COMPARATIVE STUDY OF FNAC AND HISTOPATHOLOGY IN SOLITARY THYROID NODULE

By

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In

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Dr. Santosh V Motagi

ABSTRACT

INTRODUCTION:

Solitary thyroid nodule is defined clinically as the localized thyroid enlargement with apparently normal rest of the gland. Solitary thyroid nodule is a common entity. Majority of these nodules are benign. The main goal of evaluating these nodules is to identify nodules with malignant potential. The role of FNAC in distinguishing the malignant from benign nodules has proved to be a boon. In this study, the clinical presentation with relevant symptoms and signs along with appropriate diagnostic tools like serum thyroid profile, Ultrasound Neck, FNAC and the adequate medical therapy along with required Surgical therapy after which a conclusive histopathology report should help determine the best possible outcome of Solitary Thyroid Nodule.

AIMS AND OBJECTIVE:

To evaluate a patient with solitary thyroid Nodule (STN) in terms of : Age and sex distribution of STN, their clinical presentation and their relation to malignancy.

To compare and co-relate the findings of FNAC with histopathology of resected specimen.

MATERIAL AND METHODS:

This was a Prospective study conducted at BLDEU's Shri B.M. Patil Medical college Hospital and Research Centre, Vijayapur from Oct 2015 to June 2017 and included 60 patients with solitary thyroid nodule. Patient underwent detailed pre-tested questionnaire, clinical examination, routine investigations with specific

investigations like thyroid profile, ultrasound of neck and preoperative FNAC was compared with postoperative histopathology of resected specimen.

RESULTS:

The study group included 60 patients aged between 15 to 60 years with a mean age 38.1 years, with majority (30%) of these patients were between the age group of 21-30 years followed by 28.3% in age group of 31-40 years, least (5%) was in age group of less than 20 years, with female preponderance i.e. (86.7 %) than in males (13.3%). Right lobe(56.7%) of thyroid was most commonly involved than the left lobe(43.3%), it was noted that there was no involvement of isthmus in this study. A maximum of 48.3% had thyroid size of 2x2cms, followed by 25% with 4x4cms, least was 1.7% with 1x1cm.

Out of 60 patients, 93.3% of cases showed nodular colloid goitre, 3.3% of cases showed calcifications with necrotic cells and dysplastic cells s/o papillary carcinoma, 3.3% cases showed nodular hyperplasia. However it differed in 3.3% of cases where diagnosis by FNAC was found to be papillary carcinoma of thyroid and on following final histopathological study was found to be nodular colloid goitre. Hence the diagnostic accuracy of FNAC for solitary thyroid nodules in this study was 96.67% .

CONCLUSION:

The solitary thyroid nodule is a common clinical condition in general population. FNAC done pre operatively and the intra-operative findings co-relate with post operative histopathological report in the diagnosis of Solitary Thyroid Nodule. A malignant FNAC diagnosis should be viewed with caution as false positive results do occur and these patients should be posted for surgery and confirmed by histopathological examination.

LIST OF ABBREVATIONS

TSH	Thyroid stimulating hormone
Da	Dalton
BMI	Body Mass Index
FNAC	Fine needle aspiration cytology
cms	centimetres
FNAB	Fine needle aspiration biopsy
DM	Diabetes Mellitus
HTN	Hypertension
FSTN	Functioning solitary thyroid nodule
USG	Ultrasonography
T_3	Tri-iodothyronine
T_4	Tetra-iodothyronine
^{99m}Tc	Technetium-99m Pertechnetate
APUDs	amine precursor uptake and decarboxylation
HPR	Histopathology Report.
DOS	Date of surgery

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF GRAPHS

INTRODUCTION

Solitary thyroid nodule is defined clinically as the localized thyroid enlargement with apparently normal rest of the gland. Solitary thyroid nodule is a common entity. Majority of these nodules are benign. The main goal of evaluating these nodules is to identify nodules with malignant potential.[19]

The prevalence is 4% by palpation, 19 to 67% by ultrasound examination, 50% in autopsy series. Clinically non palpable nodules are detected by ultrasonography, which increases nodule prevalence from 30% in patients younger than 50years of age to 50% in patients greater than 60years of age. Although around 95% of thyroid nodules are benign in nature, the major concern is whether it is malignant nodule. However, there are certain historical, laboratory and radiological features which raise the suspicion for malignancy.[2]

By and large there are five categories of thyroid nodules- hyperplastic, colloid, cystic, inflammatory and neoplastic. The basic step in evaluation begins with differentiating medical from surgical disease. Surgery is indicated when there is suspicion of malignancy, compressive airway obstruction, hyperthyroidism and for cosmetic reasons.[19]

Thus, evaluation of a thyroid nodule is a complex process, influenced by several factors and hence a systematic and methodical approach is needed. It begins with taking a detailed history, performing the clinical examination and then choosing appropriate investigations to arrive at a diagnosis.

OBJECTIVE OF STUDY

To evaluate a patient with solitary thyroid Nodule (STN) in terms of :

Age and sex distribution of STN, their clinical presentation and their relation to malignancy.

To compare and co-relate the findings of FNAC with histopathology of resected specimen.

REVIEW OF LITERATURE

Historical aspects :

The history pertaining to the thyroid disease has been admirably summarised by Rolleston. According to him Galen in his De Voce briefly described the gland. Vesalius in 1543 was the first to give a fuller description. The thyroid gland, previously referred to as "Laryngeal" gland was so named by Whaston in 1656 because of either its own shield-like (Thyreos : shield) shape of thyroid cartilage, with which it is closely associated.[20]

Until 1884 the gland was proposed a "Vascular shunt" cushioning the brain against sudden increase in blood flow. One of the oldest references to thyroid disorders is attributed to the legendary Chinese emperor Shen-Nung (2838-2698) who, in his book "Pen,Ts "as Tsing" is said to mention the seaweed "sargassum" as our efficacious remedy against goitre. Veso clico (1543) thought the gland to be made of two parts one on each side of trachea. Eustacerisn (1592) first described the isthmus.[21]

The first successful thyroidectomy on record appears to have been performed about A.D. 952 in Zehra, by Albucasis. **Theodore Kocher** perfects the thyroid surgery and did nearly 8000 operations on thyroid . Kocher advocated gentle, meticulous surgery with sparing parathyroids and anatomic operations of recurrent laryngeal nerve. For his monumental contributions Kocher was awarded the Nobel prize in 1909 and he is the first surgeon to get Nobel Prize. Halsted (1920) improved Kocheri technique and described local anaesthetic techniques. Surgery of thyroid has received much attention in the hands of anaesthetic Lahey, Crile and others. In the year 1883 Wolfler noted that adenoma arised from the interfollicular foetal cell rests. In 1924, Graham described the criteria for

the diagnosis of malignant thyroid. Cole (1946) and Brauson (1949) reported the incidence of malignancies in solitary nodules.[21]

Boey J, Hsu C, Wong J, Dng GB[22]. Wrote in 1982 about fine needle aspiration versus drill-needle biopsy of the thyroid nodules: a controlled clinical trial. Percutaneous needle biopsy by two dissimilar methods were evaluated in a prospective controlled study of 167 consecutive patients with thyroid nodule. Fine needle aspiration was superior to high-speed drill-needle biopsy because of its higher diagnostic yield (93.9%). When a sample adequate for diagnosis was obtained, the accurate rate of both methods was comparable. Diagnostic error were due to insufficient samples, difficulty in interpreting hypercellular adenomas and geographic sampling problems. In the detection of thyroid cancer, neither technique alone appears completely adequate because of occasional false negative errors. The choice of patients for surgery be supposed to depend on clinical parameters as well as the findings of fine-needle aspiration of thyroid nodules.

Sabel MS, Stare ED, Gianakakis LM, Dwarakanathan S, Prinz RA[23]. In 1997 wrote an article about use of fine-needle aspiration biopsy and frozen section in the management of the solitary thyroid nodule. This study evaluates the indication frozen section (FSx) in the treatment of the solitary thyroid nodule. The Charts of 561 patients who undergo either FNAB, Frozen section, or both. Results were compared to the final diagnosis to evaluate their effectiveness in predicting malignancy.

The sensitivity and specificity for FNAB alone (162 patients) were 86% and 91%, respectively, and for Frozen section (494 patients) 79% and 99%, respectively. The routine use of Frozen section with diagnostic FNABs did not improve the accuracy over

either test alone. Sensitivity, Specificity and accuracy were essentially unchanged when the use of FSx was limited to just atypical FNAB but dropped significantly when FSx was not used.

Once results of FNAB and Frozen section are interpreted as benign or malignant, both are highly accurate predictors of malignancy. Custom use of Frozen section and FNAB does not improve the sensitivity or specificity in the recognition of malignancy over that of either examination alone. Frozen section proved useful in determining the extent of operation only when results of the FNAB were atypical.

Sarda AK, Gupta A, Jain PK, Prasad S[24], in 1997 wrote an article about management options for solitary thyroid nodules in an endemic goitrous area. In a study of 546 cases of Solitary thyroid nodules in an endemic area is presented. None of the evaluating procedures could effectively isolate benign from malignant disease. Of 508 cases considered clinically to be benign, 42 harbored malignancy on histological examination whereas of the 38 cases assumed clinically to be malignant, 21 were histologically benign. ^{131} I-Thyroid scanning too lacked sensitivity in detecting malignant nodules since the prevalence of malignancy in cases which were 'cold' (44/316) was not considerably different from that between the 'uniform' cases (15/142). Fine-needle aspiration cytology, even though the majority of sensitive and specific evaluating modality, did not reduce the number of operations for solitary thyroid nodules nor did it add to the incidence of malignancy among the operated cases, because of its restrictions in differentiating benign from malignant follicular neoplasms. The conditions under which surgery was indicated are described.

Zelman Ovitz F, Gross JL[25]. Studied about FNAB in 1998 The results of cytopathological reports from fine-needle aspiration biopsy are precise of the thyroid pathology in patients with functioning solitary thyroid nodules (FSTN) are not soundly defined. This is an important matter, once this procedure is the first step in nodule evaluation. This study evaluated FNAB findings and correlated these findings with histopathology in patients posted to thyroidectomy. Eleven clinically euthyroid female patients (age range : 19 to 47 years) with FSTN, adequate specimens from FNAB and negative anti-thyroid antibodies were studied. Seven patients had autonomous nodules. The cytopathological findings were of follicular pattern suggestive of neoplasia in one case where the histopathological examination established a follicular adenoma. In all other 6 autonomous cases, the smears were suggestive of colloid goiter in all except one who presented a follicular adenoma. Four patients had functioning thyroid nodules that suppressed their ^{131}I uptake after receiving T_3. The cytopathological findings were considered malignant in one case surgically established to be a papillary carcinoma. In all other 3 non-autonomous cases, the smears were redolent of colloid goiter and they had surgery due to compressive symptoms (n= 1), aesthetic reasons (n= 11) or increase in nodule volume (n=1). The histopathological results established colloid goiter. FNAB was an accurate predictor of thyroid pathology in FSTN without false-positive results in the present study as a conclusion.

Bennedbaek FN, Hegedus L[26]. in 2000 wrote an article about management of the solitary thyroid nodule: results of a North American survey. The current survey evaluated present trends in the management of nontoxic solitary thyroid nodule by specialist endocrinologist in North America and compared their results with a similar European

Thyroid Association Survey. A questionnaire was circulated to all clinical members of the american thyroid association. An index case (a 42year old woman with a solitary 2 x 3cm thyroid nodule and no clinical suspicion of malignancy) and 11 variations were provided to evaluate how much alteration would affect management. One hundred and seventy-eight members replied and 142 responses were retained for analysis, corresponding to a response rate of 43% of clinically active members. Based on the index case, basal serum TSH was the routine choice of 9%, and serum T_4 and / or free T_4 were included by 61% of the respondents. Thyroid peroxidase antibodies and serum calcitonin be included by 30% and 5%, respectively. Thyroid scintigraphy was used by 23% ^{123}I, 63% ^{99m}Tc, 31% ^{131}I, 6%, Ultrasonography was used by 34%. Fine needle aspiration biopsy was routinely used by all and it was guided by palpation in 87%. Based on the individually chosen diagnostic tests indicating a benign solitary thyroid nodule in a euthyroid subject, L-T_4 treatment was advocated by 1%. The factors suggesting thyroid malignancy (e.g. rapid nodule growth and a large nodule of 5cm) direct considerable number of clinicians (40-50%; $P < 0.00001$) to disregard biopsy results and to choose a surgical strategy. However, North American endocrinologists greatly depend on fine needle aspiration biopsy outcome. Compared to the European Thyroid Association review, North American endocrinologists use imaging (scintigraphy, 23% vs. 66% ($P<0.00001$); Ultrasonography, 34% vs. 80% ($P < 0.0001$) and serum calcitonin (5% vs.43%; $P< 0.00001$) frequently. A nonsurgical strategy prevails in North America, and regardless of controversies on the effect of T_4, this treatment is supported by more than 40% in both Europe and America.

Gupta M, Gupta S, and Gupta V[19]. in 2010 studied about Correlation of FNAC with histopathology in the diagnosis of solitary thyroid nodule.

A total of 75 patients with solitary thyroid nodule were recognized: 6 (8%) were male and 69 (92%) were females. Patients age ranged from 22 to 58 years with mean age of 38.7 years. 51 (68%) patients were from plain areas and 24 (32%) were residents of hilly areas. Most Common presentation was neck swelling in 60 (80%) of the patients. Duration of complaints range from six days to twenty years and mean duration was 1.7 years. FNAC results revealed 39 (52%) cases as colloid nodular goitre, 12 (16%) as follicular neoplasm, 9 (12%) as papillary carcinoma, 6 (8%) as Hurthle cell lesions, 6 (8%) as benign cystic lesions, and 3 (4%) cases as suspected of malignancy. Histopathological examination of excised specimens showed 42 (56%) cases as colloid nodular goitre, 12 (16%) as follicular adenoma, 12 (16%) as papillary carcinoma, 3 (4%) as Hurthle cell adenoma, 3 (4%) as hurthle cell changes with capsular invasion and, 3 (4%) as Hashimotos thyroiditis.

Comparison of FNAC with histopathological findings was conducted. 45 cases were diagnosed as colloid nodular goitre and benign cystic lesions by FNAC. 39 of these cases were non-neoplastic lesions, 3 as papillary carcinoma and 3 as follicular adenoma in histopathological examination.

Prakash H Muddegowda , Jyothi B Lingegowda , Hiremath S S, Kishanprasad H L , Nagesh T S , Joshua D[2] done a study on Panorama of solitary thyroid nodule in 2012 : There were 162 patients with STN and FNAC was performed. Patients in the fourth decade of life constituted the major group (29.62%) with females out numbering the

males in a ratio of 1.7:1. The duration of the lesions varied from 6 months to ten years and all the cases were in euthyroid state. Out of 162 cases, 138 (85.18%) were diagnosed as non-neoplastic lesions, whereas the rest 24 (24.82%) were diagnosed as a neoplastic entity. Amongst the 138 non-neoplastic lesions, the commonest lesion was nodular colloid goitre, seen in 56 cases. Hashimoto's thyroiditis was the commonest type of thyroiditis noted. Follicular neoplasm was the commonest neoplasm encountered followed by papillary carcinoma. In the present study histopathology study was possible in 70 cases. Specimens received were lobectomy done in 35 cases (50%) followed by hemi-thyroidectomy in 25 cases (35.71%), subtotal thyroidectomy in nine cases (12.86%) and total thyroidectomy was done in one case (2.43%). Cytohistopathological correlation in the present study showed 36 cases (51.42%) having similar histopathological diagnoses as cytological diagnoses. Amongst non-neoplastic lesions diagnosis remained same in 27 (47.36%) patients. Among neoplastic lesions diagnosed by cytology, histopathological correlation was possible in 13 cases. The histopathological diagnosis remained the same in nine cases (69.23%).For neoplastic lesions statistical study showed 3 false positive reports and 28 false negative reports, whereas for malignant lesions there were no false positive reports but 3 false negative reports.

DEVELOPMENT OF THE HUMAN THYROID GLAND[27]

The epithelium of pharyngeal region gives origin to a number of endocrine glands. Of these, the thyroid is exclusively a derivative of the endoderm lining the pharynx.

ORIGIN OF THYROID **:**

The thyroid gland appears at about the fourth week as an evagination of the pharyngeal endoderm from the ventral wall of the pharynx in the midline immediately beyond the tuberculum impar between the anterior and posterior tongue rudiments. The wall of the distal portion of this diverticulum does not share to the same extent in this growth. So, this diverticulum becomes flask shaped. The lumen of this vesicle communicates with the pharyngeal lumen.

GROWTH OF MEDIAN THYROID AND ESTABLISHMENT OF THYROGLOSSAL DUCT :

As the thyroid diverticulum increases in size, the narrow stalk attaching it to the pharyngeal floor elongates. The distal part of the diverticulum gradually acquires a bi-lobed shape by differential intosis of the constituent epithelial cells. The whole structure now takes an inverted 'Y' shape.

CAUDAL MIGRATION **:**

The median thyroid complex migrates caudally due to the complicated changes which occur during the descent of heart and establishment of the embryonic neck. The caudal movement is accompanied by elongation of the stalk which can now be called

thyroglossal duct. Because of elongation, this duct loses its lumen and become markedly attenuated.

FRAGMENTATION OF THYROGLOSSAL DUCT **:**

The loss of continuity of the duct most frequently takes place first at about the middle of its course. The fragmentation then extends proximally towards the tongue and distally towards the thyroid isthmus. The distal progress of retrogressive changes in the duct may not reach the isthmus. This persistent portion of the distal end of the duct differentiates into thyroid tissue, becoming the pyramidal lobe.

THE PROBLEM OF LATERAL THYROIDS :

Before the fourth pouch separates from the pharynx, the ventral component of the fourth pouch approaches the dorsal surface of the expanding lateral lobes of median thyroid primordium. With further growth of ventral compartment and of the lateral lobe the two structures fuse.

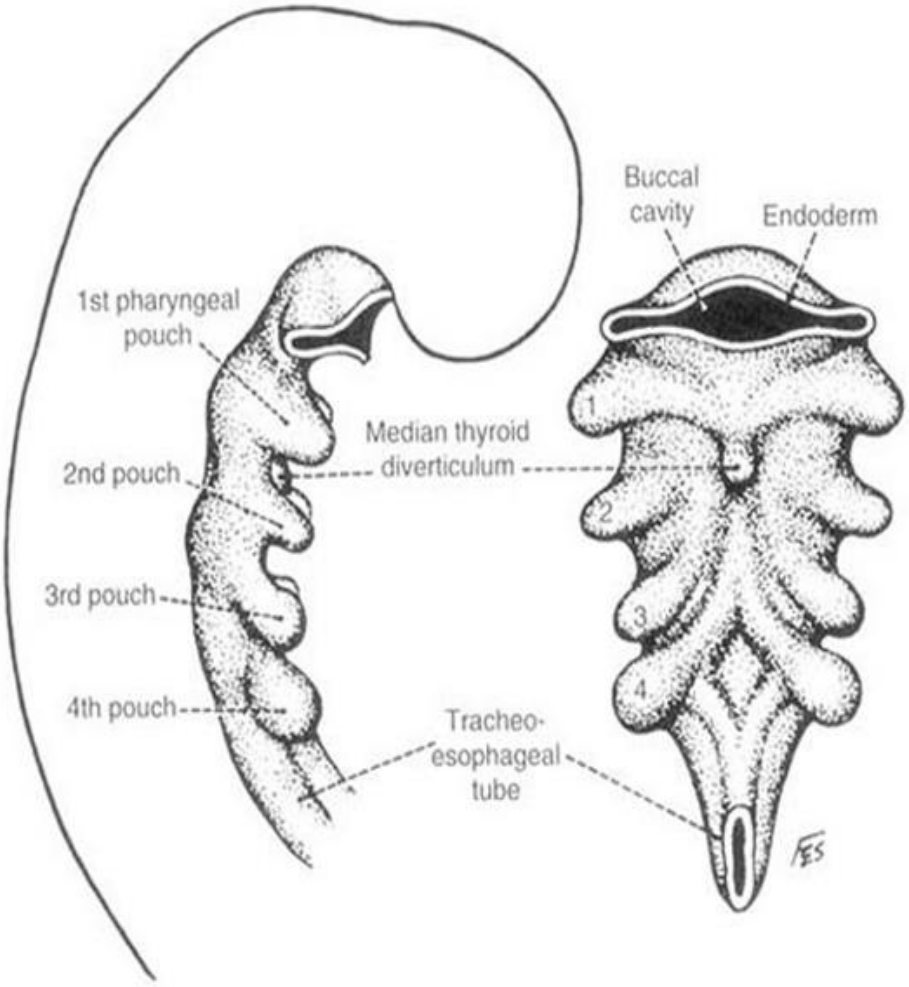


Figure 1. Development of Thyroid gland[27]

PARAFOLLICULAR CELLS :

During differentiation and fragmentation of the epithelial cords, some of the cells get isolated. Many investigators have considered that they may give origin to the so called para follicular cells or macrothyrocytes.

The concept of APUD cells series classifies the para follicular cells as the APUDs. So, theses cells are thought to have their origin from the neural crest.

CONNECTIVE TISSUE AND BLOOD VESSELS **:**

Inside the gland the arterioles branch extensively so that each follicule is surrounded by a vascular plexus. A reticular basement membrane separates the vessels from the follicular cells. The differentiation of connective tissue results in the subdivision of the gland into separate lobules. Relatively late in the development a surface capsule appears.

ANOMALIES[27] **:**

1. Absence of the isthmus with pyramidal lobs in each lateral lobe.
2. The pyramidal lobe is arisen from the junction of the left lobe with the isthmus.
3. The pyramidal lobe is arisen from the junction of the right lobe with the isthmus.
4. Accessory thyroids may be located on the trachea, thyroid cartilage or hyoid bone, under and above the hyoid bone
5. Accessory thyroid gland attaches the cricothyroid muscle and the pyramidal lobe reduced.
6. Persistent thyroglossal duct in an adult.

Failure to descend properly leaves the thyroid located in the base of the tongue called as Lingual thyroid.

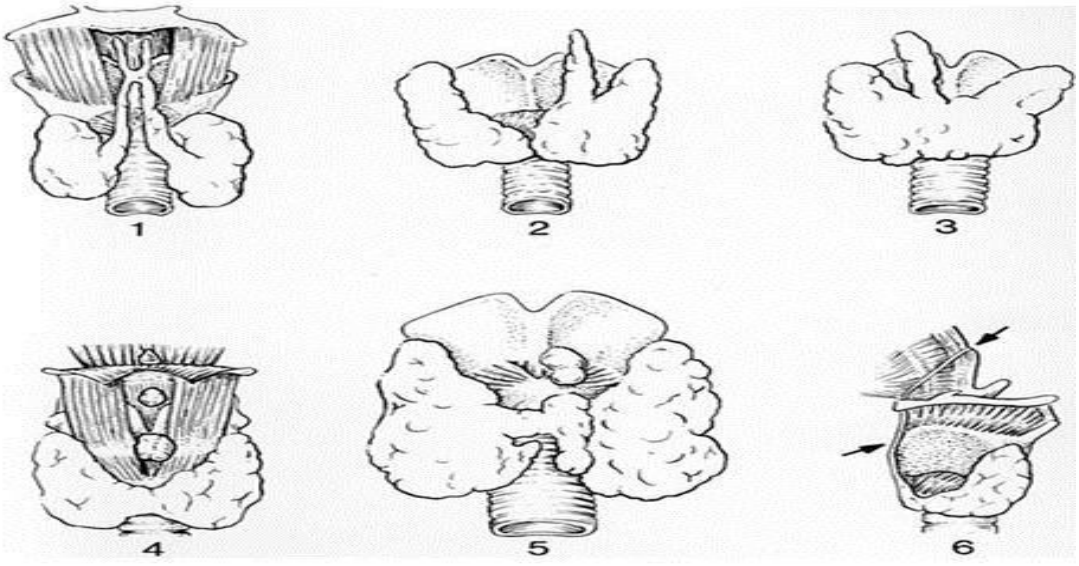


Figure 2. Anomalies of Thyroid Gland Development[27].

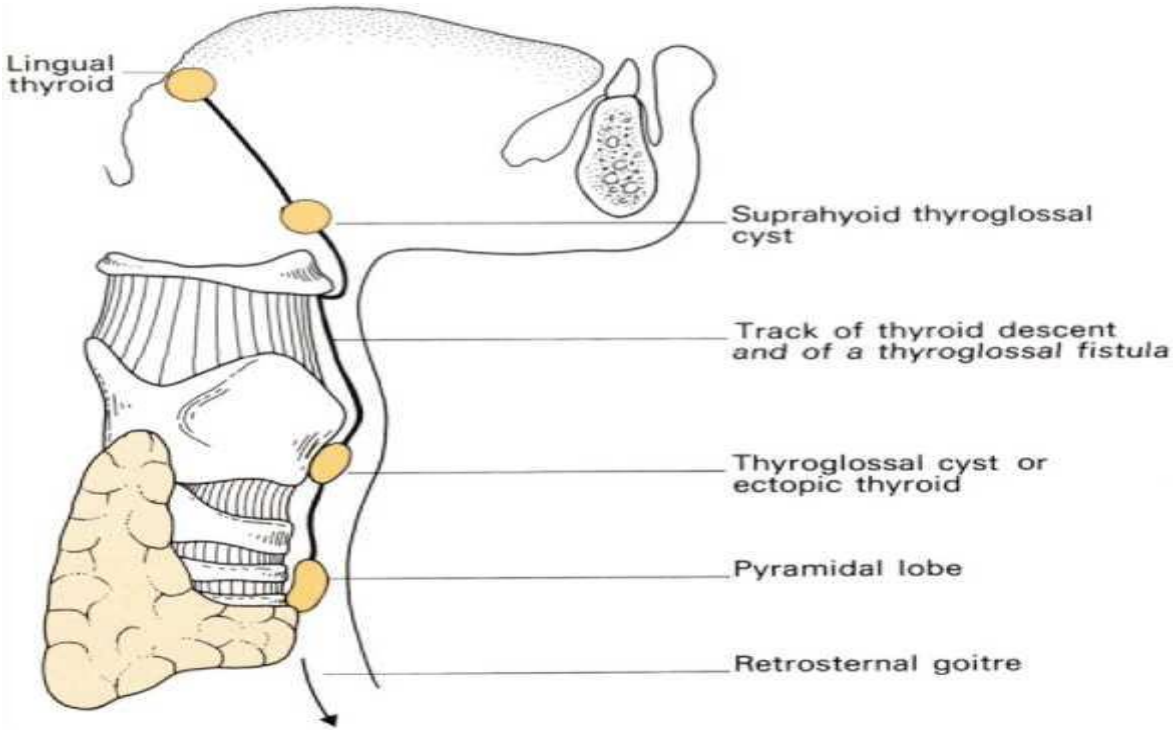


Figure 3. Anomalies of Thyroid gland development[27].

SURGICAL ANATOMY OF THE THYROID GLAND[20]

The thyroid gland, a visceral structure of the neck lies below and on the sides of thyroid cartilage, covered anteriorly by the infra-hyoid muscles. The thyroid gland consists of right and left lobes situated anterolateral to the larynx and trachea and united across the front and below the cricoid cartilage by an isthmus, thus resembling nearly the shape of butterfly.

The total gland weighs about 20-25gms. The lobes measure 5×2.5×2.5cm. The isthmus measures 3.7×1.2cm. Each lateral lobe extends vertically from the middle of the side of the thyroid cartilage to the sixth ring of trachea. A triangular projection of gland tissue called the "pyramidal lobe" of variable size extends upwards from the left side of the upper border of the isthmus and is connected t

o the hyoid bone above by a fibrous band or a muscle slip(levator glandulae thyroideae).

Each lateral lobe is roughly triangular in section. The superficial surface is covered by the infrahyoid or ribbon muscles, the sternomastoid overlapping.

The medial surface is related to two tubes- oesophagus and trachea, two nerves- reccurent and external laryngeal, two muscles- inferior constrictor and cricothyroid.

The posterior surface overlaps the common carotid artery and covers the terminal part of the inferior thyroid artery.

The Parathyroid Glands : These are two pairs (superior and inferior) of small endocrine glands, that usually lie on the posterior border of the thyroid gland, within the false

capsule. The anastomotic artery between the superior and inferior thyroid arteries is usually a good guide to the glands because they usually lie close to it.

The Parathyroid gland receive a rich blood supply from the inferior thyroid artery and from the anastomosis between the superior and inferior thyroid arteries. The veins and lymphatics of the gland are associated with those of the thyroid gland and the thymus.

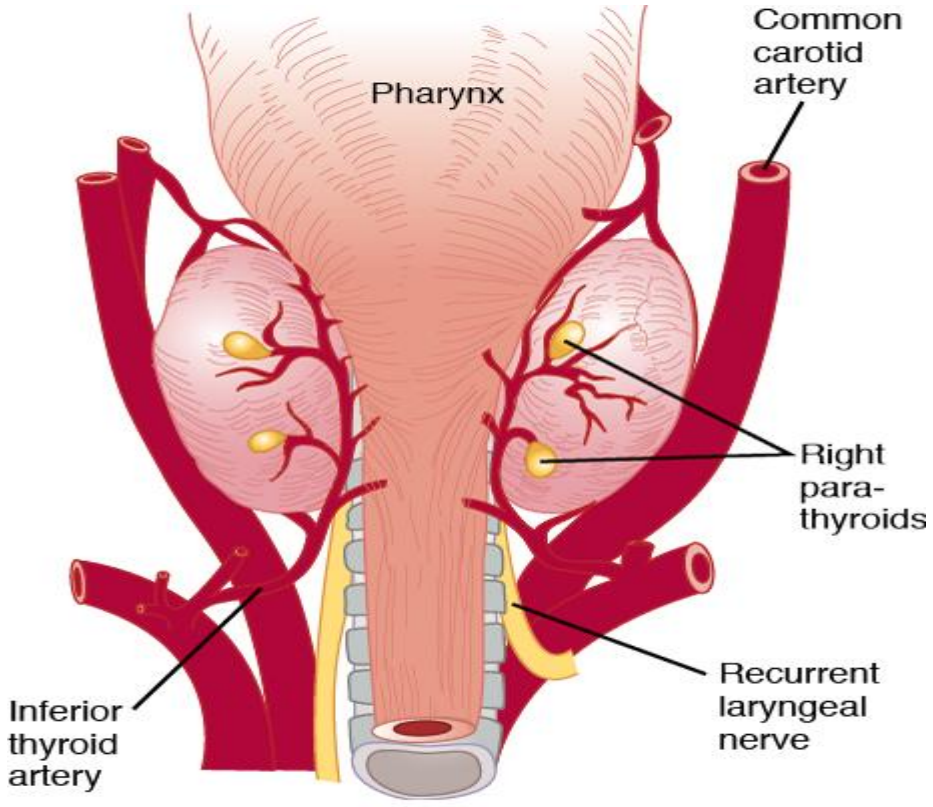


Figure 4. Surgical anatomy of Parathyroid gland[20]

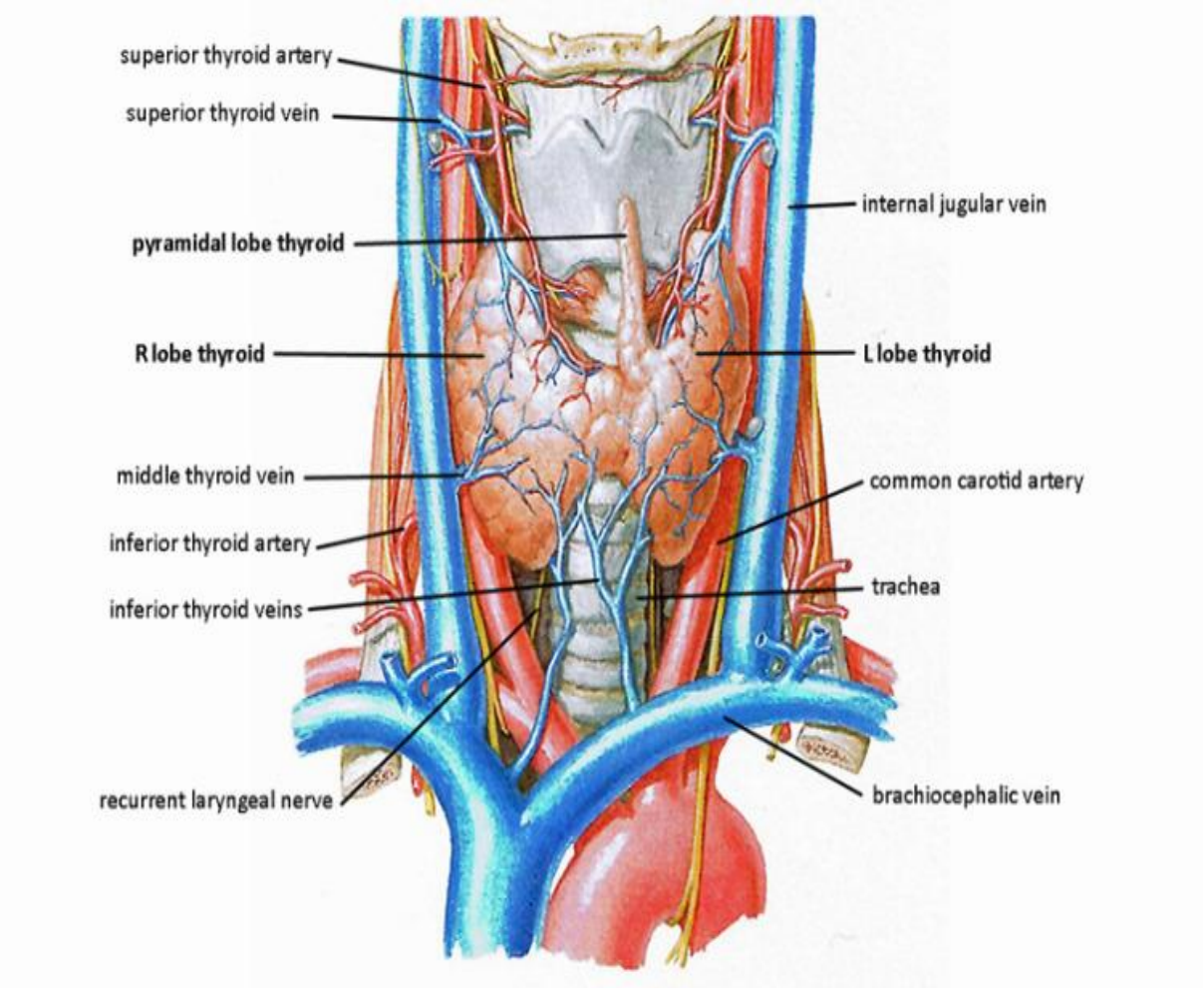


Figure 5. Surgical Anatomy of Thyroid gland[20]

THYROID FASCIA AND CAPSULE:

Thyroid has two capsules:

1.True capsule

2.False capsule.

The "True-capsule" is made up from a peripheral condensation of the connective tissue of the gland, binding it together and sending septa between the lobules. The true capsule is an integral part of the gland and in it runs the larger branches of the vessels as they enter the gland.

The "False capsule" is formed by the pretracheal fascia as it splits to enclose the gland. It is thin layer of connective tissue lying between the posterior surface of the strap muscles and the thyroid gland. This fascia is incomplete and fails to envelope the gland posteriorly. Laterally it is continuous with carotid sheath.

It is strong and thick above and thin below. The false capsule is thickened in places and these are called ligaments.

ANTERIOR LIGAMENT :

It is attached below the posterior surface and upper border of isthmus and adjoining portions of the lobes and above to cricoid cartilage, thyroid cartilage and fascia covering cricothyroid muscle.

LATERAL LIGAMENT OR SUSPENSORY LIGAMENT OF BERRY :

This is thickening of the pretracheal fascia investment of thyroid. It passes from the inner and back part of the gland to the cricoid cartilage. The two ligaments right and left form a sling anchoring the gland to the larynx.

They increase in size in large goitres thus preventing the gland falling away from the larynx and, must be severed before the gland can be removed. The reccurent laryngeal nerve is in immediate contact with the back of the ligament. The blood vessels form a plexus underneath the true capsule.

The gland is maintained in position by pretracheal fascia, vascular pedicles, ligaments of thyroid and surrounding muscles.

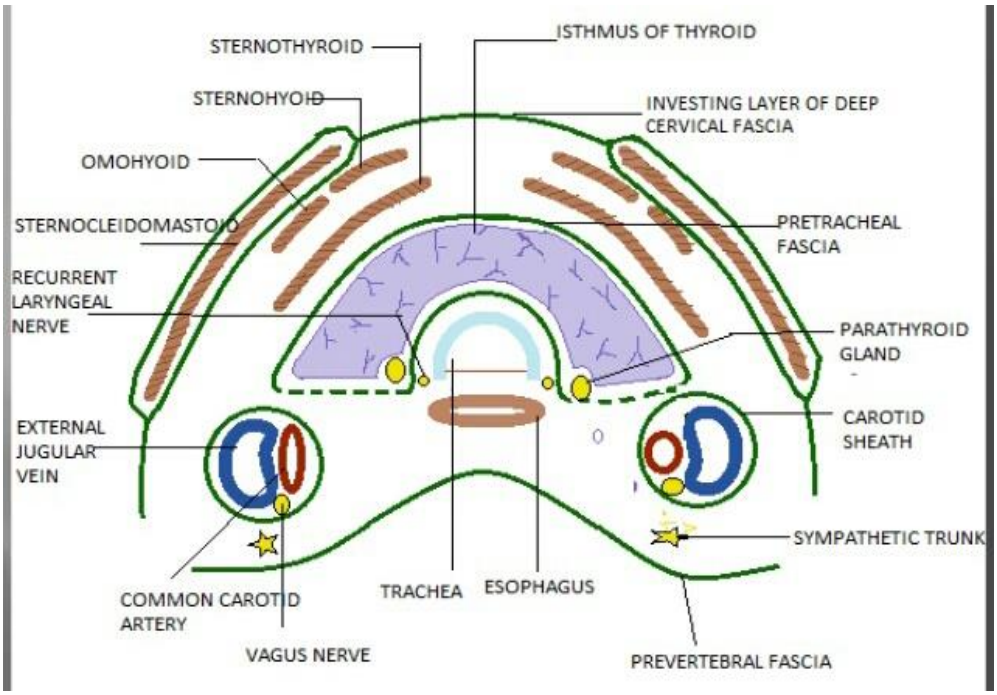


Figure 6. Various fascias and ligaments in relation to thyroid gland[20]

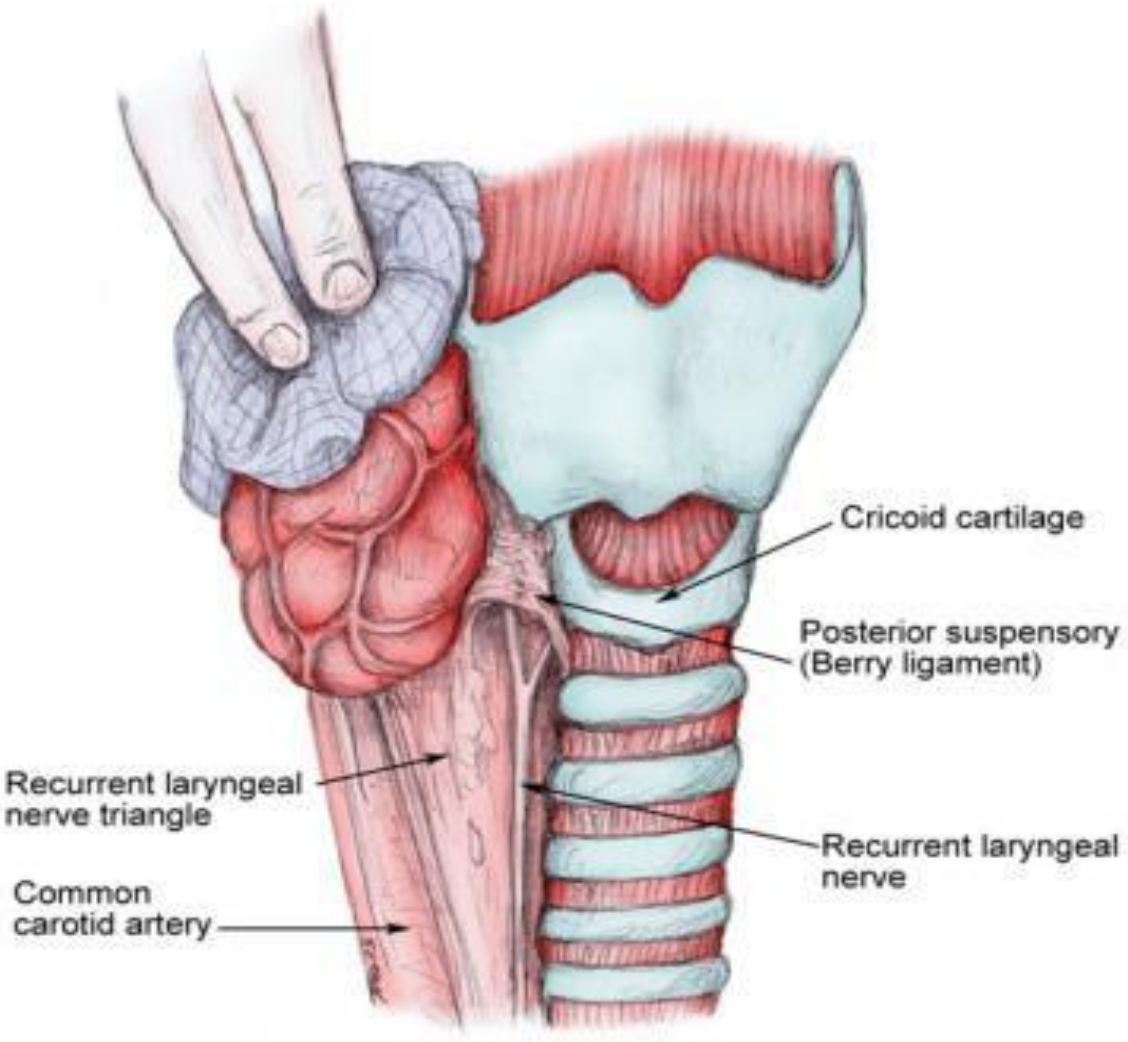


FIGURE 7. Posterior suspensory ligament(Berry Ligament)[20]

BLOOD VESSELS OF THE THYROID :

There are on each side two arteries and four veins. Unnamed vessels from oesophagus, trachea and larynx and an occasional unpaired thyroid ima artery also supplies the gland.

ARTERIES :

1.Superior thyroid artery : This, the first branch given from the anterior surface of external carotid, enters the gland superficially. It runs downwards to the upper pole of lateral lobe where it breaks up into branches to the front of the gland, branches to the back of the gland and a branch to anastomose with its fellow at the opposite side along the upper border of the isthmus.

This vessel gives off a branch to the pyramidal lobe which enters near its base where it can be easily ligated. The superior thyroid artery supplies mainly the connective tissue and capsule of the gland. There is no arterial supply at the apex of the pyramidal lobe which can be dissected out without fear of haemorrhage.

2. Inferior thyroid artery : This, is a branch of thyrocervical trunk which in turn arises from the first part of subclavian artery and is a posterior relation of the gland entering it from its deep or posterior surface. It is absent in 3.5% of patients. It usually divides into upper and lower branches. The lower branch runs towards the lower pole and the upper lies on the posterior surface of the gland. when this artery is absent its place is usually taken by a branch from superior thyroid artery of the same side or from the inferior thyroid artery of the other side or rarely by a thyroid ima artery. The lower branches of

the inferior thyroid artery supply mediastinal goiters. The inferior thyroid artery supplies the parenchyma of the gland substance proper.

Thyroid ima artery : This vessel is present occasionally and arises from the innominate right common carotid or directly from the aortic arch. It runs upwards in front of the trachea to the lower border of the isthmus where it anastomoses with branches of inferior thyroid artery.

Accessory thyroid arteries : Small vessels to oesophagus and trachea send branches to the thyroid gland. All large arteries to the gland because of these accessory vessels.

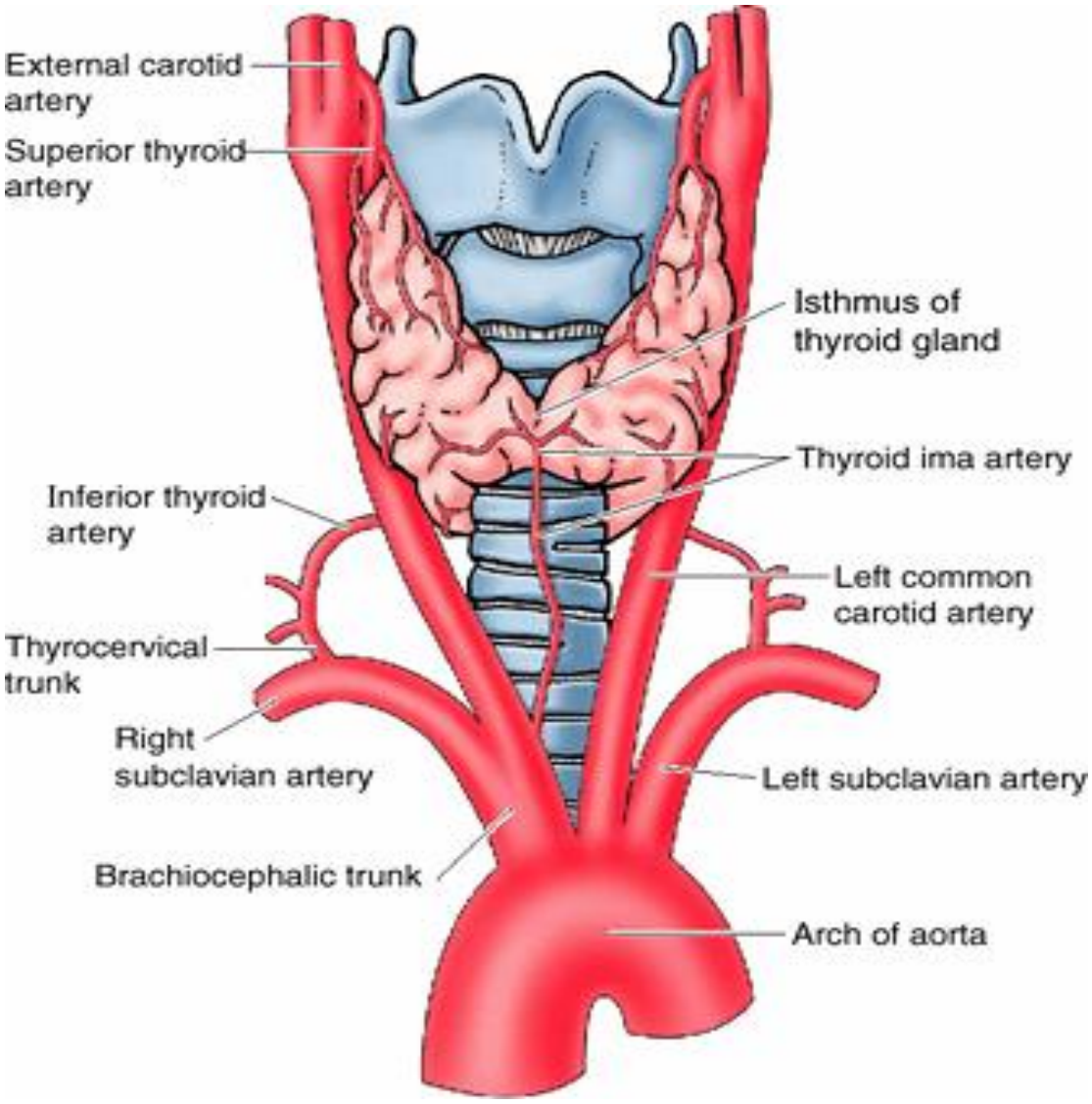


Figure 8. Arterial supply of Thyroid gland[20]

VENOUS DRAINAGE OF THYROID :

The veins of thyroid gland don't accompany their arteries. The veins of thyroid start as perifollicular venous plexus and converse under the true capsule where they form a plexus. From these plexus three pairs of veins arise.

SUPERIOR THYROID VEIN **:**

Leaves the upper part of gland and taking as its guide the outer border of omohyoid crosses the common carotid artery to terminate in internal jugular vein.

MIDDLE THYROID VEIN **:**

middle thyroid vien drains the the lower part the thyroid gland and leaves the gland about its middle, follows the inner border of omohyoid across the carotid, ending in the internal jugular vein. It is a short vessel and likely to be torn during thyroid surgery.

INFERIOR THYROID VEIN**:**

These veins typically form two trunks that descend from the lower part of the gland. The right one passes infront of the innominate vein in front of the trachea to open into the left innominate veins. The left joins the left innominate vein. Sometimes both these trunks unite to form a common stem to join the left innominate vein.

FOURTH THYROID VEIN **:** Kocher drew attention to the frequent existence of the vein passing outwards between the middle and inferior thyroid veins.

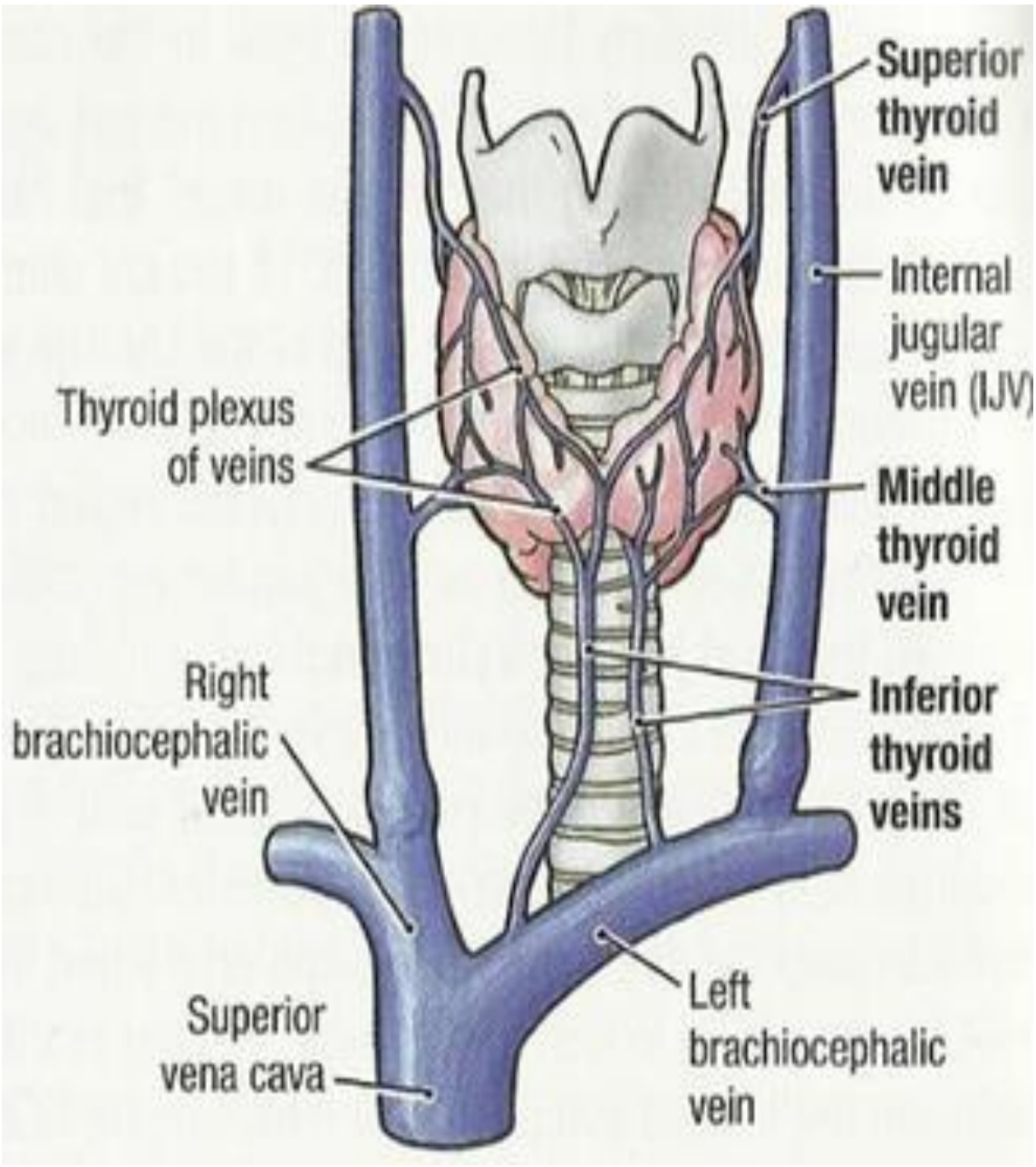


Figure 9 . Venous drainage of thyroid gland[20]

LYMPHATIC DRAINAGE **:**

The thyroid is richly supplied with the lymphatics and free communication between all the parts of the thyroid glands. The whole gland is drained by two sets of lymphatics ascending and descending which consists of medial and lateral channels, involving from level 2 to 6 cervical group of lymphnodes.

ASCENDING VESSELS **:**

MEDIAL : Leave the upper border of the isthmus and go to the gland situated on the cricothyroid membrane - the pharyngeal gland.

LATERAL : Leave the upper pole of the gland and run with superior thyroid artery to the deep cervical glands situated at the bifurcation of the common carotid artery.

DESCENDING VESSELS :

MEDIAL : Pass to the gland on the trachea -the pre tracheal gland.

LATERAL : Pass from the deep surface of the thyroid to small glands placed on the recurrent laryngeal nerve - the glands of the recurrent chain.

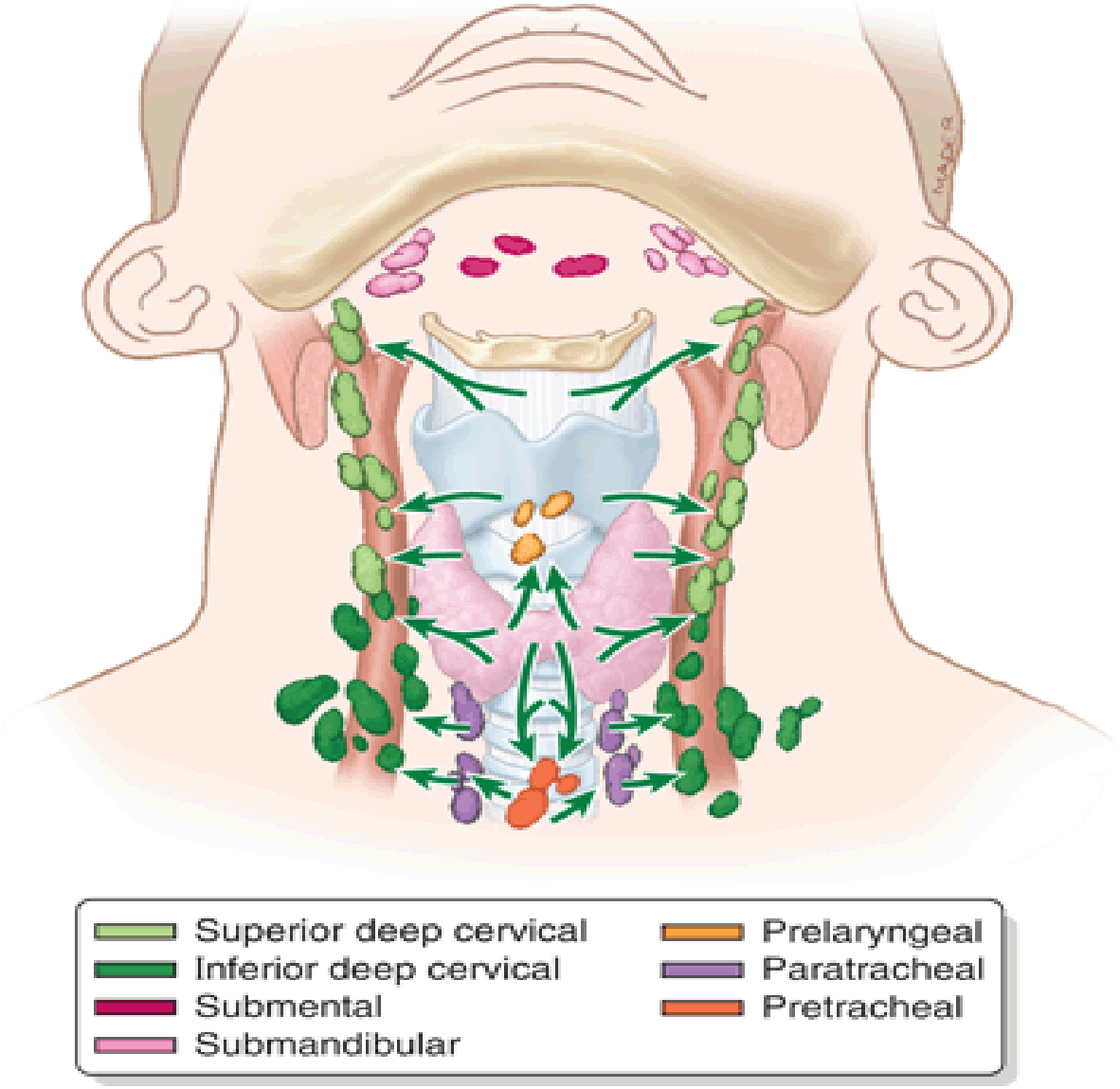


Figure 10. Lymphatic drainage of the Thyroid gland[12]

NERVE SUPPLY **:**

Nerve fibres reach the thyroid from both the superior cervical ganglion and superior laryngeal branch of the vagus. The vagal fibres form sensory arborisations upon the blood vessels. Within the gland the nerves form peri-vascular and interfollicular plexuses. Nerves are related functionally to the blood vessels and they do not materially affect the function of glandular tissue.

RELATION OF THE RECURRENT LARYNGEAL NERVE **:**

The right recurrent laryngeal nerve arises from the vagus as it passes infront of subclavian artery, curves below and behind the subclavian and then passes upwards.

The left recurrent laryngeal nerve arises from the left vagus as it passes in front of the arch of aorta. The nerve passing below and upwards behind the aorta. As these nerves ascend in the neck they cross the inferior thyroid arteries and come in direct contact with the thyroid.

RELATIONSHIP TO TRACHEA **:**

These nerves are tucked in the tracheo-oesophageal groove or may run laterally than this. The right nerve is more likely to do so.

RELATIONSHIP TO THE INFERIOR THYROID ARTERY **:**

The relationship of nerves to inferior thyroid artery is variable. The nerve may cross the main artery or its branches. It may cross behind the artery, in front of the artery, between its major branches or among minor branches or the nerve may divide before

reaching the level of artery and a part may pass in front of the artery and the other behind the artery or some of its branches.

Table 1. Relationship of the inferior thyroid artery to the RLN

	RIGHT	LEFT
Nerve in tracheo-esophageal groove	64%	77%
Nerve lateral to trachea	28%	17%
Nerve antero-lateral to trachea exposing it to accidental division during subtotal throidectomy	8%	6%
Nerve runs behind the ITA	53%	65%
Nerve anterior to artery	37%	24%
Nerve runs in between the branches of artery	7%	6%

RELATIONSHIP TO THE THYROID GLAND :

At the level of upper two to three tracheal rings the thyroid is attached to the larynx by suspensory ligament. The reccurent laryngeal nerve at this level is in closest contact with the gland and may lie against its posterior surface, pass through the adherent zone or even penetrate the gland.

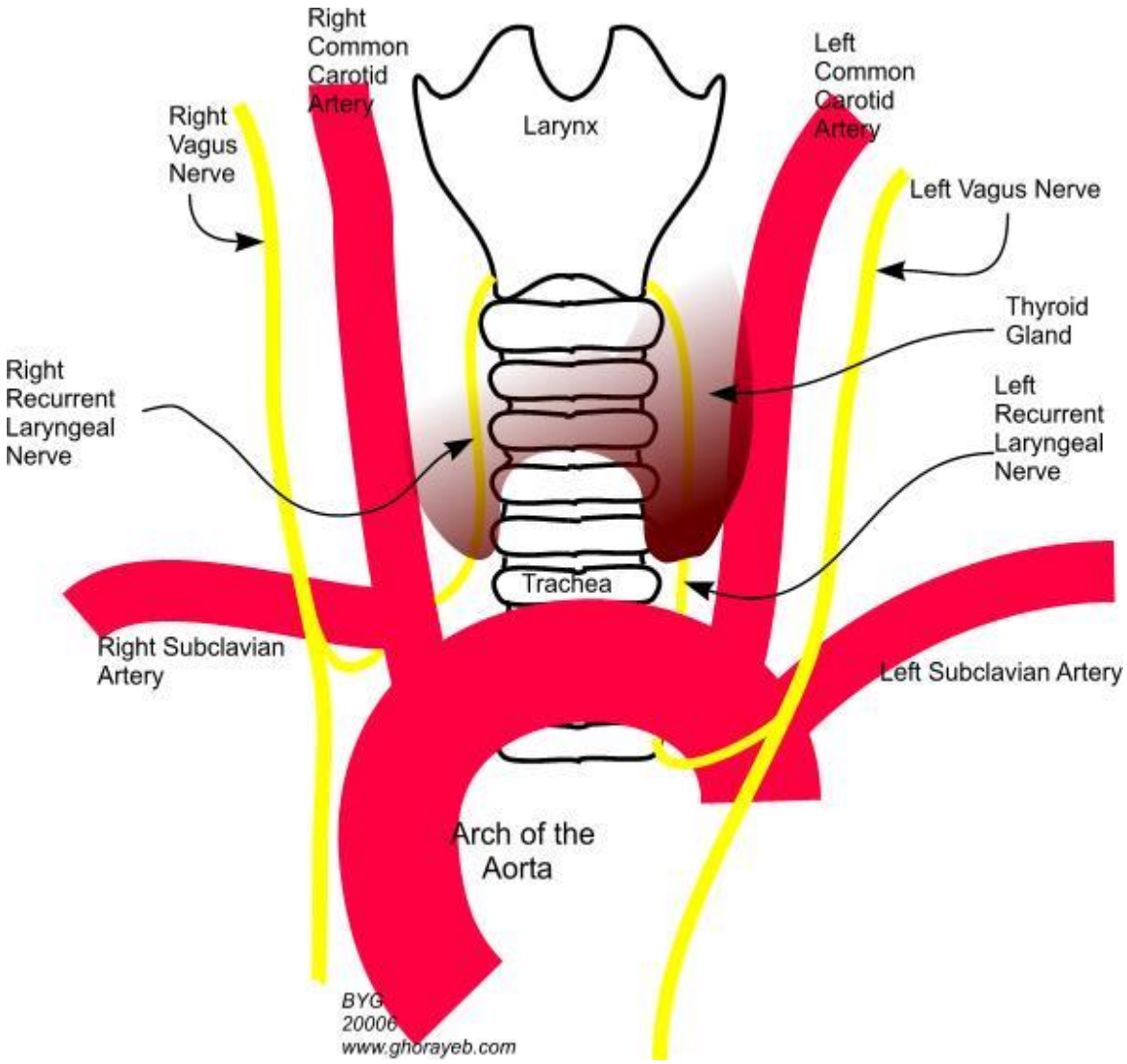


Figure 11. Relation of Thyroid gland with recurrent laryngeal nerve[20]

NON RECURRENT LARYNGEAL NERVE **:**

Sometimes the right fourth arch vessel fails to develop and the right subclavian artery then arises from the aorta beyond the left subclavian artery and passes to the right behind the oesophagus. In this case the recurrent laryngeal nerve is not drawn down and passes directly medial to larynx as non-reccurent laryngeal nerve.

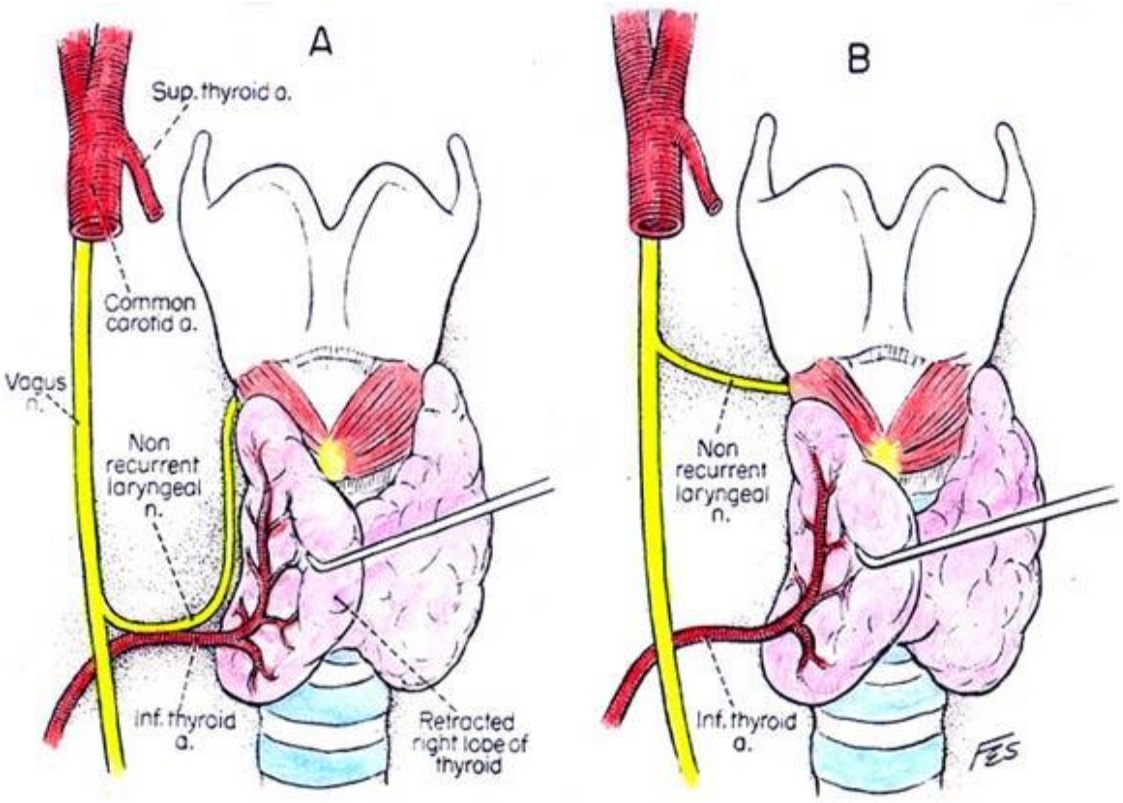


Figure 12. Non Recurrent Laryngeal Nerve[20]

MORPHOLOGY AND CYTOLOGY[28]

The microscopic appearance of the thyroid shows numerous follicles filled with proteinaceous and colloid material. Follicle is the structural unit. The wall of acinus is composed of single layer of cuboidal cells resting on a basement membrane that is richly supplied with capillaries. The acini are arranged in the sub units of 22-40 which are demarcated by connective tissue to form lobules each surrounded by an individual artery. The height of the epithelial cells lining the follicles varies with the state of functional activity but normally is about 15 microns. The size of the follicle depends on the degree of distention by secretion. It is approximately 200 microns in diameter. The total number of follicles is about 20 millions. The shape of the follicle is spheroidal or elongated.

Structure of follicular cells **:**

The apices of follicular cell may bulge slightly into the lumen and their nuclei usually lie in the basal half of the cell. The cells are low when the gland is underactive and high when the gland is active. The cytoplasm appears homogenous and rarely it contains colloid droplets which have staining properties like those of colloid.

Parafollicular cells **:**

These cells appear to be of ellipsoidal shape. Their cytoplasm appears less dense and homogenous than that of follicular cells. These cells never come into contact with the colloid and are separated from it by a layer of follicular cells. They are enclosed within the confines of follicular basement membrane.

Colloid **:**

The thyroid is a gland notable for its storage of reserve secretion. This reserve is semifluid colloid that fills the lumen. The colloid is thin, homogenous, clear fluid in fresh state. In active follicles the colloid is definitely basophilics. Inactive follicles have acidophillic colloid. It consists chiefly a thyroglobulin, A large protien having a molecular weight of 7,00,000. Colloid contains other substance in addition as for example protease activity and ribo nuclear protien. The former is the intermediatery which frees the thyroid hormones from thyroglobulin.

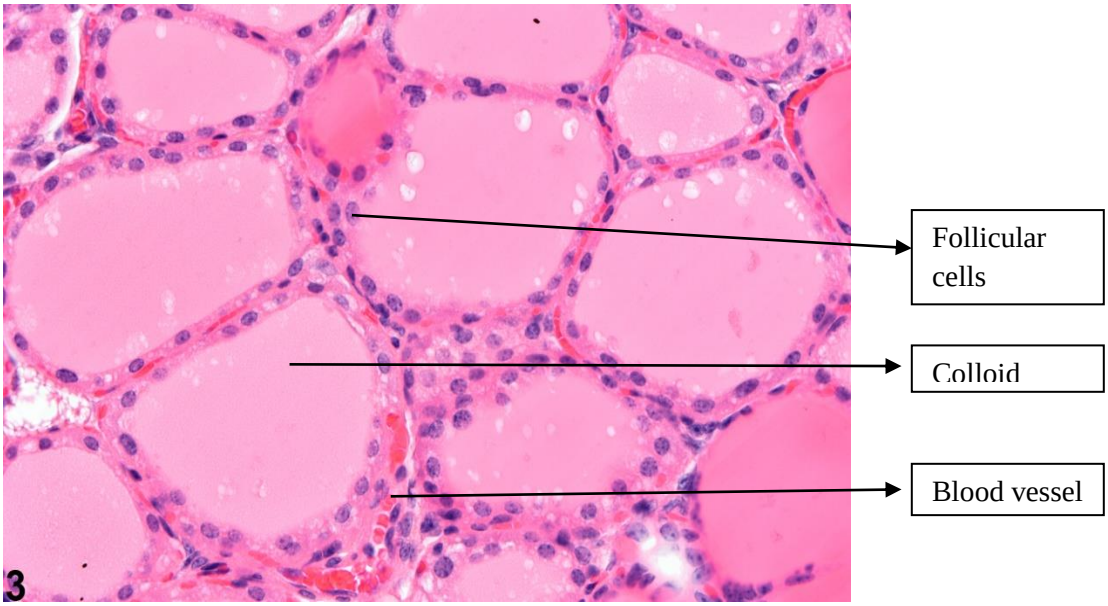


Figure 13. Normal Histology of Thyroid Gland[28]

SURGICAL PHYSIOLOGY[12]

The thyroid gland is essential for the normal development of body. It secretes two significant hormones, thyroxine and triiodothyronine, that have a profond effect on the metabolic rate of the body. It also secrets Thyrocalcitonin an important hormone for calcium metabolism.

FORMATION AND SECRETION OF THYROID HORMONES **:**

About 90% of hormones secreted by thyroid gland is thyroxine and 10% is triiodothyronine. A considerable proportion of thyroxine is converted to triiodothyronine in peripheral tissues so that both are very important functionally. The function of both the hormones is qualitatively same. Triiodothyronine is about for times as potent as thyroxine but it is present in the blood in much smaller quantities and persists for much shorter time than does thyroxine.

Requirement of iodine for formation of thyroxine **:**

To form normal quantities of thyroxine approximately 50mg of ingested iodine are required each year or approximately 1mg/week.

Fate of ingested iodides **:**

Iodides ingested orally are absorbed from the gastrointestinal tract into the blood. Within first three days two thirds of ingested iodides are normally lost into urine and almost all the remaining one third is selectively removed from the circulating blood by the cells of thyroid gland and used for synthesis of thyroid hormones.

The iodine pump (iodine trapping) **:**

The first stage in the formation of thyroid hormones is the transport of iodides from the extra cellular fluid into the thyroid glandular cells and follicles. This is called iodine trapping. Normally the iodine pump can concentrate the iodide to about 40 times its concentration in blood.

THYROGLOBULIN AND FORMATION OF THYROXINE AND TRIIODOTHYRONINE :

The endoplasmic reticulum and golgi complex synthesize and secrete into the follicles a large glycoprotien molecule called thyroglobulin with a molecular weight of 666,000. Each molecule of thyroglobulin contains 140 tyrosine amino acids which combine with iodine to form thyroid hormones within the thyroglobulin molecule.

An essential step is the **oxidation** of iodide ions to iodine by the enzyme **peroxidase** and its accompanying hydrogen peroxide provides a persistant system capable of oxidising iodides.

The binding of iodine with the thyroglobulin molecule is called **organification** of the thyroglobulin. Tyrosine is first iodised to monoiodotyrosine and then to diodotyrosine. During the next few minutes, hours and even days, more and more to diodotyrosine residues become coupled with each other. The product of **coupling reaction** is the formation of thyroxine, which remains part of thyroglobulin molecule or one molecule of monoiodotyrosine couples with diiodotyrosine to form triiodotyronine.

Each thyroglobulin molecule contains 5 to 6 thyroxine molecules and there is an average of 1 triiodotyrosine molecule for every 3 to 4 thyroglobulin molecules. In this form thyroid hormones are often stored in the follicles for several months.

RELEASE OF THYROXINE AND TRIIODOTHYRONINE FROM THYROGLOBULIN :

Pinocytic vesicles are formed in the thyroid cells, to which lysosome fuse to form digestive vesicles containing digestive enzymes from the lysosomes mixed with the colloid. The proteinase digest thyroglobulin molecules and release thyroxine and triiodothyronine, which diffuse into the surrounding capillaries. Iodinated thyronine in the thyroglobulin is cleaved by an iodase enzyme that makes most of this iodine available for recycling to new thyroglobulin. Quantities of the two hormones finally delivered to the tissues is approximately 90 micrograms of thyroxine per day and 60 micrograms of triiodothyronine per day. Triiodothyronine is about 4 times potent than thyroxine. Duration of action of thyroxine is 4 times that of triiodothyronine.

TRANSPORT OF THYROXINE AND TRIIODOTHYRONINE TO THE TISSUES :

On entering the blood, thyroid hormones combine with plasma proteins : two-thirds with thyroxine - binding globulin about one fourth with thyroxine binding prealbumin and about one tenth with albumin. Because of the very high affinity of plasma binding proteins for thyroid hormones they are released to the tissue cells only very slowly. On entering the cells hormones again bind with intracellular proteins, where they are stored and are used slowly over a period of days or weeks.

Thyroxine has latent period of two to three days, activity reaches maximum in 10 to12 days with a half-life of about 15 days. Some activity persists as long as 6 weeks to 2 months. Triiodothyronine has a latent period of 6 to 12 hours and maximum cellular activity occurs within 2 to 3 days.

REGULATION OF THYROID HORMONE SECRETION :

To maintain a normal basal metabolic rate a specific feedback mechanism operates through the hypothalamus and anterior pituitary gland to control the rate of thyroid secretion.

Thyroid stimulating hormone(TSH) also known as thyrotropine is an anterior pituitary hormone, a glycoprotien with a molecular weight of about 28,000 Da increases all known activities of thyroid glandular cells. The most important early effect of TSH is proteolysis of thyroglobulin which causes release of thyroxine and triiodothyronine into the blood within 30 minutes. Most of the effects of TSH on thyroid cell result from activation of the second messenger cyclic AMP system of the cell. The result is both an immediate increase in secretion of thyroid hormones and prolonged growth of thyroid glandular tissue itself.

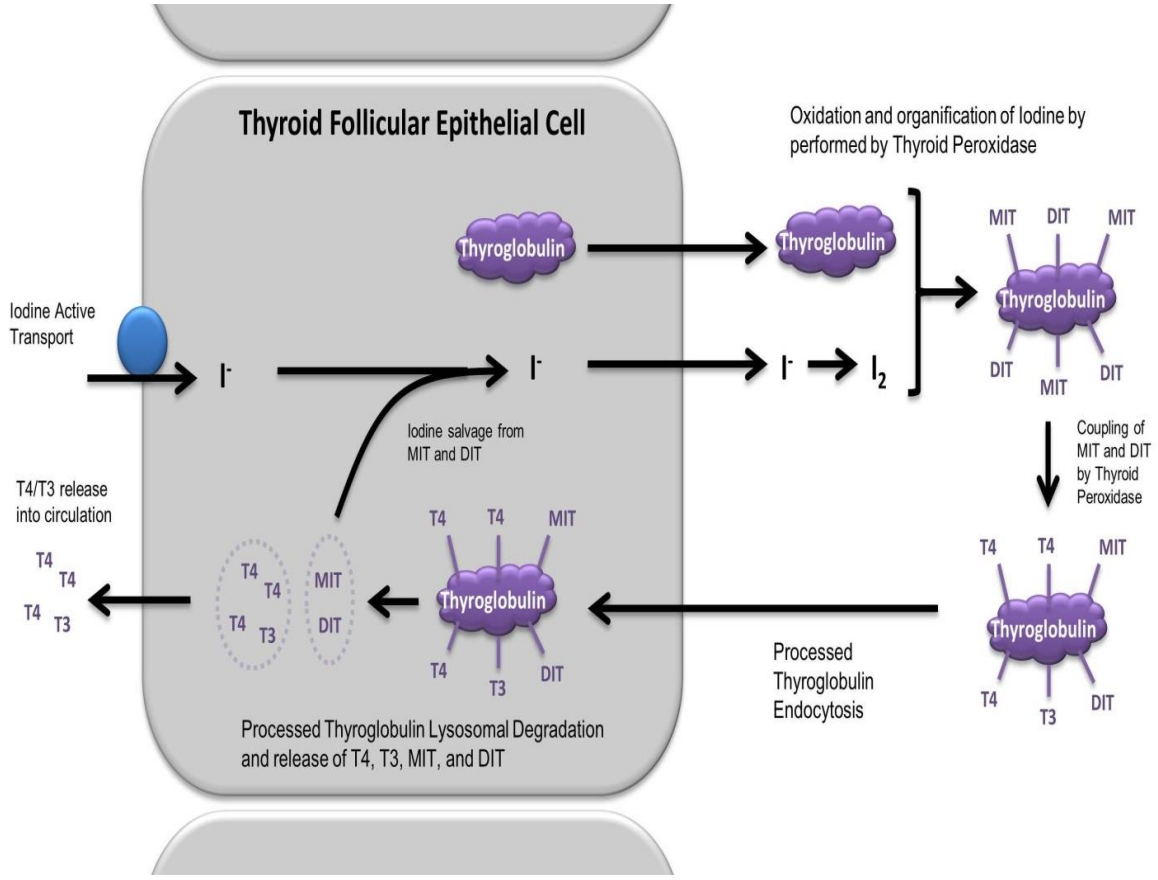


Figure 14. Steps depicting thyroid hormone formation and release[12]

HYPOTHALAMIC REGULATION OF TSH SECRETION BY THE ANTERIOR PITUITARY /THYROTROPINE RELEASING HORMONE (TRH):

TRH secreted by the nerve endings in the median eminence of hypothalamus directly effects the anterior pituitary gland cells to increase their output of TSH. The hypothalamus can also inhibit the secretion of TSH along with growth hormone secretion.

Exposure to cold increases and excitement and anxiety decreases the secretion of thyroid hormones.

FEEDBACK REGULATION OF THYROID SECRETION **:**

Increased thyroid hormones in the body fluids decreases the secretion of TSH by the anterior pituitary by direct feedback effect on the anterior pituitary and also perhaps secondarily by much weaker effects acting through the hypothalamus due to changes in the temperature of hypothalamic thermostat. Regardless of mechanism of feed back its effect is to maintain an almost constant concentration of free thyroid hormone in the circulating body fluids.

FUNCTIONS OF THE THYROID HORMONES :

The thyroid hormones have two major effects on the body :

1.An increase in the overall metabolic rate.

2. In children, stimulation of growth.

General increase in metabolic rate **:**

The thyroid hormone increases the metabolic activities of almost all tissues of the body with a few notable exceptions such as brain, retina, spleen, testes and lungs. The BMR can increase to as much as 60 to 100 percent above normal. The rates of utilization of foods for energy is greatly accelerated. The rate of protein synthesis is increased while at the same time the rate of protein catabolism is also increased. The mental processes are excited and the activity of many other endocrine glands is often increased. The most likely basic function of the thyroid hormone is their capability to activate the DNA transcription process in the cell nucleus with resulting formation of many new cellular proteins.

Effect on growth **:**

In the human being, the effect of thyroid hormone on the growth is manifest mainly in growing children. In those who are hypothyroid, rate of growth is greatly retarded. In those who are hyperthyroid, excessive skeletal growth often occurs causing the child to become considerably taller than otherwise. However, the epiphyses close at an early age so that the eventual height of the adult may be shortened.

Effect on carbohydrate metabolism **:**

Thyroid hormone stimulates almost all aspects of carbohydrates metabolism, including rapid uptake of glucose by the cells, enhanced glycolysis, enhanced gluconeogenesis, increased rate of absorption from the GIT and even increased insulin secretion with its resultant secondary effects on carbohydrate metabolism.

Effect on fat metabolism **:**

Lipids are mobilised from the fat tissue which increases fatty acid concentration in the plasma and the thyroid hormone also greatly accelerate the oxidation of free fatty acids by the cells. Increased thyroid hormone decreases the quantity of cholesterol, phospholipids and triglycerides in the blood.

Effect on vitamin metabolism **:**

As vitamins are essential parts of some of the enzymes or co-enzymes thyroid hormone increases the need for vitamins.

Effect on body weight **:**

Greatly increased thyroid hormone production almost always decrease the body weight and greatly decreased production almost always increases the body weight.

Effect on cardio-vascular system **:**

Increased metabolism in the tissues causes vasodilatation in most of the body tissues which in turn increases the cardiac output. The heart rate increases considerably more under the influence of thyroid hormone and the strength of heart beat also increases. Thyroid hormone causes the blood volume to increase slightly which results from vasodilatation. The main arterial pressure usually is unchanged because of the increased rate of run off of blood through the peripheral vessels. The pulse pressure is increased with the systolic pressure elevated by 10 to 20 mmHg and the diastolic pressure considerably reduced.

Effect on respiration **:**

The increased rate of metabolism increases the utilization of oxygen and the formation of carbon dioxide. This causes the increase in the rate and depth of respiration.

Effect on gastrointestinal tract **:**

Thyroid hormone in addition to increasing appetite and food intake increases both the rate of secretion of the digestive juices and the motility of the gastrointestinal tract.

Effect on central nervous system **:**

Thyroid hormone increases the rapidity of cerebration but also often dissociates this, while lack of thyroid hormone decreases this function.

Effect on the function of muscles **:**

Slight increase in the thyroid hormone usually makes the muscles react with vigor, but when the quantity of hormone becomes excessive the muscles become weakened because of excessive protein metabolism. Lack of thyroid hormone cause the muscle to become extremely sluggish and they relax slowly after a contraction.

Effect on sleep **:**

Hyperthyroid subject often has a feeling of constant tiredness, but because of the excitable effects of thyroid hormone on the synapses, it is difficult to sleep.

Effect on other endocrine glands **:**

Increased thyroid hormone increases the secretion of most other endocrine glands, for example insulin by pancreas, parathyroid hormone and adrenal glucocorticoids but it also increases the need of the tissues for the hormones.

Effect on sexual function **:**

For a normal sexual function to occur, thyroid secretion needs to be approximately normal, neither too great nor too little.

ASSESMENT OF THYROID HISTOLOGY[3] **:**

a. Fine needle aspiration cytology(FNAC)

b. Trucut large needle biopsy.

c. Frozen section.

Incisional biopsy is absolutely contraindicated.

Fine needle aspiration cytology(FNAC) : Fine needle biopsy is accepted as the most precise diagnostic screening procedure for differentiating benign from malignant thyroid nodules.

Procedure of FNAC: Transcutaneous FNAC of palpable Thyroid nodule is routinely performed without anaesthesia.

- The patient is asked to lie down in a position that best exposes the target area.
- The target area is thoroughly palpated and the firmest portion of the lesion or mass delineated.
- The skin is cleaned with an alcohol pad.
- The mass is fixed by the palpating hand of the operator or by an assistant; gloves may be used for protection of the operator and the assistant.
- The needle range from 25 to 20 gauge(0.6mm to 0.9mm outer diameter) is inserted into the target area. On reaching the lesion, the plunger of the syringe is retracted and at least 10ml of suction applied while moving the needle back and forth within the lesion; the direction or angle of the needle may be changed to access different areas of the lesion.

- Aspiration is terminated when aspirated material or blood becomes visible at he base or hub of the needle. For diagnostic purposes, cellular material contained within the needle is more than adequate; material drawn into the barrel of the syringe is not recovered since it is of no use for cytological diagnosis.

This technique was pioneered in Sweden and is now used increasingly as a first line investigation of the patient with solitary thyroid nodule.

Figure 15. Equipments required for transcutaneous FNAC.

Thyroid conditions diagnosed by FNAC are :

1. Colloid goitre : Aspirates obtained from colloid goitre show loosely cohesive sheaths of follicular epithelium, colloid, blood, and rare macrophages. Colloid nodules are the most common cytology and contain an abundance of colloid with

sparse follicular cells. There is considerable variation in the number of cells as well as the type and amount of colloid present

2. Thyroiditis : It has a fairly characteristic pattern on FNA smears, showing hypercellularity with lymphocytes, Hurthle cells, and minimal or no colloid.
3. Papillary carcinoma: Typically, cytology shows a papillary configuration, large irregular nuclei, and nuclear grooves. Psammoma bodies may or may not be present, but if present, they are highly suggestive of papillary thyroid carcinoma
4. Medullary carcinoma : Medullary thyroid carcinoma accounts for 5% to 10% of thyroid cancers and may present as a thyroid nodule or neck mass. Typically, aspirates from a medullary thyroid carcinoma are hypercellular, composed of large, poorly cohesive cells, and predominantly spindle shaped. Amyloid is often, but not invariably, present and there is no colloid.
5. Anaplastic carcinoma : Highly atypical, polymorphic tumor cells in a necrotic background occur singly or may form irregular clusters without any structure is pathognomonic of Anaplastic carcinoma.
6. Lymphoma : Fine needle aspiration smears from the thyroid consists of highly cellular comprising predominantly of monomorphic population of medium to large sized lymphoid cells with high nuclear/cytoplasmic (N/C) ratio and scant cytoplasm. Nuclei will be round to oval with fine chromatin, few of them showing irregular nuclear membrane, 0-2 eccentrically located nucleoli. Few centrocytes, small mature lymphocytes, occasional tingible body macrophages, plasma cells and mast cells along with lymphoglandular bodies will be seen in the background.

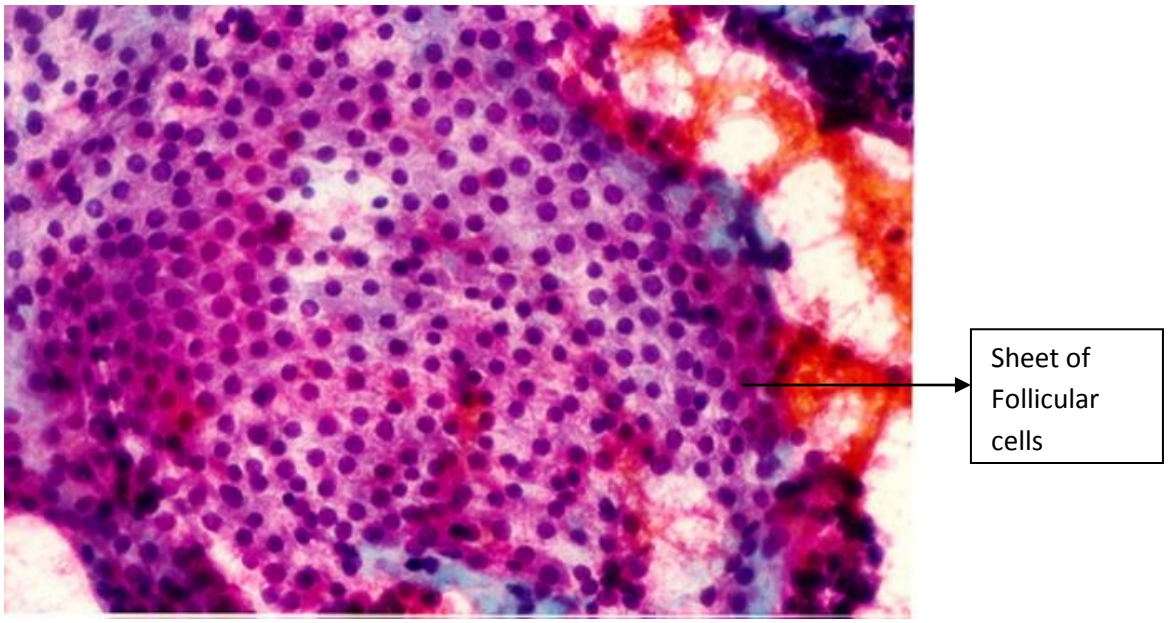


Figure 16. FNAC picture showing colloid goitre[28].

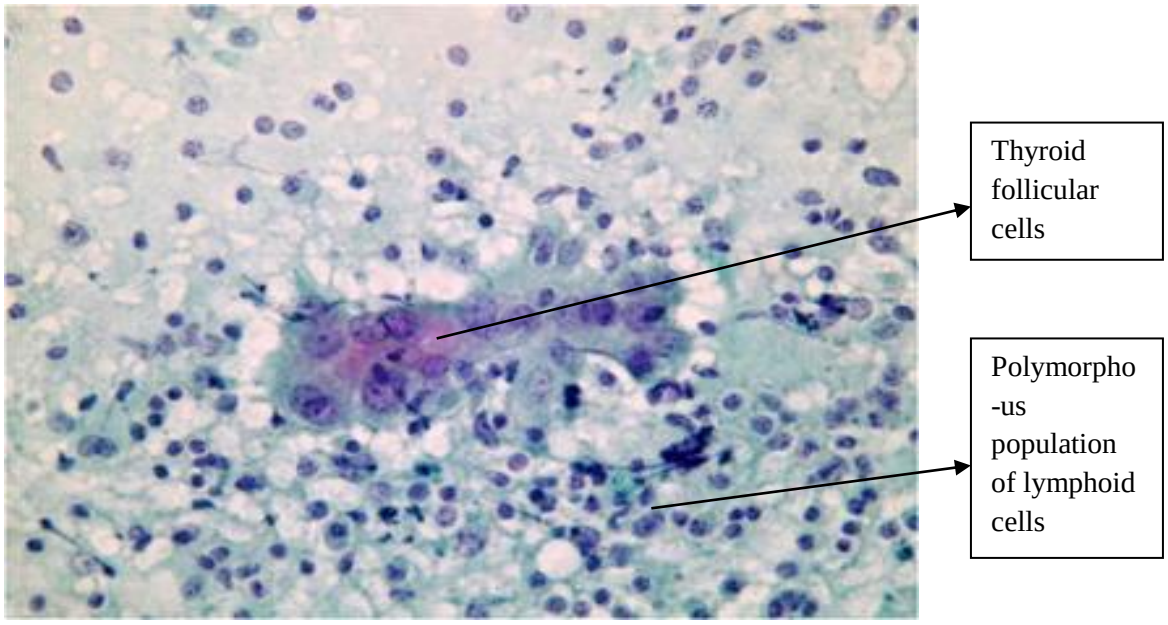


Figure 17. FNAC picture showing Thyroiditis[28].

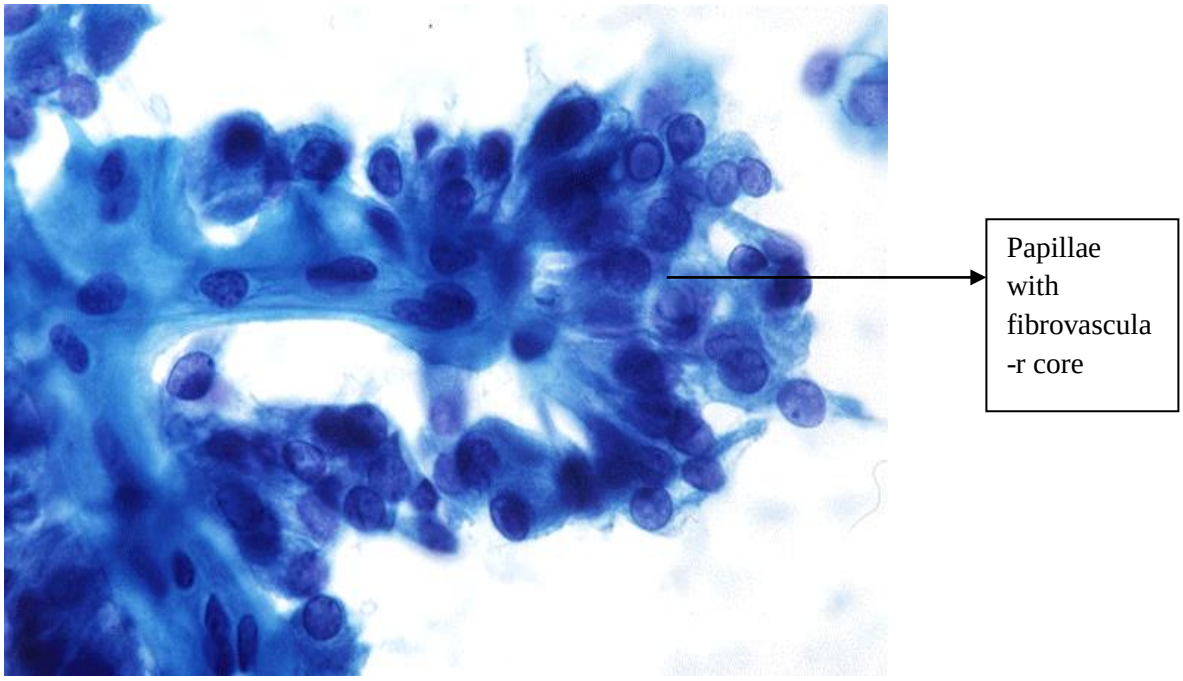


Figure 18. FNAC picture showing Papillary Carcinoma Thyroid[28].

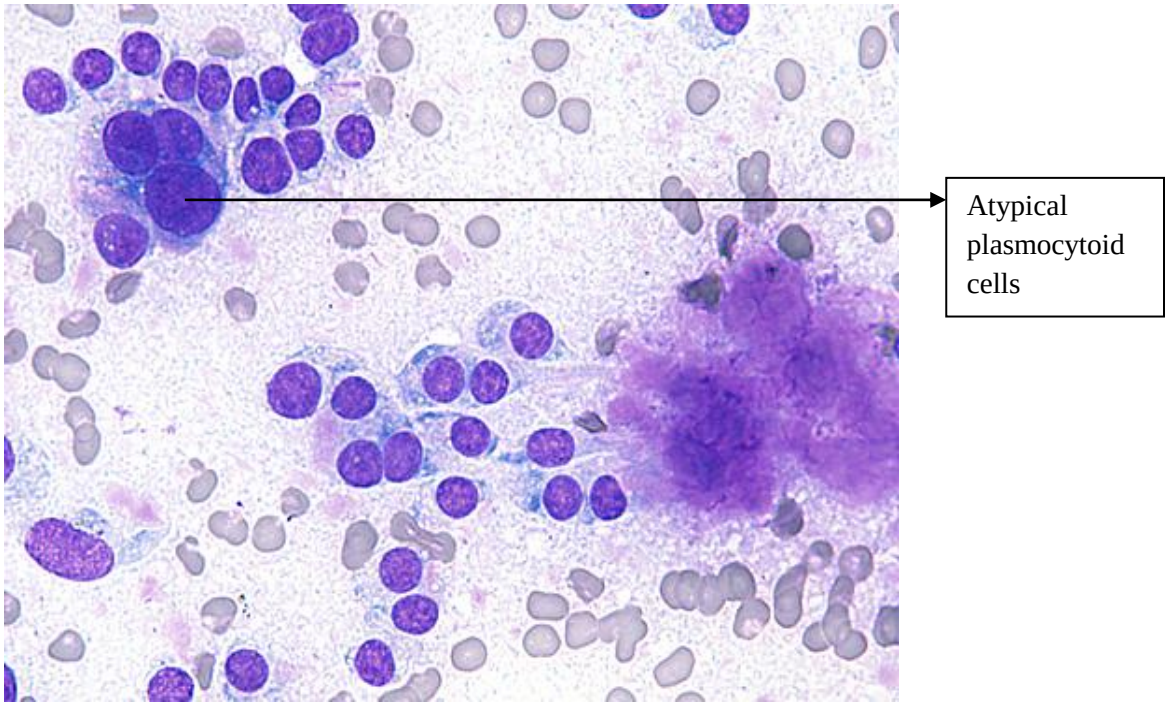


Figure 19. FNAC picture showing Medullary Carcinoma Thyroid[28].

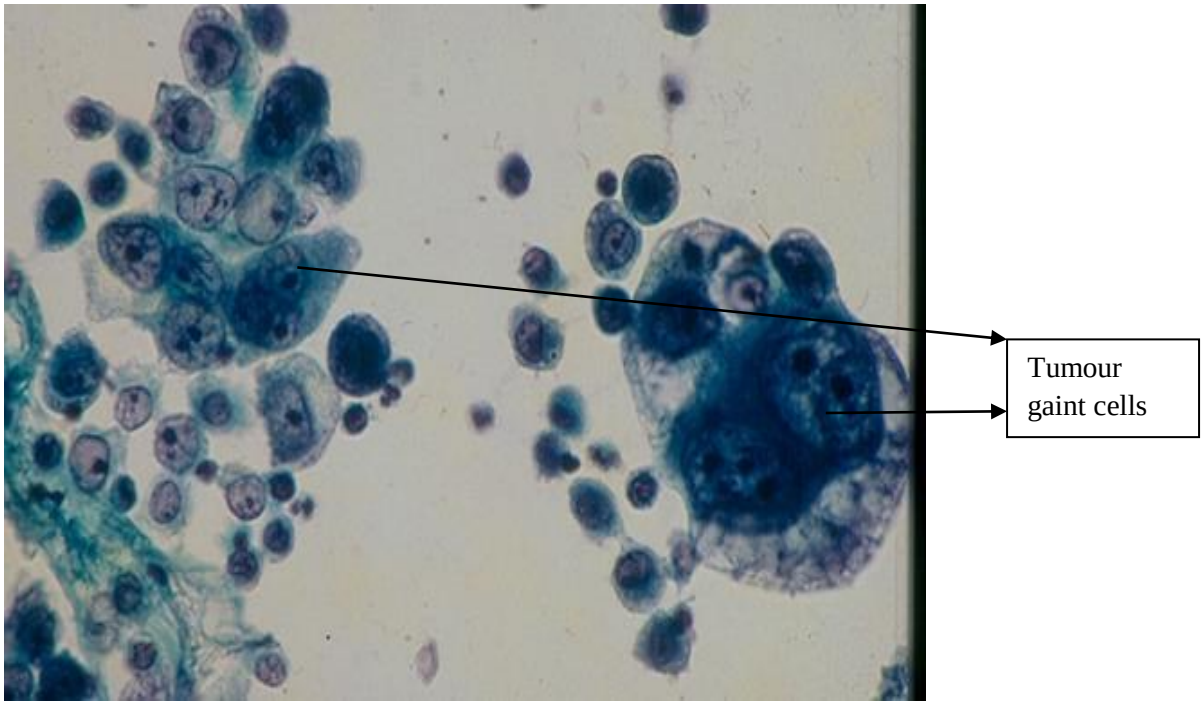


Figure 20. FNAC picture showing Anaplastic Carcinoma Thyroid[28].

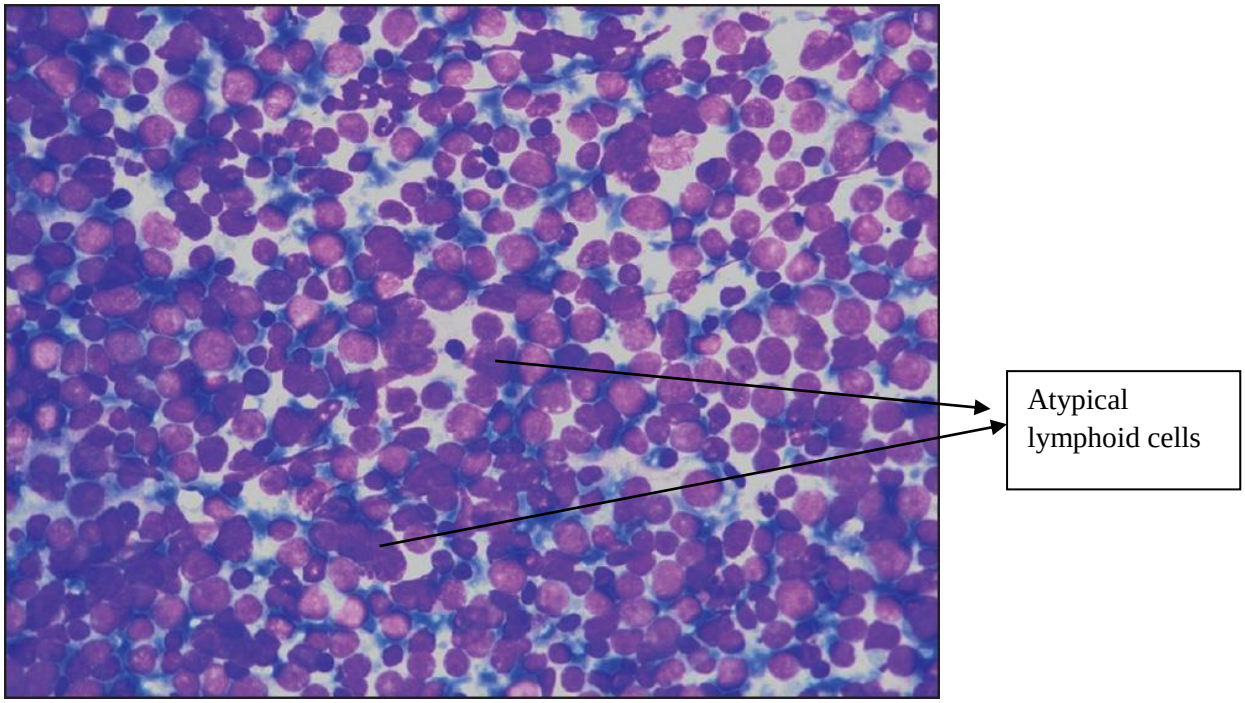


Figure 21. FNAC picture showing Primary Lymphoma of Thyroid[28].

Advantages of FNAC **:**

1. Simple, Cost effective, quick.

2. OPD procedure, good patient compliance.

3. Readily repeated if required.

4. In good hands, diagnostic accuracy is more than 90%.

5. Lesions as small as 0.5cm can be sampled.

Draw backs of FNAC **:**

Requires expert, experienced cytologist, area of sampling has to be representative of the pathology.

It is unable in Follicular neoplasms, to clearly differentiate benign from malignant lesion as it is difficult to differentiate capsular invasion and vascular invasion which are not made out in FNAC.

Trucut large needle biopsy : This produces a core of tissue for histological examination.

It has a high diagnostic accuracy but a poor patient compliance and may be associated with complications such as pain, bleeding, tracheal damage and recurrent laryngeal nerve palsy.

Frozen section[23]:

The frozen section have been done is some of the cases. The frozen section procedure is a pathological laboratory procedure to perform rapid microscopic analysis of a specimen. It is used most often in oncological surgery. The technical name for this procedure is cryosection.

The quality of the slides produced by frozen section is of lower quality than formalin fixed paraffin embedded tissue processing. While diagnosis can be rendered in many cases, fixed tissue processing is preferred in many conditions for more accurate diagnosis.

The intraoperative consultation is the name given to the whole intervention by the pathologist, which includes not only frozen section but also gross evaluation of the specimen, examination of cytology preparations taken on the specimen (e.g. touch imprints), and aliquoting of the specimen for special studies (e.g. molecular pathology techniques, flow cytometry). The report given by the pathologist is usually limited to a "benign" or "malignant" diagnosis, and communicated to the surgeon operating via intercom. When operating on a previously confirmed malignancy, the main purpose of the pathologist is to inform the surgeon if the surgical margin is clear of residual cancer, or if residual cancer is present at the surgical margin.

Procedure : The instrument for cryosection is the cryostat, which is essentially a microtome inside a freezer. The microtome can be compared to a very accurate "deli" slicer, capable of slicing sections as thin as 1 micrometre. The usual histology slice is cut at 5 to 10 micrometres. The surgical specimen is placed on a metal tissue disc which is

then secured in a chuck and frozen rapidly to about –20 to –30 °C. The specimen is embedded in a gel like medium called OCT (Optimal cutting temperature compound) and consisting of poly ethylene glycoland polyvinyl alcohol; this compound is known by many names and when frozen has the same density as frozen tissue. At this temperature, most tissues become rock-hard. Usually a lower temperature is required for fat or lipid rich tissue. Each tissue has a preferred temperature for processing. Subsequently it is cut frozen with the microtome portion of the cryostat, the section is picked up on a glass slide and stained usually with hematoxylin and eosin. The preparation of the sample is much more rapid than with traditional histology technique (around 10 minutes vs 16 hours). However, the technical quality of the sections is much lower.

Utility of frozen section diagnosis for thyroid nodule is controversial. It is theoretically useful for patients who have indeterminate FNAC results. Specifically, patients with suspicious cytology or patients with a nodule in which only an inadequate specimen could be obtained undergo surgical resection with an unknown, diagnosis, because in frozen section one or two slides are prepared but in paraffin specimen 20-30 slides are prepared.

Capsular and vascular invasion determine malignancy, and the ability to render an accurate interpretation on frozen section is very limited.

In cases suspicious for papillary carcinoma the presence of specific nuclear features necessary for the diagnosis cannot be discriminated on frozen section.

Udelsman and co-workers at Johns Hopkins[10] reported that the vast majority of patients (96.4%) with follicular neoplasms of the thyroid, frozen section is neither informative nor cost-effective.

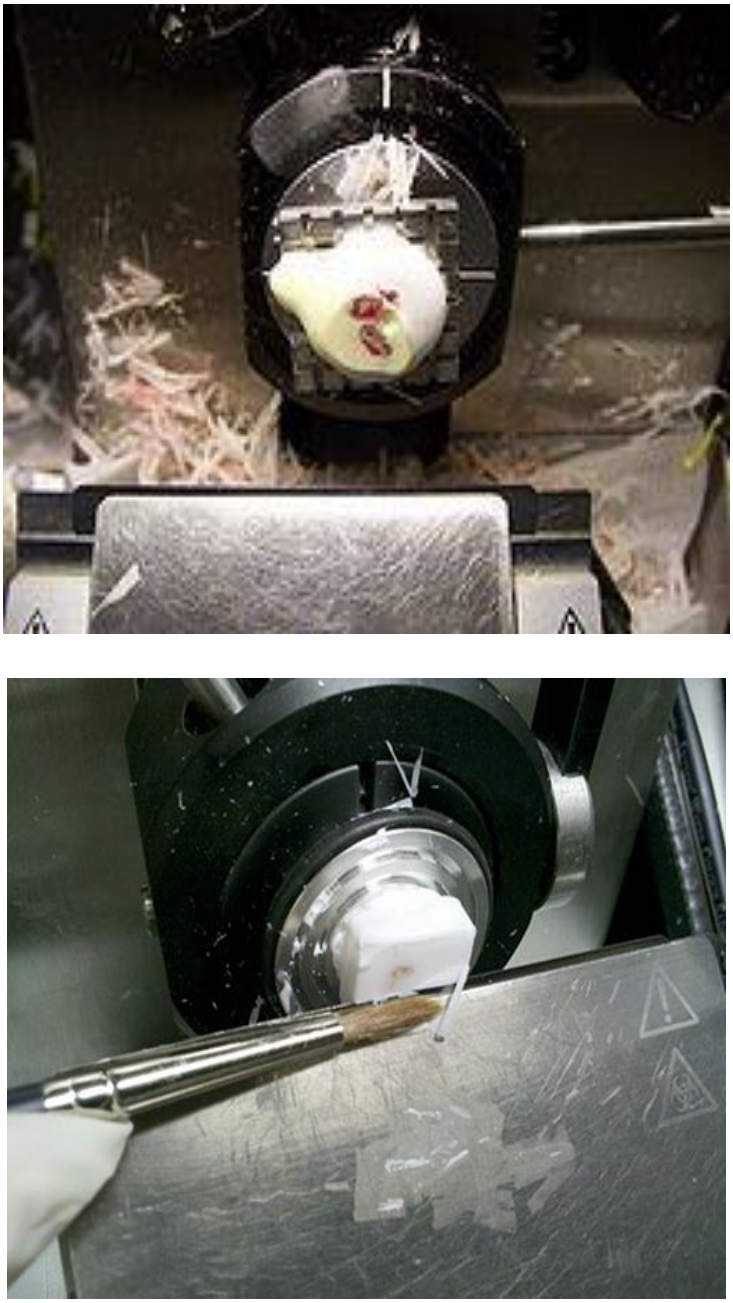


FIGURE 22. Cryostat machine for frozen section.

Management Of Solitary Nodule In The Thyroid Gland[18]

Whenever a solitary nodule is recognized on clinical examination then the problem arises as to what can be the probable pathology. The patient is subjected to the following investigation.

A. Thyroid function test:

Thyroid profile test must be done as a first line investigation before conducting other investigations. The thyroid profile typically includes thyroid hormones such as thyroid-stimulating hormone (TSH, thyrotropin) and thyroxine (T4), and triiodothyronine (T3) to look for hyperthyroidism (overactive thyroid) or hypothyroidism (underactive thyroid).

B. Ultrasound Neck**:**

It has been increasingly used not only to differentiate a solid from a cystic lesion but also recognize other cystic lesions clinically impalpable which suggests the pathology to be more in favour of a multinodular goitre and detects clinically non palpable lymph nodes.

C . Needle Biopsy **:**

A needle biopsy proves whether the nodule under consideration is cystic or solid. Since a carcinoma can also undergo cystic degeneration it is not confirmatory. However, the aspirate after cytological examination may reveal malignant cells in a carcinoma.

D. Radioactive scan **:**

i) Radioiodine scan: By this the nodule will be recognized as being hot, warm or cold.

Hot Nodule **:**

A hot nodule is one which takes up radioactive I^2 while the rest of the gland does not. It is usually a toxic nodule and it is never malignant. Surgical excision of the hot nodule is the best modality of treatment as these nodules are autonomous as they do not response well to anti thyroid drugs, in patients who are 45yrs of age. If above 45years then Radio I^2 can be used to destroy the active cells. The suppressed normal thyroid cells which do not take up radio iodine are spared and they maintain a euthyroid state after treatment.

Warm Nodule **:**

A warm nodule is one which takes up as much radio I^2 as the rest of the gland. Such nodules can be either adenomas or a cellular nodule of a multi-nodular goitre.

Cold Nodule **:**

It is the problem of cold nodule which is vexing. A cold nodule can be either a colloid cyst or a degenerative cyst of an adenomatous goitre or an adenoma or a malignancy. The other investigations which can throw some light as to the pathology are needle biopsy, ultrasound and selenium scan.

ii) Selenium Scan **:**

Though available only in few centres it can, to a certain extent recognize a carcinoma in that they take up the isotopic while colloid cyst and adenomas may not. However it is not conclusive.

Some centres advocate the following regime of management of a cold nodule.

a. Trial of therapy with thyroid hormones **:**

Children and males with suspicious nodules and patients with suggestive evidence of extra thyroidal disease should undergo surgery rather than a trial with thyroid hormone as there is a high risk of cancer in these nodules. The others are given a trial of full doses of thyroxine 0.3-0.4 mcg for at least a period of 4-6 months. It is based on theoretical grounds most nodules are known to be influenced by TSH and hence high doses of thyroxine suppresses TSH levels and promotes involution of the nodule. One theoretical worry however is that some papillary cancers especially if they are intra thyroidal can also regress in size. As they are TSH dependent and stay regressed as long as thyroxine during this period is continued with the same for the rest of life. Those in which the nodules do not regress in size or which on the contrary enlarge are subjected to surgery.

b. Surgery on isolated cold nodules[2] **:**

The surgeon should be prepared to do a total thyroidectomy and even a block dissection and hence the exposure should be adequate. Both the lobes are exposed and all the vessels ligated and both lobes mobilized so that careful thorough palpation can be done to detect nodules which commonly are hidden in the posterior margins of the gland.

1. If multinodularity is detected then a subtotal thyroidectomy is done. However, if multinodularity is present and in addition there are signs suggestive of cancer. The gland is subjected for frozen section and treated according to the type of malignancy detected.

2. Single nodule preoperatively and at surgery : If only the solitary nodule is felt without any evidence of multinodularity then a lobectomy is done on the side of the lobe which is affected, though some do an excision of the nodule with a rim of 1cm normal thyroid around it being excised. The specimen is sent for frozen section examination, and based on the report whether it is 'malignant' or 'benign' the necessary mode of surgery is chosen.

Papillary Carcinoma **:**

This is made out by the presence of atypical cells. "Psammoma bodies" if present are highly suggestive of papillary carcinoma as well as nodal involvement.

Follicular Carcinoma **:**

Lesions which show only microscopic invasion are grossly indistinguishable from follicular adenomas. However, capsular invasion and vascular invasion are diagnostic of follicular carcinoma.

Medullary Carcinoma **:** This tumour is a single, solid hard grey white mass which appears well encapsulated and without a central fibrotic scar. Vascular invasion may be evident.

Undifferentiated Carcinoma **:**

Invasion into the adjacent structures with gross anaplasia of the cells are evident, and areas of haemorrhage and necrosis are not common.

Though frozen section is helpful to come to a conclusion about the specific pathology there are many pit falls and sometimes, just a lobectomy is done and a paraffin section report awaited for to know the histological diagnosis.

Sometime a frozen section report says benign and later when a paraffin report comes as a malignant then if a lobectomy has been done and the diagnosis is papillary cancer then many surgeons go ahead once again and do a subtotal lobectomy on the other side while some put them on thyroxine to suppress TSH stimulation. If it turns out to be follicular carcinoma then nothing more need to be done. But a total lobectomy of the other side is resorted to only when secondaries develop in the bone or other organs so that they can be managed by radio iodine therapy.

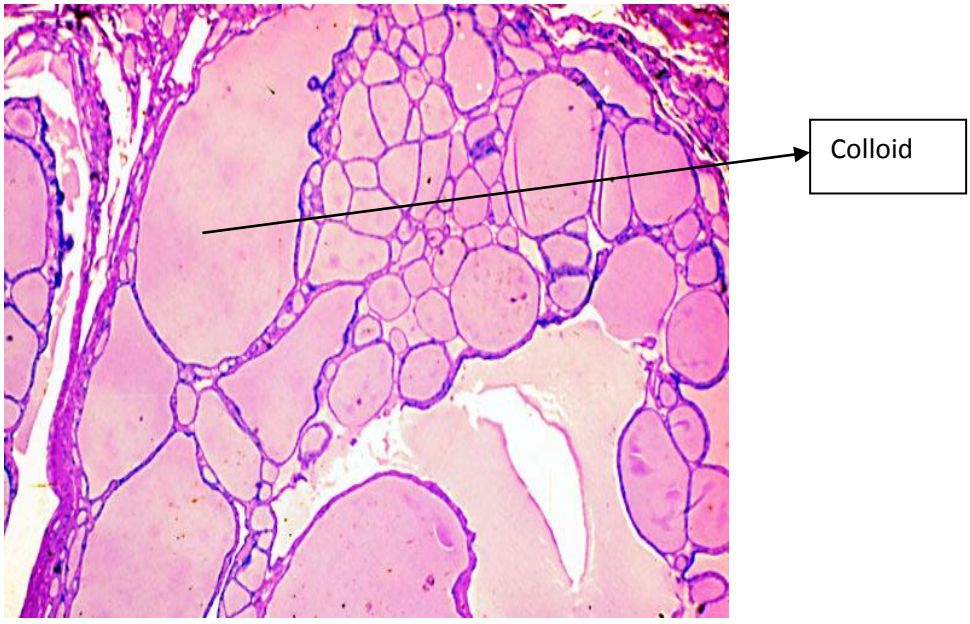


Figure 24. Histopathology picture of Colloid Nodular Goitre[28]

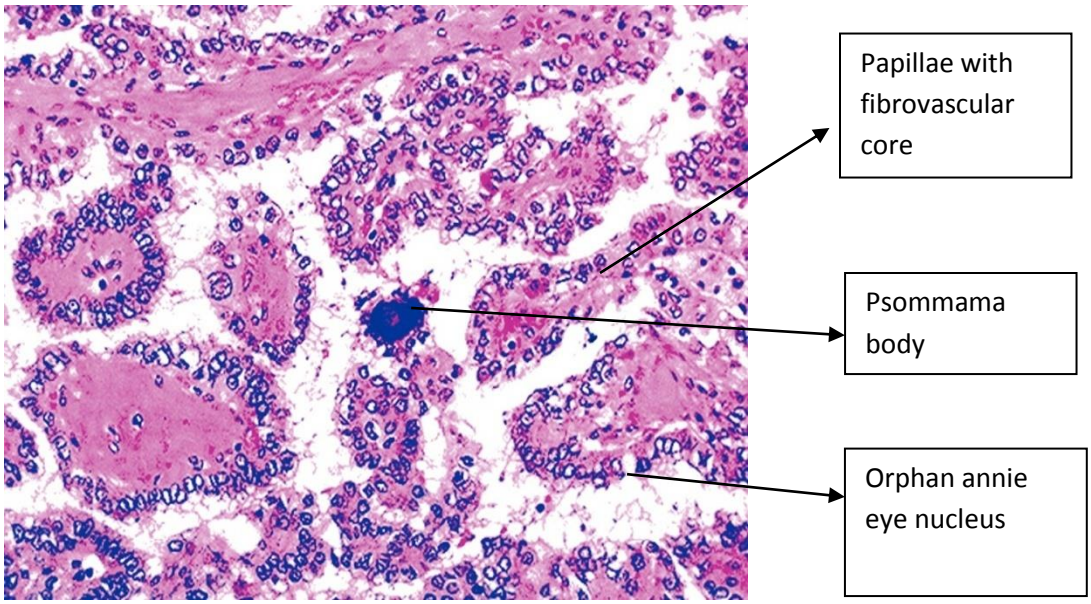


Figure 25. Histopathology picture of Papillary Carcinoma Thyroid[28].

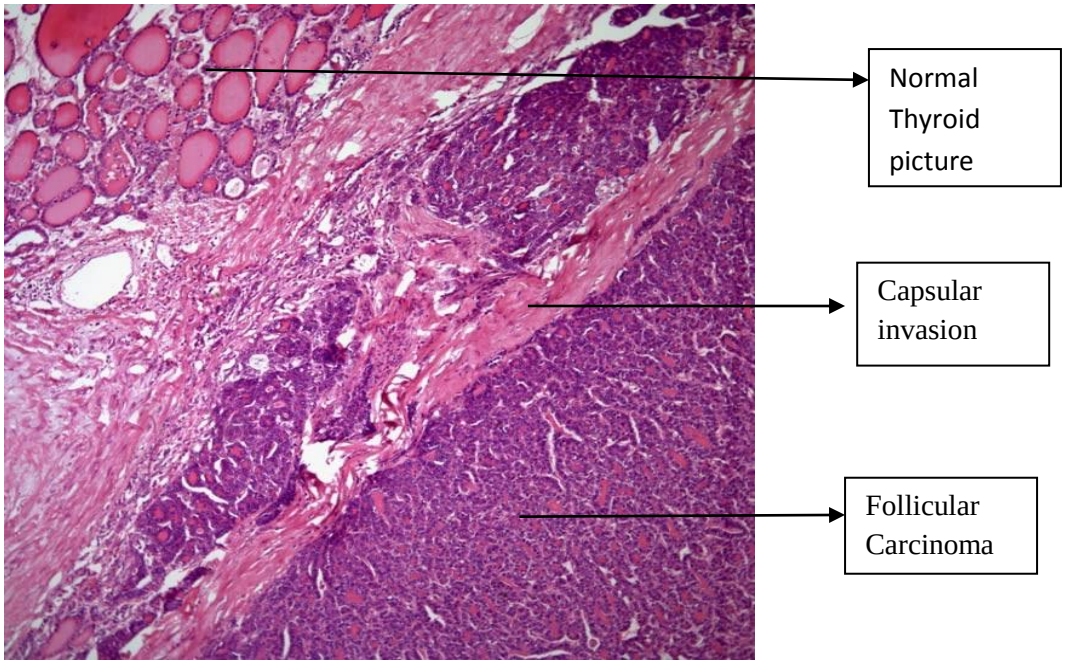


Figure 26. Histopathology picture of Follicular Carcinoma of Thyroid[28].

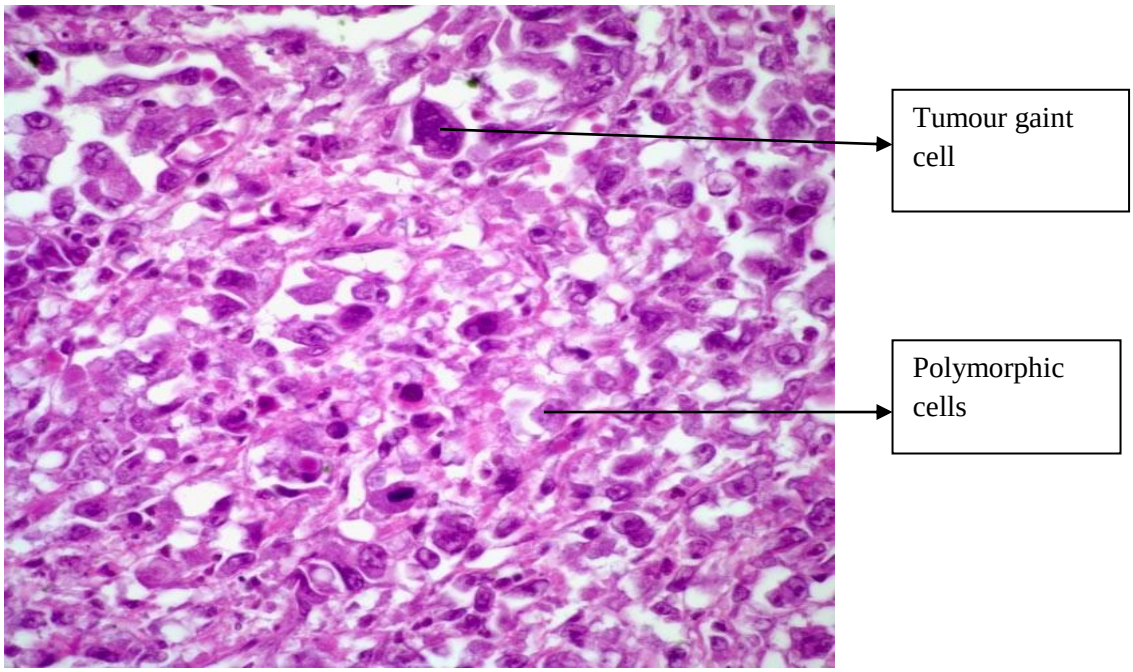


Figure 28. Histopathology picture of Anaplastic Carcinoma Thyroid[28].

Required operations after specific histological diagnosis of cancer on frozen section[23] :

Papillary Carcinoma **:**

Since these cancers have a multifocal origin in nearly 85% of the cases, a total thyroidectomy is the modality of treatment resorted to in most centres. Some do a total thyroidectomy but the chances of recurrent nerve damage and hypoparathyroidism are high. If there is involvement of the cervical lymph nodes then modified block dissection is carried out preserving the sternocleidomastoid and the internal jugular vein.

Follicular Carcinoma **:**

A total lobectomy is an adequate operation and preferably the isthmus should also be removed to obtain a sufficient margin around the tumour when there is no evidence of metastasis. In case bone or lung metastasis develop then a total lobectomy of the opposite side is done, and the patient is given radio iodine to destroy the secondaries.

Medullary Carcinoma **:**

A total thyroidectomy with central lymph node neck dissection is necessary as these glands have both a regional and distant metastatic spread.

Undifferentiated Carcinoma **:**

Since these tumours are frequently adherent to vital neck structures and as the recurrence rate is high, just a division of the isthmus to preserve the airway is all that can be accomplished. Radiation therapy can however be tried for the small cell variant but the results are poor.

METHODOLOGY

This was a prospective study conducted at BLDEU's Shri B.M. Patil Medical College Hospital and Research Centre, Vijayapur from Oct 2015 to June 2017 and included 60 patients with solitary thyroid nodule who presented to the hospital and gave consent for participation in the study.

Inclusion Criteria:

Patients who come to the OPD with a Solitary Thyroid Nodule in need of Surgery with any age.

Exclusion Criteria:

Patients with clinical STN but on investigations are found to have multiple thyroid nodules.

Pregnant and Lactating mothers.

Patients underwent detailed pre-tested questionnaire regarding duration, pain, progression of size, change in voice, difficulty in breathing, family history, previous treatment history.

In clinical examination special attention was given to the situation, size, shape of the nodule, mobility with deglutition, mobility with protrusion of tongue, skin over the swelling.

Routine investigations which includes Hb%, BT, CT, FBS,PPBS, blood urea, serum creatinine, urine routine, ECG, chest X-ray with specific investigations like thyroid profile, ultrasound of neck and preoperative FNAC of solitary thyroid nodule.

Cases were prepared for surgery after preoperative correction of anaemia, controlling of hypertension, diabetes.

- Informed written consent was obtained after explaining the surgical procedure, complications and results.
- Nil by mouth after 10:00 pm on the previous night of surgery.
- Injection tetanus toxoid 0.5ml IM
- Injection xylocaine test dose subcutaneous on left volar aspect of forearm.
- preparation of the parts by shaving.

All patients received one dose of preoperative antibiotics.

Steps of Surgery for Hemithyroidectomy / Lobectomy :

Under general anesthesia, the patient was placed in supine position with the apex of the patient's head at the top of the operating bed. A shoulder roll is placed at the level of the acromion process of the scapula to help extend the neck with elevation of head end of table. A slightly curved transverse skin crease incision was made 2–3cm above the sternum, Platysma is incised in line with the skin. Traditionally, 40–60mL of 1 in 400,000 adrenaline is infiltrated into the superficial tissue of the flaps prior to the incision to reduce bleeding, but this is of lesser value when diathermy coagulation is employed. The skin and platysma flaps are elevated down to the sternum, and up to the thyroid cartilage. A self-retaining Joll's retractor is then positioned to retract the flaps. The deep cervical fascia was incised vertically in the midline, and the strap muscles retracted laterally. The assistant's help was taken to retract the strap muscles laterally, and away from the surface of the gland. Areolar tissue around the gland was divided and the middle and inferior thyroid veins are displayed. Attention was next turned to the superior pole,

two ligatures are tied and the vessels are then divided between the ligatures and a further ligature tied on the superior thyroid pedicle before the forceps is released. The inferior thyroid artery was ligated in continuity. The medial surface of the lobe was then separated from the trachea, and attachment to the isthmus which was divided close to the contralateral lobe. A haemostatic continuous absorbable suture in the isthmus was used to control haemorrhage. A deep vacuum drain was placed beneath the strap muscles before they are approximated. The platysma was sutured, and finally the skin was closed using subcuticular sutures.

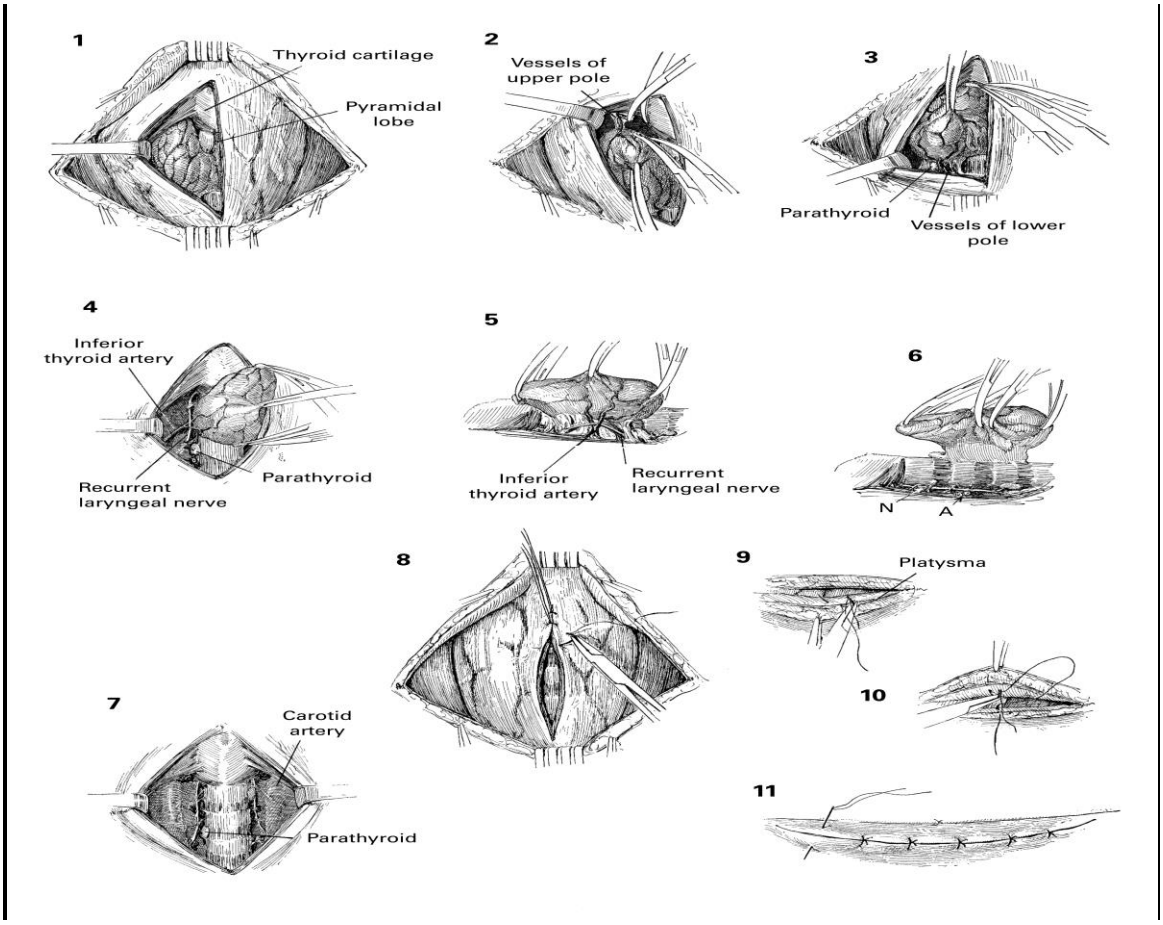


Figure 29 : Schematic representation depicting steps of right hemithyroidectomy.

Figure 30. Patient put on supine position with neck extended

Figure 31. Skin with platysma flaps

Figure 32. Flaps are retracted with Joll's retractor

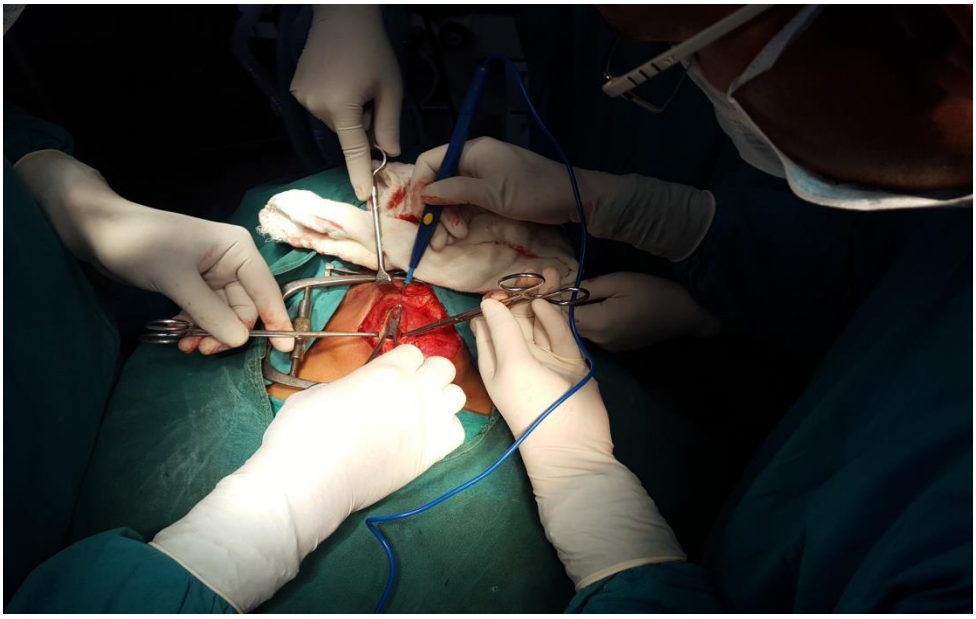


Figure 33. Investing layer of deep cervical fascia is incised vertically

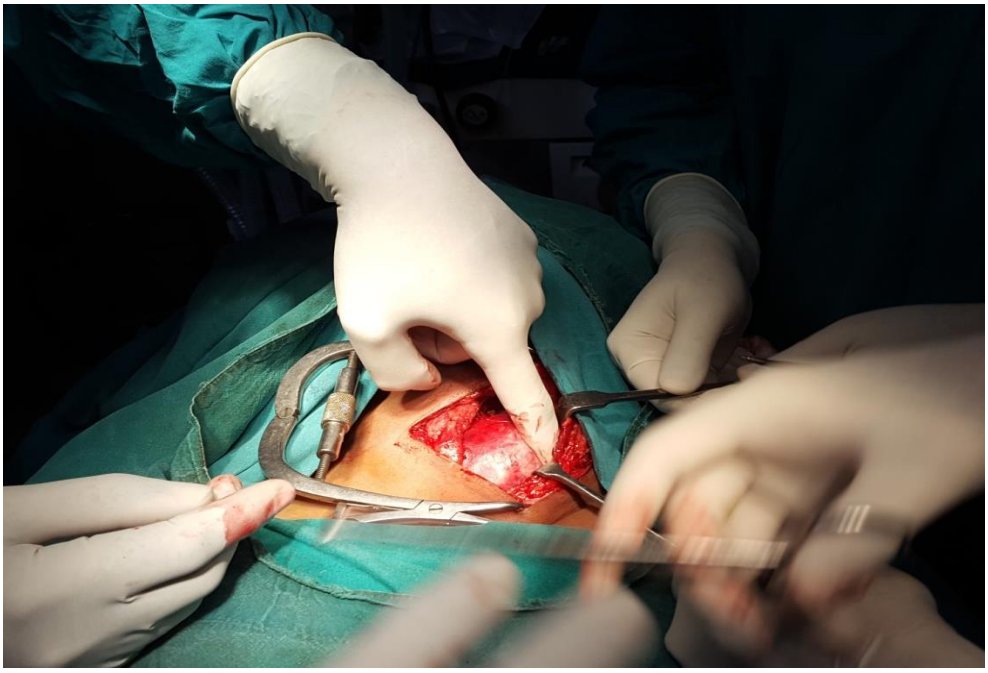


Figure 34. Strap muscles are retracted laterally

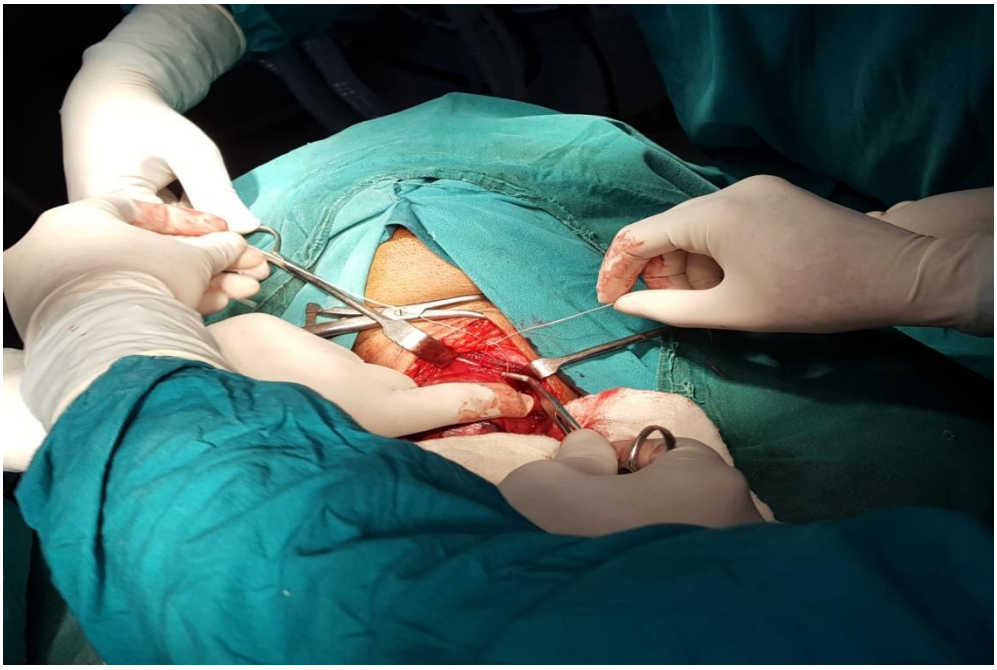


Figure 35. Ligation of superior pedicle

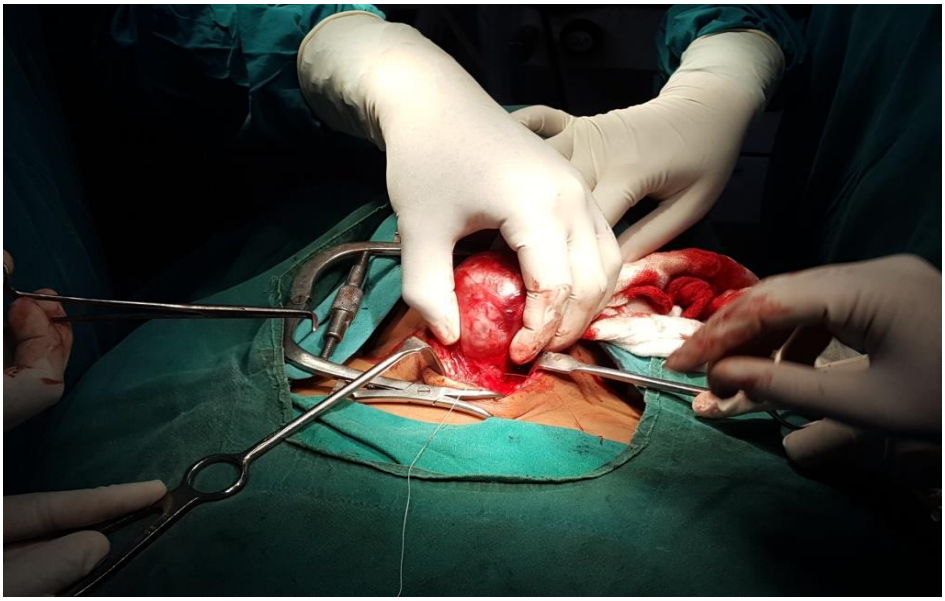


Figure 36. Ligation of inferior pedicle

After surgery, The specimen was sent to histopathology. The preoperative FNAC was compared with postoperative histopathology report of resected specimen.

RESULTS

SAMPLING:

A study conducted by Muddhegouda PH *et al* titled Panorama of solitary thyroid nodule published in the International journal of medical and health science in 2012 was taken as a reference study[2].

With 95% confidence level, anticipated prevalence of solitary thyroid nodules as 80.1% and desired precision ± 10 %, The minimum sample size is 60.

Total Sample size is found out to be 60.

$$n = \frac{Z^2 P(1 - P)}{d^2}$$

n= sample size

z= statistics for a level of confidence.

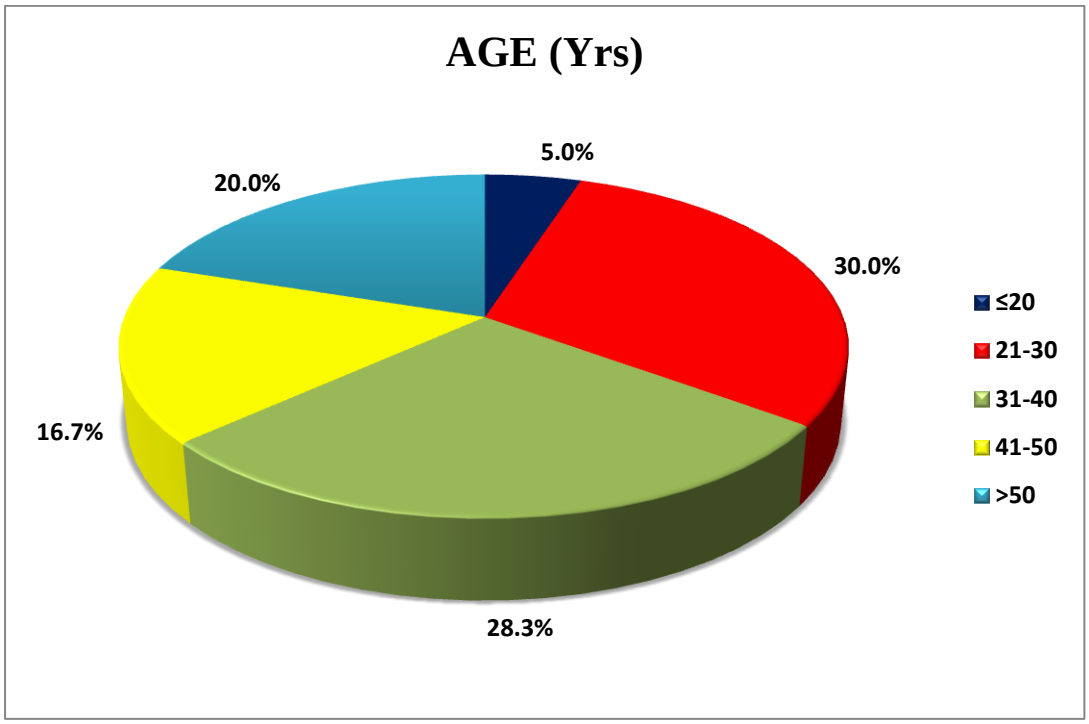
p= expected prevalence

d= Desired precision.

Table 2. Distribution of cases according to the age.

AGE (Yrs)	N	%
15-20	3	5
21-30	18	30
31-40	17	28.3
41-50	10	16.7
50-60	12	20
Total	60	100

Graph 1. Distribution of cases according to the age.

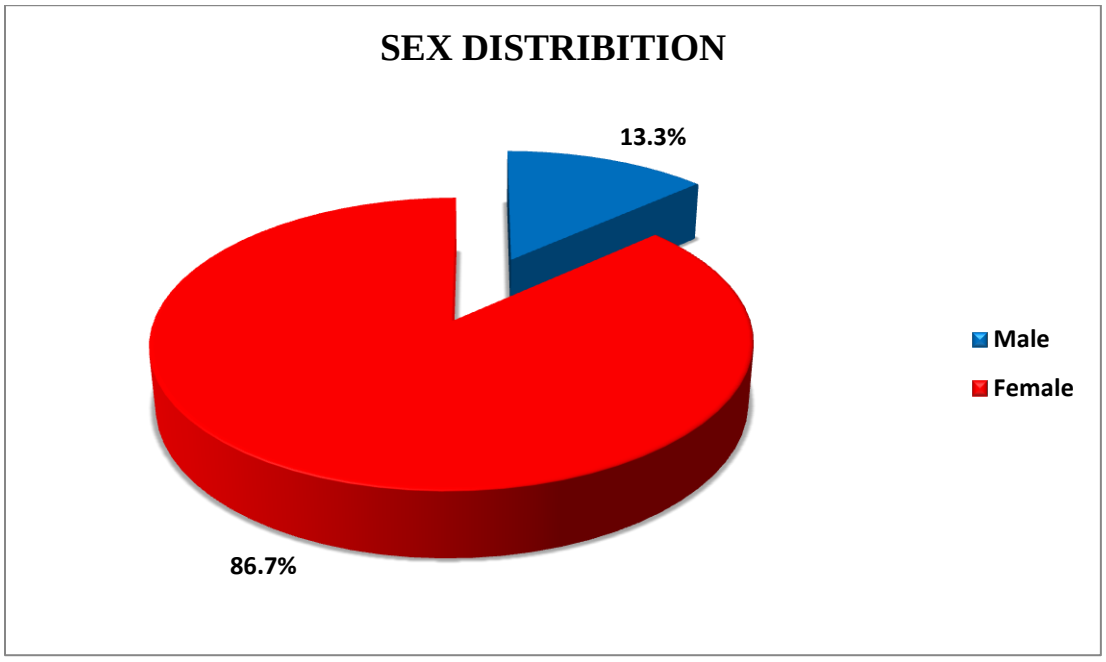


Shows maximum cases in the age group of 21- 30years.

Table 3. Distribution of cases according sex

SEX	N	%
Male	8	13.3
Female	52	86.7
Total	60	100

Graph 2. Distribution of cases according sex

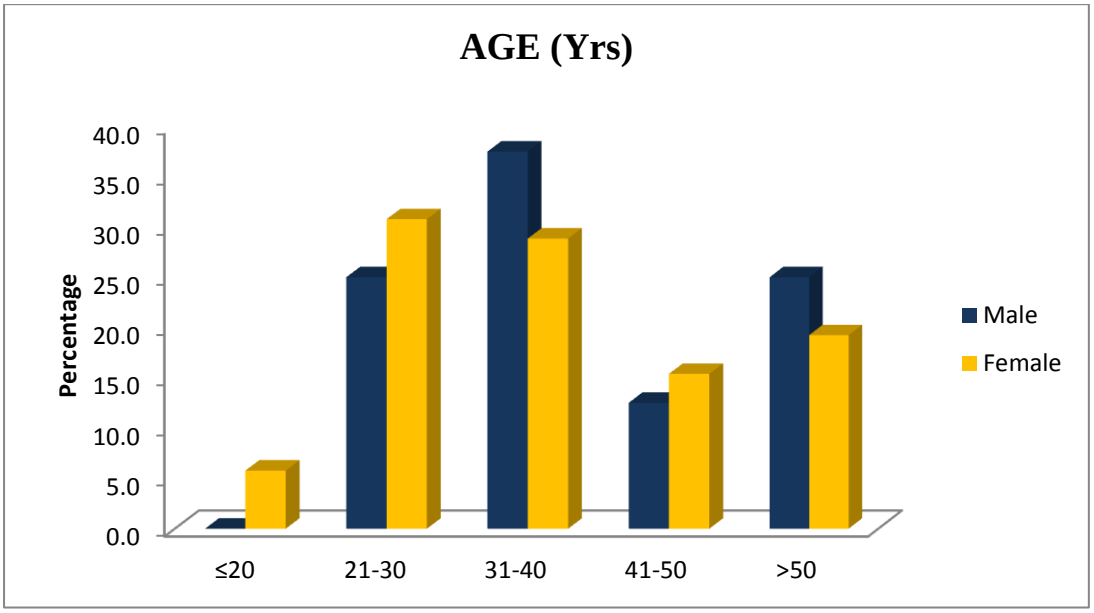


Shows maximum cases were females

Table 4. Association of age and sex

AGE (Yrs)	Male		Female		p value
	N	%	N	%	
≤20	0	0.0	3	5.8	0.898
21-30	2	25.0	16	30.8	
31-40	3	37.5	15	28.8	
41-50	1	12.5	8	15.4	
>50	2	25.0	10	19.2	
Total	8	100.0	52	100.0	

Graph 3. Association of age and sex

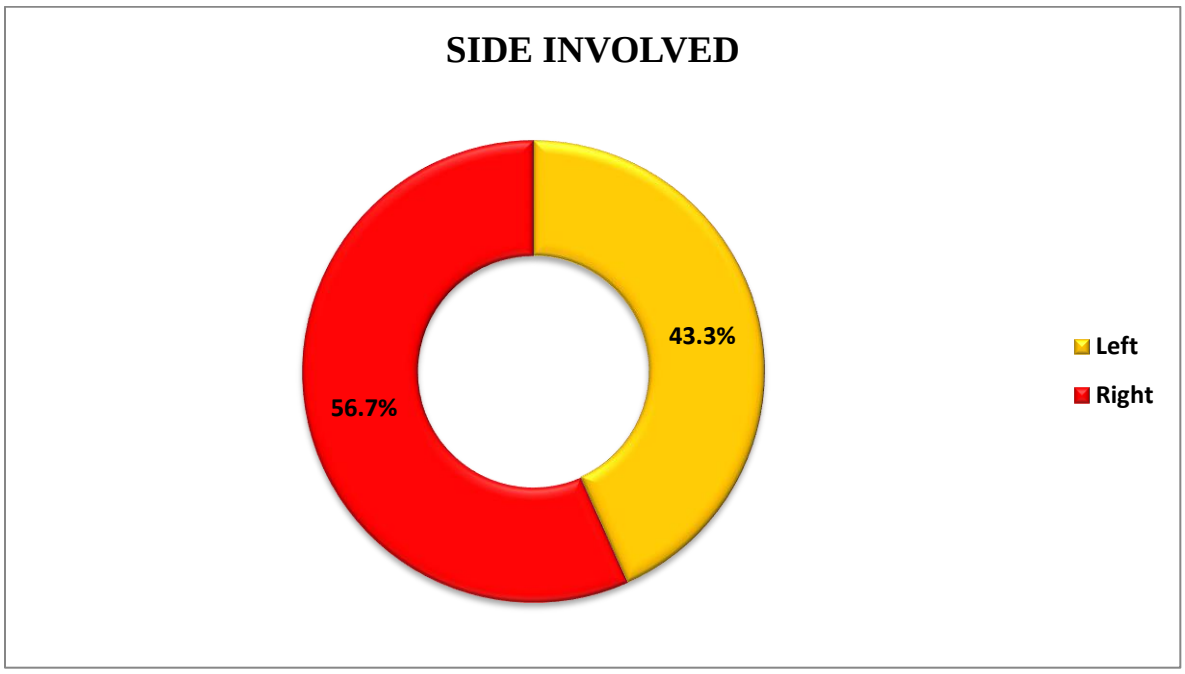


Shows among males maximum age for presentation was between 31-40 years whereas in females between 21-30 years.

Table 5. Distribution of cases according to the side involved.

SIDE INVOLVED	N	%
Left	26	43.3
Right	34	56.7
Isthmus	0	0
Total	60	100

Graph 4. Distribution of cases according to the side involved.

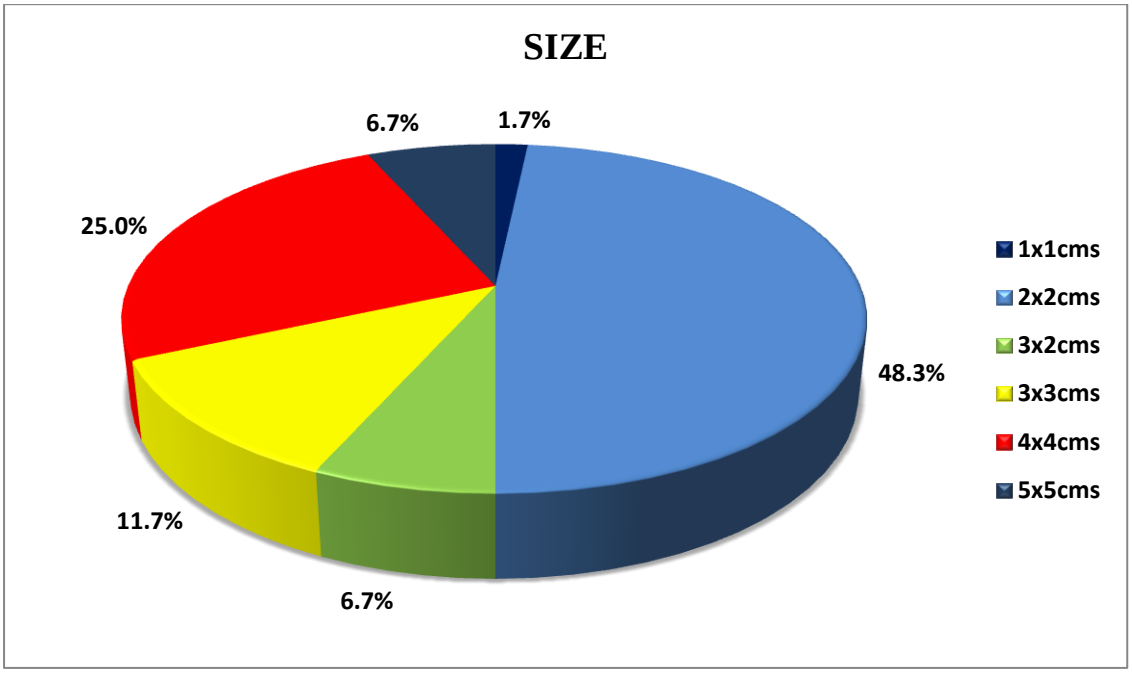


Shows right side was most commonly involved.

Table 6. Distribution of cases according to size.

SIZE	N	%
1x1cms	1	1.7
2x2cms	29	48.3
3x2cms	4	6.7
3x3cms	7	11.7
4x4cms	15	25
5x5cms	4	6.7
Total	60	100

Graph 5. Distribution of cases according to size.

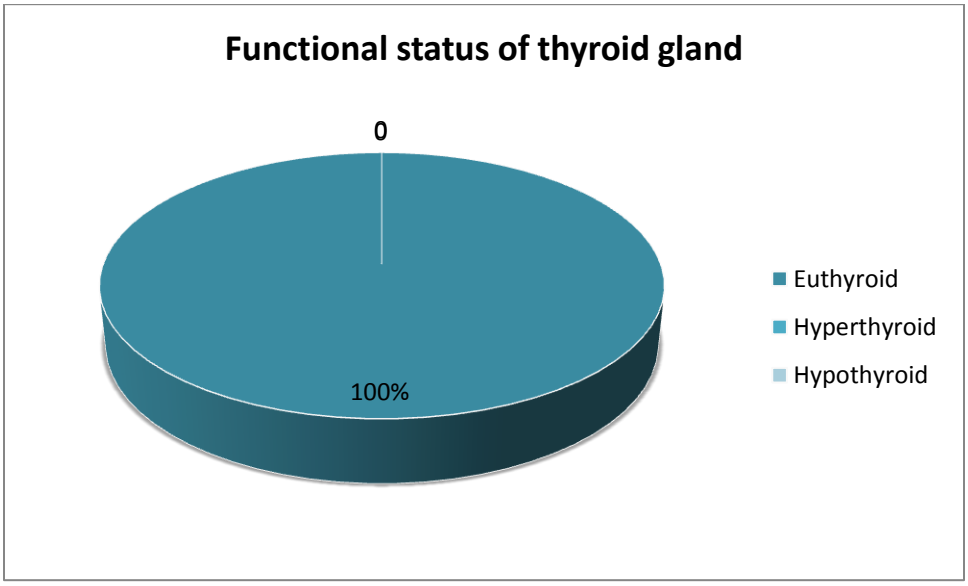


Shows maximum had size of 2x2cm

Table. 7 Functional status of thyroid gland.

Functional status of thyroid gland.	N	%
Euthyroid	60	100
Hyperthyroid	0	0
Hypothyroid	0	0

Graph 6. Functional status of thyroid gland.



Shows 100% of cases were euthyroid.

Table 8. Distribution of cases according to USG Neck findings.

USG findings	N	%
Solid	46	76.7
Cystic	14	23.3
Total	60	100.0

Graph 7. Distribution of cases according to USG Neck findings.

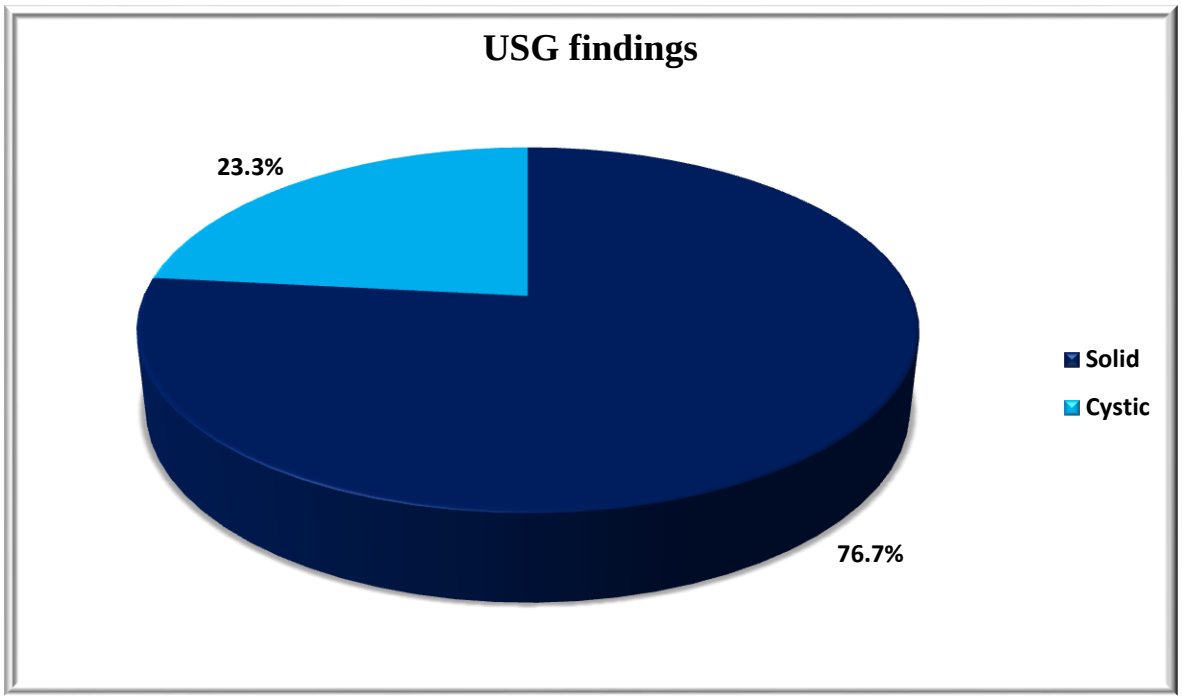
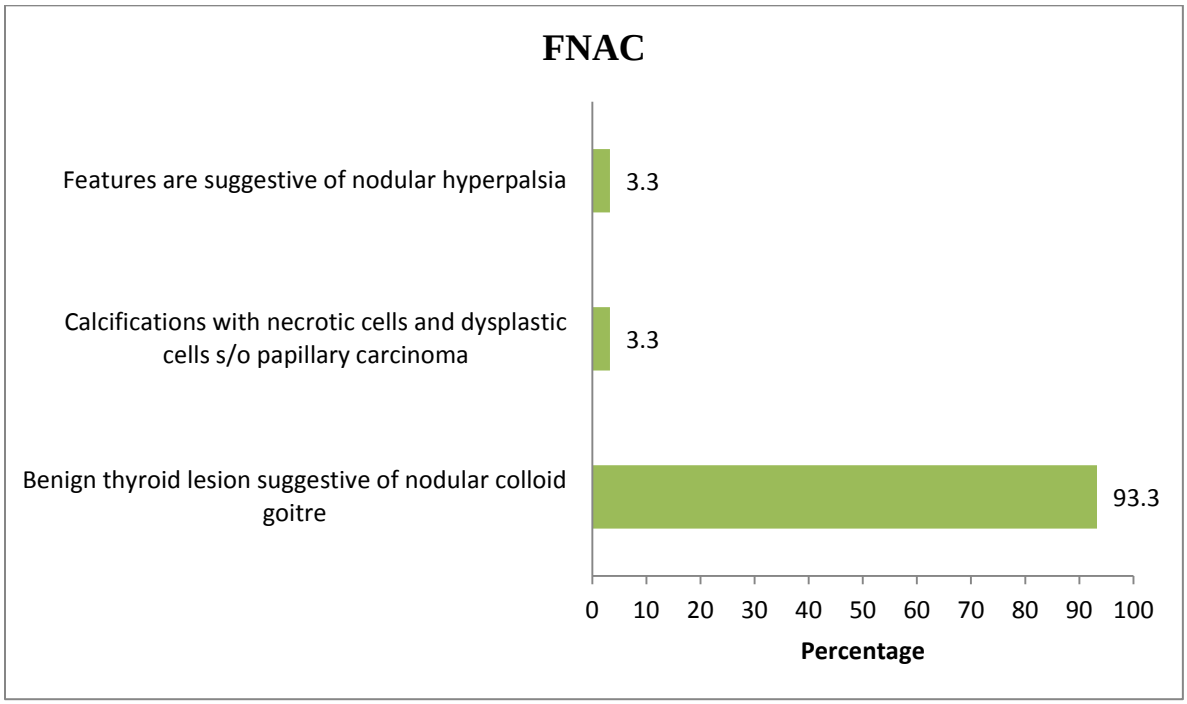


Table 9. Distribution of cases according to FNAC findings.

FNAC	N	%
Benign thyroid lesion suggestive of nodular colloid goitre	56	93.3
Calcifications with necrotic cells and dysplastic cells s/o papillary carcinoma	2	3.3
Features are suggestive of nodular hyperpalsia	2	3.3
Total	60	100

Graph 8. Distribution of cases according to FNAC findings.



Shows maximum were benign thyroid lesion suggestive of nodular colloid goitre

Table 10. Distribution of cases according to hpr findings

HPR	N	%
Benign thyroid lesion suggestive of nodular colloid goitre	60	100
Thyroid malignancies	0	0

Table 11. Sensitivity, Specificity, Negative predictive value (NPV), Positive Predictive value (PPV) and Accuracy of FNAC with comparision to HPR.

Sensitivity	-
Specificity	96.67%
PPV	0.00%
NPV	100.00%
Accuracy	96.67%

Statistical analysis

All characteristics were summarized descriptively. For continuous variables, the summary statistics of mean, standard deviation (SD) were used. For categorical data, the number and percentage were used in the data summaries. Chi-square (χ^2)/ Freeman-Halton Fisher exact test was employed to determine the significance of differences between groups for categorical data. Sensitivity- specificity analysis was done to check relative efficiency. If the p-value was < 0.05, then the results were considered to be statistically significant otherwise it was considered as not statistically significant. Data were analyzed using SPSS software v.23.0. and Microsoft office.

DISCUSSION

Solitary thyroid nodule is a common clinical problem though varying in incidence in different geographical regions having an incidence of 4-7% reported in the general population and mostly benign[37]. The major concern in such patients is the potentiality of a thyroid nodule to malignancy.

Many surgeons would advise routine surgical resection for every solitary thyroid nodule. Such a policy resulted in many patients undergoing unnecessary operations for what was subsequently shown to be benign thyroid disease. It is therefore logical to propose a more selective surgical policy for patients with solitary thyroid nodules. At present, fine needle aspiration cytology (FNAC) is the most reliable and widely used diagnostic tool in the clinical work up of solitary thyroid nodules[37].

In this study a total of 60 patients diagnosed clinically as solitary thyroid nodule in a euthyroid state were subjected to FNAC followed by surgery and then the specimen were sent for HPR.

In our study the age of patients ranged from 15 years to 60 years with mean age of 38.1 years. Majority (30%) of these patients were between the age group of 21-30 years followed by 28.3% in age group of 31-40 years, least (5%) was in age group of 15-20years. This study corresponds with study done by Rajesh kakkeri[29] where peak incidence was in the age group of 21-30 years. This differs from the study by Sabu N, Eranna R[30] where maximum age of presentation was 40years.

In our study solitary thyroid nodule were more common in females (86.7 %) than in males (13.3%). This correlates with study done by Rajesh Kakkeri were 105 patients

were females and 15 were males. This also correlates with the study done by Sabu N, Eranna R[30]. Similar study by Haridas TV, Bindhu, Vinodh[31] also showed female preponderance.

Right lobe(56.7%) of thyroid was most commonly involved lobe of thyroid than the left lobe(43.3%) in my study. This was on par with the study by Thambi CR[32], out of the 75 patients in study, right lobe was involved in 44 patients and left lobe in 24 patients.

Another study by Surendra A, Vinod NR, Tushar MD[33] showed that 78% had involvement of Right lobe of thyroid and 22% had left lobe involvement which is similar to my study.

In this study there was no involvement of isthmus. This differs from the study by Thambi CR[32] were isthmus involvement was seen in 7 patients.

A maximum of 48.3% had thyroid size of 2x2cm, followed by 25% with 4x4cm, least was 1.7% with 1x1cm in this study. This was similar to study by Surendra A, Vinod NR, Tushar MD[33] where the size of nodules was found to be between 2-6 cms.

Another study by Sabu N, Eranna R[30] also showed in their study that most of the solitary nodules was less than 6cms.

Frozen section should be considered unnecessary because it does not affect the intraoperative decision making[19].

A total of 93.3% patients had benign thyroid lesion which was suggestive of nodular colloid goitre, 3.3% had calcifications with necrotic cells and dysplastic cells

which was suggestive of papillary carcinoma thyroid and 3.3% had features which was suggestive of nodular hyperplasia in my study.

In a study by Fazal IW, Sahibzada FK, Habib UR, Iftikhar AK[34], out of the 82 patients in the study 70.73% had nodular colloid goitre, 8 patients had Papillary carcinoma which was similar to my study.

In another study done by Mahummad S, Umair I, Pervez I, Qamaruddin B[35] out of 60 patients, 83.33% was found to be benign thyroid lesion suggestive of nodular goitre following FNAC which corresponds with my study.

In our study out of 60 patients histopathology findings were suggestive of nodular colloid goitre in 100% of patients. In the previous study conducted by Christensen SB, Ericsson UB, Janzon L, Tibblin S, Trell E among 477 middle aged female patients with solitary thyroid nodule were examined by FNAC and all the patients were diagnosed to be having a benign disease except one which showed follicular neoplasm, all the patients were surgically treated and revealed as colloid goitre in 100% of the patients following final HPR which is consistent with my study.

CONCLUSION

The solitary thyroid nodule is a common clinical condition in general population. FNAC done pre operatively and the intra-operative findings co-relate with post operative histopathological report in the diagnosis of Solitary Thyroid Nodule. A malignant FNAC diagnosis should be viewed with caution as false positive results do occur and these patients should be posted for surgery and confirmed by histopathological examination.

SUMMARY

Solitary thyroid nodule is defined clinically as the localized thyroid enlargement with apparently normal rest of the gland. Solitary thyroid nodule is a common entity. The prevalence is 4% by palpation, 19 to 67% by ultrasound examination, 50% in autopsy series.

By and large there are five categories of thyroid nodules- hyperplastic, colloid, cystic, inflammatory and neoplastic. Surgery is indicated when there is suspicion of malignancy, compressive airway obstruction, hyperthyroidism and for cosmetic reasons.

Among 60 cases of solitary thyroid nodule in euthyroid state, were subjected to preoperative FNAC and subsequent histopathological study was done following surgery.

93.3% cases showed nodular colloid goitre, 3.3% cases showed calcifications with necrotic cells and dysplastic cells s/o papillary carcinoma, 3.3% cases showed nodular hyperplasia. However it differed in 3.3% cases where diagnosis by FNAC was found to be papillary carcinoma of thyroid and on following final histopathological study was found to be nodular colloid goitre. Hence the diagnostic accuracy of FNAC for solitary thyroid nodules in this study was 96.67%.

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ANNEXURES

ETHICAL COMMITTEE CERTIFICATE

B.L.D.E.UNIVERSITY'S
SHRI.B.M.PATIL MEDICAL COLLEGE, BIJAPUR – 586103
INSTITUTIONAL ETHICAL COMMITTEE

NO/568/2015
20/11/15

INSTITUTIONAL ETHICAL CLEARANCE CERTIFICATE

The Ethical Committee of this college met on 17-11-2015 *at* 03 pm *scrutinize the Synopsis of Postgraduate Students of this college from Ethical Clearance point of view. After scrutiny the following original/corrected and revised version synopsis of the Thesis has accorded Ethical Clearance.*

Title "Comparative Study of FNAC and Histopathology in solitary thyroid nodule"

—— x —— x —— x —— x ——

Name of P.G. Student : Dr Santosh V. Motagi
Dept of Surgery

Name of Guide/Co-investigator : Dr Manjunath Kotennavar, Prof of Surgery & Dr Mahesh Karigoudar Prof Pathology

DR.TEJASWINI VALLABHA
CHAIRMAN
CHAIRMAN
Institutional Ethical Committee
BLDEU's Shri B.M. Patil
Medical College,BIJAPUR-586103.

Following documents were placed before E.C. for Scrutinization:
1)Copy of Synopsis/Research Project
2)Copy of informed consent form.
3)Any other relevant documents.

SAMPLE INFORMED CONSENT FORM:

TITLE OF THE PROJECT	:	**COMPARATIVE STUDY OF FNAC AND HISTOPATHOLOGY IN SOLITARY THYROID NODULE.**
PG GUIDE	:	**Dr. MANJUNATH S. KOTENNAVAR** M.S GENERAL SURGERY PROFESSOR OF SURGERY DEPARTMENT OF SURGERY
PG Co-GUIDE		**DR. MAHESH H. KARIGOUDAR** M.D PATHOLOGY PROFFESOR OF PATHOLOGY DEPARTMENT OF PATHOLOGY
PRINCIPAL INVESTIGATOR	:	**DR. SANTOSH V. MOTAGI**

RISK AND DISCOMFORTS:

I understand that I may experience some pain and discomforts during the examination or during my treatment. This is mainly the result of my condition and the procedures of this study are not expected to exaggerate these feelings which are associated with the usual course of treatment.

BENEFITS:

I understand that my participation in the study will help to study how to manage solitary thyroid nodule in patients coming to the hospital for surgery.

CONFIDENTIALITY:

I understand that the medical information produced by this study will become a part of hospital records and will be subject to the confidentiality. Information of sensitive personal nature will not be part of the medical record, but will be stored in the investigations research file.

If the data are used for publication in the medical literature or for teaching purpose, no name will be used and other identifiers such as photographs will be used only with special written permission. I understand that I may see the photograph before giving the permission.

REQUEST FOR MORE INFORMATION:

I understand that I may ask more questions about the study to **Dr. Santosh V. Motagi** in the Department of General Surgery who will be available to answer my questions or concerns. I understand that I will be informed of any significant new findings discovered during the course of the study, which might influence my continued participation. A copy of this consent form will be given to me to keep for careful reading.

REFUSAL FOR WITHDRAWAL OF PARTICIPATION:

I understand that my participation is voluntary and that I may refuse to participate or may withdraw consent and discontinue participation in the study at any time without prejudice. I also understand that **Dr. Santosh V. Motagi** may terminate my participation in the study after he has explained the reasons for doing so.

INJURY STATEMENT:

I understand that in the unlikely event of injury to me resulting directly from my participation in this study, if such injury were reported promptly, the appropriate treatment would be available to me. But, no further compensation would be provided by the hospital. I understand that by my agreements to participate in this study and not waiving any of my legal rights.

I have explained to _____the purpose of the research, the procedures required and the possible risks to the best of my ability.

_____ _____

Dr. Santosh V. Motagi Date

(Investigator)

STUDY SUBJECT CONSENT STATEMENT:

I confirm that Dr. Santosh V. Motagi has explained to me the purpose of research, the study procedure, that I will undergo and the possible discomforts as well as benefits that I may experience in my own language. I have been explained all the above in detail in my own language and I understand the same. Therefore I agree to give consent to participate as a subject in this research project.

_____ _____

(Participant) Date

_____ _____

(Witness to signature) Date

PROFORMA FOR CASE TAKING

SL NO

Name

Age IP NO

Sex UNIT

Religion DOA

Occupation DOD

DOS

Address:

Mobile No:

Chief Complaints:

History of Presenting Illness:

A. Duration:

B. Onset:

C. Progression: Slow Rapid Constant

D. Site: Midline Rt. lateral Lt. lateral

E. Associated Symptoms :

F. **Specific Complaints:** (Primary Toxicosis, Secondary Toxicosis, Symptoms of Hypothyroidism and Pressure symptoms):

Past History:

Treatment History:

1. Anti-thyroid Drugs
2. Iodinated Drugs
3. Surgery
4. Radiotherapy

Personal History:

A. Diet

B. Smoking

C. Alcohol / Tobacco chewing

D. Bowel and Bladder

E. Menstrual history:

Family History:

GENERAL PHYSICAL EXAMINATION:

Built: Well/Moderate/Poor

Nourishment: Well/Moderate/Poor

Facial expression:

Temperature: Pulse:

B.P: Respiratory Rate:

Eye Signs:

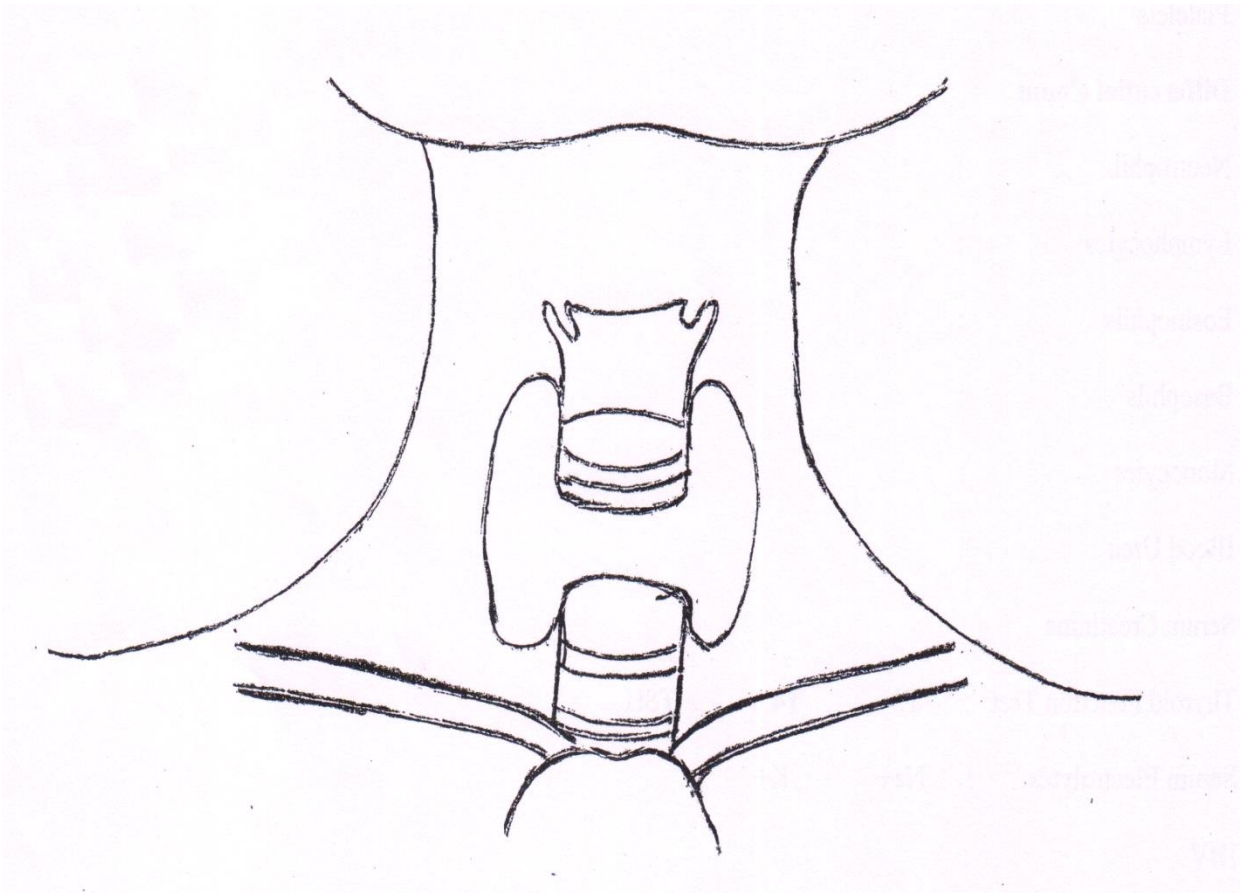
LOCAL EXAMINATION:

Inspection:

B) **Palpation**:

C)**Percussion**:

D) **Ascultation:** .



SYSTEMIC EXAMINATION:

Per Abdomen

Respiratory System

Cardio Vascular System

Central Nervous System

LABORATORY TESTS

Haemoglobin% :

Total Count :

Platelets :

Differential Count

Neutrophil :

Lymphocytes :

Eosinophils :

Basophils :

Blood Urea :

Serum Creatinine :

Thyroid Function Test : T3 T4 TSH

Serum Electrolytes : Na+ K+

HIV :

HBsAg :

Electro Cardiogram :

X-Ray neck AP & Lateral view:

Ultrasonography of Neck:

FNAC :

Indirect Laryngoscopy :

Chest X-Ray

FINAL DIAGNOSIS :

Surgery details :

Histopathology report **:**

MASTER CHART

Serial no	IP NO	NAME	AGE	SEX	SIDE INVOLVED	SIZE	FUNCTIONAL STATUS	USG Neck	FNAC	DOS	HPR
1	38073	Shantawwa	40years	female	right	2x2cms	Euthyroid	Mixed echogenic lesion in the right lobe of thyroid	benign thyroid lesion suggestive of nodular colloid goitre	1/12/2015	Benign thyroid lesion suggestive of nodular colloid goitre
2	1969	Yamanappa	50years	male	left	4x4cms	Euthyroid	Solitary Mixed echogenic lesion	benign thyroid lesion suggestive of nodular colloid goitre	24/1/2016	nodular goitre with cystic change
3	6150	Ratnabai	50years	famale	left	4x4cms	Euthyroid	Mixed echogenic lesion in the left lobe of thyroid	benign thyroid lesion suggestive of nodular colloid goitre	25/2/2016	nodular goitre with cystic change
4	19122	Seetawwa	45years	female	right	2x2cms	Euthyroid	solitary Cystic lesion in the right thyroid gland with no flow on color doppler.	benign thyroid lesion suggestive of nodular colloid goitre	18/6/2015	nodular goitre with cystic change
5	18685	Kasturi s	52years	female	right	3x3cms	Euthyroid	Mixed echogenic lesion in the right lobe of thyroid	benign thyroid lesion suggestive of colloid nodule	10/6/2016	nodular goitre with cystic change
6	12057	Savitha	28years	female	right	1x1cms	Euthyroid	Mixed echogenic lesion	benign thyroid lesion suggestive of colloid nodule	12/4/2106	nodular goitre with cystic change
7	39283	Shoba	30years	female	right	2x2cms	Euthyroid	Mixed echogenic lesion in the right lobe of thyroid	benign thyroid lesion suggestive of colloid nodule	12/12/2015	benign thyroid lesion suggestive of nodular colloid goitre
8	2212	Shantabai M	35years	female	right	2x2cms	Euthyroid	Mixed echogenic lesion in the right lobe of thyroid	benign thyroid lesion suggestive of nodular colloid goitre	29/1/2016	nodular goitre with cystic change
9	7991	Basamma B Shedyal	31years	female	left	3x2cms	Euthyroid	Mixed echogenic lesion in the left lobe of thyroid	benign thyroid lesion suggestive of nodular colloid goitre	12/3/2016	nodular goitre with cystic change
10	14958	Laxmibai M R	37years	female	right	2x2cms	Euthyroid	solitary Cystic lesion in the right thyroid gland with no flow on color doppler.	benign thyroid lesion suggestive of nodular colloid goitre	14/5/2015	nodular goitre with cystic change
11	23262	Parvathi B H	34years	female	right	2x2cms	Euthyroid	Mixed echogenic lesion in the right lobe of thyroid	benign thyroid lesion suggestive of nodular colloid goitre	1/8/2015	nodular goitre with cystic change
12	30950	Kalavathi Athani	40years	female	right	3x2cms	Euthyroid	Mixed echogenic lesion in the right lobe of thyroid	benign thyroid lesion suggestive of nodular colloid goitre	30/10/2015	nodular goitre with cystic change

13	33404	Draupadi Amboji Sinde	41years	female	left	3x2cms	Euthyroid	Mixed echogenic lesion in the left lobe of thyroid	calcifications with necrotic cells and dysplastic cells s/o papillary carcinoma	15/10/2015	nodular goitre with cystic change
14	41696	Sharadabai R	40years	female	right	2x2cms	Euthyroid	Mixed echogenic lesion in the right lobe of thyroid	benign thyroid lesion suggestive of nodular colloid goitre	8/1/2016	nodular goitre with cystic change
15	1061	Meenakumari	23years	female	right	2x2cms	Euthyroid	solitary Cystic lesion in the right thyroid gland with no flow on color doppler.	benign thyroid lesion suggestive of nodular colloid goitre	13/1/2016	nodular goitre with cystic change
16	4898	Kasthuribai	56years	female	right	3x3cms	Euthyroid	Mixed echogenic lesion in the right lobe of thyroid	benign thyroid lesion suggestive of nodular colloid goitre	15/2/2017	nodular goitre with cystic change
17	5828	Pavithra	39years	female	right	5x5cms	Euthyroid	Mixed echogenic lesion in the right lobe of thyroid	benign thyroid lesion suggestive of nodular colloid goitre	23/2/2017	nodular goitre with cystic change
18	9176	Roopa	26years	female	left	2x2cms	Euthyroid	solitary Cystic lesion in the left thyroid gland with no flow on color doppler.	benign thyroid lesion suggestive of nodular colloid goitre	23/3/2017	benign thyroid lesion suggestive of nodular colloid goitre
19	11502	Mallamma	55years	female	left	5x5cms	Euthyroid	Mixed echogenic lesion in the left lobe of thyroid	benign thyroid lesion suggestive of nodular colloid goitre	13/04/2017	benign thyroid lesion suggestive of nodular colloid goitre
20	23311	Rohini	28years	female	right	2x2cms	Euthyroid	solitary Cystic lesion in the right thyroid gland with no flow on color doppler.	benign thyroid lesion suggestive of nodular colloid goitre	2/4/2016	benign thyroid lesion suggestive of nodular colloid goitre
21	23189	Ningamma	35years	female	left	2x2cms	Euthyroid	Mixed echogenic lesion in the left lobe of thyroid	benign thyroid lesion suggestive of nodular colloid goitre	23/7/2016	benign thyroid lesion suggestive of nodular colloid goitre
22	20379	Kasthuri	52years	female	left	2x2cms	Euthyroid	Mixed echogenic lesion in the left lobe of thyroid	benign thyroid lesion suggestive of nodular colloid goitre	4/7/2016	benign thyroid lesion suggestive of nodular colloid goitre
23	728	Shamu	60years	male	right	3x2cms	Euthyroid	solitary Cystic lesion in the right thyroid gland with no flow on color doppler.	benign thyroid lesion suggestive of nodular colloid goitre	10/1/2017	benign thyroid lesion suggestive of nodular colloid goitre
24	248	Laxman	32years	male	right	5x5cms	Euthyroid	Mixed echogenic lesion in the right lobe of thyroid	benign thyroid lesion suggestive of nodular colloid goitre	5/1/2017	benign thyroid lesion suggestive of nodular colloid goitre

25	1004	Sunanda	48years	female	right	4x4cms	Euthyroid	Mixed echogenic lesion in the right lobe of thyroid	benign thyroid lesion suggestive of nodular colloid goitre	12/1/2017	nodular goitre with cystic change
26	1807	Nandita	30years	female	left	4x4cms	Euthyroid	Mixed echogenic lesion in the left lobe of thyroid	benign thyroid lesion suggestive of colloid nodule	19/01/2017	benign thyroid lesion suggestive of nodular colloid goitre
27	5002	Anil R	45years	male	right	2x2cms	Euthyroid	Mixed echogenic lesion in the right lobe of thyroid	benign thyroid lesion suggestive of nodular colloid goitre	16/02/2017	benign thyroid lesion suggestive of nodular colloid goitre
28	18967	Sumitra G D	30years	female	left	2x2cms	Euthyroid	solitary Cystic lesion in the left thyroid gland with no flow on color doppler.	benign thyroid lesion suggestive of colloid nodule	15/6/2017	nodular goitre with cystic change
29	28020	Saroja	32years	female	left	2x2cms	Euthyroid	Mixed echogenic lesion in the left lobe of thyroid	benign thyroid lesion suggestive of nodular colloid goitre	23/08/2017	nodular goitre with cystic change
30	12057	Savitha	28years	female	right	2x2cms	Euthyroid	Mixed echogenic lesion in the right lobe of thyroid	benign thyroid lesion suggestive of colloid nodule	11/4/2016	benign thyroid lesion suggestive of nodular colloid goitre
31	9687	Ambadas	22years	male	right	4x4cms	Euthyroid	Mixed echogenic lesion in the right lobe of thyroid	benign thyroid lesion suggestive of nodular colloid goitre	27/3/2017	nodular goitre with cystic change
32	37803	Pintu Chavan	30years	male	left	4x4cms	Euthyroid	Mixed echogenic lesion in the left lobe of thyroid	benign thyroid lesion suggestive of colloid nodule	23/11/2016	benign thyroid lesion suggestive of nodular colloid goitre
33	20765	Surekha	30years	female	right	2x2cms	Euthyroid	Mixed echogenic lesion in the right lobe of thyroid	benign thyroid lesion suggestive of colloid nodule	5/4/2016	benign thyroid lesion suggestive of nodular colloid goitre
34	30107	Ambawwa	40years	female	right	4x4cms	Euthyroid	solitary Cystic lesion in the right thyroid gland with no flow on color doppler.	benign thyroid lesion suggestive of nodular colloid goitre	10/4/2016	nodular goitre with cystic change
35	12231	Marewwa	60years	female	right	4x4cms	Euthyroid	Mixed echogenic lesion in the right lobe of thyroid	benign thyroid lesion suggestive of nodular colloid goitre	18/4/2017	benign thyroid lesion suggestive of nodular colloid goitre
36	1061	Meenakumari	23years	female	left	2x2cms	Euthyroid	Mixed echogenic lesion in the left lobe of thyroid	benign thyroid lesion suggestive of nodular colloid goitre	17/1/2016	nodular goitre with cystic change
37	20444	Ambika A	24years	female	right	2x2cms	Euthyroid	Mixed echogenic lesion in the right lobe of thyroid	benign thyroid lesion suggestive of nodular colloid goitre	25/1/2017	benign thyroid lesion suggestive of nodular colloid goitre

38	23078	Devindramma M	60years	female	left	3x3cms	Euthyroid	solitary Cystic lesion in the left thyroid gland with no flow on color doppler.	benign thyroid lesion suggestive of nodular colloid goitre	16/7/2017	benign thyroid lesion suggestive of colloid nodule
39	11489	Chandpatel	55years	male	left	5x5cms	Euthyroid	Mixed echogenic lesion in the left lobe of thyroid	benign thyroid lesion suggestive of colloid nodule	20/4/2017	benign thyroid lesion suggestive of nodular colloid goitre
40	8968	Mariyawwa	50years	female	left	2x2cms	Euthyroid	Mixed echogenic lesion in the left lobe of thyroid	benign thyroid lesion suggestive of colloid nodule	6/8/2016	benign thyroid lesion suggestive of nodular colloid goitre
41	21639	Gourawwa	30years	female	right	2x2cms	Euthyroid	Mixed echogenic lesion in the right lobe of thyroid	calcifications with dysplastic cells s/o papillary carcinoma	11/7/2016	benign thyroid lesion suggestive of nodular colloid goitre
42	416770	Jyothi	50years	female	left	4x4cms	Euthyroid	Mixed echogenic lesion in the left lobe of thyroid	benign thyroid lesion suggestive of nodular colloid goitre	10/12/2016	Benign thyroid lesion suggestive of nodular colloid goitre
43	18043	Anita	15years	female	right	4x4cms	Euthyroid	Mixed echogenic lesion in the right lobe of thyroid	benign thyroid lesion suggestive of colloid nodule	7/6/2017	Benign thyroid lesion suggestive of nodular colloid goitre
44	15361	Sitamahalaxmi	28years	female	left	3x3cms	Euthyroid	solitary Cystic lesion in the left thyroid gland with no flow on color doppler.	benign thyroid lesion suggestive of nodular colloid goitre	17/05/2017	nodular goitre with cystic change
45	13085	Shankarmma B	28years	female	left	4x4cms	Euthyroid	Mixed echogenic lesion in the left lobe of thyroid	benign thyroid lesion suggestive of colloid nodule	26/04/2017	nodular goitre with cystic change
46	2619	Sharanamma thoravi	36years	female	left	2x2cms	Euthyroid	solitary Cystic lesion in the left thyroid gland with no flow on color doppler.	benign thyroid lesion suggestive of nodular colloid goitre	26/01/2017	nodular goitre with cystic change
47	11588	Laxmi Bhavikatti	18years	female	right	4x4cms	Euthyroid	Mixed echogenic lesion in the right lobe of thyroid	benign thyroid lesion suggestive of colloid nodule	5/9/2016	Benign thyroid lesion suggestive of nodular colloid goitre
48	40983	Saherabegum	60years	female	left	2x2cms	Euthyroid	Solitary Mixed echogenic lesion in left thyroid lobe	benign thyroid lesion suggestive of nodular colloid goitre	22/12/2016	nodular goitre with cystic change
49	24500	Shravani	32years	female	right	3x3cms	Euthyroid	solitary Cystic lesion in the left thyroid gland with no flow on color doppler.	benign thyroid lesion suggestive of nodular colloid goitre	11/8/2016	nodular goitre with cystic change
50	19820	Suman S S	47years	female	left	2x2cms	Euthyroid	Solitary Mixed echogenic lesion in left thyroid lobe	benign thyroid lesion suggestive of colloid nodule	24/6/2015	nodular goitre with cystic change

51	32903	Sujata Basavaraj	22years	female	left	4x4cms	Euthyroid	solitary Cystic lesion in the left thyroid gland with no flow on color doppler.	benign thyroid lesion suggestive of colloid nodule	11/8/2016	Benign thyroid lesion suggestive of nodular colloid goitre
52	23527	Wasim	34years	male	right	2x2cms	Euthyroid	Mixed echogenic lesion in the right lobe of thyroid	benign thyroid lesion suggestive of nodular colloid goitre	24/7/2016	nodular goitre with cystic change
53	7314	Shrimantawwa	65years	female	right	4x4cms	Euthyroid	Mixed echogenic lesion in the right lobe of thyroid	benign thyroid lesion suggestive of colloid nodule	8/3/2016	Benign thyroid lesion suggestive of nodular colloid goitre
54	4955	Gangabai	35years	female	left	3x3cms	Euthyroid	solitary Cystic lesion in the left thyroid gland with no flow on color doppler.	benign thyroid lesion suggestive of nodular colloid goitre	15/3/2017	nodular goitre with cystic change
55	11588	Laxmi	18years	female	right	2x2cms	Euthyroid	Mixed echogenic lesion in the right lobe of thyroid	Features are suggestive of nodular hyperpalsia	6/8/2016	Benign thyroid lesion suggestive of nodular colloid goitre
56	28020	Saroja	32years	female	left	2x2cms	Euthyroid	Solitary Mixed echogenic lesion in left thyroid lobe	benign thyroid lesion suggestive of colloid nodule	23/08/2017	benign thyroid lesion suggestive of colloid nodule
57	1004	Sunanda	48years	female	right	4x4cms	Euthyroid	solitary Cystic lesion in the right thyroid gland with no flow on color doppler.	benign thyroid lesion suggestive of nodular colloid goitre	12/1/2017	nodular goitre with cystic change
58	9176	Roopa	26years	female	right	2x2cms	Euthyroid	Mixed echogenic lesion in the right lobe of thyroid	benign thyroid lesion suggestive of colloid nodule	15/2/2017	Benign thyroid lesion suggestive of nodular colloid goitre
59	4898	Kasturibai	56years	female	right	3x3cms	Euthyroid	Mixed echogenic lesion in the right lobe of thyroid	benign thyroid lesion suggestive of colloid nodule	18/4/2017	nodular goitre with cystic change
60	18967	Sumitra	51years	female	left	2x2cms	Euthyroid	Solitary Mixed echogenic lesion in left thyroid lobe	Features are suggestive of nodular hyperpalsia	15/06/2017	nodular goitre with cystic change