

Research Article

High resolution ultra sound and color Doppler in evaluation of thyroid nodule with fine needle aspiration cytology correlation

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ABSTRACT

Background: Thyroid gland is the first to develop in fetal life and is largest of all the endocrine glands. It is superficial in location which helps in its excellent visualization of normal anatomy and pathologic condition by high resolution real time grey scale sonography. The purpose of this study was to evaluate the usage of grey scale ultrasound and color Doppler with FNAC correlation for differentiation of benign and malignant thyroid nodule.

Methods: This prospective study was carried out on sixteen patients who came to our department from period of 1 February to 31 March 2016. Grey scale ultrasound of neck and Doppler followed by USG guided FNAC of thyroid swelling was done.

Results: Out of 16 cases, 3 were malignant, 10 were benign, and 3 were indeterminate. One case was diagnosed as benign lesion on sono which came out to be malignant on pathology as follicular carcinoma. The cases were presented as hypoechoic lesion with regular margins with peripheral and internal vascularity. Due to well defined margins it was diagnosed as benign adenoma but turned out to be malignant on pathology as follicular carcinoma. Colloid goiter was most common presentation on ultrasound and it showed wide spectrum of appearance, majority being nodular with anechoic echotexture.

Conclusions: High resolution grey scale ultra sound with color Doppler has emerged as initial modality of choice for evaluating the patient with thyroid enlargement.

Keywords: Thyroid, Ultrasonography, Fine needle aspiration cytology, Color Doppler

INTRODUCTION

Thyroid gland is largest of all endocrine gland and is developed first in fetal life. It is superficially located so it allows excellent visualisation and evaluation of its normal anatomy and pathologic condition by high resolution grey scale sonography. Thyroid nodules are very common. With widespread use of sensitive imaging in clinical practice, incidental thyroid nodules are being discovered with increasing frequency.¹

The thyroid gland is uniformly hyperechoic on ultrasound in comparison to strap muscles and is seen best with the use of high resolution linear array transducer having frequency 7-10 MHz, and having color flow capability

and low flow sensitivity.^{2,3} The superior resolution of ultrasound images has resulted in discovery of a large number of thyroid nodules that heretofore had been obscured. Use of color flow imaging identifies multiple small vessels within and adjacent to thyroid.^{4,6}

Normal thyroid gland is made up of two lobes located along either side of trachea and connected across the midline by isthmus. AP diameter is more precise as it is independent of possible dimensional asymmetry between in two lobes. Normal mean AP diameter in adult is 13-18 mm. When AP diameter is more than 2cm thyroid gland is considered enlarged. Normal thyroid parenchyma is homogenous so focal solid, cystic lesions are easily detectable. Thyroid nodules are frequently seen during

the scanning. All present patients were sent from Out Patient Department, and had the ultrasound done the same day, with FNAC on follow.

Objective

Objectives of the study were to evaluate the usage of grey scale ultrasound and color Doppler with FNAC correlation for differentiation of benign and malignant thyroid nodule.

METHODS

This was a prospective study done during period of two months from 1feb to 31 march 2016 was carried out on sixteen patients who attended surgery OPD and ENT OPD. Patients with thyroid nodules were first scanned with grey scale sonography of neck followed by USG guided FNAC of thyroid swelling. To visualize the thyroid gland optimally patient is placed in supine position with a pillow underneath the shoulders to extend the neck slightly allowing the head to rest on the examination table. We perform thyroid sonography for the patient using 7-10MHz linear probe. As it provide deep ultrasound penetration and high definition images. Thyroid gland is scanned in both transverse and longitudinal planes. Several US features, such as marked hypo-echogenicity, irregular margin, micro-calcifications, and a taller-than-wide shape have been introduced as potential predictors for the presence of thyroid malignancies.⁵

Ultrasonography (US) is the most commonly used imaging modality for characterization of these nodules. US characteristics that increase the likelihood of malignancy in a thyroid nodule include micro-calcifications, solid composition, and central vascularity.³ The detection of thyroid nodules has become more common with the widespread use of ultrasonography (US).⁴ Thyroid gland is one of the most vascular organ of the body so Doppler examination provide useful diagnostic information. Then ultrasound guided FNAC is performed upto maximum three passes per nodule with the help of 22 gauge needle and 10 cc syringes. Confirmed placement of the needle in targeted nodule is achieved under ultrasound guidance. Sample is mainly taken from solid portion of nodule and specimen prepared on glass slides and fix in 95% ethanol and send for cytology.

RESULTS

We examined 16 patients of thyroid nodules having different characteristics.

Gender distribution

In present study 75% patient were female and 25% were male.

Table 1: Results of the study.

Individual nature	Benign	Indeterminate	Malignant
Gender			
Female	7	2	3
Male	3	1	0
Number of module			
Single	1	0	2
Multiple	9	3	1
Margins			
Regular	10	0	2
Irregular	0	3	1
Internal content			
Solid-cystic	6	3	1
Solid	4	0	2
Calcification			
Fine	0	0	1
Coarse	0	0	0
Lymph node involvement			
Absent	9	3	2
Present	0	0	1
Halo			
Thick	1	0	3
Thin	8	3	0
Vascularity			
Peripheral	6	0	0
Internal	4	3	3
Age group			
20-40	6	2	0
41-60	3	1	2
61-80	1	0	1
Number of nodule			
Single	1	0	2
Multiple	9	3	1

Table 2: Thyroid disorders diagnosis by histopathology.

Classification	No. of cases	Percentage
Nodular diseases		
Multi nodular	3	18.7
Non goiters		
Adenoma	1	6.2
Carcinoma	3	18.7
Diffuse disorder		
Thyroiditis	3	18.7
Colloid	6	37.00
Total	16	100

Age distribution

Most of the patients studied were above the age of 20 yrs and below the age of 75 yrs. In present study most of the patients were from 20 to 40 age group (50%), 37% of the

patients belonged to age group 41-60years and 12% were between 61-80years reported to us.

Ezzat et al, prevalence being greater in women (72%) than in men and mean age range being 43 to 50. Brander et al 1989 conducted similar screening and found focal nodular changes are common in middle aged women.

Present study confirms the high prevalence of thyroid disease in women of middle age group (20-60years).

Table 3: Gender chart.

	Male	Female
Benign	3	7
Indeterminate	1	2
Malignant	0	3

Table 4: Age group chart.

	20-40	41-60	61-80
Benign	6	3	1
Indeterminate	2	1	0
Malignant	0	2	1

Clinical presentation and diagnosis

All 16 patients present with clinical thyroid enlargement either in midline or lateral aspect. One presented with complaint of hoarseness of voice with a swelling in left clavicular region.

Some patients came with complaint of pain during deglutination. Out of 16 patients 62.5% were benign (colloid), 18.2% were intermediate (chronic lymphocytic thyroiditis) and 6.2% were malignant, 12.5% were follicular neoplasm. The most common thyroid pathology was colloid goiter followed by chronic lymphocytic thyroiditis.

A 75 year old female is presented with hard swelling in neck region since 1 year. With no fever, no pain, palpable hard lump, with hoarseness of voice. Swelling also present below inferior angle of mandible on left side.

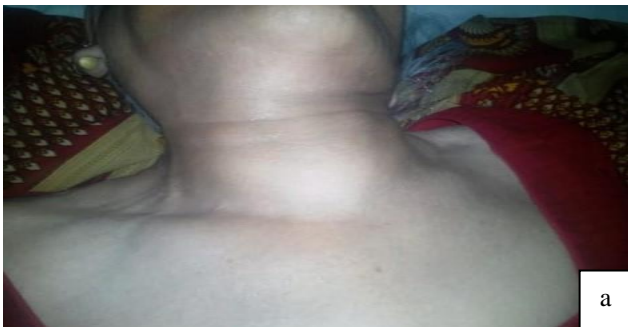


Figure 1 (a): Swelling in the mid line of neck and above left clavicular region.

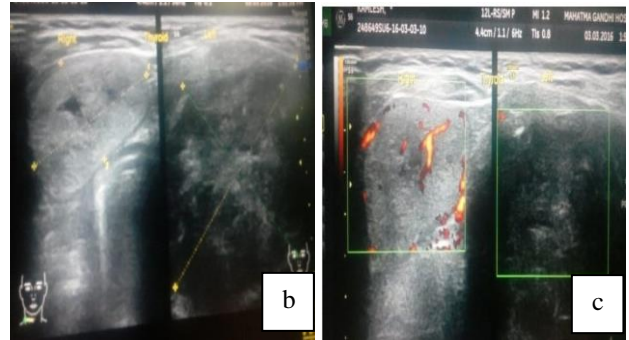


Figure 1 (b): Enlargement of right thyroid lobe; (c) on colour Doppler shows internal and peripheral vascularity.

Large heterogeneous predominantly hypo echoic irregular shaped lesion was seen in left side of the neck with tiny calcified foci. There was evidence of extension of the lesion.

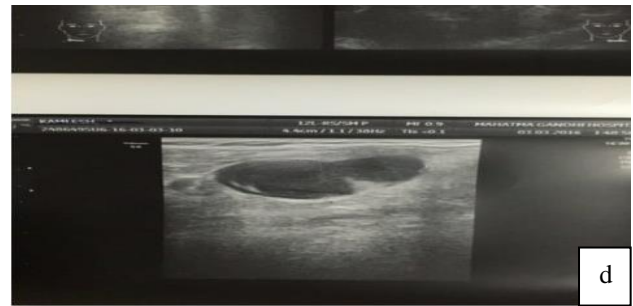


Figure 1(d): Hypoechoic lymph nodal mass on left side of neck which shows papillary carcinoma.



Figure 2(a): Patient with neck line swelling.

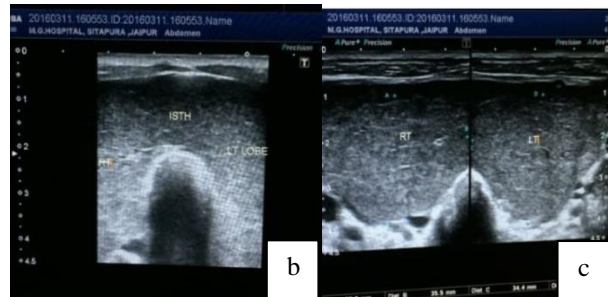


Figure 2(b): Grossly enlarged bilateral lobes of thyroid; (c) isthmus with multiple hypoechoic lesions.

A 40 year male patient was presented with neck line swelling from last 6 months, non-tender, soft and moves with deglutination.

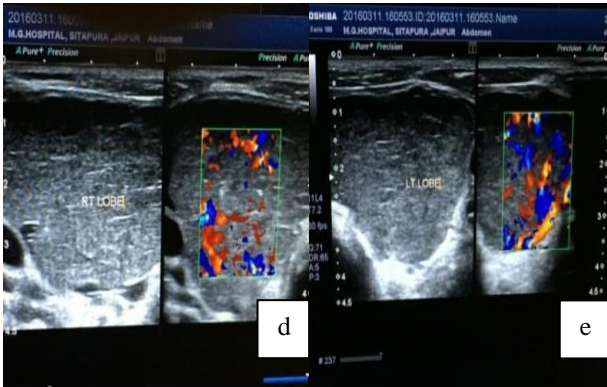


Figure 2(d): Grey scale image of right and left lobe shows increase in size; (e) colour Doppler image showing increase in vascularity.

A 47 year old female was present with neck line swelling.



Figure 3(a): Neck line swelling.

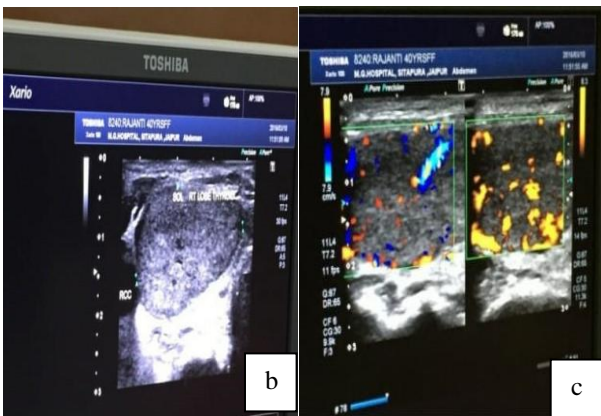


Figure 3(a): Grey scale image shows right lobe of the thyroid shows well-defined heterogeneous nodules with sonolucent rim; (b) on Doppler increased peripheral and internal vascularity seen around the nodules.

A 68 year old female was presented with neck line swelling. There was no enlargement of both the lobes of thyroid with heterogeneous areas with sonolucent rim with the areas of breakdown. On color Doppler shows generalised increase in vascularity, this case was proved to be colloidal goiter.



Figure 4(a): Neck line swelling.



Figure 4(b): No enlargement of both the lobes.



Figure 4(c): Doppler shows generalised increase in vascularity; (d) needle solid components of thyroid nodules.

DISCUSSION

Colloid goitre

Out of 16 cases we reported 7 cases as colloid on USG out of which 6 proved to be colloid goiter on FNAC. The most common echo patterns seen were anechoic with normal vascularity on color flow imaging. Comet tail artifacts are seen in cases.

Ahuja et al reported the significance of comet tail artifact in a thyroid nodule. In 85% patients with this artifact, abundant colloid was seen on FNAC suggesting that this artifact may be related to the presence of colloid.⁸ Mehta N et al states that virtually all cystic lesions within thyroid are either degenerative or hemorrhagic in origin. The comet tail artifact was appreciated by us in a number of cases which was provisionally thought of as colloid nodules on ultrasound and subsequently prove on FNAC in all cases.¹⁰ Present study confirms that most common echo pattern seen on ultrasound is anechoic with normal vascularity on color flow imaging and comet tail artifacts.

Thyroiditis

Out of 16 Cases, 3 came out to be thyroiditis on USG the number was confirmed on FNAC. The most common echo pattern seen on ultrasound was heterogeneous with diffuse vasculature and septa formation. Among the three thyroiditis cases two had diffuse vasculature, one had hetero echogenicity. Langer et al reported the sonographic appearance of focal thyroid nodule proved to be lymphocytic thyroiditis on FNAC. Hiromastu et al studied the utility of color Doppler sonography in patients with subacute thyroiditis.

Present study concludes that the most common echo pattern seen on ultrasound was heterogeneous with diffuse vasculature and septas formations.

Adenoma

Out of 16 thyroid nodules studied, two were detected as adenoma on USG while 1 was confirmed adenomatous on FNAC. The most sensitive and specific USG feature for diagnosis of adenoma proved to be hyper echoic nodule with perinodular vascularity and halo present.

Becker et al prospectively studied 53 thyroid nodules to assess possibility of recognizing autonomous adenomas of thyroid with color Doppler using internal hyper vascularisation for identification. Out of 29 patients having autonomous adenomas 28 present internal hyper vascularisation resulting in a sensitivity of 96% and specificity of 75%. Interestingly color Doppler detected 6 adenomas in patients showing normal lab data. Color Doppler can be used to exclude focal adenomas with negative predictive value of 94%.

Present study concludes that the most sensitive and specific USG feature for diagnosis of adenoma proved to be hyper echoic nodule with perinodular vascularity and halo present.

Malignant nodule

Out of 16 cases 2 cases reported as malignant on USG and were confirmed as malignant on FNAC. The most reliable signs were absent halo Lymphadenopathy,

vascularity, and micro-calcification. The most common echo pattern seen on USG was hypo-echogenicity.

Takashima et al evaluated US detection of micro-calcifications and its predictability for malignant thyroid tumours. Micro-calcification showed highest accuracy (76%), specifically (93%), and positive predictive value (70%) for malignancy as single Sonographic sign, but sensitivity (93%) was poor.⁹

On color Doppler sonography, preference central hyper-vascularity was the most common finding in malignant nodules. Among benign nodules, preference perinodular hyper-vascularity was the most common finding.² In present study 2 patients were reported as malignant and were positive for malignancy after FNAC examination. Present study concludes that the most reliable signs were absent halo, Lymphadenopathy, vascularity, micro-calcification and hypo-echogenicity.

CONCLUSION

Ultrasonounds with Doppler are valuable in appreciating the nature of lesion whether solid cystic, echogenicity of lesion and peripheral halo and differentiate between benign and malignant lesion of thyroid gland. Colloid goiter was most common presentation on ultrasound mainly shows nodular with anechoic echotexture.

The most sensitive sign for picking up malignancy on USG are intralesional vascularity; absent halo sign and regional lymph node involvement and invasion of adjacent tissue hypo-echogenicity, micro-calcification. Benign adenomas are usually hyper-echoic nodules with presence of halo and perinodular vascularity on color flow imaging FNAC is required for its confirmation. Thyroiditis usually presents with hetero-echogenicity and coarse calcification with diffuse vascularity on color flow imaging.

In conclusion gray scale ultrasound can reliably differentiate benign from malignant lesions, or diagnose lesions of toxic goiter adenoma or thyroiditis. The addition of color flow imaging has added value to prediction of thyroid pathology, but definitive diagnosis can only be reached with FNAC.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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