STUDY TOPIC- ROLE OF USG AND CT IN IMAGING OF THYROID LESIONS

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ABSTRACT

BACKGROUND

Thyroid lesions are the most common abnormality in the endocrine system. The importance of imaging is that cancers of the thyroid must be differentiated from the much more frequent benign adenomas and multinodular goiters.

METHODS

Study of 97 patients was carried out. All patients diagnosed and suspicious of thyroid lesions were included in my study. Patients referred to the radiology department for USG and/or CT scan thorax investigations, and found to have thyroid lesion, were included in this study.

RESULTS

In our study, there was a higher incidence of all thyroid diseases in females. The overall sex ratio was M:F = 1:4.7. Most of the patients were in the 31-40 yrs. age group. The largest group was comprised of non-toxic goitre followed by thyroid neoplasms. Most of the patients had multinodular type of goiter followed by solitary nodular goiter. Simple diffuse goiter was seen only in 10.5% cases. Majority of the patients showed mixed consistency, followed closely by solid consistency. Majority of the malignant lesions was papillary type of carcinoma (46%) followed by follicular carcinoma (20%) and metastasis (13.3%).

CONCLUSIONS

USG had high sensitivity of 86.6% and specificity of 96.5% in differentiating benign from malignant thyroid lesions which was better than that of CT scan which had a sensitivity of 66.6% and specificity of 80%. CT scan was found to be useful in staging of thyroid malignancies.

KEYWORDS

Thyroid Nodule, Benign, Malignant, USG, CT Scan.

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BACKGROUND

Any thyroid swelling is an ominous sign and warrants evaluation as thyroid cancer.

There are various modalities which can be used for the characterisation of thyroid lesions, which include USG (high-end) and CT scan (for staging of the neoplasm).

As per statistics, 4% of the population is afflicted by this disease, however thyroid nodules may be present in 20% or more of adults subjected to routine thyroid echography.

By far the most sensitive imaging test available for thyroid gland examination is high end USG. Its role has been enumerated as follows.

- To differentiate between possible benign and probably malignant masses, based on their sonographic appearance.
- To detect thyroid and cervical masses, including relapse in the thyroid bed and cervical adenopathy after thyroidectomy.
- To guide the performance of FNA biopsy and percutaneous treatment.

CT plays minimal role in the diagnosis but is a game changer in terms of further management of the patient, as it is imperative for staging of the neoplasm.

Scintigraphy is not used routinely to assess thyroid nodules. It allows assessment of the functional activity of a thyroid nodule and of the whole gland. A functioning, or “hot,” thyroid nodule is rarely malignant, with only a few reported cases of such malignancy.1-8 Although a non-functioning, or “cold,” nodule at scintigraphy is commonly thought to indicate an increased risk of thyroid malignancy, as many as 77% of cold thyroid nodules may be benign.2 Thyroid scintigraphy therefore is unhelpful for differentiating a benign nodule from a malignant one, and its utility for the routine evaluation of thyroid nodules is limited.
Aims and Objectives
1. To study role of USG and CT scan in diagnosis of thyroid lesions.
2. To know merits and demerits of different modalities over one another.
3. To know the sensitivity and specificity of USG and CT scan in evaluation of thyroid lesion with final pathological diagnosis.
4. To evaluate the occurrence of thyroid pathologies according of age, sex and etiological factors.

Methods
A prospective study of 97 patients was carried out. The cases were recruited from the teaching hospitals attached to GCRI, Ahmedabad. From January 2018 to January 2019.

Inclusion Criteria
- All patient diagnosed and suspicious of thyroid lesions were included in our study.
- Patients referred to the radiology department for USG and/or CT scan thorax investigations, and found to have thyroid lesion, were included in this study.
- Already diagnosed cases of such thyroid disease which need follow up radiological investigations and are referred to our radiology department were included in study.

Exclusion Criteria
- All patients with contrast allergy and contraindications to CT scan procedure, were excluded from my study.
- Patients presenting to radiology department having thyroid lesion in past and are cured completely were excluded from the study.

Results
The present study was a prospective type of study. A total of 97 patients evaluated for thyroid diseases,

Female preponderance was noted in all age group except in 61-70 yrs. age group where there was equal number of male and female patients. The age range of the patients in the study was 8 yrs to 78 yrs.

Largest numbers of patients were in the 31-40 yrs. age group.

The female preponderance was noted in patients and the overall sex ratio was M:F = 1:4.7. In my study there was higher incidence of all thyroid diseases in females.

As mentioned above most of the nodules of colloid goiter were isoechoic with cystic degeneration being present in 70% cases. A thin well defined complete halo was seen in 69.5% cases. Calcification is present in only 21% cases. Extra thyroid involvement was noted in 14 patients and lymph nodes were the most common site of extra thyroid extension.

Out of 10 pts of benign thyroid lesion CT scan showed retro sternal extension of the thyroid mass in 4 cases (40%) with well-defined and clear planes around it. Degenerative changes were noted in 40 cases of thyroid lesions.

Table 1. Sonographic Features of Thyroid Neoplasms

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>USG Features</th>
<th>Adenoma n= 8</th>
<th>%</th>
<th>p Can n=7</th>
<th>%</th>
<th>F Can n=3</th>
<th>%</th>
<th>M Can n=1</th>
<th>%</th>
<th>A Can n=1</th>
<th>%</th>
<th>Mets n=2</th>
<th>%</th>
<th>Lymphoma n=1</th>
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<td>75</td>
<td>5</td>
<td>3</td>
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<td>1</td>
<td>1</td>
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<td>1</td>
<td>1</td>
<td>80</td>
<td></td>
</tr>
<tr>
<td></td>
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<td>mixed</td>
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<td>25</td>
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<td>0</td>
<td>0</td>
<td>0</td>
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<td>0</td>
<td>0</td>
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</tr>
<tr>
<td>3</td>
<td>Halo</td>
<td>thin, complete, well-defined</td>
<td>7</td>
<td>87.5</td>
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P = Papillary, F= Follicular, M= Medullary, A= Anaplastic
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<tr>
<th>Sr. No.</th>
<th>CT Diagnosis</th>
<th>Involvement</th>
<th>Location</th>
<th>Margins</th>
<th>Degeneration</th>
<th>Contrast enhancement</th>
<th>Extension</th>
<th>Lymph nodes</th>
<th>Distal Mets</th>
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<td>1</td>
<td>Colloid goitre</td>
<td>Solitary focal</td>
<td>one lobe</td>
<td>well defined</td>
<td>cystic</td>
<td>Inhomogeneous</td>
<td>+</td>
<td>-</td>
<td>Solitary goitre</td>
<td>Papillary CA</td>
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<td>Benign lesion</td>
<td>solitary focal</td>
<td>one lobe</td>
<td>well defined</td>
<td>-</td>
<td>minimal</td>
<td>-</td>
<td>+</td>
<td>Metastasis</td>
<td>Metastasis</td>
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<td>both lobes</td>
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<td>-</td>
<td>minimal</td>
<td>-</td>
<td>+</td>
<td>Lymphoma</td>
<td>Lymphoma</td>
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<td>one lobe</td>
<td>well defined</td>
<td>cystic</td>
<td>Inhomogeneous</td>
<td>+</td>
<td>-</td>
<td>Colloid goitre</td>
<td>Papillary CA</td>
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<td>both lobes</td>
<td>irregular</td>
<td>-</td>
<td>inhomogeneous</td>
<td>vessel involvement</td>
<td>+</td>
<td>-</td>
<td>Metastasis</td>
<td>Metastasis</td>
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<td>both lobes</td>
<td>III-defined</td>
<td>necrosis</td>
<td>Rim and punctate calcification</td>
<td>inhomogeneous</td>
<td>retrosternal, muscle infiltration</td>
<td>+</td>
<td>-</td>
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<td>solitary focal</td>
<td>Crossings isthmus</td>
<td>III-defined</td>
<td>-</td>
<td>Microcalcification</td>
<td>inhomogeneous</td>
<td>-</td>
<td>+</td>
<td>Medullary ca</td>
<td>Medullary CA</td>
</tr>
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<td>one lobe</td>
<td>III-defined</td>
<td>-</td>
<td>Microcalcification</td>
<td>inhomogeneous</td>
<td>-</td>
<td>+</td>
<td>Papillary ca</td>
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<td>9</td>
<td>Malignant lesion</td>
<td>Multi focal</td>
<td>Crossing isthmus</td>
<td>III-defined</td>
<td>necrosis</td>
<td>-</td>
<td>inhomogeneous</td>
<td>muscle involvement, vessel encasement</td>
<td>+</td>
<td>+</td>
<td>Malignant lesion</td>
</tr>
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<td>Malignant lesion</td>
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<td>right lobe</td>
<td>III-defined</td>
<td>necrosis</td>
<td>-</td>
<td>inhomogeneous</td>
<td>tracheal involvement</td>
<td>+</td>
<td>-</td>
<td>Papillary ca</td>
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<tr>
<td>11</td>
<td>Benign adenoma</td>
<td>solitary focal</td>
<td>right lobe</td>
<td>well defined</td>
<td>-</td>
<td>Coarse calcification</td>
<td>inhomogeneous</td>
<td>-</td>
<td>-</td>
<td>Suspicious nodule</td>
<td>Follicular CA</td>
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<td>right lobe</td>
<td>III-defined</td>
<td>-</td>
<td>inhomogeneous</td>
<td>-</td>
<td>-</td>
<td>Malignant nodule</td>
<td>Follicular Ca.</td>
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**Table 2. CT Findings in Case of Malignant Thyroid Lesions**

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<tr>
<th>Sr. No.</th>
<th>Staging&lt;sup&gt;10&lt;/sup&gt;</th>
<th>Diagnosis</th>
<th>Additional Benefit of CT Scanning</th>
<th>Pathological Diagnosis</th>
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<tr>
<td>1</td>
<td>USG - CT</td>
<td>Colloid goiter</td>
<td>Colloid goiter</td>
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<tr>
<td>2</td>
<td>USG - CT</td>
<td>Malignant Nodule</td>
<td>Benign lesion</td>
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<tr>
<td>3</td>
<td>USG - CT</td>
<td>Lymphoma</td>
<td>Secondary lymphoma</td>
<td>Complete analysis of all LNs</td>
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<td>T1N1 - CT</td>
<td>Malignant Nodule</td>
<td>Colloid goitre</td>
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</tr>
<tr>
<td>5</td>
<td>USG - CT</td>
<td>Metastasis</td>
<td>Metastasis from oesophagus</td>
<td>Retrosternal portion evaluated</td>
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<td>T4N1 - T4N1</td>
<td>Papillary</td>
<td>Malignant lesion</td>
<td>Retrosternal portion evaluated</td>
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<tr>
<td>7</td>
<td>T3N1 - T3N1</td>
<td>Medullary CA</td>
<td>Malignant lesion</td>
<td>NIL</td>
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<tr>
<td>8</td>
<td>T2N2 - T2N2</td>
<td>Papillary CA</td>
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<tr>
<td>9</td>
<td>T4N2 - T4N2</td>
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<td>Malignant lesion</td>
<td>Retrosternal portion evaluated</td>
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<tr>
<td>10</td>
<td>T2N1 - T4N1</td>
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<td>Malignant lesion</td>
<td>Tracheal infiltration detected</td>
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<tr>
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<tr>
<td>12</td>
<td>T1N1 - T1N1</td>
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<td>Malignant lesion</td>
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<td>MNG</td>
<td>Multinodular goitre</td>
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<td>? Malignant Nodule</td>
<td>Follicular adenoma</td>
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<td>Benign solitary Nodule</td>
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On CT examination of malignant thyroid lesions, 60% lesions show ill define margin, 80% lesion shows inhomogeneous enhancement and 33% lesions shows calcification. In study of 734 patients Yoon at al. found that signs of malignancy on CT could include nodular or rim calcifications (46.7% malignant versus 13.3% benign), an anteroposterior-transverse diameter ratio greater than 1 (33.3% versus 9.5%), and mean contrast-enhanced attenuation higher than 130 HU (86.7% versus 49.5%). The overall malignancy rate was 9.4%.

In 72% cases finding of two modalities were comparable. Retrosternal extension and staging was better done with CT in 9 case out of 22 cases (40%). however Sonography found better for prediction of malignancy, local invasion.

Sonography was found better for evaluation of goiter, for local invasion and nodal metastasis.

Metastasis involving cervical lymph nodes (case no. 3): Spectrum of appearances, A. Multiple small round to oval hypoechoic lymph nodes, despite their small size the round shape and hypoechoic patterns are highly indicative of metastasis; B. Showing a lymph node with cystic change. Cystic change in cervical lymph nodes is almost always caused by metastatic papillary carcinoma; C. an enlarged reactive lymph node with intact hilum as insignificant finding.

Thyroid Metastasis (case no. 21): A. transverse scan images showed a solid homogeneously hypoechoic mass that is showing intra-nodular vascularity this was a metastatic lesion from Bronchogenic adenocarcinoma; B. An ill-defined diffusely infiltrating hypoechoic mass lesion which was a metastatic lesion from carcinoma oesophagus.
circumscribed enlarged necrotic cervical lymph nodes seen along the right internal jugular vein.

Metastatic Adenocarcinoma (Case no. 21): CECT scan in a known case of Bronchogenic carcinoma showing hypodense nodule in the left lobe of thyroid and coronal image (C), shows primary mass in the lung. FNAB suggest metastatic carcinoma from primary carcinoma of lung.

**Diagnostic Accuracy of CT Scan in Thyroid Diseases**
- CT scan could correctly distinguish between normal and abnormal thyroid in all cases
- Accuracy of high-resolution CT scanning in distinguishing malignant from benign thyroid lesion was calculated as follows:
  - **True Positive (TP):** Malignancy diagnosed by CT and at pathologic examination. True Negative (TN): Malignancy excluded by CT and at pathologic examination.
  - **False Positive (FP):** Malignancy diagnosed by CT and not found on pathologic examination.
  - **False Negative (FN):** Malignancy excluded by CT and pathology revealing malignancy.

![](Figure4.png)

**DISCUSSION**

ACR Thyroid Imaging Reporting and Data System (ACR TI-RADS) is a reporting system for thyroid nodules on ultrasound proposed by the American College of Radiology (ACR).

This uses a standardised scoring system for reports providing users with recommendations for when to use fine needle aspiration (FNA) or ultrasound follow-up of suspicious nodules, and when to safely leave alone nodules that are benign/not suspicious.

**Ultrasound Features**
Scoring is determined from five categories of ultrasound findings (Figure 2). The higher the cumulative score, the higher the TR level and likelihood of malignancy.

One score is assigned from each of the following categories:
- Composition: (choose 1)
  - Cystic or completely cystic: 0 points
  - Spongiform: 0 points
  - Mixed cystic and solid: 1 point
  - Solid or almost completely solid: 2 points
- Echogenicity: (choose 1)
  - Anechoic: 0 points
  - Hyper- or isoechoic: 1 point
  - Hypoechoic: 2 points
  - Very hypoechoic: 3 points
- Shape: (choose 1) (assessed on the transverse plane)
  - Wider than tall: 0 points
  - Taller than wide: 3 points
- Margin: (choose 1)
  - Smooth: 0 points
  - Ill-defined: 0 points
  - Lobulated/irregular: 2 points
  - Extra-thyroidal extension: 3 points
- Echogenic foci: (choose 1 or more)
  - None: 0 points
  - Large comet tail artefact: 0 points
  - Macrocalkifications: 1 point
  - Peripheral/rim calcifications: 2 points
  - Punctate echogenic foci: 3 points

The findings in each category were detailed in the ACR committee’s 2015 publication on a reporting lexicon. If multiple nodules are present only the four highest scoring nodules (not necessarily the largest) should be scored, reported, and followed up.

**Scoring and Classification**
- TR1: 0 points
  - Benign
- TR2: 2 points
  - Not suspicious
- TR3: 3 points
  - Mildly suspicious
TR4: 4-6 points
Moderately suspicious
TR5: ≥7 points
Highly suspicious

**Recommendations**
TR1: no FNA required
TR2: no FNA required
TR3: ≥1.5 cm follow up, ≥2.5 cm FNA
Follow up: 1, 3 and 5 years
TR4: ≥1.0 cm follow up, ≥1.5 cm FNA
Follow up: 1, 2, 3 and 5 years
TR5: ≥0.5 cm follow up, ≥1.0 cm FNA
Annual follow up for up to 5 years

Thyroid lesions were noted in both males and females with a female preponderance with the overall sex ratio was M:F = 1:4.5

Thus USG is better in differentiate between possible benign and probably malignant masses, based on their sonographic appearance. Also it is helpful to detect thyroid and cervical masses, including relapse in the thyroid bed and cervical adenopathy after thyroidectomy. My observations have been enumerated as follows,

- The largest group comprised of nontoxic goitre followed by thyroid neoplasms.
- Most of the nodules of colloid goiter were isoechoic
- Most of the patients with thyroid neoplasms had solid lesions (80%). Predominant echo pattern was that of hypo echogenicity (60%) Multi nodularity in thyroid was seen in 33% cases on USG. Absent halo noted in 80% cases. Micro calcification was seen in 3(20%) cases which were diagnosed on histopathology as papillary carcinoma. Coarse calcification was noted in 2 patients one was medullary carcinoma and in one with follicular carcinoma. Rim calcification was noted in one case of papillary carcinoma. 42% cases of papillary carcinoma shows calcification.
- Predominant vascularity pattern in benign thyroid neoplasm was perilesional blood flow.

**Summary**
The present study was a prospective type of study. Total 97 number of patients from were recruited. All Patients that came to the radiology department with clinical suspicion of thyroid diseases at Gujarat cancer and research institute, consisted the study material.

Out of the 97 cases studied 17 (17.5%) were men and 80 (82.5%) were women. This clearly shows predilection of thyroid diseases in females. Maximum number (28/97, 29%) of patients were within age group 31-40 years. The most common complain noted in (57 patients; 55%) was 'lump in the neck'.

The distribution of thyroid diseases as found in my study were:
1. Non-toxic goitre: 47 cases (49%)

**REFERENCES**


