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# Anatomico Surgical Study on the Thyrolaryngeal Region of Balady Dog

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## Abstract

The present study was carried out on 10 heads of adult apparently healthy of both sexes of balady dogs. The samples were attended for the anatomical study on the thyro-larngeal region. Characteristic features of the latter were declared out, outer landmarks, superficial and deep anatomical structures as well as their relations. The anatomical work in this study tried to find the guide base for the surgeons during the critical interference in regards to scanty literatures. Thyro-laryngeal surgery is indicated for malignant and benign neoplasms or hyperplasia of the organs of this region. The ventral midline cervical approach is the most common approach. Caution should be taken to avoid the surrounding neurovascular structures and esophagus. Evaluation of thyroid gland, mandibular salivary glands, and related anatomical structures should be done before proceeding surgery. Complications of thyro-laryngeal surgeries include intraoperative hemorrhage and postoperative clinical signs associated with damage to the recurrent laryngeal nerve, parathyroid blood supply, or parathyroidectomy.

## Introduction

Nowadays, many cases of diseased dogs visited veterinary clinic as well as department of surgery of the hospital of the Faculty of Veterinary Medicine, New Valley University. The affected animals suffered from an abnormal gross of the thyro-laryngeal region. The dogs were intended for physical and radiological examination.

In case of thyroid tumors, radiographs of the neck may reveal a mass caudal to the pharynx, sometimes with presence of mineralization. The mass may cause deformed laryngeal lumen andcompress or displace the trachea ventrally. Esophageal or tracheal displacement and focal dilatation of the esophagus may indicates ophageal tumors. However, neither surveynor contrast radiographs are consistently reliable in diagnosing esophageal tumors Taeymans et al [1].

Regional anatomy of the thyro-larngeal region was significantly studded for surgical approach in dogs. The respected available articles spotted the attention on the thyroid gland as the most important structure at the region. Radiological aids were applied for the study Taeymans et al [1] and Rajathi et al [2]. Abnormal masses mainly were recognized to the thyroid gland Liptak [3]. The gland composed of right and left lobes of ovoid to longitudinal in shape. The former lobe was cranially situated than the left one Hullinger [4], Herrtage [5], Koing & Liebich [6] and Taeymans et al [7]. The surgical approach for

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the thyroid region lack in the available literatures. The present study aimed to spot a light on the anatomical features of the thyro-laryngeal region, as a critical region for surgical purposes. As well as, for a comparative study to the foreign dog breeds.

## Material and methods

The current study was ethically approved from the animal use and welfare committee of the faculty of veterinary medicine, New Valley University with reference number 06/2021.

This study was applied on 10 heads attached to their neck, of adult apparently healthy of both sexes of Balady stray dogs. The dogs were prepared for the anatomical study, as the animals were euthanized by administration of a large bolus of sodium thiopental sodium 20% [8]. After conformation of death, the carcasses were injected by 10% formalin solution via the severed artery, for preservation. The neck was sharply cut at the level of the last cervical vertebra. The common carotid artery was injected by 15 ml of red colored milky latex solution. Colorizing the blood vessels was significantly indicated for identifying the arterial distribution. The injected samples were left for 48 hours for latex hardening.

Dissection started by applying a median longitudinal incision, extended from the mid intermandibular space to the level of the third cervical vertebra Figure 1. After turning off the skin covering the thyrolaryngeal region, fine dissection was applied and recorded the results.

## Results

The **Thyrolaryngeal region** is a pyramidal shaped area, has a rectangular base and apex. The rostral two borders of the base, extends caudo-dorsal from the midpoint of the intermandibular space to the maxillary vein laterally. The caudal boundaries extend caudoventrally to the point of division of the two-sternocephalic muscle Figure 1&3, While the larynx represents the apex of the pyramid.

Superficially, **Fascia coli** wraps around the ventral aspect of the thyro-laryngeal region. It is a thick fibrous coat with superficial and deep faces. The former, is related to the skin and facing ventrally while the deep one related to the deep fascia coli and facing dorsally. Firmly attached thin muscle fibers of sphincter coli superficialis muscle separate the fascia from the skin. The fibers traverse the neck and thyro-laryngeal region ventrally in a horizontal manner. Figures (2a&b, 3,4&5). At the level of larynx, the deep face of the fascia receives the terminal insertion of the depressor auriculae muscle. The deep fascia coli at the region, rolls to divide between the terminal insertions of the cervical muscles. As well as the vital structures.

**Linguofacial** vein represents the lateral boundaries of the laryngeal region. The vein opens into the external jugular one and crosses the terminal insertion of the sternocephalic muscle. It extends for about 2.2-2.5 cm in length and about 2-2.3 cm lateral to the sternohyoideus muscle. Figures (3,4&8).The linguofacial vein divides into lateral facial and medial lingual veins. The former, continues on the face, while the lingual one receives the hyoid venous arch and cranial laryngeal vein. The former, derives from a median impar lingual vein between both sternohyoideus muscle.

The **Mandibular salivary gland** Figure 8, it represents the lateral angles of the thyro-laryngeal region. The gland occupies the triangular area between the mandibular angle rostrally, facial vein ventrally and the maxillary vein caudally. The gland enclosed in a fibrous capsule separate it with the sublingual salivary gland from the surrounding structures. It has a lateral convex and medial concave surfaces; the former, is related to the depressor auriculae muscle and ramus coli nerve of facial, while the medial one is related to theterminal insertion of sternocephalicus muscle. The gland is an ovoid to elliptical shaped mass measures about 3.5-3.7cm in length, 2.1-2.3cm in width and 1.9-2.1cm in thickness. The dorsal border of the mandibular gland is related to the sublingual salivary gland while its ventral pole is related to the facial vein. The glandular vein emerges from its cranial border and opens in the facial vein. The mandibular duct arises from craniomedial and dorsal angle of the gland to the mandibular angle. The caudodorsal border of the gland receives fine nerve and arterial branch from the facial nerve and artery respectively.

At the ventromedial aspect of the mandibular angle, the **Mandibular lymph node** occupies the angle of division of the linguofacial vein. Figures (3,4,5&8) Each node consists of two lobes: large medial and small lateral where the facial vein divides between them. The right medial lobe is an ovoid to an elliptical bean shaped mass with lateral indentation. It has a medial grater curvature and lateral lesser one. The lateral lobe is a triangular in shape having a base related to the facial vein and apex to the mandibular angle. Its caudal border is related to the fibrous capsule of the mandibular salivary gland. Its length from the apex to the base is about 1.3-1.4cm, and the base is ranging from 1.7-1.8cm while its thickness reaches about 0.6-0.7cm.

The left medial lobe of the mandibular lymph node is broader than the right. It measures about 2.6-2.7 cm in length from the cranial to the caudal poles and about 1.8-1.9 cm in width. The lateral lobe is a c- shaped with greater and lesser curvatures. The former facing cranially while the lesser one facing the mandibular salivary gland. It measures about 1.7-1.8cm in length, 0.9-1cm in width and 0.6-0.7cm in thickness.

**Sternohyoid** and **Sternothyroid muscles**, Figures 3,4,5,6,7 & 8 fill the ventrolateral aspect of the trachea. At the cranial aspect of the latter, a space of triangular area Figure 4 with a base cranially and apex caudally. The base is represented by the hyoid venous arch and basihyoid while the triangular limbs are the terminal parts of the sterohyoid and sternocephalicus muscle. Cranial laryngeal nerve and Ansa cervicalis are hidden under a fatty tissue at the area. The sternohyoid muscle thickness reaches about 0.3-0.6cm, its bundles run longitudinally covering the ventral aspect of larynx to the basihyoid.

The **Sternothyroid** muscle is an elongated tapered muscle runs on the dorsomedial aspect of sternohyoideus one. The muscle extends on the ventrolateral border of the trachea and terminates at the thyroid cartilage of larynx.The ventral branch of the 1$^{st}$ and 2$^{nd}$ cervical spinal nerve pass on the dorsal border of the muscle. They give branches for the sternohyoid muscle. Figures 5,6&7. Theterminal part of the sternothyroid muscle covers the ventrolateral aspect of the thyroid gland. While the carotid sheath bounded the dorsomedial aspect of the latter in both right and left sides. The sheath traverses both dorsolateral aspect of the trachea. It encloses the common carotid artery, vagosympathetic trunk, recurrent laryngeal nerve and tracheal lymph duct. The artery and the trunk are closely related and pass laterally while the recurrent nerve runs medially on the lateral border of the trachea. Figures 6&7. At the level of the terminal attachment of the sternothyroideus muscle, the cranial thyroid artery detaches from the common carotid artery. It crosses cranially to the cranial pole of the thyroid gland, where

a descending branch runs on the ventral border of the thyroid lobe.

**The Thyroid gland** Figures 6&7 represented by fibrous capsulated two separate lobes; right and left, the former is more cranially situated than the left one. Each lobe lies on the dorsolateral aspects of the cranial part of the trachea. They are elongated elliptical masses with cranial and caudal poles, two surfaces; lateral and medial as well as two borders; dorsal and ventral. The lateral surface is related to the sternnothyroid muscle while the medial one related to the tracheal rings. The cranial pole is related to the cranial thyroid artery and vein while the caudal one receives the cranial thyroid vein from the internal jugular vein.

The right thyroid lobe measures about 2-2.2cm in length, 0.6-0.7cm in width and 0.3-0.5cm in thickness. It extends along the level of first five tracheal rings. The left thyroid lobe measures 2.5-2.6cm in length, 0.7-0.8cm in width and 0.2-0.3cm in thickness. And it extends from the level of 2nd to 6th tracheal ring.

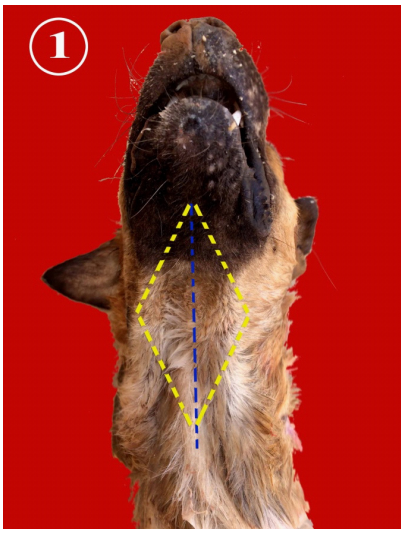


**Figure 1:** A photograph showing the ventral aspect of the head and neck.

The blue dotted line indicates the guide of incision the yellow dotted area indicates the outer boundaries of the thyrolaryngeal region.

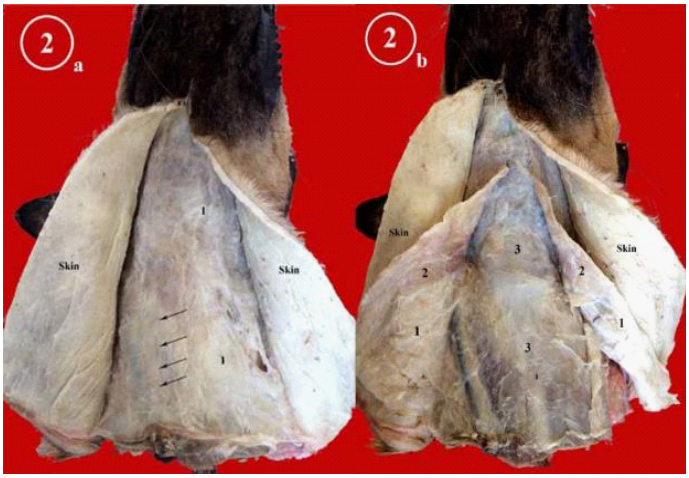


**Figure 2:** A photograph showing the superficial dissection of the ventral aspect of neck **(a)** and deeper one **(b)**.
**(1)** Facia coli (superficial part), **(2)** Depressor auriculare muscle **(3)** Facia coli (deep part)

The arrows indicate the fibers of the sphincter coli superficialis muscle

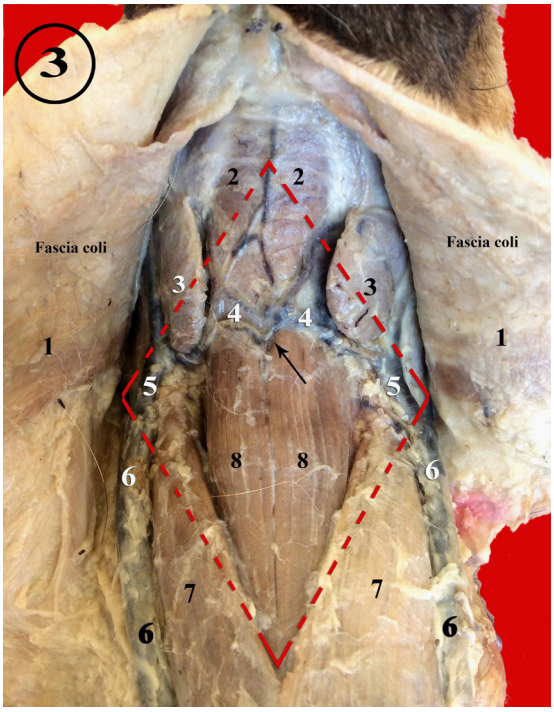


**Figure 3:** A photograph showing deep dissection of the thyrolaryngeal region.
**(1)** Depressor auriculare muscle **(2)** Mylohyoideus muscle **(3)** Mandibular lymph node (medial part) **(4)** Hyoid venous arch **(5)** Lingofacial vien **(6)** External jugular vein **(7)** Sternocephalicus muscle **(8)** Sternohyoideus muscle.
The black arrow indicates the impar vein.
The red dotted area indicates the boundaries of thyrolaryngeal region.

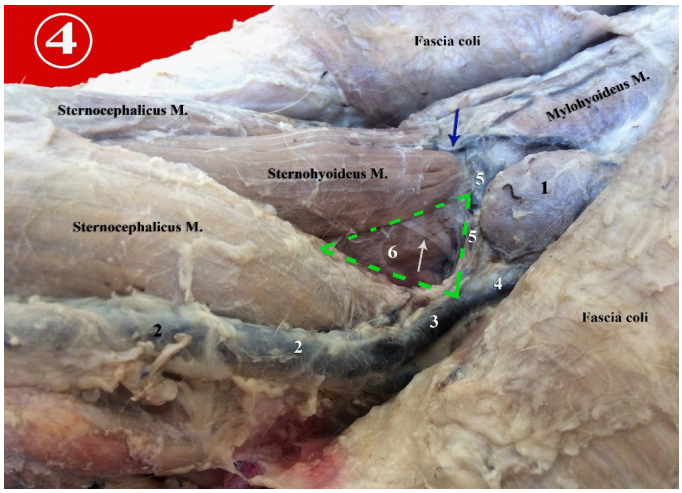


**Figure 4:** A photograph showing deep dissection of the thyrolaryngeal region (lateral view)
**(1)** Mandibular lymphnode (medial part) **(2)** External jugular vein **(3)** Lingofacial vein **(4)** Facial vein **(5)** Lingual vein **(6)** Thyrohyoideus muscle.
The blue arrow indicates the impar lingual vein.
The white arrow indicates the ansa cervicalis.
The green dotted area indicates the area for ansa cervicalis.

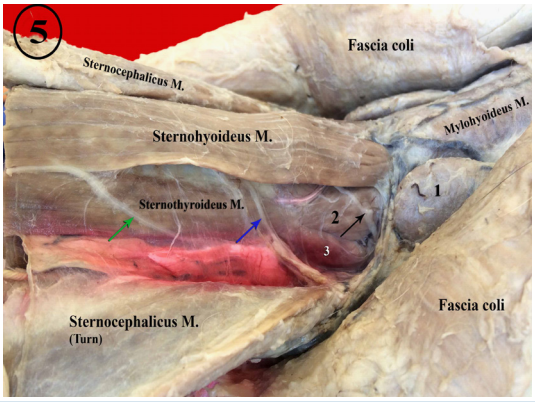


**Figure 5:** A photograph showing deep dissection of the thyro-laryngeal region (lateral view).
**(1)** Mandibular lymph node (medial part) **(2)** Thyrohyoideus muscle **(3)** Cricopharyngeus muscle.
The black arrow indicates ansa cervicalis.
The blue arrow indicates the ventral branch of first cervical nerve.
The green arrow indicates the ventral branch of the second cervical nerve.

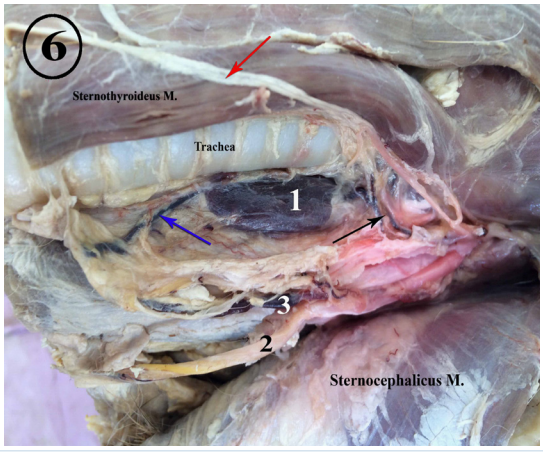


**Figure 6:** A photograph showing deep dissection of the thyroid region (lateral view)
**(1)** Thyroid gland (left lobe) **(2)** Vagosympathetic trunk **(3)** Internal jugular vein.
The black arrow indicates the cranial artery and vein.
The blue arrow indicates the caudal thyroid vein.
The red arrow indicates the ventral branch of first cervical nerve.

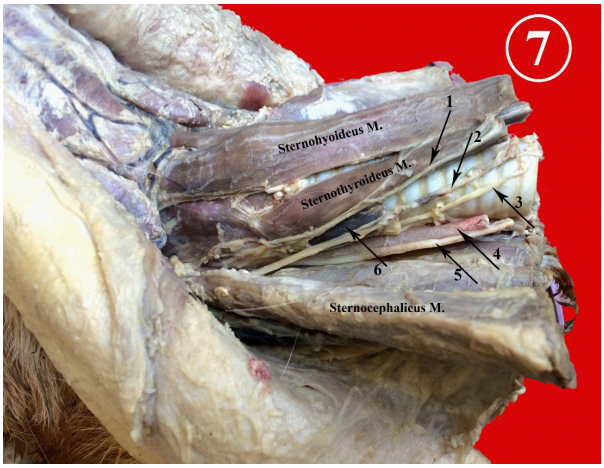


**Figure 7:** A photograph showing deep dissection of the thyroid region (lateral view)
**(1)** Ventral branch of second cervical nerve **(2)** Tracheal lymph duct **(3)** Recurrent laryngeal nerve **(4)** Common carotid artery **(5)** Vagosympathetic trunk **(6)** Thyroid gland (right lobe).

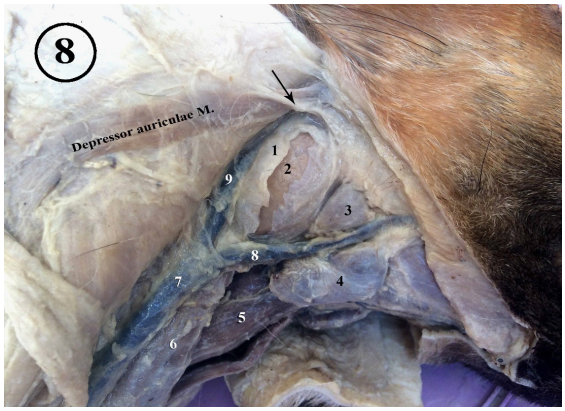


**Figure 8:** A photograph showing superficial dissection of the thyrolaryngeal region (lateral view)
**(1)** Fibrous capsule of the mandibular salivary gland **(2)** Mandibular salivary gland **(3)** Small lateral lobe of the mandibular lymph node **(4)** Large medial lobe of the mandibular lymph node **(5)** Sternohyoideus muscle **(6)** Sternocephalicus muscle **(7)** External jugular vein **(8)** Lingofacial vein **(9)** Maxillary vein

## Disscussion

Anatomical knowledge of the critical body regions was a point of significance for the surgeons. On regarding the reviewed available literatures, most of the anatomists shaded a light on studding the anatomical characteristics of the thyroid gland [1-3]. In this aspect, the recent study declared out the characteristic features of the thyrolaryngeal region as all. It included the boundaries, layers, glands, lymph nodes, vascularization and innervations. As well as tried to put the article as a guide for the surgeons.

The present results determined an imaginary anatomico surgical boundaries for the thyrolaryngeal region. As the latter was a pyramidal area with a rectangular base and an apex formed by the larynx. A result which was not notified by the available literatures.

Description of the superficial and deep layers of the fascia coli in the present work was neglected by the respected available literatures. As the former layer was a thick fibrous coat enroll the ventral aspect of the thyro-laryngeal region. Its superficial face was the terminal region for the sphincter coli superficalis and depressor auricular muscle. Regarding the muscular orientation of the recorded muscle, the study was in a agreement with that recorded by Evans & de Lahunta [9], Done et al [10] and Budras et al [11].

Concerning the findings of the mandibular salivary gland of the recent study; it revealed that the gland was enclosed in a common fibrous capsule with the sublingual salivary gland. That was nearly achieved by Evans and de Lahunta [9] and Weidner et al [12] in dog, Amano et al [13] in rodent and human and Gaber et al [14] in dog. Regarding the anatomical position of the gland, our results declared out that the gland occupied a triangular area caudally located to the mandibular angle and the facial and maxillary vein ventrally and caudally respectively. A finding, which was in a similarly cited Evans and de Lahunta [9] and Gaber et al [14]. In this aspect, our pinion for the surgical interference of the mandibular gland should be carefully applied superficially (Exta capsular) and deeply (Intra capsular). The former, was determined by the facial and maxillary veins as well as the fibrous capsule of the gland. In the same region, the capsule was covered by the depressor auricular muscle and the fine ramus coli nerve of facial. An anatomical structure that

should be finely dissected during the interference. While during the intra capsular operations, vital structures to be care, the glandular vein arose from the cranial border of the gland, the sublingual gland on its dorsal border as well as the fine branches of the glandular nerve and artery from the facial nerve and artery respectively. An opinion, which was in contrary to that mentioned by Gaber et al [14] as the authors stated that the surgical excision of the gland was safely to the maxillary vein.

A significant anatomical structure in the thyro-laryngeal region was studded, the mandibular lymph node. The present article found that the latter was consisted of small lateral and large medial lobes and they were divided by the facial vein.A result which was in an agreement with that of Done et al [10] and Budras et al [11]. While our findings described the anatomical structure of each lobe of the mandibular lymph node. Where the medial lobes were nearly similar in shape while the lateral ones were different. In this aspect, the right lateral lobe of the mandibular lymph node was a triangular in shape with base directed ventrally and apex directed dorsally to the mandibular angel. The left lateral lobe was c shaped where its greater curvature facing cranially and the lesser one facing the mandibular salivary gland. That was not cited in our available literatures. It was a significantly to notify that, the abnormal findings in the ventromedial aspect of the mandibular angel, may be referred to the affection of the mandibular lymph nodes. As well as the surgical interference was superficially intended where the facial vein finely dissected.

Anatomico-surgical description of the thyroid gland was attended in the present work. The gland was represented in a right and left lobes that enclosed in a separate fibrous capsule. Where the right lobe was cranially situated to the left one. A finding which was in agreement with the available literatures Hullinger [4], Herrtage [5], Bromel [15], Liptak [3] and Taeymans [7]. In this aspect, Liptak have the opinion that the thyroid lobes were attached to a fascia along the ventrolateral surface of the proximal part of trachea. That was inconstant to our results, where the thyroid lobes were located on both dorsolateral aspects of the cranial part of trachea. Similarly description was mentioned by Taeymans et al [7]. On the other hand, Hullinger [4], Frewein [16], Koing and Liebich [6] and Mayer and McDonald [17] founded a thin isthmus traversed the trachea ventrally and connected both caudal thyroid lobes in large dog breeds.

Regarding the anatomical position of the thyroid lobes; our study revealed that the right lobe extended along the first five tracheal rings while the left one extended from the second to the sixth tracheal rings. While Taeymans et al [7] mentioned that the thyroid lobes occupied from the first to eighth tracheal ring. In this aspect, Hullinger [4], Herrtage [5] and Koing and Liebich [6] have the opinion that the thyroid lobes extended from the level of cricoids cartilage to the fifth to the eighth tracheal rings. Similarly obtained results were recorded by Mayer and McDonald [17], the authors stated that the right thyroid lobe extended caudally to the cricoids cartilage to the fifth tracheal ring while the left lobe extended from the third to the eighth tracheal rings.

The thyroid lobes shape of our findings revealed that, each thyroid lobe was an elongated elliptical in shape. A result, which was nearly, agreed with that of Bromel et al [18] and Rajathi et al [2]. On the other hand, the thyroid volume in the recent work declared out that the left thyroid lobe was slightly larger than that of the right one. That was in an agreement with the opinion of Bromel et al [18] and Rajathi et al [2].

It was a significantly to notify that, the anatomical point of view for the surgical interference to the thyroid gland in our work, depended up on the description of the anatomical structures that surrounded the thyroid lobes. The latter were deeply hidden on the deep face of the terminal insertion of the sternothyroid muscle. Each lobe was guarded dorsolateral by the carotid sheath; the latter comprised the common carotid artery, vagosympathatic trunk, recurrent laryngeal nerve, and tracheal lymph duct. Nearly arrangement was mentioned by Hullinger [4] and observed that the thyroid lobes were bounded ventrally by the sternocephalic and sternohyoid muscles. As well as the esophagus avoided the left carotid sheath from the thyroid lobe. A result, which was in contrary to the present study.

Regarding the mentioned characteristic features and according to the critical anatomicosurgical position of the thyroid lobes in the present findings. The surgical interference should be applied through the median broach, where turning off the sternohyoideus muscle laterally and reach the affected lobe medially. As the lateral interference between the sternohyoideus and sternothyroideus was risky, so the ventral branches of the first and second cervical nerves pass. In addition to saving the carotid sheath in both right and left sides.

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