



ORIGINAL RESEARCH PAPER

Radiology

ROLE OF HIGH FREQUENCY ULTRASONOGRAPHY IN THE EVALUATION OF VARIOUS THYROID LESIONS

KEY WORDS: Thyroid, High frequency ultrasound, Fine needle aspiration cytology,

Dr. M. Soundarapandian	Post Graduate, Department of Radiology, Sri Lakshmi Narayana Institute of Medical Sciences, Puducherry, Affiliated to Bharath University Chennai, India.
Dr. S. Shrinuvasan*	Associate Professor Department of Radiology, Sri Lakshmi Narayana Institute of Medical Sciences, Puducherry, Affiliated to Bharath University Chennai, India. *Corresponding Author
Dr. S. Sajith	Assistant Professor Department of Radiology, Sri Lakshmi Narayana Institute of Medical Sciences, Puducherry, Affiliated to Bharath University, Chennai, India.
Dr. R. Chidambaram	Professor Department of Radiology, Sri Lakshmi Narayana Institute of Medical Sciences, Puducherry, Affiliated to Bharath University, Chennai, India.

ABSTRACT

BACKGROUND: Thyroid lesions are a common finding in the general population. Ultrasonography (US) is the modality of choice for diagnosis and characterization of a thyroid nodule. Ultrasound guided fine needle aspiration plays an important role in managing patients with thyroid nodules.
AIMS AND OBJECTIVES: Role of high frequency ultrasonography in detection and differential diagnosis of various thyroid lesions and in further characterization of thyroid nodules as benign or malignant with histopathological correlation.
METHODS: A prospective study methodology is followed with 150 cases. The study was conducted in Department of Radio Diagnosis at Sri Lakshmi Narayana Institute of Medical Science and Research Centre, Puducherry. Patient referred with suspected thyroid disease and thyroid swelling are included in the study.
RESULTS: The study shows 79.3% sensitivity and 89.79% specificity in detecting malignancy.
CONCLUSION: High resolution sonography is a cost-effective investigation and recommended as the primary imaging modality in the evaluation of thyroid disease.

INTRODUCTION

The thyroid's main role is to regulate the metabolism and body's ability to break down food and convert it to energy. The thyroid gland is affected by a wide spectrum of pathologic conditions including benign and malignant lesions. Thyroid lesions are a common finding in the general population, especially in iodine deficiency areas in our country. Thyroid disorders like thyroid neoplasm still pose a major problem in both developing and developed countries. In western countries approximately 5% and in iodine-deficient countries approximately 25% of the general populations have thyroid nodules. Although most of them are benign, 5-10% was malignant.¹

Colour doppler sonography is used in thyroid vascular study. Dynamic information such as velocity and direction of blood flow as well as degree of vascularity of organ can be revealed by Colour Doppler studies. The risk of malignancy in a euthyroid patient with a solitary thyroid nodule is estimated to be 5-10% with a range of 3.4-29%.²

Ultrasound vascular study is low-cost method and is a non-invasive and is very reliable in the differential diagnosis of cold thyroid nodule. Power doppler is the best ultrasonographic modality. A large number of hot nodules will demonstrate internal color flow.

With the widespread use of high resolution ultrasonography, many more subclinical nodules are being detected. They are found in 4% to 8% of adults by means of palpation, 10% to 41% by means of ultrasonography, and in upto 50% at Fine needle aspiration cytology.³ Clinical surveys have shown that 5-10% of the general population have thyroid pathologies including nodular lesions in 2.5-3% of case.⁴ The prevalence of hyperthyroidism is 2% in females and 0.6 % in males, hypothyroidism is 4.8 % and 0.9% and goitre 2.9% and 0.4% respectively.⁵

AIMS & OBJECTIVE

1. Role of high frequency ultrasonography in detection and differential diagnosis of various thyroid lesions.
2. Efficacy and accuracy of ultrasonography in further characterization of thyroid nodules as benign or malignant with Histopathological correlation.

MATERIALS AND METHODS :

STUDY DESIGN: A prospective study methodology was followed with 150 cases. It was approved by the Institutional and University ethics board before its execution.

STUDY DURATION:

Two years.

STUDY SETTING:

The study was conducted in Department of Radio Diagnosis at Sri Lakshmi Narayana Institute of Medical Science and Research Centre, Puducherry.

STUDY POPULATION:

Patient referred to the Department of Radiodiagnosis for ultrasound scanning with suspected thyroid disease and thyroid swelling from the OPD (Medicine, ENT, Surgery etc) are included in the study.

INCLUSION CRITERIA:

Those patients referred with complaints of thyroid swelling and thyroid disease will be included in the study.

EXCLUSION CRITERIA :

Those patients with no demonstrable sonographical abnormality in the thyroid gland and adjacent areas. Each patient was examined as follows 1. Brief history, clinical examination and Thyroid function tests will be obtained in all patients. 2. Radiological evaluation by high resolution real time ultrasonography and color Doppler in all patients. The finding was correlated and confirmed with follow up FNAC or biopsy.

PROCEDURE OF SCANNING:

Scanning was performed in ULTRA SONIX Expert Ultrasound machine with a 12 MHz probe in longitudinal and transverse planes.

STATISTICAL ANALYSIS

Data collected has been entered into MS excel spreadsheet and analysis conducted using a statistical package, SPSS (Statistical

Package for Social Sciences). Percentage and proportions have been applied to assess the outcome of the study.

RESULTS

During this study period, 150 patients who have undergone ultrasonography of thyroid followed by cytological/ histopathological correlation were assessed.

TABLE 1: Sonographic features of thyroid nodule as benign and malignant

Nodular Characteristics	FNAC / HistoPathology		Total	Sensitivity	Specificity
	Benign	Malignant			
Echotexture					
Hyperechoic	18	0	18	72	89
Anechoic	38	0	38	71	87
Isoechoic	6	2	8	70	88
Hypoechoic	0	12	12	73	89
Margins					
Smooth	64	0	64	72	87
Irregular	0	14	14	70	89
Shape					
Taller than wide	0	14	14	71	88
Wider than tall	64	0	64	73	89
Calcification					
Microcalcification	0	8	8	72	87
Macrocalcification	14	0	14	70	89
Vascularity					
Internodular	0	14	14	73	88
Perinodular	64	0	64	72	87

CHART 1: Distribution of the thyroid diseases finding according to age

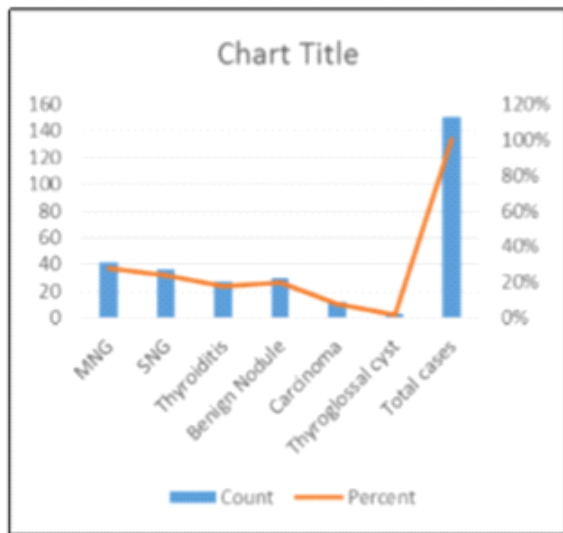
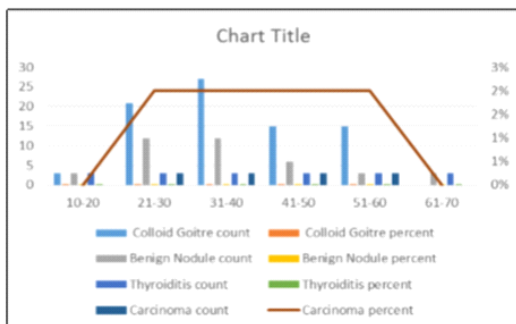


CHART 2: Distribution according to USG diagnosis



DISCUSSION:

High resolution sonography was used to evaluate thyroid

abnormalities in 150 patients in our study. It demonstrated thyroid abnormalities with remarkable clarity to distinguish normal from abnormal thyroid, to differentiate the abnormalities as diffuse or focal and also have been helpful in characterization of the lesion. Pathological correlation (FNAC/HPE) was obtained in all the cases to assess the diagnostic accuracy of high resolution. The disorder of thyroid gland is most common in 70% female population compared to 30 % male in our study. Maximum numbers of patients in our study were encountered in the age group of 21-30(36%) and 31-40 (24%).

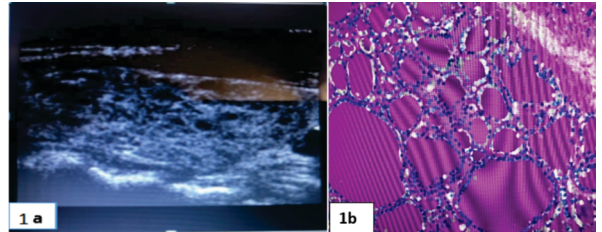


Fig 1(a,b): Ultrasound image at the level of thyroid showing enlarged gland with diffuse inhomogeneous echotexture- HPE confirmed diagnosis of diffuse thyroid hyperplasia.

Ultrasound shows maximum number of cases of colloid goiter which include SNG in 42 cases and MNG in 39 cases. Ultrasound was clearly able to delineate benign nodules in 39 cases which include adenoma and hyperplastic nodules. Carcinoma is diagnosed in 12 patient by ultrasound and in 3 patients by FNAC/HPE .out of which papillary carcinoma was 8, follicular carcinoma 3 and one case of medullary carcinoma.

Ultrasound shows irregular and spiculated margins in 14 and 4 cases of carcinoma respectively. Nodular calcification is present in 22 patients including 14 macrocalcification and 8 microcalcification in benign and malignant nodules on FNAC correlation respectively

15 patients of thyroiditis were detected by sonography. Patients of colloid goiter formed the largest proportion of the cases in our study and ultrasound was able to depict that successfully. The larger group of patient was in 21-40 year age group . The oldest patient was of 63 years and youngest was of 15yrs. A female preponderance 70% was noted in the study. Most of the cases were found in the age group of 30-50 yrs. Mary et al., studied 1985 patient of which 1742 occurred in woman and 203 were males and most of patients was in the age group of 30-50.6 The commonest thyroid pathology diagnosed in our study was colloid goitre (54%)..

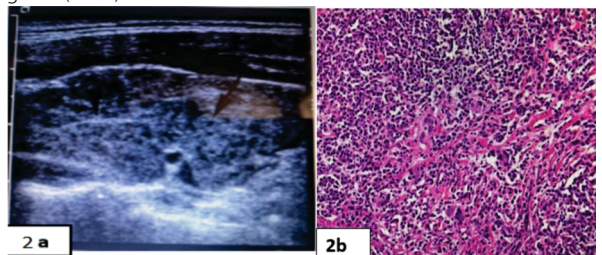


Fig 2 (a,b): Longitudinal sonogram shows multiple tiny hypoechoic solid nodules and coarse echogenic bands Note dense lymphoplasmacytic infiltrate in areas of thyroid follicles with complete replacement of normal architecture- HPE confirmed diagnosis of Hashimoto Thyroiditis.

Most of the cases were hetero echoic in appearances followed by hypo echoic. Calcification was seen only in 14%. Lymphadenopathy was seen in 8%, peripheral halo was seen in 60 cases, out of which 48 were thin halo and 12 cases had thick halo. In a study by Mary et al., they reported out of 1985 patient 1181 patients had solitary thyroid nodules and 804 patients had multiple nodules.7 Jeffery R. Winke et al., reported 27 cases of colloid cysts in their study. The second largest group were benign nodules, which includes adenoma and hyperplastic nodule.8

Carcinoma was diagnosed in 12 patients by FNAC/HPE out of 150 cases, of which Papillary carcinoma was 8, Follicular carcinoma was 3, Medullary carcinoma was one. M. Allauddin et al., studied 1140 thyroid cases of which 154 were malignant. Out of the 98 were papillary thyroid carcinoma and 32 were follicular carcinoma and 6 were medullary carcinoma. 9 Thick peripheral halo was seen in 4 cases. Irregular margin was seen in 6 cases and spiculated margin in 2 cases. On Doppler normal internal flow was seen in 16 cases (3 cases were predominantly cystic), increased flow in 2 cases and peripheral flow in one case

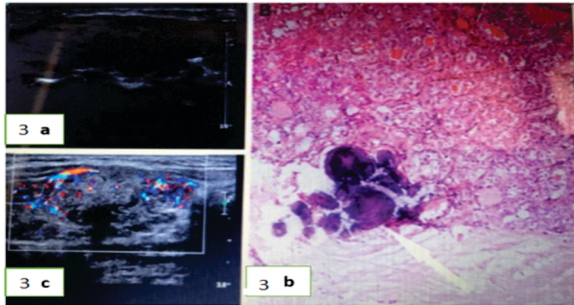


Fig 3(a,b,c) : Longitudinal sonogram of right thyroid revealed diffuse and scattered microcalcification on entire thyroid lobe without associated underlying mass. (B) Histopathological examination showed psammoma bodies (white arrow). (C) Color Doppler sonogram shows increased vascularity of the lesion - HPE confirmed diagnosis of papillary carcinoma

Wadsworth et al. reported thyroglossal cyst in 12 cases ranging from 2 months to 16 years old.¹⁰ In our study, high frequency ultrasound with doppler shows 79.3% sensitivity and 89.79% specificity for detecting malignancy. The overall diagnostic accuracy of ultrasound in our study is 96%. High resolution sonography is a useful modality in distinguishing thyroidal from other neck masses. Thyroid sonography is reliable defining whether the patient has a diffuse abnormality, multinodular pathology or a solitary nodule or thyroiditis. Ultrasound is very much useful in morphological characterization of malignant thyroid nodules in most of the cases. Ultrasound is useful in the diagnosis and follow up of diffuse thyroid diseases like thyroiditis. Ultrasound is useful in diagnosis of congenital condition like thyroglossal cyst. Ultrasound is useful imaging modality in evaluation of thyroid in children and pregnant woman as there is no radiation risk. Ultrasound can be used to guide FNAC from thyroid lesions.

CONCLUSION

High resolution sonography is a cost-effective investigation and recommended as the primary imaging modality in the evaluation of thyroid disease. It has a high sensitivity, specificity and diagnostic accuracy in the diagnosis of thyroid diseases. Ultrasound was found to be helpful in the morphological characterization of thyroid lesions.

Ultrasonography can differentiate benign from malignant lesions in most of the cases. Ultrasound guided FNAC definitely increase the yield of diagnostic materials and aid in the correct diagnosis.

BIBLIOGRAPHY

1. Vikaschudhary, Shahinabano. Imaging of thyroid: Recent advances. 2012. Indian journal endocrinology and metabolism; 3(16):371-376.
2. Mahira Yunus, Zeba Ahmed. Significance of ultrasound features in predicting malignant solid thyroid nodules: Need for fine-needle aspiration. 2010.1 pak medical assoc; 60(10): p.848-853.
3. Cooper DS, Doherty GM, Haugen BR, Kloos RT, Lee SL, Mandel SJ. Revised American Thyroid Association Management Guidelines for Patients with Thyroid Nodules and Differentiated Thyroid Cancer. Thyroid 2009; 19:1167-214.
4. World Federation for Ultrasound in Medicine and Biology History/Archives Committee, Goldberg BB, Wells PNT, Claudon M, Kondratas R. History of Medical Ultrasound [CDROM]. Presented at: 10th Congress of the World Federation for Ultrasound in Medicine and Biology; June 1-4, 2003; Montreal, Quebec, Canada.
5. Sofferan Am T, Abuja, editors. Ultrasound of the Thyroid and Parathyroid Glands; Springer. New York: p.3-8.
6. Goldberg B, Gramla R, Freimanis A. Early history of diagnostic Grann role of American radiologists. 1993. AJR Am j ultrasound: the Roentgenol; 160:p.189-194;

7. Shrizi J. Ultrasound physics. 2014, critical care clinics.; 30(1);p1-24
8. Wells PN, author: McCiahan JP, t ioldherg Mt, ctitors Phy4ic.; and Bioeffects. Diagnostic. 111trasound, A logical iiproach, 99 Philadelphia' Lippincott-Raven Publishers; p. 1-19.
9. Hangiandreou NJ, author. AAPM/RSNA physics Tutorial for residents. Topics in US: B-mode US: Basic concepts and new technology, Radiographics. 2003;23:1019-33.
10. Robert A. Sofferan. Physics and basic principles of ultrasound, editors Anil T. Ahuja, Robert A. Sofferan. Ultrasound of the Thyroid and Parathyroid Glands. Springer:p.9-21.