

A Study on the Role of Ultrasound in Evaluation of Thyroid Masses

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ABSTRACT

BACKGROUND

Thyroid swelling is a routinely encountered common clinical problem. Various immunological diseases of the thyroid including hypo- and hyper-thyroid states may present as thyroid enlargement. Clinical evaluation of the thyroid is not always conclusive. Hence, the clinician has to depend on various other diagnostic modalities such as ultrasonography, FNAC etc. to achieve a definitive diagnosis.

METHODS

It was a prospective study, conducted in the Department of Radiodiagnosis, Bollineni Super Speciality Hospital, Nellore. Individuals with enlarged thyroid gland, of both gender, aged 18 years more were included in the study. Ultrasound scan was performed with a GE LOGIQ 400MD machine using a linear probe of 11 MHz frequency. Longitudinal and transverse scans of the thyroid gland were done with the patient in supine position and head in hyper-extension. The entire gland including the isthmus was examined. Ultrasound guided FNAC was done and the smears were read by the pathologist after conducting appropriate staining techniques whenever necessary.

RESULTS

Total 30 participants were included, maximum (11) were included in 31 - 40 years category; the female male ratio was 6.5. Among cystic, solid and mixed lesions, our yield was 100% in each category.

CONCLUSIONS

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

KEYWORDS

Report, Thyroid, Ultrasound, Yield

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BACKGROUND

Thyroid swelling is a routinely encountered common clinical problem in the out-patient department. Diffuse enlargement of thyroid gland is the commonest cause for thyroid masses which is commonly seen at puberty and lactation.¹ Though goiter has ceased to be a major problem in many developed countries, it continues to be a serious health problem in many third world countries. In India, the Himalaya goiter belt is the world's biggest goiter belt. Other pathological lesions such as thyroid neoplasms also present in the form of enlarged thyroid mass or thyroid nodule. Various immunological diseases of the thyroid including hypo and hyper thyroid states may present as thyroid enlargement. Clinical evaluation of the thyroid is not always conclusive. Hence, the clinician has to depend on various other diagnostic modalities such as ultrasonography, FNAC and so on to achieve a definitive diagnosis.²

Ultrasonography provides a better anatomical representation of the thyroid gland with remarkable clarity on account of the superficial location of the gland. It can reveal the nature of the mass, number of nodules helpful to detect calcification and the pattern of calcification, assess the vascularity of the lesion. Lymph node status is better evaluated with ultrasound.³

Whereas Ultrasonography guided FNAC can pinpoint the location of lesion for which guided FNAC can be done as blind FNAC can sometimes sample a non-representative part of thyroid and can lead to inconclusive diagnosis. Invasion and involvement of the adjacent structures can be evaluated by ultrasound. Finally, ultrasound is superior to FNAC in diagnosing nodular goiter.

In spite of all the above advantages, ultrasound cannot give the confirmatory diagnosis and cannot distinguish between benign and malignant masses.⁴ Hence, it needs to be correlated with FNAC for achieving a definitive diagnosis. The overall sensitivity of FNAC for the detection of malignancy in both cystic and solid masses is high, ranging from 90-100%.

With these a study was conducted to evaluate the patients with ultrasound followed by ultrasound guided FNAC and to correlate with cytopathology.

METHODS

This study was conducted in the department of Radiodiagnosis, Bollineni superspeciality hospital, Nellore. Study protocol was approved by the ethical committee of the institution. The individuals with enlarged thyroid gland, both gender aged 18 years more were included in the study. Individuals with less than 18 years, who did not submit the informed consent were not considered in the study.

Ultrasound scan was performed with a GE LOGIQ 400MD machine using a linear probe of 11 MHz frequency. Longitudinal and transverse scans of the thyroid gland were done with the patient in supine position and head in hyper-

extension. The entire gland including the isthmus was examined. The examination has also been extended laterally to include the region of the carotid artery and the jugular vein in order to identify enlarged jugular chain of lymph nodes, superiorly to visualize submandibular lymphadenopathy and inferiorly to define any supraclavicular lymphadenopathy. US guided FNAC was done and the smears were read by the pathologist after conducting appropriate staining techniques whenever necessary.

Location of the glands, number, appearance, internal content, echotexture, calcification status, type, posterior sound transmission were recorded using sonographic examination. The results of the examination were interpreted on the basis of these findings and diagnosis was proposed after considering history and physical examination. The results were given as whether the lesion is benign or malignant and has solid, cystic or mixed characteristics.

RESULTS

Total 30 participants were included in the study. Age wise, 36.6% (11) members were included in 31-40 years category, 33% (11) in 21-30 years category, 16.5% (5) were included in 41-50 years category, 6.6% (2) were included in 51-50 years category and 3.3% (1) each were included in 11-20, 61-70 years category, respectively (Table 1). Among the study members, age was ranged between 19-68 years. Gender wise, 86.6% (26) were female participants and 13.4% (4) were male members, the female male ratio was 6.5.

Among the study members, the sonography examination revealed that 13.4% (4) were cystic lesions, 53% (16) were solid and 33% (10) mixed lesions.

On sonography, 2 (50%) lesions were diagnosed as colloid goiter with cystic degeneration which were proved to be the same by FNAC; Sonographically diagnosed two cases, which were haemorrhagic cyst, cystic papillary carcinoma respectively were also proved to be similar by FNAC also (Table 2).

Eight (80%) cases of mixed echotexture lesions were diagnosed as colloid goiter with cystic degeneration. These were proved to be same even by FNAC. One (10%) case each were diagnosed as follicular adenoma; Papillary carcinoma respectively were also proved to be correct by FNAC (Table 3).

When the overall accuracy of ultrasonography was correlated with FNAC, out of 10 (100%) cases of colloid goiter with cystic degeneration, 100% were diagnosed correctly. Out of 4 cases of colloid goiter, 75% (3) were correctly diagnosed and the 1 (25%) misdiagnosed case proved to be follicular adenoma by FNAC. Out of 3 cases of follicular adenoma, 100% were diagnosed to be same with FNAC. One case of haemorrhagic cyst, all the 3 cases of papillary carcinoma and 9 cases of Hashimoto's thyroiditis were diagnosed to be same even with FNAC.

Age	No.	%
11-20	1	3.3
21-30	10	33
31-40	11	36.6
41-50	5	16.5
51-60	2	6.6
61-70	1	3.3
Total	30	100

Table 1. Age Wise Distribution of the Study Participants

Type of Lesion	Diagnosis by	
	Sonographic	FNAC
Colloid Goiter with Cystic DEGENERATION	2 (50)	2 (50)
Haemorrhagic Cyst	1 (25)	1 (25)
Cystic papillary Carcinoma	1 (25)	1 (25)
Total	4 (100)	4 (100)

Table 2. Incidence and Types of Cystic Lesions Observed in Sonographic Examination and Correlation with FNAC; n(%)

Type of Lesion	Diagnosis	
	Sonographic	FNAC
Colloid goiter with cystic degeneration	8 (80)	8 (80)
Follicular adenoma	1 (10)	1 (10)
Papillary carcinoma	1 (10)	1 (10)
Total	10 (100)	10 (100)

Table 3. Incidence and Types of Mixed Lesions Observed on Sonographic Examination and Their Correlation with FNAC; n(%)

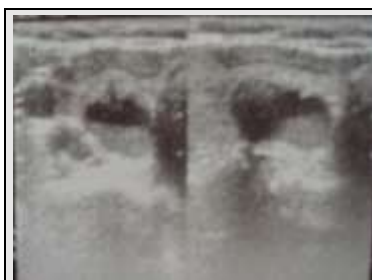


Figure 1. Thyroid Parenchyma Showing Well Defined Anechoic Lesion with Fluid-Fluid Levels

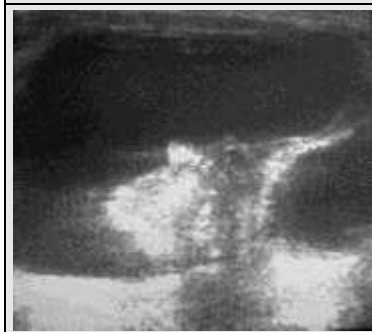


Figure 2. Cystic Papillary Carcinoma Demonstrating Mural Nodule with Calcifications



Figure 3. Nodular Areas with Microcalcifications and Increased Vascularity



Figure 4. Cystic Lymph Node Metastasis

DISCUSSION

This study comprised of 30 patients between the age group 11 to 70 years. The youngest patient in our study was 11 year old female and the eldest was 70 year old female. Majority of the cases (70%) affected were in the age group of 21 to 40 years. Watters DA et al.⁵ reported their experience with 120 patients whose age group was between 13 to 84 years. Yokozawa T et al.⁶ reported their experience with 678 patients in which case the mean age was 52.2 ± 11.9 years. Kim EK et al.⁷ reported their study including 132 patients with age group range of 20 to 77 years. Wunderbaldinger P et al.⁸ conducted a study which included 74 patients with age group range of 23 to 84 years. Screaton NJ et al.⁹ reported their study comprising of 198 patients whose age group range was 14 to 80 years. Rosario PW et al.¹⁰ reported their experience with 84 patients of whose age group range was 19 to 65 years. Lyschik A et al.¹¹ conducted a study among 103 patients, who belonged to pediatric age group range of 9 to 18 years.

Gender wise, 86.7% in this study were female and 13.3% were male participants. Rojeski MT et al.¹² reported a study on nodular thyroid disease concluded that females are more frequently affected than males. Solbiati L et al.³ reported that 71.3% of their study members were females and 28.7% were males. Kim EK et al.⁷ reported that 91% were females. Wunderbaldinger P et al.⁸ concluded that 36.5% were males. 90% females were mentioned by Wienke JR et al.¹³ and 96% female participants were reported by Su DH et al.¹⁴

In a study by Rosen IB et al.¹⁵ out of 174 cases, an accuracy rate was reported to be 96%. Whereas in this study, 100% accuracy was reported. Out of the 3 types of cystic lesions (Table 2), majority of the cases were constituted by colloid goiter with cystic degeneration. There were 4 cases presenting with cystic lesions and 2 cases were diagnosed as colloid goiter with cystic degeneration, 1 case as cystic papillary carcinoma and 1 case as haemorrhagic cyst. All these cases were proved to be correct by FNAC. Hence the accuracy in diagnosing the type of cystic lesions was 100%. Sonographically the cystic degeneration in colloid goiter presented as an anechoic lesion with some internal echoes in the 2 cases. No calcification or hypoechoic halo was observed. Intracystic septations were seen in 1 case. Haemorrhagic cyst sonographically presented as an anechoic cystic lesion with regular margins and some low level internal echoes. Cystic papillary carcinoma presented sonographically as an irregular marginated anechoic lesion with an intramural nodular component showing foci of calcifications. Cystic lymph node metastases were also noted.

Rosen IB et al.¹⁵ found 13% malignancies in cystic lesions in their study. No simple thyroid cyst was encountered in this study in contrary to the study reported by Simeone JF et al.¹⁶ where they found 1 simple cyst out of 116 patients of benign thyroid disease. Solbiati L et al.³ found 26 cystic nodules out of 401 cases. None of these were malignant lesions. They concluded that most cystic

lesions are hyperplastic nodules that have undergone extensive liquefactive degeneration with accumulation of blood, serous fluid or colloid substance. Our findings are consistent with their findings. Watters DA et al.⁵ conducted study in 120 patients with thyroid nodules and found cystic elements in 26% of malignant lesions. Chan BK et al.¹⁷ retrospectively analysed 55 patients with proven papillary carcinoma of thyroid and found that cystic carcinomas were rare and accounted for only 6% of the lesions. Rosario PW et al.¹⁰ have studied 106 thyroid nodules confirmed to be papillary carcinoma after total thyroidectomy and found cystic components in 10.3% of the cases. Wunderbaldinger P et al.⁸ have sonographically examined 74 patients with 97 histologically confirmed cystic lymph node metastases from papillary carcinoma of thyroid ipsilateral to primary tumour (87.8%), mid or lower jugular chain (73.2%).

In this study, 16 (53.3%) solid lesions were diagnosed. Among these, 9 cases (56.2%) were sonographically diagnosed as Hashimoto's thyroiditis, 4 cases (25%) as Colloid goiters, 2 cases (12.5%) as follicular adenomas and 1 case (6.2%) as papillary carcinoma. Out of the 4 cases of colloid goiters, 3 cases were proved to be correct by FNAC but 1 case was proved to be follicular adenoma. This was due to the sonographic similarities and lack of any definite sonographic criteria. Sonographic misinterpretation was also one of the causes. One case of papillary carcinoma was correctly diagnosed. This case also presented with cervical lymphadenopathy. In the case of solid lesions, our accuracy rate was 93.7%. Rosen IB et al.¹⁵ reported 100% accuracy rate for solid lesions. They studied 174 cases out of which 130 (75%) were solid both by sonography as well as FNAC. Out of these 130 cases 26 (20%) were carcinomas, 68 (52%) were adenomas, 2 (1.5%) were cystadenomas, 16 (12.5%) were colloid nodules, 7 (5.3%) were thyroiditis and 11 (8.5%) were diagnosed as goiters. Simeone JF et al.¹⁶ studied 116 cases and they found 99 (85%) cases as solid lesions out of which 66 were follicular adenomas, 21 were goiters and 12 were Hashimoto's thyroiditis. Solbiati L et al.³ studied 430 thyroid nodules out of which 351 (81.6%) were solid nodules. Out of these 65 (18.5%) were goiters, 133 (37.8%) carcinomas and 153 (43.5%) were diagnosed as adenomas. Cox MR et al.¹⁸ have performed ultrasonographic examination of 68 cases of thyroid nodules and they found 18 (26.5%) of them as solid nodules, 3 (17%) of the 18 cases were found to have malignant thyroid nodules. Consorti F et al.¹⁹ studied 196 patients out of which 33 cases were found to be malignant, 9 cases as follicular adenomas and 154 cases as colloid goiters.

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 goiters (2 were isoechoic and 2 were hyperechoic); 2 cases were follicular adenomas (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.³ 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%) goiters, 49 (66%) adenomas and 3 (4%) were malignant. Of the 119 isoechoic nodules, 35 (29%) were goiters, 53 (45%) were adenomas and 31 (26%) were malignant. Of the 158 hypoechoic nodules, 8 (5%) were goiters, 51 (32%) were adenomas and 99 (63%) were malignant lesions.

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. Out of 14 cases of colloid goiters, 5 cases (35.7%) were showing calcification. All the 3 cases of papillary carcinoma (100%) showed calcifications. Solbiati L et al.³ in their study on thyroid gland with low uptake lesions described that calcification may be present in both benign and malignant nodules. In their study the incidence of calcification in benign thyroid lesions was 11% and in malignant lesions it was 17%.

In our study, 8 cases (26.7%) presented with halo, all of which were benign. Out of these, colloid goiters constituted the maximum (87.5%) followed by follicular adenomas (12.5%). Propper RA et al.¹ in a study mentioned that 28 patients with solitary thyroid masses, found hypoechoic halo in 10 cases. Eight of these lesions were benign being either adenomas or benign nodules. Two lesions were malignant. They suggested the possibility of pericapsular inflammatory infiltrate as its underlying anatomic correlate. Solbiati L et al.³ concluded in their study that a peripheral sonolucent halo surrounding a thyroid nodule may be present in 60-80% of benign nodules and in 15% of thyroid cancers. Incomplete, irregular peripheral halo favours a malignant aetiology while a complete halo with regular margin mostly, although not exclusively is encountered in benign lesions.

Micronodulation is highly diagnostic of Hashimoto's thyroiditis and was confirmed by Yeh HC et al.²⁰ in which the positive predictive value for diagnosing Hashimoto's thyroiditis basing on this characteristic finding was 94.7%. Micronodules are 0.1 to 0.65 cm in size, hypoechoic and surrounded by an echogenic rim. In our study, 9 cases out of 30 (30%) were diagnosed as Hashimoto's thyroiditis. An overall account of cases includes 4 cases of Colloid goiter out of which 3 cases (75%) were proved to be correct by FNAC and 1 case was proved to be follicular adenoma. This was due to the sonographic similarities and lack of any definite sonographic criteria. Sonographic misinterpretation was also one of the causes. All the 10 cases (100%) of colloid goiter with cystic degeneration were proved to be correct by FNAC. Rosen IB et al.¹⁵ found 96% accuracy rate with 7 errors made in the ultrasonographic assessment of physical character of the thyroid lesion. Jones AJ et al.²¹ found 75% sensitivity rate with 61% specificity and 19% positive predictive value in a study of comparison of FNAC; radioisotope scanning and ultrasound in the management of thyroid nodule. Watters DA et al.⁵ found sensitivity rate of 74%, specificity rate of 85% and positive predictive value of 51% in a 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 thyrotoxicosis, follicular carcinoma, medullary carcinoma, lymphoma, simple thyroid cyst or thyroid abscess.

Elastography²² and Thyroid Imaging Reporting and Data System (TI-RADS)²³ were ultrasonography based, non-invasive techniques to evaluate thyroid nodules. But in this study these two were not considered.

What This Study Adds to the Existing Knowledge

Basing on our study, we suggest that more information can be gathered, by including 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 paediatric age group can be included for further variety of thyroid pathologies and study may include non-palpable nodules of thyroid 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 colour 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 a valuable diagnostic tool with almost equal sensitivity and specificity to FNAC in diagnosing thyroid lesions such as colloid goiters with cystic degenerations, haemorrhagic cysts, Hashimoto's thyroiditis, and papillary carcinomas. However, ultrasound may not be able to always differentiate colloid goiters from follicular adenomas, due to overlapping of certain features between the two pathologic entities. Ultrasound can also demonstrate cervical lymphadenopathy when present, in cases of papillary carcinoma of thyroid.

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