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RESEARCH ARTICLE

ULTRASOUND OF THYROID NODULES: FINDING THE BEST PARAMETER FOR PREDICTING MALIGNANCY

***ABHISHEK AGGARWAL [1], NAVKIRAN KAUR [2], BHARDWAJ [3], AMRITPAL S GROVER [4]**

1. Department of Radiodiagnosis, Teerthankar Mahavir Medical College Moradabad, India.

2, 3, 4. Department of Radiodiagnosis, Govt. Medical College, Patiala, India

Manuscript Info *Abstract*

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****Corresponding Author***

ABHISHEK AGGARWAL

INTRODUCTION: Fine Needle Aspiration Cytology (FNAC) has been the preferred means to rule out malignancy in thyroid nodules so far. Role of ultrasound in thyroid nodules has been widely studied, but there is no clinically feasible method based on ultrasound for predicting risk of malignancy in thyroid nodules. METHODS: Morphology of non palpable thyroid nodules in 40 patients was evaluated on ultrasound for multiple parameters. The findings were compared with pathological evaluation and results were statistically analyzed. RESULTS: High accuracy, specificity, sensitivity were obtained with all grey scale parameters used individually as well as collectively. Presence of poorly defined margins and thick incomplete halo were found to be most significant statistically. CONCLUSION: Presence of poorly defined margins and thick incomplete halo were the most reliable parameters for predicting malignancy in thyroid nodules.

Introduction

Incidence of palpable thyroid nodules in Indian population is about 12%. [1] Incidence of non-palpable nodules is however higher, from about 18.9% in iodine sufficient areas to about 80% in iodine deficient areas of north. Despite the high prevalence of thyroid nodules, incidence of thyroid cancer is rare in India with estimated frequency at 1 per 100,000 for men and 1.8 per 100,000 for women. [1-4]

Uses of High resolution ultrasound of the thyroid to detect clinically non-palpable nodules, differentiate thyroid nodules from other neck masses are well known. Besides role of ultrasound in predicting malignancy in thyroid nodules has also been extensively evaluated [5-15].

So far in clinical practice, FNAC has been the preferred means to evaluate thyroid nodules for malignancy. On grey scale ultrasound, several parameters have different diagnostic value **[Table 2]**. Evaluation of risk of malignancy based on multiple parameters would involve complex mathematical formulas especially when some features support while others negate the diagnosis. The present study aims to compare the sonographic features of thyroid nodules and find the most statistically significant feature for predicting malignancy to make prediction of malignancy based on ultrasound easier.

METHODS

This study was carried out on 40 patients with non-palpable thyroid nodules detected first on ultrasound from indoor & outdoor patients visiting the ultrasound section of the department of Radio-diagnosis, Rajindra Hospital, Patiala over 6 months .

Ultrasound Examination: All the patients were examined with Philips Envisor Whole Body Color MC 15601 Doppler machine with multi-transducer. The transducer used in this study was a 3-12 MHz linear array transducer. Following Features were evaluated in thyroid nodules:

- Internal contents
- Echogenicity
- Halo
- Margin
- Calcification

Internal contents were classified as solid, cystic , cystic with septations or mixed solid and cystic .

Nodule echogenicity was compared with that of normal adjacent thyroid tissue. Each nodule was classified as being hypoechoic, hyperechoic, isoechoic and anechoic (cysts with no solid components that can contain echogenic foci, particulate fluid, or septa).

The halo around the nodules (peripheral halo), when present, was classified by its thickness. A thin halo is < /= 2 mm and a thick halo, > 2 mm.

Margins of the nodule were classified as well defined or poorly defined.

Calcification, when present, was classified as microcalcification</= 2mm in diameter, with or without posterior shadowing and no posterior reverberation; or coarse calcification >2 mm in diameter with posterior shadowing; or as peripheral egg shell calcification.

Pathological correlation: FNAC and post operative biopsies were done in department of pathology, Rajindra Hospital, Patiala.

Statistical Analysis: Sensitivity, specificity, positive predictive value, negative predictive value, accuracy and p value was calculated independently for each sonographic feature and for grey scale ultrasound collectively.

RESULTS AND OBSERVATIONS

Morphology of thyroid nodules was evaluated using grey scale ultrasonographic characteristics including internal contents, echogenicity, margins, halo and calcification --**Fig 1-7:**

Fig 1: showing hypoechoic, solid, poorly defined mass like nodule (m) with thick incomplete halo and coarse calcification (cal) with distal acoustic shadowing (das)

Fig 2: showing poorly defined nodule with thick incomplete halo, microcalcification and large intranodular vessel

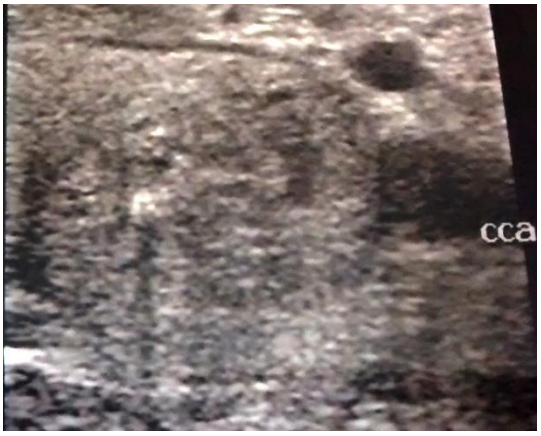

Fig 3: showing hypoechoic, solid, poorly defined nodule with thick incomplete halo, poorly defined irregular margins (inferiorly & medially) and coarse calcification.

Fig 4: showing hyperechoic, solid poorly defined nodule with necrosis (nec), thick incomplete halo and poorly defined irregular margins.

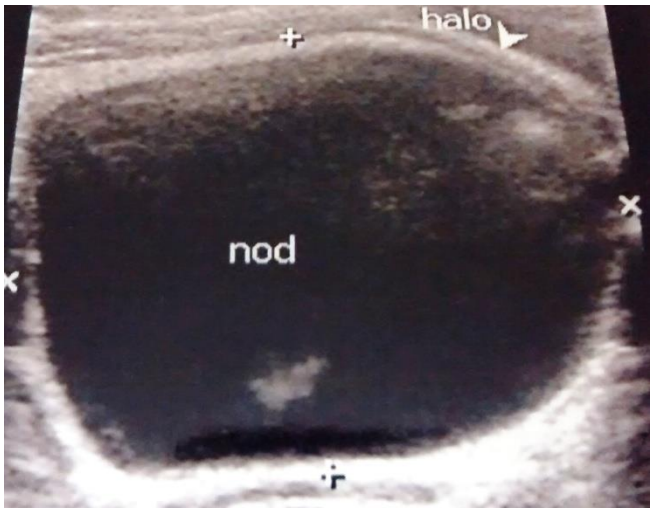

Fig 5: showing anechoic, cystic, well defined nodule with thin complete halo and no calcification

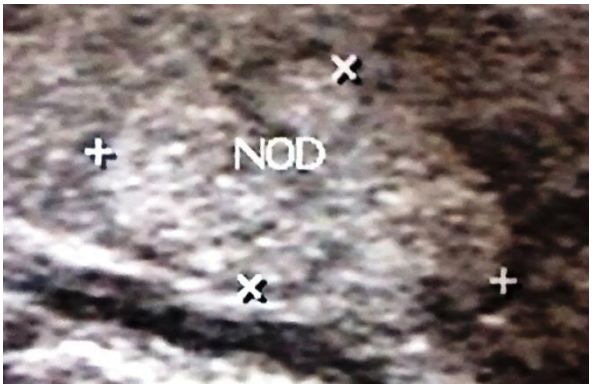

Fig 6: showing hyperechoic, solid, well defined nodule with thin complete halo and no calcification

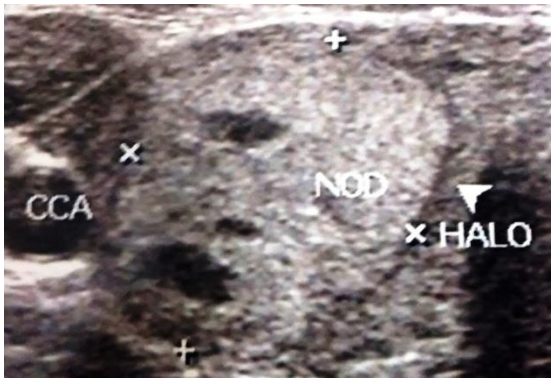

Fig 7: Showing hyperechoic , cystic +solid , well defined nodule (NOD) with Thin complete halo(arrowhead) and no calcification

Distribution of all five parameters was evaluated and statistically analyzed in 40 nodules –**Table 1, 2:**

TABLE 1: GREY SCALE SONOGRAPHIC FINDINGS IN 40 THYROID NODULES

Characteristics	Pathological Diagnosis				p-value
	Benign(n=)		Malignant(n=)		
	No.	%	No.	%	
1. Internal contents					
• Purely cystic	4	12.5	0	0	0.125
• Cystic with thin septa	4	12.5	1	12.5	
• Mixed solid and cystic	14	43.75	1	12.5	
• Solid	10	31.25	6	75	
2. Echogenicity					
• Hypoechoic	9	28.125	5	62.5	0.248
• Isoechoic	5	15.625	1	12.5	
• Hyperechoic	11	34.375	2	25	
• Anechoic	7	21.875	0	00	
3. Margins					
• Well defined	26	81.25	3	37.5	0.013
• Poorly defined	6	18.75	5	62.5	
4. Halo					
• Thin complete	25	78.125	2	25	0.004
• Thick incomplete	7	21.875	6	75	
5. Calcification					
• Eggshell	3	9.375	0	0	0.080
• Coarse	2	6.25	1	12.5	
• Micro	4	12.5	4	50	
• No	23	71.875	3	37.5	

TABLE 2: DIAGNOSTIC INDEX FOR GREY SCALE SONOGRAPHIC CRITERIA OF THYROID NODULES (N=40) AS MALIGNANCY PREDICTOR

Characteristics	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Accuracy (%)
Solid Consistency	87.5	78.125	50	96.15	80
Hypoechogenicity	62.5	71.875	35.71	88.46	70
Poorly defined Margins	62.5	81.25	45.45	89.65	77.5
Thick incomplete Halo	75	78.125	46.15	92.59	77.5
Micro Calcification	50	84.375	44.44	87.1	77.5
Grey Scale U.S.G. (including all criteria)	85.71	75	46.15	95.45	77.14

On statistical analysis, two features having p value < 0.05 and hence showing statistical significance were poorly defined margins and thick incomplete halo **[Table 1]**.

DISCUSSION

Grey scale ultrasonography was the first investigation to be requested in all cases in this study because of it being non invasive, simple and without radiation exposure.

In present study, grey scale ultrasonography was able to evaluate morphology of thyroid nodules very effectively using five features and attempted to characterize the lesion as being benign/malignant.

These parameters have been evaluated in several studies with variable results. [5-15] Despite many available studies on ultrasound of thyroid nodules, there is no definite method or formula to evaluate preoperative risk of malignancy in thyroid nodule. It is more feasible to rely on one or two most significant parameters rather than having complex formula or calculation of malignancy risk based on an array of parameters.

Not many have tried to compare the available parameters. Gul K et al [5] found irregular margins as most useful feature for predicting malignancy in thyroid nodules and Laly Jose et al [15] found microcalcification to be most specific followed by irregular margins. The present study has evaluated and statistically compared the parameters to find the most predictive ones for malignancy in thyroid nodules.

CONCLUSION:

All parameters used in the present study showed high sensitivity, specificity, predictive value and accuracy individually as well as collectively. Presence of poorly defined margins and thick incomplete halo were found to be most reliable parameters. Relying on these two parameters, a clinically feasible approach can be provided in predicting malignancy in thyroid nodules rather than a complex evaluation of multiple parameters. With high specificity, specificity and sensitivity**,** malignancy can be ruled out in thyroid nodules pre-operatively by ultrasound obviating the need to subject all nodules to FNAC.

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