



TIRADS classification of thyroid nodules: A pictorial review

Aishwarya KC¹, Santhosh Gannamaneni², Gowtham Gowda³, Abhishiek⁴, Aradhana⁵

¹ Professor, Department of Radio Diagnosis, KVG Medical College Hospital, Sullia, Karnataka, India

² Resident, Department of Radio Diagnosis, KVG Medical College Hospital, Sullia, Karnataka, India

³ Associate Professor, Department of Radio Diagnosis, KVG Medical College Hospital, Sullia, Karnataka, India

⁴ Assistant Professor, Department of Radio Diagnosis, KVG Medical College Hospital, Sullia, Karnataka, India.

⁵ Resident, KVG Medical College Hospital, Sullia, Karnataka, India

Abstract

Ultrasound is the imaging modality for the initial assessment of thyroid nodules.

There are well-established ultrasound findings that differentiate benign and malignant thyroid nodules and there are several classification systems, which categorize thyroid nodules according to the risk of cancer.

Of the many classification systems that have been described, Thyroid Imaging Reporting and Data System (TIRADS) described by Kwak *et al.* is a relatively simple system which can be easily adopted and used in regular practice to facilitate the decision-making process regarding the need to perform fine-needle aspiration cytology (FNAC) for suspicious cases.

The aim of the article is to assist in recognizing typical sonographic patterns of benign, suspicious and malignant nodules based on TIRADS criteria and thus helping in planning for further management of the patient. In this pictorial review, a complete series of sonographic images along with their pathological correlation is presented to illustrate benign and malignant features of thyroid nodules according to the TIRADS classification.

Keywords: ultrasound, TIRADS, FNAC

Introduction

A recent population based study revealed that a palpable thyroid swelling is a common disorder and almost 12% of adult Asian Indians have been shown to have a palpable nodule.³ Numerous studies suggest a prevalence of 2–6% of thyroid lesions with palpation, 19–35% with ultrasound, and 8–65% in autopsy data.⁴ When patients were assessed by ultrasound, the prevalence of a thyroid nodule was as high as 80% among children in iodine deficient parts of India. However, the incidence of thyroid cancer is low (1-1.8 per 100,000).⁵ Ultrasonography of neck is the most sensitive imaging modality in the diagnosing various thyroid lesions. Study of sonographic features in various thyroid lesions help us distinguish between benign and malignant thyroid nodules that aids the clinician in appropriate management of the patient. TIRADS stands for Thyroid Imaging Reporting and Data System. It harmonizes the reporting of thyroid US findings in a very simply way that facilitates comprehension across different specialties. For any such classification system to be useful for routine clinical practice, it should be simple to use, reproducible and very reliable. A high accuracy of any classification in predicting malignant thyroid lesions will be particularly of help in resource-limited settings where pathological analysis is not routinely performed even when confronted with some suspiciously malignant lesions. The aim of this pictorial review is to present detailed sonographic images that correspond to each feature as described in the TIRADS classification in order to help radiologists and clinicians readily recognize the sonographic patterns and classify nodules into TIRADS categories.

TIRADS scoring

On identification of nodules within the thyroid gland, the

dominant nodule or the nodule with suspicious malignant features are evaluated and characterized depending on their morphological features:

1. Size of lesion
2. Shape of lesion
3. Echogenicity
4. Margins of the lesion
5. Internal component
6. Calcifications
7. Perinodular halo
8. Vascularity on colour Doppler.

The suspicious characters of malignancy are then looked for in the above morphological features and given one point each if they are present.

1. Partially cystic nodule with eccentric location of fluid portion and lobulation of solid component
2. Hypoechogenicity
3. Microcalcifications
4. Partially cystic nodules
5. Irregular margins
6. Taller than wide shape
7. Intranodular vascularity
8. Suspicious cervical lymphnode.

Based on these characters the thyroid nodules are characterized and assigned a TIRADS score.

Sonological suspicious criteria for malignancy

(Each criteria is assigned a point in the final score)

- Partially cystic nodule with eccentric location of fluid portion and lobulation of solid component
- Hypoechogenicity
- Irregular margins

- Microcalcifications
- Perinodular thyroid parenchyma invasion.
- Taller than wide shape
- Intranodular vascularity
- Suspicious lymph node

The nodules are categorized depending on the final score of suspicious criteria of malignancy.

Reporting of the nodule

The nodules are reported according to TI-RADS classification of thyroid nodules based on a scoring system according to ultrasound criteria for malignancy.

TI-RADS 1: Normal thyroid gland. No focal lesion.

TI-RADS 2: Benign nodules. Noticeably benign pattern - Score of zero

TI-RADS 3: Probably benign nodules - Score of zero

TI-RADS 4:

- 4a – Undetermined nodules - Score of 1.
- 4b – Suspicious nodules - Score of 2.
- 4c – Highly suspicious nodules - Score of 3-4

TI-RADS 5: Probably malignant nodules - Score of 5 or higher

TI-RADS 6: Biopsy-proven malignancy.

Pictorial review

TIRADS 1

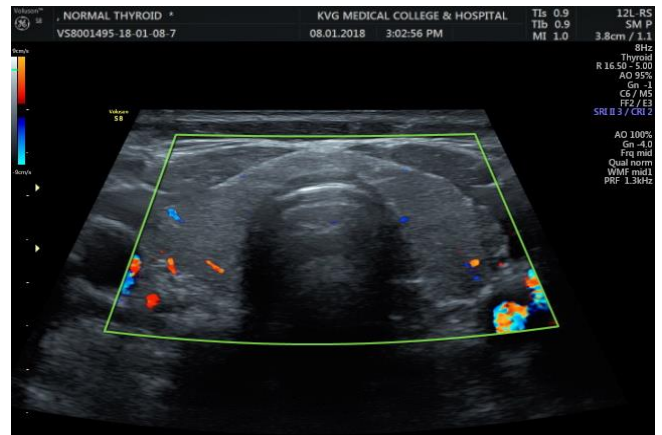
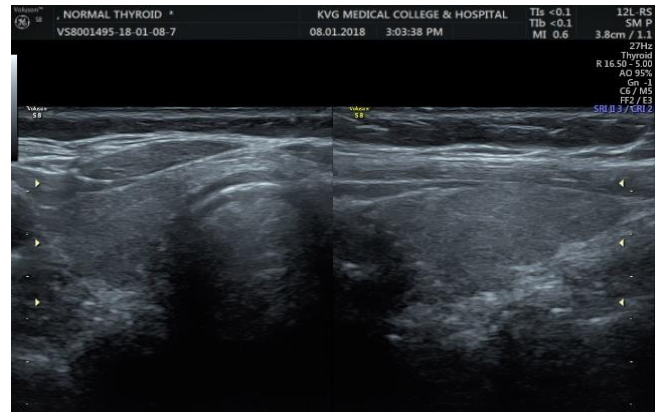
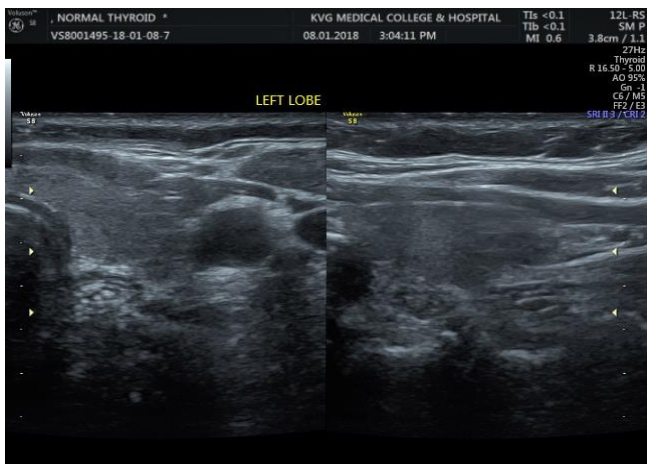


Fig 1: Normal thyroid gland showing normal vascularity

TIRADS 2

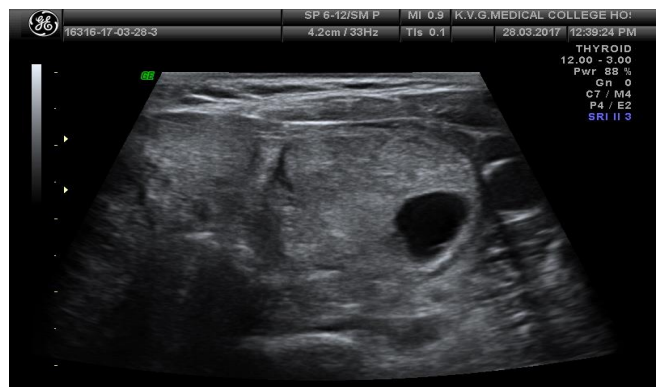


Fig 2a: A well defined anechoic cystic lesion in left lobe of thyroid gland. b) No evidence of any suspicious features

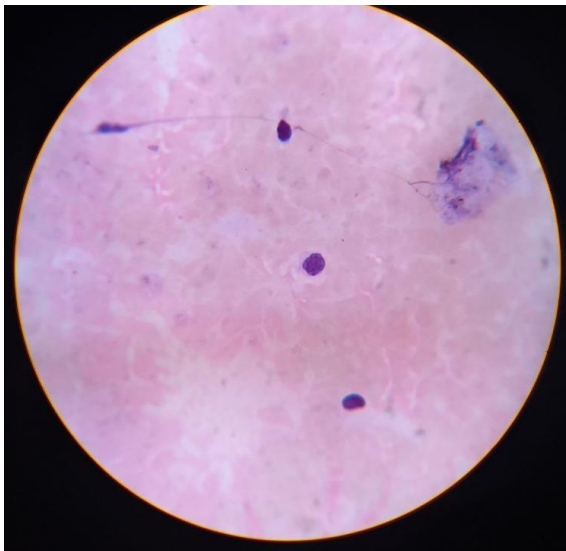


Fig 2c. Microscopy shows a large collection of colloid.

Table 3

TIRADS Score	2
FNAC Report	Colloid cyst

TIRADS 3



Fig 3a: Mixed solid cystic lesion with a typical spongiform appearance. b) Minimal flow is noted on color Doppler.

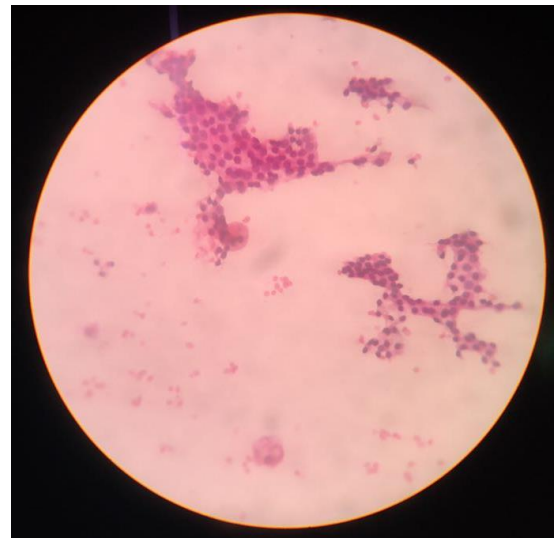


Fig 3c: Microscopy shows large follicles distended by colloid.

Table 4

TIRADS Score	3
Fnac Report	Simple goiter

TIRADS 4a

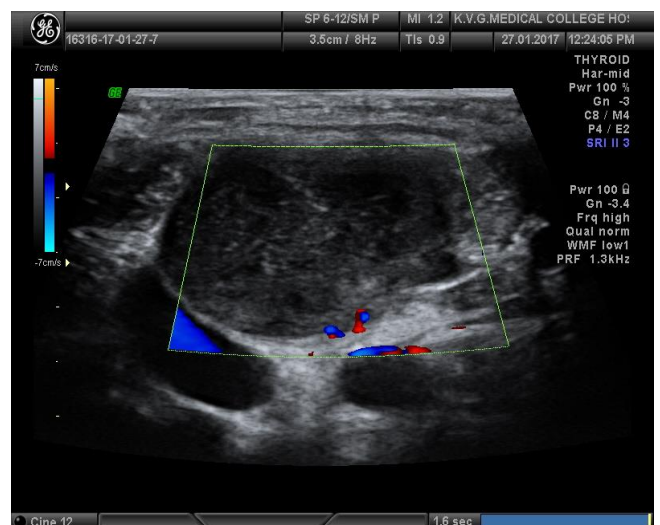
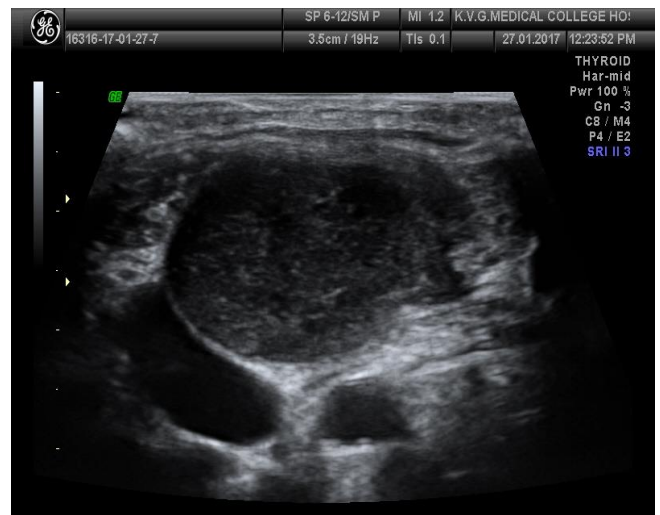


Fig 4a: USG shows a well defined iso-hypo echoic nodule with lobulations at places. b) No evidence of flow on color Doppler.

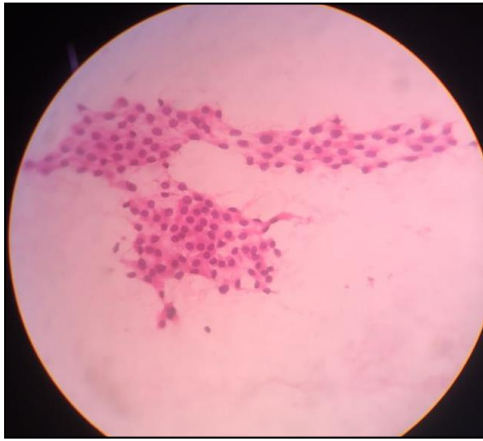


Fig 4c: Moderately cellular benign follicular cells with abundant colloid in the background.

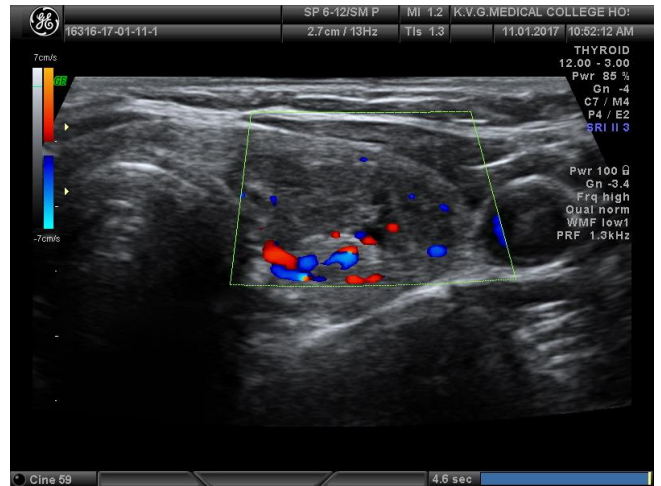


Fig 5c: Minimal flow is seen on colour Doppler

Table 5

TIRADS Score	4a
FNAC Report	Hyper plastic nodule

TIRADS 4b



Fig 5d: Histology showed large follicles distended by colloid, nodularity

Table 6

TIRADS Score	4B
FNAC Report	Nodular goiter

TIRADS 4c

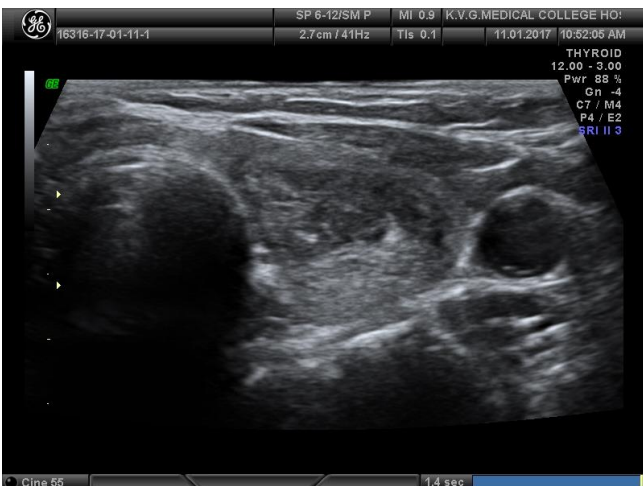


Fig 5a: An ill-defined hypoechoic lesion is noted in the left lobe of thyroid gland. b) The lesion shows lobulated margins

Table 7

TIRADS Score	4c
FNAC Report	Papillary carcinoma

TIRADS 5

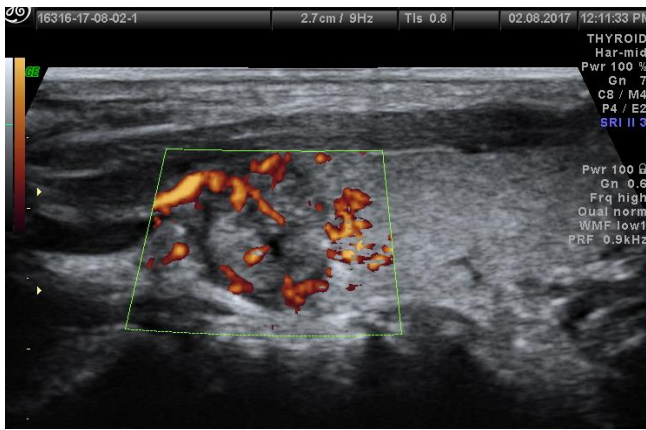


Fig 6a: A relatively small hypoechoic lesion in the right lobe of thyroid gland showing ill-defined margins in the medial aspect with microcalcifications within. b) Lesion shows peripheral and central vascularity.

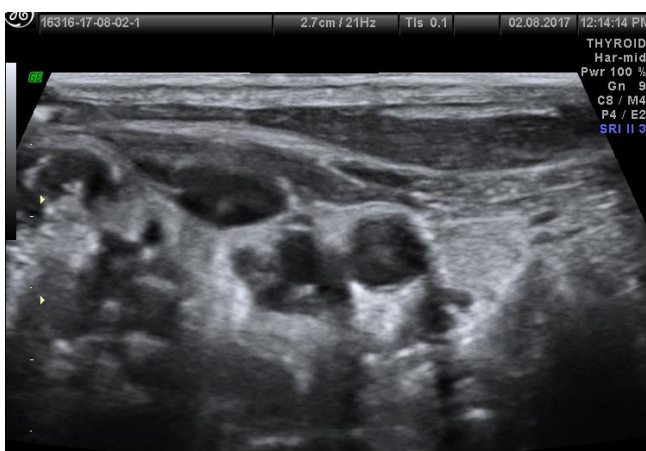


Fig 6c: Cervical lymph nodes are noted in the same patient with necrosis and loss of central echogenic hilum.

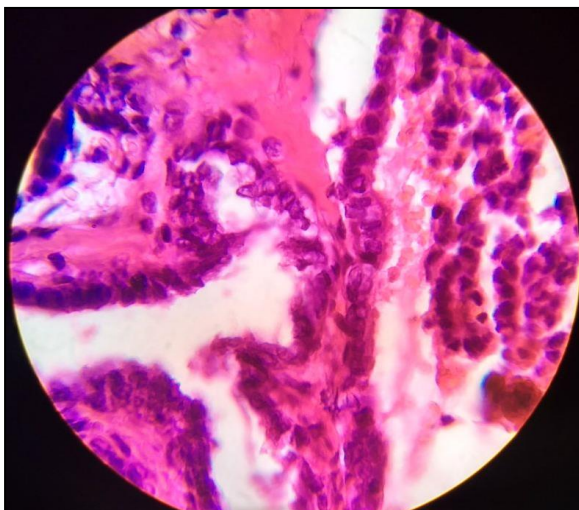


Fig 6d: Microscopy showing branching papillae having fibrovascular stalk covered by single layer of cuboidal cells.

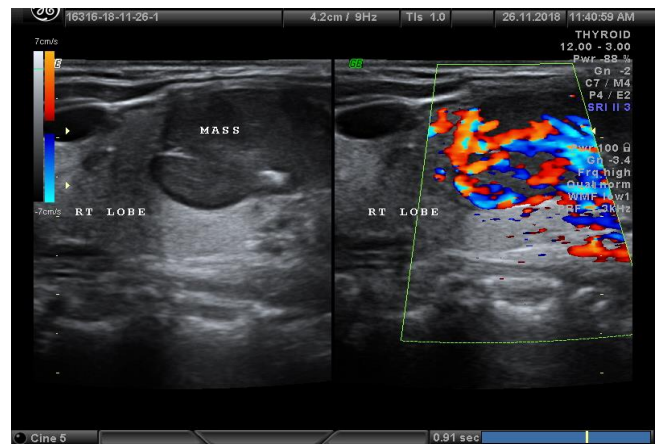
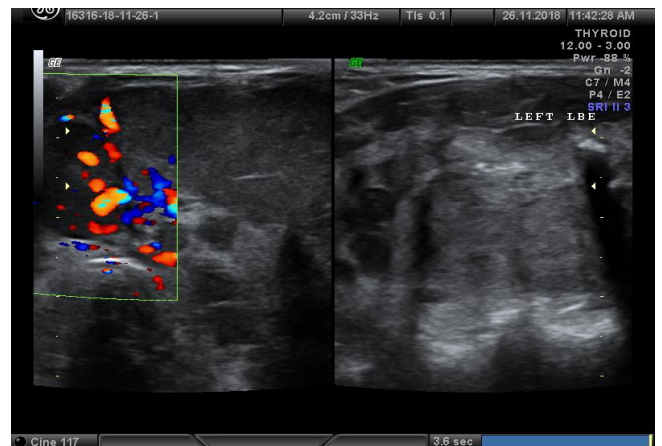
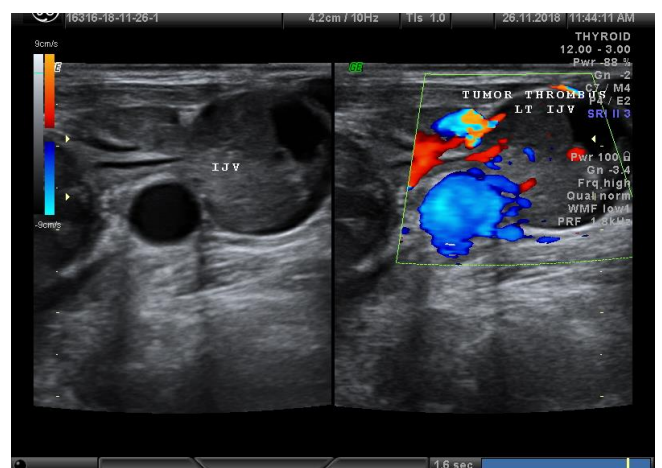


Fig 7a: An ill-defined hypoechoic lesion is seen epicentered in the left lobe of thyroid gland. b) Lesion is extending into the right lobe and shows significant vascularity on color Doppler.



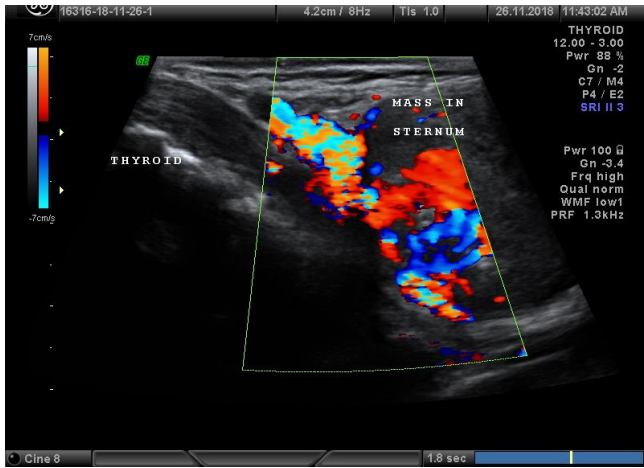


Fig 7c: There is tumoral thrombosis of left Internal jugular vein. d) Further there is a hypoechoic mass lesion in the body of sternum with high flow on color Doppler

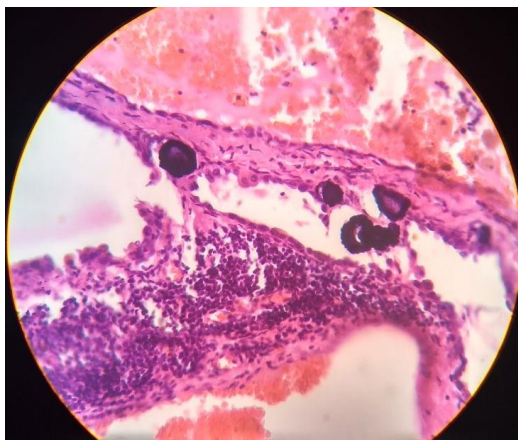


Fig 7e: Microcopy showed follicular carcinoma

Table 1

TIRADS Score	5
FNAC Report	Follicular carcinoma of thyroid

Conclusion

In this pictorial review we have described all the TIRADS categories with corresponding sonographic images and pathological correlation. We conclude that this classification system is a simple to use, reliable, easily reproducible tool and guides in standardizing and following a sonological protocol and thus reducing confusion among the referring physicians, radiologists, and the patients. In short it harmonizes the reporting of thyroid US findings in a very simply way that facilitates comprehension across different specialties.

References

1. Kim DW, Park JS, In HS, Choo HJ, Ryu JH, Jung SJ. Ultrasound based diagnostic classification for solid and partially cystic thyroid nodules. *Am J Neuroradiol.* 2012; 33:1144-9.
2. Kwak JY, Han KH, Yoon JH, Moon HJ, Son EJ, Park SH, *et al.* Thyroid imaging reporting and data system for US features of nodules: A step in establishing better stratification of cancer risk. *Radiology.* 2011; 260:892-9.
3. Usha Menon V, Sundaram KR, Unnikrishnan AG, Jayakumar RV, Nair V, Kumar H. High prevalence of undetected thyroid disorders in an iodine sufficient adult

south Indian population. *J Indian Med Assoc.* 2009; 107:72-7.

4. Dean DS, Gharib H. Epidemiology of thyroid nodules. *Best Pract Res Clin Endocrinol Metab.* 2008; 22:901-11.
5. Unnikrishnan AG, Menon UV. Thyroid disorders in India: An epidemiological perspective. *Indian J Endocrinol Metab.* 2011; 15(Suppl 2):S78-81.