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Research Article

Role of High Resolution Sonography in Differentiating Benign and Malignant Nodules of Thyroid

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Abstract: Thyroid nodules are extremely common. It found in 4–8% of adults by population, 10–41% by ultrasound, and 50% at autopsy. High resolution ultrasound is the primary imaging modality for the evaluation of these nodules. 150 patients with thyroid nodules were taken in our study. 11 were males and 139 were females approximately 189 nodules were detected sono graphically in 150 patient. Nodules less than 1cm and purely cystic lesion were excluded from our study. Most of the FNAC were performed under USG guidance and histo-pathological findings were considered as final diagnosis. Cystic lesions were found to be benign. Hyper echoic & round shape lesions were found to be benign. Calcified lesions have more chance of malignancy. 22.1% calcified lesion were found in benign lesions. Calcified lesions are further divided into micro & macro according to their sizes. Micro calcified lesions were found to be malignant lesion (approx. 83 %). To summarize, gray scale USG findings of thyroid nodules were helpful in identifying clinically significant nodules and to differentiate between malignant and benign nodules. Our study revealed, the malignant features of poorly defined margins, micro calcification, marked hypo echogenicity and cystic predominance nature were found to have high diagnostic accuracy for the identification of malignant thyroid nodules while benign lesions demonstrated solid consistency, well defined margins and regular halo.
Keywords: Nodules, Calcification, Margin, Halo, FNAC, USG.

INTRODUCTION

Thyroid nodules are very common, may be observed at ultrasonography (US) in 50% of the adult population. Thyroid malignancy is found to be relatively rare, diagnosed in approximately 25,000 patients per year in the United States [1]. Nodular hyperplasia is the most common cause of benign thyroid nodules [2]. Although less than 7% of thyroid nodules are malignant, it is critical that they be accurately identified [2]. High-resolution US is the imaging modality of choice to investigate the thyroid nodules. When multiple signs of thyroid malignancy appear in combination, US help to make an accurate prediction. Fine-needle aspiration (FNA) may help in further assessment of the nodule [3].

Recognition of specific morphologic pattern is an appropriate method for the identification of benign thyroid nodules that do not require cytologic evaluation and may substantially decrease the number of unnecessary biopsy procedures [4]. Horvath *et al*. [5] proposed the Thyroid Imaging Reporting and Data System (TIRADS) to develop a standardized US characterization and data reporting system for thyroid lesions.

Prevalence of thyroid nodules is high while thyroid cancer is rare and fewer than 7% of all nodules are reported to be malignant [2]. As there is a high prevalence of thyroid nodules in the general population, it is important to have a clear strategy for the identification of patients in whom surgical excision is genuinely indicated as opposed to those in whom conservative management is possible [6].

There are various sonographic features, which predict malignancy like irregular margin, echogenicity, calcification, halo characteristic & internal composition. The purpose of this study is to differentiate benign verse malignant on basis of characterization of nodules and confirm by pathology expect for pure cystic nodules.

MATERIALS AND METHODS

Approximately 150 patients with thyroid nodules were taken in our study from 1/7/13 to 30/11/14 referred from OPD. In our study 11 were males and 139 were females. approximately 189 nodules were detected sono graphically in 150 patients. All nodules were preceded for FNA examination. Age

range of patients is from 18 to 72 Years, written informed consent was taken from each patient. Thyroid nodules were examined on SIEMENS ACUSON 300 machine via 5-10MHZ linear probe.

Sonographic findings of each thyroid nodules were assessed just prior to FNA examination.USG and pathological findings were blinded for each other. Nodules were evaluated for their size, shape, margins, echogenicity, presence of calcification, presence of peri lesional halo and internal composition. The margins were smooth or irregular, shape was lobulated or round and echogenicity was iso, hypo or hyperechoic in relation to thyroid. The nodule is also classified on the basis of solid, predominantly solid with cystic component or predominantly cystic with solid component, or purely cystic. Another basis of classification is micro or macro calcification in the nodule.

The patients having multiple nodules, each nodule was taken as separate nodule .Nodules less than 1cm and purely cystic lesion were excluded from our study. Most of the FNAC were performed under USG guidance and histo-pathological findings were considered as final diagnosis. Approximately 32 nodules were surgically resected.

RESULTS

189 nodules were detected out of 150 patients. 29 nodules were diagnosed to be malignant on grey scale HRUSG & rests were benign. While on histopathology 35 nodules (18.5%) were found to be malignant out of 189 nodules, and rest of the 154 nodules (81.5%) were benign.

Approximately 33.3% (6/18) nodules were found malignant in male patients, while 13.5% (23/171) found to be malignant in females on USG. Cystic lesions were found to be benign. Hyper echoic &round shape lesions were found to be benign. Calcified lesions have more chance of malignancy 68.5% (24/35), while 22.1% calcified lesion (34/154) were found in benign lesions. Calcified lesions are further divided into micro & macro according to their sizes. Micro calcified lesions were found to be malignant lesion (approx. 83 %).

Table 1: USG Characteristic of benign & malignant lesions

Gender	Malignant (29)	Benign (160)	Total
Female	23	148	171
Male	6	12	18

Table 2: USG Characteristic according to margin

Margin	Malignant	Benign	Total
Smooth	3	129	132
Lobulated	3	21	24
Poorly Defined	23	10	33

Table 3: Calcification

Calcification	Malignant	Benign	Total
Present	24	34	58
Absent	5	126	131

Table 4: Internal Content USG characteristic

Internal content	Malignant	Benign	Total
Solid	22	22	44
Predominant Solid	5	36	41
Predominant Cyst	2	102	104

Table 5: According to Perilesional Halo of solid lesion

Peripheral Halo in solid lesions (44)	Malignant	Benign	Total
Thin & Regular	2	20	22
Absent or Thick	20	2	22

Table 6: According to echogenicity

Echogenicity	Malignant	Benign	Total
Hyperechoic	0	15	15
Hypoechoic	1	89	90
Markedly Hypoechoic	23	18	41
Isoechoic	5	38	43

Fig. 1: Calcifications and heterogenous hypoechoic lesion: Longitudinal USG image showing multiple punctate echogenic shadows (arrow) i.e. micro calcifications in a hypoechoic ill defined nodules suggesting malignant lesion

Fig. 2: Transverse USG image shows a solitary peripheral curvilinear calcification with distal shadowing in a benign oval nodule

Fig. 3: USG image shows a well defined hyper echoic benign nodule with smooth peripheral halo

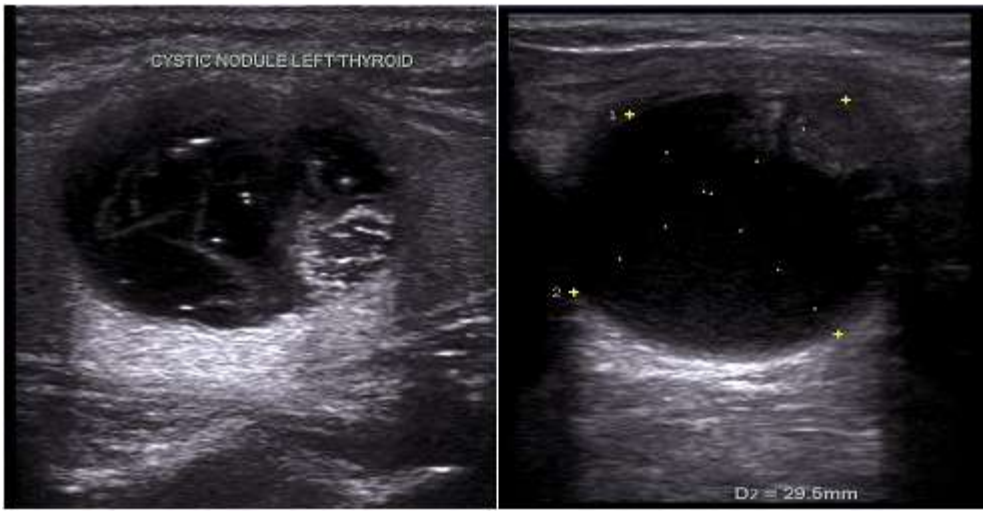

Fig. 4: USG image shows a well defined predominant solid cystic benign lesion with multiple septations

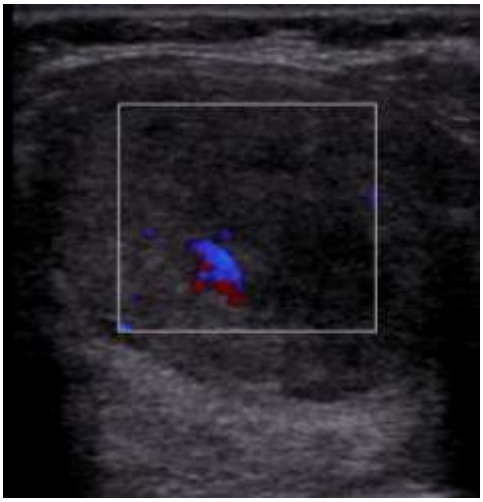

Fig. 5: Well defined heterogeneous benign nodule, which is wider than taller

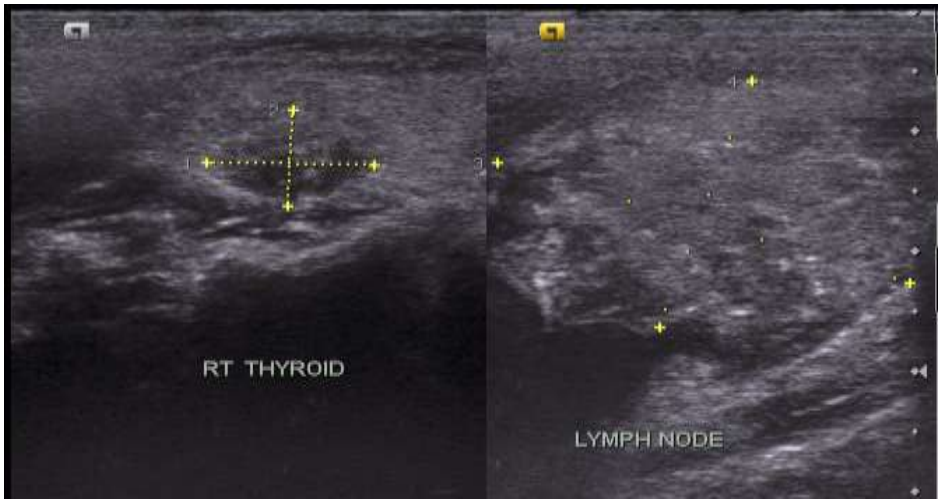

Fig. 6: USG image shows heterogenous nodule in thyroid with large lymph nodes having microcalcification in case of papillary carcinoma

Sensitivity & Specificity of each thyroid nodules were detected on USG morphology. Ill defined oval shape hypo echoic lesions with calcification were found to be malignant, while well-defined round hypo echoic nodule with regular Halo sign were found to be benign.

Overall sensitivity, specificity, positive & negative predictive values for USG of thyroid nodules is given in Table7.

Table 7: Sensitivity, specificity, positive & negative predictive values for USG of thyroid nodules

Characteristic	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Accuracy (%)
Margins	23/35 (65%)	150/154 (97.4 %)	23/33 (66.6 %)	150/156 (96.1 %)	173/189 (91.5 %)
Calcification	24/35 (68.5%)	126/154 (81.8 %)	24/58 (41.3 %)	126/131 (96.1 %)	150/189 (82.8 %)
Internal Content	27/35 (77.1%)	102/154 (66.2 %)	27/85 (31.7 %)	102/104 (98.0 %)	129/189 (68.2 %)
Peripheral Halo	23/35 (65.7%)	142/154 (92.2 %)	23/41 (56.0 %)	142/148 (95.9 %)	165/189 (87.3 %)
Echogenicity	23/35 (65.7%)	136/154 (88.3 %)	23/59 (38.9 %)	136/144 (94.4 %)	159/189 (84.1 %)

DISCUSSION

A thyroid nodule is defined as a discrete lesion within the thyroid gland which is distinguishable from the adjacent parenchyma on USG [7].

In our study approximately 18.5% of malignant nodules were detected which is higher than other studies reported [1, 8]. Thyroid disease is more common in females than males [9]. We found approximately 90.4% nodules in females.

Thyroid nodule is considered to be poorly defined when 50% of margin is not clearly defined [1]. In the present study malignant nodules had poorly defined and irregular margins (65 %). We concluded that poorly defined margins had the highest diagnostic accuracy (91.5 %) amongst all the USG characteristics for malignant nodules.

Our study revealed calcified nodules had more chances of malignancy (68.5%) than in benign nodules (22.1%). Nodules were assessed for presence of macro as well as micro calcifications. Sonographically, micro calcifications were seen as multiple punctuate echoes that are less than 2 mm in size, with or without acoustic shadowing. Microcalcification was found to be a highly specific UG feature of malignant thyroid nodules with high positive predictive value.

Moon *et al*. [10] categorized the internal composition of a nodule in relation to the ratio of the cystic portion to the solid portion in the nodules. The nodule could be predominantly solid (<50% cystic) or predominantly cystic (>50% cystic). Our study also revealed the same results approximately same results 77% sensitivity and accuracy of 68%.

A peripheral sonolucent halo that surrounds the thyroid nodules represents blood vessels coursing around the lesion. In a benign nodule this halo is usually complete and thin. In malignant nodule, the irregular thick and complete halo is thought to represent compressed normal tissue due to the rapid growth of the tumor [8, 11]. Regular complete thin peripheral halo surrounding solid nodule represent benign lesion with accuracy of 87%. Approximately 90.9% of solid lesions with absent halo around them revealed malignancy.

Most malignancies are reported to demonstrate a hypo echoic nodule. Most hypo echoic nodules are benign in view of the high prevalence benign lesion [4, 11]. In our study, most of the malignant lesions were found to be markedly hypo echoic approximately 65.7%.

CONCLUSION

To summarize, gray scale USG findings of thyroid nodules were helpful in identifying clinically significant nodules and to differentiate between malignant and benign nodules. . Our study revealed, the malignant features of poorly defined margins, micro calcification, marked hypo echogenicity cystic predominance nature were found to have high diagnostic accuracy for identifying malignant thyroid nodules while benign lesions demonstrated solid consistency, well defined margins and regular halo .

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