Correlation between Ultrasonography and Fine Needle Aspiration Cytology (FNAC) Findings in Patients with Thyroid Lesions

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Abstract:

Background: Thyroid nodules are common presentation in patients having thyroid disorders. There is approximately 4-5% incidence of clinically apparent thyroid lesions in general populations. Thyroid nodules are about four times more common in females than in males. The present study aims to diagnose the thyroid lesions and evaluate the correlation between ultrasonography (USG) and Fine Needle Aspiration Cytology (FNAC) reports. To determine the sensitivity of ultrasonography in detecting thyroid lesions.

Method: This was hospital based prospective study carried in 94 patients who came to radiology department for USG neck, after clinical examination from medicine, surgery and ENT departments. Those patients with thyroid lesions were followed and advised for USG guided FNAC of thyroid swelling. The patients who were advised for FNAC, and gave consent for procedure were included in the study. The USG guided FNAC was done and was further evaluated by pathologist.

Results: Out of 94 cases, 85 were benign nodules and 9 were malignant nodules by USG which were further confirmed by FNAC with results of 87 benign and 7 malignant. The USG diagnosed the benign thyroid nodule with sensitivity of 96.55% and specificity of 85.71%, positive predictive value 98.82%, negative predictive value 66.67%, accuracy 95.74%. The result revealed that there is a strong relation between diagnoses of benign thyroid lesions by USG and final diagnosis by FNAC ($P=0.001$).

Conclusion: High resolution grey scale imaging features can differentiate benign and malignant lesions. USG is very helpful for FNAC, characterization of nodules and provides differential diagnosis in those patients affecting with thyroid disorders.

Keywords: FNAC, benign thyroid nodules, malignant thyroid lesions, USG

Introduction:

Thyroid nodules are common findings on grey scale imaging. They are formed within thyroid parenchyma and can be solid, cystic or mixed type.¹ Ultrasound is the first line of investigation in evaluation of thyroid gland and has high sensitivity even in the detection of tiny nodules.² About 4-5% of normal population have incidence of thyroid

lesion of which female are more commonly affected than males. Most common thyroid nodules are benign comprising of 90% followed by malignant 10%.^{3, 4} USG of the thyroid gland is considered as one of the most sensitive method for diagnosis of thyroid lesions. The features of malignancy in Ultrasound include marked

hypoechoogenicity, presence of microcalcifications, irregular margins, and nodules with shape taller than wide and intra-nodular hypervascularity in color Doppler.^{5, 6}

The goal of this study is to differentiate between benign and malignant thyroid nodule using ultrasonography and correlate with fine needle aspiration cytology (FNAC) findings.

Methods

This is a prospective hospital-based study that was carried out 94 cases in department of radiology of National Medical College, Birgunj. Among patients referred for USG neck from the ENT, Surgery, and Medicine departments after clinical examination of thyroid swelling irrespective with their age group, gender and clinical complaints that were advised for FNAC and gave consent were included in the study. Those patients who went for surgery and/or radiotherapy, and those who refused for giving consent were excluded from the study.

Scans were conducted using 7 MHz linear probe with grey scale imaging followed by color Doppler study in Samsung sonoace R7, Medison and TOSHIBA machines.

USG neck was done by standard procedure, patients were put in supine position with neck hyper extended using the pillow under the shoulder. The neck was then scanned in sagittal, transverse, and oblique section so that thyroid gland and neck vessels would be easily examined.

Both the lobe of thyroid gland and isthmus were examined.

The nodules were characterized further using USG features like echogenicity, shape, margin, internal component, height and width, calcifications and vascularity. The detected thyroid nodules were advised for USG guided FNAC evaluation.

FNAC was performed using 10ml disposable syringe with a proper safety measures. Slide was prepared and cytological examination was performed by pathologist.

The data were collected and were expressed in frequency and percentage. For relationship between variables, chi-square test was used and sensitivity and specificity were calculated.

The study was conducted from October 2020 to July 2021.

Results

Out of 94 patient studied there were 10 (10.64%) males and 84 (89.36%) females with male to female ratio of 1:8.4. The mean age (SD) of male and female was 38.30 (11.742) years and 38.14 (13.064) years respectively and overall mean age (SD) of patients was 38.16 (13.198) years. So according to this study thyroid lesion are more common in female than male. In this study 30 (31.92%) patients were belongs to 30-39 year age group and there was around 90% female belong to between 20 to 50 age group. the youngest patient was 16 years of age and eldest was 72. The age wise gender distribution is shown in table 1.

Table 1: Age wise Gender distribution of thyroid lesions.

Age group	Gender		Total Patients (n=94) (%)
	Male (N=10) (%)	Female (N=84) (%)	
10-19	1 (16.67)	5 (83.33)	6 (6.38)
20-29	2 (9.09)	20 (90.91)	22 (23.41)
30-39	3 (10)	27 (90)	30 (31.92)
40-49	2 (10.53)	17 (89.47)	19 (20.21)
50-59	1 (10)	9 (90)	10 (10.64)
60-69	1 (16.67)	5 (83.33)	6 (6.38)
70-79	0 (0)	1 (100)	1 (1.06)
	Mean $\pm$ Standard deviation		
Age	38.3 $\pm$ 11.742	38.14 $\pm$ 13.064	38.16 $\pm$ 13.198

Chart 1: Bar graph showing Age wise Gender distribution of the thyroid lesions

Bar graph is representing incidence of cases with respect to age and gender. Most common population and age group that were affected by thyroid nodule were female and in between 30-39 years of age respectively.

Chart: 2: Gender distribution of population

In this study, 89.36% were female and 10.64% were male. The male to female ratio was 1:8.6

Table 2: Radiological diagnosis and FNAC diagnosis of thyroid lesion related statistics.

	Diagnosis	Number of patients (n=94)	Percentage
Radiological	Nodular goiter	21	22.34
	Colloid goiter	34	36.17
	Hashimoto	18	19.14
	Grave disease	12	12.76
	Papillary ca	3	3.19
	Follicular ca	3	3.19
	Medullary ca	2	2.12
	Ana-plastic ca	1	1.06

FNAC	Nodular goiter	19	20.2
	Colloid goiter	33	35.1
	Hashimoto	24	25.5
	Grave disease	11	11.7
	Papillary ca	4	4.3
	Follicular ca	2	2.1
	Medullary ca	1	1.1
	Ana-plastic ca	0	0.0

Table 2 shows the radiological and cytological diagnosis of thyroid lesion related statistics of total patients. Most common radiological findings was colloid goiter 34 (36.17%), followed by Hashimoto thyroiditis 18 (19.14%) and nodular goiter 21 (22.34%) and the most common finding of cytological diagnosis of thyroid nodules in which colloid goiter was 33 (35.17%) followed by nodular goiter 19 (20.2%) and hashimotos 24 (25.5%).

Table 3: Relationship between Radiological and FNAC diagnosis of benign and malignant thyroid nodules.

Radiological diagnosis(n=94)	Pathological diagnosis(n=94)		No of cases	P-value*
	Benign	Malignant		
Benign	84	1	85	0.001
Malignant	3	6	9	
Total	87	7	94	
Diagnostic Test				
Sensitivity	Specificity	Positive Predictive Value	negative predictive value	accuracy
96.55%	85.71%	98.82%	66.67%	95.74%

*Yates's chi square test $\chi^2=41.58$ is applied

Above mentioned table 3 suggest that out of 94 cases USG findings of 85 cases were suggestive of benign features whereas that of only 9 patients were suggestive of malignant features. These ultrasonography features were further compared by FNAC findings. FNAC results suggest 87 cases were benign and 7 cases where malignant. In this study the most of the cases were benign and the

USG diagnosis had a highly significant relation (P-value=0.001) to FNAC diagnosis result.

So we finally correlate the benign cases sensitivity and specificity of USG. Considering cytological data as a standard, it was revealed that USG has sensitivity of 96.55%, followed by specificity of 85.71%, positive predictive value 98.82%, negative predictive value 66.67% and accuracy 95.74%.

Table 4: Factors of USG features associated with Radiological features of various benign and malignant thyroid lesions.

USG features	Benign (%)	Malignant (%)	P-value*
Echogenicity			
Hyper echoic	54 (100)	0 (0)	0.006
Hypo echoic	28 (80)	7 (20)	
Heterogeneous	3 (60)	2 (40)	

Internal content			
Solid	44 (86.27)	7 (13.73)	0.320
Cystic	25 (100)	0 (0)	
Mixed	16 (88.89)	2 (11.11)	
Shape			
wider than Taller	77 (91.67)	7 (8.33)	0.538
taller than wider	8 (80)	2 (20)	
Margin			
Well defined	68 (98.55)	1 (1.45)	0.001
Ill defined	17 (68)	8 (32)	
Calcification			
Present	13 (61.90)	8 (38.10)	0.001
Absent	72 (98.63)	1 (1.37)	
Comet tail artifact			
Present	11 (100)	0 (0)	0.546
Absent	74 (89.16)	9 (10.84)	
Peripheral halo			
Present	24 (88.89)	3 (11.11)	0.748
Absent	61 (91.04)	6 (8.96)	
Internal vascularity			
Present	30 (78.95)	8 (21.05)	0.006
Absent	55 (98.21)	1 (1.79)	

***Yates's chi square test is applied**

Table 4 shows the USG factors associated with Radiological features of various benign and malignant thyroid lesions. Most of the nodule has benign features in our study, with hyper echogenicity in 54 (100%) cases, internal content solid in 44 (86.24%) cases, wider than taller shape in 77 (91.67%) cases, well defined margin in 68 (98.55%) cases. There was significant relation found between USG features echogenicity ($P=0.006$) and margin ($P=0.001$) and Radiological features of benign and malignant thyroid lesions and also had significant relation between calcification (P value= 0.001) and internal vascularity ($P=0.006$) with radiological features which had 72 (98.63%) cases absent calcification and 55 (98.21%) cases absent internal vascularity in benign. Other features were not showing significant relation with radiological features because they might have absent features in benign.

Discussion

Total numbers of 94 patients with various thyroid swelling were evaluated with grey scale imaging

and FNAC. FNAC cytology is gold standard for evaluation of thyroid nodule. This study identified the strong correlation between USG and FNAC diagnosis of thyroid nodules. In current study the thyroid lesion were found to be more common in females than in the males.

Avinash et. al 2016 study also revealed more commonly affected gender were female 81.5% of the occurrence. The most common age group affected by thyroid nodules was between 31-40 years, followed by 41-50 years with percentage of 41% and 25% respectively.⁷ In this study also most common age group affected was 30-39years (32.97%). Gyawali M and Sharma study in Nepal also revealed that the mean age group affected by thyroid nodule was 38 years which was similar to this study.⁸ The male to female ratio was 1: 8.4.

In this study, USG revealed that 90.42% patient has benign nodule and 9.57% have malignant nodule in ultrasonography however in FNAC diagnosed 92.55% benign and 7.44% were malignant nodules. Similar results were published

by many authors in their studies about benign and malignant thyroid nodules that were correlated with USG and fine-needle aspiration cytology in which it was revealed that 8.57% were malignant nodules.^{9, 10} Patel NR et.al also revealed in their study 6% was malignant and 94% were benign thyroid lesion on USG.¹¹

In the study of Krishna et al. out of 80 cases, 45 cases (56.25%) were colloid goiter, the most common benign lesion.¹² Similarly, Patel NR et al also found the most common lesion was colloid goiter with 36% of people were affected.¹⁰ In this study also the most common nodules were colloid goiter 35.1%, followed by Hashimoto thyroiditis 25.5% and nodular goiter 20.2% by FNAC. USG shows colloid goiter 36.17% was the most common followed by nodular goiter 22.34% and Hashimoto 19.14%.

Arun C. Nachhiappan et al. described the benign thyroid nodules which appear with uniform halo, predominantly cystic, in USG whereas malignant lesion has features like micro calcification, extension beyond thyroid margin and marked hypoechogenicity.¹³ In this study various ultrasonography features like echogenicity, solid, cystic, mixed nodule, taller than wider and vice-versa, margin, halo, calcification, comet tail, and vascularity were observed in which the most of the lesion has benign features, with hyperechogenicity in 54 cases, wider than taller in 77 cases and well defined margin in 68 cases and USG features echogenicity, margin, calcification and internal vascularity has showed the significant result with radiological features. Those were further confirmed by cytological analysis.

Alam T et al.¹⁴ also reported that USG has 82% overall diagnostic accuracy for malignant lesion. Popli MB et al. revealed that US shows 87.2% accuracy in diagnosis for thyroid nodules.¹⁵

The result of this study revealed that USG has sensitivity of 96.55%, followed by specificity of 85.71%, positive predictive value of 98.82%, and negative predictive value of 66.67% and accuracy of 95.74%. These results were consistent with a study done in Republic of Yemen which reported that ultrasonography can predict benign thyroid

lesions with high sensitivity of 96.8%, specificity 71.42%, positive predictive value 98.38% and negative predictive value of 55.55%.¹

Conclusion

High resolution grey scale imaging features can differentiate benign and malignant lesions. USG is very helpful for FNAC, characterization of nodules and provide differential diagnosis in those patients affecting from thyroid disorders.

Limitations:

The limitation of this study was that most of the diagnosis was based on cytological examination rather than histological evidence. Recent imaging modalities like Elastography and Spectral study were not used. In case of multiple thyroid nodules only the single specific nodule was evaluated by the FNAC.

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