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The Role of Conventional Ultrasound in the Assessment of Thyroid Nodule in Erbil City

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Abstract
Background: Nodular thyroid disease is relatively common although thyroid cancer is rare. The aim of this study is to evaluate the advantage and reliability of conventional ultrasound in correlating sonographic characteristics of thyroid nodule with US-FNAC guided result as a diagnostic aid in thyroid nodule.**Method:** 111 patients were examined by ultra sound and FNA done in Rizgary teaching hospital department of radiology from May 2015 – July 2016.**Result:** 9% (10 of 111) patients have malignant features by ultrasound which are include hypoechogenicity, border irregularity, ill defined out line, presence of micro calcification, halo sign not continues. 7 of them were proved malignancy by FNA. The specificity, sensitivity and accuracy of US-FNA were 96.2 %, 85.7% and 95.5% respectively. **Conclusion:** These ultrasound features aid in prediction the benign or malignant nature of given nodule but no single ultrasound criterion is reliable in differentiation all benign from malignant thyroid nodule.

Introduction

The thyroid gland is a highly vascularized organ located anteriorly in the neck, deep to the platysma, sternothyroid and sternohyoid muscles, and extending from the 5th cervical (C5) to the 1st thoracic (T1) vertebrae. The gland consists of two lobes (left and right) connected by a thin, median isthmus overlying the 2nd to 4th tracheal rings, typically forming an "H" or "U" shape [1] .

Thyroid nodules are lumps which commonly arise within an otherwise normal thyroid gland. They indicate a thyroid neoplasm, but only a small percentage of these are thyroid cancers. Often these abnormal growths of thyroid tissue are located at the edge of the thyroid gland and can be felt as a lump in the throat. When they are large or when they occur in very thin individuals, they can sometimes be seen as a lump in the front of the neck. Sometimes a thyroid nodule presents as a fluid-filled cavity called a thyroid cyst. Often, solid components are mixed with the fluid. Thyroid cysts most commonly result from degenerating thyroid adenomas, which are benign, but they occasionally contain malignant solid components [2].

By far most of thyroid knobs are kindhearted. The ID of those minority knobs, which are threatening, is thusly of incredible significance to stay away from superfluous surgery on the rest of. It is critical to know whether the patient has a singular or different thyroid knobs, as the rate of danger is around 5-30% in lone thyroid knobs, while this frequency is minimized to less than1-5%in multinodular goiter 3-6. The thyroid knob is three to four times more regular in ladies than men 7, 8.

In spite of the fact that, ultrasound can't dependably recognize benevolent from dangerous knobs, there are sure sonographic criteria that recommend threat. These incorporate microcalcification, unpredictable edges, and hypo echogenicity of the knob. Then again, there are sure sonographic highlights that can help in anticipating the benevolent way of a given knob. This incorporates hyper echogenicity and cystic nature of the knob, very much marginated knobs, coarse and eggshell calcification, in place thin hallo, and comet-tail sign 9, 10, and 11.

The point of this study is to assess the favorable position and dependability of ordinary ultrasound in corresponding sonographic attributes of thyroid knob with US-FNAC guided result as a demonstrative guide in thyroid knob. What's more, the target of this study is to examine the unwavering quality and preferred standpoint of traditional ultrasound as an indicative guide in thyroid knob, by corresponding sonographic normal for thyroid knob with US-FNAC guided results and histopathological proofs and to set up the relative vital of these components in foreseeing for danger. These will maintain a strategic distance from pointless surgery on the larger part of thyroid knobs which are kind.

Material and Method:

Design and setting: this prospective study was carried out in radiology department of Rizgary Teaching Hospital; the subject included 111 patients who presented to the department, from May 2015 – July 2016. All the patients who attended to our radiology department of Rizgary Teaching Hospital for thyroid gland imaging and with history of thyroid swelling were examined by high resolution real time sonography (Siemens model Acuson X300, made in Korea) with linear array transducer with 7.5 – 10 MHz.

Under high resolution ultrasound guided we took biopsy by fine needle aspiration under an aseptic condition.

Inclusion criteria: all Patients who attended to radiology department, who has thyroid swelling, with age ranging

from 7 years to 80 years.

Exclusion criteria: The Patients without thyroid swelling, patients with diffuse enlargement of the gland without nodularity and patient has thyroid surgery.

Data management and Statistical analysis: Data analyzed by using Statistical Package for Social Sciences (SPSS) computer software program version 19 and statistical tests (chi square and kappa tests) used , P-value of less than 0.05 considered significant in chi square test.

Questionnaire and Data collections: Data were collected by using a brief questionnaire that contains patient history including: name, age and sex, ultrasound finding and FNA results.

Result

Out of 111 patients included in this study, 16(14.4%) were males and other 95 (85.6%) were females and male to female ratio was 0.16:1.

The youngest patient in this study was 16 years old while the oldest one was 75 years old. The mean of age + SD was 42.1±12.8. The most of patients were between the age of (36 -45) years, then followed by (46 -55) years. (Table 1, Table 2)

Table 1: Age distribution of patients with thyroid nodule

Age	Frequency	Percent
16-25	12	10.8
26-35	25	22.5
36-45	32	28.8
46-55	27	24.3
56-65	9	8.1
66-75	6	5.4
Total	111	100.0

Table 2: Descriptive Statistics of Age of participants.

Measure	No.	Range	Minimum	Maximum	Mean	Std. Deviation
Age (years)	111	59	16	75	42.16	12.87

In this study, out of 10 nodules that show malignant features by U/S, only 6 of them were malignant by FNA result. While 101 nodules that show benign features by U/S, only one of them was malignant by FNA result. (Table 3)

Table 3: Frequency of benign and malignant thyroid nodule

		FNA result		Total
		Malignant	Benign	
US Diagnosis	Malignant	6	4	10
	Benign	1	100	101
	Total	7	104	111

Chi-Square Tests

	Value	P- value
McNemar Test		0.375[a]
N of Valid Cases	111	

a. Binomial distribution used.

In this study overall results, reveal that sensitivity of ultrasound for diagnosis of malignant and benign thyroid nodules was high (85.7%) and the specificity and accurate rate were very high in the rate of 96.2% and 95.5% respectively, about NPV was high 99% while PPV was medium 60%. (Table.4)

Table 4. Sensitivity, specificity, NPV, PPV and accuracy of ultrasound for diagnosis of malignant and benign thyroid nodule.

NPV	99%
PPV	60.0%
sensitivity	85.7%
Specificity	96.2%
Accuracy	95.5%

It is found that the degree of agreement of ultrasound and FNAC in diagnosis of malignant thyroid nodule is statically significant (p value =0.004)

As shown in Table. 5, among 7 malignant nodule proved by FNAC, the 6 nodules were taller than wide in shape on ultrasound examination, while among 104 benign nodules proved by FNAC only 4 was taller than wide and It is found that statistically significant fair degree of agreement between shape that taller than wide and FNAC for diagnosis of malignant thyroid nodule. (p value = 0.001).

Table 5: frequency of the shape in benign and malignant nodule.

Shape	**FNA result**		**Total**	**P-value**
	Malignant	**Benign**		
Round	0 (0%)	40 (38.5%)	40 (36%)	
Taller than wider	6 (85.7%)	4 (3.8%)	10 (9%)	<0.001
Wider than taller	1 (14.3%)	60 (57.7%)	61 (55%)	
Total	7 (100%)	104 (100%)	111 (100%)	

Out of 7 malignant nodules proved by FNAC, 6 nodules were hypo echoic in comparison with surrounding thyroid parenchyma on ultrasound examination. While among 104 benign nodule proved by FNAC result, 35 nodules was hypo echoic in comparison with surrounding thyroid parenchyma and It is found that there is statistically significant difference between hypoechogenicity and FNAC for diagnosis of malignant thyroid nodule (p value=0.04). (Table.6)

Table.6. frequency of echogenecity in benign and malignant nodule.

Echogenicity	**FNA result**		**Total**	**P- value**
	Malignant	**Benign**		
Hyper echoic mass	0 (0.0%)	26 (28.9%)	26 (26.8%)	
Hypo echoic mass	6 (85.7%)	35 (38.9%)	41 (42.3%)	0.04
Non-homogeneous	1 (14.3%)	29 (32.2%)	30 (30.9%)	
Total	7 (100.0%)	90 (100.0%)	97(100.0%)	

As shown in Table 7, 71.4% of malignant nodule that proved by FNAC result had micro calcification. While 25% among benign nodules that proved by FNAC result had micro calcification. Statistically was highly significant.

Table.7. frequency of micro calcification in benign and malignant nodule.

Calcification	FNA result		Total	**P- value**
	Malignant	**Benign**		
No Calcification	2 (28.6%)	78(75.0%)	80(72.1%)	
Micro calcification	5(71.4%)	26(25.0%)	31(27.9%)	< 0.008
Total	7(100.0%)	104(100.0%)	111(100.0%)	

Among 7 malignant nodules proved by FNAC, irregularity of margin is observed in all malignant nodules on ultrasound examination. While among 104 benign nodule proved by FNAC there was irregularity of margin in only 6 nodules and statistically show highly significant between irregular margin and malignant nodules. (Table .8)

Table.8. frequency of border in benign and malignant nodule

Border of mass	FNA result		Total	P- value
	Malignant	Benign		
Regular	0 (0.0%)	98 (94.2%)	98 (88.3%)	
Irregula r	7 (100.0%)	6 (5.8%)	13 (11.7%)	< 0.001
Total	7 (100.0%)	104 (100.0%)	111(100.0%)	

Seven malignant nodules that proved by FNAC result, ill defined border is observed in 4 nodules on ultrasound examination. While among 104 benign nodules proved by FNAC there was ill defined border only in 1 nodule and statistically was extremely significant. (Table.9).

Table.9. frequency ill define border in benign and malignant nodules.

Outline of mass	FNA result		Total	P- value
	Malignant	Benign		
Well defined	3 (42.9%)	103 (99.0%)	106 (95.5%)	
Ill defined	4 (57.1%)	1 (1.0%)	5 (4.5%)	< 0.001
Total	7 (100.0%)	104 (100.0%)	111 (100.0%)	

Out of 7 malignant nodules proved by FNAC result, discontinuity of hallo around nodule is observed in 6 nodules on ultrasound examination. While among 104 benign nodules proved by FNAC there was discontinuity only in 3 nodules and there is extremely statically significant good degree of agreement between discontinuity of halo around the nodule and FNAC in diagnosis of malignant thyroid nodule (significant P value=0.0001).

Table.10: frequency of discontinuity of halo around the nodules in benign and malignant nodules.

Halo sign	FNA result		Total	P-value
	Malignant	Benign		
Continuous	1 (14.3%)	87 (96.7%)	88 (90.7%)	
Not continuous	6 (85.7%)	3 (3.3%)	9 (9.3%)	<0.001
Total	7 (100.0%)	90 (100.0%)	97(100.0%)	

Kappa test value of each ultrasound characteristic is small because of small number of each nodule ultrasound characteristics and malignancies by FNA results. (Table 11).

Tablet.11. kappa test value and P value of individual ultrasonographic feature

Ultrasound characteristic	Degree of agreement (kappa value)	Level of significance (P value)
Shape (taller than wide)	0.15	0.001
Hypo echogenicity	0.06	0.052
Micro classification	0.02	0.001
Border of mass	0.05	0.001
Outline of mass	0.03	0.001
Discontinuity of hallo	0.05	0.001

Discussion

In this study the overall sensitivity of ultrasound in diagnosis of malignant thyroid nodule was high (85.7%), specificity and accurate rate were very high in the rate of (96.2%) and (95.5%) respectively, the result was correlate with study done in Sulaymania by Amer *et al.* [12] (2009) in which the sensitivity, specifity and accuracy were 80%, 96% and 94% respectively. While the result of this study was slightly lower in specifity and higher rate in specifity and accuracy if we comparable to result obtained by Kim *et al*(1988) which showed sensitivity, specificity, and accuracy in the rate of (93.8%, 66%,74.8% respectively), [13] the reasons behind that because ultrasound resolution more advanced and development of color Doppler now a day, and our area is endemic for thyroid diseases.

The study show high incidence of thyroid nodule among females than males, this was correlating with all other previous literatures. [12] while the incidence of thyroid malignancy was nearly equal between male and female in the rate of 6.6% and 6.3% respectively, that is mean although the thyroid nodules is more common in females, thyroid cancer is nearly equally common in males and females; thus indicate that; males with thyroid nodule at risk even more than females. [14 – 16]

This study show that; high incidence of malignancy found between the age (36 – 45), the study done in sulaymania and other study in chine shows high incidence of malignancies between ages (45 – 60), [12, 17] this is may be due to small sample size in this study, or may be due to that our patients are more orient than others in which they visit hospital as early as possible when thy feeling not good.

The US findings in this study that were significantly associated with a greater probability of malignancy were shape (taller than wider), hypoechogenicity, micro calcifications, irregular borders, ill define outline and not continuous or irrupted Hallo sign. While the US findings that were associated with a lower risk of malignancy were round shaped nodule, hyper echoic nodule, regular border line, well defined out line and presence of hallo sign. Thus correlate with study done in Spain. [18] Other studies also show the same ultrasonic features of thyroid malignancy and benign thyroid nodule. [12, 15, 19 and 20]

Conclusion

1. Ultrasound is the most useful diagnostic tool for evaluation of thyroid nodules, with high sensitivity and very high specificity.
2. Ultrasound features are helpful in differentiation the malignant from benign solid thyroid nodules.
3. No single ultrasound criterion is reliable in differentiation all benign from malignant thyroid nodule, but these ultrasound features aid in prediction the benign or malignant nature of given nodule.

Recommendations:

1. Fine needle aspiration cytology should be performed on thyroid nodules classified as positive on ultrasound examination, regardless of palpability.
2. Follow up should be performed for any thyroid nodule with negative ultrasonographic feature of malignancy.
3. Further studies on longer time interval and comparing ultrasound and FNAC with histopathology.

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