Ultrasound and Fine Needle Aspiration Cytology Correlation of Thyroid Nodules

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Abstract:

Purpose: *High resolution grey scale ultrasound has emerged as an initial imaging modality of choice for the evaluation of patients with thyroid enlargement. Thyroid malignancy cannot be diagnosed on ultrasonography but various sonographic features in combination can be used to predict malignancy in thyroid lesions. The aim of our study was to evaluate the diagnostic accuracy of ultrasonographic features for the differentiation of benign and malignant thyroid nodules by using FNAC as the reference standard.*

Materials And Methods: *The present study was a prospective study of 200 consecutive patients more than 10 years of age who attended various OPD's and IPD's of SKIMS Soura with thyroid nodules. A high-resolution grey scale sonography of the thyroid gland was performed along with a color-flow Doppler study. Sonographically guided FNAC was then performed by the standard technique. Pre-FNAC sonograms were interpreted with respect to number of nodules, nodule size (largest diameter of largest nodule, if more than one), echogenicity, echo structure, shape, border characteristics, presence or absence of calcifications, and vascularity on color flow Doppler examination. All statistical calculations were performed using a 2×2 contingency table and χ^2 analysis. Data associations were considered statistically significant at $p < 0.05$.*

Results: *Mean age was 38.91 years ±10.85 years. There were 47 males and 153 females with a male: female ratio of 1:3.26. Overall, majority (94%) of nodules were benign predominated by colloid nodules. Malignant nodules accounted for 6% of cases, out of which papillary carcinoma was most common. Microcalcifications, irregular/ill-defined margins, hypoechogenicity, taller than wide shape, and internal vascularity were the sonographic features found to be significantly associated with malignancy.*

Conclusion: *As per our results, the best compromise between risk of missing carcinomas of potential clinical aggressiveness and the need to avoid unnecessary procedures is to use FNAC on nodules with at least one of the high-risk sonographic features.*

Keywords: *Thyroid, Ultrasound, Nodule, FNAC, Malignancy*

I. Introduction

Being extremely common, the goal in management of nodular disease of the thyroid is to avoid extensive and costly evaluation in the most patients with benign disease without missing the minority of patients who have thyroid cancer. Current practice among most clinicians is to further evaluate any thyroid nodule that is palpable on physical examination by sonographically guided FNA biopsy to rule out malignancy. Several studies have sought to identify sonographic features that are both sensitive and specific for malignant versus benign disease, but currently much debate exists as to whether such features have been successfully identified[1,2,3].

Sonographic features that have been identified in previous studies as being suggestive of malignancy include marked hypoechogenicity, irregular or microlobulated borders, a shape that is more tall than wide, intranodular vascularity, and the presence of microcalcifications. [1,2,4]. The purpose of this study was to further evaluate the correlation between various sonographic features of thyroid nodules and their risk for malignancy in an attempt to suggest an optimal diagnostic approach to further workup of these lesions.

II. Aims & Objectives

To evaluate the diagnostic accuracy of ultrasonographic features for the differentiation of benign and malignant thyroid nodules by using FNAC as the reference standard.

III. Materials & Methods

The study was conducted in the Department of Radiodiagnosis and Imaging, SKIMS Soura in collaboration with the Department of Pathology. The present study was a prospective study of 200 consecutive patients more than 10 years of age who attended various OPD's and IPD's of SKIMS Soura with thyroid

nodules and gave consent for being included in the study. Patients already having a cytological or histopathological diagnosis of thyroid lesion and where FNAC showed inadequate aspirated material were excluded from the study.

After enrolling the patients on a pre-structured proforma, a high-resolution grey scale sonography of the thyroid gland was performed along with a color-flow Doppler study. Sonographically guided FNAC was then performed by the standard technique. Pre-FNAC sonograms were interpreted with respect to number of nodules, nodule size (largest diameter of largest nodule, if more than one), echogenicity, echo structure, shape, border characteristics, presence or absence of calcifications, and vascularity on color flow Doppler examination. Nodules for which all characteristics could not be assessed were excluded from the analysis.

The specific pathologic diagnosis for each case was confirmed by pathologic reports from sonographically guided FNA cytologic examinations. Individual sonographic features as well as various combinations of features were then analyzed for their correlation with malignant pathologic findings.

All statistical calculations were performed using a 2×2 contingency table and χ^2 analysis. Data associations were considered statistically significant at p< 0.05. The sensitivity, specificity, positive predictive value, and negative predictive value were defined for each individual sonographic feature in the detection of nonbenign masses.

IV. Results

Age ranged from 11 to 67 years. Mean age was 38.91 years ±10.85 years. There were 47 males and 153 females with a male: female ratio of 1:3.26. (p=0.000). Thus there were significantly more women than men presenting with thyroid nodules. 171 (=85.5%) cases had only one thyroid nodule. 29 (14.5%) had two or more nodules. The size of nodules (largest diameter) ranged from 5 mm to 50 mm. Mean size was 21.37mm ± 10.28mm.

Overall, majority (94%) of nodules were benign predominated by colloid nodules. Malignant nodules accounted for 6% of cases, out of which papillary carcinoma was most common.

V. Figures & Tables

Table 1. Frequency distribution of the various FNAC diagnosis

Colloid nodule	168	84%
Hyperplastic nodule	5	2.5%
Thyroiditis	9	4.5%
Follicular Adenoma[*]	6	3%
Follicular Carcinoma	1	0.5%
Papillary carcinoma	10	5%
Medullary carcinoma	1	0.5%

Table 2: Diagnostic accuracy of various ultrasound features predicting malignancy

| Ultrasonographic feature	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Significance p-value
Nodule size >10mm	**100**	**20.2**	**7.41**	**100**	**0.084**
Tall shape	**25**	**99.47**	**75**	**95.4**	**0.000**
Irregular/ill-defined borders	**75**	**84.6**	**23.7**	**98.1**	**0.000**
Presence of halo	**50**	**71.3**	**10**	**95.7**	**0.119**
Solid consistency	**41.7**	**47.3**	**4.8**	**92.7**	**0.46**
Hypoechoicity	**75**	**68.1**	**13**	**97.7**	**0.002**
Microcalcification	**66.7**	**96.8**	**57.1**	**97.8**	**0.000**
Internal vascularity	**91.7**	**81.9**	**24.4**	**99.4**	**0.000**
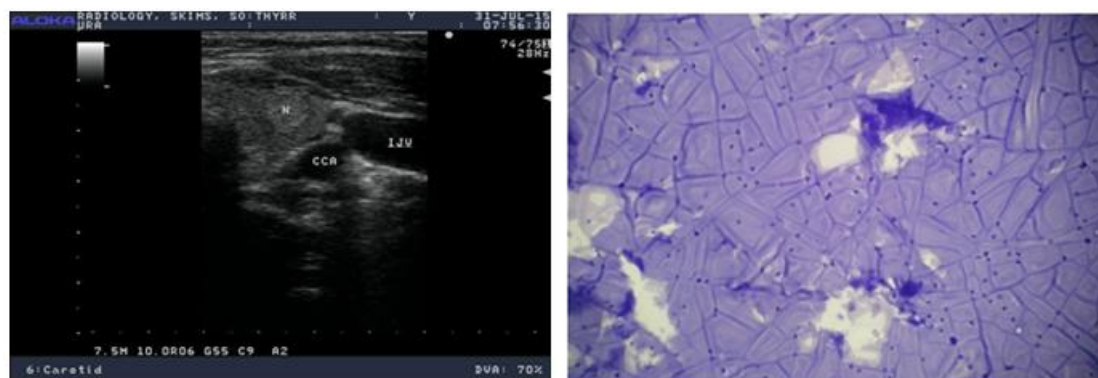
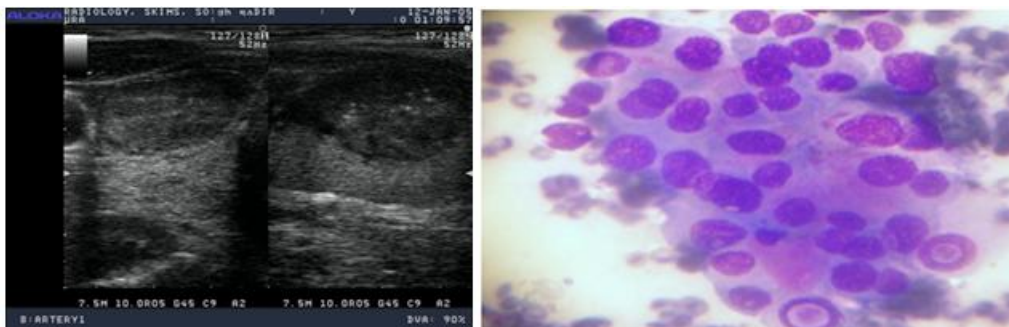**Figure 1**. Ultrasound(Right) and FNAC (Left) of Colloid nodule.

Figure 2. Ultrasound (Right) and FNAC (Left) of Papillary carcinoma

VI. Discussion

In the present study most of the patients (32.5%) were in 30-40 years age group. 77% patients were female and 23% male with a male: female ratio of 1:3.26. In a study by Ankush Dhanadia et al [5], 72% patients were female and 28% were male. The male to female ratio was 1:2.5. So, females are more commonly affected than males. Out of 200 cases, 94% were benign and 12 (6%) were malignant. Papillary carcinoma was seen in 10 out of 12 cases (83.3%), follicular carcinoma in 1 (8.3%) and medullary carcinoma in 1 (8.3%) of cases. In a study by Joseph F. Simeone, et al. [6] in 1985, 87.2% cases were benign and 12.7% cases were malignant. Most common benign pathology in the present study was colloid goiter seen in 84% cases. Follicular adenoma was found in 3% and thyroiditis in 4.5% of patients.

In the present study, among benign nodules 31.9% lesions were hypoechoic, 38.8% were hyperechoic 18.1% were isoechoic and 11.2% showed mixed echogenicity. Perilesional halo was seen in 28.7% cases, coarse calcification in 19.7% cases and microcalcification in 3.2%. Margin was well-defined in 84.6% and ill-defined in 15.4%. 52.7% were solid, 25% were cystic and 22.3% had solid-cystic components. Out of 12 malignant cases, 83.3% were in the age group of 30-60 years. Percentage of malignancy in male was 10.6% and in female it was 4.6%. 75% malignant lesions were hypoechoic, 16.7% were hyperechoic and 8.3% were of heterogeneous echogenicity. 66.7% malignant cases had calcification within nodules. Margin of lesion was well-defined in 25% and ill-defined in 75% of cases. 50% of the malignant lesions showed perilesional halo.

VII.   Conclusion

High resolution grey 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

Various sonographic features like 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 grey 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.

As per our results, the best compromise between risk of missing carcinomas of potential clinical aggressiveness and the need to avoid unnecessary procedures is to use FNAC on nodules with at least one of following sonographic features:

- Microcalcifications
- Irregular/ill-defined margins
- Hypoechogenicity
- Taller than wide shape
- Internal vascularity.

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