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RESEARCH ARTICLE

A STUDY OF SOLITARY NODULE OF THE THYROID

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ABSTRACT

- To study the epidemiology of the solitary nodule of the thyroid.
- To study the role of fine needle aspiration cytology in the management of solitary nodule of the thyroid.
- To study the incidence of malignancy in solitary nodule of the thyroid.

Materials and Methods
Case selection
All patients admitted with a solitary nodule of the thyroid.
Exclusion criteria

- Patients with severe comorbid illness.
- Patients with solitary nodule of thyroid and regional lymph adenopathy.

Materials and Methods
Place of study: Thanjavur medical college hospital, Thanjavur.
Period of study: 31.01.2014 to 31.01.2016- 2 years
No of patients: 100
A total of (110) consecutive patients admitted at TMCH, Thanjavur with solitary nodule of the thyroid and only 100 of the patients who satisfied the above criteria were included in the study.
Limitation of the study: Many patients are lost to follow up after 2 reviews and the exact incidence of post operative hypothyroidism could not be evaluated.

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INTRODUCTION

Solitary nodule of the thyroid of discrete thyroid swelling is a common clinical entity and the incidence increases with age. Although only one nodule may be palpable approximately one-half of the patients who a solitary actually have a multi nodular goiter, i.e. a clinically dominant nodule in a macro scopical multinodular goiter. The importance of this clinical entity is that 10-20% of solitary nodules of the thyroid could be malignant. The approach to thyroid nodule management is a selective one, utilizing continually Improving diagnostic techniques to reliably identify patients with malignancy and certain benign conditions that require surgery thereby avoiding unnecessary thyroidectomy for all nodules. A potentially curable cancer normally presents as a thyroid nodule and thereby the study of a solitary nodule gains importance.

HISTORICAL BACKGROUND (Hai, 2003; Bailey and Love's)

Goiters (from the Latin gutter, throat), defined as an enlargement of the thyroid have been recognized since 2700 B.C.

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In 1619, Hieronymus Fabricius ab Aquapendente recognized that goiters arose from the thyroid gland. The term thyroid gland (Greek thyreoeids, shield shaped) is however attributed to Thomas Wharton in his Adrenographia (1656). In 1776, the thyroid was classified as a ductless gland by Albrecht Von Haller. The first accounts of thyroid surgery for the treatment of goiters were given by Roger Frugardi in 1170.

Emil Theodor Kocher (1841 – 1917) C.A. Theodor Billroth (1829 – 1894) performed thousands of thyroid surgeries with increasingly successful results. In 1909, Kocher was awarded the Nobel Prize for medicine in recognition for his treatise on "the Physiology, Pathology and Surgery of the thyroid gland".
Embryology. The thyroid gland arises as an outpouching of the primitive foregut around the third week of gestation, in the vicinity of the foramen cecum of tongue. Endodermal cells in the floor of the pharyngeal anlage thicken to form the medial thyroid anlage that descends in the neck anterior to structures that form the hyoid bone and larynx and it remains connected to the foramen cecum by an epithelial lined thyroglossal duct. The epithelial cells making up the anlage give rise to the thyroid follicular cells. Paired lateral anlages originate from the fourth branchial pouch and fuse with the median anlage at approximately the fifth week of gestation.

The lateral anlages are neurectodermal in origin (ultimobranchial bodies) and provide the calcitonin producing parafollicular or C cells, which lie in the postero – superior region of the gland. Thyroid follicles are initially apparent by 8 weeks and colloid formation begins by the 11th week of gestation.

ANATOMY

MORPHOLOGY (Bouknight, 2003)

The thyroid gland occupies an important position in the centre of the visceral compartment of the neck lying astride the trachea just above the thoracic inlet. Normal gland weighs 20 - 25g. The gland has two lobes, shaped roughly like slender pears connected by an isthmus in the midline inferior to cricoid cartilage, hugging the anterolateral aspect of the cervical trachea from the level of the thyroid cartilage to the 5th or 6th tracheal ring. A pyramidal lobe, which represents the most caudal end of the thyroglossal duct is found in about 50% of individuals. The thyroid lobes extend to middle of the thyroid cartilage superiorly and lie adjacent to the carotid sheaths and sternocleidomastoid muscles laterally. It is enveloped by the deep cervical fascia that forms the false capsule. The true capsule of thyroid is a thin, densely adherent fibrous layer that sends out septa that invaginate into the gland forming pseudolobules, and is condensed into the posterior suspensory or Berry's ligament near the cricoid cartilage and upper tracheal rings. The strap muscles, sternohyoid, sternothyroid & superior belly of the omohyoid are located anteriorly and are innervated by the ansacervicalis.

BLOOD SUPPLY

ARTERIAL SUPPLY

The Superior thyroid arteries arise from the ipsilateral external carotid arteries and divide into anterior & posterior branches at the apices of the thyroid lobes. The inferior thyroid arteries are derived from the thyrocervical trunk. A thyroidea ima artery arises directly from the aorta in 1 -4% of individuals.Extensive anastomoses occur between the main thyroid arteries and branches of the tracheal and oesophageal arteries.

VENOUS DRAINAGE

Venous drainage of the thyroid gland occurs via multiple small surface veins, which coalesce to form three sets of veins, the superior, middle and inferior thyroid veins.The superior and middle veins drain directly into the internal jugular veins, the inferior veins often form a plexus, which drains into the brachiocephalic veins.

NERVE SUPPLY

Sympathetic innervations of the thyroid gland is provided by fibers from the superior and middle cervical sympathetic ganglia, which enter the gland with the blood vessels and are vasomotor in action. Parasympathetic fibers are derived from the vagus nerve and reach the gland via branches the laryngeal nerves.

LYMPHATIC DRAINAGE

The thyroid gland is endowed with an extensive network of lymphatics. Intraglandular lymphatic vessels connect both thyroid lobes through the isthmus and also drain to perithyroidal structures and lymph nodes. Regional lymph nodes include pretracheal, paratracheal, perithyroidal, recurrent laryngeal nerve, superior mediastinal, retro pharyngeal, esophageal and upper, middle and lower jugular chain nodes, posterior triangle of neck, and submaxillary triangle nodes can also be involved with metastatic activity of the malignancies.

THE IMPORTANT SURGICAL RELATIONS OF THE THYROID GLAND

The External Laryngeal Nerve

External laryngeal nerve is a branch of the superior laryngeal nerve, descends over the fascia of the inferior pharyngeal constrictor, relates closely to the superior vascular pedicle of the thyroid and then leaves this at a variable height above the gland to travel medially to its destination in the cricothyroid muscle viz the tensor of the vocal cord.

The Recurrent Laryngeal Nerve

It is a branch of the Vagus, arising embryologically in relation to the vessels arising from the 4th aortic arch. Because of the descent of these vessels forming the subclavian artery on the right and the aotic arch on the left, the recurrent nerves are taken caudally and run an upward course to reach their vocal cord destination. The nerves usually lie in the trachea – oesophageal groove and bear a variable relationship to the branches of the inferior thyroid artery before entering the larynx.

The Parathyroid glands

The number of parathyroids vary from 2 – 6, but in 80 percent of cases there are 4 (2 on each side) which derive their blood supply primarily from branches of the inferior thyroid artery. Generally parathyroid glands can be found within 1cm of the junction of the inferior thyroid artery and the recurrent laryngeal nerve. The superior glands are usually located dorsal to the recurrent laryngeal nerve whereas the inferior glands are ventral to it.

Thyroid Histology

Microscopically, the thyroid is divided into lobules that contain 20 to 40 follicles. The follicles are 30 um in diameter and $3x10^6$ in number and lined by cuboidal epithelial cells and contains a central store of colloid. The second group of thyroid secretory cells are the C cells or parafollicular cells which contain and secrete calcitonin and are found in the interfollicular stroma in the upper poles of the thyroid lobes.

THYROID PHYSIOLOGY

IODINE METABOLISM

The average daily iodine requirement is 0.1mg, which can be derived from foods such as fish, milk and eggs. In the stomach

and jejunum, iodine is rapidly converted to iodide and absorbed into the blood stream. Thyroid is the storage site of greater than 90% of the body's iodine and accounts for one-third of the plasma iodine loss. The remaining plasma iodine is cleared via renal excretion.

HISTOLOGY

NORMAL THYROID

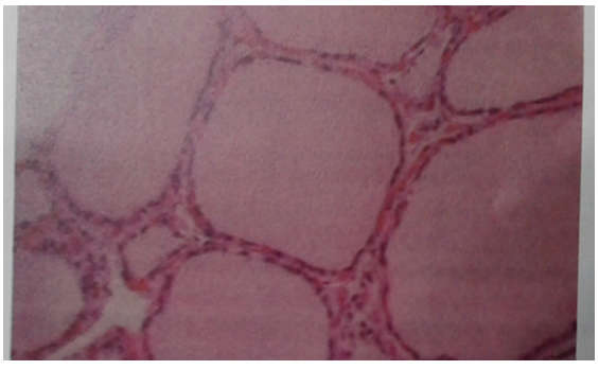

Fig.1. Histology Of Normal Thyroid

THYROID HORMONE SYNTHESIS, SECRETION AND TRANSPORT (Hanna, 2006)

The synthesis of thyroid hormone consists of several steps.The first step iodide trapping, involves active transport (ATP – dependent) of iodide across the basement membrane of the thyrocyte. The second step involves oxidation of iodide to iodine and iodination of tyrosine residues on Thyroglobulin a large (660-kDa) glycoprotein present in thyroid follicles and formation of monoiodotyrosines and diiodotyrosines. First two steps are catalyzed by thyroidperoxidase. A protein, Pendrin mediates iodine efflux at the apical membrane. The third step leads to coupling of two diiodotyrosine molecules to form tetra iodothyronine or thyroxine (T_4) and one diiodotyrosine molecule with one mono iodotyrosine molecule to form 3, 5, 3' – triiodothyronine (T_3) or 3, 3', 5' – triiodothyronine. (rT_3) or reverse T_3-.

In the fourth step, thyroglobulin is hydrolysed to release free T_3 and T_4 and mono and diiodotyrosines. The fifth step is deiodination of the mono and diiodotyrosines to yield iodide which is reused in the thyrocyte. In the euthyroid state T_4 is produced and released entirely by the thyroid gland, where as only 20% of total T_3 is produced by the thyroid. Most of the T_3 is produced by peripheral deiodination of T_4 in the liver, muscles, kidney and anterior pituitary, a reaction that is catalyzed by 5' – mono deiodinase. Thyroid hormones are transported in serum bound to carrier proteins such as thyroxine binding prealbumin (TBPA) and albumin. Only a small fraction 0.02% of T_3 and T_4 is free or unbound and is physiologically active component. T_3 is the more potent of the two thyroid hormones although its circulating plasma level is much lower than that of T_4. The half life of T_3 is about 1 day and T_4 about 7 days.

Normal value T_3-1.5 – 3.5 nmol/L T_4- 55 – 150 nmol/L

Thyroid Hormone Regulation

The secretion of thyroid hormone is controlled by the hypothalamic – pituitary – thyroid axis. The hypothalamus produces a peptide, the thyrotropin – releasing hormone (TRH), which stimulates the pituitary to release TSH or thyrotropin.TSH, a 28 kDa glycopeptide, mediates iodide trapping, secretion and release of thyroid hormones in addition to increasing the cellularity and vascularity of the thyroid gland. TSH secretion by the anterior pituitary is regulated via a negative feedback loop by T_4 and T_3-. T_3 also inhibits the release of TRH. The thyroid gland also is capable of autoregulation. As an adaptation to low iodide intake, the gland preferentially synthesizes T_3 rather than T_4 thereby increasing the efficiency of secreted hormone. In situations of iodine excess, iodide transport, peroxide generation, synthesis and secretion of thyroid hormones are inhibited. Excessively large doses of iodide may lead to initial increased organization followed by suppression, a phenomenon called the Wolff-Chaikoff effect.Epinephrine & human chorionic gonadotrophin stimulate thyroid hormone production whereas glucocorticoids inhibit thyroid hormone production.In severely ill patients, peripheral thyroid hormones may be reduced, without a compensatory increase in TSH levels, the sickeuthyroid low T_3 syndrome.

THYROID HORMONE FUNCTION (Current Surgical Diagnosis and Treatment 11th Edition, Detecting and defining hypothyroidism after hemithyroidectomy, 2005)

Thyroid hormones affect almost every system in the body. They are important for fetal brain development and skeletal maturation. It increases the basal metabolic rate.

FUNCTIONS OF THYROID HORMONES

Thyroid hormones act predominantly via a nuclear thyroid receptor (TR), which modulates gene synthesis of the cell which in turn increases protein synthesis. They are essentially catabolic in nature and

- Increase the glucose absorption from gut
- Mobilize the liver glycogen
- Promote gluconeogenesis
- Increase appetite
- Increase heart rate
- Increase gut motility
- Decrease body weight
- Decrease menstrual flow

SOLITARY NODULE OF THE THYROID[7]

DEFINITION

Solitary nodule of the thyroid is defined as the only nodule that is detectable clinically and by other means in an otherwise morphologically normal thyroid gland.

EPIDEMIOLOGY

INCIDENCE

- 3-4% of adult

- More common in females, : = 1:3. 15% are malignant which is more common
- after 50yrs.
- 30-40% are follicular Adenomas.

CLINICAL AND PATHOLOGICAL CLASSIFICATION OF THYROID NODULES

NON – NEOPLASTIC NODULES

HYPERPLASTIC

- Spontaneous
- Compensatory after partial thyroidectomy
- Hemiagenesis with contralateral lobe hyperplasia

INFLAMMATORY

- Acute bacterial thyroiditis
- Subacute thyroiditis
- Lymphocytic thyroiditis

NEOPLASTIC NODULES

BENIGN
- Adenoma
- Cyst
- Simple
- Complex

Malignant

Primary

- Papillary Carcinoma
- Follicular Carcinoma
- Anaplastic Carcinoma
- Medullary Carcinoma
- Lymphoma

Thyroid Metastasis From Other Primaries (Kidney, Breast, Lung, Melanoma)

- **Toxic nodules**

CLINICAL HISTORY

- Age and Sex of the patient
- Details regarding the nodule such as the time of onset, change in size and associated symptoms such as pain, dysphagia, dyspnea or choking.
- Pain is an unusual symptom, occurs in intrahyroidal hemorrhage in a benign nodule, thyroiditis or malignancy.
- Hoarseness of voice is a omnious symptom
- History suggestive of hypo functioning or hyper functioning of the thyroid gland.
- Risk factors for malignancy such as exposure to ionizing radiation during childhood and family history of thyroid and other malignancies associated with thyroid cancer.

PHYSICAL EXAMINATION

- Visible and palpable swelling in the thyroid region.
- Rest of the gland not enlarged.
- Moves up with deglutition.
- Nature of the Nodule – site, size, shape, consistency.
- Regional lymph nodes
- Features of thyroid dysfunction
- Clinical features suggestive of pathological change in nodule like tenderness.

EVALUATION OF PATIENTS WITH THYROID NODULE TESTS OF THYROID FUNCTION[8]

Serum TSH

TSH & now the Ultrasensitive TSH assay has become the most sensitive and specific test for the diagnosis of hyper and hypothyroidism and for optimizing T_4 replacement and suppressive therapy, the normal level being 0.5 – 5 uU/ml.

SERUM T_4 & T_3

Total T_4 level reflects the output from the thyroid gland and increase in hyperthyroid, normal level being 55 – 150 nmol/L. Total T_3 level in the non-stimulated gland are more indicative of peripheral thyroid hormone metabolism and not suitable as a general screening test. It is important in clinically hyperthyroid patients with normal T_4 levels who may have T_3 thyrotoxicosis. Total T_3 levels are often increased in early hypothyroidism & normal level being 1.5 – 3.5 n mol/L.

Free T4 and Free T3

- Normal value being,
- Free T4 – 12 – 28 pmol/L
- Free T3 – 3 – 9 pmol/L

Are useful in confirming the diagnosis of early hyperthyroidism.

Thyrotropin – Releasing Hormone (TRH)

This test is useful to evaluate pituitary TSH secretory function and is performed by administering 500ug of TRH intravenously and measuring TSH levels after 30& 60 minutes. In a normal individual TSH levels should increase at least 6 uIU/mL from the baseline.

Thyroid Antibodies

Thyroid antibodies include anti thyroglobulin (anti – Tg), antimicrosomal or antithyroid peroxidase (anti – TPO) and thyroid stimulating immunoglobulin (TSI). Anti – Tg and anti – TPO antibody levels indicate an autoimmune thyroiditis. They are increased is 80% of patients with Hashimoto's thyroiditis, Graves' disease, nodular goiter and occasionally with thyroid neoplasms. TSI is elevated in Graves' disease.

Serum Thyroglobulin

Thyroglobulin level increases dramatically in destructive processes of the thyroid gland such as thyroiditis or overactive

states such as Graves' disease and toxic nodular goiter. The most important use for serum thyroglobulin levels is in monitoring patients with differentiated thyroid cancer for recurrence, particularly after total thyroidectomy and radioactive iodine ablation.

THYROID IMAGING

ULTRA SOUND

Ultrasound is an excellent, non invasive and portable imaging method for studying the thyroid gland and it has the added advantage of no radiation exposure. It is helpful in the evaluation of thyroid nodules, distinguishing solid from cystic ones and providing information about size and multicentricity and can be used to assess for cervical lymphadenopathy and to guide fine – needle aspiration cytology.

CT / MRI SCAN

These studies provide excellent imaging of the thyroid gland and adjacent nodes and are particularly useful in evaluating the extent of large, fixed or substernal goiters and their relationship to the airway and vascular structures. Non contrast CT scans should be obtained in patients who are likely to require subsequent radioactive iodine therapy.

RADIO ISOTOPE IMAGING

Used to screen and treat patients with differentiated thyroid cancers for metastatic disease. The images provide information not only about the size and shape of the gland but also the distribution of functional activity. Areas that trap less radioactivity than the surrounding gland are termed "cold", whereas areas that demonstrate increased activity are termed "hot". The risk of malignancy is higher in cold lesions (15-20%) than in hot or warm lesions (<5%). Technetium – 99m (99m Tc) pertechnetate is taken up by the thyroid and quickly washes out of the gland before being organified. It has a shorter half life and is particularly sensitive for nodal metastatases.

MAGNETIC RESONANCE IMAGING

Recently Thallium – 201 scan was reported to be a useful diagnostic tool to differentiate between benign and malignant thyroid nodules. More recently, 18F – fluorodeoxy glucose positron emission tomography (FDG – PET) has been used to screen for metastases in patients with thyroid cancer in whom other imaging studies are negative. This technique is expensive and not widely available.

FINE NEEDLE ASPIRATION CYTOLOGY[16]

Fine needle aspiration cytology has become the single most important test in the evaluation of patients with thyroid masses and can be performed with or without ultrasound guidance. After FNA cytology, the majority of nodules can be categorized into the following groups: benign 65% suspicious (20%), malignant (5%) and non – diagnostic 10%. The incidence of false positive results is 1% and false negative is 3% of patients. Non diagnostic cytology is to be repeated and often indicates a follicular neoplasm. Benign lesions include cysts and colloid nodules and the risk of malignancy is <3% but in suspicious cytology the risk varies from 10 – 20%. FNA cytology is less reliable in follicular or hurthle cell neoplasm and in patients with history of head and neck irradiation or a family history of thyroid cancer because of a higher likelihood of multifocal lesions.

TECHNETIUM 99 M NUCLEAR SCAN

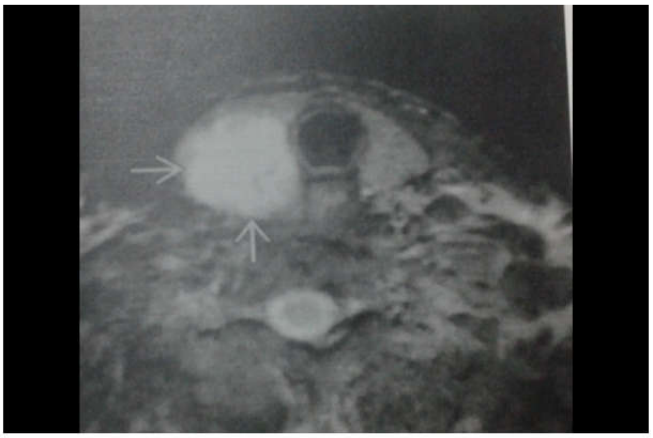

Fig. 2. Uniform Hyperintense Lesion Right Lobe – Adenoma

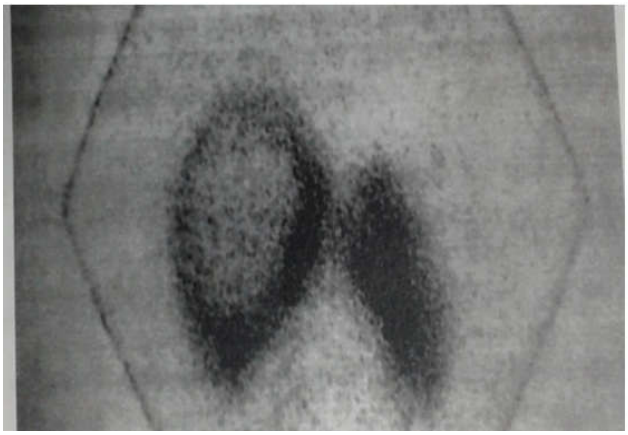

Fig-3.Cold Nodule – Left Lobe

OTHER INVESTIGATIONS

Serum calcitonin

Serum Calcitonin levels should be obtained in patients with medullary thyroid cancer (MTC) or a family history of MTC or MEN II (Multiple Endocrine Neoplasia).

TUMOR MARKERS

- Sr. TSH
- Sr. Thyroglobulin
- Sr. Calcitonin
- Tumor markers have diagnostic and prognostic value.

URINE ANALYSIS

A 24-hour urine collection with measurement of levels of vanillyl mandelic acid, meta – nephrine and catecholamine in

patients with medullary thyroid cancer to rule out coexisting pheochromocytoma.

RET Oncogene mutation (Krohn *et al*.,2002)

Approximately 10% of patients with familiar MTC and MEN 2A have a denovo RET mutation so that their children are at risk for thyroid cancer.

MANAGEMENT (Knudsen *et al*., 2002; Lee, 12th editon; MC Dougall, 1993)

Thyroid cysts

Simple thyroid cysts < 4 cm in diameter –aspiration 75% of cysts completely resolve.Simple cyst > 4 cm in diameter, complex cysts and if cyst persists after 3 attempts of aspiration, ipsilateral hemi thyroidectomy is recommended.

Collioid Nodule

Colloid Nodule < 3cm in diameter – observation (or) suppression therapy with L – thyroxine To maintain serum TSH between 0.1 and 1.0 uU/ml Large nodules and when the nodule enlarges, causes pressure symptoms or for cosmetically poor appearance, either hemi thyroidectomy or isthmusectomy depending on the site of nodule is done. 3. Adenomas are managed by ipsilateral hemi thyroidectomy and frozen section analysis to rule out malignancy and if positive, total thyroidectomy is done. 4. Malignant tumors are treated by total thyroidectomy. During thyroidectomy enlarged ipsilateral neck nodes should be removed. Lymph node metastasis in the lateral neck should be managed with modified radical or functional neck dissection. Prophylactic neck node dissection is not necessary in patients with papillary thyroid cancer. In case of medullary thyroid carcinoma central compartment nodes are frequently involved and a bilateral central neck node dissection should be routinely performed. In Anaplastic carcinoma in which the tumor may be fixed to surrounding structures causing pressure symptoms, tracheostomy may be needed to alleviate airway obstruction.

Lymphoma

Combination Chemo therapy with CHOP regimen that includes cyclophosphamide, Doxorubicin, vincristine and prednisolone ensures a rapid response and an improved survival.

Metastatic carcinoma

Ipsilateral hemi thyroidectomy is helpful in many patients depending on the status of their primary tumor. 7. An exception to the General rule is the patient who has had previous irradiation of the thyroid gland or has a family history of thyroid cancer. Total or near-total thyroidectomy is recommended in these patients as the incidence of thyroid cancer is high (40%) and the reliability of FNAC is decreased on this setting.

Toxic nodules

Small nodules < 3 cm size can be managed with antithyroid medications and Radioactive Iodine ablation. Larger nodules and toxic nodules in young patients are treated by surgery (ipsilateral hemi thyroidectomy) after adequate preparation of the patient before surgery.

Indications for surgery in solitary nodule of the thyroid

- NEOPLASIA (FNAC Positive, Clinical Suspicion)
- Age (younger than 20 or older than 45)
- Male sex
- Hard texture
- Fixity

Recurrent laryngeal nerve palsy Lymphadenopathy Large nodule >4cm

- TOXIC ADENOMA
- PRESSURE SYMPTOMS
- COSMESIS
- PATIENT'S WISHES

Thyroid surgery

Pre operative preparation

- Vocal cord assessment by indirect laryngoscopy
- Hyperthyroid patients are rendered euthyroid before surgery with anti-thyroid drugs that should be continued up to the day of surgery.
- Prophylactic antibioties are not used routinely

Conduct of thyroidectomy

- Performed under general anaesthesia
- Position of the patient

Supine with a sand bag between the scapulae. Head is placed on a donut cushion and neck is extended.

Incisions

Kocher transverse collar incision 4 – 5cm in length is placed parallel to a natural skin crease 1cm below the cricoid cartilage. Low collar incision about 2 finger breaths above the suprasternal notch along a skin crease.

TECHNIQUE (Giuffrida *et al*., 2003; Hedayati, 2002)

- The subcutaneous tissues and platysma are incised sharply and sub platysmal flaps are raised superiorly to the level of thyroid cartilage and inferiorly to the suprasternal notch.
- A self retaining retractor Jolls is applied
- The strap muscles are divided in the midline along the entire length of the mobilized flaps and the thyroid gland is exposed.
- On the side of the lesion, the sternohyoid muscle is separated from the sternothyroid by blunt dissection until the internal jugular vein and ansacervicalis nerve are identified. If needed, the strap muscles can be divided high avoiding injury to ansacervicalis and if infiltrated by tumor the muscle involved can be excised.

- The Sternothyroid muscle is dissected off the underlying thyroid exposing the middle thyroid veins which are ligated & divided after retracting the thyroid lobe anteromedially.
- The fascia just cephaled to the isthmus is divided. The superior thyroid pole is identified by inferomedial retraction of the lobe and superior pole vessels are individually identified, skeletonized, ligated and divided low on the thyroid gland to avoid injury to the external branch of superior laryngeal nerve. The recurrent laryngeal nerve should be identified at the level of cricoid cartilage and the parathyroids with in 1cm of crossing of the inferior thyroid artery and the recurrent laryngeal nerve.
- The lower pole is mobilized by gently sweeping all tissues dorsally. Inferior thyroid vessels are dissected, skeletonized, ligated and divided close to the surface of the thyroid gland as possible to minimize devascularization of the Parathyroids or injury to the recurrent laryngeal nerve.
- If a lobectomy is to be performed, the isthmus is divided flush with the trachea on the contralateral side and suture ligated. For a total thyroidectomy the procedure is repeated on the opposite side.
- After adequate hemostasis and drain placement viz optional, the strap muscles are reapproximated in the midline using absorbable sutures. After approximation of platysma, skin closure is done with sub cuticular sutures or clips.

- Several approaches to minimally – invasive thyroidectomy such as video assisted thyroidectomy and endoscopic thyroidectomy via axillary incisions have been proposed. These methods are feasible but clear benefits over the traditional open approach have not been established.

COMPLICATIONS OF THYROID SURGERY (Fewins *et al*., 2003)

- Primary and reactionary hemorrhage
- Airway compromise due to tracheal collapse
- Injury to recurrent laryngeal nerve – vocal cord dysfunction.
- Injury to external laryngeal nerve – Dysphonia
- Injury to Parathyroid glands-hypo calcemia
- Seromas
- Wound cellulitis and infection
- Post operative hypothyroidism.
- Keloid formation at incision site.

FOLLOW UP OF THE PATIENTS

- Physical Examination
- Hormone Assay
- Thyroid auto antibody assay in patients with lymphoeytic thyroiditis.
- Radioactive lodine scan for malignancies, to rule out local recurrence or lymph node metastasis and bone scan to rule out skeletal metastasis.
- Post operative thyroxine support for 3 months to enable the remaining thyroid to take over and to prevent compensatory hypetrophy.
- Any delayed occurrence of goiter in the remaining lobe must be investigated to rule out carcinoma. Mostly it is compensatory hypertrophy and responds to thyroxine supplementations.

OBSERVATIONS AND ANALYSIS OF RESULTS

OBSERVATIONS AND ANLYSIS OF RESULTS

In the present study 100 patients were included and majority of the patients were in their third, fourth and fifth decades of life.

AGE DISTRIBUTION

AGE IN YEARS	NO. OF PATIENTS	PERCENTAGE
11-20	1	1%
21-30	39	39%
31-40	31	31%
41-50	23	23%
51-60	6	6%

The age of the patients studied ranged from 20 years to 60 years.

GENDER DISTRIBUTION

GENDER	NO OF PATIENTS	PERCENTAGE
Females	89	89%
Males	11	11%

89 females and 11 males out of 100 were included in this study.

FREQUENCY OF SYMPTOMS

SYMPTOMS	NO OF PATIENTS	PERCENTAGE
SWELLING	64	64%
SWELLING & PAIN	4	4%
Swelling & dysphagia	23	23%
Swelling, Pain & dysphagia	9	9%

All the 100 patients complained of a swelling in the front of their neck. 13 patients had pain, 32 complained of some difficulty in swallowing.

PHYSICAL EXAMINATION

- Size of the nodule varied from 4 to 7cm
- Nature of the nodule – smooth, firm, no fixity & confined to right/left lobe +/isthmus.
- No regional lymph node enlargement
- No signs of thyroid dysfunction

THYROID FUNCTION

THYROID FUNCTION	NO. OF PATIENTS	PERCENTAGE
Euthyroid	96	96%
Hypo thyroid	4	4%
Hyper thyroid	0	0

Fig-4.Solitary Nodule Of The Thyroid

Fig-5.Solitary Nodule of The Thyroid

Among the 100 patients 96 were euthyroid and 4 patients had mild elevation of the level of Sr. TSH. No case of hyperthyroidism was noted.

ULTRA SONOGRAM NECK

All 100 patients were subjected to ultrasonogram neck and all 100 nodules were reported as solid areas. No area of cystic lesion or multi nodular lesion identified.

CYTOLOGICAL ANALYSIS – FNAC

Cytology	No. of patients	Percentage
Colloid nodule	53	53%
Adenoma	47	47%

53 cases were reported to have a colloid nodule on FNAC and 47 cases reported as adenomatous goiter. No case of malignancy was reported on cytological analysis. Computerized Tomography of neck was done in one patient, the youngest patient in this study, which identified the solitary nodule as a adenoma thyroid.

Only one among the patients who was affordable was subjected to Radio active iodine uptake study which revealed a cold nodule.

All the 100 patients were assessed for hemi thyroidectomy under general anaesthesia and per operative evaluation by palpation of the contralateral lobe done and no evidence of nodularity in the contralateral lobe or no regional lymph node metastasis identified and hemithyroidectomy proceeded with in all patients.

HISTOPATHOLOGICAL EXAMINATION

All the 100 patients underwent Hemithyroidectomy and the histopathology of the excised specimens tabulated. The incidence of malignancy was found to be 16%. 30% of the patients had benign adenomas of papillary and follicular types. The incidence of inflammatory goiter was 3% and 4 patients showed evidence of toxicity in the excised specimen.

Table 1. Histopathological Examination

Solitary Nodule of the Thyroid	Solitary Nodule of the Thyroid	Solitary Nodule of the thyroid	Solitary Nodule of the Thyroid
1.	Dominant nodule of multi nodular goitre	47	47%
2.	Papillary adenoma	17	17%
3.	Follicular adenoma	13	13%
4.	Papillary carcinoma	14	14%
5.	Follicular carcinoma	2	2%
6.	Thyroiditis	3	3%
7.	Toxicity	4	4%

Table 2. Age Distribution Of Malignant Nodules

Age in yrs	No. of Patients	Percentage
11 – 20	0	0
21 – 30	6	37.5%
31 – 40	4	25%
41 – 50	4	25%
51 – 60	2	12.5%

Malignancy most common in the 3rd decade of life in this study

Table 3. Sex Distribution Of Solitary Thyroid Nodule

Sex	Benign	Malignant	Total
M	9	2	11
F	75	14	89
Total	84	16	100

18.18% of nodules in males were malignant and 15.73% of nodules were malignant in females. Majority of Patients 84% had an uneventful post operative period.

Table 4.Post – Operative Complications

Complication	No. of patients	Percentage
Hemorrhage	1	1%
Dysphonia	4	4%
Wound infection	1	1%
Hypothyroidism	10	10%

One among the patients had reactionary hemorrhage and the hematoma was let out in the post operative period. 4 had transient dysphonia in the form of loss of pitch of voice which improved subsequently. I had would infection and pus culture & sensitivity revealed staphylococci sensitive to Cephalexin.10 patients among developed postoperative hypothyroidism and were given L – thyroxine therapy.

FOLLOW UP

The follow up period of the patients varied from 3 months to 12 months. First review after 2 weeks and second review after 6 weeks thyroid function tests done in all patients all at 6 weeks. More than 70 patients lost follow up after 3 months. Patients with lymphocytic thyroiditis had thyroid auto antibody assay and were given tablet L – thyroxine therapy.

Patients with post operative hypothyroidism were managed with L – thyroxine. Among patients with malignancy, 2 lost their follow up, 8 were referred to higher centers for further evaluation and treatment, 2 had complete metastatic workup (CT Scan neck and radioactive iodine uptake study done) and completion thyroidectomy done. 4 patients who were not willing for further evaluation were managed by L- thyroxine suppression therapy.

DISCUSSION

Solitary nodule of the thyroid are common clinical entities which needs careful evaluation to correctly identify patients who need thyroidectomy.

AGE

Age group in the present study ranges from 20 – 60yrs. Majority of the patients, 97% were young and middle aged 21 – 50 of age. The incidence of malignancy was found to be high in the 21 – 50 yrs age group.

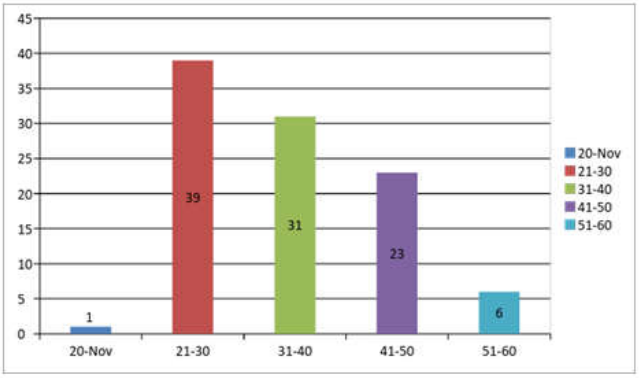

Chart 1.Solitary Nodule of The Thyroid

GENDER

There were 89 females and 11 males in this study. The solitary nodule of the thyroid was 8 times more common in females than males which is very high in comparison to world statistics which show a male to female ratio of 1:3. The incidence of malignancy was more in males than in females.

Males 18.18% Females 15.73%

- Mean age at presentation – 36 years
- More common in 3rd, 4th & 5th decades of life

RISK FACTORS – no significant risk factor was identified

CLINICAL ASPECTS

At the time of admission all the patients presented with a swelling in the anterior aspect of the neck. 13 patients had complaints of pain over the swelling which post operative, retrospective evaluation with the help of histopathology was attributed to thyroiditis and cystic degeneration or hemorrhage into a nodule. 32 patients complained of vague discomfort in neck during swallowing which could not be attributed to any pathology or size of the swelling. On physical examination solitary nodules of thyroid of varying sizes from 4 – 7cm confined to right or left lobe with or without involvement of the isthmus of thyroid were noted. All patients were clinically euthyroid.

HORMONE ASSAY FOR THYROID FUNCTION

Only 4 patients had hypothyroidism which was attributed to lymphocytic thyroiditis and multi nodular goiter diagnosed on histopathological examination post operatively and these patients benefited by post operative L – thyroxine supplementation. Majority, about 96% were euthyroid at the time of admission.

ULTRA SONOGRAM NECK

All 100 patients were subjected to ultrasonogram neck and all 100 nodules were reported as solid areas. No area of cystic lesion or multi nodular lesion identified.

CYTOLOGICAL ANALYSIS

In fine needle aspiration cytology, the Gold standard investigation in the evaluation of solitary nodule of the thyroid, all 100 cases were reported as benign and 53 were colloid nodules and 47 were adenomas. Retrospective comparison with Histopathology of excised specimen revealed a false negative report in FNAC in detecting malignancy in 16 cases of malignant nodules.

SOLITARY NODULE OF THE THYROID

FINE NEEDLE ASPIRATION CYTOLOGY

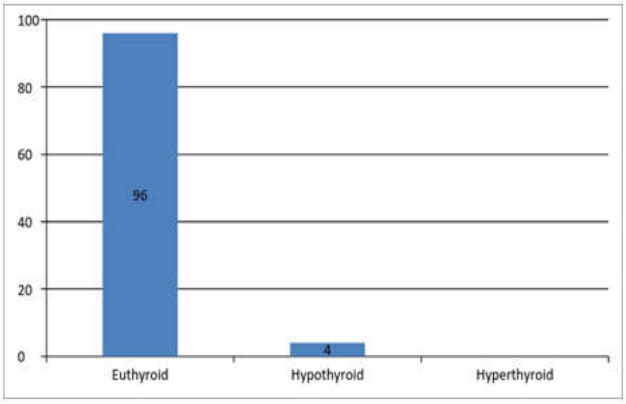

Chart 2.Thyroid Function

3 colloid nodules diagnosed by FNAC revealed foci of thyroiditis in Histopathology. 3 colloid nodules and 1 case of adenomatous goiter diagnosed by FNAC revealed features of toxicity in Histopathology.

HISTOPATHOLOGY

47 cases out of 100 were dominant nodules of a multinodular goitre. 30 cases of adenomas, 17 papillary adenomas and 13 follicular adenomas were noted. 16 cases of malignant nodules among which 14 revealed a papillary carcinoma and 2 cases of follicular carcinoma were diagnosed. The incidence of inflammatory goiter was 3% and toxic features in colloid nodules and an adenoma were noted in 4 patients.

SURGERY

All 100 patients were posted for surgery after fitness for anaesthesia and per operative palpation of contralateral lobe showed no evidence of nodules and ipsilateral hemithyroidectomy was done.

POST OPERATIVE COMPLICATIONS

84 Patients had an uneventful post operative period. I had reactionary hemorrhage and another one had wound infection which were managed appropriately. 4 suffered transient dysphonia that settled without specific therapy. 10 cases of post operative hypothyroidism was detected and the patients had either inflammatory goiter or a multinodular goiter and were managed with L – thyroxine therapy.

FOLLOW UP

All patients were followed up for a period of 3 months to 1 year. During the follow up patients had thorough physical examination, TSH and thyroxine assay and thyroxine therapy for selected patients. Patients with lymphocytic thyroiditis had thyroid auto antibody assay and were given tablet L – thyroxine therapy. Among patients with malignancy, 2 lost their follow up, 8 were referred to higher centers for further evaluation and treatment, 2 had complete metastatic workup (CT Scan neck and radioactive iodine uptake study done) and completion thyroidectomy done. 4 patients who were not willing for further evaluation were managed by L – thyroxine suppression therapy.

Conclusion

- Solitary nodule of the thyroid was found to be more common in young and middle aged patients.
- Solitary nodule of the thyroid was 8 times more common in females than males.
- Majority of the solitary nodule were dominant nodules of a multinodular goiter.
- In the individuals admitted with solitary nodule of thyroid and managed by hemithyroidectomy, the incidence of malignancy was 16%.
- The incidence of malignancy in solitary nodule of thyroid in males exceeds that of females the ratio being, 18:15.

SUMMARY

A total of 100 consecutive patients with solitary nodule of the thyroid admitted were evaluated clinically, biochemically, radiologically and cytologically. The patients underwent Hyemithyroidectomy and the histopathology of the excised specimens were studied to evaluate the incidence of malignancy. The incidence of malignancy in solitary nodule of the thyroid in the present study was 16% and incidence of malignancy in males exceeds that of females. Fine needle aspiration cytology, now considered as the gold standard diagnostic test in the evaluation of a thyroid nodule revealed false negative report in 16 patients in this study. Ultra sonogram and nuclear scans are also useful tests, but are best used in conjuction with fine needle aspiration cytology. Solitary nodule of the thyroid is a common entity whereas malignancy although rare needs a selective approach for further management and follow up.

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