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Role of ultrasound and doppler in characterizing thyroid nodules and differentiating benign and malignant thyroid nodules

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Abstract

One of the consequences of increased use of imaging has been the discovery of incidentalomas, or pseudodiseases, that are common in the general population but have no or minor clinical significance. One such incidentaloma, the thyroid nodule, is extremely common, found in some autopsy series in as much as 50% of the general population. Most thyroid nodules are benign, usually as a part of multinodular changes. Clinical examination is poor at detecting small thyroid nodules, highlighted by the fact that approximately 70% of clinically normal thyroid glands contain nodules of less than 1 cm when examined sonographically. The ultimate aim in the management of a thyroid nodule is to identify the small group of patients in whom the nodule is malignant and would benefit from early aggressive treatment while avoiding unnecessary investigation and surgery in the majority of patients who have a benign nodule. In view of the above said, we conducted this study to evaluate the diagnostic utility of ultrasound and doppler in characterizing thyroid nodules and differentiating benign and malignant thyroid nodules and correlation of this with the results of FNAC and or histopathology. A prospective study comparing FNAC and HPE on 110 patients was performed. Majority of our patients were in the age group of 40-49 years, predominant in females.

Conclusion: FNAC sampling is a simple technique, which is easier to perform by the personnel and has better patient acceptability. FNA of thyroid is basically a technique that helps in differentiating lesions that require surgery from those can be managed conservatively. It can be used as initial modality in the evaluation of palpable thyroid nodules. But imaging also yields accuate results comapable to FNA.

Keywords: Ultrasound , Doppler, Thyroid, FNAC, Benign and malignant.

Introduction

One of the consequences of increased use of imaging has been the discovery of incidentalomas, or pseudodiseases, that are common in the general population but have no or minor clinical significance. One such incidentaloma, the thyroid nodule, is extremely common, found in some autopsy series in as much as 50% of the general population. Most of these nodules are benign; the incidence of malignancy is quite low, 3–7%. Thyroid swelling is one of the commonest presentations in head and neck outpatient department. Patients presenting with a palpable thyroid nodule is a common clinical dilemma. They are four times more common in women than in men and the prevalence increases with age. The risk of malignancy in a euthyroid patient with a solitary thyroid nodule is estimated to be 5%–10% with a range of 3.4%–29%.[1]

Most thyroid nodules are benign, usually as a part of multinodular changes. Clinical examination is poor at detecting small thyroid nodules, highlighted by the fact that approximately 70% of clinically normal thyroid glands contain nodules of less than 1 cm when examined sonographically.[2] The ultimate aim in the management of a thyroid nodule is to identify the small group of patients in whom the nodule is malignant and would benefit from early aggressive treatment while avoiding unnecessary investigation and surgery in the majority of patients who have a benign nodule.

The use of fine needle aspiration cytology is a valuable method in diagnosis of thyroid lesions and has reduced the number of patients subjected to thyroidectomy for benign diseases of the thyroid. The success of FNAC is contingent upon several important contributing influences including aspirator's experience, skillful cytological interpretation and a rational analysis based upon a synthesis of cytological and clinical information in the context of an individual patient FNAC is an Invasive Procedure More-ever the tissue id take only from one area and may not be representative of the whole gland, a small foci of micro cancers less than one cm in the thyroids may be missed in FNAC.

Imaging, especially with the use of high resolution ultrasound, helps to differentiate a malignant nodule from a more common benign thyroid nodule. Ultrasound is an ideal imaging modality for detection and assessment of a thyroid nodule. It is easy to perform, widely available and does not involve ionizing radiation. Addition of color and spectral doppler imaging that determines the vascular pattern of thyroid diseases has been found to be a very useful tool in screening the thyroid nodule for malignancy.

In view of the above said, we conducted this study to evaluate the diagnostic utility of ultrasound and doppler in characterizing thyroid nodules and differentiating benign and malignant thyroid nodules

and correlation of this with the results of FNAC and or histopathology.

Materials and Methods

This study was done at on 100 patients with suspected thyroid disease referred to the department of Radiodiagnosis at Father Muller Medical College Hospital, Mangalore for evaluation using ultrasonography.

A prospective study was done at Father Medical Muller Hospital between June 2012 to June 2014 in which 110 patients who presented with thyroid diseases and were referred to the department of Radiodiagnosis at Father Muller Medical College Hospital, Mangalore for evaluation using ultrasound. The patients were chosen by purposive sampling technique after excluding patients who did not meet the inclusion criteria and those who met the exclusion criteria. Patient was advised to be supine position with neck extended. After explaining to the patient the procedure in brief ultrasound was done using Philips HD 11 scanner and to ensure acoustic contact ultrasound gel was used.

Ultrasound Scanning

Technique: The thyroid gland is uniformly hyperechoic on ultrasound and is best seem with the use of high resolution linear array, transducers ranging from 7 to 12 MHz. In our study, we used using Philips HD 11 scanner short focus transducer without water bath, and to ensure acoustic contact ultrasound gel was used.

Positioning of the Patient: The patient is examined in the supine position with the neck hyper-extended to identify the inferior margin of the gland, which may extend to the clavicle in some patients. A small pad may be placed under the shoulders to provide better exposure of the neck, particularly in patient with a short, stocky habitus. The examiner usually sits at the head of the table and can steady the transducer by resting an elbow of the forearm on the table next to the patient's head.

The thyroid gland is scanned in both longitudinal and transverse planes.

Imaging of the lower poles can be enhanced in some patients by asking them to swallow which momentarily raises the thyroid gland in the neck. The entire gland from upper to lower pole, including the isthmus is carefully examined.

The examination is extended laterally to include the region of the carotid artery and jugular vein in order to identify the enlarged cervical lymph nodes. On transverse scans the upper, mid, and lower patterns of the thyroid gland is identified and on longitudinal scan, the lateral, mid, and medial portions of the thyroid are demarcated.

The thyroid gland was evaluated first with grey scale imaging followed by color doppler to assess the presence of any focal lesions and their ecopattern, compressibility, capsular integrity, extension of the disease process outside the limits of the gland margin. ultrasonography findings were correlated with the biopsy or histopathological examination of the thyroid specimen.

Inclusion Criteria:

1. Patients in whom histopathological findings are available for correlation.
2. Patients of all ages and both sexes.
3. Patients with thyroid lesions who are referred to radiology department for ultrasound/FNAC of thyroid.

Exclusion Criteria: Patients in whom cytology or histopathological findings are not available for correlations.

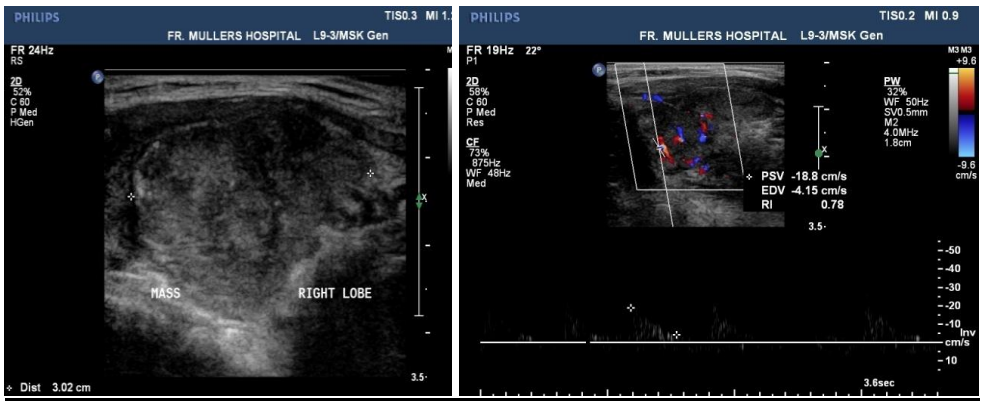

Fig. 1: Right lobe thyroid enlargement solitary thyroid nodule (A) Gray scale (B) Doppler

Fig. 2: Cystic lesion with solid component comet tail artifacts (A) Gray scale (B) Doppler

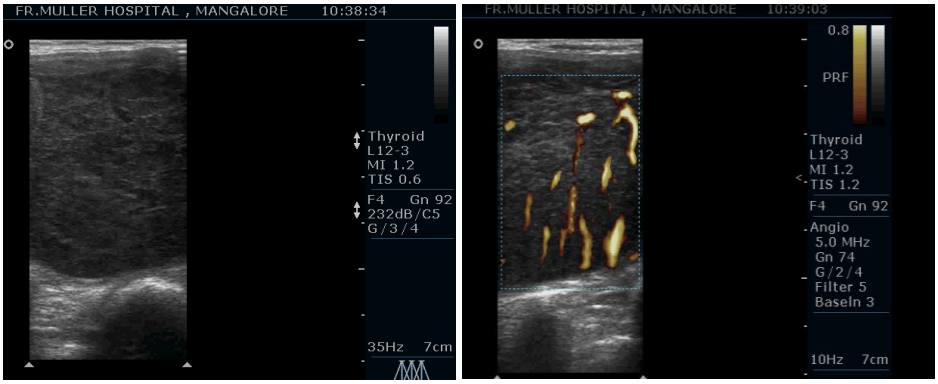

Fig. 3: Follicular carcinoma of the thyroid (A) Gray scale (B) Doppler

Results and Observations

In our study when we analyzed the demographic data the age group of 41-50 years (36.4%) constituted most of the cases with mean age group of 40 yrs. in our study where 83.6% of the patients were females, In our case series we analyzed the ratio of comparison of neoplastic to non-neoplastic lesions on FNAC we found that the ratio was 1: 14. In our study sensitivity was 77.78% and specificity was 100%.

Discussion

In our study when we analyzed the demographic data the age group of 41-50 years (36.4%) constituted most of the cases with mean age group of 40 yrs. Similar findings were seen in a study by Afroze[3] et al in 2000, 40.2 years was found to be the mean age group when thyroid diseases were studied by them. In a study by Islam M S [4] et al in 2010, 37.7 years was found to be the mean age group when thyroid diseases were studied. In another study by Sreeramulu[5] et al in 2012, 35.4 was the mean age group.

In a study by Kamal[6] et al in 2002, 86.5% of patients were females, which was the similar to finding in our study where 83.6% of the patients were females. While in a study by Afroze,[3] 71.76 % of patients were female.

In our case series we analyzed the ratio of comparison of neoplastic to non-neoplastic lesions on FNAC we found that the ratio was 1:14. In the reports by Safirullah[7] et al in 2004 and Kamal et al[6] 2002 ratio of neoplastic to non-neoplastic lesions were 1: 7.6 and 1: 7.2 respectively. Similarly in study by Hyang-Mi Ko et al[8] in 2003, ratio of neoplastic to non neoplastic lesions was 1:19.2.

Results obtained in a study by Rizvi and Khan,[9] the non neoplastic group consisted of 82% of patients with colloid goitre. In another study by Sengupta A[10] and colleagues 76% of cases were diagnosed as colloid goitre based on FNAC. In our study 98 patients had benign lesions, out of which, 90(91.83 %) patients had colloid goitre, 3 patients had hashimotos thyroiditis, 2 patients had adenomatous hyperplasia, 2 patients had hyperplastic nodule and 1 patient had adenomatous nodule on FNAC.

In a study by Islam[4] and others on evaluation FNAC of the neoplastic thyroid swellings, papillary carcinoma was the most common with 14 of the 19 patients with malignancy having papillary carcinoma, followed by follicular carcinoma in 3 patients, follicular variant of papillary in 1 patient and one patient with high suspicision of malignancy which was in which based on FNAC of the neoplastic thyroid swellings papillary carcinoma was detected contrast to our study, in 3 patients and follicular neoplasm in 4 patients.

In a study by Islam,[14] sensitivity and specificity of FNAC in the diagnosis of thyroid swelling was evaluated to be 73.68% and 97.26%. Similarly Sengupta[10] et al studied FNAC of patients with enlarged thyroid and their study demonstrated sensitivity around 90%, and specificity 100%. Agarwal et al.[8] in their study evaluated thyroid nodules in 100

cases and in their study FNAC demonstrated a sensitivity of 76.5%, and a specificity of 95.9%.

In our study sensitivity was 77.78% and specificity was 100% which is comparable to a study by Sreeramulu[9] where sensitivity was 74% and specificity was 100%.

The diagnostic accuracy of Correlation between FNAC diagnosis and final histological diagnosis was 88.8%in a study by Basolo[10] et al. same was demonstrated as 90.9% in a study by Agarwal S.[9]

Study by Islam had accuracy of 94.44% and Senguta A[8] and group had accuracy of 98.31%. In our study accuracy was 98.18%.

In our study we correlated the cytological findings with HP findings for malignant lesions. In our study – we had Accuracy 98.18 %, Sensitivity 77.78%, specificity 100%, PPV 100%, NPV 98.05%, kappa statistics is 0.786 and p value for the comparision was <0.001. This shows that there is a significant co relation between FNAC diagnosis and final histological diagnosis.

Conclusion

Thyroid gland ailments are a common disorder in the coastal region of South India. The presentations of the thyroid gland diseases are widely varied. The course of treatment and follow up rests on the proper diagnosis of the disorder with specific investigations.

Among our study material in highly cellular lesions in which abundant material was obtained FNA can diagnose most of the lesions. FNAC is an invaluable, minimally invasive, highly accurate and cost effective procedure for the preoperative assessment of patients with thyroid lesions.

Surgical excision of all nodular thyroid lesions would entail a large number of unnecessary procedures. Thus, FNA of thyroid is basically a technique that helps in differentiating lesions that require surgery from those can be managed conservatively. It can be used as initial modality in the evaluation of palpable thyroid nodules.

FNA of palpable thyroid nodules allows for the identification of thyroid carcinoma and planning of subsequent appropriate therapy.

Low rate of false positive and false negatives can be achieved by applying strict criteria for specimen adequacy.

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