



ORIGINAL RESEARCH PAPER

Radiodiagnosis

ROLE OF IMAGING IN EVALUATION OF THYROID LESION WITH HISTOPATHOLOGICAL CORRELATION AND ESTABLISH ROLE TO FIND OUT MALIGNANT POTENTIAL

KEY WORDS: Papillary carcinoma, Thyroiditis, Colloid, CT, Doppler

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ABSTRACT

Mostly benign, Thyroid masses can be malignant sometimes and may occasionally lead to fatal complications like airway compression, vascular compromise or metastatic spread of the lesion to adjacent structures. This study is an effort to assess the role of X-ray, CT, High resolution sonography, colour doppler and MRI in detection and characterisation of thyroid and help in deciding further course of management.

I. INTRODUCTION

Thyroid is endocrine gland, situated in lower part of the front and sides of neck and consist right and left lobes and joined by isthmus. It has true and false capsules. it extends from oblique line of thyroid cartilage to the 5th and 6th tracheal ring and lies against C5, C6, C7 and T1 vertebrae.

Ultrasonography is most sensitive imaging test available. It is also useful in evaluation of thyroid nodules/ masses. Ultrasound is often helpful in localizing a thyroid mass for guided FNAB.

CT scanning of the neck with contrast is considered the most useful initial imaging study in the evaluation of the neck mass. It can define the origin and full extent of deep, ill-defined masses, and when used with contrast can delineate vascularity or blood flow.

MRI provides much of the same information as CT, and is generally not necessary as part of an initial evaluation. It is currently better for upper neck and skull base masses due to possible dental artifact on CT. It is better than CT in evaluation of the pulsatile mass or mass with a bruit or thrill.

II. AIMS & OBJECTIVES

1. To evaluate the role of various radiological imaging modalities in thyroid lesion for pre-operative characterization, location, extent, morphological characteristics and enhancement pattern.
2. For accurate staging of malignant lesions to guide further management.
3. To guide FNAC of these lesions whenever indicated and establish their pathological correlation.

III. MATERIAL AND METHODS

Study type: The present study is observational study.

Study setting: This study was conducted in the department of Radio-diagnosis, Civil Hospital, Ahmedabad. North Gujarat and Rajasthan are the main catchment area of the hospital.

Study period: Study was conducted over a period of 24

months which include data collection, data analysis from September 2017 to August 2019.

Sample size: As it was decided to include all patients with clinically palpable neck swelling who were referred to department of Radio-diagnosis during the study period (September 2017 to August 2019). At the end of study total **63** patients were included in this study.

Selection of patients: The patients matching the inclusion criteria will be included, and those falling within the exclusion criteria and not affirming to the consent or procedural guidelines will be eliminated out of the study.

INCLUSION CRITERIA

1. Patients who have presented with a clinically palpable neck mass.
2. Only those patients who were willing to participate were included.
3. Patient referred to radiology department for USG and/or CT scan investigation and found to have lesion were included in this study.

EXCLUSION CRITERIA:

1. Post operative patients.
2. Patients with contraindications to intravenous administration to contrast medium.
3. Pregnant females (for CT Scans only).
4. Cases with lesion other than thyroid origin
5. Cases of Non specific Lymphadenopathy.

METHODOLOGY:

1. This was a prospective observational study.
2. A detailed clinical history was taken from patient and thorough local examination was carried out. Relevant laboratory investigations, Thyroid function Tests, were done as required.
3. X-ray soft tissue neck antero-posterior view (AP view) and lateral view is the preliminary mode of the investigation of the thyroid mass then-after high resolution sonography with colour doppler being the initial investigation.

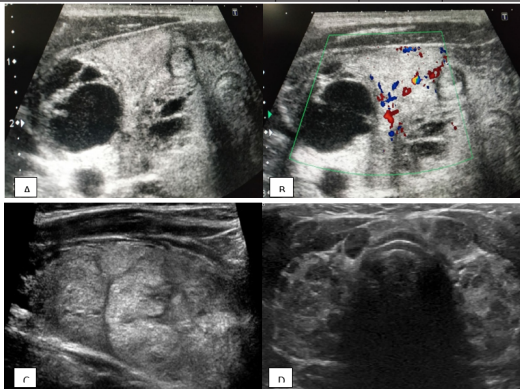
4. Computed tomography and Magnetic resonance imaging were done according to the need of the study. Confirmation of the thyroid pathology by the histopathological examination.

IV. OBSERVATIONS AND RESULTS

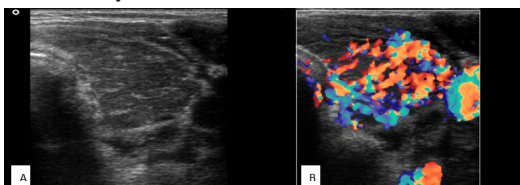
The study was observational type of study. A total of 63 patients evaluated for neck masses who referred to Department of Radiodiagnosis, in tertiary care hospital.

Table 1 : Incidence of various Thyroid diseases by Pathologic examination. (Total no. of cases 63)

Pathology	Male	Female	Total	Percentage
Colloid goiter	4	32	36	57.14
Graves disease	1	2	3	4.76
Hashimoto thyroiditis	1	7	8	12.69
Thyroid adenoma	1	3	4	6.34
Thyroid neoplasm	3	6	9	14.28
Thyroglossal cyst	0	3	3	4.76
Total	10	53	63	100



Multinodular goiter Figure A & B: Longitudinal images of the right lobe of the thyroid gland shows the increases in the size of the thyroid gland with multiple well defined, heteroechoic nodules having internal cystic areas which show peripheral vascularity of colour Doppler examination. Figure C: Longitudinal images of right lobe of thyroid in other patient with MNG showing multiple well defined hyperechoic nodules. Figure D: Transverse image of thyroid in patient with MNG showing multiple well defined heterogenous nodules in both lobes of thyroid.



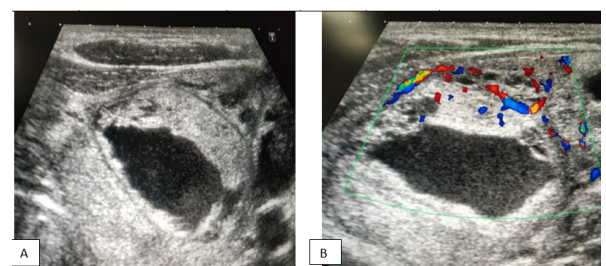
Thyroiditis Figure A & B: Transverse images of the thyroid gland shows the homogenous enlargement of the thyroid gland with hypoechoic in echotexture. On colour Doppler examination increase in the vascularity noted which is suggestive of acute stage of thyroiditis.

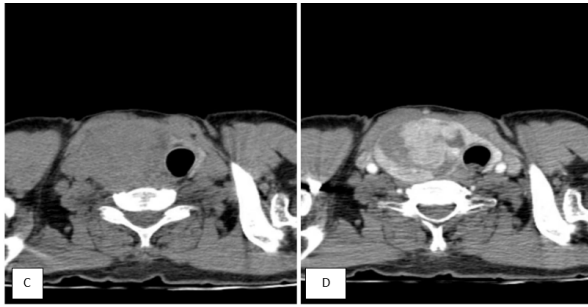
1. Most number of the patients with colloid goiter shows mixed consistency followed by solid consistency.
2. Most of the nodules of colloid goiter were isoechoic. Cystic degeneration was present in 59.6% of cases.
3. Variable echopattern was noted with majority of the lesions being isoechoic while hyperechoic pattern was noted in least number of lesions. Similar type of consistency and echotexture were observed by Blum et al 1975 (2) and Solbiati et al 1992 in their respective study groups(1).
4. Four patients with solitary thyroid nodule (STN) had intranodular flow pattern on colour doppler study, however 60% of patient with STN shows peripheral vascularity.

5. Most of the nodules of colloid goiter were isoechoic. Cystic degeneration was present in 63.05% of cases
6. Calcification is present in 31.5% of cases which 26.3% have coarse calcification and 5.25% have micro calcification
7. Solbiati et al (1) studied USG appearance of 401 cold radionuclide nodules. Out of 401, 156 were nodular goiter. There was presence of coarse calcification in 22 cases and rim type of calcification in 10 cases. No evidence of microcalcification was seen in any case. These findings are consistent with findings of present study.
8. Most of the patients with multinodular goiter shows inter-nodular vascularity.
9. Colour Doppler scan showed peripheral vascularity 73.68.0% of multinodular goiter(MNG) nodules and 60% cases of STN. 11.7% cases (4 cases) were avascular while 20.5% (7 cases) showed intranodular flow in the dominant nodule. Similar colour Doppler findings have been reported in literature i.e. Solbiati et al(1).
10. Sonographic appearance of thyroid in patients of Hashimoto's thyroiditis comprised of the 8 cases which are predominantly hypoechoic pattern and increased in the gland sized.
11. Nodularity is seen in the 4 number of cases out of 8 patients
12. Predominantly normal vascularity is observed in the hashimoto thyroiditis.
13. Cervical lymphadenopathy is seen in the 50% of patients.
14. Similar USG findings have been reported by various authors, Nordmeyer et al 1990(4), Blum et al 1977(2).
15. Colour Doppler was done in all 8 patients. It showed diffuse parenchymal flow of low to medium velocity in 62.5% of the patients (5 cases). Similar colour Doppler findings have been observed in study by Ralls et al 1988 and Clark et al 1995(3).
16. USG appearances of thyroid in patients of Graves disease comprised of the 3 cases which are predominantly hypoechoic pattern and increase in the gland size.
17. Predominantly increased vascularity is observed in Graves disease.
18. All 3 cases of thyroglossal duct cyst showed well defined, hypoechoic, round to oval shaped lesion with internal echoes, without internal vascularity. Two cases showed evidence of peripheral vascularity. One patient got CECT done and one patient got MRI done. On MRI the lesion appeared hypointense on T1WI and hyperintense on T2WI and showed peripheral enhancement. In CT the lesion appeared hypodense with peripheral enhancement. There was no evidence of sinus tract extending to skin.

Table 2: Distribution of Thyroid Neoplasm as found at Pathologic examination (Total no. of cases 13)

No.	Pathology	No. of cases			Percentage (%)
		M	F	Total	
1	Thyroid adenoma	M	F	Total	30.76%
		1	3	4	
2	• Malignant lesions	2	3	5	38.46%
3	• Follicular	1	1	2	15.38%
4	• Anaplastic	1	1	2	15.38%





Papillary Carcinoma of thyroid : (fig A,B) large well defined heterogenous lesion is seen involving the right lobe of thyroid gland with internal cystic areas and vascularity, (fig. C,D) on CECT neck axial images shows large well defined heterogeneously enhancing lesion involving right lobe of thyroid gland with lateral displacement of the trachea on left side.

1. Follicular adenoma of thyroid gland is well-defined, solid

Table 3: ACR TIRADS Grades of Thyroid Nodules (Number of patients 47)

Tirads Grade	Patients in present study (n-47)	Histological diagnosis of patients in present study	Malignancy potential in present study	Malignancy Potential in Gokulakrishnan Periakaruppan et al study (n-184)(5)
TIRADS 1	17% (8 patients)	Bathesda category II – Colloid Goiter (8)	0%	0%
TIRADS 2	36% (17 patients)	Bathesda category II – Colloid Goiter (17)	0%	0%
TIRADS 3	19% (9 patients)	Bathesda category II – Colloid Goiter (8), Follicular Adenoma (1)	0%	2.2%
TIRADS 4	17% (8 patients)	Bathesda category II – Colloid Goiter (1), Follicular Adenoma (3), Papillary Carcinoma (4)	50%	38.5%
TIRADS 5	11% (5 patients)	Papillary Carcinoma (1), Follicular Carcinoma (2), Anaplastic Carcinoma (2)	100%	77.8%

1. Highest number of patients was present in TIRADS Grade 2 category.
2. Upto TIRADS Grade 3 category no case of malignancy was found.
3. In TIRADS 4 category, 4 cases were proved to be of benign etiology and 4 cases were proved to be of malignant etiology on histopathological correlation.
4. In TIRADS 5 category all 5 cases were proved to be of malignant etiology. Similar results were found in Gokulakrishnan Periakaruppan et al study(5).

IV. DISCUSSION

This study was an observational and prospective study. Total 63 All Patients that came to the radiology department wide clinical suspicion of thyroid masses. Out of 100 cases of neck masses 69% were female and 31% were male. Maximum number 26% of patients were within age group 31-40 years. Out of the 63 cases of thyroid diseases 84.1% were female and 15.9% were male which clearly shows predilection of thyroid diseases in females. Maximum number 36.5% of patients were within age group 31-40 years. In our study of 63 patients were evaluated for thyroid pathologies by using various radiological modalities

1. X-ray is helpful in detection of calcifications within the thyroidal or masses and compression or shifting of trachea by the masses.
2. USG is reliable in distinguishing normal from abnormal thyroid. Thyroid sonography is useful in defining whether the patient has a diffuse abnormality, a multinodular pathology or a solitary nodule. USG with color Doppler is an excellent modality for morphological characterization of thyroid lesions. USG is better than CT scan in characterization of thyroid lesions. High resolution sonography with color Doppler can differentiate benign

- lesions with variable parenchymal echotexture in 4 cases.
2. Coarse calcification was noted in 25% case while rim calcification in 25% case of benign follicular adenoma.
3. Perilesional vascularity was noted in 75% cases followed by intralesional vascularity.
4. Microcalcifications is seen in the 33.3% of the cases of malignant thyroid neoplasm however it is absent in benign neoplasm. Microcalcifications were observed in three cases of thyroid malignancy and one case of multinodular goiter.
5. A high specificity of microcalcification for malignancy was documented by author Solbiati et al 1991(1). Ring or egg shell calcification has been documented by various authors to be reliable indicator of benignancy Solbiati et al 1985(1). Four cases were encountered in our study which showed nodules with rim calcification. One case was revealed to be a papillary carcinoma, one to be benign follicular adenoma and other two cases were diagnosed on histopathology as hyperplastic goiter nodule. This is consistent with other studies that stated that rim calcification is a reliable indicator of benignity.

from malignant thyroid nodules in most of the cases. Benign vs Malignant thyroid lesions, the sonographic features favouring malignancy are Predominantly solid lesions, Hypoechoic echopattern in a solid lesion, microcalcifications, local invasion, significant cervical lymphadenopathy, intralesional vascularity on colour Doppler. Sonography can only predict retrosternal and substernal extension of the thyroid masses. However, the substernal and retro tracheal components of the thyroid masses cannot be adequately imaged due to technical constraints.

3. CT scan plays an important role in evaluating thyroid masses with substernal or retro tracheal extension which can't be adequately imaged by high resolution USG. High resolution USG is useful in diagnosis and follow up of diffuse diseases i.e. Grave's disease, thyroiditis and simple diffuse goiter. High resolution USG can be used to guide FNAC from impalpable thyroid lesions. CT scan is complimentary to high resolution USG in evaluation of thyroid masses and in detecting local invasion by thyroid malignancies. CT scan is superior to sonography in staging and its further management of thyroid malignancies. High resolution USG is recommended as the primary imaging modality in the evaluation of thyroid diseases. It has a high sensitivity and specificity in the diagnosis of thyroid diseases. CT scan plays a role in evaluation of retrotracheal and retrosternal goiters, large thyroid masses and staging of thyroid malignancies.
4. MRI findings such as nodal level, extracapsular spread, adjacent soft tissue invasion, vascular encasement, signal intensities, presence of necrosis and enhancement characteristics helps in differentiating pathologic lymphadenopathy from reactive benign lymphadenopathy and can also help differentiating

various pathologies in the sitting of give clinical scenario. MR imaging provides excellent contrast resolution to help identifying the epicenter of the lesion in the particular neck space and the narrowing down the list of differential diagnosis. In the study, MR criterians like margin, signal intensity, necrosis/cystic areas or presence or absence of soft tissue components broadly classified the lesion in to categories like neoplastic/non-neoplastic and benign/malignant, presence of fluid signal intensity suggested vascular malformation. Presence of fat signal intensity without malignant features like soft tissue, septum or enhancement suggested benign fat containing tumours. Excellent contrast also provides better delineation of the lesion and soft tissue invasion providing valuable pre-operative information to surgeons.

V. CONCLUSION

So, here we conclude USG is the primary modality of choice, and although CT is the workhorse for the imaging in thyroid lesions, MRI is a valuable problem solving tool when multimodality approach is needed and Being radiation free, it should be the modality of choice as specially in certain group like children.

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