

## ORIGINAL RESEARCH

### A Study to Correlate Preoperative Ultrasonographic Tirads Scoring System and Postoperative Histopathology of Thyroid Swellings

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#### ABSTRACT

**Background:Aim & Objectives:** To correlate preoperative TIRADS scoring system with postoperative histopathology of thyroid swellings.

**Materials and Methods:** A total of 66 patients of thyroid swellings who were treated at the Department of General Surgery, Govt Medical College, Nalgonda, with an age range of 20 – 68 years, were evaluated in this study with respect to age, sex, symptoms type and symptom duration and were investigated with routine hemogram, thyroid profile, FNAC and USG with TIRADS score. The results of USG TIRADS score were compared with the histopathology after excision of the thyroid swelling.

**Results:** Thyroid swellings are more common in females than in males (M:F ratio = 1:4). Majority of the patients are in the age group of 30-50 years. Swelling in front of the neck is the most common complaint. Majority of the patients had an average duration of symptoms of 6months to 3 years. On clinical evaluation all patients had swelling of thyroid. On USG with TIRADS scoring, TIRADS – 3 is the most common category of the thyroid swelling with 30 patients (45%). On USG TIRADS score, majority were benign lesions 55 (83%), while the rest were malignant 11 (17%). On histopathology, 55 lesions (83%) were benign, while 11 lesions (17%) were malignant. Incidence of malignancy with respect to TIRADS score is TIRADS 2- 4%, TIRADS 3 – 16.7%, TIRADS 4 – 50%, TIRADS 5 – 0%. The present study has a USG TIRADS score sensitivity of 45.5%, specificity of 89.1%, positive predictive value of 45.5%, negative predictive value of 89.1% and accuracy of 81.8%. The prevalence of malignancy among the patients with thyroid swellings in the present study is 16.7%. USG proved to be a more sensitive modality to evaluate the nodularity of thyroid swellings than clinical evaluation.

**Conclusion:** The present study was undertaken to evaluate the usefulness of clinical evaluation and USG TIRADS score in management of thyroid nodules High resolution ultrasound is an accurate technique, that has helped to analyse the suspicious sonographic features of thyroid swellings and to assess the risk of malignancy and quantify it using TIRADS score.

**Keywords:** TIRADS score, USG, Thyroid Nodules, Histopathology, Sensitivity.

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#### INTRODUCTION

Thyroid gland is unique among endocrine glands, in that it is the first endocrine gland to appear in the foetus. It is the largest endocrine gland (weighing about 25gms) and it is accessible to clinical examination due to its superficial location.The common presentations of

thyroid nodules are swelling, pressure symptoms or signs of toxicity. Thyroid nodules can be solitary or dominant. The importance of solitary nodules lies in the high risk of malignancy as compared to other types. Clinical presentation alone might not be sufficient to distinguish benign lesions from malignant lesions. Complications of surgery include injury to RLN, hypoparathyroidism (transient or permanent), need for life long thyroid hormone replacement therapy, and recurrence in case of malignancy. The investigative modalities for thyroid disease include thyroid function tests, thyroid antibody titres, isotope scans, ultrasonography, fine needle aspiration cytology. Cytology and histopathology are the gold standard investigations for any thyroid nodule.

Autopsy studies have demonstrated presence of thyroid nodularity in 37% of general population. Incidence of clinically detectable thyroid nodules is 4-5%. It is 4-5 times more common in women than men. The incidence of malignancy in solitary thyroid nodules ranges from 10-30%, whereas the overall incidence of thyroid malignancy in general population is about 5%. India has one of the world's largest goiter belt in the sub-Himalayan region with approximately 55 million cases to be affected with endemic goiter.

Ultrasonography has the advantages of portability, cost effectiveness, non-invasiveness and lack of ionizing radiation. High resolution ultrasonography is being increasingly employed for imaging of superficial structures like the thyroid gland in exquisite detail. The improved resolution available with modern day high frequency transducers allows appreciation of disease process much before clinical detection. Even in established disease, the characterization by ultrasound is extremely useful. To standardize ultrasonographic findings, TIRADS classification can be used. This scoring system categorizes thyroid nodules into 6 classes based on certain sonographic features and can help in differentiation of benign nodules from malignant nodules. Nevertheless, ultrasonography has its own limitations which include observer variations, overlapping of findings, equipment resolution.

This study attempts to use the TIRADS scoring system to categorize thyroid swellings into benign and malignant lesions, and compares it with histopathology.

### **Aim of the Study**

To correlate preoperative TIRADS scoring system with postoperative histopathology of thyroid swellings

### **Objectives of the study:**

- To score the patients of thyroid swellings using ultrasonographic TIRADS scoring system.
- To compare the TIRADS score with postoperative histopathology report of thyroid swellings.

### **MATERIALS & METHODS**

The study includes the patients admitted in the surgical wards of Govt General Hospital from to for treatment of thyroid diseases.

**Study design:** A prospective study

**Place:** Govt General Hospital, Nalgonda

**Study period:** 12 months (December 2019-November 2020)

**Source of data:** Patients with thyroid swelling having admitted for thyroid surgery in the wards of Department of General Surgery, Govt General Hospital, Nalgonda during the study period

**Sample size:** 66

### **Inclusion criteria**

This study includes all patients of thyroid swellings who are

1. Age between 20 years and 70 years
2. Euthyroid status

#### Exclusion criteria

This study excludes all the patients of thyroid swellings who are

1. Age >70 years and <20 years
2. Hyperthyroid or hypothyroid status
3. Patients with comorbidities of uncontrolled hypertension, diabetes mellitus, heart failure, liver failure, renal failure

#### Procedure

Patients with goiter were evaluated clinically. Relevant aspects of patients history including age, sex, rapidity of growth, recent onset of hoarseness, dysphagia, dyspnoea, symptoms of hypo or hyperthyroidism, h/o head and neck irradiation, family history of endocrine diseases were included.

Physical examination to determine whether the gland was diffusely enlarged, solitary, nodular or multinodular with symmetric or asymmetric enlargement was done. In nodular swelling, the size, shape, consistency, location and mobility were assessed. The patient was also examined for the presence of cervical lymphadenopathy. A TFT and a USG were performed using a 7.5MHz high frequency linear array transducer. HPE was done in the Department of Pathology, Osmania General Hospital. The USG findings were used to stratify the thyroid swellings into various TIRADS classes and correlated with HPE diagnosis.

#### RESULTS

The results of the present study of the 65 patients with their TIRADS score and HPE is as follows:

**Table 1: Age and sex distribution**

Age (in years)	Male	Female	Total
20 to 29	0	14	14
30 to 39	7	12	19
40 to 49	4	17	21
50 to 59	0	8	8
60 to 70	2	2	4
Total	13	53	66

The age range of the present study is 20-68 years, with a median age of 39.5 years. Majority of the patients were in the age group of 40-49 years.

Majority of the patients in this study were females, accounting for 80% (53) of the total sample size. The male to female ratio in the current study is 1:4.

**Table 2: TIRADS score frequency**

TIRADS score	Male	Female	Total
TIRADS 2	5	20	25
TIRADS 3	3	27	30
TIRADS 4	4	6	10
TIRADS 5	1	0	1

In the present study, total number of benign lesions as per TIRADS score is 55 (83%), while the total number malignant lesions are 11 (17%). In the present study, the suspicion or

features of malignancy with respect to gender, as per TIRADS score is higher in males (38%) when compared to females (11%).

### Histopathological findings

Of the 66 thyroid swellings that were included in the present study, the number of benign swellings were 55 (83%), and the number of malignant swellings were 11 (17%).

**Table 3: HPE diagnosis**

Nature of pathology	Number of cases	Percentage
Benign	55	83%
Malignant	11	17%

### Benign lesions on HPE

**Table 4: Histopathology – benign diseases**

Benign pathology	Male	Female	Total	Percentage
Nodular hyperplasia	4	18	22	40%
Multinodular goiter	1	5	6	11%
Colloid goiter	1	4	5	9%
Hashimoto's thyroiditis	0	13	13	24%
Hurthle cell adenoma	1	2	3	5%
Follicular adenoma	2	3	5	9%
Parathyroid adenoma	0	1	1	2%

The most frequent benign diagnosis of the present study is Nodular hyperplasia, followed by Hashimoto's thyroiditis. All the cases of Hashimoto's thyroiditis were seen in female patients in this study.

### Malignant lesions on HPE

**Table 5: Histopathology – malignant diseases**

Malignant pathology	Males	Females	Total	Percentage
Papillary thyroid carcinoma	3	4	7	64%
Medullary thyroid carcinoma	0	2	2	18%
Anaplastic thyroid carcinoma	1	1	2	18%

The most frequent malignant lesion, in the present study is PTC. There is an equal gender distribution of PTC and ATC in the present study. All cases of MTC were seen in female patients. M:F ratio 1:1.75.

**Table 6: Correlation of TIRADS score with HPE**

TIRADS score	Histopathology report		Total
	Benign	Malignant	
TIRADS 2	24	1	25
TIRADS 3	25	5	30
TIRADS 4	5	5	10
TIRADS 5	1	0	1
Total	55	11	66

In the present study, most of the benign cases were categorized as TIRADS 2 or TIRADS 3 (total percent: 89%). Only one lesion was categorized as TIRADS 5, and it was diagnosed to be MNG. There is an equivocal categorization with respect to malignant lesions in the present study, with almost half the lesions being categorized as benign and the other half malignant. Sensitivity, Specificity, Positive predictive value, Negative predictive value and Accuracy

The parameters of sensitivity, specificity, positive predictive value, negative predictive value, accuracy of TIRADS score versus HPE was calculated for the present study using the data from following table:

**Table 7: Sensitivity and specificity of Malignant and Non-malignant**

	<b>Malignant</b>	<b>Non-malignant</b>
TIRADS 4/ TIRADS 5	5(true positive-TP)	6(false positive-FP)
TIRADS 2/ TIRADS 3	6(false negative-FN)	49(true negative-TN)

$$\begin{aligned} \text{Sensitivity} &= \text{TP} / (\text{TP} + \text{FN}) \times 100 \\ &= 5 / (5+6) \times 100 \end{aligned}$$

**Sensitivity = 45.5%**

$$\begin{aligned} \text{Specificity} &= \text{TN} / (\text{TN} + \text{FP}) \times 100 \\ &= 49 / (49+6) \times 100 \end{aligned}$$

**Specificity = 89.1%**

$$\begin{aligned} \text{Positive predictive value} &= \text{TP} / (\text{TP} + \text{FP}) \times 100 \\ &= 5 / (5+6) \times 100 \end{aligned}$$

**Positive predictive value = 45.5%**

$$\begin{aligned} \text{Negative predictive value} &= \text{TN} / (\text{TN} + \text{FN}) \times 100 \\ &= 49 / (49+6) \times 100 \end{aligned}$$

**Negative predictive value = 89.1%**

$$\begin{aligned} \text{Accuracy of the test} &= (\text{TP} + \text{TN}) / (\text{TP} + \text{TN} + \text{FP} + \text{FN}) \times 100 \\ &= (5+49) / (5+49+6+6) \times 100 \end{aligned}$$

**Accuracy = 81.8%**

$$\begin{aligned} \text{Prevalence} &= (\text{TP} + \text{FN}) / (\text{TP} + \text{TN} + \text{FP} + \text{FN}) \times 100 \\ &= (5+6) / (5+49+6+5) \end{aligned}$$

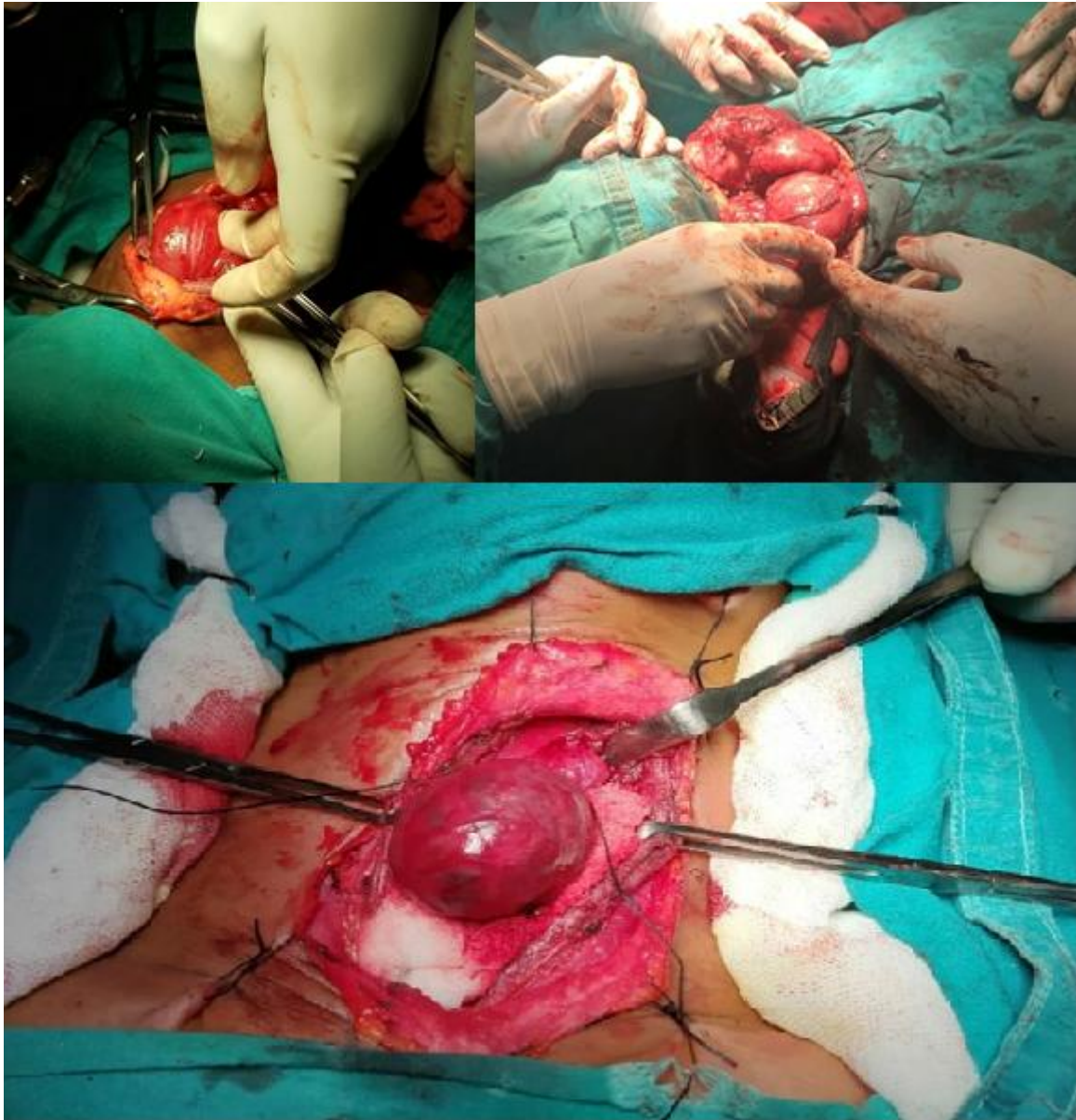
**Prevalence = 16.7%**

It should be noted that this prevalence value denotes the prevalence of the malignant disease among the total number of thyroid swellings that were treated at Osmania General Hospital. It does not denote the true prevalence of thyroid diseases or malignancies in the general population.

### Clinical Photographs



**Figure 1: Clinical photographs of thyroid swellings  
INTRAOP Photographs**



**Figure 2: Intraoperative photographs of thyroid swellings**

## **DISCUSSION**

Thyroid swellings are one of the common diseases that present to the surgical OPD. Knowledge of the various diseases that affect the thyroid gland is important for proper and timely diagnosis and intervention. The patients may present with a wide spectrum of symptoms that may range from cosmetic deformity to compressive symptoms of trachea, oesophagus and RLN causing hoarseness of voice. The swelling of thyroid may be solitary or dominant within a multinodular goiter. The incidence of thyroid nodules has shown an increasing trend in the past decade, mainly due to the reason of better understanding of the disease process and advanced imaging modalities.<sup>[1-5]</sup>

The present study deals with the clinical evaluation, USG along with TIRADS scoring of the thyroid swelling and its correlation to the post-operative HPE.<sup>[6]</sup>

The present study shows the age range of patient as 20-68 years, with a median age of 39.5 years. A study conducted by Tabagchali et al,<sup>[7]</sup> in 2000 had an age range of 8.5 – 85 years, with a median age of 48 years. Sekhri et al in 2001,<sup>[8]</sup> had a median age of 33.9 years with the

range of 9-70 years. Another conducted by Jose RJ et al<sup>[9]</sup> in 2002, had a median age of 35.5 years with a range of 17-65 years. Afroze N et al<sup>[10]</sup> study in 2002, the median age was 40.2 years with the range of age in the study group being 16-78 years.<sup>[9]</sup> Mitra et al in 2002 study, showed a median age of 39.6 years and a range of 16-70 years.<sup>[10]</sup> Thus, the above data shows that the median age of presentation in the present study is comparable to the other studies, especially the study by Mitra R B et al.<sup>[10]</sup>

**Table 8: Age range and median age of different studies**

Study	Range of age (in years)	Median age (in years)
Tabagchali et al(2000) <sup>[7]</sup>	8.5-85	48
Sekhri et al(2001) <sup>[8]</sup>	9-70	33.9
Jose R J et al(2002) <sup>[9]</sup>	17-65	35.5
Afroze N et al(2002) <sup>[10]</sup>	16-78	40.2
Mitra R B et al(2002) <sup>[11]</sup>	16-70	39.6
Present study	20-68	39.5

Although the overall median age of presentation of thyroid swellings is 39.5 years, the median age of presentation for thyroid malignancy is 38 years in this study. The range was 20-68 years, which is equal to over range of the study.

The number of male patients in the present study was 13 (20%) and the number of female patients is 53 (80%), indicating a male to female ratio of 1:4.1. This gave the male to female ratio of 1:3.6. Sekhri et al,<sup>[8]</sup> had a sample size of 300 individuals comprising of 44 males and 256 females, which obtained a male to female ratio of 1:6. Tabagchali et al,<sup>[7]</sup> study included 239 patients, with 26 males and 213 females, which stated the male to female ratio to be 1:8.2. Jose R M et al,<sup>[9]</sup> had a relatively smaller study group of 16 male patients and 82 female patients, a total of 98 patients. The study reported a male to female ratio of 1:5.1. A recent study by Afroze et al,<sup>[10]</sup> had 48 males and 122 females, a total of 170 cases. This study obtained a male to female ratio of 1:2.54.

The male to female ratio in thyroid malignancy in the present study is 1:1.75. The ratio for papillary thyroid carcinoma, in the present study is 1:1.33, while that for anaplastic carcinoma was 1:1. All the patients of medullary carcinoma of thyroid were females in this study, thus the male to female ratio couldn't be quantified.

The most common presentation in the present study is the presence of a neck swelling in front of the neck. The second most common symptom in this study is dysphagia. The majority of the patients presented within the duration of 6months to 3years from the onset of the first symptom. The other symptoms as evaluated by this study, in decreasing order of frequency are pain associated with the swelling, hoarseness or change in character of voice and dyspnoea. It is emphasized that this study excluded any patients who were hyperthyroid or hypothyroid clinically and biochemically. An important aim is to identify the benign lesions from the malignant lesions as a part of clinical examination. The rule of 12s can be useful in such evaluation.

The thyroid nodules on USG were subdivided in to 3 groups – benign, suspicious and malignant on the basis of various ultrasonographic features. The features suggestive of malignancy on USG are – hypoechoic pattern, incomplete peripheral halo, irregular margins, internal micro calcifications, presence of cervical lymphadenopathy, and peripheral degeneration in the mixed nodules. The features suggestive of benign disease process on USG are – halo sign (transonic uniform rim surrounding the mass), variable echogenicity, multi nodularity, large cystic lesion, diffusely nodular lesion homogenous gland, and peripheral calcification.

In the present study, out of 11 cases that were diagnosed to be malignant on USG, 5 cases were confirmed to have malignancy on histopathology and the remaining 6 cases were found to be benign lesions. In 5 cases, where ultrasonogram gave a diagnosis of benign lesion, the histopathology differed to be malignant.

Takashima et al reported a series of microcalcifications with a specificity of 93% and positive predictive value of 70% for cancer, albeit with a sensitivity of only 36%.<sup>[12]</sup>

The sensitivity of the preoperative diagnosis was 86.5% for patients with non-follicular neoplasms, and 18.2% for patients with follicular neoplasms. The specificity was 92% and 89% respectively. In Kamaljit Kaur et al study,<sup>[13]</sup> they found the sensitivity and specificity of ultrasonography to be 71.4% and 77.7% respectively, for differentiation of benign nodules from malignant nodules. They interpreted an ultrasonography report as suggestive of malignancy if the nodule was solid or a mixed solid-cystic variety and a hypo-echoic and non-haloed lesion. They emphasized that the ultrasonography has added advantage of allowing the whole gland to be examined rather than the dominant nodule but was limited by the fact that no features were pathognomonic of malignancy, so it should be regarded as a complementary investigation, rather than an alternative or replacing investigation to fine needle aspiration cytology, in the management of thyroid nodules. Jones et al (1990),<sup>[12]</sup> found the sensitivity and specificity of ultrasonography to be 75% and 61% respectively.

In the present study, the sensitivity and specificity of ultrasonography and TIRADS scoring in detection of malignancy was found to be 45.5% and 89.1%.

**Table 9: Sensitivities and specificities of different studies**

Study	Sensitivity	Specificity
Jones et al <sup>[12]</sup>	75%	61%
Kamaljitkaur et al, <sup>[13]</sup>	71.4%	77.7%
Present study	45.5%	89.1%

It has been a consistent observation according to published literature, that the risk of thyroid cancer is less with multiple nodules than with solitary nodules. High-resolution real time ultrasonography is far better than clinical examination in detecting thyroid nodularity. Jones et al<sup>12</sup> have shown that the prevalence of multi-nodularity in clinically solitary thyroid nodules is between 20% to 40%, and it has been observed that for a thyroid nodule to be detected by palpation, it must be at least 1cm in diameter, while ultrasonography can detect nodules as small as 3mm in diameter.

In the present study, there were 7 patients of PTC, 2 patients of MTC and 2 patients of ATC. Among the patients of PTC, 4 patients (57%) underwent total thyroidectomy as the primary surgery. The other 3 patients (43%) underwent limited thyroid resections which include 2 hemithyroidectomies (29%) and 1 subtotal thyroidectomy (14%), due to pre-operative misdiagnosis of a benign condition. All the patients with limited thyroid resections underwent completion thyroidectomy and were placed on levothyroxine replacement therapy with suppressive dose for suppression of TSH to levels below 0.1 to 0.5 mIU/L without causing symptoms of hyperthyroidism.

The two patients of MTC underwent total thyroidectomy as their primary surgery. Both the patients were placed on thyroid replacement therapy.

Both the patients who were diagnosed as ATC, underwent limited thyroid resections, one patient underwent hemithyroidectomy while

subtotal thyroidectomy was done for another patient. Both the patients were lost to follow up.

An ultrasonogram is a safe, non-invasive, non-radioactive test that should be ordered judiciously.



### **Limitation if the Study**

The sample size of this study is limited. The number of malignant cases during this study period is not sufficient enough to make concrete conclusions regarding the sensitivity, specificity, positive predictive value, negative predictive value and accuracy of the ultrasonography and TIRADS scoring system in correlation with the histopathological diagnosis.

### **CONCLUSION**

The present study was undertaken to evaluate the usefulness of clinical evaluation and USG TIRADS score in management of thyroid nodules.

1. Thyroid swellings are common in females in ages group 30-50 years.
2. Commonest presenting symptom is swelling in front of neck.
3. In the present study, the sensitivity and specificity of USG thyroid with TIRADS score was 45.5% and 89.1%.
4. High resolution ultrasound is an accurate technique, that has helped to analyse the suspicious sonographic features of thyroid swellings and to assess the risk of malignancy and quantify it using TIRADS score.
5. The sonographic features like irregular margins, solid component, hypoechogenicity, taller than wide shape, micro-calcifications, nodularity are associated with risk of malignancy.
6. Features on USG like isoechogenicity or hyperechogenicity, mixed (solid and cystic) content of the nodule, macrocalcifications are associated with benign type lesions.
7. USG – TIRADS score offers the following advantages
  - a) Non-invasive, easily available, cost effective investigation
  - b) No patient dis-comfort
  - c) Offers objectivity (if done by an experienced radiologist)
  - d) Identifies malignant lesions with high accuracy.
  - e) Aids in clinical decision making
  - f) Prevents unnecessary surgeries.
8. The ideal test should have a sensitivity and specificity of 100%. A multimodality approach with use of FNAC and USG will give optimal results and avoid mismanagement.

### **Acknowledgment**

The author is thankful to Department of Surgery for providing all the facilities to carry out this work.

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