

Sonological evaluation of thyroid swellings

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Abstract

Background: Ultrasonography has become the procedure of choice for the initial evaluation of thyroid gland in many centers. It permits a quick evaluation of thyroid gland; its relationship with adjacent structure and an assessment of the main lymph node chains of the neck. The major advantage of ultrasound is the rapidity with which the images are obtained. In order to study the various typical and atypical sonological features of those lesions presenting as thyroid swellings, this study was undertaken. **Aims and Objectives:** To evaluate thyroid swelling with reference to-Ultrasonic appearance and characteristics of thyroid gland in its various disorders. **Materials and Methods:** In this series, during the period from September 2002 to September 2004, 65 cases of clinically suspected thyroid swellings were studied using real time ultrasound. The patients were referred from surgical and medical units of Victoria hospital, Bangalore. Results: 16.92% of patients were males and 83.08% females with male to female ratio of 1:4.9. Maximum number of cases was found in the age group 31-40 years (25 out of 65 cases i.e. 38.46%). Nodular goiter was found in 56.91% and 5 patients of thyroid malignancy of which 3 patients were papillary carcinoma, 1 was follicular carcinoma, and 1 patient was anaplastic carcinoma. The sonographic findings in clinical diagnosis of solitary thyroid nodule in 38 patients only 22 (i.e. 57.89%) of these were truly solitary on ultrasound examination. Of 27 patients referred with clinical diagnosis of multinodular disease, 6 patients had diffuse enlargement of the gland, 20 patients had multinodular involvement on ultrasonographic examination. **Conclusions:** Thyroid lesions were more common in females with male to female ratio of 1:4.9. Most frequently encountered thyroid lesion was nodular goiter and maximum incidence occurred in the age group of 31-40 years. 11 cases of adenoma and 5 cases of thyroid malignancy were found which included 3 cases of papillary carcinoma suggesting it as the commonest malignancy.

Key Words: Thyroid swelling, ultrasonography FNAC, thyroid malignancy

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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. The new advances in the field of nuclear medicine and radiology

have improved the evaluation of normal as well as the 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 widespread use.^{1,2} 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. 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 ultrasound are that, no

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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. At present sonography has become the procedure of choice for the initial evaluation of thyroid gland in many centers. It permits a quick evaluation of thyroid gland; its relationship with adjacent structure and an assessment of the main lymph node chains 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 needle aspiration cytology or biopsy and for follow up of thyroid lesions. In order to study the various typical and atypical sonological features of those lesions presenting as thyroid swellings, this study was undertaken.

AIMS AND OBJECTIVES

To evaluate thyroid swelling with reference to-Ultrasonic appearance and characteristics of thyroid gland in its various disorders, study the color flowmetry changes in various lesions of the thyroid and demographic factors affecting it. To study the histopathology report/fine needle aspiration cytology in patients with various thyroid lesions diagnosed sonographically and comparisons of the observations with previous studies.

MATERIALS AND METHODS

In this series, during the period from September 2002 to September 2004, 65 cases of clinically suspected thyroid

swellings were studied using real time ultrasound. The patients were referred from surgical and medical units of Victoria hospital, Bangalore. Prior to subjecting the patients for ultrasound examination, age, sex and detailed clinical history was obtained along with thorough physical examination. The color Doppler sonography was routinely performed in all these patients after sonography of the thyroid. Subsequently these patients were followed up for other laboratory investigations like T3, T4, and TSH levels. These cases were followed up and correlated with histopathology report / fine needle aspiration cytology results.

Equipment: - In the present study sonography examination was carried out using 7.5 to 10 MHz linear transducers of **ESOATE AU5** system at Victoria hospital, Bangalore. Ultrasound gel was evenly applied on the skin over the gland.

Scanning technique: - With the patient supine and neck hyper extended the entire gland was examined. Hyperextension of the neck was obtained by placing a pad under the shoulders. The superficial location of the thyroid permits Sonographic demonstration of even subtle anatomical changes. The neck was surveyed in sagittal, transverse, and oblique positions to optimally visualize both lobes of thyroid, isthmus, carotid arteries, as well as internal jugular veins. Imaging of the lower poles of thyroid can be improved by having the patient swallow. This tends to raise the thyroid gland in the neck.

RESULTS

TABLE 1: Distribution of cases according to sex

	No. Of patients	Percentage
Males	11	16.92%
Females	54	83.08%
Total	65	100.00%

Out of 65 patients studied there were 11 males (16.92%) and 54 females (83.08%) with male to female ratio of 1:4.9.

TABLE 2: Distribution of cases according to various age groups

Sl no	Age group (years)	Male	Female	Total	Percentage
1	0 – 10	0	0	0	00
2	11 - 20	0	3	3	4.62%
3	21 - 30	1	14	15	23.08%
4	31 - 40	5	20	25	38.06%
5	41 - 50	4	12	16	24.62%
6	51 - 60	1	3	4	6.15%
7	61 - 70	0	2	2	3.07%
	Total	11	54	65	100.00%

Table no 2 shows the age incidence in various thyroid lesions in this study. No case was found below 10 years of age with youngest being 17 years old. And the eldest patient was 65 years old. Maximum number of cases was found in the age group 31-40 years (25 out of 65 cases i.e. 38.46%).

TABLE 3: Incidence of individual lesions

Sl no	Lesion	Male	Female	Total	Percentage
1.	Nodular goiter	5	32	37	56.91%
2.	Hyper plastic goiter	-	2	2	3.08%
3.	Adenoma	2	9	11	16.92%
4.	Thyroiditis	-	3	3	4.62%
5.	Thyroid carcinoma	2	3	5	7.69%
6.	Thyroglossal cyst	1	2	3	4.62%
7.	Grave's disease	1	-	1	1.54%
8.	Colloid nodule	-	3	3	4.62%
Total		11	54	65	100.00%

All the 65 patients were followed up by histopathology or fine needle aspiration cytology study and hence histopathological diagnosis was done in all the cases. Table no 3 illustrates the number of cases of each type encountered in this study. Nodular goiter was found in 37 out of 65 cases (ie.56.91%) and accounted for maximum number of cases. There were 5 patients of thyroid malignancy of which 3 patients were papillary carcinoma, 1 was follicular carcinoma, and 1 patient was anaplastic carcinoma. 11 cases of adenoma, 3 cases of thyroiditis, 3 cases of thyroglossal cyst, 2 cases of hyperplastic goiter, 3 cases of colloid nodules, and 1 case of Grave's disease were found in the study.

TABLE 4: Correlation of ultrasound findings with clinical diagnosis of solitary nodule

Clinical diagnosis	No.Of cases	Ultrasound diagnosis	No.of cases	Percentage
Solitary nodule	38	Solitary nodule	22	57.89%
		Multinodular involvement	16	42.11%

The sonographic findings in clinical diagnosis of solitary thyroid nodule in 38 patients are illustrated in table no.4. Only 22 (i.e. 57.89%) of these were truly solitary on ultrasound examination. Remaining 16 patients showed additional nodule or nodules suggesting multinodular disease.

TABLE 5: Correlation of ultrasound findings with clinically diagnosed multinodular disease

Clinical diagnosis	No.of cases	Ultrasound findings	No.of cases	Percentage
Multinodular lesion	27	Multinodular disease	20	74.07%
		Diffuse disease	6	22.22%
		Solitary nodule	1	3.71%

Table no 5 shows 27 patients referred with clinical diagnosis of multinodular disease of which 6 patients had diffuse enlargement of the gland, 20 patients had multinodular involvement on ultrasonographic examination. 1 patient had large solitary nodule on sonographic examination, which histologically was a colloid nodule.

TABLE 6: Lesions as solitary nodule on ultrasound examination

Sl no	Lesion	No of cases	Percentage
1.	Adenoma	11	47.84%
2.	Hyper plastic nodule	3	13.04%
3.	Colloid cyst	3	13.04%
4.	Thyroglossal cyst	3	13.04%
5.	Carcinoma	3	13.04%
Total		23	100.00%

There were 23 cases of solitary nodules on sonological examination. Of these 11(47.84%) were adenomas and 3(13.04%) each of hyperplastic nodules, colloid nodules, and thyroglossal cysts. There were 3 cases of thyroid malignancy (2 papillary carcinoma and 1 follicular carcinoma).

DISCUSSION

Our study included 65 cases of various thyroid disorders presenting with thyroid swelling. In our study female preponderance was noted as mentioned previously with female to male ratio of 4.9:1. This was also seen in the study by Brandes A and Nickels J *et al.*¹ The peak incidence of various thyroid lesions was found in 31-40 years age group accounting for 25 cases (38.46%). Next

frequency was found in 41-50 years age group. In this study the most frequent thyroid lesion was nodular goiter, constituting 37 out of 65 cases (57%). The term nodular goiter included euthyroid nodular goiter, simple nodular goiter, toxic nodular goiter, hyperplastic nodule, and toxic nodule. Nodular goiter is usually multinodular although one macroscopic nodule and other microscopic changes can also be seen. Some nodules in multinodular goiter

exhibited hypoechoic halo around them. It included 3 patients with complete halo and incomplete halo around 3 nodules. 2 patients of solitary hyperplastic nodule exhibited complete halo around them. This correlates well with the study by Solbiati *et al.*² There was discrepancy seen in the cases clinically diagnosed as solitary thyroid nodules. 16 out of 38 such cases i.e. 42.11% cases turned out to be multinodular sonographically. This is comparable to study by William Schiebe and M D George *et al.*³ who identified 40% as multinodular in clinically diagnosed solitary nodules. Of the 27 cases clinically diagnosed as multinodular, sonography was supportive in 20 cases (74.07%), 6 cases showed diffuse enlargement and 1 case ultrasonography indicated a single lesion. This again was comparable to above-mentioned study. The incidence of thyroid malignancy is more in solitary nodule than in multinodular disease. In our study 5.56% of multinodular disease had malignancy which is comparable to study by Judith .F. Katz *et al.*⁴ Out of the 7 nodules, which showed calcifications of different pattern in our study, 3 were adenomatous nodules of nodular goiter. One of these 3 patients had egg shell calcification. Other 2 patients had peripheral coarse plaque like calcification with few scattered calcific foci. James and Charbeneau mentioned that eggshell calcification is the most reliable sign of the benign nature of thyroid nodule.⁵ Using criteria in the diagnosis of nodular goiter such as glandular asymmetry, multiple solid nodules with varying amounts of hemorrhage, necrosis and calcific spherules, sonography is quite accurate in the diagnosis. Adenomas were the next most common group of thyroid disorders encountered numbering 11 out of 65 cases i.e. 16.9%. These were hyperechoic in 3 cases (27.27%), isoechoic in 3 cases (27.27%), hypoechoic in 2 cases (18.18%), heterogeneous echotexture in 1 case (9.09%) and 2 cases (18.18%) showed mixed cystic and solid echotexture. One patient with adenoma had coarse and scattered foci of calcifications. The adenomas are usually solitary and slowly growing well-encapsulated lesions. In our study 11 out of 23 solitary nodules i.e. 47.84% were adenomas and thus the commonest lesion in patients presenting with solitary nodule. This is comparable to study by Simeone *et al* who found adenoma as the commonest etiology for solitary thyroid nodule (79 out of 116 cases).⁶ On sonography a well-defined 1-2 mm sonolucent rim (halo) is seen around the lesion. This is probably due to the combined effect of a thin capsule investing the adenoma plus the compression of surrounding normal parenchyma and vascularity, which can be seen on color Doppler. In our study halo was seen in 6 out of 11 cases of adenoma. It included 4 cases with complete halo and 2 cases of incomplete halo. This correlates well with the study by Simeone *et al* who found halo in 43 out of 79 cases.⁶ The

complete halo is said to be suggestive of a benign process but it can be seen in malignant nodule. In our study we encountered 1 patient of adenoma who had hypoplasia of contralateral lobe. Totally there were 2 cases of lobar hypoplasia. Other patient of lobar hypoplasia had nodular goiter in the contralateral lobe. Of the 2 above patients there was hypoplasia of left lobe in one patient and right in the other. The papillary carcinoma is the commonest among the thyroid neoplasms. In our study 5 cases of thyroid malignancy were encountered of which 3 were proved to be papillary carcinoma, 1 follicular carcinoma, and 1 case of anaplastic carcinoma. Out of 3 papillary carcinomas 2 were solitary nodules and other had multinodular involvement. All the malignant lesions in our study were solid and hypoechoic, which is comparable to study by Solbiati *et al.*⁴⁹ None of the malignant lesions were cystic in nature. This is comparable to study Nirad Mehta and Rajendra Tripathi *et al.*⁷ However study by Walters *et al* showed cystic component in 26% of cases.⁸ Calcifications were seen in 3 patients with thyroid malignancy including 2 papillary and 1 follicular carcinoma. 2 of these 3 patients showed faint scattered, punctiform, microcalcifications with distal acoustic shadowing. And other patient showed coarse calcification. One case of follicular carcinoma showed incomplete halo suggesting that halo is not entirely specific of benignity, which was also described in study by Gatti S Fanconi *et al.*⁹ Anaplastic carcinoma case was multinodular in presentation with solitary, lytic, expansile metastasis seen in left humerus on radiograms. The next most common finding was thyroiditis, which was seen in 3 patients. All the patients showed diffuse enlargement of the thyroid involving both lobes and generalized decrease in echogenicity. One of these 3 patients had pseudolobulated appearance. Histologically all the 3 proved to be Hashimoto's thyroiditis. There were 3 patients of thyroglossal cyst in our study. In all the 3 patients upward movement of the cyst on protrusion of the tongue was demonstrated. There were 3 cases of solitary colloid nodule in our study. All the cases were predominantly cystic with low-level echoes seen in 1 case. These nodules were varying in size. There were 2 cases of physiological goiter in our study. Both cases showed diffuse enlargement of the thyroid gland with no obvious nodularity. Physiological goiter is commonly seen in puberty age group, which correlates well with the finding in our study. There was 1 case of Grave's disease encountered in our study. It showed diffusely enlarged thyroid gland, which was hypoechoic in nature. It showed characteristic increase in vascular flow on color Doppler examination both in systole and diastole giving a "thyroid inferno" appearance. Ralls and colleagues coined the above terminology, which is considered specific for

Grave's disease.¹⁰ Spectral Doppler examination showed increased peak systolic velocity of 74-cms/ sec.

SUMMARY AND CONCLUSION

Sixty-five cases with various thyroid lesions were studied with real time ultrasonography and Doppler examination. Thyroid lesions were more common in females with male to female ratio of 1:4.9. Most frequently encountered thyroid lesion was nodular goiter and maximum incidence occurred in the age group of 31-40 years. 11 cases of adenoma and 5 cases of thyroid malignancy were found which included 3 cases of papillary carcinoma suggesting it as the commonest malignancy. 3 cases of thyroiditis, 3 cases of thyroglossal cyst and one case Grave's disease were found in our study and ultrasound proved to be a sensitive modality for diagnosing clinically undiagnosed thyroid lesions. The abnormal color Doppler signals did not necessarily point to the diagnosis but provided a clue in diagnosing malignancy and hyperfunctioning adenomas. Few limitations of ultrasound are it is operator dependant and operator skill is necessary for acceptable diagnostic accuracy. It is dependant to a lesser degree on patient co-operation. It cannot specifically differentiate benign from malignant lesions but can be over come by combining with fine needle aspiration studies thus avoiding surgery in large number of patients.

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