Print ISSN: 2321-6379
Online ISSN: 2321-595X

Original Article

Ultrasonography and Ultrasound-guided Fine-Needle Aspiration Cytology Correlation of Thyroid Lesions

Kamlesh Prasad Gupta[1], Sonal Gupta[2]

[1]Associate Professor, Department of Radio Diagnosis, Sukh Sagar Medical College and Hospital Chargawan Road Mukunwara, Jabalpur, Madhya Pradesh, India, [2]Resident Medical Officer III Year, Department of Radiodiagnosis, GMC, Bhopal, Madhya India

Abstract

Introduction: The thyroid gland is the largest of all endocrine glands and is the only one which is amenable to direct physical examination due to its superficial location. Superficial location of the thyroid gland allows excellent visualization and evaluation of its normal anatomy and pathologic condition by high-resolution real-time gray scale sonography. The aim of this study is to assess the role of high-resolution real-time gray scale ultrasonography in evaluating patient with thyroid enlargement.

Materials and Methods: This prospective study was carried out on 100 patients who came our department from period of February 2022 to November 2022. Gray scale ultrasound of neck followed by ultrasound-guided (USG) fine-needle aspiration cytology of thyroid swelling in 100 patients aged 10 to 80 years was done.

Results: Out of 100 cases, 8% were malignant, 66% were benign, and 26% were indeterminate lesions on gray scale ultrasound. All the eight malignant cases were correctly diagnosed as malignant on pathology. Out of 66 benign cases, two benign cases proved to be malignant on pathology as papillary carcinoma. Both cases on USG presented as a hypoechoic lesion with well-defined margin and coarse calcification. Due to coarse calcification, they were diagnosed as benign on ultrasonography but turned out to be malignant on pathology as papillary carcinoma. Out of 26 indeterminate cases, two cases proved to be malignant and 24 cases benign on pathology.

Conclusion: High-resolution gray scale ultrasound has emerged as an initial imaging modality of choice for the evaluation of patients with thyroid enlargement ultrasound can detect solitary nodule, multiple nodules, and diffuse thyroid enlargement. It can also differentiate solid and cystic lesions.

Key words: Fine-needle aspiration cytology, Thyroid, Ultrasound-guided

INTRODUCTION

The thyroid gland is the largest of all endocrine glands and is the only one which is amenable to direct physical examination due to its superficial location. Superficial location of the thyroid gland allows excellent visualization and evaluation of its normal anatomy and pathologic condition by high-resolution real-time gray scale sonography.[1-4]

Access this article online

www.ijss-sn.com

Month of Submission : 11-2022
Month of Peer Review : 12-2022
Month of Acceptance : 12-2022
Month of Publishing : 01-2023

Ultrasound is generally the first choice for the evaluation of thyroid morphology due to its high sensitivity for small nodule detection. The spatial resolution achieved by ultrasound is of the order of 0.7–1 mm, not achieved by any other imaging method.[5] The advantages of sign and symptoms suggestive of thyroid disorder ultrasound are that it is an easily accessible, inexpensive, non-invasive, and highly sensitive imaging modality for distinguishing cystic from solid lesion. Color Doppler study helps in assessment of blood flow in addition to depiction of the morphology.

The aim of this study is to prove ultrasound-guided (USG) as the best first-line investigation for thyroid lesions supported by fine-needle aspiration cytology (FNAC) correlation.

Corresponding Author: Dr. Kamlesh Prasad Gupta, Associate Professor, Department of Radio Diagnosis, Sukh Sagar Medical College and Hospital Chargawan Road Mukunwara, Jabalpur - 482 003, Madhya Pradesh, India.

MATERIALS AND METHODS

This prospective study was carried out on 100 patients who attended the various OPD and/or IPD of in Sukh Sagar Medical College and Hospital, Jabalpur MP., from February 2022 to November 2022.

Gray scale ultrasound of neck followed by USG FNAC of thyroid swelling in 100 patients aged 10–80 years was done.

Patient Selection

It was based on following criteria:

Physical examination suggestive of palpable thyroid swelling in lower neck in midline or on either side(hyper/hypothyroidism).

Exclusion Criteria

The patient already diagnosed and treated for thyroid lesion. FNAC showing inadequate aspirated material.

RESULTS

Out of 100 cases, 8% were malignant, 66% were benign, and 26% were indeterminate lesions on gray scale ultrasound. All the eight malignant cases were correctly diagnosed as malignant on pathology. Out of 66 benign cases, two benign cases proved to be malignant on pathology as papillary carcinoma. Both cases on USG presented as a hypoechoic lesion with well-defined margin and coarse calcification. Due to coarse calcification, they were diagnosed as benign on ultrasonography but turned out to be malignant on pathology as papillary carcinoma. Out of 26 indeterminate cases, two cases proved to be malignant and 24 cases benign on pathology [Figures 1-5 and Tables 1-9].

DISCUSSION

Age Distribution

In the present study, most of the patients (30%) were in 30–39 years age group, the youngest being 18 years old and the eldest 74 years old. The mean age was 39 years. In a similar study by Goong *et al.*, the age range was 26–75 years with mean age of 51 years.

Gender Distribution

In the present study, 72% patients were female and 28% were male. The male-to-female ratio was 1:2.5. Hence, females are more commonly affected than males. In a study by Goong *et al.,* 78% patients were females and 22% males.

Clinical Presentation

All the 100 patients presented with clinical thyroid enlargement, either in the mid line or on the lateral aspect. About 94% patients presented with gradual onset and 6% presented with sudden onset of thyroid swelling. Pressure Leopold *et al.* out of 73 solitary nodule 36 effects from thyroid swelling (Dyspnea, dysphagia, and hoarseness of voice) was seen in 13 (13%), signs of thyrotoxicosis (loss of weight in spite of good appetite, insomnia, tremors, irritability, exophthalmos, menstrual irregularities, dry skin, hair loss, lethargy, hoarseness of voice, and failing memory) was present in 6%, pain in 15% fever 10%, pathological fracture due to metastases from thyroid malignancy seen in 2%, and convulsion in 1% from CNS metastases. Clinically, 56 (56%) presented with solitary thyroid nodule, out of which 8 (14.2%) had multiple nodules on ultrasound. In a study by William Scheible and (48.6%) showed multiple nodules on USG.

Thus, USG is helpful in finding other nodules in cases of clinically suspected solitary thyroid nodule, though the detection rate was lower in our study as compared to others.

Pathological Diagnosis

Out of 100 cases, 88% were benign and 12% were malignant. Out of 12 malignant cases, 5 (41.6%) seen in male and 7 (58.4%) seen in female with wide age distribution between 30 and 79 years. Percentage of malignancy in male is 5 (17.85%) out of 28 and female is 7 (9.72%) out of 72. Papillary carcinoma seen in (50%) cases, follicular carcinoma in 4 (33.37%) and anaplastic carcinoma in 2 (16.7%) of cases. In a study by Simeone *et al.* in 1985, 87.2% cases were benign and 12.7% cases were malignant. Out of 17 malignant cases, 9 (52.9%) had papillary carcinoma, 2 (11.7%) had medullary carcinoma, 2 (11.7%) had follicular carcinoma, 2 (11.7%) had anaplastic carcinoma, and 2 (11.7%) had metastases.

Most common benign pathology in the present study was benign goiter seen in 72% cases. Follicular adenoma was found in 10% and thyroiditis in 6% of patients.

Benign Thyroid Lesion (88 Cases)

Ratio (male: female)

In the present study, ratio of male: female was 1:2.7, While in study by Kim in 2002, the ratio of male-to-female and 12 (10.34%) was diagnosed to be thyroiditis.

Goitre (72 Cases)

In the present study, maximum 30.5% lesions were anechoic, 25% each were hyperechoic and hypoechoic, 11.1% were isoechoic, and 8.3% showed mixed echogenicity.

Table 1: Age incidence

Age group (years)	Number of patients	Percentage
10–19	4	4
20–29	24	24
30–39	30	30
40–49	18	18
50–59	12	12
60–69	8	8
70–89	4	4
Total	100	

Table 2: Clinical symptomatology

S. No.	Clinical symptoms	Patients	Percentage
1.	Thyroid enlargement	100	100
2.	Pressure effects	13	13
3.	Signs of Hyperthyroidism	6	6
4.	Pain	15	15
5.	Fever	10	10
6.	Fracture Bone	2	2
7	Convulsion	1	1

Table 3: Clinical diagnosis

Clinical diagnosis	Number of patients	Percentage
Solitary thyroid nodule	56	56
Diffuse thyroid swelling	32	32
Multinodular goiter	6	6
Cystic lesion	6	6
Total	100	100

Perilesional halo was seen in 27% cases, calcification in 30.5% cases and comet-tail artifacts in cystic lesion due to cholesterol crystal were seen in 16.6% cases.

Single nodule noted in 72.2% cases, multiple nodules in 22.2%, and diffuse thyroid enlargement in 5.5% cases. Margin was well-defined in 77.7% and ill-defined in 22.3%.

Out of 72 cases, 41.6% were solid, 33.3% were cystic, and 25% had solid-cystic components.

In a study by Ahuja *et al.*, all 100% patients with comet-tail artifact proved to be benign by FNAC.

Follicular Adenoma Ten Cases

Out of ten cases, 8 (80%) were isoechoic and 2 (20%) were anechoic. Perilesional halo was seen in 80% cases which help to identify isoechoic lesion surrounded by peripheral sonolucentrim. In a study by Simeone *et al.*,[56] 81% of follicular adenoma showed decreased echogenicity relative to normal thyroid gland, 12.6% showed increased echogenicity, and 6.4% were isoechoric. A cystic lesion was seen in 1.$% cases. Perilesional halo was seen in 54.4% cases.

Thyroiditis Six Cases

Two were seen in male and four in female patients. The ratio of male-to-female being 1:2. All the 6 (100%) cases

Table 4: Distribution of various thyroid pathologies in relation to age and sex

Age group (in years)	Benign			Malignant				Total
	Goiter	Thyroiditis	Follicular adenoma	Follicular	Papillary	Anaplastic	Medullary	
10–19								
M	0	0	0	0	0	0	0	0
F	4	0	0	0	0	0	0	4
20–29								
M	2	1	2	0	0	0	0	5
F	16	1	2	0	0	0	0	19
30–39								
M	5	1	2	2	0	0	0	10
F	19	1	0	0	0	0	0	20
40–49								
M	2	0	0	0	0	0	0	2
F	8	2	4	0	2	0	0	16
50–59								
M	3	0	0	0	1	0	0	4
F	5	0	0	0	2	1	0	8
60–69								
M	4	0	0	0	2	0	0	6
F	2	0	0	0	0	0	0	2
70–79								
M	1	0	0	0	0	0	0	1
F	1	0	0	0	0	2	0	3
Total								
M	19	2	2	2	3	0	0	28
F	53	4	8	2	3	2	0	72
	72	6	10	4	6	2	0	100

were diffusely enlarged hypoechoic thyroid with ill-defined margin. In a study by Simeone *et al.* all 100% patients showed diffusely abnormal echo-pattern consisted of multiple small low-level echoes with a decrease in overall echogenicity.

Malignant Thyroid Lesions (12 Cases)

In present study, our of 12 cases, 66.6% were in the age group of 30–60 years and 33.3% patients were more than 60 years of age. Mary *et al.* showed that malignancy was more common in patients who were younger than 20 years or older than 60 years of age; than in patients between 20 and 60 years of age.

Percentage of malignancy in male was 17.85% and in female, it was 9.72% in the present study.

Table 5: Pathological diagnosis of thyroid lesions

Pathological diagnosis	Number of patients	Percentage
Goiter	72	57
Thyroiditis		6
Follicular adenoma	10	10
Carcinoma	12	12
Total	100	100

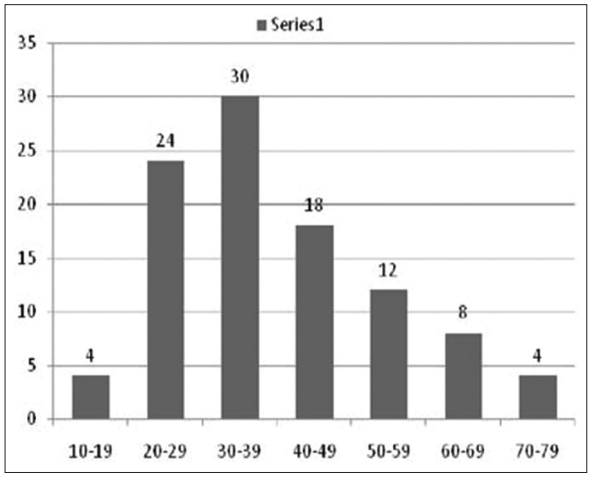

Figure 1: Incidence – Age group (years)

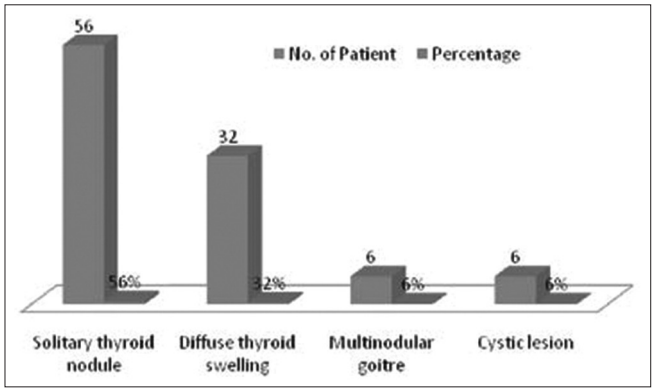

Figure 2: Sex distribution: Thyroid lesion

In a study by Kim *et al.*, the rate of malignancy was significantly higher in women than in men (23.6% in women and 11.9% in men).

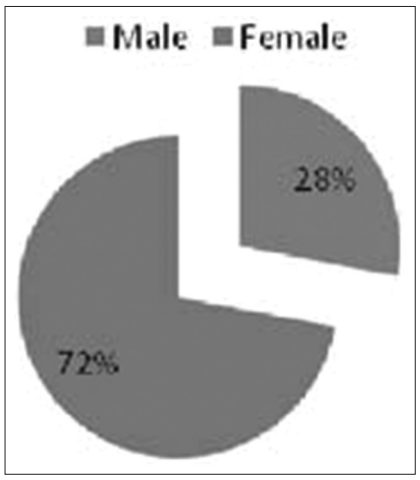

Figure 3: Clinical diagnosis

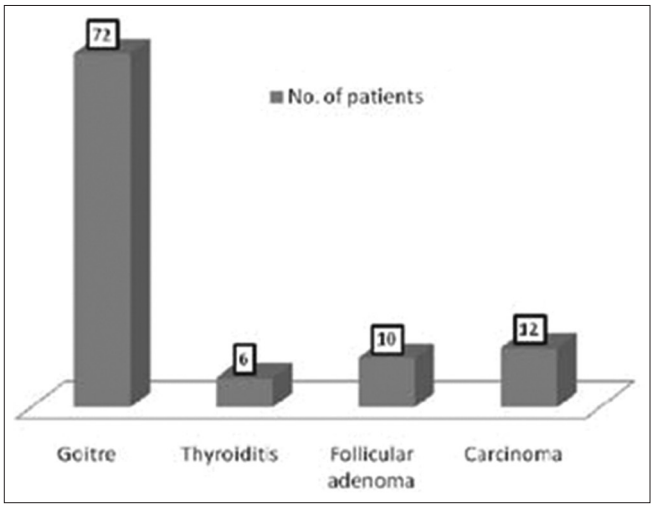

Figure 4: Pathological diagnosis of thyroid lesion

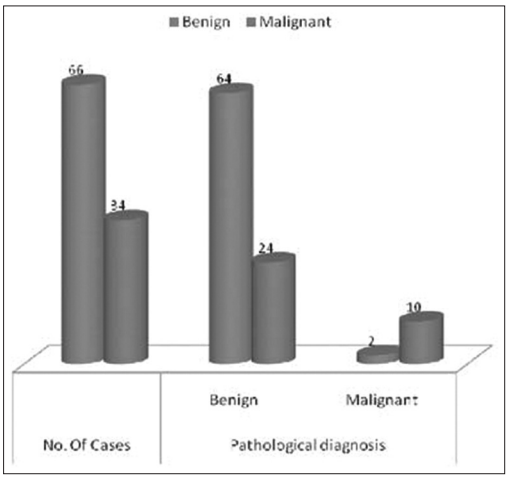

Figure 5: Correlation of radiological diagnosis with pathological diagnosis

Table 6: Sonographic features of various thyroid lesions

Sonographic Features	Benign			Malignant				Total
	Goiter	Thyroiditis	Follicular Adenoma	Follicular	Papillary	Anaplastic	Medullary	
Hyperechoic	18	0	0	0	0	0	0	18
Hypoechoic	18	6	0	0	6	0	0	30
Anechoic	22	0	2	0	0	0	0	24
Isoechoic	8	0	8	2	0	0	0	18
Mixed echo	6	0	0	2	0	2	0	10
Single nodule	52	0	10	2	6	2	0	72
Multiple nodules	16	0	0	2	0	0	0	18
Diffuse	4	6	0	0	0	0	0	10
Peri-lesional halo	20	0	8	0	0	0	0	28
Calcification	22	0	2	2	6	2	0	34
Comet-tail artifact	12	0	0	0	0	0	0	12
Well-defined margin	56	0	8	2	4	0	0	70
Ill-defined margin	16	6	2	2	2	2	0	30
Solid	30	6	8	2	6	2	0	54
Cystic	24	0	2	0	0	0	0	26
Solid+cystic	18	0	0	2	0	0	0	20

Table 7: Radiological diagnosis of thyroid lesions

Radiological diagnosis	No. of patients	Percentage
Benign thyroid lesion	30	30
Goiter	26	26
Diffuse thyroid enlargement	10	10
Malignancy	8	8
Indeterminate lesion	26	26
Total	100	100

Table 8: Correlation of radiological diagnosis with pathological diagnosis

Radiological Diagnosis	Number of Cases	Pathological diagnosis	
		Benign	Malignant
Benign	66	64	2
Malignant	34	24	10
Total	100	88	12

In the present study, 50% malignant lesions were hypoechoic, 33.3% were mixed echogenic, and 16.7% were isoechoic.

In our study, 10 (83.3%) malignant lesions had single nodule and 2 (16.7%) had multiple nodules.

In the present study, 83.3% malignant cases had calcification within nodules.

Study done by Mary *et al.* noted that the presence of any calcification within nodule raises the likelihood of malignancy. In particular, microcalcification in a predominantly solid nodule is associated with approximately three-fold increase in cancer risk as compared with solid nodule without calcification.

Table 9: Correlation of sonographic findings with pathological diagnosis

Sonographic findings	Histopathology			
	Benign		Malignant	
	Reading	%	Reading	%
(a) Single/multiple nodules				
Single	62	62	10	10
Multiple	16	16	2	2
Diffuse	10	10	0	0
(b) Echogenicity				
Hyperechoic	18	18	0	0
Hypoechoic	24	24	6	6
Anechoic	24	24	0	0
Isochoric	16	16	2	2
Mixed echoic	6	6	4	4
(c) Halo				
Present	28	28	0	0
Absent	60	60	12	12
(d) Calcification				
Present	24	24	10	10
Absent	64	64	2	2
(e) Comet-tail artifact				
Present	12	12	0	0
Absent	76	76	12	12
(f) Margin				
Well defined	64	64	6	6
Ill-defined	24	24	6	6
(g) Component				
Solid	44	44	10	10
Cystic	26	26	0	0
Solid+cystic	18	18	2	2

Margin of lesion was well-defined in 50% and ill-defined in 50% of cases in the present study.

Solbiati *et al.,* in 1985, showed that margin was ill-defined and irregular in 69.7% and well-define in 30.3%. Thyroid lesion with well-defined margin suggests benign pathology. However, results are equivocal in our study.

None of the malignant lesions showed perilesional halo or comet-tail artifacts due to cholesterol crystal.

Sensitivity/specificity of ultrasound for detecting malignant thyroid Lesion

In our study for detection of malignancy, ultrasound had sensitivity of 83.3%, specificity 72.7%, positive predictive value 29.4%, negative predictive value 96.9%, and accuracy of 74%. In study by Koike *et al.*, the sensitivity was 81.8% and specificity was 91%.[6-10]

CONCLUSION

High-resolution gray scale ultrasound has emerged as an initial imaging modality of choice for the evaluation of patients with thyroid enlargement. Ultrasound can detect solitary nodule, multiple nodules, and diffuse thyroid enlargement. It can also differentiate solid and cystic lesions.

Ultrasound has detected additional occult nodules in eight patients out of 56 presented with solitary thyroid nodule clinically.

Various sonographic features such as number, echogenicity, solid/cystic component, margin, peripheral halo, calcification, and comet tail artifact help to characterize the thyroid lesion which is not possible on any other imaging modality.

Neck masses can be differentiated whether they are arising from thyroid or extrathyroidal tissue. Thyroid lesions with capsular invasion, displacement of adjacent structure, and cervical lymph nodes enlargement can also be detected.

Thyroid malignancy cannot be diagnosed on ultrasonography, but various sonographic features in combination can be used to predict malignancy in thyroid lesions. Using these multiple features, gray scale ultrasound has accuracy of 74% with sensitivity of 83.3% and specificity of 72.7% for detecting thyroid malignancy, considering USG guided FNAC as a standard. FNAC is always suggested for the final confirmation of diagnosis in sonographically detected suspicious thyroid nodule.

Real-time sonography is a valuable tool to guide the needle for FNAC, especially for the small size thyroid nodule (<1.5 cm) as well as for the aspiration of cysts.

REFERENCES

1. Tessler FN, Tublin ME. Thyroid sonography: Current applications and future directions. AJR Am J Roentgen 1999;173:437-43.
2. Damascelli B, Cascinelli N, Livraghi T, Veronesi U. Preoperative approach to thyroid tumors by a two dimensional pulsed echo technique. Ultrasonics 1968;6:242-3.
3. Fujimato Y, Oka A, Omoto R, Hirose M. Ultrasound scanning of the thyroid gland as a new diagnostic approach. Ultrasonics 1967;5:177-80.
4. Blum M. Enhanced clinical diagnosis of thyroid disease using echography. Am J Med 1975;59(3):301-37.
5. Solbiati L, Charboneau JW, Osti V, James EM, Hay ID. The thyroid gland. In: Rumack CM, Wilson SR, Charboneau JW, editors. Diagnostic Ultrasound. 3rd ed., Vol. 1. St. Louis, Missouri: Elsevier Mosby; 2004. p. 735-70.
6. Iannuccilli JD, Cronan JJ, Monchik JM. Risk for malignancy of thyroid nodules as assessed by sonographic criteria: The need for biopsy. J Ultrasound Med 2004;23:1455-64.
7. Papini E, Guglielmi R, Bianchini A, Crescenzi A, Taccogna S, Nardi F, *et al.* Risk of malignancy in nonpalpable thyroid nodules: Predictive value of ultrasound and Colo-Doppler features. J Clin Endocrinol Metab 2002;87:1941-6.
8. Kim EK, Park CS, Chung WY, Oh KK, Kim DI, Lee JT, *et al.* New sonographic criteria for recommending fine-needle aspiration biopsy of non-palpable solid nodule of the thyroid. AJR Am J Roentgen 2002;178:687-91.
9. Frates MC, Benson CB, Doubilet PM, Charboneau JW, Cibas ES, Clark OH, *et al.* Management of thyroid nodules detected at us: Society of radiologists in ultrasound consensus conference statement. Radiology 2005;237:794-800.
10. Kang HW, No JH, Chung JH, Min YK, Lee MS, Lee MK, *et al.* Prevalence, clinical and ultrasonogrpahic characteristics of thyroid incidentalomas. Thyroid 2004;14:29-33.

How to cite this article: Gupta KP, Gupta S. Ultrasonography and Ultrasound-guided Fine-Needle Aspiration Cytology Correlation of Thyroid Lesions. Int J Sci Stud 2023;10(10):24-29.

Source of Support: Nil, **Conflicts of Interest:** None declared.