



The Endocrine System



ANATOMY

☒ Sheet

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Number:

2

Subject:

The Thyroid gland

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Date: 20/6/2016

Price: 10

THE THYROID GLAND

In this lecture we are going to talk mainly about the anatomy of the thyroid gland with few points on the histology and embryology of the gland.

The pathology of thyroid gland is classified into either **functional** (hypo or hyperactive gland) or **anatomical**(enlarged gland), or **both** as in *Graves' disease* in which the gland is enlarged and hyperactive at the same time.

- **Note:** When you want to examine patient's thyroid gland, you should consider observing his/her neck from all sides to avoid misdiagnosis.



Figure:1

Enlarged Thyroid (Goitre)

Enlarged thyroid anterior view

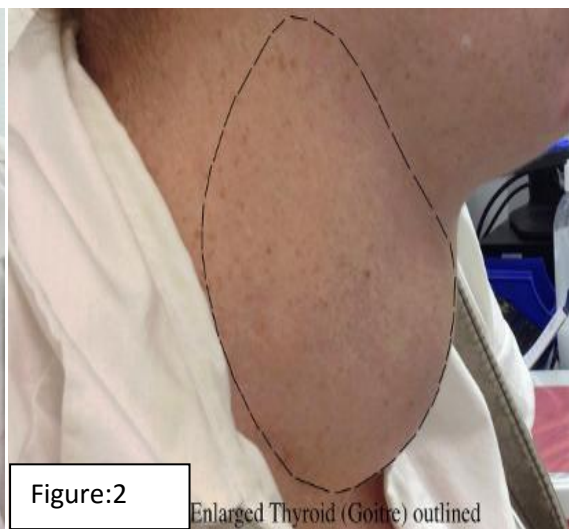


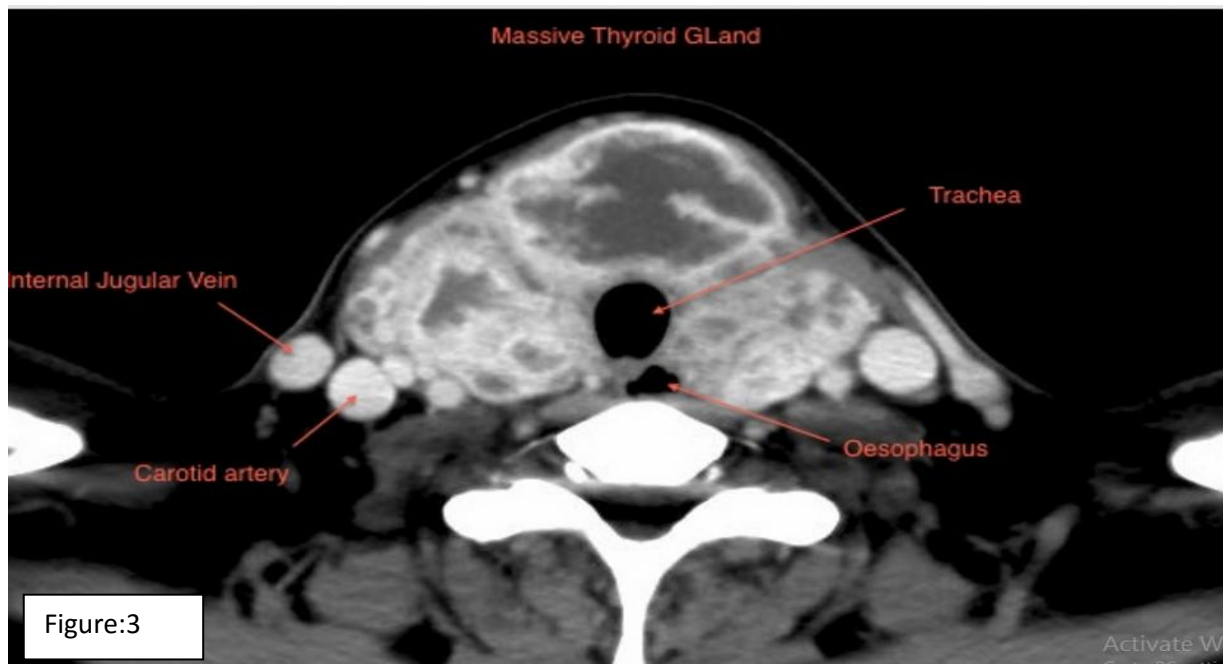
Figure:2

Enlarged Thyroid (Goitre) outlined

Enlarged thyroid side view

- The normal thyroid gland measures 25-30g (slightly heavier in women), and may reach up to one kilogram in cases of malignancy.

- **Case:** A 45 year old female patient showed up at the hospital complaining from swelling in the neck, obviously from her thyroid gland, the doctor showed us neck CT scan that clearly shows the enlarged gland.



-Most of the patients with *Goiter*(which is a swelling of the neck resulting from enlargement of the thyroid gland) and patients with cancer in the thyroid gland have **Euthyroid** which is typically functioning thyroid organ.

-Patients may show a huge thyroid swelling with retrosternal extension, in this case when the thyroid reaches retrosternal position it may cause compression and damage to other structures/organs in that area, most importantly the trachea and the esophagus so it may cause *Dysphagia* (swallowing difficulty)or *Dyspnea* (breathing difficulty), patients with huge goiter may show the image of *Bronchial Asthma* which goes away after operating on the enlarged thyroid, also it may compress major blood vessels such as the superior vena cava accompanied with bulging neck veins.

The anatomy of the thyroid gland:

The first surgeon to perform a thyroid surgery was Albucasis (أبو القاسم الزهراوي). Thomas Warton is the one who gave the thyroid its name (thyroid means shield).

The thyroid is found in the anterior and sides of the neck, and consists of three or four lobes, right and left lobes with the isthmus connecting the two lobes, and the pyramidal lobe which is the remnant of the Thyroglossal duct. This lobe is found in 50% of the population and 80-85% of the time it's on the left side, sometimes the pyramidal lobe stays connected to the hyoid bone by *the levator glandulae thyroideae* which is a fibrous or muscular band that connects both structures.

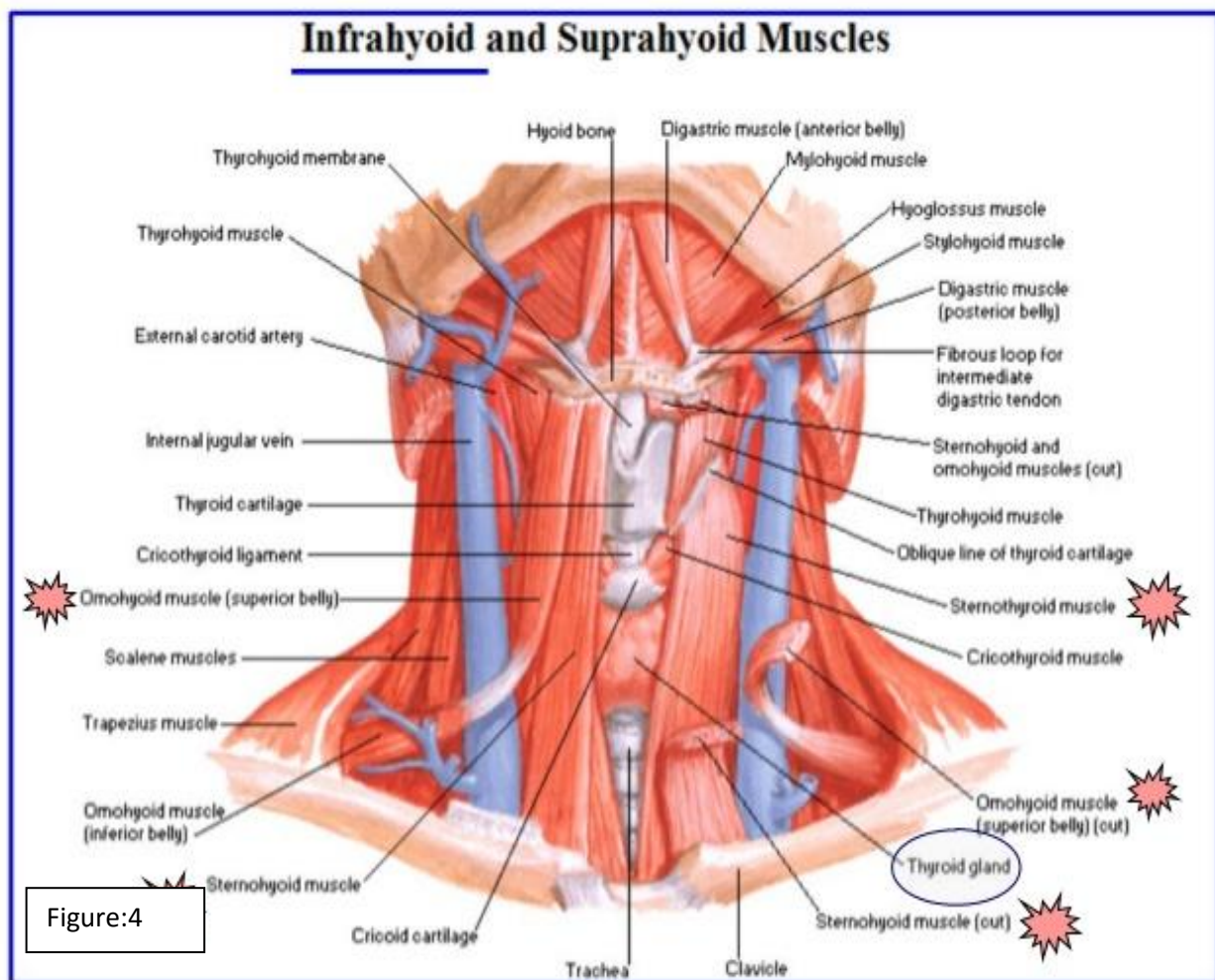


Figure:4

Note: The importance of the pyramidal lobe arises in cases of malignancy, it's very important to remove it to avoid recurrence of the cancer.

The most important structure to be preserved during surgery is the recurrent laryngeal nerve, as its damage may cause the loss of voice.

Remember that the recurrent laryngeal nerve supplies all the intrinsic muscles of the larynx with the exception of the cricothyroid muscle.

Keep in mind that, thyroid is the first endocrine organ to be formed in gestation, it usually starts to form during the 5th week of gestational age, after that it is formed in the foramen cecum of the tongue then it enlarges and starts to descend downwards going through the central portion of the hyoid bone, until it reaches its normal location which is the lower third of the anterior triangle of the neck.

Recall the borders of the anterior triangle of the neck:

Superiorly: The inferior border of the mandible.

Medially: The midline of the neck.

Laterally: The anterior border of the sternocleidomastoid muscle.

As the thyroid gland descends downwards it may stop at the level of hyoid bone or just below it and it doesn't reach its normal location, this anomaly is called

thyroglossal duct cyst or thyroglossal cyst, so the organ won't form.

In other cases thyroid descends normally but the thyroglossal duct doesn't get obliterated, and here the thyroid will form with persistent thyroglossal duct.

The treatment for this anomaly is to remove the cyst and most importantly to remove the central portion of the hyoid bone to avoid recurrence.



- The upper part of the thyroid lies over the thyroid cartilage that surrounds the larynx, also called the voice box.
- The lower part of the hyoid bone lies at the level of the 5th, 6th tracheal rings
- the isthmus (the part connecting the two lobes) lies at the level of the tracheal rings 2-4 and that's how you look for and locate the thyroid.
- Generally surgeries on the thyroid require a transverse incision called **neck collar incision** that goes through different layers of the neck;
 - 1- the skin
 - 2- subcutaneous fascia
 - 3- subcutaneous fat
 - 4- the platysma (well-developed muscle in males but not in females) that is supplied by the cervical branch of the facial nerve,
 - 5- pretracheal fascia that surrounds thyroid gland, trachea, esophagus and the strap muscles, being in the same compartment with the strap muscles is the reason why the thyroid moves during the process of swallowing.

Note: Any mass in the lower portion of the anterior triangle of the neck that moves with swallowing is the thyroid gland until proven otherwise.

The strap muscles (aka Infrahyoid muscles) are a group of four pairs of muscles in the anterior part of the neck responsible for the act of swallowing, (can be seen in figure 4) and they are:

- 1) Omohyoid muscle**, that originates from the shoulder, specifically from the upper border of the scapula and inserts on the hyoid bone, and it has anterior and posterior bellies separated by an intermediate tendon.
- 2) Sternohyoid muscle**, as the name implies it goes from the sternum to the hyoid bone, and it is the most superficial one in the group.
- 3) Sternothyroid muscle**, that goes from the sternum to the thyroid cartilage, underneath the sternohyoid muscle.
- 4) Thyrohyoid muscle**, between the thyroid cartilage and the hyoid bone.

These muscles collectively are called strap muscles and they have common innervation which is the *Ansa Cervicalis*.

Looking at the thyroid from the side, it lies over the thyroid and cricoid cartilage (the cricoid cartilage is the only complete ring and behind it is the narrowest area of the cervical esophagus), and there we can see the *recurrent laryngeal nerve* which is a branch from the vagus nerve, which itself originates from the cranium descends downward in the carotid sheath reaching the chest, at this point we can see differences in the right and left side, at the right side it loops over the brachiocephalic artery and ascends as the RIGHT recurrent laryngeal nerve, while at the left side it loops over the arch of aorta and ascends as the LEFT recurrent laryngeal nerve.

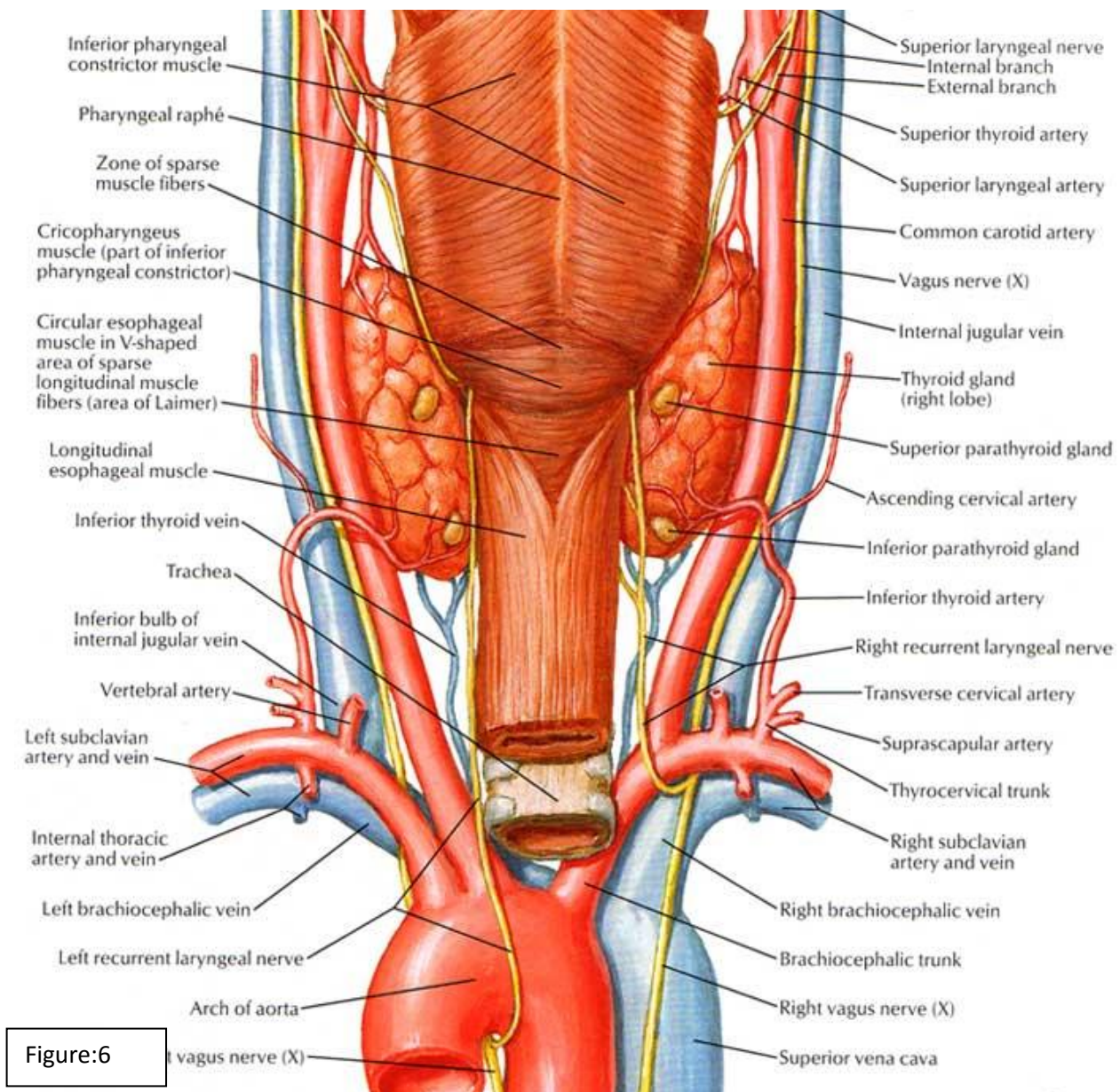


Figure:6

The recurrent laryngeal branch of the vagus nerve X (aka the inferior laryngeal nerve) supplies all the muscles of the larynx except for the *cricothyroid muscle*, which is supplied by the *superior laryngeal branch of the vagus nerve X*.

The larynx, commonly called the voice box is located inside the thyroid cartilage and it's responsible for breathing and it houses the vocal cords which vibrate in the presence of air to produce sounds, the larynx and the vocal cords are also supplied by the *recurrent laryngeal nerve* except the cricothyroid as we said.

The cricothyroid muscle pulls the vocal cords and makes them tense, exactly like guitar the higher the tension at the cords the higher the volume/pitch of the produced sound, so if the superior laryngeal nerve is injured specifically its external branch the muscle won't function and as a result the individual's quality of sound production is affected.

Posterior relations to the thyroid:

(Refer to figure 6.)

1) The pharynx which belongs to the GIT is located just posterior the thyroid, recall from last semester we talked about *zenker's diverticulum*, a pouch of the mucosa in a weak area of the pharynx.

Note that aneurysms or any damage to blood vessels or even trauma around the thyroid can damage the recurrent laryngeal nerve causing *Hoarseness*, which is a symptom not a disease itself where the patient presents with difficulty in speaking or in making sounds.

2) The *parathyroid glands* are small endocrine glands embedded in the posterior surface of the thyroid gland well that produce the parathyroid hormone, humans usually have four of these glands two on each side.

3) common *Carotid artery* and the *thyrocervical trunk* also lie posterior to the thyroid.



Arterial supply of the thyroid: (figure 7)

Keep in mind that neither the internal carotid artery nor the common carotid artery give branches in the neck, only the external carotid artery does.

The superior thyroid artery which is 1st branch from the external carotid artery, supplies the upper one third of the thyroid and half of the isthmus and is joined by the superior laryngeal nerve which supplies the vocal cords

The inferior thyroid artery which is a branch from the thyrocervical trunk (from the subclavian artery) also supplies the thyroid.

Pay attention to the relation between the inferior thyroid artery and the recurrent laryngeal nerve, in most cases the nerve passes deep to the artery.

On the posterior aspect of the thyroid gland, the inferior and superior thyroid arteries form a network that supplies the parathyroid, the superior thyroid artery supplies the parathyroid with higher amounts of blood compared to the inferior thyroid artery.

In addition to these two, a third artery participates in the blood supply to the thyroid and sometimes to the thymus gland is called *Thyroidea ima artery* which is a branch from the brachiocephalic artery or from the arch of aorta that supplies the lower part of the thyroid and may supply the thymus or the parathyroids, is present in 3-10% of the population, and because of the variations it may cause surgical complications.

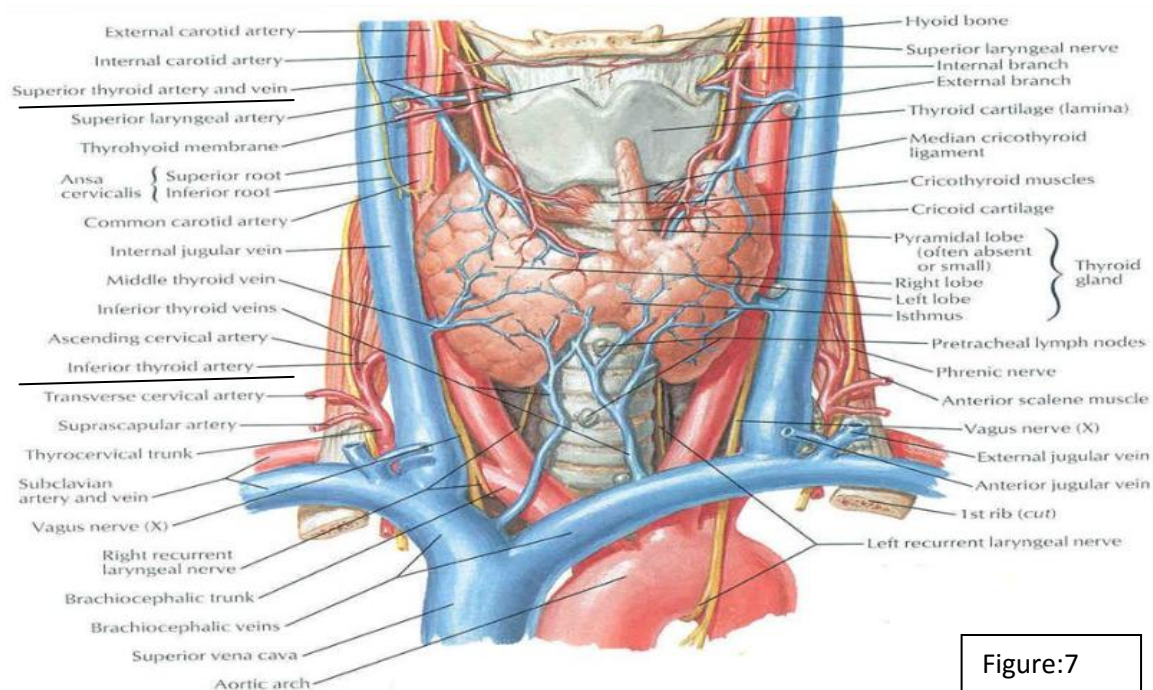


Figure:7

Venous drainage of the thyroid: (figure 7)

- All the veins in the neck will eventually drain into the internal jugular vein.

1) *Superior thyroid vein* that drains to either internal jugular vein or to the common facial vein that itself drains into the internal jugular vein.

2) *Inferior thyroid vein(s)* drain directly to the brachiocephalic veins.

3) *Middle thyroid vein* usually drains to the internal jugular vein

Note: when we want to perform a surgery on the thyroid, we tie the superior thyroid artery and the superior thyroid vein, we try to tie all the structures in that area such as the middle thyroid vein and we DON'T tie the external branch of the superior laryngeal nerve, because if its tied by mistake the patient will suffer from loss of high pitch sound, after that you can mobilize the thyroid and proceed in the surgery.

Lymphatic drainage of the thyroid:

Lymphatic drainage is very important to know, so we can detect metastasis and to know the stage of the cancer if present, which varies among patients.

Staging depends on the size of the tumor (T), lymph nodes (N) and metastasis (M)

Thyroid drains into :

1. *Prelaryngeal lymph nodes (aka delphian LN)* located around the larynx usually the first lymph node that cancer metastasize or the first sign of malignancy

2. *Pretracheal lymph nodes* located anterior to the trachea.

The most common cancer in the thyroid is called *papillary thyroid carcinoma*, and there are other types such as follicular, anaplastic which metastasize by the blood stream not by the lymph as in the papillary thyroid carcinoma, papillary thyroid carcinoma accounts for more than 80% of thyroid carcinomas and it's characterized with high survival rate (i.e. good prognosis).

3. The *paratracheal lymph nodes* located alongside the trachea

4. the *brachiocephalic lymph nodes* at the superior mediastinum.

5. the *deep cervical lymph nodes* along the internal jugular vein.

Note: some thyroid malignancies don't metastasize to lymph nodes , they may metastasize to bones as an example.

Histology of the thyroid gland:

Thyroid follicle is the main structure in the thyroid gland, that consists of a group of cells and usually these follicles store the thyroid hormone.

As we said earlier, the pathology of the thyroid can be functional or anatomical, *hashimoto's thyroiditis* is one of the functional disorders that affect the thyroid gland by destroying the thyroid follicles (autoimmune), the stored thyroid hormone in these follicles is released, so the patient presents with symptoms and signs of *hyperthyroidism* after that when the patient will show the image of *hypothyroidism* because the follicles are damaged and the hormone is not being produced anymore, this disorder is the most common cause of hypothyroidism.



Please make sure you use the figures in your textbooks.

THE END.