EVALUATION OF THYROID NODULES: AN ULTRASONOGRAPHIC STUDY

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ABSTRACT: Thyroid nodules are common in adults, with a reported prevalence of up to 50%. (1–5). Furthermore, 9% to 15% of nodules identified during clinical examinations are diagnosed as malignant (6–8). It is generally accepted that sonography and sonographically guided fine-needle aspiration cytologic examination are the modalities of choice for differentiating benign and malignant thyroid nodules (1, 9). Thyroid ultrasonography (USG) is the major diagnostic modality for evaluating thyroid nodules. Using USG, a thyroid nodule appears as a nodular lesion within the thyroid gland that is distinguishable from the adjacent parenchyma. Several USG features, such as marked hypoechogenicity, irregular margin, micro calcifications, and a taller-than-wide shape have been introduced as potential predictors for the presence of thyroid malignancies. **AIMS & OBJECTIVE:** The aim of this study was to assess the accuracy of USG diagnosis for thyroid nodules. **MATERIALS & METHODS:** The present study was conducted in the Department of Radiodiagnosis, TMMC & RC, TMU, Moradabad. Patients under the study were referred from department of Surgery, Paediatrics, Medicine, ENT, Gynaecology and Obstetrics. Patients for the study were evaluated by Clinical & Radiological examination. The total number of patients were 120. **RESULT:** On clinical examination, multiple nodules were found only in 17% of cases, whereas on USG, multiple nodules were found in 58%. 50% of clinically solitary nodules were demonstrated to be multiple on USG. **CONCLUSION:** In conclusion, similar to the recent literature reviewed so far, for a large majority of patients, diagnosis changed after ultrasonography, so the results necessitate the use of ultrasonography, which is a noninvasive method, as a complementary method to physical examination in the diagnosis of thyroid diseases, especially thyroid nodules.
KEY WORDS: ultrasonography, solitary nodules, multiple nodules.

INTRODUCTION: Thyroid gland lies in the anterior neck with one lobe on either side of the trachea connected by an isthmus across the midline. Diseases of the thyroid gland are common and comprise a spectrum of entities causing systemic disease or a localized abnormality. Thyroid nodules come to clinical attention when noted by the patient, as an incidental finding during routine physical examination, or during a radiologic procedure. Thyroid nodules are common in adults, with a reported prevalence of up to 50%. (1–5).

Nodules are more common in iodine-deficient areas, in women, and with aging. Women are two to three times as likely to develop radiation-induced thyroid nodules as compared to men (10).

Palpation is insensitive for detection of thyroid nodules, as shown by a study in which up to half of patients with normal neck examinations were found to have nodules when imaged with ultrasonography (11).

Most palpable nodules are >1 cm in diameter, but the ability to feel a nodule is influenced by its location within the gland (superficial versus deeply embedded), the anatomy of the patient's neck, and the experience of the examiner. Non palpable nodules have the same risk of malignancy as palpable nodules with the same size. Generally, only nodules >1 cm should be evaluated, since they

have a greater potential to be clinically significant. Occasionally, there may be nodules <1 cm that require evaluation because of suspicious US findings, associated lymphadenopathy , a history of head and neck irradiation, or a history of thyroid cancer in one or more first-degree relatives. Following initial evaluation, the use of selected radiographic studies can be helpful in managing thyroid masses. Thyroid ultrasound (US) is the major diagnostic modality for evaluating thyroid nodules. It is noninvasive, may be more readily available than the FNAB in a primary care setting, and provides information that may suggest malignancy or benign. High-resolution thyroid US is the most useful diagnostic tool for evaluating thyroid nodules. Many studies report variability in the diagnostic accuracy or a considerable overlap in the appearance for distinction between benign and malignant thyroid nodules. The evaluation of a thyroid nodule is stressful for most patients. They are concerned about the possibility of thyroid cancer. It is constructive, therefore, to review the diagnostic approach and to reassure patients when no malignancy is found. When a suspicious lesion or thyroid nodule is identified, an explanation of the generally favorable prognosis and available treatment options should be provided.

The prevalence of cancer is higher in several groups:

- Children
- Adults less than 30 years or over 60 years old
- Patients with a history of head and neck irradiation
- Patients with a family history of thyroid cancer

The aim of this study is to assess the accuracy of US diagnosis for benign and malignant solid thyroid nodules.

MATERIALS & METHODS: Clinical material (patients/subjects) made available in this study is the result of continuous referral of patients (for more than last two years, August 2011 to September 2013) to department of Radio-diagnosis for radiological evaluation by faculty members of department of Surgery, Paediatrics, Medicine, ENT, Gynaecology and Obstetrics The present study is conducted in the Department of Radio-diagnosis, TMMC & RC, TMU, Moradabad on 120 patients.

Every patient examined in this study gave his/her consent. (Scanned copy of consent form attached (Annexure-1).

In case of minor consent from guardians was taken.

Institutional Ethical and research committee approval was taken prior to start the study.

Female subjects were examined in presence of female nursing staff and one female attendant.

A detailed clinical history was taken from all the cases and thorough general physical & local examination was carried out. Relevant laboratory investigations were done.

RADIOLOGICAL EVALUATION: High resolution real time sonography of the neck was done using Scanners with 7-10 MHz transducers on MEDISON Diagnostic ultrasound system installed in Department of Radiodiagnosis TMMC&RC, TMU, Moradabad.

RESULTS:

N=120

Age group (In years)	Male	Female
0-10	10	-
11-20	-	-
21-30	10	30
31-40	-	30
41-50	20	10
51-60	-	-
61-70	-	-
71-80	10	-
Total	**50**	**70**

Table 1: Age and Sex distribution of thyroid disease

N=120

No. of Nodules	On Clinical Examination	On US
Solitary Nodules	100 (83%)	50 (42%)
Multiple Nodules	20 (17%)	70 (58%)

Table 2: Detection of thyroid nodules: Variance in number between clinical examination and imaging

N=120

Benign Disease	80	66.6%
Thyroid malignancy	40	33.3%

Table 3: Histo-pathological Spectrum of thyroid disease

Imaging Features	No. of cases	Percentage
CONSISTENCY		
Solid	20	40%
Cystic	-	-
Mixed	30	60%
ECHOGENECITY		
Hypoechoic	10	20%
Isoechoic	-	-
Hyperechoic	-	-
Heteroechoic	30	60%
Anechoic	-	-
Contents not visualized	10	20%
ATTENUATION		
Hypodense	50	100%
Isodense	-	-
Hyperdense	-	-
CONTRAST ENHANCEMENT		
Homogeneous	10	20%
Heterogeneous	40	80%
RIM ENHANCEMENT	10	20%
CALCIFICATION		

Coarse	30	60%
Micro calcification	10	20%
Rim calcification	10	20%
HALO ON USG		
Incomplete, thick ill defined	10	20%
Complete, thin well defined	20	40%
Absent.	20	40%

Table 4: Imaging Features of solitary nodules (50 cases)

Nature of lesion	No. of cases	Percentage of total cases
CONSISTENCY		
Solid	20	29%
Mixed	40	57%
Predominantly Cystic	10	14%
ECHOGENECITY		
Hypoechoic	30	43%
Isoechoic	-	-
Hyperechoic	-	-
Heteroechoic	40	57%
Anechoic	-	-
HALO		
Thin, complete, regular	40	57%
Thick, incomplete, Irregular	20	29%
Absent.	10	14%
ATTENUATION		
Hypodense	70	100%
Isodense	-	-
Hyperdense	-	-
CONTRAST ENHANCEMENT		
Homogeneous	30	43%
Heterogeneous	40	57%
RIM ENHANCEMENT	30	43%
CALCIFICATION		
Coarse	50	71%
Micro calcification	-	-
Rim calcification	-	-

Table 5 :- Imaging features of multi nodular thyroid disease (70 cases)

Imaging Features	No. of cases	Percentage
CONSISTENCY		
Solid	20	50%
Mixed	10	25%
Predominantly Cystic	10	25%
ECHOGENECITY		
Isoechoic	-	-
Hypoechoic	20	50%
Heteroechoic	20	50%
Anechoic	-	-
HALO		
Complete, thin well defined	-	-
Incomplete, thick ill-defined	20	50%
Absent.	20	50%
CALCIFICATION		
Coarse	20	50%
Micro calcification	10	25%
Rim calcification	-	-
Absent	10	25%

Table 6 :- Imaging Features of Thyroid neoplasms (40 cases)

N: denotes number of patients/subjects

DISCUSSION: Fundamental to evaluation of the thyroid nodule is differentiating medical from surgical disease. Although not mutually exclusive, five categories of thyroid nodules classify this broad spectrum of pathology — hyperplastic, colloid, cystic (containing fluid), inflammatory, and neoplastic, (12) with the last being the most feared. Due to anatomic factors, approximately 90% of all thyroid nodules are not palpable (2, 4).

An earlier perception that solitary nodules are more likely malignant than a nodule within a goiter is now replaced with a general acceptance that the risk of cancer is similar in patients with solitary or multiple nodules (7, 13, 14).

Evaluating the thyroid nodule is an involved process that begins with taking a history, performing the physical examination, and then choosing appropriate additional tests.

Ultrasound (US) and computed tomography (CT) are two noninvasive techniques which are widely used in the evaluation of solid and cystic neck masses.

The role of sonography in the neck region has become increasingly important with the advent of high frequency probes. Specifically, thyroid ultrasound (US) is an invaluable instrument in evaluating thyroid nodular disease. It is non invasive, may be more readily available than the FNAB in a primary care setting.

The exquisite sensitivity of sonography often leads to the discovery of non palpable thyroid nodules during routine sonography of head and neck and these lesions are colloquially termed “incidentalomas”. The incidentally discovered nodules in this case were less than 1 cm in diameter and appeared benign in nature. Similar observations have been made by (15).

The age range of patients was 7-72 years in this study. A female preponderance was noted in patients as male to female sex ratio was 1: 1.4. Similar female preponderance was seen by

(16).

(83.3%) patients were clinically found have solitary nodules. However US revealed only five (50%) cases to be solitary.

On Ultrasonographic study the thyroid nodules showed heterogeneous echo-texture in two thirds (66%) of the cases with both solid and cystic components. The cystic degeneration was seen as irregular anechoic areas. A complete, well defined, halo could be seen in (40%) cases.

There were (58%) cases showing multi-nodular thyroid disease. Majority of the cases (57%) exhibited a heterogeneous echotexture with areas of cystic change and calcification. The peripheral halo was seen as a rim in 57% of cases. 29% of cases showed incomplete rims. A distinct margin was absent in 14% of cases. Differentiation between adenomatous nodules of a multi-nodular goiter and true adenomas can be difficult on imaging and pathologically as well (17).

Forty cases of thyroid masses were found to be malignant in the present study. Thirty cases were of follicular carcinoma and ten of medullary carcinoma. Malignancies represented 25% of all thyroid masses. Peak incidence of thyroid malignancy has been described in the 3rd and 4th decades. Of the thirty adults cases, twenty were females and ten male. A female preponderance of thyroid malignancy is known (18).

Microcalcification could be appreciated in ten cases. Twenty cases exhibited coarse calcifications.

In our study features commonly associated with malignant disease were hypoechogenicity, incomplete irregular haloes, ill defined margins, micro-calcifications, invasion of surrounding structure and presence of cervical metastasis. Our findings were similar to those of (19, 20, 21)

Sonography is the best known diagnostic tool for evaluation of thyroid nodules, and many suspicious sonographic findings predictive of the presence of a malignant thyroid nodule, such as microcalcification, marked hypoechogenicity, an irregular margin, a taller-than-wide shape, and macrocalcification, are well recognized (6, 22, 23, 24, 25).

Thyroid ultrasound (US) is the major diagnostic modality for evaluating thyroid nodules. Using US, a thyroid nodule appears as a nodular lesion within the thyroid gland that is distinguishable from the adjacent parenchyma.

Ultrasonography is an ideal technique for establishing whether a palpable cervical mass is within or adjacent to the thyroid and for differentiating thyroid nodules from other neck masses (26).

In addition, thyroid ultrasonography is particularly useful for measuring the size of the nodule and calculating the volume. Different formulas have been used for calculation of volume from the measured dimensions (27, 28).

Results also indicate that physical examination (a) works reasonably well for the detection of nodules in the isthmus of the thyroid but not for the far more common nodules lying deeper within the glands and (b) is an unreliable method for distinguishing solitary and multiple nodules. These patterns generally agree with the findings of previous smaller clinical and epidemiologic studies. (29, 30, 2, 31).

CONCLUSION: Clinical evaluation and epidemiologic studies of nodular thyroid disease stand to benefit from the greater sensitivity and specificity of ultrasonographic examinations.

Thyroid nodules are common, yet treatment modalities range from observation to surgical resection. Because thyroid nodules are frequently found incidentally during routine physical examination or imaging performed for another reason, physicians from a diverse range of specialties encounter thyroid nodules.

Results confirm previous assessments that physical examination alone is an insensitive and relatively non reproducible method for detecting thyroid nodules, and further the findings indicate that the underestimation is not limited to small, clinically insignificant nodules.

Even nodules measuring more `than 2 cm on sonograms were missed half of the time in physical examinations by experienced clinicians who routinely perform thyroid evaluations.

Ultrasonographic findings provide a basis for approximate estimates of sensitivity and specificity of palpation.

In conclusion, similar to the recent literature, for a large majority, patient's diagnosis changed after ultrasonography in our study, so the results necessitate the use of ultrasonography, which is a noninvasive method, as a complementary method to physical examination in the diagnosis of thyroid diseases, especially thyroid nodules.

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