THYROID - USG DOPPLER IN DIFFERNTIATING FOLLICULAR ADEOMA OF THYROID FROM FOLLICULAR CARCINOMA

BY

DR. JEEVA.S

Dissertation submitted to the

THE TAMILNADU DR.M.G.R. MEDICAL UNIVERSITY

In partial fulfilment of the requirements for the degree of

M.S. GENERAL SURGERY – BRANCH I

DEPARTMENT OF GENERAL SURGERY

THANJAVUR GOVERNMENT MEDICAL COLLEGE AND HOSPITAL

THANJAVUR- 613004.

THE TAMILNADU DR. M.G.R. MEDICAL UNIVERSITY

APRIL- 2017

DECLARATION BY THE CANDIDATE

I,Dr.JEEVA.S, solemnly declare that this Dissertation **"THYROID - USG DOPPLER IN DIFFERNTIATING FOLLICULAR ADEOMA OF THYROID FROM FOLLICULAR CARCINOMA"**

was done by me in the Department of General Surgery, ThanjavurMedical College and Hospital , Thanjavur under the Guidance and Supervision of my **Unit Chief Dr. K. MAHADEVAN. M.S**., and **Dr. J. SELVARAJ M.S., (i/c)** and Department of General Surgery, ThanjavurMedical College, Thanjavur during the period from September 2015 to august 2016.

This Dissertation is submitted to The TamilnaduDr. M.G.R Medical University , Chennai in partial fulfilment of University requirements for the award of M.S Degree (Branch – I) in GENERAL SURGERY.

DR.JEEVA.S

Postgraduate Student,

Thanjavur Medical College.

Thanjavur.

CERTIFICATE BY THE GUIDE

This is to certify that this dissertation titled "**THYROID - USG DOPPLER IN DIFFERNTIATING FOLLICULAR ADEOMA OF THYROID FROM FOLLICULAR CARCINOMA"**

is a bonafide research work done by **Dr. JEEVA.S ,** in partial fulfilment of the requirement for the degree of **M.S.GENERAL SURGERY – BRANCH I** to be held in April 2017.

UNIT CHIEF (i/c): DR. J.SELVARAJ M.S.,

Department of General Surgery,

Thanjavur Medical College,

Thanjavur-613004

CERTIFICATE

This is to certify that the dissertation titled " **THYROID - USG DOPPLER IN DIFFERNTIATING FOLLICULAR ADEOMA OF THYROID FROM FOLLICULAR CARCINOMA"**

Is a bonafide research work done by **Dr.JEEVA.S**under the guidance of **Dr.K.MAHADEVANM.S.,** (UNIT CHIEF, Department of General Surgery) and **Dr.J.SELVARAJ M.S.,**(UNIT CHIEF (I/C), Department of General Surgery)Thanjavur, Government Medical College Hospital, Thanjavur in partial fulfilment of the requirements for M.S Branch-I (GENERAL SURGERY) Examination of the TamilnaduDr. M.G.R. Medical University to be held in APRIL – 2017.

Dr. M.VANITHAMANI, M.S, M.Ch.,
The Dean,
Thanjavur Medical College,
Thanjavur – 613004.Thanjavur Medical College,
Thanjavur – 613004.

Dr. M. ELANGOVAN M.S.,
The Professor and HOD,
Department of General surgery,

A**CKNOWLEDGEMENT**

I am grateful to **Dr**.**M**.**VANITHAMANI M.S., M.Ch.,**Dean, Thanjavur Medical College, Thanjavur, for giving me permission and opportunity to conduct study, data collection and utilize the institutional facilities.

I am deeply grateful to my professor and Head of the Department of General Surgery, **Prof. Dr. ELANGOVAN.M M.S.**, for his encouragement and suggestions in preparing this work.

I owe my sincere and grateful acknowledgement to my beloved chief, teacher and guide **UNIT CHIEF: Dr.K.MAHADEVAN M.S.,** Department of General Surgery who inspired me to take this topic of "**THYROID - USG DOPPLER IN DIFFERNTIATING FOLLICULAR ADEOMA OF THYROID FROM FOLLICULAR CARCINOMA**".

I owe my special thanks to **Prof. Dr.A.Srinivasan MD.,** (**Radiodiagnosis**) and Asst. Prof. **Dr.A.Balaji** (**Radiodiagnosis**) who helped me in every stage of my study.

I extend my grateful acknowledgement to my teachers,**Dr.V.MARIMUTHUM.S.,**Asst. Prof. of General Surgery, **Dr. A.MUTHUVINAYAGAMM.S**, Asst. Prof. of General Surgery.

Mysincerethanksto Assistant Professors of other unit, my colleagues and friends who have been a constant source of encouragement

.

I would like to thank Assistant Professors, my colleagues and Staff in Department of pathology and other faculty members who enabled me to complete this work effectively.

I wish to express my whole hearted thanks to all the patients who participated in the study. Completion of this work would not have been possible without their co-operation. And most of all I would like to thank my friends for their tireless efforts, guidance, and patience in helping me to finish the study.

Dr. JEEVA.S

Thanjavur Medical College

THANJAVUR, TAMILNADU, INDIA - 613001

(Affiliated to the T.N.Dr.MGR Medical University, Chennai)

INSTITUTIONAL ETHICAL COMMITTEE

CERTIFICATE

Approval No. : 273

This is to certify that The Research Proposal / Project titled

THYROID - USG DOPPLER IN DIFFERENTIATING FOLLICULAR ADENOMA OF THYROID FROM FOLLICULAR CARCINOMA

submitted by Dr. S. JEEVA **of**

Dept. of GENERAL SURGERY **Thanjavur Medical College, Thanjavur**

was approved by the Ethical Committee.

Thanjavur

Dated : 21.9.16

Secretary
Ethical Committee
TMC, Thanjavur.

THE SECRETARY
INSTITUTIONAL ETHICAL COMMITTEE
THANJAVUR MEDICAL COLLEGE,
THANJAVUR.

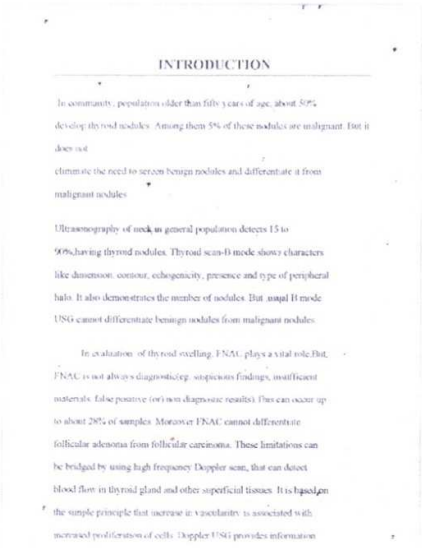
turnitin

Digital Receipt

This receipt acknowledges that Turnitin received your paper. Below you will find the receipt information regarding your submission.

The first page of your submissions is displayed below.

Submission author:	221411203 Ms Gensur S.JEEVA
Assignment title:	2015-2015 plagiarism
Submission title:	THYROID USG DOPPLER IN DIFFE...
File name:	Jee_final.docx
File size:	822.79K
Page count:	81
Word count:	9,099
Character count:	50,249
Submission date:	26-Sep-2016 09:00PM
Submission ID:	709195315



INTRODUCTION

In community, population older than fifty years of age, about 50% develop thyroid nodules. Among them 5% of these nodules are malignant. But it does not

eliminate the need to screen benign nodules and differentiate it from malignant nodules

Ultrasonography of neck in general population detects 15 to 90%having thyroid nodules. Thyroid scan-B mode shows characters like dimension, contour, echogenicity, presence and type of peripheral halo. It also demonstrates the number of nodules. But usual B mode USG cannot differentiate benign nodules from malignant nodules.

In evaluation of thyroid swelling, FNAC plays a vital role.But, FNAC is not always diagnostic(eg. suspicious findings, insufficient materials, false positive (or) non diagnostic results). This can occur up to about 20% of samples. Moreover FNAC cannot differentiate follicular adenoma from follicular carcinoma. These limitations can be bridged by using high frequency Doppler scan, that can detect blood flow in thyroid gland and other superficial tissues. It is based on the simple principle that increase in vascularity is associated with increased proliferation of cells. Doppler USG provides information

Welcome to your new class homepage! From the class homepage you can see all your assignments for your class, view additional assignment information, submit your work, and access feedback for your papers.

Hover on any item in the class homepage for more information.

Class Homepage

This is your class homepage. To submit to an assignment click on the "Submit" button to the right of the assignment name. If the Submit button is grayed out, no submissions can be made to the assignment. If resubmissions are allowed the submit button will read "Resubmit" after you make your first submission to the assignment. To view the paper you have submitted, click the "View" button. Once the assignment's post date has passed, you will also be able to view the feedback left on your paper by clicking the "View" button.

Assignment Inbox: The Tamil Nadu Dr.M.G.R.Medical Uty 2015-16 Examinations

	Info	Dates	Similarity	
2015-2015 plagiarism	ⓘ	Start 23-Nov-2015 2:27PM Due 07-Nov-2016 11:59PM Post 01-Dec-2015 12:00AM	13%	Resubmit View

INTRO

In community, population older than

develop thyroid nodules. Among then

does not

eliminate the need to screen benign n

malignant nodules.

Ultrasonography of neck in general p

90%.having thyroid nodules. Thyroid

like dimension, contour, echogenicity

halo. It also demonstrates the number

USG cannot differentiate beningn no

In evaluation of thyroid swelli

FNAC is not always diagnostic(eg. su

materials, false positive (or) non diag

TABLE OF CONTENTS

INTRODUCTION

In community, population older than fifty years of age, about 50% develop thyroid nodules. Among them 5% of these nodules are malignant, But it does not eliminate the need to screen benign nodules and differentiate it from malignant nodules.

Ultrasonography of neck in general population detects 15 to 90%,having Thyroid nodules. Thyroid scan-B mode shows characters like dimension, contour, echogenicity, presence and type of peripheral halo. It also demonstrates the number of nodules. But, usual B mode USG cannot differentiate benign nodules from malignant nodules.

In evaluation of thyroid swelling, FNAC plays a vital role. But, FNAC is not always diagnostic (eg. suspicious findings, insufficient materials, false positive or non diagnostic results).This can occur up to about 28% of samples. Moreover FNAC cannot differentiate follicular adenoma from follicular carcinoma. These limitations can be bridged by using high frequency Doppler scan, that can detect blood flow in thyroid gland and other superficial tissues. It is based on the simple principle that increase in vascularity is associated with

increased proliferation of cells. Doppler USG provides information about nodule vascularisation and is useful in identification of atrisk nodules for malignancy by analyzing various parameters like resistance index, pulsatility index and filling patterns.

AIM

1) To Evaluate that Doppler USG is useful in diagnosing thyroid nodules at risk for malignancy, more importantly in differentiating benign follicular neoplasm from malignant follicular neoplasm

2) It aids in management of patients with solitary nodule of thyroid with high risk for malignancy that they may directly undergo total thyroidectomy rather than going for hemithyroidectomy and later for second stage completion thyroidectomy,

This is a prospective study in patients with thyroid nodules. Patients were recruited after obtaining informed consent, details of clinical diagnosis, preoperative investigations, FNAC, USG neck and USG Doppler, postoperative histopathology, followup period were recorded. Data analysed and results interpreted. Ethical approval for the study was obtained from ethical committee, THANJAVUR MEDICAL COLLEGE AND HOSPITAL, THANJAVUR.

REVIEW OF LITERATURE

DEVELOPMENT

The thyroid gland develops from a median down growth of a column of cells from the pharyngeal floor between the first and second pharyngeal pouches (Subsequently marked by the foramen caecum of the tongue).

The canalised column becomes the thyroglossal duct which is displaced forward by the developing hyoid bone and then below the hyoid, lies slightly to one side, more commonly to the left. The duct bifurcates to from the thyroid lobes and a portion of the duct forms the pyramidal lobe.

ANATOMY

It is located in the anterior triangle of the neck. It weighs about 20 grams.

PARTS

- Right and left lateral lobes located in a space (thyroid fossa) between trachea and oesophagus medically and carotid sheath laterally. Each lobe is 5x3 x1.5 cm in size, extends from the middle of the thyroid cartilage to 6th tracheal ring.
- Isthmus is the connecting part between two lateral lobes in midline extending from 2nd to 4th tracheal ring.

- ❖ Pyramidal lobe is upward extension as fibrous strands or muscular strands from the junction of the isthmus and left lateral lobe.
- ❖ Gland is invested by pretracheal fascia.

BLOOD SUPPLY

- ❖ Superior thyroid artery is first anterior branch of external carotid artery enters the gland near superior pole as a larger anterior superficial branch and a smaller posterior branch.
- ❖ Inferior thyroid artery, a branch of thyrocervical trunk of subclavian artery passes behind the carotid sheath running medially reaching the posterolateral aspect of the gland.
- ❖ Thyroidea ima artery, a branch of aorta or brachiocephalic artery enters the isthmus or lower pole of one of the lateral lobes (10%)
- ❖ Tracheal and oesophageal branches serve blood supply to retained thyroid gland after thyroidectomy.

VENOUS DRAINAGE

- ❖ Superior thyroid vein
- ❖ Middle thyroid vein is short and drains into the internal jugular vein. It is first to be ligated in thyroidectomy.

- ❖ Inferior thyroid veins are many in number.
- ❖ Kocher's vein may be present which drains lower or middle thyroid.

LYMPHATIC DRAINAGE

Primary:

- ❖ Tracheo-oesophageal nodes.
- ❖ Prelaryngeal nodes (Delphian nodes). Formerly purpose of these lymph nodes were uncertain hence the name .Delphi is a place in Greece where Pythia, snake women after sulphurous fume inhalation uttered meaningless jargon purpose of it was unclear.
- ❖ Mediastinal nodes

Secondary:

- ➢ Deep cervical nodes.
- ➢ Supraclavicular nodes.
- ➢ Occipital nodes.
    - ▪ Ascending medial lymph vessels from the upper border of isthmus drain to prelaryngeal nodes which are located in the cricothyroid membrane.

- Ascending lateral vessels from the upper pole of the gland along the superior thyroid artery drain into deep cervical nodes.
- Descending medial vessels begins at lower part of the isthmus to reach pretracheal lymph nodes.
- Descending lateral vessels run from the deep surface of the thyroid to recurrent laryngeal chain nodes.

IMPORTANT RELATIONS OF THYROID GLAND

- ❖ Recurrent laryngeal nerve lies in the tracheooesophageal groove, in relation to Berry's ligament.
- ❖ Superior laryngeal nerve which gives a branch, external laryngeal nerve supplies cricothyroid muscle. It accompanies superior thyroid artery.
- ❖ Parathyroid glands - four in number, two on each side embedded in thyroid.

PHYSIOLOGY

Thyroid gland has two secretory cells:

1. Follicular cells - secretes thyroid hormones (Thyroxine (T4), Tri-

iodothyronine (T3).

2. Parafollicular cells ('C' Cells) - secretes calcitonin.

IODINE METABOLISM

Ninety per cent of body iodide uptake is in the thyroid gland, whose uptake into the follicular cells is regulated by TSH and follicular iodide content.

THYROID HORMONE SYNTHESIS

Iodothyronins (MIT, DIT) are formed in follicular cells by the coupling of inorganic iodide with tyrosine. These are biologically inert molecules. T4 (Thyroxine) is formed by coupling of 2 DIT molecules and T3 (Tri-iodothyronine) is formed by coupling of 1 MIT and 1 DIT molecules. Both are bound to thyroglobin which is the primary component of colloid matrix.

The hypothalamus-pituitary-thyroid axis regulates thyroid hormone production and releases in a classic feedback system. TRH is a regulatory hormone from hypothalamus and TSH is a regulatory hormone from anterior pituitary.

THYROID function tests

1. T3 (Serum tri-iodothyronine):1.2-3.1 nmol/litre. 80% of T3 is from deiodination of T4 at periphery in liver, muscle, kidney and pituitary. T3 is 4 times more potent with half life of 24 hours.

2. T4 (Serum thyroxin):55-150 nmol/litre. It reflects the output of the gland (Edward Calvin Kendall 1915).

3. TSH: 0-5 IU/ml of plasma. TSH is secreted from anterior pituitary; its secretion is inversely related to circulating thyroid hormones. TSH secretion is regulated by TRH from hypothalamus.

4. PBI (Protein bound iodide)- 8 mcg/100 ml.

5. Free T3 is 0.3% (3-9 nmol/litre). It is the best single test is assessing hyperthyroidism.

6. Free T4 is 0.03% (8-26 nmol/litre)

7. RA I123 scan show either cold nodule, hot nodule, or warm nodule.

8. TRH stimulation test for hypothalamic - pituitary axis: Intravenous TRH (200 mg) shows rise in serum TSH level in 20 minutes (from basal 1 m unit/ml to 10 m unit/ml) and reaches to normal in 2 hours. Patients with

pituitary insufficiency developa subnormal response, patient with hypothyroidism will show enhanced TSH response; in hypothyroidism there will be no response. This test is useful in doubtful hyperthyroidism, hypothyroidism, T3 thyrotoxicosis, Ophthalmic Graves' disease.

9. Serum creatinine is increased in hyperthyroidism; decreased in hypothyroidism.

10. Serum cholesterol is increased in hypothyroidism and decreased in hyperthyroidism.

11. BMR is increaed in hyperthyroidism.

12. Thyroid autoantibodies are also useful to evaluate the function (LATS). TSH receptor antibodies (TSH RAb) has got long acting potential and are reasons for all primary thyrotoxicosis.

13. Werner's T3 Suppression test: Initial isotope uptake study is done. 40 mcg of T3 is given to the patient orally 8th hourly for 5 days. Uptake study is repeated. In normal uptake suppression up to 80% is noted. In toxic goitre suppression is 10-20%. It is used in patients with antithyroid drugs for primary thyrotoxicosis to assess the remission status.

14. Thyroglubulin estimation: Normal value is 0.5-50 mg/L. It is used during follow up period especially in follicular carcinoma of thyroid. But if thyroglobulin antibodies are raised in patient, then it is of no use. Thyroglobulin is produced only by the thyroid tissue. After total thyroidectomy, its level drastically reduces. It is the ideal follow up marker in well differentiated thyroid carcinoma after thyroidectomy. Sudden raise in its serum can occur in thyroiditis, primary or secondary toxic goitre.

FNAC OF THYROID

- It is the investigation of choice in most of the thyroid diseases to conclude pathological diagnosis.
- It is useful in papillary/medullary (amyloid)/anaplastic carcinomas, lymphomas, colloid nodule, thyroiditis.
- 23G needle is used. Suspicious solitary/multiple nodules/dominant nodules should be aspirated.
- Karolinska hospital (Lowhagen) at Sweden pioneered this method.

- Minimum 6 aspirations should be done. An adequate FNAC smear should have six aspirations with six groups of cells with each group containing 20 cells. USG guided aspiration is better.
- Diagnostic accuracy of FNAC is 95%; sensitivity 85%; Specificity 94%.
- Aspiration is graded as: Thy1-Nondiagnostic;Thy2-Nonneoplastic;Thy3-Follicular;Thy4-Suspicious of malignancy; Thy 5 - malignancy.
- In a cyst of thyroid FNAC may be less reliable; if cyst recurs after 3 aspirations, surgery is needed.
- Malignancy rate in a simple cyst is 5%; in a complex cyst it is 75%.
- FNAC is not reliable at present in follicular carcinoma of thyroid as capsular and vascular invasions cannot be found. But by newer technique it is possible to identify the differences - Benign is polyploidy, malignant is aneuploidy;benign are monoclonal, malignant are polyclonal; MR spectroscopy and thyroimmunoperoxidase estimation are useful to differentiate.

- ❖ FNNAC is the fine needle nonaspiration cytology - is said to be more reliable.

USG IN THYROID

- ❖ To identify nodules, number, size, vascularity, echogenicity.
- ❖ To do USG guided FNAC.
- ❖ To identify neck lymph nodes
- ❖ To find out solid or cystic nature.
- ❖ Benign lesion is hyperechoic, often cystic with well-defined margin; shows peripheral egg shell calcification with sonolucent rim (halo) around nodule.
- ❖ Malignant lesion is hypoechoic with poorly defined margin with high vascularity, with microcalcification without any halo around.

CLASSIFICATION OF GOITRE

Goitre is enlargement of thyroid gland. ('goitre'-latin-gutter- throat)

1.Simple nontoxic

a. Diffuse hyperplastic:

- Physiological

-Puberty.

- Pregnancy

- Primary iodine deficiency (Endemic; dietary iodine intake less than 100 mg/day).

- Secondary iodine deficiency:

- Goitrogens of Brassica family, e.g. cabbage, soyabean. Common in hill station.

- Excess dietary fluoride.

-Drugs: PAS, lithium, phenylbutazone, thiocyanates, potassium perchlorate, antithyroid durgs, radioactive iodine.

- Dyshormonogenetic goitre.

b. Colloid goitre.

c. Nodular goitre (Multinodular).

d. Solitary nontoxic nodule.

e. Recurrent nontoxic nodule.

2.Toxic

a. Diffuse (Primary) -Graves disease.

b. Multinodular (Secondary) -Plummer's disease.

c.Toxic nodule (Solitary) (Tretiary)

d. Recurrent toxicosis.

3.Neoplastic

a.Benign - adenomas:follicular,Hurthle cell.

b. Malignant:

-Carcinomas: Papillary, follicular, medullary, anaplastic.

- Lymphomas.

4.Thyroiditis

a. Hashimoto's autoimmune thyroiditis.

b. de-Quervain's autoimmune thyroiditis.

c. Riedel's thyroiditis.

5. Rare causes: Bacterial (suppurative), amyloid.

DIFFUSE HYPERPLASTIC GOITRE

Initial persistent increase in TSH level causes diffuse active lobules. In late stages of diffuse hyperplasia, TSH stimulation decreases and many follicles become inactive ,get filled with colloid and it is called as colloid goitre.

As diffuse hyperplastic goitre is a reversible stage, L-thyroxine is beneficial.

MULTINODULAR GOITRE (MNG)

- MNG is discordant growth with functionally and structurally altered thyroid follicles presenting as multiple nodules in thyroid.

- It may be due to mainly fluctuation in TSH level; other causes may be iodine deficiency, goitrogens, hereditary,dyshormonogenesis.

- Other factors involved are growth stimulating immunoglobulins and growth prone cell clones.

STAGES OF MULTINODULAR GOITRE FORMATION

- Stage of hyperplasia and hypertrophy
- Stage of fluctuation in TSH
- Stage of information of nodules

Colloid goitre is a goitre to long standing iodine deficiency with localised accumulation of significant colloid in the gland.

CLINICAL FEATURES

- ❖ More common in middle aged females
- ❖ It is a slowly progressive disease with many years of history.
- ❖ Multiple nodules of different sizes are formed in both lobes, also in isthmus, which is firm, nodular, nontender, moves with deglutition.
- ❖ Recent increase in size signifies malignant transformation or haemorrhage.

- Positive Kocher's test is due to compression over trachea(tracheomalacia/scabbard trachea) in a long standing MNG.
- Nodule when calcified becomes harder; necrosis softens the nodule.

COMPLICATIONS OF MNG

- Secondary thyrotoxicosis (30%)
- Follicular carcinoma of thyroid (10%)
- Haemorrhage in a nodule
- Tracheal obstruction, calcification
- Cosmetic problem.

INVESTIGATION

- T3, T4, TSH, U/S neck, FNAC. FNAC is done from most dominant and suspicious nodule. FNAC from more than one nodule is better; US guided FNAC is more reliable. High resolution US identifies impalpable nodules, number, nature of nodule, vascularity of nodules. Nodule less than 0.3 cm is identifiable in US.

- X-ray neck shows ring or rim calcification; also reveals the position (displacement) and compression of trachea.
- Indirect laryngoscopy to see vocal cords prior to surgery. occult recurrent laryngeal nerve (RLN) palsy.
- Radioisotope iodine scan – in selected patients when indicated only.
- Routine blood investigations, serum calcium.
- CT Scan/MRI are routinely not indicated. It is done in retrosternal extension.

TREATMENT

Usually surgery is preferred.Reason for doing surgery in nodular goitre is -it is an irreversible stage and chances of complications like development of toxicity, haemorrhage and follicular carcinoma is high and also for cosmetic reason.

- when entire gland is diseased, total thyroidectomy is a better option.
- Subtotal thyroidectomy is done depending on the amount of gland involved, amount of normal gland existing and location of nodules-commonly done procedure in multinodular goitre.Eight grams of thyroid tissue is retained in each lateral lobe.

- Often partial thyroidectomy or Hartley Dunhill operation is also done depending on the amount of diseased gland and normal tissues behind.Partial thyroidectomy is not well approved now.
- Postoperative L thyroxine is often given to prevent any fluctuation is TSH level which may cause recurrent nodule formation.
- Prevention of multinodular goitre is possible by supplementing with L-thyroxine when patient develops goitre in puberty.Formation of nodular goitre can be prevented by correcting iodine deficiency by using iodine rich diet like eggs/seafood/milk or iodized salts and also avoiding goitrogenic drugs and diet.
- Suppressive dose of L-thyroxine alone may be used occasionally in small nodule with limited results. TSH level shoud be supperessed consistentlybelow 0.5 ml IU/L.Problems are need of periodic monitoring with TSH estimation ; hormone insensitive part of thyroid tissue continue to grow;indefinite period of treatment;high recurrence after stopping L-thyroxine.So it is not ideally accepted therapy. It is found that TSH suppression is of no use in treating residual/recurrent MNG.

DISCRETE THYROID NODULE

- Discrete thyroid nodule is a clearly palpable nodule if clinically only a nodule is felt without palpable remaining gland OR it can be dominant nodule if clinically a nodule is felt in a palpable remaining gland OR it can be dominant nodule (30%)if clinically nodule is felt ina palpable remaining one or both lateral thyroid lobes.
- A discrete thyroid nodule is common in females. Discrete nodule may be solid or cystic.USG,CT,MRI may confirm the diagnosis.
- 15% solitary/isolated nodule may be malignant;40% may be follicular adenoma.Other causes are thyroid cyst,thyroiditis or colloid degeneration.

SOLITARY THYROID NODULE

It is a single palpable nodule in thyroid on clinical examination,in otherwise normal gland.Rest of the gland is impalpable.

CAUSES:

1. Thyroid adenomas-20%

    a. Follicular – colloid(commonest);embryonal;fetal.

    b.Hurthle cell.

Note: papillary adenoma earlier called,was actually papillary carcinoma.

2. Papillary carcinoma of thyroid-20%
3. Only one nodule may be clinically palpable in an underlying multinodular goiter-50%.
4. Throid cyst-10%

TYPES

1. Toxic solitary nodule -3-5% of solitary nodules of thyroid
2. Nontoxic solitary nodule.

Based on radioisotope study:

- Hot: Means autonomous toxic nodule. Normal surrounding thyroid tissue is inactive and so will not take up isotope. Nodule is overactive. It is 5% common of which only 5% can be malignant.

- Warm: Normally functioning nodule. Nodule and surrounding normal thyroid will take up isotope (active).It is 10% common of which 10% can be malignant.
- Cold:Nonfunctioning nodule;may be malignant(need not be always).Nodule will not take up isotope (underactive).It is 80% common of which 20% are malignant.

FEATURES

- Single nodule palpable in one or other lobes of the thyroid which is usually smooth and firm.
- Lahey's test does not show any other nodules in posterior part of the gland.
- Hot or warm in 99m Tc scan but cold in I123 scan(discordant nodule)commonly they are malignant.
- Thyroid nodule in children and elderly can be malignant.
- Rapid enlargement of thyroid nodule can be malignant.
- Tracheal deviation towards opposite side is common confirmed by trail sign,three –finger test,auscultation and X-ray neck.
- 30% of solitary nodules are cystic.

- 20% of cold nodules are malignant. Cold nodule may be due to malignancy,thyroiditis,thyroid cyst or haemorrhage, benign adenoma.
- Commonest site of a nodule is at the junction of isthmus with one of the lateral lobes.
- Solitary thyroid nodule is the most common thyroid surgical disease.

INVESTIGATIONS

- U/S neck (very useful).
- FNAC.
- T3,T4,TSH.
- Power Doppler is done to know the vascularity of the gland.Vascularity is described in resistive index(R1).Normal RI is 0.65-0.7;if RI is more than 0.7 it indicates malignancy in that nodule.Malignant nodule shows anarchical angiogenesis.Flow pattern are:Type0- no flow; Type1:only peripheral flow; Type2: peripheral with small central flow; Type3:peripheral with extensive central flow;Type 4:only central flow.
- Radioisotope study(I123/I 131/ 99mTc)

- ❖ Serum calcitonin estimation if FNAC confirms medullary carcinoma.
- ❖ CT scan or MRI neck is not done routinely, but only in selected cases.Large swelling/to see vascularity/retrosternal extension are the indications.
- ❖ X-ray neck to see tracheal deviation.

TREATMEANT

Indicationsforsurgeryin solitary nodule thyroid

Malignant nodule

Follicular neoplasm

Toxic nodule in young

Nodule with obstruction

Recurrent cystic nodule

Complex cyst

Cosmetic reason

- If it is a nontoxic nodule due to any cause,hemithyroidectomy with complete removal of lateral lobe and whole of the isthmus is done.
- If it is papillary carcinoma thyroid,then near total thyroidectomy is done along with suppressive dose of L-thyroxine given 0.3 mg OD daily.
- If it is a toxic nodule,radioiodine therapy,I131-5 milli curie is given orally ,if the age of the patient is more than 45 years.
- If age is less than 45 years,then initially toxicity has to be controlled by antithyroid drugs,always followed by surgery-Hemithyroidectomy.
- If FNAC report says follicular adenoma,then hemithyroidectomy is done.If histology report says follicular carcinoma then completion total thyroidectomy is done.Completion thyroidectomy is done usually within 7 days or after 3 weeks.If frozen section biopsy proves carcinoma then total thyroidectomy is done.
- If there is a nodule in the isthumus ,isthumectomy is done with excision of part of adjacent lateral lobes.

- If FNAC report says medullary carcinoma of thyroid,then total thyroidectomy with bilateral neck nodal dissection including central compartment is done.
- Colloid nodule may respond for conservative drug treatment using thyroxine orally in 50% cases.If nodules reappears/enlarges progressively and significantly/causing cosmetic problem then hemithyroidectomy is indicated in colloid nodule.

RETROSTERNAL GOITRE

Retrosternal goitre is defined as having> 50% goitre below the suprasternal notch.

- Primary is rare-1%.Primary retrosternal goitre arises from ectopic thyroid tissue from mediastinum.it gets its blood supply from mediastinum itself,not from the neck.And also it is not related to the existing thyroid in the neck.
- Secondary is common. It is extension from the enlarged thyroid from the neck.Usually arises from the lower pole of a nodular goitre.Commonly seen in short neck or obese individuals.Due to

negative intrathoracic pressure ,nodule gets drawn into the superior mediastinum.

CLINICAL FEATURES

- Dyspnoea at night during lying down or neck extended.
- Cough and stridor .
- Dysphagia.
- Engorgement of neck veins and superficial veins on the chest wall.
- Lower border is not seen on inspection and not felt on palpation.
- Pemberton's sign is positive.The patient is asked to raise the arm above the shoulder level.Dilated veins are seen over neck and upper part of chest wall.Stridor and rarely dysphagia may occur.(when patient raises the arm above the shoulder level, retrosternal goiter compresses over the easilycompressible structure like SVC and trachea causing dilated venis and dyspnoea respectively).
- Dull note over and the sternum on percussion.
- Retrostrernal goitre can be either nodular, toxic or malignant.
- Rarely recurrent nerve palsy can occur.

DIFFERENTIAL DIAGNOSIS

- Mediastinal tumours.

INVESTIGATIONS

- Chest X-ray shows tissue shadow under the sternum.
- Radioactive iodine study is diagnostic.
- CT scan is useful.

TREATMENT

- Surgical removal of retrosternal thyroid is done. Commonly it can be removed through an incision in neck but in case of large retrosternal extension or in malignant type median sternotomy is required (rarely).

THYROID NEOPLASMS

A.Benign

a. Follicular adenoma-colloid,embryonal,fetal.

b. Hurthle cell adenoma.

Colloid adenoma(commonest adenoma)

Papillary adenoma-its existence is doubtful.It is invariably low -grade papillary carcinoma.

B.Malignant(Dunhillclassification)

a.Differentiated-80%

1. Papillary carcinoma(60%).

2. Follicular carcinoma(17%).

3.Papillofollicular carcinoma behaves like papillary carcinoma of thyroid.

4.Hurthle cell carcinoma behaves like follicular carcinoma.

b.Undifferentiated-20%.

Anaplastic carcinoma(13%).

c.Medullary carcinoma(6%).

d.Malignant lymphoma(4%).

e.Secondaries in thyroid(rare) -from colon,kidney,melanoma,breast.

Annual incidence of thyroid cancers is 3.7 per 1,00,000 population. It is common in females(3:1).

Papillary carcinoma mainly spreads through lymphatics; follicular through blood; anaplastic through lymphatics and blood.

Aetiology of Thyroid Malignancy

1. Radiation either external or radioiodine can cause papillary carcinoma thyroid.There is increased incidence of thyroid carcinoma among children following exposure to ionising radiation after thenuclear disaster in Ukraine in 1986.Earlier irradiation was practised to head and neck region to treat benign conditions like tonsillitis,adenoids,thymus enlargement,acne vulgaris,haemangiomas during first two decades of life. As a consequence papillary carcinoma of thyroid.

DIFFERENTIATED THYROID CARCINOMA(DTC)

DTC is a spectrum of disease derived from follicular cells.Both papillary and follicular carcinomas are grouped under this 90% of thyroid malignancies are differentiated .Papillary,follicular and Hurthle cell carcinomas are DTCs.

AGES;AMES(LaheyClinic);MACIS; Sloan kettering scoring includeslow,intermediate and high risk groups.First three scoring systems have low and high risk groups.

Papillary carcinoma spreads to lympth nodes;follicular carcinoma through blood.FCT causes pulsatile vascular secondaries.

Incidence of thyrotoxicosis in DTCs is 2%.

Galectin-3,RET/PTC rearrangements,CD44

THYROIDECTOMY

1) Hemithyroidectomy: Along with removal of one lobe, entire isthumus is removed. It is done in begin diseases of only one lobe. It is also done in follicular neoplasm involving only one lobe. Solitary toxic or nontoxic nodule, thyroid cyst are other indications.

2) Subtotal Thyroidectomy: Commonly done in toxic thyroid either primary or secondary and also often for nontoxic multinodular goitre. Here about 8 grams, or a tissue, size of pulp of finger is retained on lower pole, on both sides and rest of the thyroid gland is removed. It is also done in MNG.
3) Partial thyroidectomy (By Thomas) is removed of the gland in front of trachea after mobilisation. It is done in nontoxic multinodular goitre. Its role is controversial.
4) Near total thyroidectomy: Here bothlobes except the lower pole (One or both sides) which is very close to recurrent laryngealnerve and parathyroid is removed (To retain blood supply to parathyroids) It is done in case of papillary carcinoma of thyroid.
5) Total thyroidectomy : Entire gland is removed. It is done in case of follicular carcinoma of thyroid, medullary carcinoma of thyroid.
6) Hartley Dunhill Operation is removal of one entire lateral lobe with isthums and partial/subtotal removal of opposite lateral lobe. It is done in non-toxic multinodular goitre. 4 grams of tissue is left behind only on one side.

PREOPERATIVE PREPARATION

- Blood grouping and cross matching. Keep the required blood ready.
- Indirect laryngoscopy. Patient is asked to tell ‘E’ to check the abduction of vocal cord.
- Serum calcium estimation.
- T3,T4,TSH
- Thyroid antibodies
- ECG and cardiacfitness especiallyin toxic goitre
- Lugol’s iodine 10 days prior to surgery to make gland firm and less vascular.

PROCEDURE

Position:

Under general anaesthesia patient is put in supine position with neck hyperexetended by placing a sand bag under shoulder – with table tilt of 10 degree head up to reduce venous congestion.

Incision:

- Horizontal crease incision is done, two finger breadth above the sternal notch, from one sternomastoid to the other (Kocher's thyroid incision) (Posterior margin of sternomastoid).
- Skin and platysma are incised (Subplatysmal plane) – upper flap raised up to thyroid cartilage, lower flap up to sternoclavicular joint. Deep fascia is opened vertically in the midline.
- Hemithyroidectomy: Entire one lateral and entire isthumus are removed retaining entire opposite lateral lobe. It is done in solitary nodule/toxic or nontoxic adenoma in one lobe.
- Subtotal thyroidectomy- it is done in toxic/nontoxic multinodular goitre. Most of the gland except lower pole on both sides is removed.
- Strap muscles are retracted: in large goitre they are often divided in upper part to retain their nerve supply ansacervicalis. Often anterior jugular veinn need to be ligated using 3 zero vicry1.
- Pretracheal fascia is opened vertically to expose thyroid gland. Short stout middle thyroid vein which enters the IJV is ligated immediately using vicry1 or silk and divided.

- Superior Pedicle is dissected. artery and vein are individually ligated and divided.
- In olden days mass ligation close to gland at superior pole was the practice. Chances of injuring external laryngeal nerve and AV fistula may happen is mass ligation. Dissection is done in an avascular plane between criothyroid and gland.
- Parathyroids both superior and inferior and indentified. They are 6x4x2 mm in size weighing 50 mg with yellowish brown/orange brown colour. Both glands are indentified and dissected. Superior parathyroid is above and behind the junction of RLN and inferior thyroid artery: inferior parathyroid is below and in front of this junction.
- Recurrent laryngeal nerve should be identified with careful dissection through its entire course. Riddle's triangle is between inferior thyroid artery ,trachea medially. From this area nerve runs upwards to enter the larynx at greater cornua of thyroid cartilage. Many branches of nerve and variations are common, should not use monopolar cautery here: only bipolar cautery should be used. Posterior extension of lateral thyroid lobes close to Berry's ligament is called as Zuckerkandl tubercle which is seen in 40% of cases. Nerve runs upwards in a fissure between

zuckerkandl tubercle and thyroid gland. Non recurrent laryngeal nerve is occasionally seen in right side due to failure of developmentof 4th aortic arch: it directly arises from vagus enters the larynx at the level of inferior horn of thyroid cartilage.

- Inferior thyroid artery which is a branch of thyrocervical trunk ascends upwards reaching gland at its lower pole after turning towards midline behind the carotid artery. This retains the blood supply of parathyroids which is important. In olden days ligation of inferior thyroid artery was done away from the gland often in continuation using absorbable suture material is now not in practice.
- Mobilized gland is removed. Critical points of recurrent laryngeal nerve are-at the entry of interior thyroid artery and crossing the nerve at suspensory ligament of Berry, at lower pole of the gland.

COMPLICATIONS of THYROIDECTOMY

1) Haemorrhage:

May be due to slipping of ligatures either of superior thyroid artery or other pedicles or small veins. It causes hypotension, breathlessness and

compression over the trachea may cause severe stridor, respiratory obstruction due to tension haematoma under strap muscles. Then patient is shifted to operation theatre and under general anaesthesia exploration is done and bleeders are ligated. Blood transfusion may be required.

2) Respiratory obstruction:

It may be due haematoma or due to laryngeal oedema or due to tracheomalacia or bilateral RLN palsy. Often emergency tracheostomy may be required as a life saving procedure.

3. Recurrent laryngeal nerve palsy:

It can be transient or permanent. Transient is common. They usually require steroid supplement and speech therapy. Permanent paralysis is rare. It presents with hoarseness of voice, aphonia, aspiration, ineffective cough. Unilateral injury can be well compensated. It is advisable to do routine postoperative ILS on 5th postoperative day. Later ILS is done in 4 weeks and 12 weeks.

4. Hypoparathyroidism:

Mostly it is temporary due to vascular spasm of parathyroid glands occurs in 2^{nd}-5^{th} post operative day. Present with weakness, +ve Chvostek's sign, carpopedal spasm, convulsions. Serum calcium estimation is done and then 10

ml of 10% calcium gluconate is given IV 8th hourly. After 3-6 weeks, patient is admitted, drug is stopped and serum calcium level isrepeated.

5. Thyrotoxic crisis 2% (Thyroid storm)

Occurs in a thyrotoxic patient inadequately prepared for thyroidectomy and often a thyroid stress. Other causes are infection, trauma , pre eclampsia, diabetic ketosis, emergency surgery.

Features: It can present after surgery, with circulatory collapse, with severe dehydration, , hypotension, hyperpyrexia, tachypnoea, hyperventilation, palpitation, restlessness, tremor, delirium,diarrhoea, vomiting and cardiac failure,later coma.

6. Injury to external laryngeal nerve causes weakness of cricothyroid muscle leading to alteration in pitch of voice, voice fatigue, breathy voice, frequently throat clearing. ILS reveals short hyperaemic vocal cords, lower level affected of the posterior commissure to the paralyzed one.

7. Hypothyroidism Revealed clinically after 6 months.

8. Wound infection, stitch granuloma formation.

9. Keloid formation.

10. Recurrent thyrotoxicosis is 5% common. It is due to retaining of more thyroid tissue during thyroidectomy for toxic thyroid. It is difficult to manage. It is treated with antithyroid drugs. It is difficult to manage. It is treated with antithyroid drugs, radioiodine therapy or re-excision surgically which is technically demanding.

RECURRENT LARYNGEAL NERVE PALSY

Anatomy and Relations of Nerves with Thyroid Gland:

- External laryngeal nerve is a branch of superior laryngeal nerve. Vagus gives superior laryngeal nerve branch at inferior ganglion of vagus which is at the level of greater cornua of hyoid bone which in turn divides into internal laryngeal and external laryngeal nerves. External laryngeal nerve runs close to superior thyroid vessels to supply cricothyroid muscle which is tensor of vocal cord. It may get injured while ligating superior pedicle causing defective pitch of the voice. So upper pedicle of thyroid should be ligated close to gland.
- Recurrent laryngeal nerve is a branch of vagus which hooks around ligamentum arteriosm with arch of aorta on the left and right subclavian

artery on the right side. Nerve may lie within the ligament of berry (25%). Non recurrent laryngeal nerve may be present in 1 in 1000 cases with a horizontal course. RLN supplies all muscles of the larynx except cricothyroid and also gives sensory supply of larynx below the vocal cords.

MUSCLES OF THE LARYNX

- Cricothyroid : It is the only muscle which is located on the external aspect of the larynx. It is supplied by external laryngeal nerve.
- Abductors of the vocal cord – Posterior cricoarytenoids.
- Abductors of the vocal cord –Lateral cricoarytenoids, transverse arytenoids, thyroaryteniods and cricoarytenoids.
- Relaxant of vocal cords- thyroarytenoids and vocalis.
- Muscles which close the laryngeal inlet – Oblique arytenoids and aryepiglottic.
- Muscles which open the laryngeal inlet: Thyroepiglotticus.

POSITION OF VOCAL CORD

Median, Paramedian (1.5 mm), normal cadaveric/neutral (3.5 mm), gentle abduction (7 mm), Completely abducted.

Assessment of voice change:

- Pitch of the voice – whether raised/lowered or pitch absent.
- Breath support during speaking is adequate or not
- Ability to alter the rapidity of speech – slow/fast/medium
- Altered laryngeal and neck muscle tension.
- Indirect laryngoscopy- with tongue pulled out using gauze, warmed ILS is placed into the oral cavity to see vocal cords. patient is asked to say 'e' to see the vocal cord movements.

TYPES

1. Unilateral recurrent laryngeal nerve palsy.
2. Bilateral recurrent laryngeal nerve palsy.
3. Unilateral,combined recurrent laryngeal and superior laryngeal nerve palsy.

1.UNILATERAL RECURRENT LARYNGEAL NERVE PALSY

All intrinsic muscles of the larynx except cricothyroid are paralyzed.Vocal cord becomes median or paramedian position.

Reasons are;

a) Only retained cricothyroid is a weak adductor of vocal cord causing median or paramedian position of vocal cords.
b) Abductor fibres which are phylogenetically newer of the recurrent laryngeal nerve is moresusceptible and paralysed than adductor fibres.

2.BILATERAL RECURRENT LARYNGEAL NERVE PALSY

Both side intrinsic muscles are paralysed.So both vocal cords lie in median or paramedian position due to unopposed action of the both side cricothyroids.

Clinical features

- ❖ change in voice.
- ❖ Severe dyspnoea and stridor leading to airway block and respiratory arrest.

Treatment

- ❖ Emergency tracheostomy.
- ❖ Lateralisation of the cord by:
    - Arytenoidectomy by open surgery or through an endoscope.

- Vocal cord lateralisation through endoscope.

❖ Excision of vocal cord through an endoscope or laser cordectomy.

❖ Implantation of sternohyoid.

❖ Thyroplasty.

3. UNILATERAL, COMBINED RECURRENT LARYNGEAL NERVE AND SUPERIOR LARYNGEAL NERVE PALSY

All the muscles on one side are paralysed. Vocal cord is in cadaveric position,3.5 mm from the midline.

Clinical features

❖ Hoarseness of voice.

❖ Aspiration through ineffective glottis.

❖ Ineffective cough.

Treatment

❖ Speech therapy

❖ Injection of Teflon to the paralysed cord.

❖ Muscle or cartilage implant to the paralysed cord.

❖ Arthrodesis of cricoarytenoid joint.

4.Bilateral,Combined Recurrent Laryngeal Nerve and Superior Laryngeal Nerve Palsy

- All paralysis of intrinsic muscles of larynx
- Total laryngeal anaesthesia

Clinical features

- Aphonia
- Aspiration due to severe glottis incompetence and laryngeal anaesthesia.
- Absence of cough.
- Retention of secretions in the chest.
- Respiratory arrest.

Treatment

- Emergency tracheostomy.
- Fixing epiglottis over the arytenoids to prevent aspiration.
- Plication of vocal cords to prevent aspiration.
- Total laryngectomy.

MATERIALS AND METHODS

In my study One hundred seventy seven patients with solitary thyroid nodule were analysed, sex distribution found to be 171 women & 6 men at our hospital. Age distribution found to be 15 to 75 years (mean 42 years). Once

the presence of thyroid nodules were confirmed clinically, FNAC was done . these people were subjected to ultrasound neck along with Doppler imaging, We included only the nodules for which representative cytological material was available in FNAC. Ethical committee clearance was obtained and patients were enrolled for study after getting informed consent.

All Doppler scans were performed with Siemens accuson , high-frequency variable linear transducer , frequency used is 10 MHz (7.5MHz to 10MHz).

Microscopic study of the FNAC specimens demonstrated that 119 of the 177 nodules were benign, 29 had indeterminate cytology(follicular cells/ neoplasm) and 29 were malignant.

In 29 patients with follicular cytology, 27 were proceeded with surgery and post op biopsy revealed 19 patients with beningn disease and 8 patients with malignant disease. In this group of patients preoperative Doppler studies were correlated with post operative biopsy. In other patients Doppler studies were compared with FNAC

B-Mode Ultrasonography

USG neck has been a standard investigation in evaluation of thyroid nodules. It classifies thyroid nodules in to multi nodular goitre and solitary nodular goitre basedon number of nodules. It also gives as an idea about the swelling that whether it is solid or cystic, also tells us the size , exact shape, idea about margins and adjacent tissue infiltration. .

Echogenicity of the nodule has been compared with rest of the gland and categorised into hypo echoic , hyper echoic and nodules with mixed echogenicity.

Peripheral halo which is a significant indicator of benignity can be classified in to thick and thin based on thickness. If less than 2mm , it is said to be thin halo and if more than 2mm , it is said to be thick halo.

Calcification can be seen through USG , parameters like thickness, posterior shadowing, posterior reverberation can be analysed. Microcalcification can indicate malignancy.

Power Doppler

Analysis of vascular patterns can be done by power Doppler, in our study we customise the flow patterns in 5 groups

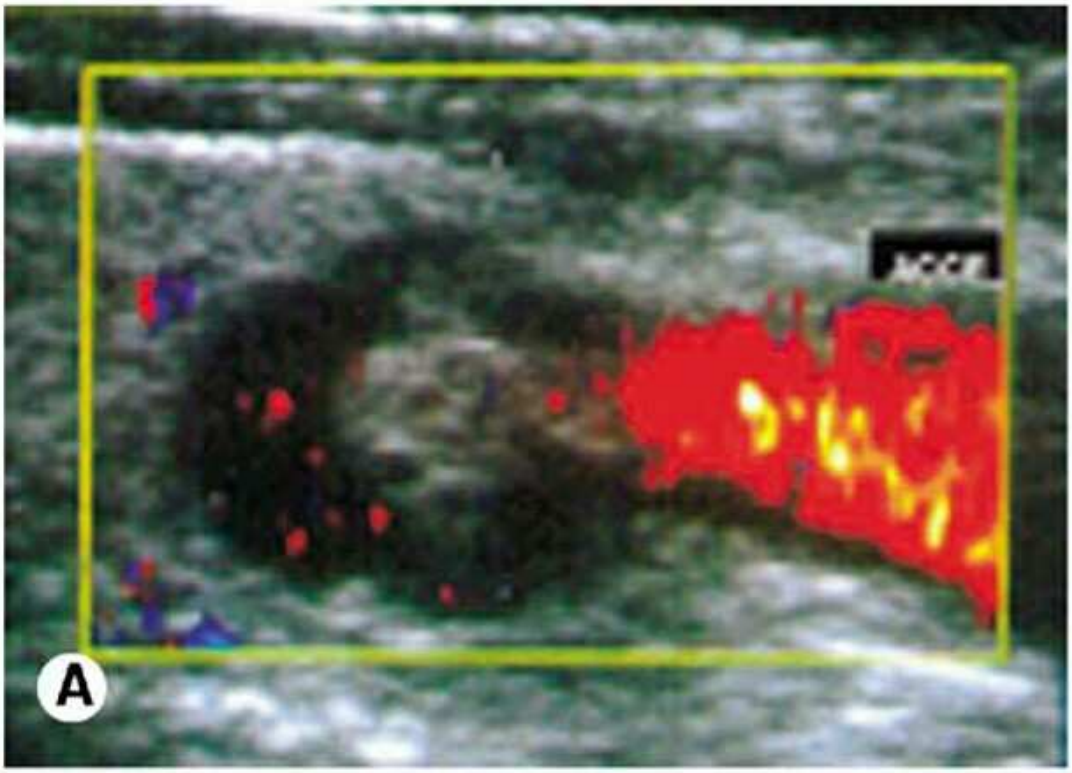
I- absent blood flow

II – flow pattern, exclusively perinodular

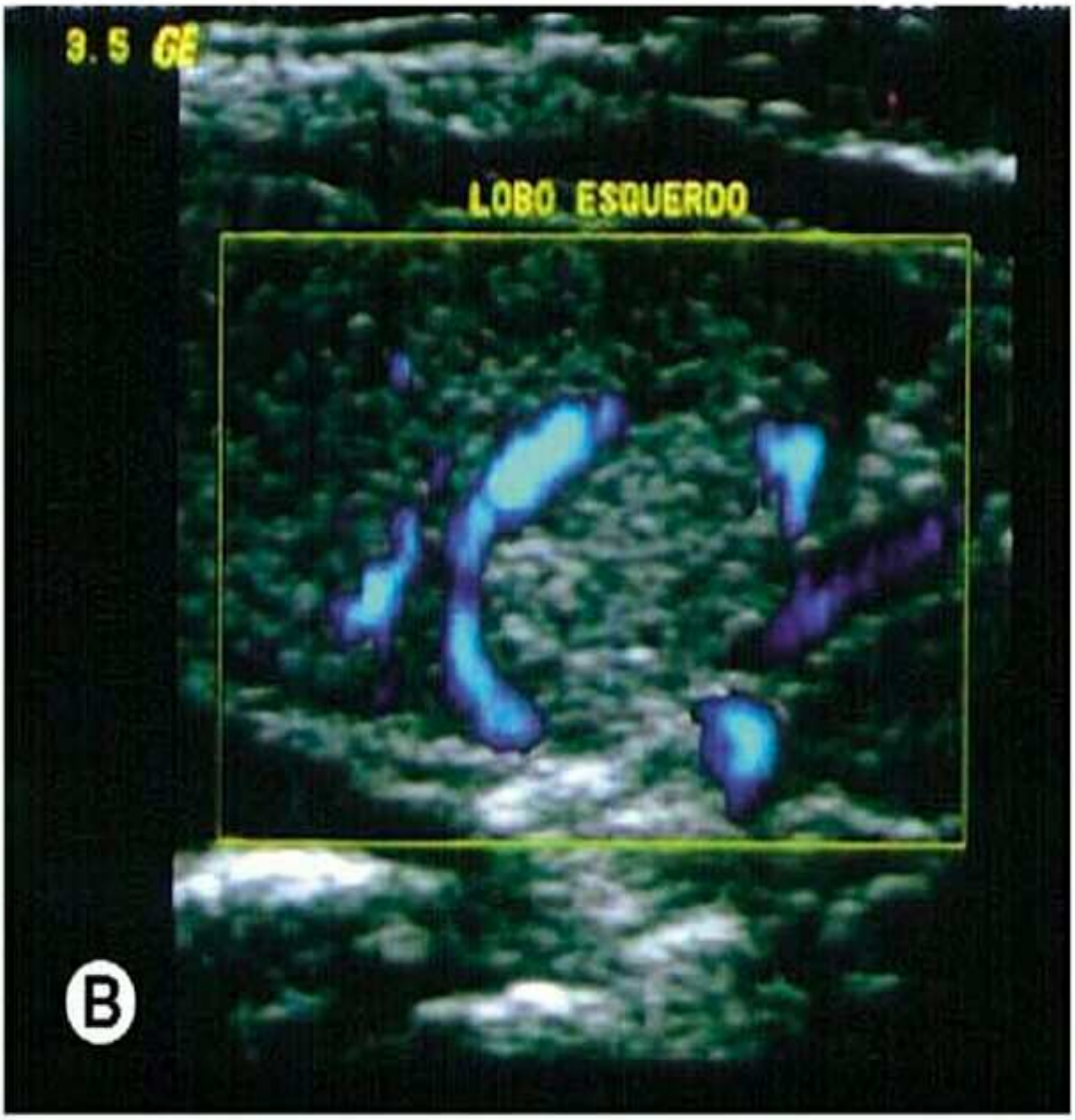
III-predominantperinodular blood flow (with some central flow)

IV - predominant central flow (with insignificant perinodular flow)

V - only central blood flow.

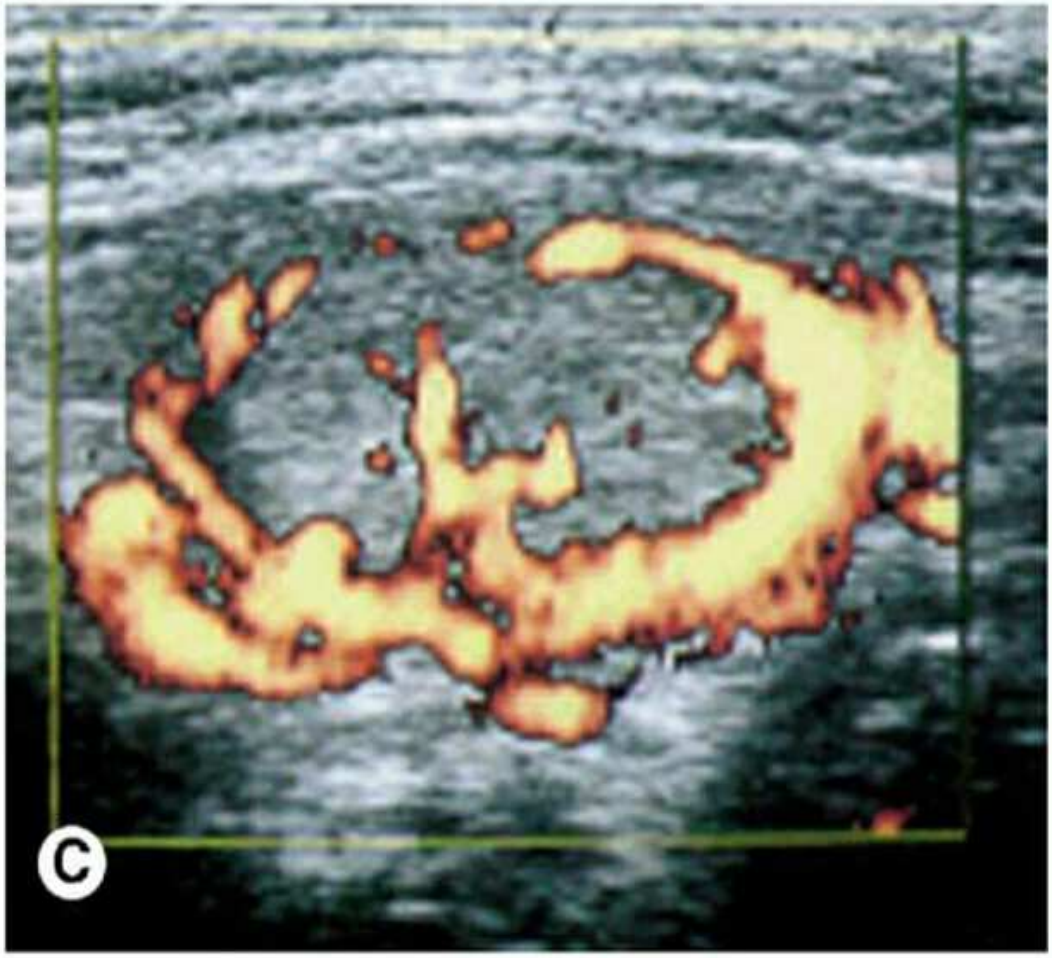


Picture shows a colloid cyst with absent blood flow we categorise it as pattern I.



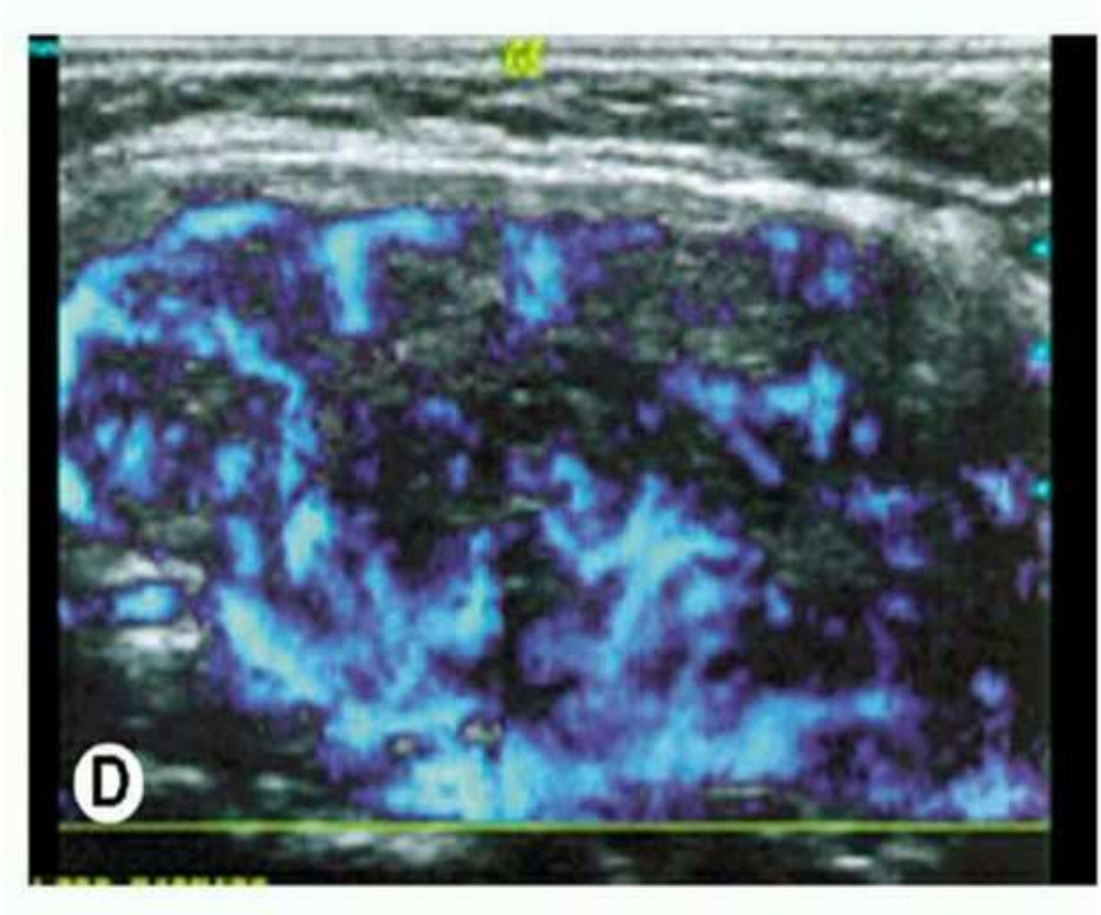
exclusively perinodular blood flow seen in nodular goitre

Categorised under pattern II



Predominant perinodular pattern of blood flow with less significant central blood flow seen in a case of nodular goitre

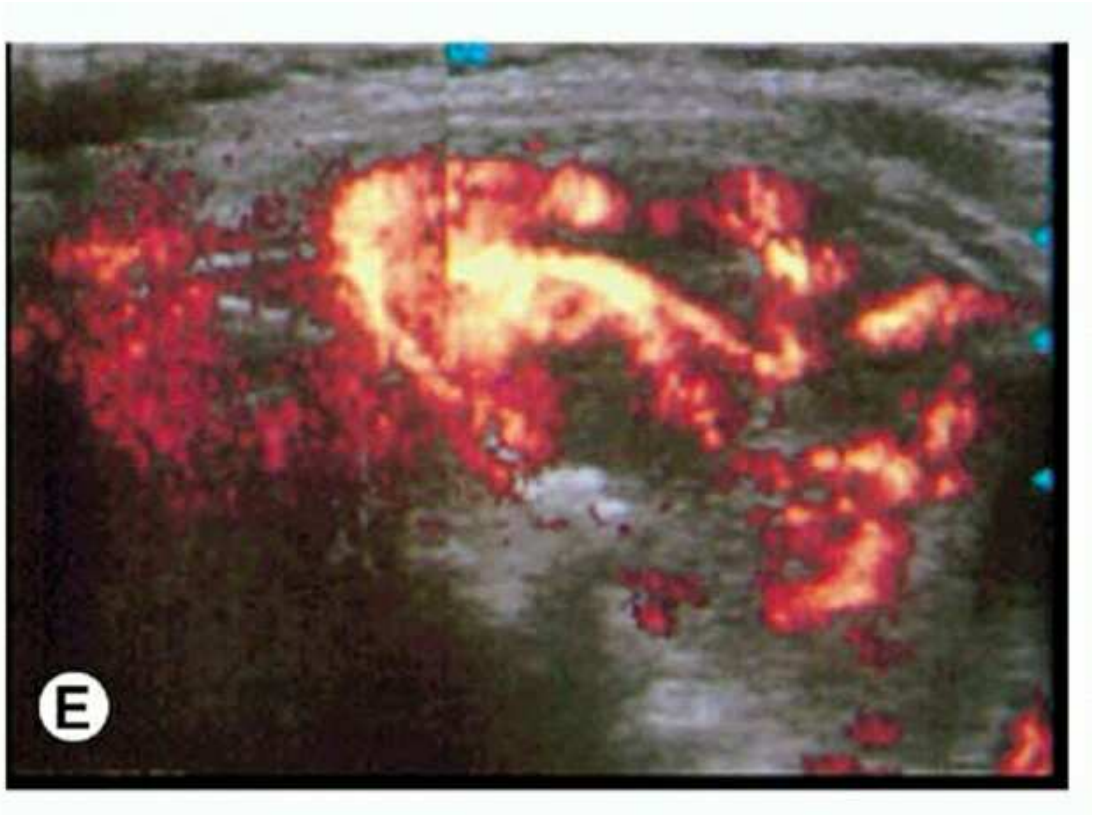
Categorised under pattern III



Perinodular blood flow is equal to intranodular blood flow

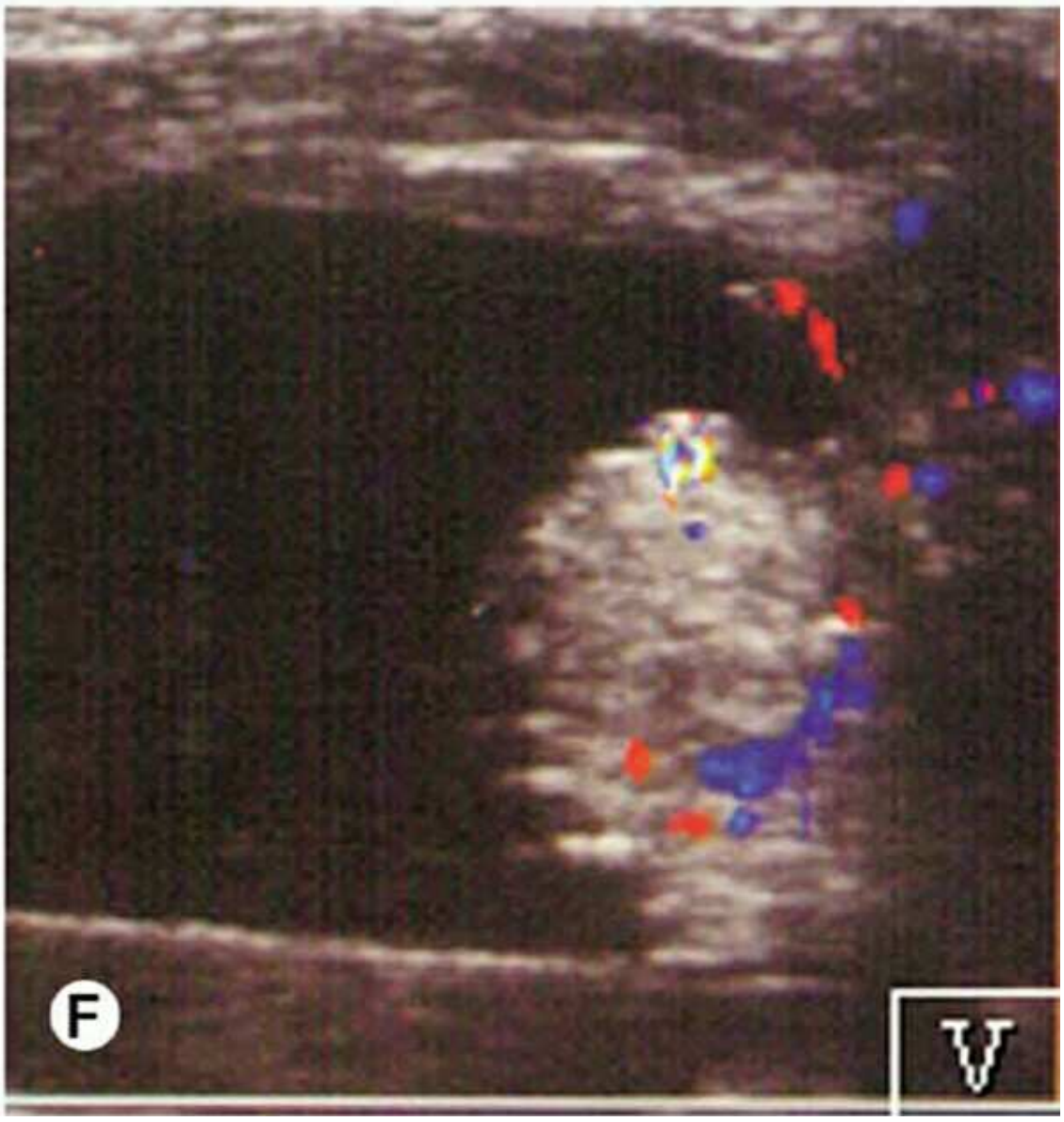
In a patient with beningn follicular adenoma

Categorised under group IV



Predominant central pattern in a patient with follicular carcinoma

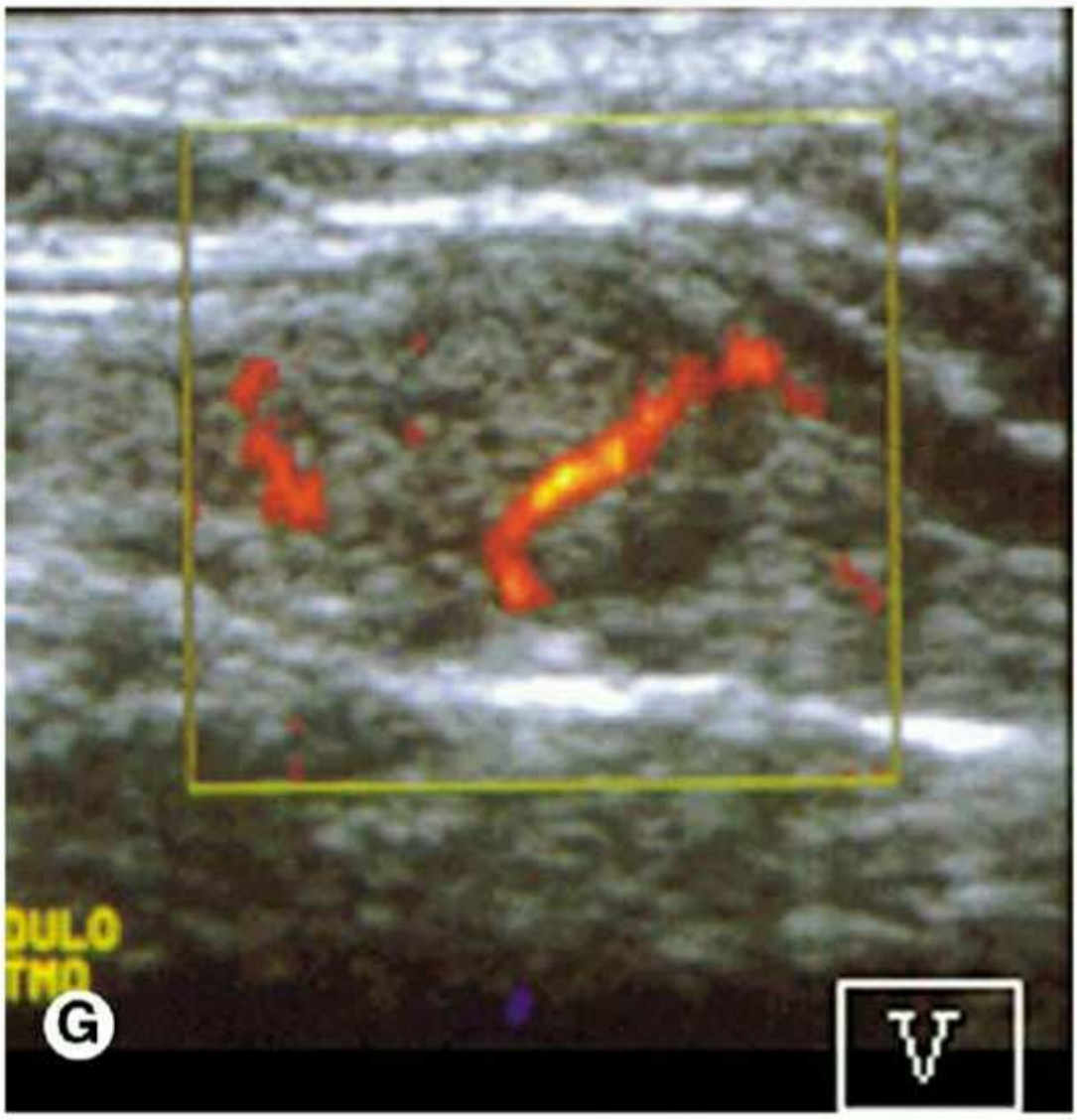
Categorised as pattern IV



Exclusive central blood flow

Seen in a patient with follicular carcinoma

Categorised as group V



Thick halo seen in a patient with chronic thyroiditis

Pulsed Doppler

Power Doppler analysis were qualitative and subjective, another method using spectral analysis is quantitative , objective and accurate. This can be done through pulsed Doppler by analysing 2mm thickness tissue.

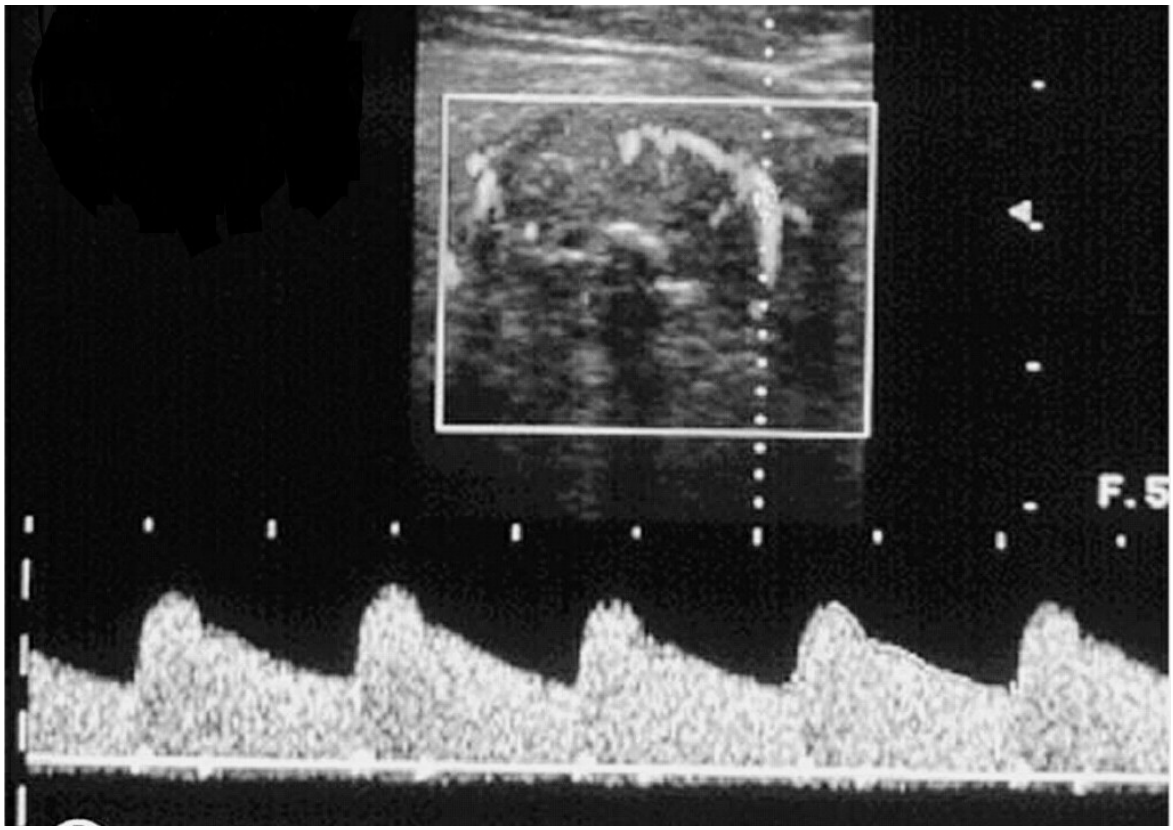
The duplex indices obtained are resistance index [RI] and.Pulsatility index [PI]

Formulas used for calculation:

“PI=PSV-MDV/Mean Velocity”

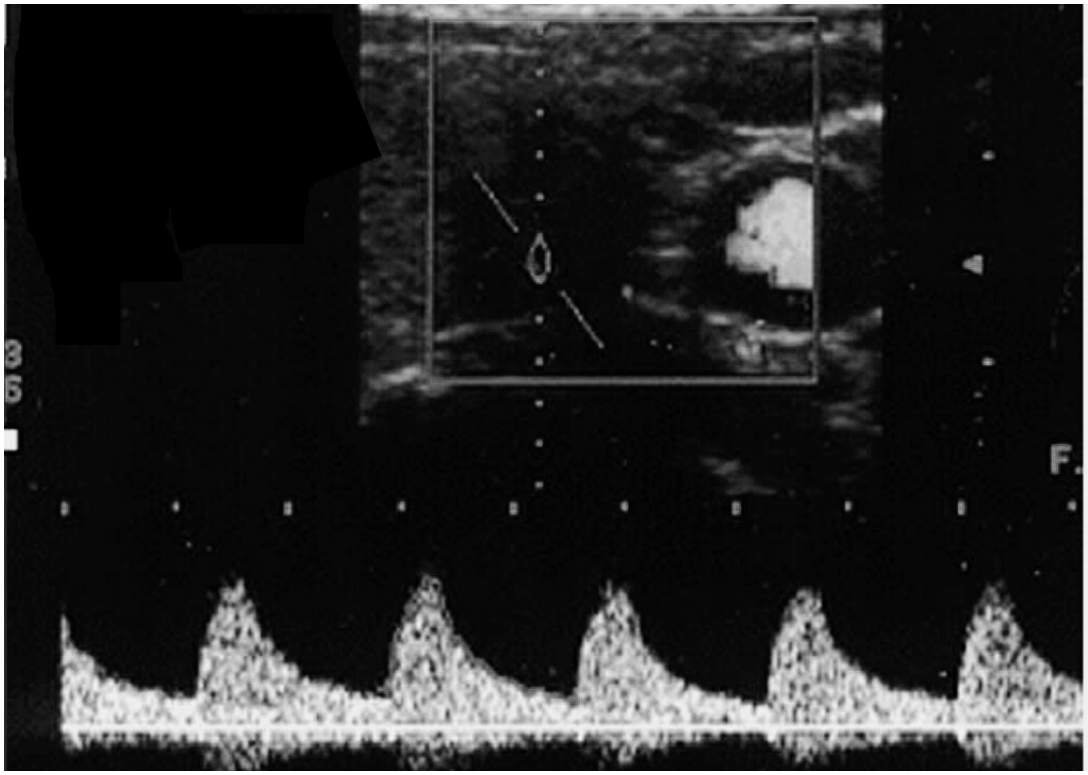
“ RI=PSV-MDV/PSV”

(Where as PSV is peak systolic volume, MDV is mean diastolic volume)



Low resistance wave pattern seen on pulse Doppler ina patient with nodular goitre

Typically seen in beningn lesions



High resistance blood flow pattern seen in a patient with follicular carcinoma

Typically seen in malignant lesions

Ultrasound –guided Fine-needle Aspiration Cytology (FNAC)

After using the spectral analysis, FNAC was done. biopsy specimens were examined in conformity with the established criteria by the "Papanicolaou Society of Cytology".

OBSERVATION AND DISCUSSION

Statistical Analysis:

The association between the biopsy result and the qualitative variables (halo, echogenicity, margins, number of nodules, colour Doppler Study and calcification) and were assessed using likelihood chi-square test. P value of < 0.05 was considered significant.

B-Mode USG:

Based on echogenicity sixty nine of the hundred and seventy seven nodules were hypoechoic, ten were hyperechoic, twenty were isoechoic, seventy two were mixed and six were anechoic. Statistical analysis didn't reveal a significant statistical association between the cytological findings and the above parameters(P=0.059). Twenty nine of thirty seven malignant nodules were hypoechoic. Eighty seven of the hundred and seventy seven nodules showed peripheral halo.

Three had suspicious cytology and only two had malignant cytology. Among the nodules without halo six were classified as suspicious, thirtyone were classified as malignant and thus the presence of halo was considered a significant evidence of benign lesion. Presence of a thick halo was a sign of malignant lesion and a thin halo was an important sign of benign lesion.

Depth,width and Length measurements showed that malignant nodules were larger than indeterminate and benign nodules (P=0.001). Malignant nodules had an average width of 3.5 cm vs 1.75cm for benign nodules. 50 of the 177 nodules showed calcifications. Among 50 nodules with calcifications, 10 were coarse, fine in 37, mixed in 3. Twenty Seven of the 37 nodules with micro calcifications had malignant cytology. Thus the association between fine calcification and malignant were considered statistically to be significant (P= 0.001). Micro calcifications were seen in twenty four of the thirtyseven malignant nodules.

Power Doppler:

Vascularisation patterns were identified with Power Doppler USG on all 177 nodules. It revealed that

- thirteen nodules with pattern I (absent blood flow –these patients were not subjected to pulsed Doppler as there is no flow),
- sixty-onehad pattern II (exclusively perinodularblood flow),
- sixty-six had pattern III (perinodular blood flow equal or greater than central flow)

- twenty six had pattern IV (central blood flow greater than perinodular flow)
- Eleven had Pattern V (exclusively central blood flow)

In malignant nodules pattern IV and Pattern V were significantly associated with malignancy. Thirtyfive of thirtyseven malignant nodules showed these vascular patterns.

Pulsed Doppler:

In malignant nodules mean PI is 1.54, (SD 0.033)and mean RI is 0.75 (SD 0.29).These values were statiscally significant and identify malignant nodules with good accuracy.

Descriptive Statistics

	BENIGN					**MALIGNANT**				
	n	**Min.**	**Max.**	**Mean**	**S.D**	**N**	**Min.**	**Max.**	**Mean**	**S.D**
Age	127	15	75	42.17	15.426	37	15	78	41.89	14.208
RI	127	.532	.741	.61674	.043748	37	.699	.812	.75319	.029478
PI	127	.902	1.089	.96277	.031596	37	1.494	1.614	1.54873	.033278
Stage	140	1	3	2.01	.802	37	3	5	4.16	.602

T-Test

	n	**Mean**	**S.D**	**t**	**df**	**statistical inference**
Age						
BENIGN	127	42.17	15.426	.097	162	.923>0.05
MALIGNANT	37	41.89	14.208			Not Significant
RI						
BENIGN	127	.61674	.043748	-17.811	162	.000<0.05
MALIGNANT	37	.75319	.029478			Significant
PI						
BENIGN	127	.96277	.031596	-98.084	162	.000<0.05
MALIGNANT	37	1.54873	.033278			Significant
Stage						
BENIGN	140	2.01	.802	-15.137	162	.000<0.05
MALIGNANT	37	4.16	.602			Significant

Chi-square test

	Benign		**Malignant**		**Total**		**statistical inference**
	n	**%**	**n**	**%**	**N**	**%**	
Sex							
Male	3	9.2%	3	8.1%	6	3.7%	X^2=2.684 Df=1 .101>0.05 Not Significant
Female	124	43.57%	34	91.9%	158	96.3%	
Stages							
I	13	9.2%	0	.0%	13	7.34%	X^2=143.14 Df=4 .000<0.05 Significant
II	61	43.57%	0	.0%	61	34.46%	
III	64	45.71%	2	5.4%	66	37.28%	
IV	2	0.11%	24	64.86%	26	14.68%	
V	0	.0%	11	29.72%	11	6.21%	
Total	**140**	**100.0%**	**37**	**100%**	**177**	**100%**	

DISCUSSION

Due to the advent of technology innocent lesions are increasingly detected. As the resolution of thyroid ultrasound increases many nodules that are clinically not detected are being detected resulting in diagnostic and therapeutic confusions. Although B-mode USG is the investigation of choice for thyroid lesions but it cannot reliably differentiate benign lesions from malignant lesions. Preoperatively we largely rely on FNAC to find the nature of lesion. Though FNAC guides us through many clinical dilemmas, it has its own disadvantages.

Increased vascularisation is well seen in tumour growth. It is now possible to identify vascular patterns inside superficial tissues with the invent of power Doppler. Thus this tool is very useful in studying and identifying thyroid nodules that should undergo FNAC.

B-Mode USG Parameters:

Larger part of the nodules were hypoechoeic and mixed because we included those patients referred to our department after FNAC for screening sonography, if FNAC shows follicular cells (indeterminate) patients were asked to proceed with preop Doppler and post operative HPE report was correlated.

In our study, of the thirty seven malignant nodules identified, eight had mixed echogenicity and twenty nine had hypoechogenicity.

A significant evidence of benignity was the presence of halo.

Anddo signified absence of malignancy.Another significant indicator of malignancy was decreased halo thickness. These results are in concordance with those in other studies.

USG can detect nodules in half of the population. Most of the detected nodules are less than 1.5 cm and are considered clinically occult nodules.

FNAC has been advocated as the prime investigation for both occult and clinically palpable thyroid nodules, generally nodules less than 1.5 cm are followed up with clinical examination and ultrasound.

Yet, sonographic features like microcalcifications, hypoechogenecity, irregular margins, can be exempted from follow up protocol and are managed more aggressively as they may indicate malignancy.

Fifty of the one seventy seven nodules had micro calcifications and twenty four of thirty seven malignant nodules had microcalcification. Our data are in accord with reports in the literatureand indicates that microcalcification is a good predictor of malignancy and are present in close to 65 percent of malignant nodules.

Power Doppler Indices:

Power Doppler helped to identify low velocity blood flow in vessels that previously could not be visualised .we adopted our own classification , based on vascular patterns by modifying the one proposed by "Lagalla et al". Our classification includes the followings 5 vascular patterns:

- Absence of blood flow- Pattern I
- Exclusively perinodular blood flow- Pattern II
- perinodular blood flow pattern is equal to central blood flow-pattern III
- blood flow Central blood flow>perinodular blood flow - patternIV
- Exclusively central blood flow – pattern V.

Nodules with vascular pattern III have a peripheral ring on USG colour Doppler.

Thirteen of the one seventy seven nodules in my study had no blood flow and no malignant nodule is listed in this group. These results are in around with number of published reports,where absence of blood flow signal is seen only in benign lesions.

Though, both perinodular and central blood flow pattern is seen in both benign and malignant nodules, central predominant flow is seen in malignant groups and perinodular predominant patterns are seen in benign disease.

As the intranodular blood flow becomes more dominant the risk of malignancy increase. For Ex. (A small number of the nodules with pattern III blood flow (two of sixty six nodules) were malignant whereas (twenty four of twenty six nodules with pattern IV blood flow) and (all nodules with pattern V blood flow were malignant). “Holden identified carcinomas as having more concentrated intranodular blood flow”

“Cerbone et al7” made various studies and analysed, patterns of flow and increase in vascularity in malignant lesions and found that pattern of flow (central predominance) is more associated with malignancy, than increase in vascularity .

On comparing observed vascular patterns with our cytological findings we found that most benign nodules had vascular patterns II or III and accounted for 127. Though Pattern I and Pattern II were marked goes more in favour of benign nodules, pattern III is found in both benign and malignant diseases. 35 of the 37 malignant nodules is associated with malignancy.

Doppler detection of nature of thyroid swelling depends on many technical aspects, like, wall pulse repetition frequency, filters signal

amplification,Doppler Sensitivity, intervening tissue attenuation and depth of region of interest. Even breathing and swallowing can create artefacts minimising the utility of application, in this study standard guidelines has been used to minimise these disadvantages.

Analysing the vascular patterns is rather subjective than objective, though guidelines has been followed in categorising patterns, still it is prone for error. This can be overcome by integrating the technology and software in to modern USG such that it objectively interprets patterns.

CONCLUSION

USG evaluation of thyroid nodules by using power doppler caneffectively differentiate nodules with high risk for malignancy from benign nodules . Power Doppler and RI have a high sensitivity and specificity in detecting malignancy.

Patients showing follicular cells in FNAC can reliably be differentiated in to benign and malignant groups using Doppler sonogram, which can bridge the limitation of FNAC which cannot identify malignant follicular neoplasm

ANNEXURES

MASTER CHART

S.NO	NAME	AGE/SEX	BENIGN		
1	KAVITHA	40/F	0.573	0.967	III
2	THAMARAISLVI	65/F	0.592	0.982	II
3	DHAVAMANI	55/F	0.58	0.932	II
4	LAKSHMI	22/F	0.592	0.933	II
5	ANITHA	32/F	0.671	1.034	III
6	PADMAVATHI	50/F	0.548	0.902	III
7	KASTHURI	22/F	0.572	0.973	II
8	MALARVIZHI	28/F	0.533	0.961	III
9	BABY	50/F	0.592	0.922	II
10	AMIRTHAM	57/F	0.627	0.932	III
11	LATHA	30/F	0.624	0.944	II
12	CHINNAPONNU	45/F	0.574	0.986	II
13	ANUSHIYA	24/F	0.632	0.932	III
14	DHANALAKSHMI	65/F	0.587	0.974	II
15	SENBHAGAVALI	48/F	0.612	0.912	II
16	VALARMATHI	19/F	0.684	0.982	II
17	MANIYAMMAL	55/F	0.624	0.974	III
18	ANJALI	60/F	0.592	0.941	II
19	POONGODI	42/F	0.641	0.954	III
20	PRIYADHARSHINI	28/F	0.654	0.944	III
21	SAMBOORNAM	70/F	0.632	0.987	II
22	CHINNAMMAL	65/F	0.613	0.971	III
23	JEEVITHA	25/F	0.594	0.933	III
24	GANAGAMSAM	55/F	0.575	0.924	III
25	RAJAMANI	47/F	0.624	0.975	III
26	VALLIAMMAI	65/F	0.633	0.994	III
27	RASAMMAL	55/F	0.671	0.913	III
28	MARIAMMAL	45/F	0.587	0.932	III
29	RAJESWARI	38/F	0.594	1.001	II
30	KAMU	50/F	0.632	1.054	III
31	CHANDRA	50/F	0.644	1.041	II
32	REETA	30/F	0.671	0.992	III
33	RISABELLA	57/F	0.588	0.971	III
34	PRIYA	26/F	0.647	0.988	II
35	SUNITHA	34/F	0.672	0.947	III
36	VENKATESWARI	15/F	0.678	0.978	II
37	DHIVYA	18/F	0.634	0.972	III
38	KASTHURI	22/F	0.546	0.974	III
39	VAIJAYANTHI	24/F	0.574	0.946	III
40	PAPPATHI	37/F	0.672	0.975	II
41	GANESH	28/M	0.574	0.939	III

42	KALYANI	55/F	0.592	0.989	III
43	GANGA	40/F	0.622	0.979	II
44	DHANAM	60/F	0.642	0.994	III
45	LAKSHMI	60/F	0.602	0.933	III
46	GOVINDAMMAL	65/F	0.671	0.924	III
47	ANSHARI	33/M	0.544	0.948	III
48	KANISHKUMARI	30/F	0.542	0.974	II
49	MALLIKA	55/F	0.556	0.937	III
50	VIJAYAKUMARI	30/F	0.571	0.947	II
51	VELAMMAL	50/F	0.672	0.982	II
52	DHANALAKSHMI	55/F	0.613	0.914	II
53	KOKILA	29/F	0.624	0.934	III
54	KANAGA	28/F	0.633	0.978	III
55	BAKKIYAM	58/F	0.534	0.933	III
56	PACHAIYAMMAL	60/F	0.578	0.924	III
57	SUBAIDHA	30/F	0.614	0.913	II
58	THAMAYANTHI	32/F	0.672	0.972	III
59	ELAKIYAM	60/F	0.682	0.971	II
60	CHINNAMMAL	70/F	0.647	0.956	III
61	RAJESWARI	40/M	0.637	0.942	III
62	DHIVYA	23/F	0.574	0.944	II
63	ALAGI	50/F	0.648	1.024	III
64	PATTUROJA	40/F	0.624	0.971	III
65	DEEPA	33/F	0.675	0.902	II
66	AMUTHA	36/F	0.574	0.942	II
67	GNANASUNDARI	53/F	0.533	0.922	III
68	MALLIGA	53/F	0.594	1.003	II
69	GANDHIMATHI	37/F	0.594	0.992	III
70	SANGEETHA	22/F	0.674	0.974	II
71	ELAKIYAM	33/F	0.584	0.972	III
72	MARIAMMAL	45/F	0.584	0.992	III
73	RAJESWARI	35/F	0.741	0.932	III
74	KAMU	50/F	0.674	0.954	III
75	CHANDRA	60/F	0.632	0.942	II
76	VIJAYA	42/F	0.672	0.942	II
77	KAMALA	45/F	0.594	1.089	III
78	MARIAMMAL	24/F	0.574	0.934	II
79	VASANTHA	56/F	0.586	0.942	III
80	PARIPOORANAM	57/F	0.671	0.978	III
81	JEEVAMANI	23/F	0.587	0.988	III
82	NEELAVATHI	35/F	0.594	1.017	III
83	NIRMALA	65/F	0.631	0.972	III
84	LAKSHMI	65/F	0.574	0.958	II

85	DHANALAKSHMI	18/F	0.568	0.992	III
86	NISANTHI	24/F	0.547	0.941	II
87	ISWARYA	18/F	0.597	0.954	III
88	MUTHULAKSHMI	36/F	0.632	0.975	III
89	PARIMALA	27/F	0.644	1.003	II
90	TAMILARASI	45/F	0.675	0.944	II
91	SATHYA	33/F	0.654	0.999	II
92	THESAIYAMMAL	55/F	0.641	0.932	III
93	RAJKUMARI	70/F	0.592	0.947	II
94	RAJESWARI	38/F	0.658	0.968	III
95	PADMAVATHI	75/F	0.672	0.974	II
96	MARIYAMMAL	60/F	0.588	0.931	II
97	RENUGA	32/F	0.578	0.994	II
98	SELVI	26/F	0.634	0.987	II
99	VIJAYALASHMI	27/F	0.684	0.971	II
100	LAKSHMI	60/F	0.642	0.986	III
101	GOVINDAMMAL	65/F	0.654	0.994	II
102	POONKODHAI	54/F	0.632	0.941	II
103	AKILANDAM	45/F	0.592	0.988	II
104	SUPATHRA	43/F	0.671	0.971	II
105	DEEPA	31/F	0.642	0.932	III
106	MARIYAMMAL	60/F	0.672	0.954	III
107	KAMU				I
108	AMARAVATHY				I
109	MUTHULAKSHMI				I
110	JAYALASHMI				I
111	RAFIYABGAM				I
112	PARVEN				I
113	SHANTHI				I
114	PRABHAWATHI				I
115	AKILA				I
116	KANNAMMAL				I
117	THILAIYAMMAL				I
118	JAYANTHI				I
119	ASHOKKUMARI				I

INDETERMINATE CYTOLOGY IN FNAC.

(Doppler findings correlated with post op HPE)

1	AKASH	54/F	0.586	0.932	II
2	SENTHIL	48/F	0.534	0.984	II
3	SAROJA	34/F	0.654	0.971	III
4	KAVITHA	31/F	0.674	1.009	III
5	SUMATHI	32/F	0.671	0.992	II
6	NEELA	21/F	0.577	0.994	III
7	MANIVANNAN	27/F	0.568	0.942	II
8	SUBASHINI	26/F	0.684	0.922	III
9	PRAGALYA	16/F	0.634	0.971	III
10	SEKAR	49/F	0.674	0.942	II
11	MIRUNAZHILINI	60/F	0.612	0.972	II
12	MIRUDULLA	21/F	0.622	0.986	II
13	LEKHA	52/F	0.642	0.934	III
14	SAHUNTHALA	31/F	0.594	0.974	III
15	PRIYA	21/F	0.592	0.954	III
16	MALLIKA	52/F	0.571	0.912	III
17	THAILAMMAI	31/F	0.584	0.922	III
18	SARANYA	21/F	0.532	0.974	II
19	PUSPAM	39/F	0.554	0.934	III
20	RUKUMANI	65/F	0.632	0.987	IV
21	SAHUNTHALA	67/F	0.671	0.968	IV
22	SANGEETHA	47/F	0.742	1.524	III
23	DEVAGI	45/F	0.771	1.584	IV
24	AMUTHA	39/F	0.724	1.582	IV

25	KUMARAN	45/F	0.711	1.554	IV
26	LALITHA	48/F	0.714	1.574	IV
27	NAGAVALLI	38/F	0.724	1.568	III
28	DHIVYA	32/F	0.736	1.532	V
29	MUTHU	51/M	0.742	1.584	IV

S.NO	NAME	AGE/SEX	MALIGNANT		
1	JASMINE	35/F	0.784	1.524	IV
2	RASAMMAL	50/F	0.724	1.571	V
3	SUBASHINI	38/F	0.764	1.614	IV
4	SURYA	34/F	0.774	1.582	IV
5	PRAPAVATHI	34/F	0.787	1.591	IV
6	MURALI	35/M	0.734	1.536	V
7	FATHIMABANU	45/F	0.747	1.524	IV
8	LAKSHMI	52/F	0.782	1.522	IV
9	PONNAMBAL	61/F	0.742	1.602	V
10	EVANGELIN	25/F	0.801	1.494	IV
11	RAJAKUMARI	36/F	0.812	1.527	IV
12	BHARATH	29/M	0.774	1.545	IV
13	AMUSU	60/F	0.742	1.514	III
14	JAYASELI	35/F	0.792	1.599	IV
15	ALAGAMMAL	78/F	0.812	1.524	IV
16	SATHYA	24/F	0.772	1.545	IV
17	SUNITHA	20/F	0.762	1.532	V

18	SUGANYA	15/F	0.747	1.542	V
19	PADMAVATHI	78/F	0.722	1.547	IV
20	KAVITHA	40/F	0.747	1.609	IV
21	THAMARAISELVI	65/F	0.742	1.522	V
22	DHAVAMANI	35/F	0.732	1.496	IV
23	LAKSHMI	47/F	0.699	1.512	V
24	ANITHA	32/F	0.714	1.501	IV
25	PADMAVATHI	50/F	0.745	1.547	III
26	KASTURI	42/F	0.736	1.534	IV
27	MALARVIZHI	28/F	0.742	1.507	V
28	PERIYANAYAGI	52/F	0.782	1.574	V
29	JENNIFER	30/F	0.791	1.564	IV

REFERENCE

1) Solbiati L. Livraghi T, Ballarati E, et al. Ultrasound superficial structure: high frequencies, Doppler interventional procedure. New York, NY:Churchill Livingstone 1995.
2) Tramallom J, Legger A, Correas JM. Et al. Imagerie du nodule thyroidien J Radiol 1999:80:271-7.
3) Brander AE, Viikinkoski VP, Nickles JI, et al. Importance of thyroid abnormalities detected at US screening a 5-year follow up Radiology 2000:215:801=6.
4) Naik KS, Bury RF, Imaging the thyroid Clin Radiol 19988:53:630-9.
5) Sabel MS, Haquw D, Velasco JM, et al. Use of ultrasound –guided fine needle aspiration biopsy in the management of thyroid disease. Am Surg 1998:64L:738-41.
6) Lagalla R, Caruso G, Novara V, et al. Analisi flussimetrica nella patologia titoidea : ipotesi di integrazione con to studio qualitative con-color Doppler Radiol Med 1993:85:606-10.
7) Cerbone G, Spies S, Colao A, et al. Power Doppler improves the diagnostic accuracy of color Doppler ultrasonograohy in cold thyroid nodules : follow-up results. Hormone res 1999:52:19-24.

8) Ross DS, Evaluation of the thyroid nodule. I Nucl Med 1991:32:2181:92 Holden A, The role of color and duplex Doppler ultrasound in theassessment at thyroid nodules. Australian Radiol 1995:39:343-92.

9) Solboati L, Cioffi V, Ballarati E, Ultrasonography of theneck Radiol Clin Noirth Am 1992:30:941-54.

10) Burns P, Interpreting and analyzing th Doppler examination. In Taylor KJW Burns P, Wells PNT: Clinical applications of Doppler ultrasound 2 nd New York NY: Raven Press 1995:PP 55-98.

11) The Papanicolaou Socitey of Cytopathology Task Forces on Stanbdards of Practice for the examination of fine-needle aspiration specimens from thyroid nodules. Diagn Cytopathol 1996:15:84-9.

12) Rsener B, Fundamentals of biostatistics 2nd Boston MA:PSW publishers 1986.

13) Ahuja At, The thyroid and Prarathyroid In Ahuja A, Evans R Practical head and neck ultrasound LKondon: UK Greenwich Medical Media 2000:PP 37-59.

14) Gharib H, Thyroid Nodules: Management controversies Washigton Mayo Foundation 1995-1-111 (Ls)

15) Dlum M,Yww J, Opperheimer JH, Advances in thyroid imaging thyroid sonography when and how should it be used? Thyroid Today1997:20:1-1

16) Takashima S, Fukuda H, Nomma N, Thyroid nodules re-evaluation with ultrasound: Clin ultrasound 1995:23:179:84

17) Shimamoto K, Satake H, Sawaki Preoperative staging of thyroid papillay carcinoma with ulrtasonography Eur J, Radiol 1998:29:4-10

18) Rago Vitti P, Chonovato L, Role of convential ultra sonography and color flow-Doppler sonograp[hy in predicting malignant in could thyroid nodules Eur J Endocronic 1998:138:41-6.

19) Gritzmann N, Koischwitch D, Rettenbacher T, Sonography of the thyroid and parathyroid glands Radioal Clin North Am 2000:38:1131:45.

CASE PROFORMA

Name: Age/SEX: IP.NO: UNIT:

Date of admission: Date of Discharge:

1. COMPLAINTS:

a. Swelling in neck

i) Duration ii)Onset and progression:

iii) Associated complaints

b. H/S/O hyper or hypo thyroidism

c. H/O hoarseness of voice, dyspnoea and dysphagia

d. H/S/O metastasis

e. H/O loss of weight, loss of appetite

f. H/O trauma

g. H/O Fever

2. PAST HISTORY:

a) H/o Previous operation

b) H/o radiation to neck

c) Any comorbid illness

HT/DM/TB/COPD/CAD.

3. PERSONAL HISTORY:

a) Diet : Mixed / Vegetation

b) Appetite: Good / Impaired

c) other adverse social practices

4. FAMILY HISTORY:

Any other member of the family suffered from similar disease

5. GENERAL PHYSICAL EXAMINATION:

a) Vital signs:

Pulse: Blood Pressure:

Temperature: Respiratory rate:

b) Built and Nutrition:

c) State of hydration

d) Anaemia / Jaundice / Pedal edema / Lymphadenopathy

e) eye signs

f) facies, tremors, palms and soles

6. EXAMINATION OF THE NECK:

a) Inspection

1. Shape 2.size

3. Site

4. Movement with deglutition/ protrusion of tongue

5. Skin over swelling 6. Lower border visible

7. Trachea :

b) Palpation:

1. Shape 2. size

3. site

4. movement with deglutition

5.lower border palpable

6. surface of swelling

7. carotid pulsation

8. Trachea

9. lymph nodes

c) Percussion

mediastinal widening

d) Auscultation

Bruit

7. EXAMINATION OF OTHER SYSTEMS

a. Cardiovascular system

b. Respiratory system

c. abdomen

d.Nervous system

e. Spine and cranium

8. INVESTIGATION

Blood investigations:

1.Hb% TC Blood Group

2. RBS, Urea, Creatinine

3. thyroid function tests

4.Xray STNL

5.USG neck

6. USG Doppler thyroid

7. FNAC of swelling

8. Histopathological examination

9. ECG/Cardiac evaluation

10. Remarks