# Study of Management of Thyroid Swellings (A Study of 50 Pts With Thyroid Swellings)

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The normal thyroid gland is impalpable. The term goiter (Latin, Gutter = the throat) is used to describe generalized enlargement of the thyroid gland. It is a ductless gland. It is an unique gland among all endocrine glands; it is the largest of all endocrine glands, weighing about 25 grams It is amenable to direct physical examination due to its superficial location. The incidence of clinically apparent thyroid swellings in general population is 4-5%. Biosynthetic defects, iodine deficiency, autoimmune disease, nodular disease can lead to goiter, though by different mechanisms, especially MNG (Multinodular goiter) which is due to iodine deficiency is prevalent in India. Grave's disease and Hashimoto's thyroiditis are also associated with goiter. In addition, various forms of thyroid enlargement; physical examination should prompt further evaluation to identify its cause. More sensitive methods of detection such as CT scan, thyroid ultrasound and pathological studies reveal thyroid nodules, reserving ultrasound for monitoring nodule size or as an aid in thyroid biopsy. Otherwise, FNA (Fine Needle Aspiration) cytology should be the first step in the evaluation of a thyroid nodule. FNA (Fine Needle Aspiration) cytology has a good sensitivity and specificity. The distinction of benign and malignant follicular lesions is often not possible using cytology alone. In this study much emphasis is placed on the clinical presentation of thyroid swellings and the role of pathological investigations in the management of thyroid swellings. Treatment modalities of thyroid swellings depend on the clinical presentation, investigations and pathological evaluation of thyroid swellings.

The thyroid, an endocrine gland can be afflicted by various diseases of endocrine, inflammatory or neo-plastic origin. It is the nodular thyroid that is a diagnostic enigma for the clinician in view of the fact that a few are malignant and many benign. The incidence of malignancy in multi nodular goiter is 2 - 4% and 10-15% in solitary nodular goiter. Most thyroid cancers occur in euthyroid individuals; often an asymptomatic nodule is discovered by a physician during a routine physical examination or by the patient, while shaving or while applying makeup. Thyroid carcinoma patients present with goiters. In 25% cases there is lymph node enlargement, in 41% cases there is hoarsencess of voice, in 13% pressure or tightness, in 8%, neck pain and dysphagia in less than 2% of patients. Thyroid swelling can be diagnosed by various methods, like thyroid scientiscaning with radio-iodine I and technetium (99m Tc) per technete which can classify the thyroid nodule into cold (non-functional), warm (normal functional) or hot (hyperfunctional). Malignancy is present in 10-15% of cold nodules but is also present in 5% of warm and 2% - 8 % of hot nodules. Fine needle aspiration cytology and imprint cytology are presently valuable adjuvants to pre-operative screening in the diagnosis of thyroid nodule. Whenever there is doubt about diagnosis, intraoperative frozen sections may help to overcome the difficulty. Since thyroid neoplasia is common in this part of the world, this study was undertaken with a view to evaluate the management modalities of thyroid swellings with particular reference to their surgical line of treatment.

## ANATOMY

The thyroid gland occupies an important position in the center of the visceral compartment of the neck, lyring astride the trachea just above the thoracic inlet. It weight about 25gm. The gland has 2 lobes,shaped roughly like slender pears,hugging the anterikateral aspect of the cervical trachea from the level of the thyroid cartilage to the 5 or 6 tracheal rings. The right lobe is often larger than the left and the lobes

are joined together across the midline by a thin isthmus plastered quite firmlu to the anterior surface of the trachea, at the level of the trachea, at the level of the 2nd and 3rd tracheal rings. A variable sized but usually small, pyramidal lobe arises from the isthmus somewhere along its upper border near the midline. The thyroid gland us covered by fascia and the strap muscles and more laterally, it is tucked under diverging anterior boarders of the stern mastoid muscles.

**MUSCULO - FASCIAL COVERINGS :** The strap muscles are unsheathed by the general investing layer of cervical fascia and this unites them in the midline. These muscles are applied to the anterior surface of the gland, but separated from it by a loose condensation of fascia derived from the pre-tracheal fascia. This false capsule covers the glad which is enclosed by its diaphanous true capsule with its very rich blood supply, clearly visible just beneath its surface.

In the surgical approach to the thyroid gland the musculo fascial envelope is incised down in the midline which is relatively avascular and the 'space' between the two capsules of the gland is entered. This loose plane is easily developed and the gland exposed by retracting the strap muscles. The other important implication of the musculo fascial covering of the gland is that, at the end of thyroid operations the divided fascial envelop is re-sutured in the midline and this again closes the visceral space. If there is post-operative haemorrhage into this closed space, respiratory embarrassment from tracheal compression results and requires immediate release of the sutures to restore the airway.

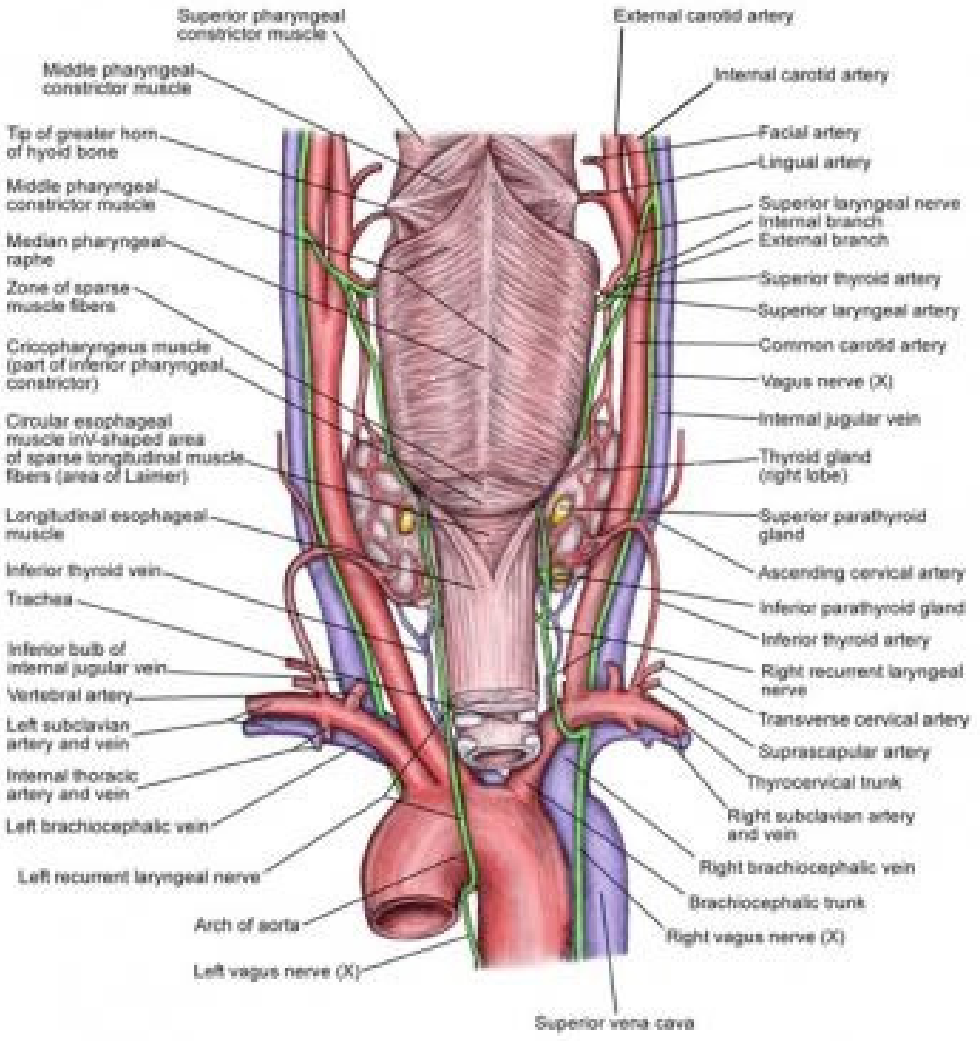
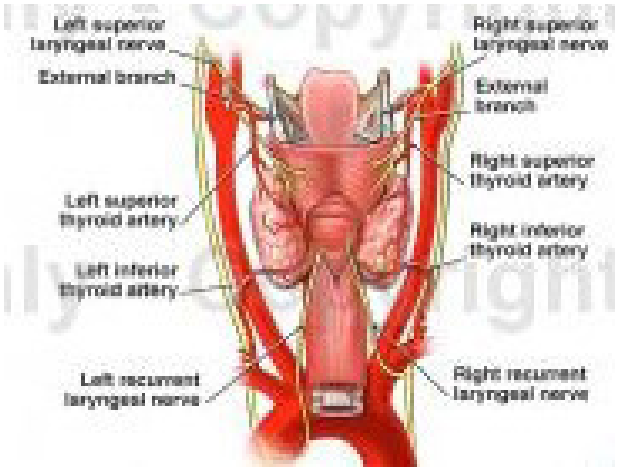



**FIG. NO. 1 – MUSCULO-FASCIAL COVERINGS**



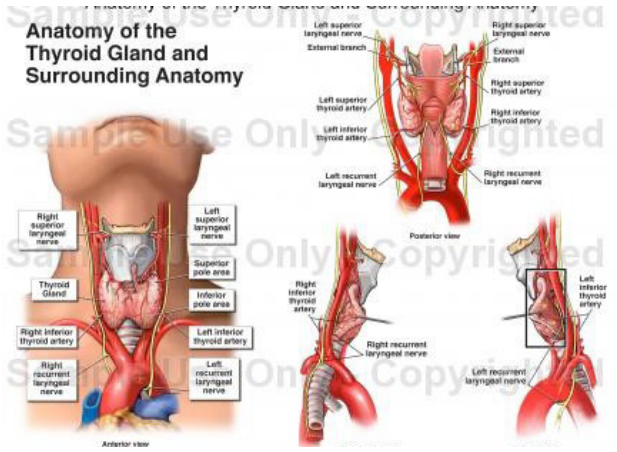




**FIG. NO. 2 AND 3 – ANATOMY OF THYROID GLAND**

**BLOOD SUPPLY :**

The thyroid is a highly vascular organ with a normal flow rate of 5 ml/gm/min. Perfect knowledge of its blood supply will facilitate any surgical procedure on it and make possible the minimization of haemorrhage.

Two pairs of arteries (superior and inferior thyroid artery), two pairs of veins (superior and inferior thyroid veins) and an inconstant artery (thyroidea ima artery) and vein (middle thyroid vein) serve the thyroid gland.

The superior thyroid artery is the first branch of the external carotrid artery arising from its lower anterior part, turning caudal and ending at the apex of the corresponding lobe of the thyroid by dividing into glandular branches.

The superior thyroid vein – accompanies the superior thyroid artery and ends in the internal jugular vein. At the anterior surface of the thyroid gland are prominent connections between superior and inferior thyroid veins.

A middle thyroid vein – which has no accompanying artery is often present, leaving the gland in its mid position to follow the outer border of the omo-hyoid muscle, cross the common carotid artery and terminate into the internal jugular vein. Applied anatomy is important because it is a short, thin walled vessel.

Inferior thyroid vein - inferior thyroid veins, frequently two or three in number arises from venous plexus in front of trachea, behind the sterno-thyroid muscle.

Thyroidea ima artery - the thyroidea ima artery is an uncommon variant of the blood supply to the inferior aspect of the thyroid gland. It is reported in up to 12% (1.5 – 12.2%) of individuals and can arise from :

- (right) brachiocephalic artery (aka innominate) – most common – (1.9- 10.5%)
- Right common carotid artery – (1.4 – 1.7%)
- Aortic arch
- Internal mammary artery

It is often associated with absent inferior thyroid arteries. When an anomalous artery arises from the subclavian artery directly, rather than from the thyro-cervical trunk, it is referred to as an accessory inferior thyroid artery, rather than a thyroidea ima artery.

Its clinical significance is that during surgery either on the thyroid or in the thoracic inlet, if unrecognized it can be a source of brisk and potentially difficult to control bleeding, as the vessel may retract behind the manubrium.

Inferior Thyroid Artery – The inferior thyroid artery is one of the blood vessels that supply the thyroid gland with oxygenated blood. It arises from the thyrocervical trunk which is a branch from the subclavian artery that arises from the aorta originally. The inferior thyroid artery lies in front of the vertebral artery and a muscle of the neck, the longus colli. It travels vertically and forms a curve medially before it enters the groove in the trachea-esophageal region.

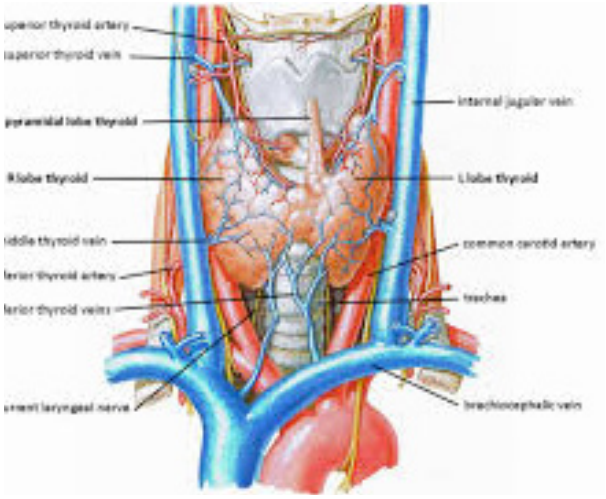


**FIG. NO. 4 – ARTERIAL SUPPLY OF THYROID GLAND**

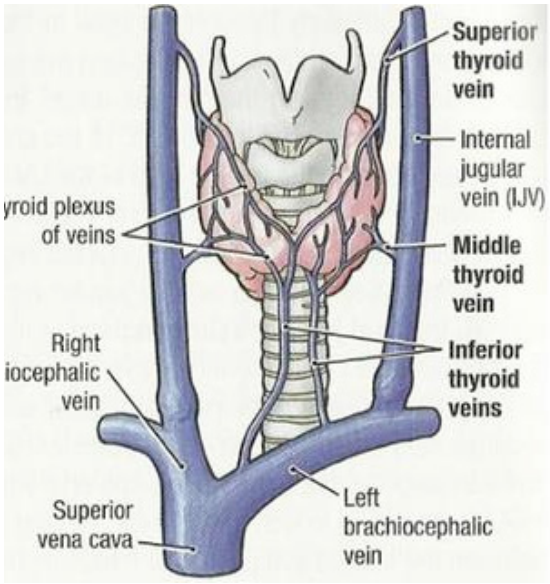



**FIG. NO. 5 – VENOUS SUPPLY OF THYROID GLAND**

The inferior thyroid artery thus comes to rest in a plane posterior to the carotid sheath. This is also behind the cervical ganglion that runs through the region resting upon the vessel. At the base of the thyroid gland the inferior thyroid artery branches into two supplying the posterior and inferior parts of the gland.

The inferior thyroid artery undergoes multiple branching to give rise to the inferior laryngeal artery, the tracheal artery muscular artery, ascending cervical artery and branches that supply the esophagus with blood.

The inferior thyroid artery is closely associated with the recurrent nerve, also known as the laryngeal nerve. This nerve also travels vertically in the same groove as the inferior thyroid artery and is bound at the superior end by the thyroid lobe. The position of the laryngeal artery with respect to the inferior thyroid artery is found to vary in a given population. The nerve is commonly found to be associated deeply or superficially between the branches of the inferior thyroid artery in a considerable number of cases.

Also it is a fact that the kind of relation that exists between the inferior thyroid artery and the laryngeal nerve on one side of the neck may be different from that on the other side. It is also possible that branches of the recurrent nerve may be present. This is considered a clinical challenge during surgery performed on the thyroid gland since caution must be exercised to not damage the nerve.

The inferior thyroid artery undergoes extensive anastomoses with the superior thyroid artery and the thyroidea ima that are also vessels that supply the thyroid gland with blood.

**LYMPHATIC DRAINAGE OF THYROID GLAND –**

Lymph from upper part of gland reaches upper deep cervical lymph nodes either directly and through the pre-laryngeal nodes. Lymph from lower part of gland drains to lower deep cervical nodes directly.

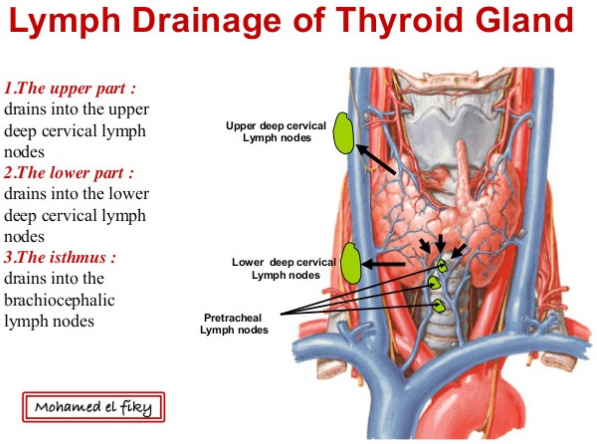



**FIG. NO. 6 – LYMPHATIC DRAINAGE OF TRYROID GLAND**

NERVE SUPPLY OF THYROID GLAND - These nerves are derived from the superior, middle and inferior cervical sympathetic ganglia.

They reach the thyroid gland through the cardiac and laryngeal branches of the vagus nerve, which runs along the arteries supplying the gland.

These postganglionic fibres are vasomotor and indirectly affect the gland through its blood supply.

**THE IMPORTANT CLOSE SURGICAL RELATIONS :**

These are recurrent laryngeal nerves, the external laryngel nerves and the parathyroid glands. Like all important relations, they should be recognized immediately and cared for respectfully.

1) Recurrent Laryngeal Nerve (RLN) : Innervates the intrinsic laryngeal musculature and provide sensory innervation to the glottis larynx. The RLN arises from the vagus at thelevel of the subclavian artery on the right and at the level of the aortic arch on the left. The nerves then turn suiperior-medial to run towards the trachea-esophageal (TE) groove, giving off esophageal and tracheal branches. The RLN ascends in close association with the trachea and esophagus but not necessarily in the true trachea – esophageal groove.

Weisberg et al stated that the right RLN is at a higher risk for stretch injuries during cervical spine surgeries because of its lateral position relative to trachea-esophageal groove. Typically the nerves may pass superficial or deep or between branches of the inferior thyroid artery (ITA). This variable branching pattern (of the nerves and the arterial system) limits the ability of the surgeon to rely solely on the ITA as a landmark to identify the nerve. The position of the nerve can be further influenced by the formation of the suspensory ligament of the thyroid gland (berry's ligament). It is the pre-tracheal fascia that covers the thyroid gland, condenses and attaches the thyroid to the upper two to three tracheal rings. RLN often passes through this layer on its way to enter the larynx.

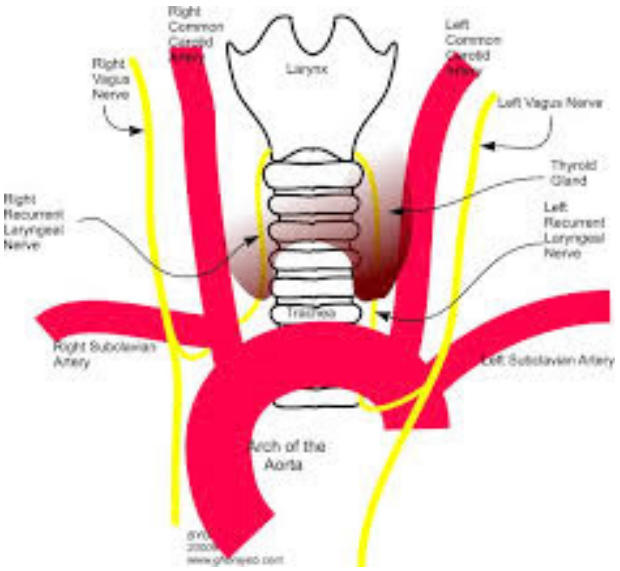



**FIG. NO. 7 - ANATOMIC RELATIONSHIPS OF THE THYROID GLAND AND RLN**

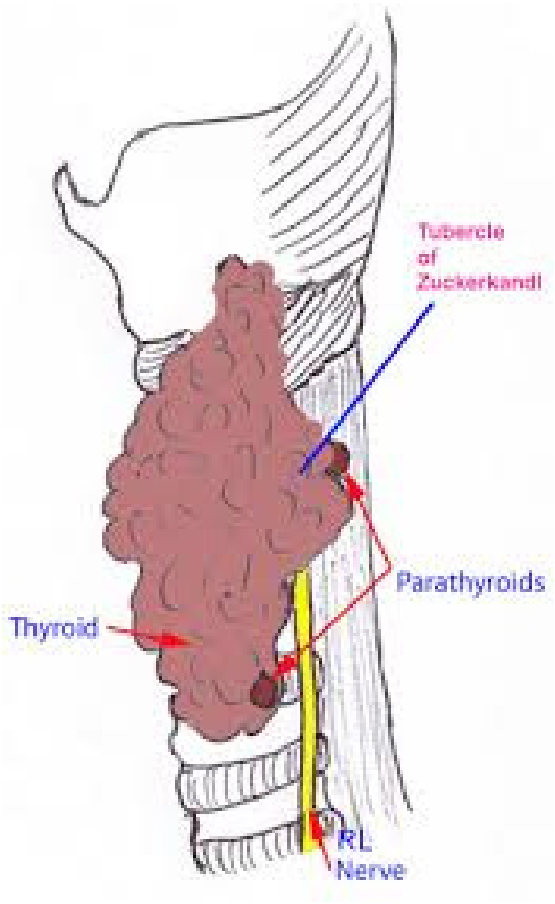



**FIG. NO. 8 – ANATOMIC RELATIONSHIPS OF THE THYROID GLAND AND RLN**

RLN may divide extra-laryngeally in 35 – 80% of anatomic dissections. The typical division includes an anterior (motor division) and a posterior (sensory division) but patterns with two to eight brnaches were described. The RLN will then enter the larynx posterior to the cricothyroid joint. An anomalous or non-recurrent nerve was reported in 0.3% to 0.8 % of cases. It arises directly from the cervical portion of the vagus at about the level of the larynx or the thyroid gland and enters the larynx posterior to the crico-thyroid joint without looping low in the neck. It commonly occurs on the right side but rare cases from left side also reported.

2) Superior laryngeal nerves : The superior laryngeal nerves (SLN) arise from the inferior (nodose) vagal ganglion and descend inferiorly deep to carotid system. Posterior to the internal carotid artery the SLN branches into an external branch (SLNE) and an internal branch.

Cerna et al described a classification system with 37% of nerves crossing the superior thyroid pedicle within 1 cm of superior thyroid pole (type 2). Regardless of the classification system, it is clear that the SLN travels in close proximity to the STA (Superior Thyroid Artery) (approximately 20% - 60% within one cm of STA and superior thyroid pole) and must be protected by the surgeon. Unilateral damage of the external laryngeal nerve may result in variable hoarseness or weakness of the voice and bilateral injury may add easy fatiguability in speaking or decrease of range volume or pitch. Another vulnerable structure, the cervical sympathetic chain is in close relation to the inferior thyroid artery, where the latter arches medially in front of the thyro-certical trunk. Damage to the chain may result in "Horner's syndrome". Damage usually occurs during the attempts to ligate the inferior thyroid as far laterally as possible to avoid damage to the recurrent laryngeal nerve.

3) Parathyroid glands : Most commonly 4 in number, arise from the third branchial pouch (inferior parathyroids) and fourth branchial pouch (superior parathyroids). The superior parathyroids are most consistently located (-80%) within 1 cm superior to the intersection of the RLN and ITA (Inferior Thyroid Artery) (near the cricothyroid joint). The inferior parathyroids are more variable in their location because of the longer migration with inferior thyroid and thymus. Approximately 45% - 61% are located inferior, lateral, or posterior to the inferior thyroid pole below the level of the ITA, 26 – 35% are positioned immediately inferior to the inferior thyroid pole in association with the cervical thymus and less than 1% are in the anterior mediastinum. The blood supply to the parathyroids is predominantly byway of the ITA system with some variable component from the STA.

From surgical view point, they are seen as small bean shaped structures with a yellow tan to careamel color. A medial to lateral dissection is utilized with the plane of dissection along thyroid capsule, which allows identification and mobilization away from the thyroid while preserving the blood supply.

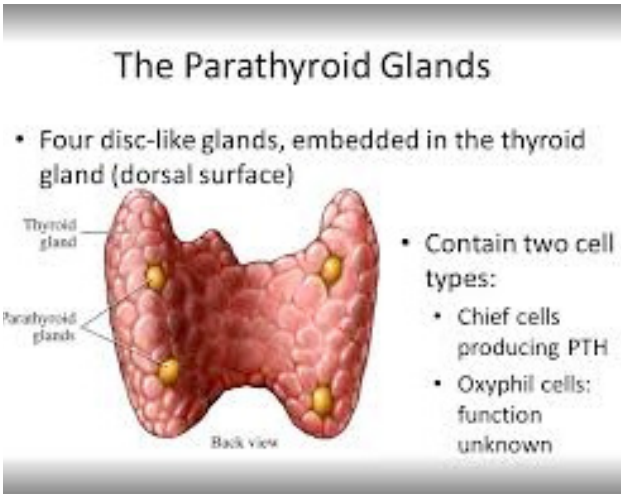



**FIG. NO. 9 – PARATHYROID GLAND**

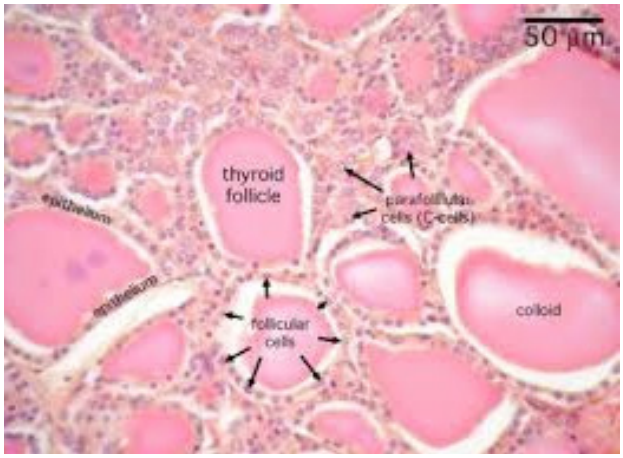



**FIG. NO. 10 – HOSTOLOGY OF THYROID GLAND**

## PHYSIOLOGY

The thyroid gland is responsible for the production of two families of metabolic hormones: the thyroid hormones- thyroxine (T4) and triiodothyrononine (T3) and hormone calcitonin. The thyroid follicle us the major production unit, as well as storage space for thyroid hormones. The effect of T3 and T4 is qualitatively very similar but differs dramatically in their time and course of action. They play an important role in the regulation of growth, heat production and cellular metabolism. The thyroid function is closely related to the iodine metabolism.

The C cells or parafollicular cells secrete a polypeptide hormone called calcitonin, which has a hypocalcemic effect.

Iodine deficiency can result in nodular goiter, hypothyroidism and cretinism, and possibly, the development of follicular thyroid carcinoma. In iodine excess, Grave's disease and Hashimoto's thyroiditis can occur.

**Regulation of Thyroid secretion :**

The main factors that determine the amount of harmone secreted by the thyroid gland are the thyroid stimulating hormone (TSH) secreted by the anterior pituitary and availability of iodine to the gland.

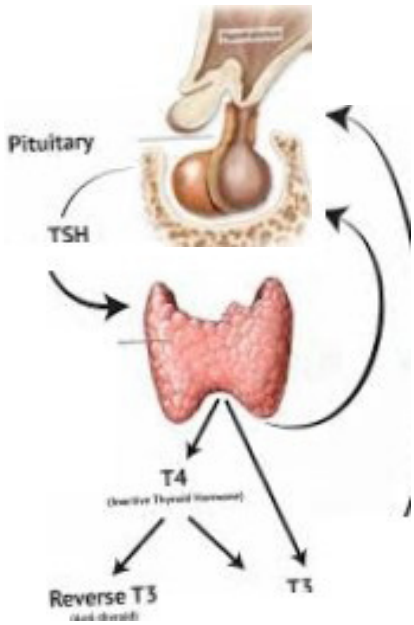



**FIG. NO. 11 – PHYSIOLOGY OF THYROID GLAND**

**Hypothalamic – pituitary – thyroid axis**

**Control of thyrotropin (TSH) secretion :**

1) **Hypothalamic control :** Thyrotropin releasing hormone (TRH) from the hypothalamus stimulates production and release of TSH.

2) **Thyroid hormone :** The thyroid hormones, in turn, inhibit the secretion of TSH at the level of pituitary and antagonize the effect of TRH by down regulating TRH receptors at the thyrotropic cells.

Each change in the T4 levels by 2, causes an inverse change in TSH secretion by 100. Thus, TSH is sensitive to minute and subclinical changes in T4 levels. This delicate relationship is the basis of obtaining thyrotropin levels as first line testing for thyroid dysfunction.

Other factors that affect are, somatostatin and dopamine which are physiologic inhibitors of TRH secretion, glucocorticoids decrease responsiveness to TRH and estrogens enchance responsiveness to TRH.

**Functions of thyroid hormones :**

1) Stimulates metabolism by increasing the ATP synthesis in cells, relative increase in the heat production and raises cardiac output.

2) Participates in co-enzyme reactions of the metabolic processes, so that normal development, growth and maturation are attained.

3) Adenohypophysis requires thyroxine for adequate synthesis of growth hormone.

4) Increase glycogen synthesis and peripheral utilization of glucose and thus potentiates insulin in this respect. Also increase glycogenosysis, gluconeogenesis and enhance rate of intestinal absorption of glucose and galactose. Overall in thyrotoxic patients, there is hyperglycemia and diminished sensitivity to exogenous insulin and converse changes occur in hypothyroidism. Thyroxine plays a vital role in glucose metabolism in RBC by influencing the synthesis 2,3- di-phosphoglycerate.

5) In physiological amounts it increases the synthesis of protein from accelerated synthesis of specific enzymes.

6) Increase the synthesis and degradation of lipids.

7) Required for synthesis of vitamin A from carotene. In hypothyroidism, the requirement of water soluble vitamins and vitamin D and E are increased.

8) Calcitonin regulates the calcium homeostasis.

## DISCUSSION AND CONCLUSION

Total 50 cases of thyroid swellings were evaluated in tertiary care hospital from January 2016 to November 2017; they were studied with respect to age, sex and duration of signs and symptoms, and investigated with routine haemogram, thyroid profile, fine needle aspiration cytology and USG. In all 50 cases surgical intervention were done and histopathological reports were obtained. Correlation was made between clinical diagnosis and final diagnosis (histopathology). An attempt was made to judge relative accuracy of signs and symptoms in clinical assessment of thyroid swellings, cyto-histopathological correlation and limitations of FNAC in diagnosis of thyroid swellings. Also study was done regarding preoperative role of ultrasonography, in management of thyroid swellings.

**Considering the results of present study we have come to certain conclusion :**

1) Commonest clinical presentation of thyroid swelling is solitary thyroid nodule (52%)

2) Maximum number of patients belong to rural areas (66.67%)

3) Category wise, it is more common in SC category. It may be due to Iodine deficiency.

4) Majority of the patients were in the age group of 31-40 years (38%)

5) In majority of the patients, duration of swelling prior to presentation was between 1 m – 1 year (30%)

6) None of patient in our study hand family history of similar complaints or carcinoma.

7) The incidence of malignancy in benign Thyroid swelling is 12 % - 15%.

8) Clinical diagnosis in combination with FNAC for benign disease has high accuracy. (90 – 100% accuracy)

9) In our study, USG (Ultrasonography) of neck was done in all (50) cases. On comparing USG neck results and final histopathological diagnosis, sensitivity of USG neck in diagnosing malignant cases was 75% positive (Those cases which were positive on USG were actually positive on HPE). In diagnosing benign and malignant conditions the sensitivity was 100%. Ultrasound also diagnoses multinodular goiter which is clinically not diagnosed.

Therefore, use of ultrasound along with FNAC will improve the diagnostic accuracy to a higher level. It also helps in management of STN. (Solitary Thyroid Nodule)

10) In our study FNAC was done in all 50 cases. There were 35 benign cases on FNAC. All these cases later, on confirmed to be benign histopathologically. (Those cases which were diagnosed by FNAC, were actually benign on Histopathological Examination) FNAC was able to diagnose 3 malignant cases out of total 4 malignant cases. So sensitivity to diagnose malignancy was 75%. Out of remaining 12 cases, 4 were suspicious (suspicious for malignancy) and 8 cases showed inadequate results on FNAC 4 cases which were labelled as suspicious for malignancy (i.e. FNAC was unable to differentiate between follicular adenoma and follicular carcinoma) all these 4 cases were confirmed to be follicular adenoma on HPE. Out of 8 cases which were labelled as inadequate results on FNAC (i.e. FNAC was unable to provide sufficient information for proper final diagnosis), 5 cases were of colloid adenoma, 2 cases were of hyperplastic thyroid nodule, and one case was confirmed to be papillary carcinoma on histopathological examination.

There were few limitations of FNAC which were noted in our study.

They are as follows :

1) Due to suspicious and inadequate results on FNAC, final diagnosis of thyroid swellings could not be made out in our study therefore for final diagnosis further evaluation was necessary.

2) FNAC was not able to differentiate between follicular adenoma and follicular carcinoma in study.

Besides few limitations of FNAC which

were noted in our study, the role of FNAC for diagnosis of thyroid swellings was very important because of following reasons –

I) It avoids frozen section due to high sensitivity and specificity for diagnosing benign and malignant lesions.

II) It has got a high positive predictive value for diagnosing benign lesion.

III) It is an OPD procedure. Admission in ward not required.

IV) The results of FNAC are obtained within 24 hrs.

11) In our study all thyroid swellings were subjected to surgery as the modality of treatment. Out of 50 cases, 19 patients required preoperative medical treatment (all these cases were subjected to surgery after they have attained euthyroid state) by antithyroid, drugs and thyroxine. Most common surgery performed was Near total thyroidectomy, followed by total thyroidectomy and hemithyroidectomy. RLN (Recurrent laryngeal nerve) was identified in all cases. Parathyroid insufficiency (hypocalcemia) developed in 5 patients, later on it recovered in 1-2 weeks, followed by change in voice in 2 patients, Postoperative period was uneventful in all cases.

12)The ideal test should have a sensitivity of 80% and specificity of 100% . The closest method to ideal test is, thus, FNAC which gives sensitivity of 76% and specificity of 100%. Also fine needle aspiration biopsy is safe, accurate, and cost-effective. The procedure has a central role in the management of thyroid nodules and should be used as the initial diagnostic test.

**A combination of FNAC and USG as diagnostic modalities gives optimal results and therefore avoid mismanagement.**

Therefore, we conclude that all patients with Thyroid swellings should be subjected to Fine Needle Aspiration Cytology (FNAC) and Ultrasonography of Thyroid Gland (USG – Thyroid) in preoperative period.