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Thyriod Swelling--Evaluation by Ultrasonography with FNAC Correlations

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Abstract
Objective:*(1) Study was done to evaluate sonomorphological characteristics of thyroid swelling. (2) To correlate USG findings in various thyroid swelling with cytology/ HPE.*
Materials: *A hospital based cross sectional study of 80 patients were conducted over a period of 1 year from 1st Aug 2008 to 31st July 2009.*
All the patients are subjected to gray scale USG of thyroid followed by color Doppler study. The examination were done by using 12 MHz linear Probe and 5MHz curvilinear probe.
Results: *Out of 80 patients 32 (4%) were clinically thought to have solitary nodule. USG was confirmatory 20 (25%) cases. Multiple nodules were detected 12(15%) cases. USG consistency of the lesion- solid -60(80%), cystic- 8(10%), Mixed- 8-10%. USG echopatterns- hyperechoic- 46,(75%), hypoechoic- 24(30%) iso-echoic- 2(2.5%) cases. Margin of lesion- well defined- 72(90%), illdefined- 8(10%) cases. Doppler.. pattern- Peripherial flow- 36(45%) cases. Thyroid infernos- (PSV > 70cms/s) – 4 (5%) cases.*
Conclusion: *USG is fast, safe, cost effective imaging procedure for thyroid swelling. It can differentiate cystic and solid lesion. Multinodularity of the gland can be detected by using high resolution ultrasound. USG combined with FNAC is a reliable method for study of thyroid swelling.*
Keyword : *USG, Doppler, FNAC, Thyroid Swelling*

INTRODUCTION

The clinical spectrum of thyroid swelling varies from a simple benign goitre to a profound malignancy. So it is essential to have proper imaging tools for the evaluation of thyroid gland.

Before the advent of high resolution ultrasound, radionuclide scintigraphy was the chief means to evaluate the thyroid gland both functionally and morphologically. Ultrasound is much cheaper alternative to C.T and M.R.I and Radionuclide study to evaluate thyroid masses. Because of ultrasound being non-ionising, fast procedure, its acceptability to evaluate thyroid diseases are increased day by day.

Thyroid ultrasound differentiates solid from cystic lesions, solitary nodules from multinodular gland. Diffuse enlargement of thyroid and extrathyroidal lesions, lymphadenopathy can be detected by USG. Nearly 50% of patients with a clinically solitary thyroid nodule have avoided surgery by

thyroid scanning as stated by Walker J, Findlay D et al[16]. High resolution USG with color Doppler flow mapping can reveal details of the thyroid gland and the hemodynamic features of thyroid neoplasms stated by Taylor KJW, Carpenter DA et al[17].

MATERIALS AND METHODS

A hospital based cross sectional study of 80 patients weres carried out at Deptt of Radio-diagnosis in Assam Medical College and Hospital, Dibrugarh from 1st August 2008 to 31st July 2009.

Patients referred for thyroid ultrasound scan were included in the study if the following inclusion criteria were met.

- Clinically suspected cases of thyroid diseases.
- As a pre requisite before surgery in patients of thyroid diseases.

The exclusion criteria for the study were-

- Pregnant patients.
- Patients not willing to undergo ultrasonography and fine needle aspiration cytology.

Color assisted duplex sonography was performed following a detailed history and physical examination. Ultrasound guided FNAC was done after taking patients consent. Later the patient was subjected to thyroidal hormonal assay depending on the clinical and sonographic picture.

ULTRASOUND SCANNING:

Machine used: PHILIPS HD 11 Color Doppler Machine is used for the study.

Technique:

We used 5 & 12 MHz short focus transducer.

The patient is examined in the supine position with the neck hyper extended to identify the inferior margin of the gland, which may extend to the clavicle in some patients. A small pad may be placed under the shoulders to provide better exposure of the neck.

The thyroid gland is scanned in both longitudinal and transverse planes. Imaging of the lower poles can be enhanced in some patients by asking them to swallow which momentarily raises the thyroid gland in the neck. The entire gland from upper to lower pole, including the isthmus is carefully examined. The examination is extended laterally to include the region of the carotid artery and jugular vein in order to identify the enlarged cervical lymph nodes.

The gland was evaluated using the well established criteria of solid, mixed and cystic pattern. Solid nodules were divided into homogeneous and heterogeneous pattern, the homogeneous being subdivided into hyperechoic, isoechoic and hypoechoic echotexture.

The mixed group was divided into predominantly Solid, predominantly Cystic and a Complex groups. The predominantly solid group was again divided into hyperchoic, isoechoic and hypoechoic depending upon the echopattern of the solid elements. The margins of the nodule were evaluated for regularity, surrounding and calcification when present, were also assessed. In addition, surrounding structures were studied in any pathology especially lymphadenopathy.

Color Doppler was applied in order to study the vascularity of the thyroid gland. The inferior thyroid artery was identified by duplex sonography and spectral waveforms were obtained. Power Doppler was applied to detect intranodal vascularity.

Diagnosis & Follow up:

After the history, physical examination, ultrasound, thyroidal hormonal array and FNAC, a diagnosis is made. Whenever feasible, some cases were subjected to histopathological examination.

USG GUIDED FINE NEEDLE ASPIRATION CYTOLOGY

Procedure

Before taking FNAC the patient was explained about the procedure and consent was taken. At least 2 puncture were done for every case. The puncture of the thyroid nodule was best performed with patient in supine position and neck slightly extended. The skin overlying the nodule was

cleaned with antiseptic solutions. After detecting the suitable site, no anesthesia was given. Then under USG guidance the needle of the syringe was introduced into the target site with a single quick motion without any negative pressure in the syringe. The plunger of the syringe was then retracted to create negative pressure in the syringe and needle lumen. The needle was moved back and forth for several times and directed in into different areas of mass maintaining a constant negative pressure in order to detach the tissue fragments. As soon as material was seen, the aspiration was completed. Then the plunger was gently released to allow the pressure in the syringe to return to atmospheric pressure. The aspirated material was remained within the needle. Aspirate was blown over the microscopic slides and smears were made immediately by applying pressure with another slide. The aspirate was spread thinly and evenly. This slides were air dried/ alcohol fixed and were sent to the Department of Pathology for cyto analysis.

Statistical Analysis

The sensitivity, specificity and positive predictive value were determined by using following formulae:

Sensitivity = TP/(TP+FN) X 100%, Specificity = TN/(TN+FP) X 100%

PPV = TP/(TP+FP) X 100%, NPV = TN/(TN+FN) X 100%

PPV=Positive predictive value, NPV= Negative predictive value,

TP = True positive, FP = False positive, FN = False negative, TN = True negative.

RESULTS AND OBSERVATIONS

The present study of 'Sonographic evaluation of Thyroid swelling with FNAC correlation' was carried out in the Department of Radiology, in collaboration with the Department of Pathology, Assam Medical College & Hospital, Dibrugarh during a period of one year from 1st August 2008 to 31st July 2009.

80 patients with clinically suspected thyroid diseases were evaluated sonographically assisted by Color Doppler.

The age of the patient ranged from 14 years to 60 years. It is evident that

21 to 30 yrs age group showed the highest incidence. The incidence among females was also highest in this decade.

The youngest in this study was 14 years old boy and the oldest cases were two women aged 60 years.

DURATION OF SWELLING

The duration of swelling ranged from 6 months to 10 years.

The longest history was that of a woman aged 60 years with a duration of swelling of 10 years. The shortest duration was that of 6 months in 3 patients.

CLINICAL DIAGNOSIS

Clinical diagnosis was arrived from the patients symptoms, signs and by clinical examination. Thyroid function tests also done simultaneously. Clinical involvement of thyroid gland was assesed depending on the extent of lobar involvement and cervical lymphadenopathy.

ULTRASOUND EVALUATION:

The size of the nodule varied in our study from 4mm to 6cm.

Out of the 80 patients, 32 patients were thought to have solitary nodule by palpation. Ultrasonograhy was confirmatory in 20 cases. Multiple nodules were detected in 12 cases.

Comparison of clinical and ultrasound assessment of intra-thyroidal position of lesion:

It seems to be evident that most of the intrathyroidal lesions are seen in both lobes. In USG internal consistency of the lesion Solid 64(80%), Cystic-10%, Hyperehcoic -57.5%, hypoechoic -30%, well defined -90% illdefined – 10% calcification- 8%. Doppler USG- peripheral pattern- 45%, thyroidal inferno (PSV>70cm/s)-5%,Cervical lymphadenopathy-2.5%.

F.N.A.C. diagnosis:

Out of the 80 patients all 80 underwent FNAC, 2 underwent FNAC of cervical lymph adenopathy along with FNAC of thyroid nodule.

On follow up, out of the 14 follicular neoplasms, 1 case- 15yr female was diagnosed as follicular carcinoma by histopathological (HPE) study.

Sensitivity of USG in detecting malignancy compared with Pathology

= TP/(TP + FN) x 100% = 6/(6+1) x 100% = 85.7%

Specificity of USG in detecting malignancy compared with Pathology

=TN/(TN+FP) x 100% = 70/(70+3) x 100% = 95.8%

Positive predictive Value = TP/(TP+FP) x 100% = 6(6+3) x 100% = 66.8%.

TABLE – 1 : SEX DISTRIBUTION

Sex	No. of Patients	Percentage
Female	70	87.5
Male	10	12.5
Total	**80**	**100**

GRAPH 2: PIE CHART SHOWING SEX DISTRIBUTION OF PATIENTS

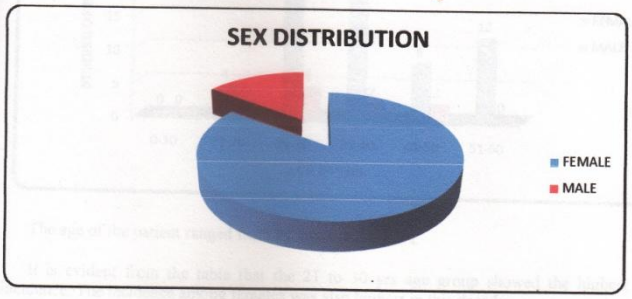
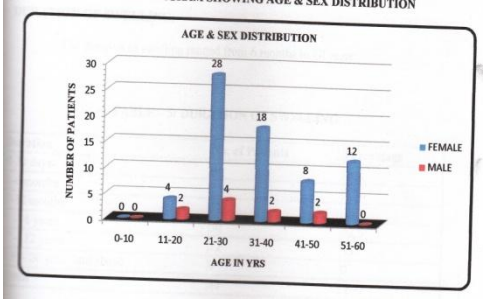


TABLE – 3: AGE AND SEX DISTRIBUTION

Age in years	Male	Female	Total	Percentage
0-10	0	0	0	0
11-20	2	4	6	7.5
21-30	4	28	32	40
31-40	2	18	20	25
41-50	2	8	10	12.5
51-60	0	12	12	15

GRAPH 4: BAR DIAGRAM SHOWING AGE & SEX DISTRIBUTION



CLINICAL MANIFESTATIONS:

TABLE – 5: SYMPTOMS

Symptoms	No. of Patients	Percentage
Swelling in front of neck	80	100
Difficulty in swallowing	8	10
Difficulty in breathing	4	5
Hoarseness of voice	6	7.5
Pain in the swelling	6	7.5
Evidence of hyperthyroidism (palpitation, HR, BP)	6	7.5
Evidence of hypothyroidism	0	0

TABLE – 6: DURATION OF SWELLING

Duration	No. of Patients	Percentage
0-30 days	0	0
1-6 months	6	7.5
7-12 months	12	15
1 – 6 years	50	62.5
7 – 12 years	12	15
13 – 20 years and above	0	0
Total	**80**	100

TABLE – 7 : CLINICAL DIAGNOSIS

Clinical diagnosis	No. of Patients	Percentage
Solitary thyroid nodule	32	40
Multinodular goitre	24	30
Thyroiditis	8	10
Carcinoma of thyroid	2	2.5
Thyrotoxicosis	10	12.5
Thyroid cyst	4	5.0

GRAPH 8:

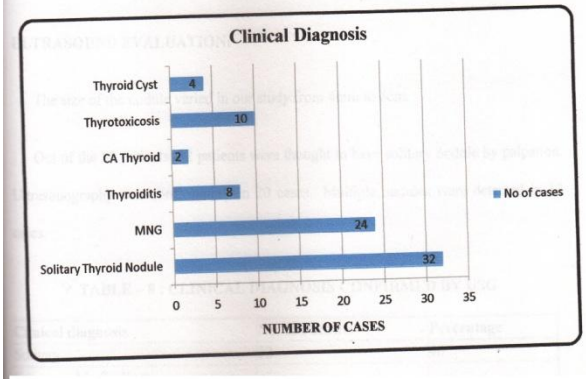


TABLE – 9 : CLINICAL DIAGNOSIS CONFIRMED BY USG

Clinical diagnosis	No. of Patients	Percentage
Solitary	32	40
Sonographic findings Solitary nodule	20	25
Multiple nodule	12	15

GRAPH: 10

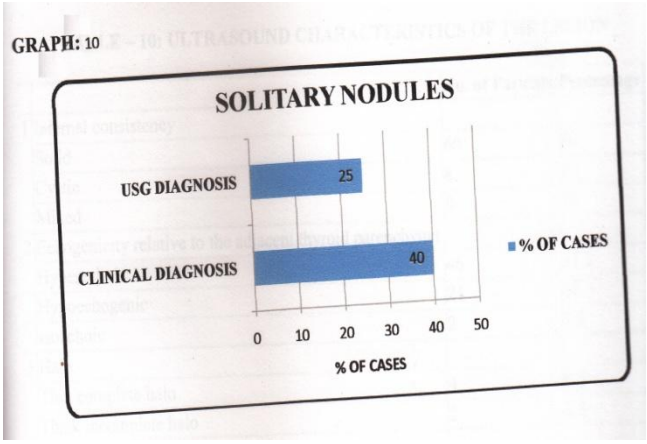


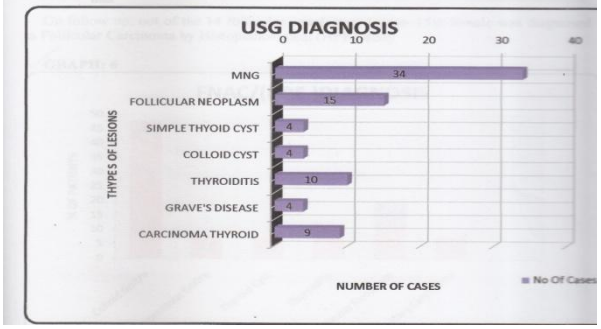
TABLE – 11: ULTRASOUND CHARACTERISTICS OF THE LESION

		No. of Patients	Percentage
1	Internal consistency		
	Solid	60	80
	Cystic	8	10
	Mixed	8	10
2	Echogenicity relative to the adjacent thyroid parenchyma		
	Hyperechoic	46	57.5
	Hypoechogenic	24	30
	Isoechoic	2	2.5
3	Halo		
	Thin complete halo	4	0.5
	Thick incomplete halo	2	2.5
4	Margin		
	Well defined	72	90
	Illdefined	8	10
5	Calcification		
	Egg shell calcification	2	2.5
	Course calcification	2	2.5
	Microcalcification	4	5
6	Doppler		
	Peripheral flow pattern	36	45
	Internal flow pattern done	4	5
	Both together (peripheral and internal flow pattern)	24	30
	No significant vascularity	16	20
	Thyroid inferno (PSV > 70cm/s)	4	5
7	Others		
	Vascular enhancement	-	-
	Cervical lymphadenopathy	2	2.5

TABLE – 12: ULTRASONOGRPAHIC DIAGNOSIS OF THE PRESENT CASES

	Ultrasound diagnosis	No. of Patients	Percentage
1	Multinodular goitre	34	42.5
2	Follicular neoplasm	15	18.75
3	Simple Cystic of Thyroid	4	5
4	Colloid cyst of Thyroid	4	5
5	Thyroiditis	10	12.5
6	Grave's disease	4	5
7	Carcinoma of thyroid	9	11.25

GRAPH: 13



GRAPH: 14

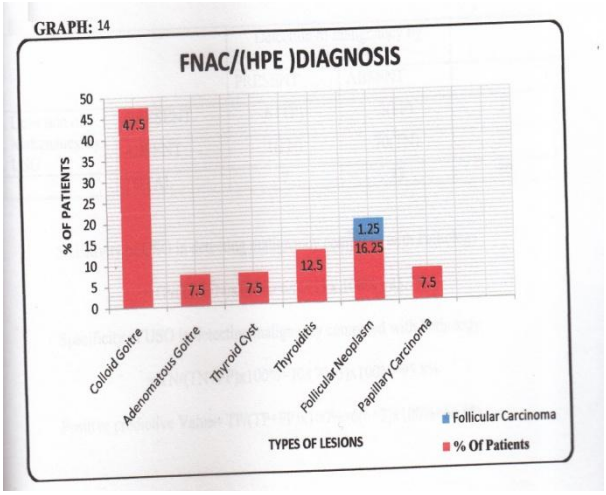


TABLE – 15: COMPARISON BETWEEN ULTRASONOGRAPHIC AND PATHOLOGICAL (FNAC/HPE) DIAGNOSIS

	Disease	USG diagnosis	Clinically detected	Pathological diagnosis
1	MNG & Solitary nodular (Colloid goitre)	34	24	38
3	Adenomatous nodule	11	-	6
4.	Follicular neoplasm	4		13
5	Thyroid cyst	8	4	6
6	Thyroiditis	10	8	10
7	Grave's disease (Toxic goiter)	4	10	-
8	Carcinoma	9	2	7

TABLE – 14: COMPARISION OF USG WITH PATHOLOGY IN DETECTION OF MALIGNANCY

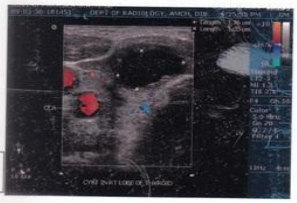
		Detection of malignancy by FNAC/HPE		
		PRESENT	ABSENT	
Detection of Malignancy by USG	PRESENT	6 (TP)	3(FP)	9
	ABSENT	1(FN)	70(TN)	71
	TOTAL	7	73	80

USG transverse scans showing Multi nodular goitres with cystic changes

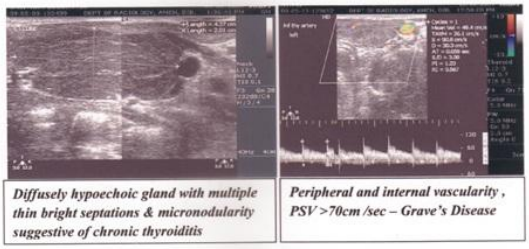
USG transverse scan showing Colloid goitres – Colloid crystals with ring down artifacts

USG transverse scan showing a benign nodule with peripheral egg shell calcification

USG transverse scan showing multiple hyperechoic nodules with well defined smooth complete halo and peripheral vascularity – benign nodules



USG transverse scan showing a simple cyst of thyroid



Diffusely hypoechoic gland with multiple thin bright septations & micronodularity suggestive of chronic thyroiditis

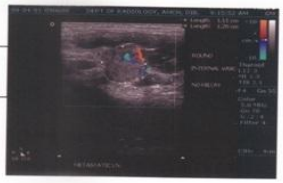
Peripheral and internal vascularity , PSV >70cm /sec – Grave's Disease

USG Transverse scan showing an ill-defined focal hypoechoic area in patient with pain and fever -Focal thyroiditis

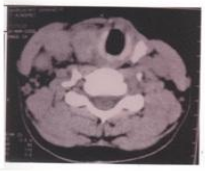
FNAC Procedure showing the needle in situ in a case of thyroiditis

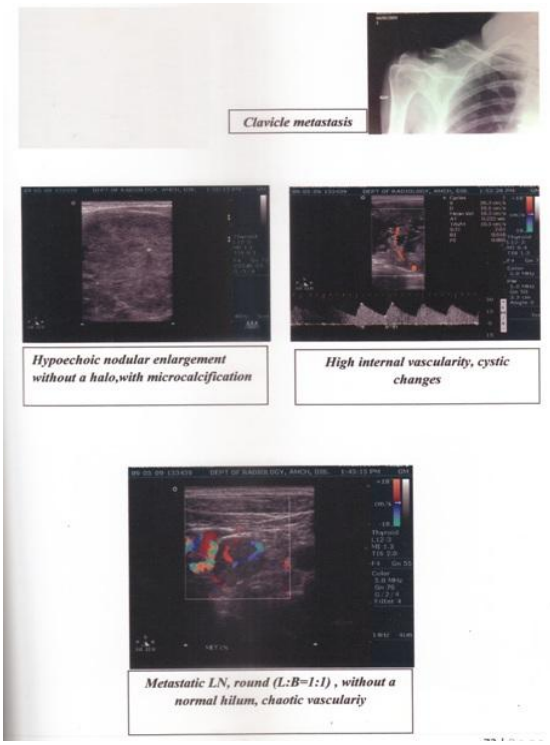
Follicular carcinoma in a 15 yr Girl

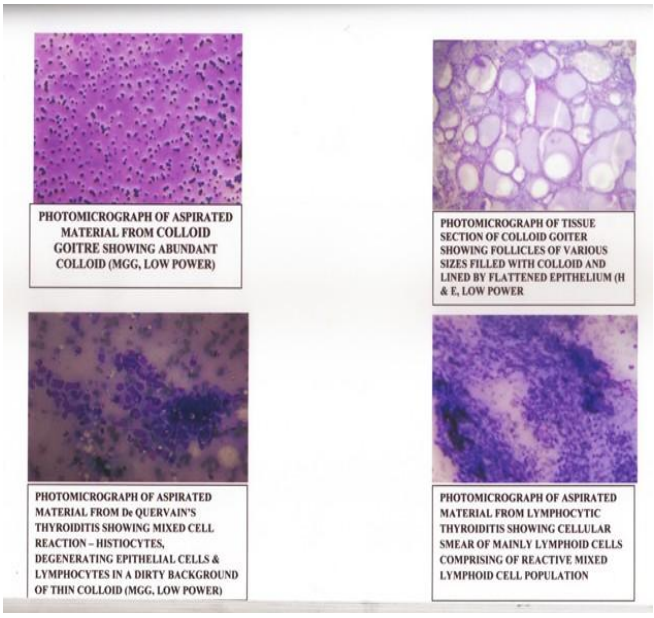
Ill defined hyperechoic nodule, without a halo with internal chaotic vascularity

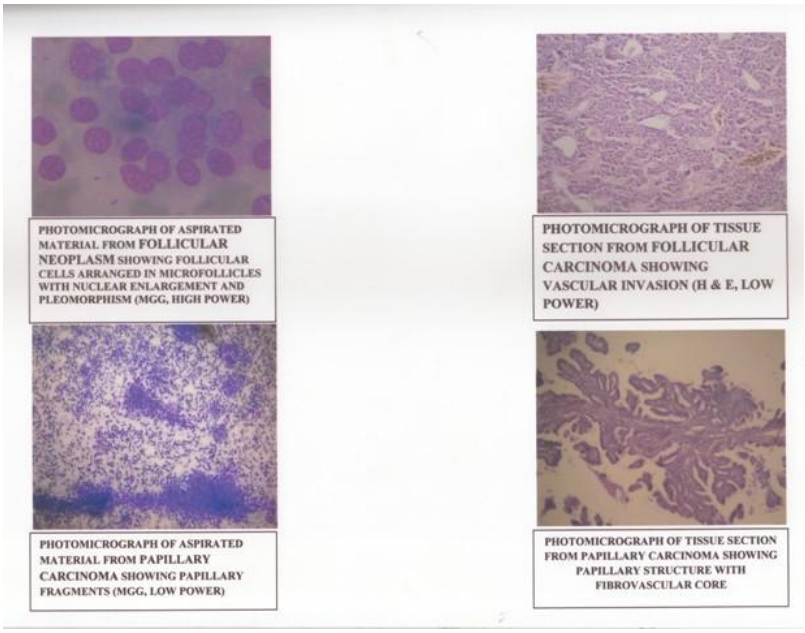


Metastatic LN, round (L:B=1:1) , without a normal hilum









DISCUSSION

Goiter is a common disorder of the thyroid gland and it occurs in varying incidence in different regions of the country. India has the World's biggest goiter belt in the sub Himalayan region. However, cancer of the thyroid gland is a comparatively rare disease. It is therefore important to identify patients who are likely to benefit from surgery and thus avoid essentially diagnostic surgery (Agrawal, 1995).

Although most of the thyroid nodules are benign, the annual incidence of thyroid cancer ranges from 0.5 to 10 cases per 100000 populations. According to Anderson and Webb the preoperative identification of thyroid malignancy on the basis of clinical findings, isotope scintigraphy and ultrasonography results in a low percentage of patients. Clinically not more than 50% cases of thyroid cancer have been diagnosed correctly in the pre-operative period (Catel et al: 1953; Frazell et al: 1953). Hasselstrom and

Herniques (1975) also pointed out that even with the help of these sophisticated investigations it was not possible to ascertain whether a particular thyroid nodule is malignant or benign.

With the development small part sonograpy, it has become practice to evaluate routinely the superficial structures of the neck. A basic and practical use of sonography is the establishment of the precise location of the palpable mass.

Ultrasound can easily differentiate between thyroid nodules and other cervical masses. This has added a new dimension to the management of solitary nodule of the thyroid. Rodney J Butch et al[1] in 1985 stated that the major use of thyroid scanning has been to identify additional thyroid nodules when one of them is palpable.

Conventional ultrasound is highly sensitive in finding nodules and texture differentiation of thyroid mass , these findings are non-specific in distinguishing benign from malignant lesion . In 1978 Brown M C et al[2] stated that ultrasound offers more accurate assessment of thyroid volume than either on palpation or radionuclide scanning. Nirad Mehta et al[3] in 1994 stated that ultrasound of the thyroid is a reliable method for evaluation of solitary thyroid nodules when combined with FNAC.

In our study, we found colloid goiters the commonest lesion with 45 cases out of 80 cases (56.25%). Almost 35 of these lesions were hyperechoic, 3 of the cases were isoechoic. Associated cystic changes were there in 7 cases. Nirad Mehta et al[3] in 1993 found colloid goiter in 119 patients. The sonographic patterns of 119 patients were as follows: 13 (10.9%) were hyperechoic 25 (21%) isoechoic, 30(25.2%) was hypoechoic, 5 (4.2%) were heterogeneous in echotexture. 19 (15.9%) were mixed echogenicity, 20(16.8%) were predominantly cystic and 7 (5.8%) were completely cystic. William Scheible et al[4] found 13 (52%) out of the 25 cases were colloid goiters. William Scheible has seen peripheral “halo” rim in 4 of 13 cases and incomplete “halo” in another 4 cases. In our study we saw 4 cases with complete peripheral halo and 2 cases with incomplete thick halo.

James and Charbeneau et al[5] mentioned that peripheral or egg shell calcification is the most reliable sign of benign nature of the thyroid nodule. Our study revealed 2 cases showing peripheral or egg shell calcification.

Follicular Neoplasm

It may not be possible to differentiate follicular adenoma from follicular carcinoma by imaging means or even by FNAC; entire specimen must be examined histologically for capsular and vascular invasion as mention by Anil Ahuja et al[6].

In our study, sonographically 15 cases were found to be follicular neoplasm. Maximum of these of these nodules were hyperechoic, a few are is to hypoechoic. Simeone et al[7] found follicular adenoma in 79(68%) out of 166 cases. This was very high when compared to our study.

Thyroid Cyst

Cysts in the thyroid gland can be easily diagnosed by sonography. These cysts are rarely true epithelial cysts. Most of the cystic lesions represents degenerative changes in adenomatous nodular goiter or adenoma. These cysts may contain colloid fluid, yellow fluid (old blood), fresh blood or infective material (suppurative thyroiditis) as observed by Maier R. In the series of Simeone et al[7] and associates, 16% of follicular adenomas had greater than half of the lesion containing fluid.

In our study, we found 8 cases completely cystic in nature. On ultrasonic imaging we found the cystic lesion were very similar to other cysts in the body. They were anechoic lesions with well defined walls showing posterior acoustic enhancement. No calcification was detected within any lesion. 4 of these cases show colloid crystals with ring down or comet tail artifacts. Ultrasound guided fine needle aspiration cytology was done in all 8 cases. In colloid cysts macrophages are found along with abundant

colloid materials. In simple cyst no colloid is seen microscopically.

Thyroiditis

he most common type is chronic autoimmune lymphocytic thyroiditis (Hashimoto's thyroiditis). It is an autoimmune disease where the patient develops anti-bodies to their own thyroglobulin. The typical sonographic appearance of Hashimoto's thyroiditis is diffuse coarsened parenchymal echotexture generally more hypoechoic than the normal thyroid. Micronodulation is a highly sensitive sign of chronic thyroiditis with a positive predictive value of 94.7% study stated by Shawker T.H et al[8] .

Erdogan MF, Anil C, Cesur M et al[9] had found 24 cases of Hashimoto's thyroiditis while evaluating 55 patients with hyperthyroidism. Lin JD, Huang B Y et al[15] had found 11 cases of chronic thyroiditis. Ultrasonic patterns of 11 cases were diffusely enlarged gland with diffuse hypoechogencity. Micronodulation was seen in all cases.

In our study, we found 10 cases of thyroiditis with 8 of them being Hashimoto's thyroiditis (Chronic lymphocytic thyroiditis). One case was non-specific thyroiditis and the other being de Quervain's thyroiditis (subacute granulomatous thyroiditis). All of them showed diffuse enlarged gland with diffuse hypoechogencity. Small micro-nodules were seen in 8 cases.

Graves Disease

Autoimmune disorder with Late Acting Thyroid Stimulating antibodies (LATS) producing hyperplasia with hypertrophy of thyroid gland. On ultrasound imaging, enlarged gland is hypoechoic and with hetergenous spotty echopattern with increased in parenchymal vascularity. Color Doppler sonography often demonstrates a hypervascular pattern referred to as the ''thyroid inferno". Spectral Doppler will often demonstrate peak systolic velocities exceeding 70 cm/s which is the highest velocity found in thyroid disease.

Erdogan MF, Anil C et al[9] had studied 55 patients with hyperthyroidism.29 patients were diagnosed as Graves disease. Gray scale pattern of both Graves disease and Hashimoto's thyroiditis are similar and difficult to differentiate. Vascular patterns were significantly more prominent, and the mean PSV values were significantly higher in the Graves disease rather than Hashimoto's thyroiditis.

Thyroid Malignancy

Most of the primary thyroid cancers are epithelial in origin and most of them are well differentiated and Papillary carcinoma accounts for 75-90 of all cases. Thyroid micro calcifications are one of the most specific features of thyroid malignancy. Coarse calcifications are common type of calcification which is commonly associated with medullary carcinomas.

Ultrasound is valuable for identifying many malignant or potentially malignant thyroid nodules. These features include micro-calcifications, local invasion, lymph node metastases, a nodule that is taller than it is wide, and markedly reduced echogencity. Other features, such as absence of halo, ill-defined irregular margins, solid composition, and vascularity are less specific but may be useful ancillary signs. Distinction between follicular adenoma and well differentiated follicular carcinoma is based solely on microscopic evidence of vascular invasion which is often over difficult to determine pathologically, much less sonographically as observed by Gershengover M et al[10].

Walters et al[11] in a study had found out 26% of cystic lesions are malignant. However in our study we did not find any cystic lesion with malignant changes. Most of the authors agree that absolutely specific echographic features of thyroid carcinoma do not exist, but literature data are very variable. Some authors described carcinoma as exclusively hypoechogenic but Solbiati et al[12] found out only 68% of the malignant lesions were hypoechogenic. In our study we found 5 cases of

malignancy showing predominantly hypoechogenic lesions. 2 cases were heterogenous containing both hypo and hyperechoic areas.

In a study conducted by Jenny K. Hoang, MBBS, FRANZCR, Wai Kit Lee et al[13] showed that microcalcifications are one of the most specific ultrasound finding of a thyroid malignancy. Microcalcifications were found in 29%-59% of all primary thyroid carcinomas. In our study we detected 5 cases of malignancy showing microcalcifications. 1case of malignancy showed coarse calcification.

Rago T, Vitti P et al[14] showed in their study that the combination of absent halo sign plus microcalcification plus intranodal flow pattern achieved a 97.2% specificity for the diagnosis of thyroid malignancy. In our

study we obtained a specificity of 95.8% using these parameters to evaluate malignancy.

Sex distribution

In the present series, there was a female predominance (87.5%) compared to males (12.5%). This finding correlates with the finding of other authors- Hall et al (1989) had 84% females and 16% females in their series, Ravi Chander et al (2000) had 85% females & 15% males in their series.

Age distribution

In the resent series we found maximum number of patients in the 2nd, 3rd, 4th decades. In the series of Sirpal (1996), also maximum numbers of patients were in the 3rd and 4th decades.

Cytological findings:

In the present study, benign lesions included colloid goitre, adenomatous goitre, thyroid cysts (simple cyst and colloid cyst) and thyroiditis. As follicular adenoma can not be differentiated from follicular carcinoma cytologically.

Colloid goitre was the commonest lesion encountered out of all cases and amongst the malignant tumors we found papillary carcinoma was the commonest. Nggada et al (2006) and Harsh Mohan et al (2008).

CONCLUSION

Ultrasonography is a safe, fast, popular, cost-effective, repeatable, non-invasive procedure for investigating thyroid gland.

Sonography can accurately determine involvement of the lobes thus detecting multinodularity of the gland when one nodule is suspected clinically.

Sonography is very a helpful guide for F.N.A.C.

Combined with FNAC, USG is a reliable method for evaluation of thyroid swelling & can assist surgery in large number of patients.

REFERENCE

1. Rodney J et al: Radiologic Clinics of North America; March 1985, Volume 23, 111-112.
2. Brown MC et al: Thyroid gland volume estimation by the use of ultrasound in addition to scintigraphy, Acta Radiol Onco. Biol, 1978, 17, 337-41.
3. Nirad Mehta et al: Sonographic appearance of solitary thyroid nodules, IJRA 1994; volume 4;207-211.
4. William Scheible et al: High resolution real time ultrasound of thyroid nodules-Radiology, Nov 79, 133:413-417.
5. James GM and Charbeneu et al: High frequency ultrasound sonography seminar, AJR 1985,6(3) 294-309.
6. Practical Head and Neck Ultrasound by Anil Ahuja and Rhodri Evans. Chinese university of Hong Kong, Prince of Wales Hospital, China; Chapter 3;pg 37-55.
7. Simeone JF et al: Sonography in follow up of 100 patients with thyroid carcinoma AJR 1987; 148:45-49.
8. Shawker TH, Avila NA et al: Ultrasound evaluation of Primary hyperparathyroidism. Ultrasound Quart 2000;214:393-402.

9. Erdogan MF, Anil C et al: Color flow Doppler sonography for the etiologic diagnosis of hyperthyroidism. Thyroid 2007 Mar; 17(3);223-8.
10. Gershengorn M et al: FNAC in the preoperative diagnosis of the thyroid nodule, Ann Internal Med 1977-87, 265-269.
11. Walters DA et al: Role of ultrasound in the management of thyroid nodules, Am J Surgery 1992, 164(6):654-57.
12. Solbati S et al: Microcalcification- A clue in the diagnosis of the thyroid malignancies, Radiology 1990;177:140.
13. Jenny K. Hoang, MBBS, FRANZCR, Wai Kit Lee, MBBS, et al: US Features of Thyroid Malignancy: Pearls and Pitfalls, Aug 2006.
14. Rago T. Vitti P et al: Role of conventional ultrasonography and color Doppler sonography in predicting malignancy in cold thyroid nodules. Eur J endocrinology 1998, 138:41-46.
15. Lin JD et al: Ultrasonography and fine needle aspiration cytology of acute supportive thyroiditis, Change Kengi Hsch, 1993; June 16(2):93-98.
16. Walker J, Findlay D et al: A prospective study of thyroid ultrasound scan in the clinically solitary thyroid nodule. British Journal of Radiology 1985, 58(691): 617-619.
17. Taylor KJW, Carpenter DA et al: Gray scale ultrasonography in the diagnosis of thyroid swellings. Journal of Clinical Ultrasound 2005; 2(4): 327-330.