Section: Radiology

Original Research Article

ULTRASOUND EVALUATION OF THYROID NODULES WITH FNAC CORRELATION

Bhavani Bonla[1]

[1]*Assistant Professor, Department of Radiology, Rajeev Gandhi Institute of Medical Sciences, Adilabad, Telangana, India.*

Received *: 09/06/2024*
Received in revised form *: 12/08/2024*
Accepted *: 27/08/2024*

Corresponding Author:
Dr. Bhavani Bonla,
Assistant Professor, Department of Radiology, Rajeev Gandhi Institute of Medical Sciences, Adilabad, Telangana, India.
Email: bhavanibonla89.bb@gmail.com

DOI: 10.70034/ijmedph.2024.3.183

Source of Support: Nil,
Conflict of Interest: None declared

Int J Med Pub Health
2024; 14 (3); 1014-1022

ABSTRACT

Background: Ultrasonography is a safe, fast, inexpensive, popular, cost-effective, repeatable, non-invasive procedure for investigating thyroid gland and is also a helpful guide for F.N.A.C. Color assisted duplex sonography also helps in accurate estimation of thyroid volume. **Aim:** To study validity of ultrasonographic diagnosis in relation to Fine Needle Aspiration Cytology (FNAC) diagnosis.

Materials and Methods: Cross section study was conducted from June 2023 to May 2024. Based on the inclusion and exclusion criteria, 70 cases of thyroid nodules diagnosed by ultrasound were included in the study. The ultrasound examination was done in the department of Radiology, Rajeev Gandhi Institute of Medical Sciences, Adilabad. These 70 cases which were found to have thyroid nodules on ultrasound were subjected to FNAC for confirmation of ultrasound finding and establishment of final diagnosis.

Results: The disorders of thyroid gland are most common in female population compared to male population. Maximum number of patients in our study were encountered in the age group of 31-40 (41%) and 41-50 (25.7%). Patients of solitary thyroid nodule formed the largest proportion of the cases in our study and ultrasound was able to depict successfully solitary thyroid nodule, colloid cyst and multinodularity in our study. In comparison, to other studies our study gave a similar picture in terms of benign lesions being much more common than malignant lesions. In comparision to other studies, we were able to detect malignant nodules with better specificity. The most common benign lesion determined in our study was adenomatous nodules which was the most common benign lesion in many other studies. Ultrasound was able to detect micro calcification in 4 cases and lymph node invasion in 6 cases of our study group which were diagnosed as carcinomatous lesion. On HPE there turned out to be 4 cases of papillary carcinoma, 2 follicular and medullary carcinoma 1 case which was diagnosed as multinodular goiter with degenerative changes turned out to be papillary carcinoma.

Conclusion: Ultrasound clearly helps to differentiate between micro and macro calcification and lymphnode involvement. Micro calcification and lymph node involvement are most commonly seen in most of thyroid carcinoma Being a safe, simple, repeatable and without radiation exposure to the patient, it is worthy of being included in routine diagnostic work up.

Keywords: Seasonal influenza, vaccination, hospitalization, high-risk populations, FNAC, Thyroid, Multinodular, Papillary Carcinoma, USG.

INTRODUCTION

Thyroid nodules are a common clinical problem with prevalence varying according to method of examination used. Ultrasonography (USG) is the most sensitive diagnostic tool for detecting presence of thyroid nodule. Thyroid diseases are most common among all the endocrine diseases in India. Thyroid nodules are very common and may be

observed in Ultrasonography in 50% of the adult population.[1]

Nodular thyroid disease is detected in 3–7% of the adult population worldwide. The high prevalence of thyroid nodules in the general population calls for a clear strategy to identify patients in whom surgical excision is genuinely indicated as opposed to those who can be managed conservatively,[2,3]

Ultrasonography is relatively cheap, easily accessible, rapidly performed and has advantage of no exposure to ionizing radiation. Since the thyroid gland is superficially located, high resolution real time grayscale sonography can demonstrate normal thyroid anatomy and pathologic conditions with remarkable clarity. As a result, this technique has come to play an increasingly important role in the diagnostic evaluation of thyroid diseases.

USG of the thyroid helps in measuring the tumour size, diagnosing multinodularity and excluding contralateral disease.

USG can also suspect malignancy in a lesion on the basis of certain sonographic characteristics and further categorize it into papillary, follicular, medullary, anaplastic.

So the basic use of sonography for the evaluation of nodular thyroid is to

- Determine location of palpable neck mass, example thyroid or extra thyroid.
- Characterize benign or malignant nodule features.
- Detect acute nodule in a patient with history of head and neck irradiation or MEN II syndrome.
- Determine extent of known thyroid malignancy.
- Determine residual or recurrent and metastatic carcinoma.
- Guide fine needle aspiration of thyroid nodule or cervical lymph node.[5]

Aim and Objectives

1. To study ultrasonography as a prime diagnostic imaging modality on 70 patients with palpable and non-palpable thyroid nodules.
2. To study validity of ultrasonographic diagnosis in relation to Fine Needle Aspiration Cytology (FNAC) diagnosis.

MATERIAL AND METHODS

Cross section study was conducted from June 2012 to May 2024. Based on the inclusion and exclusion criteria, 70 cases of thyroid nodules diagnosed by ultrasound were included in the study. The ultrasound examination was done in the department of Radiology, Rajeev Gandhi Institute of Medical Sciences, Adilabad. These 70 cases which were found to have thyroid nodules on ultrasound were subjected to FNAC for confirmation of ultrasound finding and establishment of final diagnosis. Following inclusion and exclusion criteria were used for selection of cases for the present study.

Inclusion Criteria

- Patients presenting with clinically palpable swelling in the thyroid region.
- Patients presenting with congenital abnormalities of thyroid gland.
- Patients with clinical suspicion of thyroid dysfunction.
- Patients complaining of pain in thyroid region.

Exclusion Criteria

- Secondaries in the neck.
- Swelling in the neck other than thyroid.
- Ectopic thyroid.
- Post-operative recurrences.
- Post-radiotherapy and post radio isotopic therapy of thyroid.

Equipment

In the present study gray scale real time ultrasound examination was using 7.5 to 10 MHz, liner array transducer was used at Rajeev Gandhi Institute of Medical Sciences, Adilabad.

Ultrasound Machine used is:

P H I L I P S E N V I S O R

Technique of Examination

The patient is examined in the supine position with an extended

FNAC Technique

Before the ultrasound guided FNAC, the neck is hyper extended and the skin is cleansed with povidone –iodine (Betadine) solution. The transducer is also cleansed with same solution. Sterile gel is used as a coupling agent. In our study we used 7.5 MHz linear transducer to take FNAC. Then the needle is held in one hand and the transducer in the other. The needle is inserted through the skin of thyroid region in front of the neck at an oblique angle within the image plane of transducer.

The needle used for thyroid FNAC is standard 1½" 25 gauge, non-cutting beveled edge needle. The needle is attached to 10ml syringe. After introducing the needle, the needle is moved gently but rapidly through the nodule center under US guidance. Then gentle suction is done by putting the piston of the syringe. If the specimen contains much blood a non-aspiration technique is used. In this 25-gauge needle is inserted under ultrasound guidance into the thyroid gland and no suction is applied and this needle is moved in back and forth excursions. Due to capillary action the fluid of cells from the nodule moved into the needle such fluid specimen is often in less bloody.

Two drops of the aspirate/ fluid in the syringe is ejected over a clean slide and with the help of the other blank slide with 60° angle, the aspirate on the first slide is spread on it to form a film of coating on it. The slide making procedure is repeated once more and after smearing the second slide, these slides are put in a jar containing absolute alcohol for fixation. These two slides in alcohol along with container is sent to Pathology department for cytopathological study.

Statistical Analysis: Statistical analysis was done by using proportions. The sensitivity, specificity, positive predictive value and negative predictive values were determined for all cases.

RESULTS

Figure 1: Adenomatous nodule in left lobe of thyroid

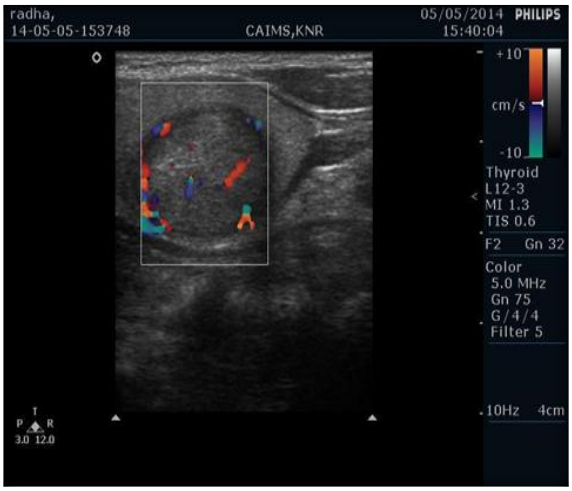

Figure 2: Peripheral halo sign with vascularity in adenoma

Figure 3: Colloid cyst in left lobe of thyroid gland

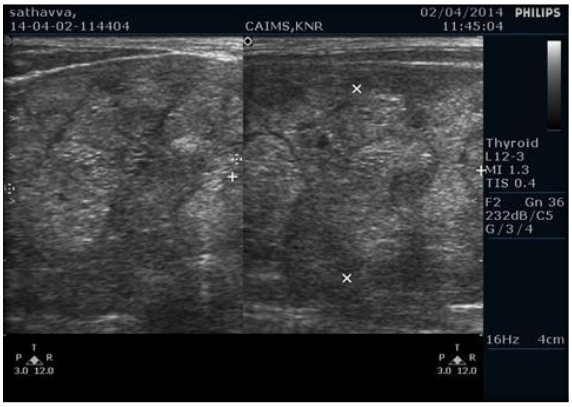

Figure 4: Multinodular goitre in both lobes of thyroid gland

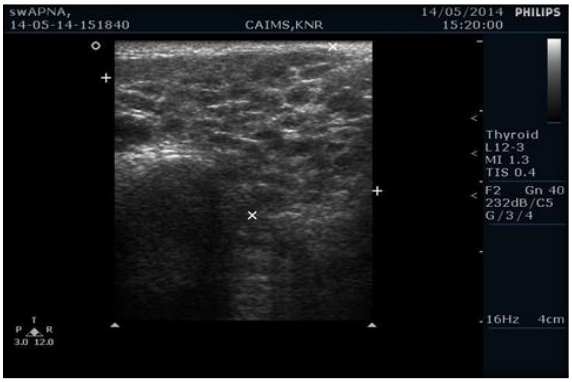

Figure 5: Hashimoto's Thyroiditis

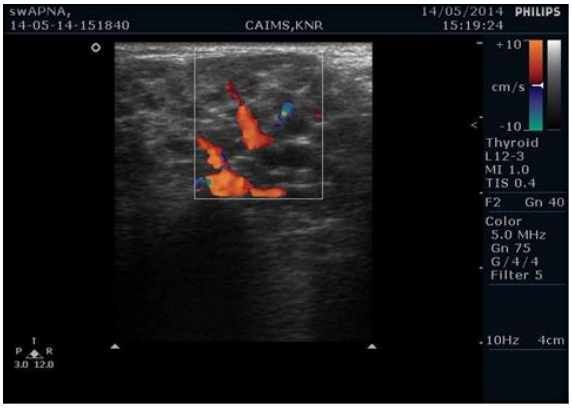

Figure 6: Increased Vascularity in Hashimoto's Thyoriditis

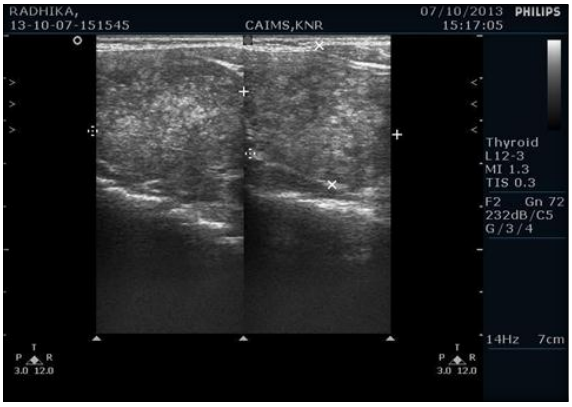

Figure 7: Hetrogenous Architecture of Left Lobe of Thyroid Gland in Patient with MNG

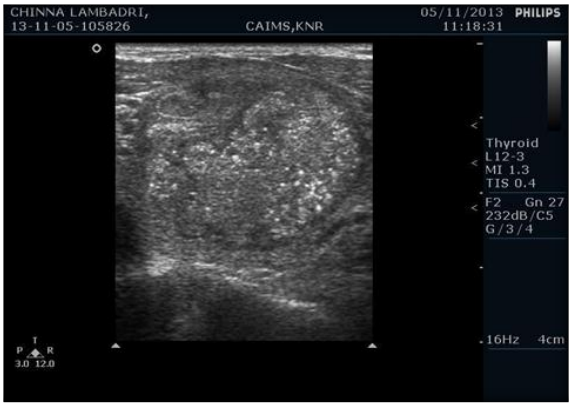

Figure 8: Mass with microcalcifications in Left lobe of Thyroid gland

Figure 9: Mass with peripheral incomplete egg shell calcifications and cystic changes in Left lobe of Thyroid gland

In the study, the youngest patient was 11 years of age and oldest 70 years. The maximum number of cases in the age group of 31-40 (41%) and 41-50 (25.7%) and female predominating (70%) over males 30%). [Table 1]

In the study, in maximum cases swelling was observed on both sides (32.8%) followed by midline (24.1%) and right side (20.0%). Lowest swelling sites observed on left side (7.1%). Total cases of swelling are more (84.3%) as compared to non swelling cases (15.7%). [Table 2]

Out of 59 swelling cases, maximum time duration of swelling cases is observed to be 7 months to 1 year i.e., (44.1%) and minimum time duration of swelling cases is more than 2 years i.e., (51%). [Table 3]

It was observed that among 59 patients of thyroid swelling most common consistency was soft i.e., 27 (45.8%), followed by nodular 15 (25.4%), firm 3 (5.0%) and hard 4 (6.8%). [Table 5]

It is seen that the lesion site in maximum number of cases through ultrasound were seen in both lobe i.e., 32 (45.7%) followed by left lobe and right lobe 20 (28.6%) and 15 (21.4%) respectively. The minimum number of lesion site was seen at Isthmus 3 (4.3%). [Table 6]

In the study it revealed that the echo texture of lobe in maximum number of cases seen are Hypoechoic 22 (31.2%), followed by Iso echoic 20 (28.6%) and Hetrogenous in 12 (17.2%). [Table 7]

It is observed that most of the cases are single nodules 52 (74.3%), followed by multiple nodule cases 08 (25.7%) and diffuse cases are less 4 (5.6%). [Table 8]

It is observed that out of 70 thyroid cases, calcification was seen in 10 (14.3%) cases. Among calcification, micro calcification was seen in 6 (60%) cases and macro calcification was seen in 4 (40%) cases. [Table 9]

Out of 70 thyroid cases, involvement of lymph nodes was seen in 6 cases (8.5%)and no involvement of lymph node in 64 (91.5%). [Table 10]

The above table show that ultrasound can detect Adenomatous nodule in 28 (38.8%) patients and colloid cyst in 16 (22.9%) and Multinodular goiter in 12 (17.2%) cases. [Table 11]

In the study, maximum number of cases observed by FNAC test are Adenoma cases 28 (40%), followed by colloid goiter 20 (28.6%) and Multinodular goitre 12 (17.2%). [Table 12]

Table 1: Age and Sex wise distribution of Thyroid Swelling Cases

Age in Years	Sex					
	Male		Female		Total	
	No.	%	No.	%	No.	%
11-20	01	1.4	02	2.9	03	4.3
21-30	04	5.7	09	12.9	13	18.6
31-40	08	11.5	21	30.0	29	41.4
41-50	05	7.1	13	18.5	18	25.7
51-60	02	2.9	04	5.7	06	8.6
61-70	01	1.4	00	0.0	01	1.4
Total	21	30	49	70	70	100

Table 2: Distribution of cases according to site of swelling

Site of Swelling	No. of Cases	Percentage
Left Side	05	7.1
Right Side	14	20.0
Mid Line	17	24.4
Both Sides	23	32.8
Total Swellings	59	84.3
No Swelling	11	15.7
Total	70	100

Table 3: Classification of cases according to duration of swelling

Duration	No. of Cases	Percentage
0 – 6 Months	21	35.6
7 – 1 Year	26	44.1
1.1 – 2 Years	09	15.2
> 2 Years	03	05.1
Total	59	100

Table 4: Movement of Swelling

Movement	No. of cases	Percentage
Positive	59	84.3
Negative	11	15.7
	70	100

Table 5: Clinical Examination of Consistency of Thyroid Swelling

Consistency	No. of Cases	Percentage
Soft	27	45.8
Solid	10	17.0
Nodular	15	25.4
Firm	03	05.0
Hard	04	6.8
Total	59	100

Table 6: Distribution of cases according to site of lesion on ultrasound

Lesion	No. of Cases	Percentage
Left Lobe	20	28.6
Right Lobe	15	21.4
Both Lobe	32	45.7
Isthmus	03	4.3
Total	70	100

Table 7: Distribution of cases according to echo textures of the nodules

Echotextures	No. of Cases	Percentage
Iso echoic	20	28.6
Hypoechoic	22	31.4
Hyperechoic	06	8.6
Hetrogenous	12	17.2
Anechoic cyst	05	7.1
Hetrogenous with cystic	01	1.4
Left hetro and Right Iso	03	4.3
Normal	01	1.4
Total	70	100

Table 8: Nodules Wise Distribution of Cases

No. of Nodules Present	No. of Cases	Percentage
Single	52	74.3
Multiple	08	11.4
Diffuse	04	5.6
No Nodules	06	8.5
Total	70	100

Table 9: Distribution of goiter cases according to calcification

Calcification	No. of Cases	Percentage
Micro	06	60
Macro	04	40
Total	10	100

Table 10: Distribution of thyroid cases according to involvement of lymph node

	Present	Absent	Total
Lymphnodes	6	64	70
Percentage	8.5	91.5	100

Table 11: Overview of Various Ultrasound Findings

Ultrasound Findings	No. of Cases	Percentage
Adenomatous nodule	28	38.8
Multinodular goitre	12	17.1
Colloid cyst	16	22.9
Hashimotos thyroiditis	02	2.8
Carcinoma	12	17.1
Total	70	100

Table 12: Distribution of thyroid nodules According to FNAC Findings

Findings	No. of Cases	Percentage
Adenoma	28	40
Multinodular goitre	12	17.2
Colloid goitre	16	28.6
Hashimotos thyroiditis	02	2.9
Medullary carcinoma	01	1.4
Papillary carcinoma	04	5.7
Follicular carcinoma	02	2.9
Diffuse hypertrophy	05	7.1
Total	70	100

Table 13: Diagnostic Validity of Ultra Sonography with Correlation to FNAC

		FNAC	
Ultra Sonography	**Total**	**Malignant**	**Benign**
Malignant	12	7	5
Benign	58	2	56
Total	70	09	61

Sensitivity 77.7%
Specificity 91.0%

Positive Predictive Value 58.3%
Negative Predictive Value 96.5%
Diagnostic E fficiency 90%

DISCUSSION

With the development of real time small part sonography, it has become practical to evaluate routinely the superficial structures of the neck.
Ultrasound is an useful modality in the work up of thyroid abnormalities. It can easily differentiate between thyroid nodules and other cervical masses. Alternatively sonography may help to confirm the presence of a thyroid nodule when the findings of physical examinations are equivocal.
The present series of study consisted of 70 cases who presented with palpable and non palpable thyroid nodules. Certain points related to the subject are considered in the discussion.

Age and Sex Distribution of thyroid nodules

In a study conducted by Jeffery R. Wienke et al., with an age range of 20–60 years, in patients with thyroid nodules – most of the patients were in the age group of 3rd to 5th decade and out of 70 cases 63 were females and 7 were males constituting a ratio of 4:1.[4]
In the present study out of 70 patients with varios thyroid disorders maximum number of cases (47) were found them from 3rd to 5th decades (66.71%) and most of the lesions were seen in females (70%) as compared to males Age of touhe patients in present study ranged from 11-70 years with a Median age of 35 years. (66.71%) and most of the lesions were seen in females (70%) as compared to males (30%). Age of the patients in present study ranged from 11-70 years with a Median age of 35 years. Age distribution of the present study is comparable to Jose RJ et al,[5]

Solitary Thyroid Nodules

In a study conducted by C. Cappelli et al., a total of 6135 nodules were obtained of which 4495 patients had solitary nodules and 1231 patients had multiple nodules.[6]
In present study out of 70 cases, 52 cases had solitary thyroid nodules and 12 patients had multiple nodules. The result of the present study was similar as compared to previous studies.

Sonographic Patterns of Thyroid Lesions

Adenomas

In a study conducted by Jeffery R. Winke et al., on 82 thyroid nodules of which 41 (50%) revealed to be adenomas, 27 cases were colloid cyst.[4]
In a study carried out on 50 cases by Kamaljit Kaur et al., out of 50 cases of STN, 20 cases were adenoma (40%) colloid in 14 (28%) and thyroiditis in 3 cases.[7]
In the present study, out of 58 benign thyroid nodules 28 were adenomatous nodules (50%), 16 were colloid goitre (28.5%), 12 were diagnosed as multinodular goitre (21.4%) and 2 were hashimototo's thyroiditis (2.8%) on ultrasonography. All of them were subjected to FNAC and 28 cases were diagnosed as adenomas.

USG Features of Adenomatous nodules

On USG, adenomas appear as solid masses that may be hyperechoic, isoechoic or hypoechoic. They often have a peripheral hypoechoic halo that is smooth and thick. This halo is due to fibrous capsule and blood vessels, which can be readily seen by color doppler. Often, vessels pass from the periphery to the central regions of the nodule, creating a "spoke-and-wheel-like"appearance.[8]
A completely uniform halo around a nodule is highly suggestive of benignity, with a specificity of 95%.[9]
In one series 7 cases of adenomas were studied. Sonographic features present in nearly all the cases included a well-defined sonolucent rim or halo (5 cases) and varying degrees of internal cystic change

within the nodule (6 cases). In one study, of the 16 follicular adenomas studied all of them on ultrasound showed a solid element. Whereas cystic components were seen in follicular cystadenoma and colloid adenomas.[10]

In one very large series of over 200 patients, the solitary hyperechoic ultrasound pattern was the most frequent, seen in 66% of the adenoma the common ring like calcification around the periphery of the nodule producing posterior shadowing from the anterior margin and is quite specifics and the halo in about 60% of these lesions. Calcification of adenomas is for adenoma.[11]

The presence of a sonographic halo surrounding follicular neoplasms is a frequent finding and was more frequently associated with benign follicular neoplasia in our study. In all likelihood, the sonographic halo corresponds with the well-defined capsule that surrounds many follicular adenomas and whose continuity is important for the pathologist to describe as a feature of benignity.

In present study out of 56 benign thyroid nodules, 28 were adenomas,20 cases were colloid goiter and 12 cases were multinodular goiter. Of the 28 adenomas, USG revealed hypoechoic nodule in 15 cases, isoechoic in 10 cases and 2 cases revealed hetroechoic with cystic changes. Peripheral halo sign was seen in 15 cases and macro calcification was present in 4 cases. The findings in the present study is nearly comparable to Simeone et al.[12]

Malignant Tumours

The histological classification includes papillary carcinoma (60% to 80%), follicular carcinoma (20% to25%), anaplastic carcinoma (3% to 10%), medullary carcinoma (4% to 5%), lymphoma (5%), and metastases.[13]

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 microcalcifications are one of the most specific features of thyroid malignancy. With ultrasound, microcalcifications appear as punctate hyperechoic foci without acoustic shadowing. Coarse calcifications are the most common type of calcification are commonly associated with medullary carcinomas. They may be seen in multinodular goitres also.

Papillary Carcinoma

In present study out of 70 cases, carcinoma was diagnosed on ultrasound in 12 cases and on FNAC as 7 cases, of which papillary carcinoma was diagnosed in 4 patients, lymph node invasion was seen in all the patients. The results of the present study were comparable to the previous studies. 14,7

USG Features of Papillary Carcinoma

Sonographically appears as hypoechoic mass (90%) due to closely packed cells with minimal colloid substance. There are punctuate echogenic foci due to microcalcifications with or without acoustic shadows. These microcalcifications are diagnostic of papillary carcinoma of thyroid gland.

Pedro Weslley et al., studied features of papillary carcinoma in 106 nodules which revealed hypoechogenicity in 90.5% no calcification in 59.4% and micro calcification in 264%.[15]In the study conducted by Chan et al, 86% of the papillary cancers were hypoechoic; other authors found 77% to 89% of papillary thyroid carcinomas to be hypoechoic.[16,17]

In present study, our study cases diagnosed with papillary carcinoma revealed following features - hypoechogenicity in 3 cases. 1 case was hetrogenous with multiple nodules, micro calcification was present in a 3 cases and lymphnode invasion was seen in all the cases.

Follicular Carcinoma

In a study conducted by Kamaljit Kaur et al., of the 9 malignant cases 2 cases were diagnosed as follicular carcinoma which revealed similar findings of hypoechoic nodule with irregular margins and no cystic component.[6]

Present study: In a total of seven cases, only 2 (2 8. 5 %) cases were diagnosed as follicular carcinoma on FNAC. Ultrasound: Ultrasound revealed solid hypoechoic pattern with no cystic component with irregular margins.

Medullary Carcinoma

In our study, 1 case is diagnosed by HPE as medullary carcinoma. USG showed a solid hypoechoic pattern with microcalcification and posterior acoustic shodowing. The lesion showed irregular margins and no peripheral halo.

Solbiatial et al., conducted a study in which a total of 9 cases with 9 nodules were histopathologically proved to be the cases of medullary carcinoma, which revealed a solid isoechoic lesion in 3 of 9 cases and all the 9 nodules had irregular margins and none of them had a peripheral halo around it.[18]

In a study by Saller et al,[19] hypoechogenicity was present in all 19 carcinomas investigated, and intranodular calcifications were present in 19 patients (95%).

Hashimoto's Thyroiditis

On microscopy hurthle cells are diagnostic of Hashimotos thyroiditis. These findings are described by Rumack, et al.[20]

In a study conducted by Sao Paulo et al.,38 patients previously diagnosed as thyroiditis by the ultrasound had been studied 37 of 38 patients revealed thyroid gland with heterogeneous echotexture and diffuse hypoechogenicity.[21]

Thyroglossal cyst

Sonographically appears as anechoic lesion with posterior acoustic enhancement and moves with deglutition, situated in midline and extends upto lobe of thyroid gland. These findings are in accordance with Rumack et al,[20]

In present study one case was diagnosed by FNAC as Thyroglossal cyst.

Multinodular Goiter

The ultrasound diagnosis rests on the finding of multiple nodules within a diffusely enlarged gland. A diffusely enlarged thyroid gland with multiple

nodules of similar US appearance and with no normal intervening parenchyma is highly suggestive of benignity, thereby making FNA biopsy unnecessary.

In the present study 12 cases were diagnosed sonographically and all of them were confirmed on FNAC as MNG. It shows 100% usg and FNAC correlation.

Colloid cyst

In present study,[16] cases were found which were predominantly cystic in nature. There is no lesion which is completely cystic. On ultrasonic imaging 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. Solid component within the cysts were echogenic in 11 cases. Ultrasound guided fine needle aspiration biopsy was done in all 16 cases and showed that they were benign colloid goitres.

In present study the percentage of colloid goitre cases is very less as compared to William Scheible et al,[11] and Nirad Mehta et al,[22] probably because of low sample size as compared to the previous studies.

DIAGNOSTIC VALIDITY OF DUPLEX SONOGRAPHY WITH FNAC CORRELATION

According to several reports, for the differentiation of benign versus malignant thyroid nodules, sonography has sensitivity rates ranging from 63% to 94%, specificity from 61% to 95% and an overall accuracy from 80% to 94%.[23]

In our study we found sensitivity of 77.7%, specificity of 91%, positive predictive value of 58.3%, negative predictive value of 96.5% and overall diagnostic efficiency of 90%.

In the study conducted by Ankush Dhanadia92, for detection of malignancy ultrasound had sensitivity of 83.3%, specificity 72.7%, PPV 29.4%, NPV 96.9% and accuracy of 74%. In present study for detection of malignancy ultrasound had sensitivity of 77.7%, specificity 91%, PPV 58.3%, NPV 96.5% and diagnostic efficiency of 90%.

CONCLUSION

Color Doppler sonography is a safe, fast, inexpensive, popular, cost- effective and repeatable non-invasive procedure for investigating thyroid gland. Ultrasound in our study of 70 patients was found to be the gold standard for assessing the morphological structure of the gland along with the gland size. It helps us to know clearly whether the lesion is solitary or multiple. It helps to clearly differentiate between solid and cystic lesions.

Ultrasound was clearly able to depict solitary nodules in more than 50% of our cases (of which around 38.8% were adenomatous lesion and around 22% were colloid cyst). The diffuse heterogenous echotexture of the gland with characteristic hypoechoic nodules clearly helps us in diagnosing Hashimotos thyroiditis (2 cases in our study revealed the above features). In addition, ultrasound helps to differentiate benign lesions from malignant thyroid lesions in most of the cases. The characteristic of benign lesions are well defined margin, thick sonolucent halo, purely cystic lesions can be clearly depicted by ultrasound.

Conflict of Interest: None

Funding support: Nil.

REFERENCES

1. Henrichsen, T.L., Reading, C.C.2011. Thyroid Ultrasonography. Part 2: nodules, Radiol. Clin. North Am.,49: 417-24.
2. Solbiati L, Charboneau JW, Osti V, James EM, Hay ID. The Thyroid Gland. In: Wilson SR, Charboneau JW, Rumack CM, editors. Diagnostic Ultrasound. 3rd ed. Missouri: Mosby, Elsevier Inc;2005:735-70.
3. Yeung MJ, Serpell JW. Management of the solitary thyroid nodule. Oncologist 2008; 13:105-12.
4. Jeffery R Wienke MD., Wuikchong MD., et al. Sonographic features of benign thyroid nodules. In observer reliability and overlap well malignancy.
5. Jose RM, Smile SR, Iyengar KR.The role of imprint cytology in Intra operative diagnosis of thyroid swelling. Indian J Pathol Microbiol 2002; 45:393-96.
6. C. Cappelli, M. Castellano, I. Pirolo et al. Department of Medical and Surgical Sciences, Internal Medicine and Endocrinology Unit, University of Brescia, Brescia Italy. QJM Advance Acess Published 2006; 56:78-86.
7. Kamaljit Kaur, Nishi Sonkhya, A.S. Bapna, Pradeep Mital. A Comparative study of fine needle aspiration cytology, ultrasonography and radionuclide scan in the management of solitary thyroid nodule: A prospective analysis of fifty cases. Indian Journal of Otolaryngology and Head & Neck Surgery.2002; 54: 96-101.
8. Luigi solbiati, J. William et al: The USG of thyroid gland, Rumack diagnostic ultrasound, 2nd edition 1997, Vol-I: 703-28.
9. Carcangiu ML, Zampi G, Pupi A, Castagnoli A, Rosai J. Papillary carcinoma of the thyroid: a clinicopathologic study of 241 cases treated at the University of Florence, Italy. Cancer 1985; 55:805–28
10. Ralph S., Patrica K., Malcoln CB., David A. Ultrasound scanning for the thyroid as a guide to the treatment of clinically solitary nodule. B. J. R.1997; 64: 841 – 46.
11. Scheible W., Leopold GR., Gosink GR. High resolution real time ultrasonography of the thyroid nodules. Radiology 1979; 133:413– 17
12. Simeone JF et al: Sonography in follow up of 100 patients with thyroid carcinoma AJR 1987; 148:45-49.
13. BrKljacic B et al: Ultrasound evaluation of benign and malignant nodules in echographically multinodular thyroids. J Clin Ultrasound 1994; 22:71-76.
14. Uzma Bhukare, Saleem Sadiq, Jawid Menon et al. Thyroid carcinoma in Pakistan: a respective review of 998 cases from an academic referral center.2009; 2:345-48.
15. Pedrowesslly Souza do Rosario MD., Tales Alvarenga Fagundes et al.USG features of papillary thyroid carcinoma. J Ultra Med. 2004;23: 572-78.
16. Watters DA, Ahuja AT, Evans RM, et al. Role of ultrasound in the management of thyroid nodules. Am J Surg 1992; 164:654–57.
17. Lu C, Chang TC, Hsiao YL, Kuo MS. Ultrasonographic findings of papillary thyroid carcinoma and their relation to pathologic changes. J Formos Med Assoc 1994; 93:933–38.
18. Solbiati L., Votterren, Rizzoechi G., Candiani F., Ferrari F., Giuseppetti G., et al. Thyroid gland with low uptake. Evaluation by ultrasound. Radiology 985; 55: 187 – 91.
19. Saller B., L Mocller, R. Gorges, OE. Janssen, K. Mann. Role of conventional ultrasound and color Doppler sonography in the diagnosis of medullary thyroid

carcinoma. Exp. Clin. Endocrinal Diabetes. 2002; 110:403 – 07.
20. Rumack CM, Wilson SR, et al: Diagnostic ultrasound. Third edition 2005; Vol.1, page 735-767.80 Scheible W, Leopold GR, et al: High resolution real time ultrasonography of thyroid nodules. Radiology. 1979; 133:413-17
21. Sao Paulo. Ultrasound findings in thyroidites. Radiol Bras. 2007; 40:101-06
22. Nirad Mehta et al: Sonographic appearance of solitary thyroid nodules, IJRA 1994; volume 4;207-11.
23. Jenny K. Hoang, MBBS, FRANZCR, Wai Kit Lee, MBBS, et al:US Features of Thyroid Malignancy: Pearls and Pitfalls, Aug 2006.