Section: Radiology

Original Research Article

EVALUATION OF THYROID LESIONS BY DUPLEX ULTRASONOGRAPHY AND CORRELATION WITH ULTRASOUND GUIDED FINE NEEDLE ASPIRATION CYTOLOGY

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ABSTRACT

Background: Thyroid swellings are more common in women than in men, with a reported prevalence of 12% in the general population. The patient frequently ignores the swelling's development for a considerable amount of time. It frequently remains undetected until the patient experiences symptoms brought on by the swelling. In order to minimise patient morbidity, the clinician must make the right diagnosis as quickly as possible. Ultrasound is a non-invasive, quick, simple, reproducible, and minimally uncomfortable modality. Most significantly, it doesn't use any ionising radiation, which is bad for the patient. High resolution ultrasonography makes it possible to quickly analyse the thyroid gland and its relationship to surrounding tissues, including the neck's major lymph node chains. An effective supplement to greyscale ultrasonography in the assessment of thyroid swellings is colour Doppler evaluation, which aids in the investigation of vascularity.

Materials and Methods: Patients who satisfied the inclusion and exclusion criteria had their clinical history, physical examination, investigations, including thyroid function tests, entered into a standardised, pre-made case proforma. The GE Voluson 730 Pro Ultrasound machine's high resolution, 7.5–12 MHz linear array transducer was used to perform the ultrasound examination of the thyroid gland in both greyscale and colour Doppler modes. After obtaining informed consent and completing a coagulation profile, fine needle aspiration cytology of the thyroid enlargement was performed. The sensitivity, specificity, positive predictive value, and negative predictive value of the high resolution ultrasonography results were determined by correlating them with the fine needle aspiration cytology report.

Results: Thyroiditis, colloid goitre, multinodular goitre, hyperplastic nodular colloid goitre, and benign adenomatous nodular goitre are examples of benign thyroid abnormalities. Papillary carcinoma, medullary carcinoma, follicular carcinoma, and anaplastic carcinoma are examples of malignant thyroid lesions. The thyroid nodule's marked hypoechogenicity was 88% specific and 100% sensitive in identifying a malignancy nodule. Thyroid nodule hyperechogenicity achieved 100% specificity and 19.2% sensitivity in identifying benign nodules. The presence of macrocalcification was 12.77% sensitive and 100% specific in predicting the benign nature of the nodular lesion, while the presence of microcalcification was 100% sensitive and 70% specific in identifying malignant lesions. The thyroid nodule's taller than wide dimensions is a 100% sensitive and 100% specific indicator of cancer. The presence of spiculated margin is 100% sensitive and 100 % specific in the diagnosis of a malignant thyroid lesion. Intralesional vascularity was 100% sensitive and 100 % specific in the diagnosis of malignant thyroid nodule. Lymphadenopathy is 100% sensitive and 100% specific in the diagnosis of a malignant thyroid nodule.

Conclusion: High-definition Duplex ultrasonography is a non-invasive, safe, quick, simple, repeatable procedure that causes the patient little discomfort. Above all, it doesn't use any ionising radiation that could endanger the patient. The thyroid gland's echotexture, features, nodules, and vascularity, as well as any related lymphadenopathy and distant metastases, can all be evaluated with ultrasound. Aside from the precise lobar involvement, it makes it easier for us to determine whether the lesion is single or numerous. It makes it easier to distinguish between cystic and solid lesions. When assessing thyroid swellings, colour Doppler examination is a helpful supplement to greyscale ultrasound. In the majority of situations, high resolution ultrasound aids in the distinction between benign and malignant thyroid lesions. A regular diagnostic work-up for patients with clinically suspected thyroid swellings should include ultrasound because it is a safe, straightforward, reproducible, non-ionizing investigative modality with a high specificity and sensitivity rate. USG-guided FNAC improves the diagnostic effectiveness of FNAC by precisely locating and sampling tissue in cases with small nodular lesions.
Keywords: Ultrasonography, Fine needle aspiration cytology, Thyroid.

INTRODUCTION

The thyroid gland, previously referred to as the "laryngeal gland" was so named by Wharton in 1646 because of its own shield like (thyreos ~ shield) shape of the thyroid cartilage to which it is closely associated.[1] The new advances in the field of nuclear medicine and radiology have improved the evaluation of normal as well as abnormal thyroid gland. The introduction of static gray scale ultrasound with short focal distance transducer was an important step forward for evaluating the superficial structures in the neck. Imaging however was cumbersome and did not come into wide spread use.[1-6]

It was not until the development of high-resolution real time small parts sonography that it became practical to evaluate superficial neck structures routinely. At the high frequencies (5 to 10 MHz) resolution is considerably improved so that structures close to the skin are visualized with striking clarity.[2,3]

Many technical and clinical developments have occurred in the past decade. Although the transducer frequency used for the evaluation of superficial neck structures still remains the same, there have been improvements in the transducer electronics and digital signal processing that have led to improved image quality. Few obvious advantages of high resolution ultrasound are that, no specific patient preparation is required, there is minimal discomfort to the patient, its easily available, portable, repeatable and most importantly it does not employ any ionizing radiation.[7-12]

At present high resolution sonography has become the procedure of choice for the initial evaluation of thyroid gland in many centres. It permits a quick evaluation of thyroid gland; its relationship with adjacent structures and an assessment of the main lymph node groups of the neck. The major advantage of ultrasound is the rapidity with which the images are obtained. Two other very important usages that cannot be disputed are, first as a guide for fine needle aspiration cytology or biopsy and for follow up of thyroid lesions.[2,3] This study was undertaken in order to study the various typical and atypical sonological features of those lesions presenting as thyroid swellings and in correlation with fine needle aspiration cytology findings.[13-20]

MATERIALS AND METHODS

Type of study: Study was a Prospective Correlative Study.

Source of data: 50 patients with clinically palpable thyroid swellings presenting to the outpatient as well as inpatient services at MVJ Medical College and Research Hospital for a period of two years from November 2015 to October 2017.

Selection Criteria

Inclusion Criteria

- Patients with thyroid lesions of all ages and both sexes.
- Patients with thyroid lesions presenting to both outpatient and inpatient services who are referred to the radiology department for ultrasonography or FNAC services.

Exclusion Criteria

- Patients in whom cytological findings were not available for correlations.

Ethical Clearance: The study required an invasive investigation (FNAC) to be conducted on patients. Hence an ethical clearance was obtained from the institution of MVJ Medical College and Research hospital.

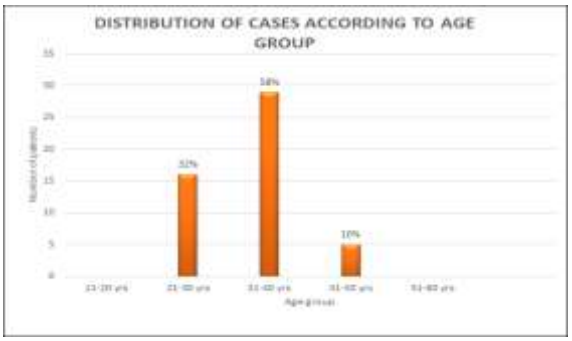
Method Of Collection of Data: All patients with clinically palpable thyroid swellings will be approached for consent and enrolled into the study. Baseline demographic and diagnostic details will be collected from the patients and charted in a structured Proforma.

The thyroid gland will be evaluated first with gray scale imaging followed by color Doppler to assess the presence of thyroid lesions. The scan will be done using a real time scanner with 7.5-12 MHz high resolution linear array transducer of GE Voluson 730

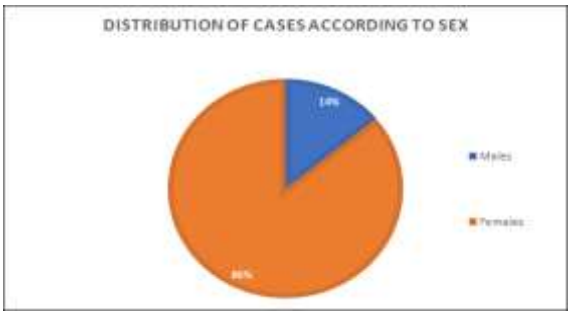
Pro Ultrasound machine. The patients will be placed in supine position with the neck slightly hyperextended. The scan will be done in standard longitudinal and transverse, as well as multiple oblique positions. The thyroid gland lesions will be characterized as benign or malignant based on the architecture, margins, echo pattern, compressibility, capsular integrity and extension of the lesion beyond the gland margins.

Then ultrasound guided fine needle aspiration of the thyroid gland will be done and the aspirated material will be sent for cytological assessment. Both the ultrasound and the cytological findings will be correlated.

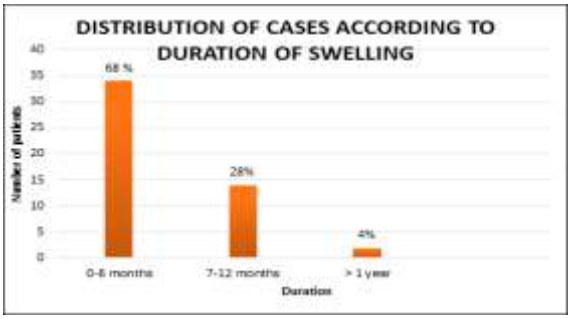
RESULTS



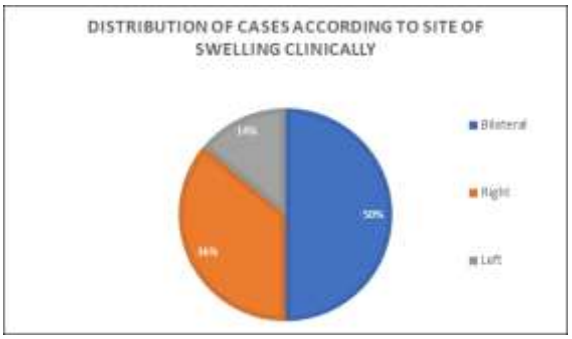
In this study, the youngest patient was 21 years old and the eldest patient was 50 years old. The average age of patients with thyroid lesions according to this study was 35 years with peak age of 31-40 years.



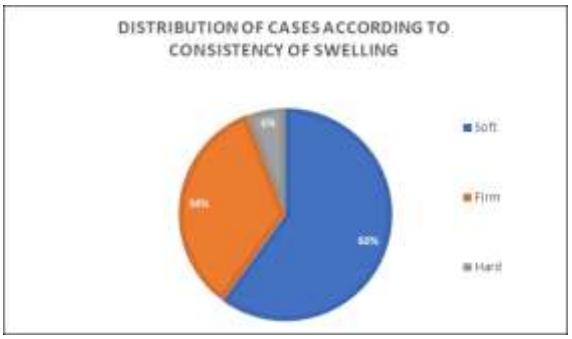
Out of 50 patients studied, there were 7 males (14%) and 43 females (86 %) with male to female ratio of 1: 6.1. So, according to this study, thyroid lesions are commoner in females. The possible reason for this is due to the presence of estrogen receptors in thyroid gland in females.



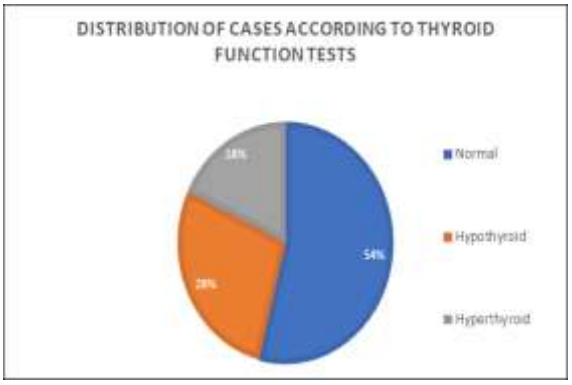
In this study, 34 (68 %) of the 50 cases presented with their clinical complaints dating under 6 months. There were only 2 cases presenting with complaints lasting more than 1 year which were of malignant etiology.



Majority of the patients (25 cases 50%) presented with bilateral swelling in the neck followed by swelling on the right side 36% and left side 7%.



The majority 30 out of the 50 cases (60%) in this study were soft in consistency (most of the cases were thyroiditis and colloid goitre). 17 cases (34%) were firm in consistency (most of the cases were benign lesions like adenomatous nodule, multinodular goitre and hyperplastic nodule with cystic degeneration). 3 cases (6%) which were hard in consistency were all proven to be malignant. The probable reason is either because of loss of elasticity in the malignant tissues or because of the microcalcifications.



According to this study, most of the patients presented with euthyroid state (27 cases, 54%) followed by hypothyroid (14 cases, 28%) and hyperthyroid states (9 cases, 18%).

Table 1: Distribution Of Cases According to Age Group

Age Group	Number Of Patients	Percentage
21-30 years	16	32%
31-40 years	29	58%
41-50 years	05	10%

Table 2: Distribution Of Cases According to Sex

	Number of patients	Percentage
Males	7	14%
Females	43	86%

Table 3: Distribution Of Cases According to Duration of Swelling

	Number of patients	Percentage
0-6 months	34	68%
7-12 months	14	28%
> 1 year	2	4%

Table 4: Distribution Of Cases According to Site of Swelling Clinically

	Number of patients	Percentage
Bilateral	25	50%
Right	18	36%
Left	07	7%

Table 5: Distribution Of Cases According to Consistency of Swelling Clinically

	Number of patients	Percentage
Soft	30	60%
Firm	17	34%
Hard	03	6%

Table 6: Distribution of Cases According to Thyroid Function Tests

	Number of patients	Percentage
Normal	27	54%
Hypothyroid	14	28%
Hyperthyroid	09	18%

DISCUSSION

A total of 50 patients with various thyroid swellings were studied by high resolution ultrasonography and these findings were correlated with the fine needle aspiration cytology report. The sensitivity and specificity, positive predictive value and negative predictive value of high resolution ultrasonography was assessed using the fine needle aspiration cytology report as a reference standard.

Age Distribution

Sl.no.	Authors	Age range (years)	Average age (years)
1	Silverman JF et al (1987)	16-79	44.80
2	Afroze et al (2000)	16-78	40.20
3	Sekri T et al (2001)	9-70	33.90 ± 11.70
4	Mitra et al (2002)	16-70	39.60
5	Safirullah et al (2004)	17-80	45.50
6	Present study	21 – 50	35

In this study, the youngest patient was 21 years old and the eldest patient was 50 years. The average age of patients with thyroid lesions according to this study was 35 years. This is similar to the findings of Mitra et al (2002) and Afroze et al (2000). The age distribution according to this study was similar to that of the previous studies. So, the thyroid lesions are commoner in females in their active reproductive age group and are uncommon in post menopausal age group.

Sex Distribution

Sl.no.	Authors	Total cases	Male	Female	Male: female
1	Silverman JF et al (1987)	295	25	270	1 : 10.8
2	Pandit A A and Kinare S G (1986)	64	26	58	1 : 2
4	Sekhri T et al (2001)	300	44	256	1 : 6
5	Kamal et al (2002)	200	27	173	1 : 6.4
6	Present study	50	7	43	1 : 6.1

Out of 50 patients studied, there were 7 males (14 %) and 43 females (86 %) with male to female ratio of 1: 6.1. Two other studies by Sekhri T et al (2001) and Kamal et al (2002) also yielded similar findings. So,

according to this study, thyroid lesions are commoner in females. The possible reason for this is due to the presence of estrogen receptors in thyroid gland in females. For the same reason, the level of thyroid hormones also changes according to the phase of menstruation.[21-25]

In this study, 34 (68 %) of the 50 cases presented with their clinical complaints dating under 6 months. There were only 2 cases presenting with complaints lasting more than 1 year which were found to be malignant thyroid lesions.[26,27]

In their study, C S Vyas et al also found that majority (40%) of patients came with complaint of swelling of duration less than 6 months. So, our study also confirmed the findings given by the other studies with respect to duration of swelling. Most of these patients presented within 6 months either due to pain, inconvenience, swelling, cold/heat intolerance or easy fatiguability or underlying comorbidities.[28]

During the clinical evaluation in our study, in majority of cases, swelling was observed on both sides (50 %) followed by right side (36%) and left side (14%). Lowest swelling sites were observed on left side (14 %). However, high resolution ultrasonography showed that the commonest lesion site was both the lobes of the thyroid gland (50 %) followed by the right lobe (36%). The least common site to be affected was the isthmus. In our study, we found that there was a correlation between the site of lesion suspected clinically and on ultrasound, with more than 50% of cases showing same location of lesion site both on clinical examination and on ultrasound, although smaller lesions cannot be picked up on clinical examination.[29]

In this study, most of the cases showed movement of the swelling on deglutition. Movement of the swelling with deglutition is a characteristic feature of thyroid swellings because pretracheal fascia that surrounds the thyroid gland is attached to larynx.[30]

The majority 30 (60 %) of the cases in this study were soft in consistency. 34% of the cases were firm and the remaining 6% were hard. This observation is in line with the observations of C S Vyas et al who also observed that the consistency of most of swellings (58%) were soft while hard swellings were seen in all cases of carcinomas. All the 3 cases where the consistency was hard were proven to be malignant (papillary carcinoma thyroid). The probable reason is either because of loss of elasticity in the malignant tissues or because of the microcalcifications. Hence, according to our study, the consistency of the thyroid swelling is a helpful factor to predict if a lesion is of benign or malignant etiology.

In this study, 32 cases (64%) showed isoechoic echotexture of the involved lobe of thyroid gland in majority of the cases. Isoechoic to heterogeneous echotexture of the involved lobe of the thyroid gland were seen in majority of the cases of thyroiditis. Hyperechoic echotexture of the involved lobe of the thyroid gland was seen in 6 cases of multinodular goitre, 2 cases of hyperplastic nodule with cystic degeneration and 1 case of papillary carcinoma of thyroid.

Out of the 50 cases, there were 9 cases where the thyroid nodule was hyperechoic in appearance. These were 7 cases of adenomatous nodule and 2 cases of hyperplastic nodule with cystic degeneration. So, according to our study, hyperechogenicity of the thyroid nodule was 19.2% sensitive and 100% specific in the diagnosis of a benign nodule with a positive predictive value of 100% and a negative predictive value of 7.3%. There were 20 cases where the thyroid nodule was hypoechoic in appearance.

CONCLUSION

High-definition Duplex ultrasonography is a non-invasive, safe, quick, simple, repeatable procedure that causes the patient little discomfort. Above all, it doesn't use any ionising radiation that could endanger the patient. Aside from the precise lobar involvement, it makes it easier for us to determine whether the lesion is single or numerous. The distinction between solid and cystic lesions is made easier. Whether the lesion is benign or cancerous, it is helpful to appropriately describe it. Malignant thyroid lesions include papillary carcinoma, medullary carcinoma, follicular carcinoma, and anaplastic carcinoma; benign thyroid lesions include thyroiditis, colloid goitre, ultinodular goitre, hyperplastic nodule with cystic degeneration, and benign adenomatous nodular goitre.

When assessing thyroid swellings, colour Doppler examination is a helpful supplement to greyscale ultrasound. While perilesional vascular pattern is useful in identifying benign lesions, intralesional vascularity with a RI > 0.7 is useful in identifying malignant lesions. In the majority of situations, high resolution ultrasound aids in the distinction between benign and malignant thyroid lesions. Benign lesions have well-defined borders, are larger than tall, hyperechogenic, have thick, complete peripheral halo macrocalcifications, and have perilesional vascularity. Sonological features of malignant lesions include spiculated edges, taller than wide dimensions, hypoechogenicity, microcalcification with an incomplete perilesional halo, and intralesional vascularity.

A regular diagnostic work-up for patients with clinically suspected thyroid swellings should include ultrasound because it is a safe, straightforward, reproducible, non-ionizing investigative modality with a high specificity and sensitivity rate. Ultrasonography can identify associated lymphadenopathy and vascular involvement, which will help with biopsy. Compared to other imaging modalities, ultrasound provides a somewhat higher diagnostic accuracy in identifying and characterising thyroid lesions. USG-guided FNAC improves the diagnostic effectiveness of FNAC by precisely locating and sampling tissue in cases with small nodular lesions. The most reliable diagnostic

technique for precisely identifying thyroid lesions is ultrasound-guided FNAC.

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