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Predictive Value Of Concordant Imaging In Thyroid Malignancies With Structural Ultrasound And Functional Technetium 99M Scintigraphy.

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ABSTRACT

There are numerous scoring systems for thyroid malignancies like AMES, AGES, MACIS, etc., which were designed to suit individual institutions. The Bethesda. However, the Bethesda classification is commonly adopted for pathology. Bethesda 3,4 & 5 Which Are 3- Atypia Of Undetermined Significance .4- Follicular Neoplasm and 5-Suspcious For Malignancy Need Genetic armamentarium. Concordant imaging involving structural ultrasound and functional scintigraphy are utilized to bridge the lack of genetic tests and compared with final histopathology to aid surgical decision-making about the completeness of surgery. To Evaluate & Establish the preoperative predictive value of malignancy utilizing concordant imaging using zone-specific structural ultrasound correlated with functional Technetium 99m Scintigraphy. The study was conducted Tertiary care hospital in Tamil Nadu with 620 ADULTs with thyroid nodules where 360 solid cold nodules in thyroid patients from 2011-2017 in the Department of Endocrine Surgery, Madras Medical College, Chennai were identified and analyzed. The parameters employed were Clinical, Ultrasound, Scintigraphy, Cytology, Surgical grossing, and Histopathology. Four patients of Graves' disease had malignant nodules in addition to Graves' Disease and two patients had a histological surprise of Lymphoma in Histopathology. Follicular neoplasm and Suspicious for malignancy which is a grey area especially when the much-needed genetic analysis is lacking to establish a diagnosis.
Keywords: FNAC, Ultrasound, Scintigraphy, Histopathology (Gold Standard)

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INTRODUCTION

Thyroid nodules are a common clinical dilemma. The prevalence of a palpable thyroid nodule is approximately 5% in women and 1% in men in iodine-sufficient parts of the world [1]. The main aim of evaluating thyroid nodules is to detect thyroid cancer that occurs in 5–10% depending on age, gender, history of radiation exposure, family history, and other factors [2]. More than 90% of thyroid cancers are differentiated, comprising papillary and follicular carcinoma. High-resolution ultrasound is the most common and ideal initial imaging investigation for thyroid nodules [3]. Combining ultrasound with guided fine needle aspiration cytology (FNAC) markedly improves its specificity and diagnostic accuracy [4]. In particular, the positive predictive value of FNAC is very high and this plays a major role in the management of thyroid cancer. However, with the advent of newer investigations and the changing clinical characteristics of thyroid malignancies with increased incidence of aggressive histological subtypes undergoing Subclassification the prognostic outcome remains varied with no standardized operating protocol [5]. Risk categorization with tumor size and aggressive histology and age remains the mainstay in the current workup of thyroid malignancies. In this setting and background, we have developed the preoperative predictive value of malignancy utilizing concordant imaging using zone-specific structural ultrasound correlated with functional Technetium 99m Scintigraphy [6].

METHODS

The study was conducted in a Tertiary care referral hospital in Tamil Nadu with 620 adults with thyroid nodules from 2011-2017 in the Department of Endocrine Surgery, Madras Medical College, Chennai. Based on previous Indian studies with an error of 5% & power of 80%, 620 ADULTs with thyroid nodules (a subset of 74 for USG vs Scinti) undergoing thyroidectomy were studied to allow detection of a 25% reduction in the primary outcome. Following parameters were assessed Clinical, Ultrasound, Scintigraphy, Cytology, Surgical grossing, and Histopathology (Gold Standard).

Inclusion Criteria: Solitary nodule, Multinodular goiter, Nodules with and without nodes, Nodules with toxicity, and Nodular Graves.

Exclusion criteria: Diffuse Toxic goiter, autonomously functioning thyroid nodule, Nodal Metastasis, Recurrent nodules, Nodular goitre in pregnancy, Patients Deemed Unfit for surgery. Our STUDY involves clinical, sociological, scintigraphic, and cytopathological correlation in solid thyroid nodules and we have developed an innovative zone-specific charting. Sociologically solid tumors are categorized under subzones of the thyroid and zone-specific nodules are plotted along with +/- calcification. These are subjected to determine Scintigraphically Cold areas in the corresponding zone. The nodules are then correlated cytologically with and without surgical grossing. Surgical grossing is to plot the corresponding nodule. Patients with a risk score of three or more are confirmed with superimposed Histopathology in the corresponding zones after Total thyroidectomy was employed in the prescribed Pathology proforma**.**

Statistical Analysis

For the univariate analysis, data analysis would use the chi-square test or Fisher's exact test to categorical variables, and the non-parametric test (Mann-Whitney) to quantitative variables of the two groups ($P < 0.05$) For the multivariate analysis, a logistic regression model was applied to data, using the predictors of malignancy for statistically significant in the univariate analysis. To analyze the relationship between age and thyroid nodule malignancy, we create a receiver operating characteristic (ROC) loop to identify cutoff points to enable the identification of specificity and sensitivity of age related to thyroid cancer.

RESULTS

All 620 nodules were evaluated by a Surgeon who performed Ultrasound and Technetium99m Scintigraphy. Four patients of Graves' disease had malignant nodules in addition to Graves. Disease and two patients had a histological surprise of Lymphoma in Histopathology. Thyroid antibody titers viz., Antimicrosomal Antibodies (TPO) and Antithyroglobulin antibodies for all nodules were carried out to rule out thyroiditis. Positive predictive value is the proportion of patients with positive results who are correctly diagnosed. Negative predictive value is the proportion of patients with negative results who are correctly diagnosed.

We carried out Thyroid antibody titers viz., Antimicrosomal Antibodies (TPO) and antithyroglobulin antibodies for all nodules as part of the evaluation of a thyroiditis overlayWith the help of experienced Radiologists, a thyroid ultrasound workshop was undertaken with structured training for surgeon-performed ultrasound focusing on three parameters viz., composition, echogenicity, and calcification. These were easy to detect by the surgeon performs an ultrasound. Other parameters like margins, vascularity, and dimensions were not included in this study.

Picture 1: Ultrasound For Nodules
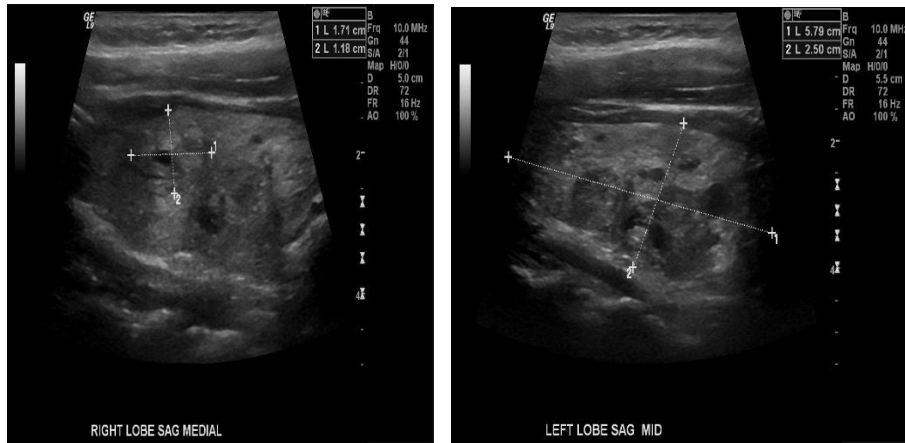
Picture 2: Concordant Imaging Of Ultrasound With Technetium 99M Scintigraphy
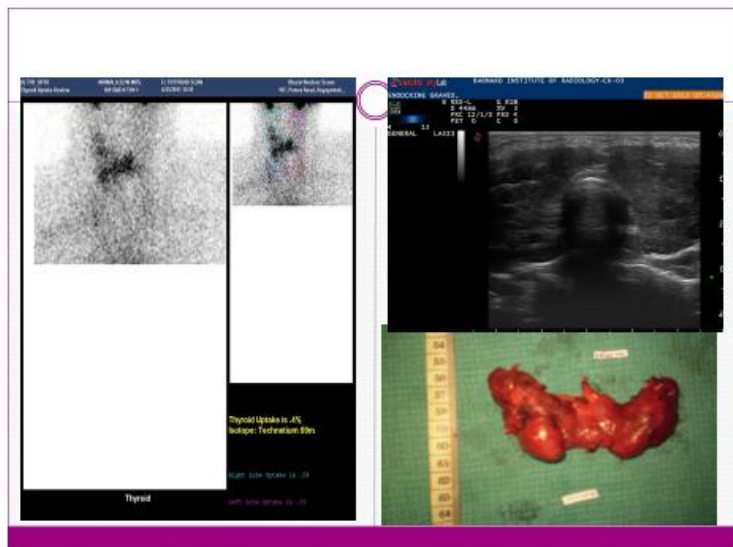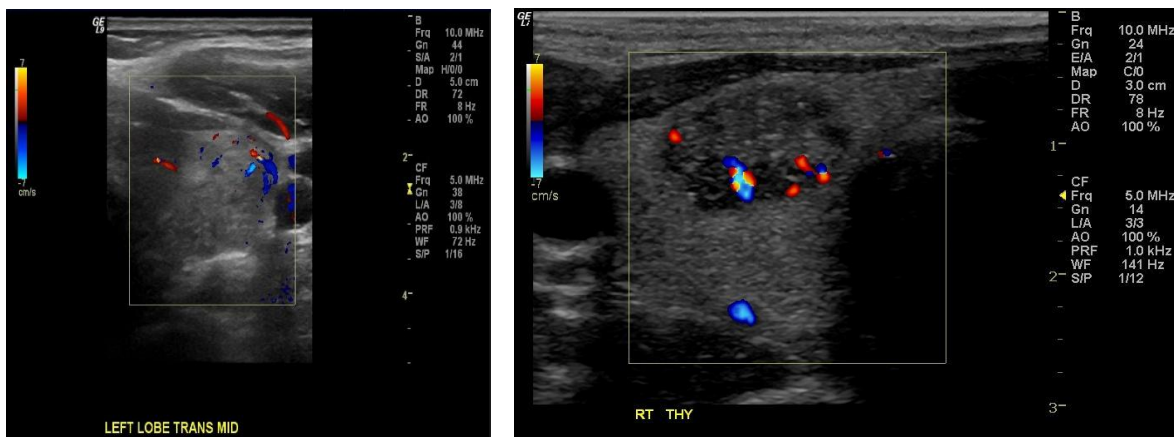
Picture 2 demonstrates the benefit of concordant imaging to plot the nodule in the same zone both in ultrasound and scintigraphy. Accordingly, zones were classified and nodules were marked specific to the zone for further comparison with Histopathology which is the Gold Standard.

Table 1: P- Malignancy-AUS/FN/ SM (N=74).

PARAMETERS	FNAC	USG	SCINTI	USG+SCINTI
SENSTIVITY	83	71	63	80
SPECIFICITY	95	87	77	91
+PRED VALUE	85	81	71	83
_PRED VALUE	90	83	74	87
ACCURACY	91	84	71	89

Table 1 shows the concordant imaging together complements and adds to the diagnostic accuracy which approached the diagnostic accuracy of FNAC levels. Based on these parameters Bayesian Classifier was developed to test the efficacy of FNAC, Ultrasound & Scintigraphy.

Table 2: Histopathology of subtypes of malignancies and the extent of Surgery.

DIAGNOSIS	NO OF PATIENTS	INTERVENTION
PAPILLARY CARCINOMA With variants remnant recurrence	56	TT (31) TT + CCLND (11) TT+MRND (9) REOPERATIVE (2) REC(6) COMP.THY(3)
FOLLICULAR Variants & Met	4	TT EXCISION OF MET
MEDULLARY CA	2	TT CCLND +/_MRND
ANAPLASTIC CA	2	HEMI
HURTHLE CELL NEOPLASM	2	TT
Oxyphil adenoma	2	TT

Table 2 shows Pathological subtypes of 74 malignancies detected with concordant imaging. The concordant imaging had given a lead toward malignancy. However, the dedifferentiation had been a fallacy in Anaplastic which led to Hemithyroidectomy. The combination of Concordant imaging of Ultrasound and Scintigraphy complement each other to compound an additive effect towards diagnosis of malignancy in the absence of genetic analysis.

DISCUSSION

Every patient with a palpable thyroid nodule is a candidate for fine needle aspiration (FNA) and should undergo further evaluation to determine if an FNA is warranted. Thyroid nodules detected by palpation are usually at least 1.0 cm in dimension and are therefore clinically significant [7]. Patients with a normal or elevated serum TSH level should proceed to a thyroid US to determine if an FNA needs to be performed (see section B below); those with a depressed serum TSH should have a radionuclide thyroid scan, the results of which should be correlated with the sonographic findings [8]. Functioning thyroid nodules in the absence of significant clinical findings do not require an FNA because the incidence of malignancy is exceedingly low. A nodule that appears either iso- or hypo-functioning on radionuclide scan, however, should be considered for FNA based on US findings [9]. With the exception of low-risk unifocal microcarcinoma, total thyroidectomy followed by radioiodine ablation and TSH-suppressive thyroid hormone therapy is the standard treatment for differentiated thyroid cancers. Sentinel lymph node (SLN) biopsy has been advocated to avoid the morbidity of routine nodal dissection but allows the identification of draining nodes from the tumor and the detection of micrometastases [10]. These nodes can be located with preoperative lymphoscintigraphy followed by an intraoperative hand-held gamma probe. SLN biopsy may play a role in early small thyroid cancers and larger clinical trials are awaited. TSH-stimulated thyroglobulin, measured by sensitive immunoradiometric assays, provides one of the most sensitive means for the detection of persistent disease in the absence of interfering anti-thyroglobulin antibodies [11]. For follow-up after standard treatment, a combination of TSH-stimulated thyroglobulin and ultrasound of the neck +/− FNAC are often sufficient in low-risk patients [12]. For high-risk patients or in cases of increasing TSH-stimulated thyroglobulin, radioiodine whole body scan (WBS) or FDG-PET is recommended for detection of persistent or metastatic disease. The Bayesian

classifier is Stratified as explanatory (independent) and response (dependant) based on Systematic Enumeration of all the variables that have a successful outcome and hence the applied use of structural ultrasound and functional scintigraphy in solitary nodules offers benefit as a diagnostic model [13]. Clinically solid, ultrasounds solid and scintigraphically cold had been proven to be malignant independent of FNAC [14, 15].

CONCLUSION

FDG-PET serves an important role only in dedifferentiated and metastatic thyroid carcinomas. Technetium m scintigraphy is more often false positive with a diagnostic yield of 40 percent accuracy only. Image-guided ultrasound has a diagnostic yield and contributes to diagnostic accuracy as an adjunct to scintigraphy. Concordant imaging combining structural USG correlation with functional Scintigraphy may offer additional insight for diagnosis and planning surgical interventions especially when they are superimposed and one specific leading to improving diagnostic accuracy Bethesda Classification 3,4,5 viz a typia of undetermined significance, follicular neoplasm and suspicious for malignancy are all grey zones when FNAC fails to detect and hence genetic studies are employed. Concordant imaging with zone-specific superimposed interpretation has proven to be of value as a supplement to zone-specific image-guided ultrasound and Technetium99 M scintigraphy. Since these Diagnostic Modalities complement each other, they are useful, especially in Bethesda Classification for Atypia of undetermined significance, Follicular neoplasm, and Suspicious for malignancy. The final histopathology has confirmed the value of superimposed concordant imaging as a diagnostic aid to improve diagnostic accuracy.

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