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"USG Finding in Spectrum of Thyroid Pathology"

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Aims &Objectives :-

- *To confirm presence of a thyroid nodule when physical examination is equivocal.*
- *To characterize a thyroid nodule, i.e. to measure the dimensions accurately and to identify internal structure and vascularisation.*
- *To differentiate between benign and malignant thyroid masses, based on their sonographic appearance.*
- *To differentiate between thyroid nodules and other cervical masses like lymphadenopathy, thyroglossal cyst and cystic hygroma.*
- *To evaluate diffuse changes in thyroid parenchyma.*

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I. Introduction

The thyroid gland is an endocrine gland situated in the lower part of front and the sides of the neck. Its main function is regulation of the basal metabolic rate, stimulation of somatic and psychic growth and it also plays an important role in calcium metabolism. The normal thyroid gland is impalpable.

Thyroid disorders are the most common among all the endocrine diseases in India[(1)]. Various studies have estimated that 42 million people in India suffer from thyroid diseases. 8.5% population have thyroid nodule[(2)]. Thyroid diseases are different from other diseases in terms of their ease of diagnosis, accessibility of medical treatment, and the relative visibility that even a small swelling of the thyroid offers to the treating physician.

Nodule incidence increases with age, and is increased in women, in people with iodine deficiency, and after radiation exposure. Numerous studies suggest a prevalence of 2-6 % with palpation, 19-35 % with ultrasound, and 8-65 % in autopsy data.[(3)]

Clinical examination is poor at detecting small thyroid nodules, highlighted by the fact that approximately 70% of normal thyroid glands contain nodules of less than 1 cm when examined sonographically[(4-8).] Imaging, especially with the use of high resolution ultrasound, helps to differentiate a malignant nodule from a more common benign thyroid nodule and identify a malignant nodule against a background nodular goiter, the incidence of which varies between 1% and 3% [(9).]

Clinical history and examination followed by Ultrasonography have become the main stay in the initial evaluation of thyroid nodule.

II. Material and Methods

Study was conducted in GCS medical college, Ahmedabad and includes 50 patients that have clinical symptoms such as dysphagia, hoarseness of voice, weight gain, altered menstrual cycles etc with altered levels of thyroid hormones or clinically symptomatic but with normal thyroid hormone levels or clinically suspected cases with no specific symptoms and had thyroid lesions on ultrasonography were enrolled in the study with a written informed consent.

- The study took place over a period of 24 months (JANUARY 2021 – DECEMBER 2022)

All scans are done using GE Logiq P5, colour Doppler equipment with a linear array high frequency (4-10 MHz) transducer and on MINDRAY USG machine(8-10 MHZ).

Inclusion criteria : -

- Both male and female of any age group.
- All patients who have compatible clinical features along with diagnostic investigation findings suggesting thyroid pathologies.
- Asymptomatic adults age ≥18 years
- High-risk populations (those with a history of radiation exposure or family history of thyroid cancer)
- Assess the comparative size of nodules, lymph nodes, or goiters in patients who are under observation or therapy.
- Surgery, including lobectomy, near-total thyroidectomy, total thyroidectomy, and lymphadenectomy; radioactive iodine ablation.

Exclusion criteria : -

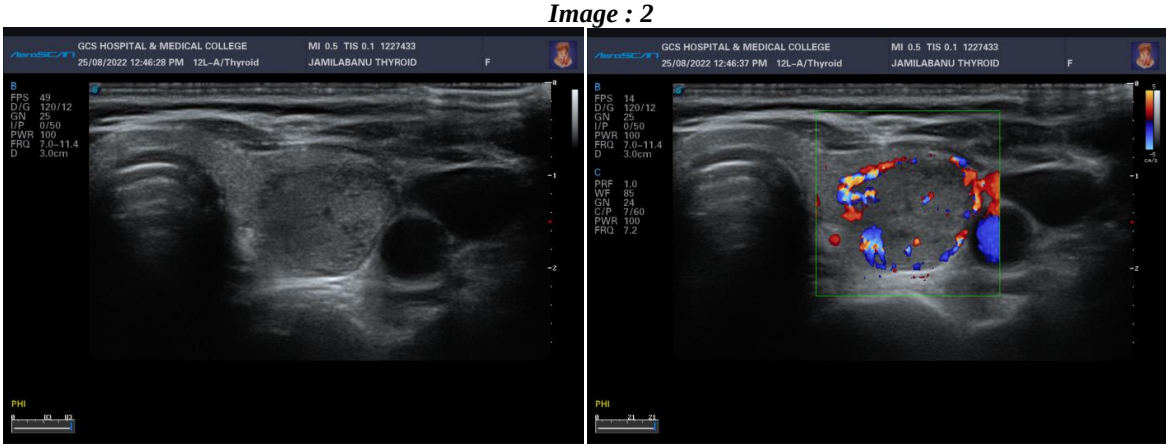
- Patient refuses for USG

III. Results

Image : 1

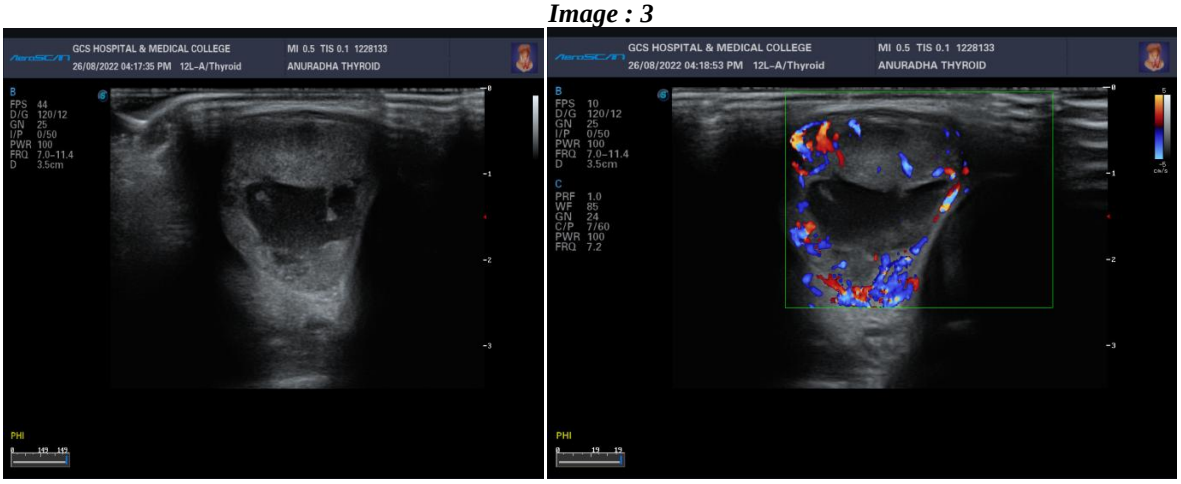
Presence of well-defined, anechoic cystic lesion with internal echoes/debris is noted in left lobe of thyroid gland , s/o ***Colloid cyst.***

Image : 2



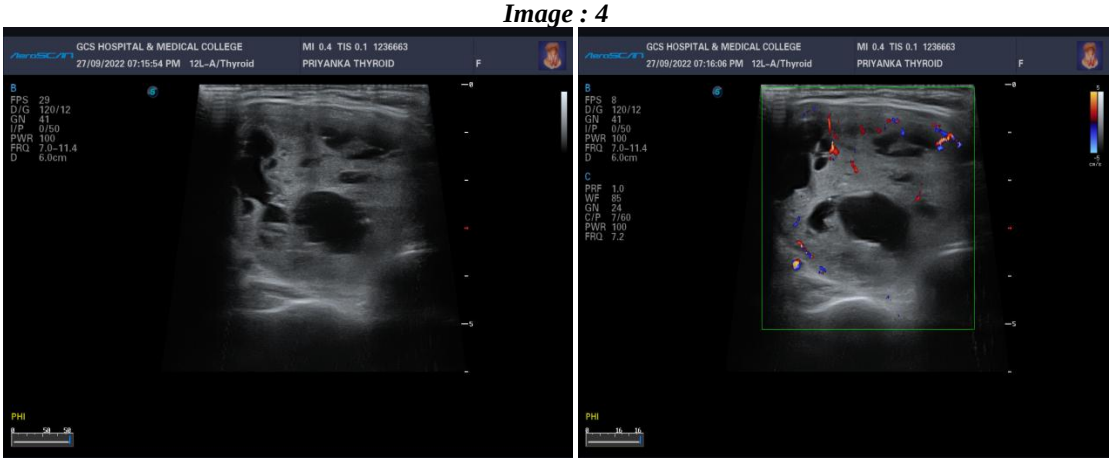
A well-defined, Isoechoic nodule with predominantly peripheral vascularity and surrounding hypoechoic halo is seen in left lobe of thyroid gland ,s/o ***follicular adenoma***, which was further confirmed by FNAC.

Image : 3



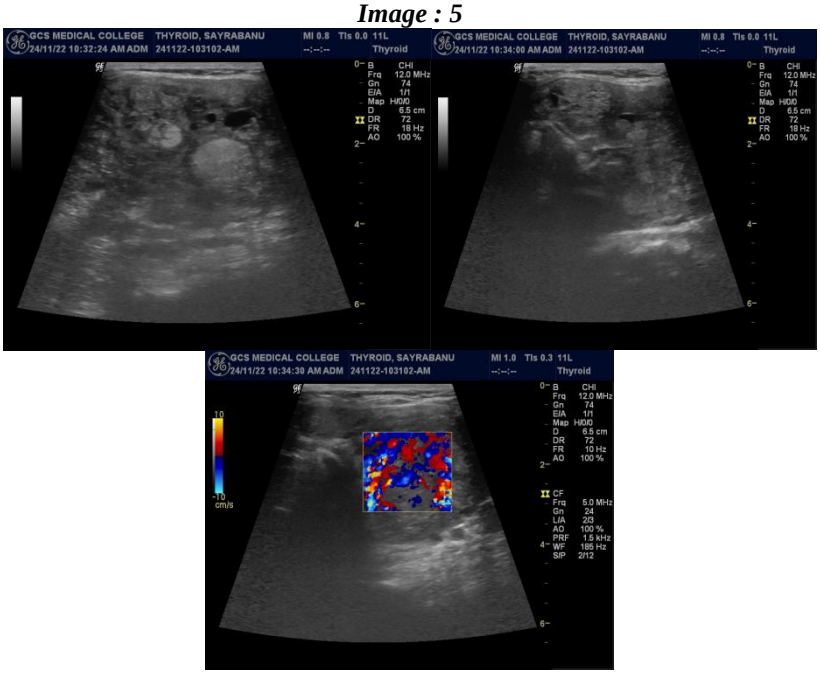
A well-defined solid-cystic lesion and with peripheral vascularity is seen in right lobe of thyroid gland , s/o ***colloid goiter***, Which is proven on FNAC.

Image : 4



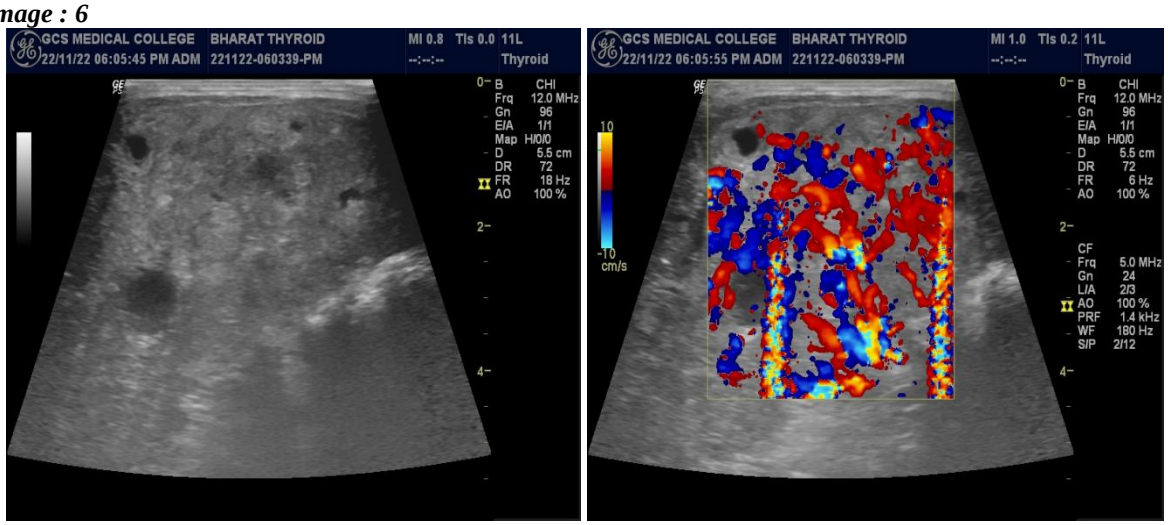
Presence of well definedisoechoic lesion with multiple internal cystic areas and minimal internal vascularity is noted in right lobe of thyroid gland, p/o ***Colloid goiter with cystic degeneration.***

Image : 5



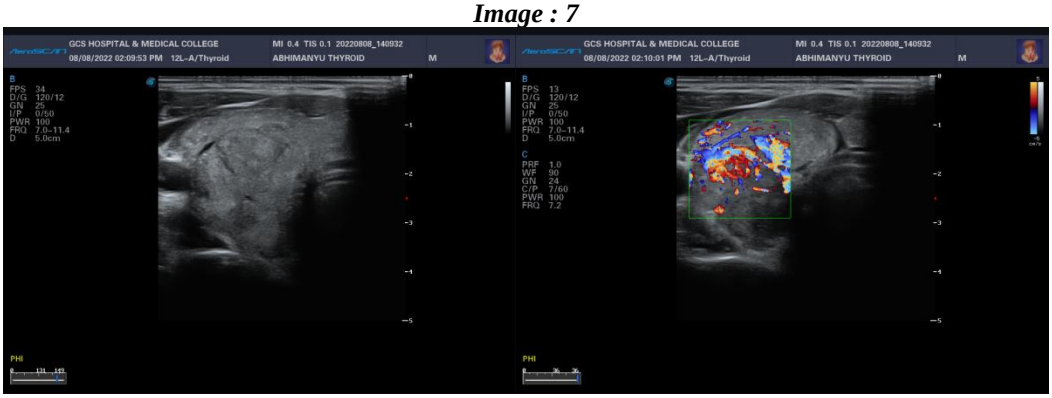
Presence of multiple well defined variable sized ischo, hypo and hyperechoic lesions are noted in both lobes of thyroid and isthmus of thyroid gland with internal vascularity, p/***o Multinodulargoiter.***

Image : 6



Thyroid gland appears heterogenous and enlarged and shows ill defined heterogeneously hypoechoic lesion in right lobe of thyroid gland with significant internal vascularity. On FNAC, this turned out to be a case of ***Papillary carcinoma of thyroid***.

Image : 7



Presence of ill definedisochoic lesion with internal heterogeneity is noted in right lobe of thyroid gland with significant internal vascularity. FNAC of patient shows ***intermediate lesion*** and biopsy was advised for further confirmation.

Statistical analysis :-

Table : 1 showing Age wise distribution of thyroid lesions

Age group (years)	No of patients	Percentage
10-19	2	4
20-29	6	12
30-39	15	30
40-49	12	24
50-59	8	16
60-69	5	10
70-75	2	4
Total	50	100.0

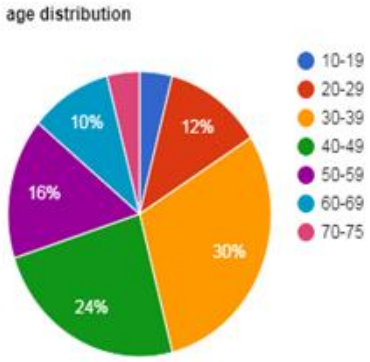
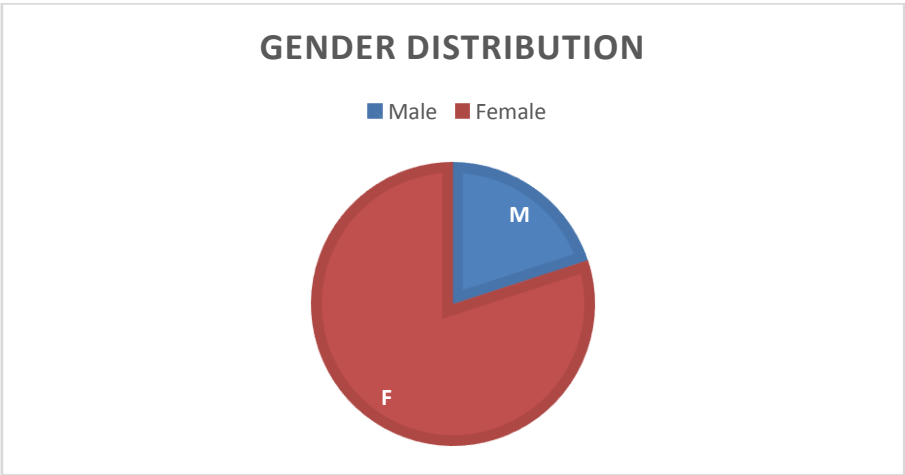


Table : 2 showing clinical symptoms

Sr no	Clinical symptoms	Patients
1	Thyroid enlargement	40
2	Pressure effects	24
3	Signs of hyperthyroidism	8
4	Pain	2
5	Fever	1

The most common clinical symptom was Thyroid enlargement noted in either midline or on the lateral aspect of neck in 40 patients.
Pressure effects from thyroid swelling (Dysphagia, Dysphonia, Hoarseness of voice) was seen in 24 patients.



Out of 50 patients 10 patients were male and 40 patients were female. Male: Female ratio was 1:4. Females are more commonly affected than the males.

Table : 3 showing distribution of types of thyroid lesions

Ultrasound	Number	Percentage
Follicular adenoma	8	16
Colloid cyst	8	16
Multinodular Goitre	10	20
Colloid Goitre	14	28
Hashimoto Thyroiditis	6	12
Intermediate	3	6
Neoplastic	1	2
Total	50	100

Table shows distribution of thyroid lesions based on ultrasonographic diagnosis. Most common lesion that was diagnosed on ultrasonography was Colloid Goiter in 28 % of patients.

Table : 4 showing age wise distribution of different types of thyroid pathology

Age group		Benign					Malignant		Total
		Follicular Adenoma	Colloid cyst	Multi Nodular Goitre	Colloid Goitre	Hashimoto Thyroiditis	Neoplastic	Inderminate	
10-19	M	-	-	-	-	-	-	-	0
	F	1	-	1	-	-	-	-	2
20-29	M	-	-	-	1	-	-	-	1
	F	1	1	2	3	2	-	-	9
30-39	M	-	-	2	1	-	-	-	3
	F	-	4	1	4	1	-	-	10
40-49	M	1	-	-	1	-	-	-	2
	F	3	1	1	2	2	-	1	9
50-59	M	-	-	-	1	-	1	1	3
	F	1	1	2	1	1	-	1	7
60-69	M	1	-	1	-	-	-	-	2
	F	-	-	-	-	-	-	-	0
70-75	M	-	1	-	-	-	-	-	1
	F	-	-	-	-	-	-	-	0
Total	M	2	1	3	4	0	1	1	12
	F	6	7	7	10	6	0	2	38
Total		8	8	10	14	6	1	3	50

Table : 5 showing distribution of patients based on size of thyroid gland.

Size	Number	Percentage
Normal	23	46
Enlarged	27	54
Total	50	100

Sonographic evaluation and Discussion:-

Our study selected 50 patients (related to thyroid) which were referred to the Department of Radio diagnosis; GCS Medical College and Hospital. All scans are done using GE Logiq P5, colour Doppler equipment with a linear array high frequency (4-10 MHz) transducer and on MINDRAY USG machine(8-10 MHZ).The patients who had lesions in thyroid were subjected to FNAC with informed written consent.

1) Echogenicity

The incidence of malignancy is 4% when a solid thyroid nodule is hyperechoic. If the lesion is hypoechoic , the incidence of malignancy rises to 26%[(10).]

2) Margins

A malignant thyroid nodule tends to have ill-defined margins on ultrasound . A peripheral halo of decreased echogenicity is seen around hypoechoic and isoechoic nodules and is caused by either the capsule of the nodule

or compressed thyroid tissue and vessels [12].The absence of a halo has a specificity of 77% and sensitivity of 67% in predicting malignancy [13].

3) Calcification

Fine punctate calcification due to calcified psammoma bodies within the nodule is seen in papillary carcinoma in 25%–40% of cases [16]. If used as the sole predictive sign of malignancy, microcalcification is the most reliable one with an accuracy of 76%, specificity of 93% and a positive predictive value of 70% [11]. Coarse, dysmorphic or curvilinear calcifications commonly indicate benign.

4) Comet tail sign

The presence of a comet tail sign in a thyroid nodule indicates the presence of colloid within a benign colloid nodule [20] and is a strong predictor of benignity.

5) Solid/cystic

It is generally believed that thyroid nodules with large cystic components are usually benign nodules that have undergone cystic degeneration or haemorrhage .However, papillary carcinoma occasionally demonstrates a cystic component and may mimic a benign nodule, though the presence of punctate calcification within the solid component helps in its identification .

6) Multinodularity

It is a myth that multinodularity implies benign, as approximately 10%–20% of papillary carcinomas may be multicentric[14].In those with true solitary nodules confirmed at surgery the risk of cancer is the same as in those with multinodular goitres [15].Therefore against a background of multinodular changes, extra caution should be taken not to miss a suspicious nodule.

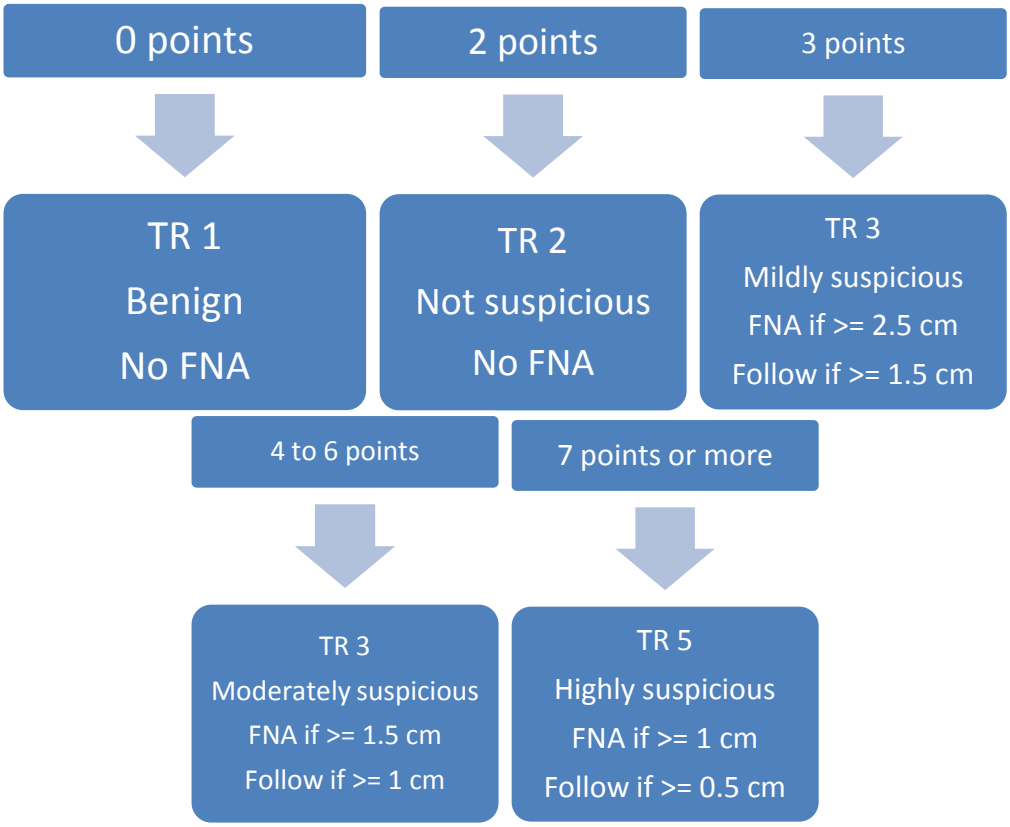
7) Colour flow patterns

In general there are three patterns of vascular distribution within a thyroid nodule [17].

Type I: complete absence of flow signal within the nodule
Type II: exclusive perinodular flow signals
Type III: intranodular flow with multiple vascular poles disorderly arranged, with or without significant perinodularvesselsType III pattern is generally associated with malignancy. Types I and II are more commonly seen in benign hyperplastic nodules [17,18].Unfortunately if used as the sole predictor of malignancy, colour flow characteristics are not accurate[12] and have to be used in combination with other features seen on grey scale ultrasound.

ACR TIRADS

COMPOSITION (Choose 1)		ECHOGENICITY (Choose 1)		SHAPE (Choose 1)		MARGIN (Choose 1)		ECHOGENIC FOCI (Choose 1)	
Cystic or almost completely cystic	0 points	Anechoic	0 points	Wider than tall	0 points	Smooth	0 points	None or large comet tail artefacts	0 points
Spongiform	0 points	Hyperechoic or isoechoic	1 point	Taller than wide	3 points	Ill-defined	1 point	Macro-calcifications	1 point
Mixed cystic and solid	1 point	Hypoechoic	2 points			Lobulated or irregular	2 points	Peripheral (rim) calcifications	2 points
Solid or almost completely solid	2 points	Very hypoechoic	3 points			Extra-thyroidal extension	3 points	Punctate echogenic foci	3 points



COMPOSITION	ECHOGENICITY	SHAPE	MARGIN	ECHOGENIC FOCI
Spongiform: Composed predominantly (>50%) of small cystic spaces. Do not add further points for other categories. *Mixed cystic and solid:* Assign points for predominantly solid component Assign 2 points if composition cannot be determined because of calcification.	*Anechoic:* Applies to cystic or almost completely cystic nodules. *Hyperechoic/isoechoic/hypo echoic:* Compared to adjacent parenchyma *Very hypoechoic*: More hypoechoic than strap muscles. Assign 1 point if echogenicity cannot be determined.	*Taller than wide*: Should be assessed on a transverse image with measurements parallel to sound beam for height and perpendicular to sound beam for width. This can usually be assessed by visual inspection.	*Lobulated:* Protrusions into adjacent tissue *Irregular*: Jagged, spiculated, or sharp angles. *Extrathyroidal extension:* Obvious invasion=malignancy. Assign 0 points if margin cannot be determined.	*Large comet tail artefacts:* V-shaped, >1mm, in cystic components. *Macrocalcifications:* Cause acoustic shadowing *Peripheral*: Complete or incomplete along margin *Punctate echogenic foci*: May have small comet-tail artefacts.

IV. Conclusion:-

In this study of sonographic evaluation of thyroid lesions done in GCS Medical College and Hospital, Ahemdabad had led to the following conclusions:

- There is female preponderance for thyroid lesions.
- All the anechoic nodules were benign lesion.
- Ultrasound is a better modality of investigating the thyroid gland as a whole and non-invasive when compared to FNAC.
- Ultrasound is the best imaging modality which can characterize the number of nodules, size of each nodule, margins of the nodule and contents of the nodule.
- Ultrasound can predict if the lesion is benign or malignant, but when it is combined with ultrasound guided FNAC, then it can give an accurate diagnosis.

- Around 90 % of the lesions were benign, and 10 % of the lesions were malignant.

Limitations:-

- Smaller malignant lesions can be mistaken as benign lesion on ultrasound (e.g., Small papillary carcinoma can be mistaken as colloid goiter).
- There can be inter observer variation on ultrasound evaluation.
- Follicular adenoma and Follicular carcinoma are difficult to differentiate on ultrasound.
- Even though there are specific characters of benign and malignancy on ultrasound, it may overlap in some cases. So, USG guided FNAC should be done for an accurate diagnosis.

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