Thyroid gland morphology with special considerations of the recurrent laryngeal nerves variations

Mohamed Kheir E.A. ElKarim[1]. Mohamed A/Salam Nurein[2], Mohamed A. Hassan[1]

[1] Faculty of Medicine, University of Khartoum,[2] College of Medicine, Karary University

Abstract

Background: Various anatomical positions of the recurrent laryngeal nerves were reported in relation to the inferior thyroid artery. Knowledge of these variations is especially important in thyroid surgery.

Objectives: This study aimed to explore the anatomical relationship between the inferior thyroid artery (ITA) and the recurrent laryngeal nerve (RLN) in Sudanese cadavers. Moreover, it aimed at detecting any other morphological findings e.g. the presence of non-recurrent laryngeal nerve, the presence of a pyramidal lobe and/or a thyroidea ima artery.

Methods: The gross anatomy of the thyroid gland and recurrent laryngeal nerves were studied by direct dissection in fifty Sudanese cadavers in Khartoum State.

Results: On the right side the RLN was detected between the branches of the ITA in 16 cadavers (32%), behind the artery in 12 cadavers (24%) and in front of the artery in 22 (44%). On the left side, the nerve passed between the branches of the artery in13 cadavers (26%), behind the artery in 30 cadavers (60%) and in front of the artery in 7 cadavers (14%). The pyramidal lobe was present in five cadavers (10%) and the thyroidea ima artery in one cadaver (2%). Congenital abnormalities and non-recurrent laryngeal nerve were not detected.

Conclusion: location of the right RLN was significantly detected in front of the ITA while the left nerve was detected more commonly behind the artery. The surgeon's knowledge about these variations helps in identification and preservation of the RLN and prevention of some complications in thyroid surgery.

***Corresponding author:** Mohamed Kheir Eltigani Awad Elkarim.College of Medicine, Karary University, Khartoum, E-mail: mokheir1510@yahoo.com*

Introduction

The variations of the relations of the recurrent laryngeal nerves as they approach the larynx are especially important in the surgery of the thyroid gland. Recurrent laryngeal nerve palsy (RLNP) is an important and potentially catastrophic complication of thyroid surgery(1).The nerves do not always lie in the protected position in the tracheo-oesophegal groove, but may sometimes lie in front of it, lateral to the trachea at the level of the lower part of each lobe of the thyroid gland. Injuries to the recurrent laryngeal nerve occurring during ligation of the inferior thyroid artery during thyroidectomy are not uncommon. This is usually due to lack of knowledge about the relationship of the inferior thyroid artery to the recurrent laryngeal nerve. Identification of the recurrent laryngeal nerve (RLN) has decreased the rate of permanent RLN palsy during thyroid operations; however, unexpected RLN palsy still occurs, even though the visual integrity of the nerve was assured(1).

The objectives of this study were to identify the anatomical relationship between the inferior thyroid artery and the recurrent laryngeal nerve, to assess the frequency of the pyramidal lobe of the gland and the thyroidea ima artery, and to detect any congenital abnormality of the thyroid gland (2).

Methods

The morphological picture of the thyroid gland was

studied in fifty Sudanese cadavers in the Dissecting Rooms (DR) of the Faculties of Medicine of the Universities of: Khartoum(20 cadavers), Medical Science and Technology(13), Taghana(7), Kassala(3), AlZaeim AlAzhari(3), AlNeileen(2), and Gadarif(2).The Cadavers were brought from the Mortuary of Khartoum Civil Hospital. Fixation of the bodies was done in the Dissecting Rooms (DR) of the Faculty of Medicine, University of Khartoum and Khartoum Civil Hospital by trained attendants using intravenous washing with 10% formalin solution for 48 hours, followed by immersion in 3% formoglycerine for four weeks. Open dissections of the neck in the DR were carried out with emphasis on the thyroid gland. Information regarding the presence of the pyramidal lobe, the thyroida ima artery, the relationship between the inferior thyroid artery and the recurrent laryngeal nerves for each cadaver was recorded on a master sheet.

Results and Discussion

On the right side of the thyroid gland in 44% of the cadavers the recurrent laryngeal nerve (RLN) passed in front of the inferior thyroid artery (ITA), in 32% between the branches of the artery and in 24% behind the artery Table1.On the left side of the gland the nerve passed between the branches of the artery in 26%, behind the artery in 60%, and in front of the artery in 14%.Table 2.

The pyramidal lobe was present in 10% of the glands and in only 2% of the glands, the thyroidea ima artery was present. (Table 3).Congenital abnormalities of the gland and non-recurrent laryngeal nerve were not detected.

Table 1. Relationship between the ITA and the right RLN (n= 50)

Anatomical position of the right RLN	**Frequency/ (%)**	
Behind the artery	12	(24%)
In front of the artery	22	(44%)
Between the branches of the artery	16	(32%)
Total	**50**	**(100%)**

Table 2. The relationship between ITA and the left RLN (n= 50):

Anatomical position of the left RLN	**Frequency/ (%)**	
Behind the artery	30	(60%)
In front of the artery	7	(14%)
Between the branches of the artery	13	(26%)
Total	**50**	**(100%)**

Table 3. Presence of pyramidal lobe and thyroidea ima artery (n= 50):

	Frequency / (%)	
Pyramidal lobe	5	(10%)
Thyroidea ima artery	1	(2%)

Surgical injuries to the recurrent laryngeal nerve are responsible for 11 to 32% of the (RLN) palsy[3,4], thyroidectomy accounts for 35.7% of these[4]. The incidence of the (RLN) injury in thyroidectomy varies from 0 to 12%[5]. There are numerous techniques described for preservation of the recurrent laryngeal nerve during thyroid surgery e.g. nerve-monitoring technique[6]. However, the gold standard for preservation of the RLN is still the visual anatomical identification[7,8].

Most authors recognize three types of relationships between the RLN and ITA, the RLN can be anterior, posterior or between the branches of the ITA.

In the present study, the right RLN passed in front of the ITA in 44% of the cadavers while the left RLN passed behind the ITA in 60% of cadavers. These results are in agreement with some previous reports in the literature[4,9].

Regarding the presence of the pyramidal lobe the current study detected the pyramidal lobe in five cadavers (10%). The pyramidal lobe was reported to occur in 40 to 50% of thyroid glands[10,11].

The thyroida ima was detected in one cadaver only (2%) which is at the lower scale of the range reported in the literature i.e. 2-12%[12]. Non-recurrent laryngeal nerve was not detected in the current study.

Conclusion

The right recurrent laryngeal nerve was more commonly detected anterior to the inferior thyroid artery (44%), whereas the left recurrent laryngeal nerve was found more commonly posterior to the artery (60%).

Acknowledgement

We would like to thank the staff of the Anatomy Departments of Al Zaeim Al Azhari, Gadaref, Taghana Universities and the Academy of Medical Sciences and Technology for their help. In addition, we would like to thank Dr Mamoun Magzoub, Faculty of Medicine, Kassala University, Kassala, Sudan.

References

1. Hayward NJ, Grodski S, Yeung M, Johnson WR, Jonathan Serpell J. Recurrent laryngeal nerve injury in thyroid surgery: a review. *ANZ Journal of Surgery* 2013; 83: 15–21.
2. Feng-Yu Chiang, Chen Lu,Wen-Rei Kuo, Ka-Wo Lee, Ning-Chia Chang, Che-Wei Wu.The mechanism of recurrent laryngeal nerve injury during Thyroid surgery: The application of intraoperative neuromonitoring. *Surgery* 2008; 143:743-749.
3. Remachandra DJ, Radcliffe GJ , Stearns MP -Intraoperative identification of the recurrent laryngeal nerve and demonstration of its function.*Laryngoscope* 1990; 100:94-96.
4. Titche LL - Causes of recurrent laryngeal nerve paralysis. *Arch Otolaryngol* 1976; 102 : 259-261.
5. Campos BA, Henriques PR. Relationship between the recurrent laryngeal nerve and the inferior thyroid artery: a study in corpses. *Rev. Hosp. Clin. Fac. Med. S. Paulo* 2000; 55:195-200.
6. Shindo M, Chheda NN. Incidence of vocal cord paralysis with and without recurrent laryngeal nerve monitoring during thyroidectomy. *Arch Otolaryngol Head Neck Surg*. 2007;133:481-485.
7. Lore JM, Median JE. An Atlas of Head and Neck surgery. Fourth edition. Pennsylvania: Elsevier; 2005.
8. Wang C. The use of the inferior cornu of the thyroid cartilage in identifying the recurrent laryngeal nerve. *Sur Gynecol Obstet*. 1975;140:91-94.
9. Jacob S. Matubis ,Karen June P. Dumlao ,Ryner Jose C. Carrillo. The Recurrent Laryngeal Nerve in Relation to the Inferior Thyroid Artery in Adult Filipino Cadavers. *Philipp J Otolaryngal Head Neck Surg*2011;26:13-17.
10. Rodrrick NM, MacSween. Thyroid gland. Muirs Texbook of pathology. 13th ed. Edward Arnold, London. 1993 P. 1084.
11. Romanse GJ. The ductless glands. Cunningham's Text Book of Anatomy. 12th ed.Oxford-Yugoslavia 1981:595.
12. Hamilton WJ. Endocrine system. Text Book of Human Morphology . 2nd ed. Macmillan.Hong Kong 1976 :490.