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EVALUATION OF THYROID LESIONS WITH USG AND PATHOLOGICAL CORRELATION

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Abstract : To calculate the incidence of different types of thyroid lesions in rural people.In the diagnosis and characterisation of various thyroid lesions, ultrasonography is frequently utilised as the first investigative modality.

Objective : To assess the diagnostic accuracy of ultrasonography in distinguishing benign and malignant thyroid nodules by correlating sonographic findings with pathological diagnosis as a reference..

Method: From June 2020 to December 2021, a prospective study was conducted on 100 patients who visited the Apollo medical college and District head quarters hospital, in the OPD of the department of radio diagnostics. All patients with thyroid swelling, mass, or enlargement were examined with USG before undergoing FNAC.

Results: Of the 120 Thyroid disease patients in my study, 77 percent were females and 23 percent were males. The patients with the highest number of instances were between the ages of 41 and 50, accounting for 37 percent of all cases. 'Lump in the neck' was the most common complaint. Euthyroidism was the most common diagnosis (73). Solitary Thyroid Nodule was the most prevalent disease found on thyroid sonography (42percent). The diagnostic accuracy of high resolution sonography in thyroid disorders was 84 percent Sensitivity and 96 percent Specificity.

Conclusion: Many malignant or potentially malignant thyroid nodules can be detected with ultrasonography. Although there is some overlap in the appearance of benign and malignant nodules on ultrasonography, some ultrasonography features can aid distinguish between the two. Even though it can report malignancy of the follicular variety, FNAC can diagnose benign disorders and can also be used as a supplement to ultrasonography features to signal malignancy.

Key words: Ultra Sonography (USG), Fine Needle Aspiration Cytology (FNAC), Thyroid Nodules, Benign, Malignant.

INTRODUCTION:

Thyroid gland pathologies range from diffuse enlargement (goitre) to nodular lesions, thyroiditis, and malignancies. High resolution ultrasound is currently the imaging modality of choice for morphological evaluation of the thyroid gland.[1]

Many more subclinical nodules are being detected as high resolution ultrasonography becomes more widely used. They are detected by palpation in 4% to 8% of adults, ultrasonography in 10% to 41%, and autopsy in up to 50%.[2]

The American Association of Clinical Endocrinologists (AACE), Society of Radiologist in Ultrasound, American Thyroid Association, European Thyroid Association, and Associazione Medici Endocrinologi (AME) have all chosen USG as the imaging modality of choice to confirm the presence of a thyroid nodule when physical examination is equivocal, and to characterise it, particularly to differentiate between benignity and malignancy. It has a significant advantage over radiation in distinguishing between solid and cystic lesions and is ideal for guided biopsies without radiation risk.[3]

FNAC of the thyroid gland has radically changed the management of thyroid lesions with clinicopathological. FNAC is widely accepted as the most accurate, sensitive, specific, and cost-effective diagnostic procedure in the preoperative assessment of thyroid nodules.[4]

In the case of discrete thyroid swellings, fine needle aspiration cytology (FNAC) is the investigation of choice. FNAC has high patient acceptance, is simple and quick to perform in the outpatient setting, and is easily repeated.For more accurate sampling, ultrasound may be used to guide the needle.[5]

The purpose of this study was to investigate the sonographic features of various benign and malignant thyroid nodules, as well as to correlate the sonographic findings with Fine Needle Aspiration Cytology (FNAC) and/or Histopathological Examination (HPE), in order to assess the accuracy of ultrasonography in diagnosing malignant nodules.

MATERIALS AND METHODS

This prospective study was carried out at the Apollo medical college and District head quarters hospital , for one and half years between June 2020 to December 2021.Consent was taken from the Ethics committee of the institute and from the patients participating in the study. Inclusion criteria: Patients with thyroid swelling/ mass or thyroid gland enlargement (diffuse or nodular) Exclusion criteria: Patients undergoing treatment or recovery after proper diagnosis were not included in the study. Patients name, age, sex and the presenting complaints were noted. Patients who were referred for ultrasonographic evaluation of the thyroid gland and detected to have thyroid nodules on USG, were subjected to further evaluation with fine needle aspiration cytology (FNAC).

The investigations were performed using ‘Toshiba Nemio’ USG machine, with a high frequency probe of 7.5-10.0 MHz's. FNAC was done under all aseptic precautions, using a gauge spinal needle and a 10 mL syringe for proper suction.

The thyroid gland was ultrasonographically examined with the patient supine and head dorsally extended. The echo texture of the entire thyroid gland was evaluated by comparing the echo pattern of the lesion to characteristics of the adjacent neck musculature.The nodules were assessed on the basis of internal composition, echogenicity, margins, shape of the nodule, presence or absence of peripheral halo, calcifications and internal vascularity. The nodules were categorised as solid, predominantly solid (50% cystic changes). The

echogenicity was assessed as hyperechoic, isoechoic, hypoechoic, or anechoic in comparison to normal thyroid parenchyma. The margins were assessed as smooth (or well defined), irregular (or ill defined), and whether surrounded by a circumferential peripheral halo. Based on the shape, nodules were characterised as taller-than-wider or otherwise. Calcifications, when present were characterised as microcalcifications (tiny calcifications 2mm) which includes coarse as well as curvilinear, or "rim" calcifications. Presence of internal vascularity on Doppler was documentedFollowing pathological correlation, FNAC/histopathology findings were noted.

These ultrasonographic findings were tabulated and correlated with the final pathological diagnosis. The data thus obtained was entered into Microsoft Excel spreadsheet, and the sensitivity, specificity and accuracy for each of the findings were calculated.

Sensitivity and Specificity[6] : The specificity or true negative rate (TNR) is defined as the percentage of patients who are correctly identified as being healthy

Specificity = TN/ TN+ FP The sensitivity or true positive rate (TPR) is defined as the percentage of patients who are correctly identified as having the disease Sensitivity =TP /TP+ FN

Positive predictive value The positive predictive value (PPV) of a test is defined as the proportion of people with a positive test result who actually have the disease.

Negative predictive value The NPV of a test is the proportion of people with a negative test result who do not have disease. Sensitivity of FNAC is upto 94% and specificity is upto 98% for diagnosis of malignant lesions and nearly 90% accurate in the identification of malignancy, other than follicular lesion.

RESULTS

There were 98 females (age range of 20 years to 65 years) and 22 males (25 years to 70years) in this study. Of the 120 nodules that were encountered, 104 were benign and 16 were malignant. Ultrasonography was able to correctly identify 10 out of 16 malignancies, and 98 out of 104 benign nodules. 9 nodules were described as suspicious for malignancy on USG; final pathologic diagnosis was malignancy in 3 cases, benign follicular nodule in 5 cases and focal thyroiditis in 1 case.

The USG findings in these 120 nodules are summarised in[Table/Fig-2].Allthenodulesthatwerediagnosedasmalignantin our series were solid onUSG.Noneofthecystic nodulesare observed in Malignant.

The majority of malignant nodules (12/16)showedhypoechoicinternalechotexture,whilemostbenignnodules (74/104) were either hyperechoic or anechoic (cystic).Most of the malignant nodules (14/16) hadpoorly defined margins, i.e., the margins were either indistinctorwereirregularinoutline,whilethemajority(92/104)benignnodules showed a smooth, well-defined outline. Calcificationswere seen in 14/16 malignancies and in 5/104 benignnodules. These calcifications were either microcalcification ormacrocalcification.Microcalcificationswereseenexclusivelyinpapillarycarcinomasinourseries,occurringin8/10cases.Macrocalcification was seen in 5/16 malignancies and in18/104 benign nodules. Majority of malignant lesions (14/6)showed internal vascularity within the nodule, while benignnodules predominantly were either avascular or showed aperinodularvascularpattern

MostcommonlesionthatwasdiagnosedonUSGwasColloid goitre of the patients followed by thyroiditis .Multinodular goiter was seen in 9 patients . the remaining lesionswere papillary carcinoma (10) medullary carcinoma (1), adenomatousnodules(2)andMNGwiththyroiditis(6) On comparison with USG diagnosis and FNAC, the positive predictivevalue to detect thyoiditis by ultrasound was 92.5% in this study. In this studyultrasoundis86.2%sensitiveand90%specficityindetectingthyroiditis.Andthepositivepredictivevaluefordetectingmedullarycarcinomawas100%andpapillarycarcinomawas66%.Ultrasoundhas94%positive predictive value for adenomatous nodule. Positive predictive value for colloidgoiter was 94 % and that of MNG was 100%. Ultrasound has 80% sensitivityand75% specificityindetectingmalignantnodule.

TABLE 1: GENDER WISE DISTRIBUTION OF PATIENTS

Gender	No.Of Patients	Percentage
Male	22	18
Female	98	82

TABLE 2: DISTRIBUTION OF THYROID NEOPLASM AS FOUND AT PATHOLOGIC EXAMINATION.

Final Diagnosis (FNAC / HPE)	No. of Cases
Malignant (n=16)	
Papilary carcinoma	**10**
Follicuar Carcinoma	**4**
Medullary Carinoma	**1**
Anaplastic Carcinoma	**1**
Benign (n = 104)	
Colloid Nodule	**80**
Follicular Adenoma	**9**
Hashimoto's Thyroiditis	**3**
Subacute Thyroiditis	**3**
Cyst	**9**

TABLE 3: SONOGRAPHIC FEATURES OF THYROID NODULES

	Internalcomposition			Echogenicity			Margins		PeripheralHalo		calcification		Internal vascularity	
	Solid	Cystic	Honeycomb	Hyperechoic	Hypoechoic	Anechoic	Well defined	ill defined	+	–	+	–	+	–
Malignant	16	0	0	4	12	0	2	14	9	7	14	3	14	2
Benign	61	30	13	55	30	19	92	12	10	94	5	99	33	81
TOTAL	70	34	16	59	42	19	96	26	19	103	19	102	47	83

TABLE 4:Distributionofthyroidlesionsbasedonultrasounddiagnosis

Ultrasounddiagnosis	Number
Thyroiditis	20
Colloidgoiter	72
MNG	09
Medullarycarcinoma	01
Papillarycarcinoma	10
Adenomatousnodule	2
MNGwiththyroiditis	6
Total	120

Table-5:ComparisonofultrasounddiagnosiswithFNACdiagnosis

Type	Positivep redictivev alue	Negative predictiv evalue	Sensitivity	Specificity
Thyroiditis	92.59	07.41	86.20	90.00
Colloidgoiter	94.12	05.88	88.89	72.00
MNG	100.00	00.00	100.00	100.00
Medullarycarcinoma	100.00	00.00	100.00	100.00
Papillarycarcinoma	66.67	33.33	85.00	75.00
Adenomatousnodule	66.67	33.33	85.00	75.00

DISCUSSION

Thyroid nodular disease is defined as a discrete lesion within the thyroid gland that is differ from the adjacent parenchyma in ultrasound study. In the initial workup of thyroid nodules, ultrasonography is the modality of choice for distinguishing benign from malignant nodules . Malignant USG features include a predominantly solid component, hypoechogenicity, microcalcifications, a taller-than-wider shape, irregular margins, internal vascularity, and the absence of peripheral halo.

A total of 120 cases were studied, of which 98 were females and 22 were males. Most of the patients were more than 25 years of age and less than 60 years of age, maximum in the age group of 41 to 60 years (38%).

Variable consistency of thyroid lesions was noted.Allthemalignantnodulesinourstudyweresolid,thushavingasensitivityof100%.Benign nodules showing solid consistency in majority of numbers followed by cystic and honey comb appearance .

In this study, it is observed that 15.83% of nodules were anechoic. All these anechoic nodules were diagnosed as benign on USG and it was confirmed by FNAC. In a study by Moonetal.,reported that ahypoechoicnodulehada sensitivity of 87.2%, specificity of 58.5% and an accuracy of 70.7% inpredicting malignancy.[7] Inthisstudymajorityofthehypoechoicnodules(71.42%)werefoundtobemalignantnodules,inasimilarstudyPedroWeslleyetal studiedfeaturesofpapillarycarcinomain106noduleswhichrevealedhypo-echogenicity in 90.5% no calcification in 59.4% and micro calcification in26.4%.[8]Inthisstudy7 5 %ofhypoechogenicnodulesturnedouttobe malignantnodules.AllthecaseswhichweredetectedasmalignantbyultrasoundwereconfirmedasmalignantonFNAC.Isoechoiclesionswereseeninbothbenignandmalignantlesions.Mostofthebenignlesionswerehyperechoic

A thyroid nodule is considered to have ill-defined margins if more than 50% of its border is not clearly demarcated. Malignant nodules tend to have ill-defined or irregular margins due to the infiltrative nature of their growth . Margins of the nodules were well defined and smooth in 80 of patients and ill defined in 20% in a similar study done by Ankush Danadia et al, margin was well defined in 77.7% and ill defined in 22.3% of nodules.[9]

A thin, well-defined peripheral halo represents displacedblood vessels coursing around the lesion [Table/Fig-7] andis considered highly suggestive of a benign nodule [6]. Anincomplete or complete absence of peripheral halo is oftenassociated with a malignant nodule, probably due to rapidgrowth of the tumour.Rago et al., found that the absenthalo sign was the USG pattern which was most predictiveofmalignancyintheirseries,withasensitivityof66.6%andspecificity of 77% [10]

Wefoundthatmacrocalcificationswereseenin14/16(87.5%) malignant nodules, and in 5/104 (48%) benignnodules.Moreover,allthemicrocalcificationsinourstudyoccurredinpapillarycancers,suggesting100%specificity.Pallaniappan et al., reported that microcalcifications had 100% specificity for papillary carcinoma [11], which is similar to our study

Intrinsic vascularity is a feature of malignant thyroid nodules and is defined as flow that is greater in the central part of the nodule than in the thyroid parenchyma . The published opinion on this finding is somewhat contradictory, with some reports claiming that Doppler USG is useful and others claiming that Doppler USG did not improve diagnostic accuracy satisfactorily [12]. In our study, 13 nodules had a honeycomb internal echotexture, which is defined as multiple tiny cystic spaces within the nodule separated by thin septae . On cytology, all of these nodules were classified as benign colloid nodules. According to Bonavita et al., a honeycomb or "spongiform" appearance was highly specific for a benign colloid nodule, particularly if it was also avascular [13]. Similarly, Reading et al. concluded that a spongiform appearance was sufficiently indicative of a benign aetiology to eliminate the need for FNAC.[14]

In this study, the positive predictive value for detecting thyroiditis by ultrasound was 92.5 percent when compared to USG diagnosis and FNAC. Yeh et Al demonstrated that micronodulation on sonography is useful for diagnosing diffuse lymphocytic thyroiditis, with a 94.7 percent positive predictive value[15]. Venkatachalapathy et al discovered that for benign lesions, the overall sensitivity for FNAC was 81.3 percent.[16] In this study, ultrasound

detected thyroiditis with 86.2 percent sensitivity and 90 percent specificity. This study looked at heterogeneous thyroid parenchyma with increased vascularity and micronodulations.[16]
The positive predictive value for detecting medullary carcinoma was 100%, and it was 66% for papillary carcinoma. For adenomatous nodule, ultrasound has a 94 percent positive predictive value. The positive predictive value for colloid goitre was 94%, and the value for MNG was 100%. According to Fratesetal.,reportedthatsolidcompositionwithinanodule the highest sensitivity (of 69.0% to 75.4%) in predicting malignancy. According to the findings of this study, ultrasound has an 80% sensitivity and a 75% specificity in detecting malignant nodules based on sonographic findings.[17]
In this study 86 % of the cases were benign and only 14 % of the caseswere malignant. Similarly in a study conducted by Bonovita et al the samplesizewas1232patients.Amongthesepatientsmalignantcaseswereonlyabout3%to7%,restof thecaseswerebenignlesions.[13]similarlyinastudydonebyAnkushDanadiaetalon100 cases in Gujarat showed 66 benign cases, 8 malignant cases and 26 caseswere indeterminate on USG. Out of these 66 benign cases 2 cases which werediagnosedasbenignturnedouttobemalignantonFNAC(aspapillarycarcinoma)[9]

Conclusion: Ultrasound is a better modality of investigating the thyroid gland as awholeandnoninvasivewhencomparedtoFNAC.Ultrasound isthe best imagingmodalitywhichcan characterizethenumberofnodules,sizeofeachnodule,marginsofthenodule,contentsofthenodule.Ultrasoundcanpredictifthelesionisbenignormalignant,butwhenitiscombinedwithultrasoundguidedFNAC,thenitcangiveanaccuratediagnosis. . While FNAC/HPE remains the gold standard for final diagnosis, awareness of specific sonographic features may be useful in targeting suspicious nodules and avoiding unnecessary intervention in the vast majority of benign nodules.

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