DILEMMA OF THYROID NODULES AND THE TIME TESTED RATIFICATION OF USG WITH HISTOPATHOLOGY, IN A SHORT PROSPECTIVE STUDY OF THE LOCAL POPULATION.

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ABSTRACT

Ultrasonography enjoys the intrinsic advantages of universal availability economy and non-invasive nature. It presents no radiation hazards and can be readily repeated. Ultrasonography can demonstrate normal thyroid anatomy and pathologic with remarkable clarity. The role of ultrasonography as an initial diagnostic modality for thyroid nodules with high sensitivity and specificity as correlated with the pathological findings.

Keywords: Thyroid nodules, Ultrasonography.

Introduction:

Normal ultrasonographical appearance of Thyroid

The two lobes of thyroid are located in anteroinferior part of neck (infrathyroid compartment) along either side of trachea, connected across the midline by the isthmus. Normal thyroid parenchyma has a characteristic homogenous medium to high level echogenicity with little identifiable internal architecture. The thin hyperechoic line, that bounds the thyroid lobes in the capsule is often identifiable by ultrasound.

Ultra sound features of thyroid pathologies

Evaluation of thyroid nodule: The term nodule is given to the lesion of at least 6 to 8 mm in diameter. The fundamental anatomic features of thyroid nodule on high resolution sonography are as follows:

Internal consistency 70 % of thyroid nodules are solid, remaining 30 % exhibit various amounts of cystic changes.

Solid Nodules: 80% of solid nodules are hyperplastic nodules due to iodine deficiency, disorder of homogenous and poor utilization of thyroid. 10% of all are adenomas benign follicular adenomas include fetal adenoma, hurthle cell adenoma and embryonal adenoma.

Mixed solid and cystic nodules: Most commonly, the mixed solid and cystic pattern is appreciated in hyperplastic nodules which undergo liquifactive

degeneration with accumulation of blood, serous fluid and colloid substance.

Purely cystic:

Pathologically, a true epithelium – lined, simple thyroid cyst is extremely rare.

Virtually all cystic thyroid lesions seen with high-resolution ultrasound demonstrate some wall irregularities and internal solid elements or debris caused by nodule degeneration.

Echogenicity

Thyroid cancers are usually hypoechoic related to the adjacent normal thyroid parenchyma but benign lesions may also be hypoechoic. Predominantly hyperechoic nodules are more likely to be benign.

Isoechoic nodule with peripheral sonolucent rim has intermediate risk of malignancy.

HALO

A Peripheral sonolucent halo that completely or incompletely surrounds a thyroid nodule may be present in 60% to 80% of benign nodules and 15% of thyroid Carcinoma.

Histologically, it represents compressed normal thyroid parenchyma. Color and power doppler imaging have demonstrated that the thin complete peripheral halo, which strongly suggests benign nodules, represents blood vessels coursing around the periphery of the lesion.

Thick, incomplete Basket Pattern halo is more likely to be indicative of malignancy.

Shape

A taller-than-wider shape, in which the anteroposterior diameter is equal or less than its transverse diameter on a transverse or longitudinal plane is specific for differentiating malignant nodules from benign nodules, likely because malignant neoplasms (taller than wide) grow across normal tissue planes, whereas benign nodules grow parallel to normal tissue planes.

Margins

Benign nodules have sharp, well defined margins whereas malignant lesions tend to have irregular or poorly defined margins.

Calcification

Detected in 10%-15% of all thyroid nodules but the location and pattern of calcification have more predictive value.

Peripheral or egg shell like calcification suggests benign nodules though scattered echogenic foci of calcification with or without acoustic shadowing are more common in benign nodules.

Large and coarse calcification favors benign lesions.

Fine and punctate calcifications favor malignancy. Pathologically, these fine calcifications may be caused by psamoma bodies.

Doppler Flow Pattern

The most important doppler feature that may be useful in distinguishing benign from malignant lesion is distribution of vessels. Two main categories of vessels distribution are nodules with peripheral vascularity and nodules with internal vascularity (with or without peripheral component).

80% to 95% of benign lesions display peripheral vascularity and 70% to 90% of thyroid malignancies display internal vascularity, with or without a peripheral component.

Signs of Invasion of anatomical surrounding structures:

This sign is pathognomic of malignancy but rare and occurring in less than 10% of neoplasm, being caused by large and rapidly growing tumours or peripheral aggressive neoplasm. The main sign of invasion detectable on sonography are infiltration of strap

muscles, encasement of great vessels and laryngeal nerve.

Above described sonographic features except the last one may be present in both benign and malignant nodules. This suggests that there are no reliable sonographic features which differentiate a malignant lesion from benign nodules of thyroid. However, a cystic nodule is unlikely to be malignant.

Table 1: Differences between benign and malignant nodules

FEATURE	BENIGN	MALIGNANT
SHAPE		
WIDER THAN TALL	+++	++
TALLER THAN WIDE	+	++++
INTERNAL CONTENTS		
PURELY CYSTIC CONTENT	++++	+
CYSTIC WITH THIN SEPTA	++++	+
MIXED SOLID AND CYSTIC	+++	++
COMET- TAIL ARTIFACT	+++	+
ECHOGENICITY		
HYPERECHOIC	++++	+
ISOECHOIC	+++	++
HYPOECHOIC	+++	+++
MARKEDLY HYPOECHOIC	+	++++
HALO		
THIN HALO	++++	++
THICK, INCOMPLETE HALO	+	+++
ABSENT	+	+++
MARGIN		
WELL DEFINED	+++	++
POORLY DEFINED	++	+++
SPICULATED	+	++++
CALCIFICATION		
EGGSHELL CALCIFICATION	+++	++
COARSE CALCIFICATION	+++	+
MICRO CALCIFICATION	++	++++
DOPPLER		
PERIPHERAL FLOW PATTERN	+++	++
INTERNAL FLOW PATTERN	++	+++
ULTRASONOGRAPHY		
PATTERNS 1 AND 2	++++	+
PATTERNS 3 AND 4	+	+++

Materials and Methods

A prospective study in 40 patients of Geetanjali medical college and hospital for evaluating the role of USG in detecting and characterizing thyroid nodules and its pathological correlation ; conducted during the period June 2018 to November 2018. Relevant history related to thyroid and significant clinical features of all patients were recorded. This was done

with close co-operation of the pathologist and treating clinician.

Patient written consent was obtained for performing FNAC / FNAB.

Final diagnosis was based on FNAC or postsurgical histo-pathological examination study, correlation with clinical data, laboratory and other radiological investigations was done.

The data was tabulated and results were analyzed.

Inclusion Criteria

All patients with thyroid swelling either diffuse or localized, patients with pain in the thyroid region and patients with signs and symptoms of hyperthyroidism and hypothyroidism.

Observation, analysis and discussion

A study of 40 patients of thyroid lesions, done with 6-11 Mhz linear probes.

TABLE- 1 and CHART I

Table 2: Age Incidence of thyroid lesions.

AGE GROUPS	NO. OF CASES	%
0-10	1	2.5
11-20	3	7.5
21-30	8	20
31-40	13	32.5
41-50	7	17.5
51-60	5	12.5
>60	3	7.5

The maximum incidence of thyroid lesions was observed in the age group of 31 to 40 years. The youngest case was of 8 years and oldest of 71 years.

CHART II-GENDER INCIDENCE

Study shows that thyroid lesions are more common in female than male as established in previous studies.

CHART III- INCIDENCE OF THYROID STATUS

Maximum patients of thyroid lesions were euthyroid (EU) and there was equal incidence of hyperthyroidism (HYPER) and hypothyroidism (HYPO).

CHART IV- SITE OF LESION

USG lesions more common (60% i.e. is 24 out of 40 cases) bilaterally than unilateral lesion, with multinodular goiter most commonly having a bilateral presentation. However no significant difference was seen in the incidence of involvement of right and left lobe of thyroid. 2.5% (1 out of 40) cases had extra-thyroidal lesion e/o thyroglossal cyst.

Table 3: Incidence of thyroid lesions on USG

LESION	NO. OF CASES	%
GOITER	22	55
MNG with CYSTIC DEGENERATION	14	(35)
MNG without CYSTIC DEGENERATION	5	(12.5)
GRAVES	3	(7.5)
THYROIDITIS	7	17.5
CARCINOMA	4	10
ADENOMA	5	12.5
THYROGLOSSAL CYSTS	1	2.5
OTHERS (THYROID GRANULOMA)	1	2.5

In the present study nodular goiter(i.e. colloid, adenomatous, hyperplastic goiter) is the most common lesion ,incidence is 55 % i.e 22 out of 40 patients.Malignancy was found in 10 % i.e. 4 out of 40 patients.1 case of each thyroid granuloma and thyroglossal cyst was observed.

TABLE 3 and CHART V

Table 4: Incidence of benign and malignant lesion on FNAC AND USG

TYPE OF LESION	NO. OF CASES		PERCENTAGE	
	FNAC	USG	FNAC	USG
BENIGN	33	36	82.5%	90%
MALIGNANT	07	04	17.5%	10%

FNAC suggests benign processes in 82.5% (33 out of 40) cases and malignant in 17.5% (07 out of 40) cases. USG examination suggested benign process in 90%(36 out of 40)cases and malignancy in 10% (4 out of 40) cases.

Table 5: Showing comparison of sensitivity and specificity of USG with its correlation on FNAC/FNAB in detecting benign and malignant tumours

	True Positive	True Negative	False Positive	False Negative
BENIGN	33	3	3	1
MALIGNANT	3	32	1	4

The results observed were as follows:

Sensitivity of USG in detecting benign mass lesions was 97.06%

Specificity of USG in detecting benign mass lesions was 50%

Sensitivity of USG in detecting malignant mass lesions was 42.86%

Specificity of USG in detecting malignant mass lesions was 96.97%

Table 6: USG characteristics of thyroid nodule(S) in lesions of thyroid and FNAC / FNAB correlation.

Lesion on USG	Nodularity		Echogenicity				Vascularity			calcification	Cystic areas	Halo		
	M	S	Iso	Hypo	Hyper	Mixed	Increased	Peripheral	Central			Absent.	I.D.	W.D.
Nodular goiter	15	4	5	7	1	6	7	4	2	2	14	3	2	9
Thyroiditis	1	1	-	1	-	1	2	-	-	-	-	-	-	1
Malignancy	2	2	1	2	-	1	3	1	3	3	2	1	2	1
Adenoma	-	5	1	1	1	2	2	3	1	1	-	-	-	5

Multiple nodules were seen in 32.5%(13 out of 40) cases of thyroid lesions and solitary nodules in 30% (12 out of 40) cases of the thyroid lesions. 50% (2 out of 4) cases of malignancy showed multinodular pattern. 25%(1 out of 4) cases of nodular malignant lesions showed hypoechoic nodules and 25%(1 out of 4) showed mixed echogenic nodules, suggesting that malignant nodules were mostly hypoechoic or mixed echogenic and rarely hyperechoic or isoechoic, with calcification being present in 75% (3 out of 4) cases of the malignant nodules. 40%(2 out of 5) cases of adenoma showed mixed echogenic pattern and rest of 20% each (1 out of 5) cases showed isoechoic, hypoechoic and hyperechoic pattern, almost 100% showed well defined halos with 60% showing peripheral vascularity. 25%(1 out of 4) cases of nodular malignant lesions showed peripheral vascularity in the nodule and 75% showed central vascularity with peripheral component. Nodular goiters had multiple nodules in 78% (15 out of 19) cases, with cystic areas in 73% and having well defined halos in 47% of them, increased vascularity was seen in 36% of them.

ILLUSTRATIONS

MULTINODULAR GOITER WITH CYSTIC DEGENERATION

The ultrasound and color doppler images reveal multiple cystic lesions in both lobes of the thyroid. There is also evidence of few nodular, solid masses within the lobes. Color doppler imaging reveals multiple vessels around the lesions. These images suggest multinodular goiter, more of a cystic variety.

PAPILLARY CARCINOMA On USG thyroid showed altered echopattern, predominantly hypoechoic, irregular margins and few specks of calcification in the left with increased chaotic vascularity on Doppler and cervical lymph nodes metastasis.

MEDULLARY CARCINOMA On USG a markedly hypoechoic but solid mass in the lower half of the right lobe with coarse calcification. This is a typical finding in ultrasound imaging of medullary carcinoma of the thyroid. The marked vascularity of the lesion and chaotic vessels in the tumor are also suggestive of a malignant mass (in this case- medullary carcinoma) of the thyroid.

BENIGN FOLLICULAR NODULE There is a large, solid, echogenic, homogenous oval nodule with a hypoechoic halo around the lesion, in the right lobe of thyroid. The lesion is solitary, shows no cystic areas and has a rim of

vessels entering its central area. These ultrasound images are diagnostic of a benign follicular adenoma of the thyroid.

SUMMARY AND CONCLUSION

- Thyroid lesions are more common in females than males and thyroid lesions are more common in the age group of 30-40 years, the incidence being 35% as observed by Brander A et al^{9,10} with their studies involved middle aged women. The studies revealed that the prevalence of abnormalities increased with age and women showed more lesions than did men.
- USG is helpful in differentiating benign solid from cystic lesions. Benign nodules tend to be of mixed echogenicity (hypo-, hyper-, isoechoic) with well defined halo and peripherally increased vascularity. USG is 100% accurate in detecting cystic abnormalities; it is 97% sensitive and however only 50% specific in detecting benign lesions similar to the observation by Won-Jin Moon et al⁹, study on Benign and Malignant Thyroid Nodules differentiation by USG and J. Walker et al¹⁴ conducted prospective study of thyroid USG scan in the clinically solitary thyroid nodule.
- In patients with a clinically solitary nodule, USG is helpful in evaluating the underlying multinodular goitre with enlargement of a single nodule. So the whole gland is examined rather than just the dominant nodule.
- Incidence of thyroid malignancy is very low according to the text book of Robbins pathology – 0.002 to 0.003%. In my observation, incidence of thyroid malignancy is about 10%. This increased incidence of thyroid malignancy in my observation is because of small number of patients included in the study or because of the increasing incidence of thyroid malignancy.
- Though malignancy is more common in solitary thyroid nodule, malignancy cannot be ruled out in multinodular goitre, as with USG specificity is almost 97% while sensitivity is only 43% in opposition with

the observation by Baris B et al¹⁶ investigated the role of USG in multinodular thyroid and drew results of the lack of absolute specificity in the USG evaluation of thyroid nodule were confirmed, Scheible W et al⁶, Simeone J.F. et al⁷ and Judith F. Katz et al⁸ analysed the sonographic pathological correlation in the case of thyroid nodules. They came to the conclusion that ultrasound is very accurate in detecting architectural variation, adenomatous goitre and solitary nodules but lacks specificity in distinguishing benign from malignant nodules and our study being in accordance with the study observed by Popli MB, Rastogi A, Bhalla P, Solanki Y. Utility of gray-scale ultrasound to differentiate benign from malignant thyroid nodules.

- Certain features help in arriving at the correct diagnosis. These are echogenicity of the gland, type of calcification present, presence or absence of cystic areas, any discrete nodules and involvement or invasion of surrounding structures as similarly observed by Jenny K. Hoang et al⁵ study on US Features of Thyroid Malignancy: Pearls and Pitfalls showed shape, margin, echogenicity, and presence of calcification are helpful criteria for the discrimination of malignant from benign nodules.
- On USG malignant lesions tend to be solid, hypoechoic, with or without a thick or ill defined halo, and increased vascularity in the centre of the nodule with or without a peripheral component with USG having a specificity of almost 97% in detecting malignancy in accordance to the observation by Popli MB, Rastogi A, Bhalla P, Solanki Y. Utility of gray-scale ultrasound to differentiate benign from malignant thyroid nodules.
- High resolution USG examination, in conjunction with doppler ultrasound examination, of thyroid proved to be having a high degree of sensitivity of 100%. However, most of the cases required FNAC to reach the final diagnosis.

- USG also enables an accurate aspiration to be done under direct vision, especially when a thyroid nodule is small and virtually impalpable.
- USG is also the investigation of choice in the young, pregnant and lactating women.

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