

Ultrasound Evaluation of Thyroid Lesions with Pathological Correlation



Radiology

KEYWORDS: Ultrasound, thyroid gland, neoplastic lesions, cervical lymphadenopathy, calcifications, cystic changes, nodules

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ABSTRACT

Thyroid disorders presenting as swellings constitute a significant number of cases encountered among the patients in our country and attending various OPDs. Although thyroid is a superficial gland easily accessible to physical examination, it needs various biochemical and radiological investigations to confirm the diagnosis. In the case of thyroid, ultrasound offers an extension to the physical examination, as to the confirmation of the mass lesion, the character of gland and response to therapy. The present study describes the various sonographic features of thyroid lesions with pathological correlation

INTRODUCTION:

In Indian subcontinent the "Himalayan goiter belt" is severely affected. Diffuse enlargement of thyroid gland can occur during puberty, lactation etc. Other pathological lesions such as thyroid neoplasms also present in the form of enlarged thyroid mass or thyroid nodules. Various immunological diseases of the thyroid including hypo and hyper thyroid states may present as thyroid enlargement.

In the case of thyroid, ultrasound offers an extension to the physical examination, as to the confirmation of the mass lesion, the character of gland and response to therapy

Thyroid disorders presenting as swellings constitute a significant number of cases encountered among the patients in our country and attending various OPDs in our hospital. Although thyroid is a superficial gland easily accessible to physical examination, it needs various biochemical and radiological investigations to confirm the diagnosis.

MATERIALS & METHODS

The present study has been done in the Department of Radio diagnosis, GGH Guntur affiliated to Guntur medical college

The study includes a total of 115 patients presenting with a palpable thyroid mass, referred to our department from the departments of General Surgery, General Medicine and ENT. Cytopathological correlation has been obtained for every case. The study was conducted from May 2012 to October 2013

Due to the superficial location of thyroid gland, high-resolution real time gray scale and color Doppler sonography can demonstrate normal thyroid anatomy and pathological conditions with remarkable clarity. This technique being non invasive, economical and without radiation hazards has come to the fore as an appropriate study in the diagnostic evaluation of thyroid diseases.

Ultrasound scan was performed with MEDISON SONO ACE 6000C machine using a linear probe of 7.5 MHz frequency which provides excellent image details of thyroid anatomy and various pathological conditions of thyroid gland.

OBSERVATIONS:

The present study includes 115 patients referred to our department for ultrasonographic examination of various thyroid masses.

Table No. 1 AGE WISE DISTRIBUTION OF CASES

Age in years	No. of cases	Percentage distribution
0-10	3	2.60 %
11-20	8	6.95%
21-30	39	33.91%
31-40	30	26.08%
41-50	21	18.26%
51-60	8	6.95%
61-70	6	5.21%
71-80	0
Total	115	100%

This table shows the distribution of patients among various age groups. Major affected age group is between 21-50 years.

Table No. 2 SEX WISE DISTRIBUTION OF CASES

Sex	No. of cases	Percentage
Male	12	10.43%
Female	103	89.56%
Total	115	100%

This table shows the male and female ratio of the patients referred to us for sonographic examination. In our study, ratio between males and females is 1:8.5 Indicates that the incidence of thyroid lesions is higher in female patients.

Table No.3 INCIDENCE OF DIFFERENT TYPES OF THYROID LESIONS ON SONOGRAPHY DEPENDING ON INTERNAL CONTENT.

Type of lesion on sonographic examination	No. of cases	Percentage
Cystic	13	11.30%
Solid	80	69.56%
Mixed	22	19.13%
Total	115	100%

This table shows the distribution of cases according to internal content of the lesions detected on sonographic examination. Out of total of 115 cases, 11.30% of them appeared as cystic and 69.56% as solid and 19.13% as mixed echotexture lesions.

Table No. 4 INCIDENCE AND TYPES OF CYSTIC LESIONS OBSERVED ON SONOGRAPHIC EXAMINATION AND THEIR CORRELATION WITH FNAC

Type of lesion	Sonographic diagnosis	FNAC diagnosis
Goiter with cystic degeneration	10	9
Haemorrhagic cyst	2	2
Cystic papillary carcinoma	1	2
Total	13	13

This table shows the distribution of lesions appearing cystic on sonographic examination. We encountered 3 types of lesions appearing cystic and proved by FNAC. On sonography, 10 lesions were diagnosed as goiter with purely cystic degeneration, of which 9 cases were proved to be the same on FNAC. Two cases of haemorrhagic cyst and one case of cystic papillary carcinoma sonographically diagnosed were proved to be correct by FNAC. One case of cystic papillary carcinoma was misdiagnosed as colloid cyst.

TABLE No. 5 SONOGRAPHIC FEATURES OF DIFFERENT TYPES OF CYSTIC LESIONS TOTAL-13

Sonographic Feature	Goiter with cystic degeneration	Papillary Carcinoma (Cystic)	Haemorrhagic cyst
Shape	2	2	2
Round	7		
Oval	0		
Irregular			
Margins	9	2	2
Regular	0		
Irregular			
Echotexture	7	2	2
Hypo	0		
Hyper	2	0	
Iso	0		
mixed			
Calcification	1	2	0
Intra cystic septations	1	0	0
Hypochoic HALO	0	0	0
Lymphadenopathy	0	2	0
Distant	0	0	0
Total	9	2	2

Table No: 5 gives an account of the sonographic features of cystic lesions encountered in our study. Two cases of colloid cysts showed round shape, seven cases showed oval shape and no cases showed irregular shape. Nine cases of colloid cyst showed regular margins. Seven cases were hypochoic and two cases were isochoic. One among nine cases showed calcification and intracystic septations.

We encountered two haemorrhagic cysts which are hypochoic and oval in shape with regular margins.

Two out of Thirteen cases were cystic papillary carcinomas, irregular in shape and margins and appear hypochoic with calcification and metastatic lymphadenopathy.

Table No. 6 INCIDENCE AND TYPES OF SOLID LESIONS OBSERVED ON SONOGRAPHIC EXAMINATION AND THEIR CORRELATION WITH FNAC

Type of lesion	Sonographic diagnosis	FNAC diagnosis
Colloid goiter	22	18
Follicular adenoma	13	16
Papillary carcinoma	9	10
Hashimoto's thyroiditis	36	36
Fdd Total	80	80

Table 6: shows distribution of solid lesions on sonographic examination. Among 80 cases of solid lesions 70 were benign and 10 were malignant. We came across 4 varieties of lesions proved by FNAC. 22 cases were diagnosed as colloid goiters 18 were proved to be correct by FNAC. Out of 16 proved follicular adenoma cases, 13 were sonologically diagnosed. Among 10 papillary carcinomas 9 were sonologically diagnosed. There were 36 cases of Hashimoto's thyroiditis, all of them were diagnosed correctly by FNAC.

TABLE-7 SONOGRAPHIC FEATURES OF DIFFERENT TYPES OF SOLID LESIONS

Sonographic Feature	Colloid Goiter	Follicular Adenoma	Papillary Carcinoma	Hashimotto's Thyroiditis
Shape	0	3	0	Diffusc-36
Round	17	12	2	0
Oval	1	1	8	0
Irregular				
Margins	17	14	1	36
Regular	1	2	9	0
Irregular				
Echotexture	11	6	8	36
Hypo	1	0	0	0
Hyper	6	10	0	0
Iso	0	0	2	0
Mixed				
Calcification	0	0	10	0
Hypochoic HALO	16	12	0	0
Lymphadenopathy	0	0	9	0
Distant Metastasis	0	0	0	0
Total	18	16	10	36

Table No. 7: shows the sonographic features of different type of solid lesions. Among 18 goiter cases 17 showed oval and one showed irregular shape. 17 showed regular margins and one showed irregular margins. 16 cases of colloid goiter showed peripheral halo. None of them showed either calcification or lymphadenopathy.

Among 16 cases of follicular adenoma cases 12 showed oval shape, 3 showed round shape and one was irregular. 14 cases showed regular margins 2 showed irregular margins. 6 were hypochoic, 10 were isochoic. 12 cases showed peripheral halo. None of them showed either calcification or lymphadenopathy.

Among 10 cases of papillary carcinoma Two were oval and 8 were irregular in shape. One had regular margin 9 cases showed irregular margins. 8 were hypochoic and 2 were mixed echoic. Metastatic lymphadenopathy in 9 cases, calcification were seen in 10 cases.

Among 36 cases of Hashimoto's thyroiditis diffuse thyromegaly observed in 36 cases. 36 cases were hypochoic

Table No. 8 NATURE OF THE SOLID THYROID LESIONS

Solid lesion	Hyperechoic	Hypoechoic	Isoechoic	Mixed	Total no. of cases
Goiter (nodular hypertrophy)	1	11	6	0	18
Follicular adenoma	0	6	10	0	16
Papillary carcinoma	0	8	0	2	10
Hashimoto's thyroiditis	0	36	0	0	36

Table No: 8 show Among 18 solid goiter cases one was hyperechoic, 11 were hypoechoic, and 6 were isoechoic.

10 cases of follicular adenoma were isoechoic, 6 were hypoechoic
8 papillary carcinoma cases were hypoechoic and 2 were mixed echoic.

36 cases of Hashimoto's thyroiditis were hypoechoic

TABLE-9 INCIDENCE AND TYPES OF MIXED LESIONS OBSERVED ON SONOGRAPHIC EXAMINATION AND THEIR CORRELATION WITH FNAC

Type of lesion	Sonographic diagnosis	FNAC diagnosis
goiter with cystic degeneration	22	19
Follicular adenoma	0	2
Papillary carcinoma	0	1
Follicular carcinoma	0	0
Total	22	22

Table No 9=Total 22 cases were diagnosed as goiter with cystic degeneration and 19 cases were proved to be so. 3 were falsely diagnosed as goiter with cystic degeneration, of which 2 were proved as follicular adenoma & one as papillary carcinoma.

Table No.10 SONOGRAPHIC FEATURES OF VARIOUS MIXED LESIONS

Sonographic Feature	Colloid Goiter	Follicular Adenoma	Papillary Carcinoma	Follicular Carcinoma
Shape				
Round	16	2	0	0
Oval	3	0	0	0
Irregular	0	0	1	0
Margins				
Regular	18	2	0	0
Irregular	1	0	1	0
Echotexture				
Hypo	17	0	0	0
Hyper	0	0	0	0
Iso	1	0	0	0
Mixed	0	2	1	0
Calcification	4	0	1	0
Intra cystic septations	4	0	0	0
Hypoechoic HALO	2	0	0	0
Lymphadenopathy	0	0	1	0

Distant Metastasis	0	0	0	0
Total	19	2	1	0

This table shows the sonographic features of various lesions with mixed echo textural presentation. Among 19 colloid goiter cases 16 showed round shape and 3 showed oval shape. 1 had irregular margins and 18 had regular margins. 17 cases were hypo echoic, 1 isoechoic & 1 mixed echoic. Calcification and internal septations found in four cases. Peripheral halo observed in 2 cases. 2 follicular adenomas were round & mixed echoic, 1 case of papillary carcinoma has irregular margins & mixed echogenic, with calcification & lymphadenopathy

Table No. 11 INCIDENCE OF CALCIFICATION FOUND WITH THE LESION

Lesion	Total No. of cases	No. of cases showing calcification	Percentage
Colloid adenoma	46	5	10.86%
Follicular adenoma	18	0	0%
Papillary carcinoma	13	13	100%
Follicular carcinoma	0	0	0%

Table No. 11 shows distribution of calcification among thyroid lesions

Calcification seen in 13 cases of papillary carcinoma (100%).
Only 5 cases of colloid goiter showed calcification (10.86%).

Table No. 12 HYPOECHOIC HALO IN VARIOUS THYROID LESIONS

Lesion	No. of cases	Incidence of hypoechoic rim	percentage
Colloid Goiter	46	18	39.13%
Follicular	18	12	66.66%

The above table shows 18 among 46 (39.13%) colloid goiter showed peripheral halo. 12 among 18 cases of follicular adenoma (66.66%) showed peripheral halo.

DISCUSSION

Thyroid disorders presenting as swellings constitute a significant number of cases encountered among the patients in our country and attending various OPDs in our hospital. Although thyroid is a superficial gland easily accessible to physical examination, it needs various biochemical and radiological investigations to confirm the diagnosis. The present study has been done in the Department of Radio diagnosis Government general hospital Guntur.

The study includes a total of 115 patients presenting with a palpable thyroid mass, referred to our department from the departments of General Surgery, General Medicine and ENT. Cytopathological correlation has been obtained for every case. The study was conducted from May 2012 to October 2013. Due to the superficial location of thyroid gland, high-resolution real time gray scale and color Doppler sonography can demonstrate normal thyroid anatomy and pathological conditions with remarkable clarity. This technique being non invasive, economical and without radiation hazards has come to the fore as an appropriate study in the diagnostic evaluation of thyroid diseases.¹

Ultrasound scan was performed with MEDISON SONO ACE 6000C machine using a linear probe of 7.5 MHz frequency which provides

excellent image details of thyroid anatomy and various pathological conditions of thyroid gland.

In Indian subcontinent the "Himalayan goiter belt" is severely affected. Diffuse enlargement of thyroid gland can occur during puberty, lactation etc. Other pathological lesions such as thyroid neoplasms also present in the form of enlarged thyroid mass or thyroid nodules. Various immunological diseases of the thyroid including hypo and hyper thyroid states may present as thyroid enlargement.

In the case of thyroid, ultrasound offers an extension to the physical examination, as to the confirmation of the mass lesion, the character of gland and response to therapy^{2,3}.

This is a prospective study of only a small group of patients, referred to us with brief clinical history, physical examination and provisional clinical diagnosis. All the patients were examined sonographically and the results were made using various sonological parameters and the findings were then subsequently correlated with US -guided FNAC.

AGE:-

The study comprised of 115 patients between the age group 0 to 70 years. The youngest patient in our study was 5 year old female and the eldest was 70 year old female. Majority of the cases (78.2%) affected were in the age group of 21 to 50 years..

Rosario PWS et al (2004) reported their experience with 84 patients of whose age group range was 19 to 65 years.

Lyschik A et al (2005) conducted a study among 103 patients, who belonged to pediatric age group range of 9 to 18 years

SEX DISTRIBUTION:-

Of the 115 patients in our study group, females constituted 89.56% and males 10.43%.

Solbiati et al (1985)⁴ reported their experience with 401 cases in which 71.3% were females and 28.7% were males.

Wienke JR et al (2003)⁵ reported their experience with 70 patients in which 90% were females and 10% were males.

The above studies indicate that females are much more commonly affected than males and our study is in agreement with this finding.

NATURE OF THE LESION:-

Differentiation of a mass lesion into cystic, solid or mixed is probably the most important application of US evaluation of thyroid. Our yield was 100% in this respect. Out of 115 patients, we categorized 13 cases as cystic, 80 as solid and 22 cases as mixed lesions which were later proved to be correct by FNAC. The solid lesions were more in our study group than the cystic lesions.

In a study by Rosen IB et al (1979), out of 174 cases. An accuracy rate of 96% was observed.

CYSTIC LESIONS:-

We encountered 3 types of cystic lesions namely colloid goiter with purely cystic degeneration, cystic papillary carcinoma and the hemorrhagic cyst. Out of this majority of the cases were constituted by colloid goiter with cystic degeneration. There were total 13 cystic lesions of which 10 cases were goiter with cystic degeneration. One was cystic papillary carcinoma of thyroid and two cases were goiter with internal haemorrhage. Among goiter with cystic cases majority were oval in shape with regular margins and only three were mixed echogenic rest were hypo-anechoic. Calcification was seen in one case and intracystic septations in one case. case of papillary carcinoma had irregular shape and margin. Both showed

calcification and metastatic lymphadenopathy. Two cases of goiter with internal haemorrhage which is oval in shape with regular margins and its internal contents were moving according to patient's position. Among cystic lesions 12(92.30%) were benign and 1(7.69%) were malignant.

Solbiati L et al (1985) found 26(6%) cystic lesions out of 401 cases. None of these were malignant lesions.

Wunderbaldinger P et al (2004)⁶ have sonographically examined 74 patients with 97 histologically confirmed cystic lymph node metastases from papillary carcinoma of thyroid ipsilateral to primary tumor (87.8%), mid or lower jugular chain (73.2%).

Solbiati L et al (1992) concluded in their study that most cystic lesions are hyperplastic nodules that have undergone extensive liquefactive degeneration with accumulation of blood, serous fluid and colloidal substance. In the course of this cystic degenerative process, calcification may develop. Our findings are consistent with their findings

SOLID LESIONS:- Among 80 cases of solid lesions 36 cases of Hashimoto's thyroiditis (total-36) showed diffuse enlargement, 36 cases were hypoechoic. Among follicular adenoma cases (total-13) majority were oval in shape and isoechoic showing regular margins. Hypoechoic halo observed in 84.6% of cases. Among 9 papillary cases majority were hypoechoic and irregular in shape with irregular margins. Calcification in 9 cases and lymphadenopathy seen in 8 cases. Among 22 goiter cases 21 showed oval shape one was hyper echoic and 20 cases showed hypo echoic halo. 88.75% cases were benign and 11.25% cases were malignant.

Solbiati L et al (1985) studied 430 thyroid nodules out of which 351(81.6%) were solid nodules. Out of these 65 (18.5%) were goiter, 133 (37.8%) carcinomas and 153 (43.5%) were diagnosed as adenomas.

Consorti F et al (2003) studied 196 patients out of which 33 cases were malignant, 9 cases were follicular adenomas and 154 cases of goiter. Solid lesions were characterized as hypoechoic, isoechoic and hyperechoic lesions depending upon their sonographic appearance. Out of 16 cases presenting with solid thyroid nodules, 4 cases were diagnosed as colloid adenoma (2 were isoechoic and 2 were hyperechoic); 2 cases were diagnosed as follicular adenoma (both of them were isoechoic); 9 cases were diagnosed as Hashimoto's thyroiditis (5 were isoechoic and 4 were hypoechoic); 1 case was diagnosed as papillary carcinoma which presented as hyperechoic lesion.

Solbiati L et al (1985) studied 351 solid thyroid nodules, out of which 74 were hyperechoic, 119 were isoechoic and 158 presented as hypoechoic nodules. 74 hyperechoic nodules comprised of 22 (30%) goiter, 49 (66%) adenoma and 3 (4%) were malignancy. Of the 119 isoechoic nodules, 35 (29%) were goiter, 53 (45%) were adenomas, 31 (26%) were malignancy. Of the 158 hypoechoic nodules 8 (5%) were goiter, 51 (32%) were adenoma and 99 (63%) were malignant lesions.

MIXED LESIONS:-

We encountered 22 cases of mixed (both solid and cystic) lesions in our study group. Total 22 cases were diagnosed as goiter with cystic degeneration and 20 cases were proved to be so. Two cases were falsely diagnosed as goiter with cystic degeneration. Two cases of follicular carcinoma were falsely diagnosed as goiter with cystic degeneration on ultrasound.

Solbiati L et al (1985) found that out of 430 lesions studied by them, 53 were mixed echotexture masses. Out of these 53 cases, 28 (53%) were goiter, 19 (36%) were adenoma and 6 (11%) were malignancies.

CALCIFICATION:-

Calcification within the lesion is very important for characterizing a lesion.

In our study we found 2 types of lesions in which calcification was present 11.11% of colloid goiter cases showed calcification. 100% of papillary carcinoma cases showed calcification.

Solbiati L et al (1985) in their study on thyroid gland with low uptake lesions described that calcification may be present in both benign and malignant nodules. They concluded that it is the location and pattern of calcification that has more predictive value in distinguishing benign from malignant lesions.

Peripheral or eggshell like calcification is perhaps the most reliable feature of a benign nodule but occurs in only a small percentage of benign nodules. When these calcifications are large and coarse, the lesion is most likely to be benign. Fine and punctate calcification is mostly seen in malignant lesions. But we were not able to determine the exact nature of calcification in all lesions; also however not much variation was present among the lesions.

Watters DA et al (1992) have reported calcifications in 37% of malignancies and there was cystic component in 26% of the malignancies.

Microcalcifications are defined as punctate hyperechoic foci without acoustic shadowing where as dense calcifications are defined as hyperechoic foci with acoustic shadowing as stated by Chang TC et al (1990).

Takashima S et al (1995)7 conducted a study to clarify ultrasound evaluation of microcalcifications and to determine whether the calcification seen in ultrasound scans can reliably predict malignant thyroid tumors. They found that out of the various sonographic signs, microcalcification showed the highest accuracy (76%), specificity (93%) and positive predictive value (70%) for malignancy as a single sonographic sign.

HYPOECHOIC HALO:-

Presence and nature of hypoechoic halo is one of the important features that help in differentiating benign from malignant lesion.

In our study, 7.40% of colloid goiter cases and 80% of follicular adenoma cases showed peripheral halo.

Solbiati L et al (1985) concluded in their study that a peripheral sonolucent halo surrounding a thyroid nodule may be present in 60-80% of benign nodules and 15% of thyroid cancers.

Incomplete, irregular peripheral halo favours a malignant etiology while a complete "halo" with regular margin mostly; although not exclusively are encountered in benign lesions.

MICRONODULATION:-

Micronodulation is highly diagnostic of Hashimoto's thyroiditis and was confirmed by Yeh HC et al (1996) in which the positive predictive value for diagnosing Hashimoto's thyroiditis basing on this characteristic finding was 94.7%. Micronodules are 0.1 to 0.65cm in size, hypoechoic and surrounded by an echogenic rim. In our study 36 cases out of 115 were diagnosed to be Hashimoto's thyroiditis.

BENIGN vs. MALIGNANT:- In our study among cystic lesions 92.85% were benign and 7.15% cases were malignant. 83.01% solid lesions were benign and rest were benign. 93.75% of mixed lesions were benign and 6.25% were malignant. Total benign lesions constitute 88.49% and malignant lesions constitute 11.50%. Sensitivity of ultrasound in diagnosing benign lesions is 97% and false positive rate is 3%. The positive predictive value in diagnosing malignant lesions is 76.9%.

Watters DA et al (1992)8 found sensitivity rate of 74%, specificity 85% and positive predictive value of 51% in the study of role of ultrasound in the management of thyroid nodules.

Our diagnostic yield was in between them. We have not come across any case of medullary carcinoma, lymphoma, simple thyroid cyst of thyroid, metastasis or thyroid abscess. Basing on our study, we suggest that more information can be gathered, by taking into account, more number of cases and conducting the study in an endemic area where the turnover of thyroid pathologies would be higher. Also more cases of pediatric age group can be included for further variety of pathologies and study can include non palpable nodules of thyroid as well which can be found out either by clinical symptomatology or by a routine ultrasonological screening procedure especially in goiter endemic areas. It is also advisable to perform color Doppler studies of the thyroid disorders as Doppler evaluation has emerged as a recent and helpful mode of investigation in supplementing the diagnoses of various thyroid pathologies.

CONCLUSIONS

Ultrasound is valuable diagnostic tool with almost good sensitivity and specificity to FNAC in diagnosing thyroid lesions such as Goiter with cystic degenerations, haemorrhagic cysts, Hashimoto's thyroiditis and papillary carcinomas.

- Ultrasound can demonstrate the number of nodules, whether solitary or multiple nodules in a goiter.
- Ultrasound may not be able always to differentiate colloid goiter from follicular adenomas due to overlap of certain features between the two pathologic entities.
- Ultrasound can demonstrate various secondary degenerative changes in thyroid lesions namely, Cystic changes, calcifications, haemorrhage.
- Ultrasound can demonstrate cervical lymphadenopathy when present, in cases of papillary carcinoma of thyroid.

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