurrent laryngeal nerve maintains its location at tracheo-oesophageal groove throughout its length but right recurrent laryngeal nerve lies first laterally then medially as it ascends towards the gland just below the inferior thyroid artery then superficial, deep or in between branch of the artery then in the tracheoesophageal groove. As a very rare occurrence recurrent laryngeal nerve may be non-recurrent on the right side (Jauregui et al., 2000).

In a study Pimpl et al (1992) have undergone thyroid surgery and have found 159 nerves in typical site out of 163 nerves. The topographical relation of the recurrent laryngeal nerve to the inferior thyroid artery has revealed the differences for the right and left side of the neck. On the right side the nerve has been found to be behind in 48.0%, in front in 33.0% and between the branches of the artery in 15.0% of cases. In contrast, on the left side the nerve has been found to be dorsal in 53.0% cases, ventral in 23.0% cases and between the branches of the artery in 23.0%. Another study was carried out by Poyraz et al (2001) on the fixed cadavers of 4 adult women and 26 adult men. Out of 52 recurrent laryngeal nerves, 27 nerves on the left and 25 on the right side have been dissected. Inferior thyroid artery is missing in 4 sides which include bilaterally in one cadaver and unilaterally in 2 cadavers. Thus artery-nerve relationship has been assessed on 48 sides of which 25 on the left and 23 on the right. On the right, 39.2% are in between the branches while 30.4% are in anterior to the artery and 30.4% cases are posterior. On the left, 52% nerves were in between the branches whereas 44% nerves are posterior and 4% nerves are anterior to the artery. Thus, the position of the nerve in between the branches has the highest incidence while the anterior position has the lowest and the differences is statistically insignificant.

There is a controversy on relation and side variation of the recurrent laryngeal nerve to the inferior thyroid artery (Herranz-Gonzalez et al., 1991). So, the purpose of this study was to find out the relation and side variations of recurrent laryngeal nerve to the inferior thyroid artery during thyroid surgery as well as in autopsy, which is very important for a surgeon during the operation.

Methodology

This comparative cross-sectional study was conducted in the Department of Otolaryngology and Head-Neck surgery at MAG Osmani Medical College Hospital, Sylhet, Bangladesh from January to December 2004 for a period of one (1) year. This study place was of the one of the largest public hospital in Bangladesh which was located 300 km northeast of Bangladesh. This hospital represented one of the largest parts of Bangladeshi people. This centre had a tertiary clinical laboratory and both routine and specialized biochemical and endocrinological tests were undertaken including thyroid function tests. Patients whose recurrent laryngeal nerve was identified during thyroidectomy due to various pathological conditions of thyroid gland were selected as group I. Again, the dead body which were undergone dissection were designated as group II. All the patients whose recurrent laryngeal nerve and inferior thyroid artery were identified during total, near total, sub-total, hemithyroidectomised or lobectomised were included in this study. Patient who refused operative treatment and those who were unfit for general anaesthesia and whose nerve was not identified were excluded from this series. In autopsy (Group-II), severely injured in the neck due to RTA, Burns or Cutthroat injury and decomposed bodies were excluded from autopsy series. Each side of the inferior thyroid artery and recurrent laryngeal nerve was considered as a separate unit in the analysis of the results. The diagnosis of the thyroid dysfunction was confirmed by a number of investigations including FNAC, thyroid function tests and ultrasonography. The study protocol was approved by the Ethical Research and Review Committee of the institution. Purposive sampling procedure was used for this study. Only thyroid function test results within the period were selected. A questionnaire was designed for collection of data with respect to age and gender of the patients. The thyroid function test results consisting of either serum total thyroxine (TT₄) or free thyroxine (FT₃), total triiodothyronine (TT₃) or free triiodothyronine (FT₃), and thyroid-stimulating hormone (TSH) values were evaluated for the diagnosis of thyroid disorders. Serum samples of patients were tested within 1-hour of sample collection

using automated immunoassay analyzer. Histopathological test was done after collection of biopsy material after surgery to confirm the different pathological abnormalities. Analyses was performed by SPSS software, versions 22.0 (IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp.). Continuous data that were normally distributed were summarized in terms of the mean, standard deviation, median, minimum, maximum and number of observations. Categorical or discrete data were summarized in terms of frequency counts and percentages.

Result

A total number of 32 patients were recruited for this study after fulfilling the inclusion and exclusion criteria. In group-I maximum age range was from 21 to 40 years which was 19(59.4%) cases followed by 41 to 50 years and 61 to 70 years which were 4(12.4%) cases in each. In this series lowest age was 16 years and highest were 70 years and the average age was 39.8 ± 11.65 years. In Group-II most of the dead bodies were in between 11 to 50 years of age, with lowest age 4.5 years, highest 70 years and the average age was 32.8 years (Table 1).

Table 1: Age Distribution of Study Population

Age Group	Group I	Group II	Total	P value
4 to 10 Years	0(0.0%)	4(12.5%)	4(6.2%)	0.021
10 to 20 Years	2(6.2%)	6(18.8%)	8(12.5%)	
21 to 30 Years	8(25.0%)	7(21.9%)	15(23.4%)	
31 to 40 Years	11(34.4%)	5(15.6%)	16(25.0%)	
41 to 50 Years	4(12.5%)	5(15.6%)	9(14.1%)	
51 to 60 Years	3(9.4%)	3(9.4%)	6(9.4%)	
61 to 70 Years	4(12.5%)	2(6.2%)	6(9.4%)	
Total	32(100.0%)	32(100.0%)	64(100.0%)	

Chi-square test was performed to see the level of significance.

In this study 32 patients were undergone thyroid surgery and out of them 22 were unilaterally dissected and rest 10 were bilaterally dissected. In unilateral dissection-right recurrent laryngeal nerve was identified in 13 cases and left recurrent laryngeal nerve was identified in 9 cases. In bilateral dissection-both right and left recurrent laryngeal nerve were identified in 10 cases. On the left side-nerve was found anteriorly in 2(10.53%), in between in 4(21.05%) and posteriorly in 13(68.42%). On the right side-nerve was found anteriorly in 7(30.43%), in between in 6(26.09%) and posteriorly in 10(43.48%) (Table 2).

Table 2: Relation of Recurrent Laryngeal Nerve to Inferior Thyroid Artery in Thyroid Surgery Cases (n=32)

Recurrent Laryngeal Nerve	Anterior	Posterior	In Between	Total
Left	2(10.5%)	13(68.4%)	4(21.05%)	19
Right	7(30.4%)	10(43.5%)	6(26.1%)	23
Total	9	23	10	42

In this study 32 dead bodies were dissected on both sides. Recurrent laryngeal nerve and inferior thyroid artery was identified on each side. On the left side nerve was found anteriorly in 2(6.25%) cases, in between in 6(18.75%) cases and posteriorly in 24(75%) cases. On the right side-nerve was found anteriorly in 8(25%), in between in 9(28.12%) cases and posteriorly in 10(46.88%) cases. In this series nerve was seen posteriorly more than other two relations and in between relation is more than that of anterior relation on both sides. In this series (Group II) no right recurrent laryngeal nerve was found non-recurrent (Table 3).

Table 3: Relation of Recurrent Laryngeal Nerve to Inferior Thyroid Artery in autopsy cases (n=64)

Recurrent Laryngeal Nerve	Anterior	Posterior	In between	Total	P value
Left	2(6.25%)	24(75.0%)	6(18.75%)	32	0.03
Right	8(25.0%)	15(46.88%)	9(28.12%)	32	
Total	10(15.6%)	39(60.9%)	15(23.4%)	64	

Chi-square test was performed to see the level of significance.

Discussion

In this study, 32 patients were included who had undergone surgical treatment for various thyroid disorders (Group I) in Otolaryngology department of Osmani Medical college hospital, Sylhet and 32 dead bodies (Group II) were dissected at autopsy room of Forensic Medicine and Toxicology Department of Osmani Medical College, Sylhet. The diagnosis of the thyroid disorder cases was established preoperatively by FNAC and various thyroid function tests and later confirmed by histopathological examination.

In Group I, patient's maximum age range was between 21 to 40 years with an average age was 39.84 years which has the similarity with a study in our country by Rahaman (1988). In Group II, most of the dead bodies were in between 11 to 50 years of age, with lowest age 4.5 years, highest 70 years and the average age was 32.8 years. These results show a similarity with the study by Poyraz et al (2001).

In Group-I, one (3.125%) patient had recurrent laryngeal nerve paralysis which is very high in comparison to Iqbal et al (1989) where nerve paralysis was 0.9% cases. Herranz-Gonzalez et al (1991) found 2.3% cases of unilateral recurrent laryngeal nerve injury in 513 patients who underwent thyroidectomy. They have found a significant relationship of recurrent laryngeal nerve injury with secondary procedures, histologic findings and no nerve identification during surgery. Another Bangladeshi study by Rahaman (1988) revealed a 4.0% incidence of recurrent laryngeal nerve injury. Permanent paralysis is extremely rare if the nerve has been identified at operation (Iqbal et al., 1989). Intraoperative identification of the recurrent laryngeal nerve is mandatory to avoid surgical damage. The right recurrent laryngeal nerve is more commonly anterior or passes between the branches of the artery, while the left recurrent laryngeal nerve is more commonly posterior (Farrar 1983). Moreover, though variation in position of the recurrent laryngeal nerve is unusual, non-recurrent laryngeal nerve can occur in 0.2% to 0.4% of patients, invariably on the right side (Farrar 1983). Probably this is why injury is more common on the right side. It is now generally agreed that identification of the course of nerve is the best way to avoid damage. Some authors advocate routine electrical stimulation of the nerve as a method of identification (Gavilan and Gavilan 1986).

In group-I unilateral resections were carried out in 22(68.75%) patients and incidence of immediate major postoperative complication was zero, whereas in 10(31.25%) patients who were subjected to bilateral resection, the overall incidence of major postoperative complications was 20%, which was more than that occurred following unilateral resections and a similarity with the study by Siddique (1994). Out of, the 32 patients in the present series, none developed postoperative haemorrhage or acute respiratory distress or thyrotoxic crisis except two patients among them one (3.125%) developed clinical hypoparathyroidism and another (3.125%) developed permanent right recurrent laryngeal nerve paralysis. The incidence of hypoparathyroidism should be less than 0.5 percent (Lakhoo et al., 2001). Most cases present dramatically 2-5 days after operation, but very rarely the onset is delayed for 2 to 3 weeks. A similar study by Herranz-Gonzalez et al (1991) 185 patients found an incidence of permanent hypocalcaemia was 8%. Another study by Iqbal et al (1989) on 111 patients had an incidence of transient parathyroid insufficiency of 8.10%, while permanent damage occurred in 0.9% cases only. In another study of 1037 patients by Ronga et al (1988) found postoperative prevalence of hypoparathyroidism was 16.6%. Schwartz and Friedman (1987) recorded that 3.3% cases developed permanent hypoparathyroidism. The incidence of permanent hypoparathyroidism as a consequence of thyroid surgery increases with the magnitude of operation. It is rare after unilateral lobectomy and is uncommon after subtotal thyroidectomy. In this series only one (3.125%) patient developed hypoparathyroidism who had bilateral resection (total thyroidectomy).

Previous thyroid surgery increased the risk of postoperative hypoparathyroidism (Watkinson et al., 2000). Most cases of respiratory distress were due to laryngeal oedema. The most important cause of laryngeal oedema was a tension haematoma. Lakhoo et al (2001) in their study found that large glands and

radiological evidence of a compressed trachea were statistically significant risk factor for postoperative airway obstruction. Iqbal et al (1989) in a postoperative study of 111 cases found a mortality rate of 0.9% due to fatal laryngeal oedema. In Group-I no patient expired during or after operation. So, mortality rate was zero. The mortality rate accompanying thyroidectomy was very low. Ronga et al (1988) reviewed patients operated on consecutively by a large group of surgeons over a 5-years period and reported no hospital death. Overall major postoperative complications such as haemorrhage, acute respiratory distress, recurrent laryngeal nerve damage, hypo-parathyroidism and also mortality depends on the magnitude of surgery.

In group-I unilateral dissection was carried in 22 cases where right recurrent laryngeal nerve was identified in 13 cases and left recurrent laryngeal nerve was identified in 9 cases. In bilateral dissection-both right and left recurrent laryngeal nerves were identified in 10 cases. The nerve was found anteriorly in 2(10.53%), in between in 4(21.05%) and posteriorly in 13(68.42%) on the left side. The nerve was found anteriorly in 7(30.43%), in between in 6(26.09%) and posteriorly in 10(43.48%) on the right side. In this series posterior relation (68.42%, 43.48%) of recurrent laryngeal nerve were more than other two relations on both sides and anterior relation (30.43%) was more than in between relation (26.09%) on right side, which has a similarity with the study by Pimpl et al (1992) but reverse on the left side. In this Group-I, no right recurrent laryngeal nerve was found non-recurrent.

In group II, 32 dead bodies were dissected on both sides. Recurrent laryngeal nerve and inferior thyroid artery was identified on each side. The nerve was found anteriorly in 2(6.25%), in between in 6(18.75%) and posteriorly in 24(75%) on left side. The nerve was found anteriorly in 8(25%), in between in 9(28.12%), and posteriorly in 10(46.88 %) on right side. In this series posterior relation (75%, 46.88%) of recurrent laryngeal nerve on both sides were more than other two relations, which has a similarity with the study by Jauregui et al (2000) and in between relation more than anterior relation on both sides, which has a similarity with, the study by Poyraz et al (2001). In this Group-II, no right recurrent laryngeal nerve was found non-recurrent.

Another study was carried by Jauregui et al (2000) on 55 adult formulated cadavers. It was found that on the right side, the nerve passes behind the artery in 54.5%; it passes in front of it in 38.1%, and passes between its terminal branches in 7.2%. Regarding the left side, the nerve passes behind the artery in 67.2%, it does so in front of it in 27.2%, and passes between its terminal branches in 5.4%; being the right nerve more anterior and lateral than the left one which would possibly explain the higher index of nervous damage on this side. In recent years, there is a remarkable advancement in thyroid surgery.

Conclusion

In conclusion the left recurrent laryngeal nerve lies posterior to the inferior thyroid artery in the majority of the occasions whereas the nerve lies in between the branches of the inferior thyroid artery less commonly. The anterior position of the nerve is found in least number of cases on left side. The right recurrent laryngeal nerve also lies posteriorly to the inferior thyroid artery in many occasions. The second common position attained by right recurrent laryngeal nerve is in between position. In this side the "anterior position" is seen in small number of cases. As there are many variations in anatomical relation between recurrent laryngeal nerve and inferior thyroid artery in the same side as well as opposite side. Therefore, sound knowledge of regional anatomy combined with an unhurried meticulous operative technique with intraoperative identification of these structures is essential if injury of these structures is to be avoided.

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