

Evaluation of Solitary Nodule of Thyroid using Ultrasonogram and Color Flow Doppler: A Prospective Study

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Abstract

Introduction: Thyroid nodules are common and a frequent reason for referral to secondary care. Clinical assessment and investigation should aim to address the functional status of the thyroid, exclusion of malignancy, and the presence of other symptoms.

Aim: The aim of this study is to correlate the results of sonography, color flow Doppler (CFD), fine-needle aspiration cytology (FNAC), and histopathology of solitary thyroid nodule.

Materials and Methods: This comparative single-institutional study was conducted in the Department of Surgery, Tirunelveli Medical College. A total of 50 patients with solitary thyroid nodule confirmed by ultrasound were included in this study. The patient's demographic data were recorded and written and informed consent was obtained from all the patients. All patients were subjected to a thorough clinical evaluation and went through routine investigations such as FNAC, thyroid profile, X-ray neck-AP, and lateral. The reports were evaluated, statistically analyzed, and discussed.

Results: Out of the 50 patients, 46 were female (92%) and 4 patients were male (8%). The peak age of occurrence of thyroid nodule was in the age group of 41–50 years. On FNAC examination, 32 patients were present with colloid nodular goiter (64%) followed by simple colloid goiter in 10 patients (20%), thyroiditis in 3 patients (6%), follicular adenoma in 2 patients (4%), follicular neoplasm in 2 patients (4%), and cystic lesion in 1 patient (2%). Based on echogenicity, 43 patients (86%) showed hypoechogenicity, 6 patients (12%) showed hyperechogenicity, 1 patient (2%) showed isoechogenicity. Perinodular flow was observed in 33 nodules (66%), absent flow present in 8 nodules (16%), and intranodular flow in 9 nodules (18%). Based on histopathology, 25 patients (50%) had a nodular colloid goiter, 13 patients (26%) had a simple colloid goiter, 9 patients (18%) had follicular adenoma, and 3 patients (6%) had thyroiditis.

Conclusion: From this study, we concluded that no positive correlation is established between the various sonographic and CFD criteria with malignancy. However, FNAC reports correlated remarkably well with histopathological examination reports. FNAC in combination with ultrasonography and Doppler tests can be remarkable in detecting thyroid malignancies.

Key words: Doppler, Fine-needle aspiration cytology, Histopathology, Solitary thyroid nodule

INTRODUCTION

The solitary thyroid nodule, defined as a palpably discrete swelling within an otherwise normal gland, is usually a benign lesion. Thyroid nodules are common in both

hyperthyroid and euthyroid patients; they are present in half of all thyroid glands that are subject to careful pathologic examination. More than 80% of all patients with thyroid nodules are women; palpable thyroid nodules have been detected in 1.5% of men and 6.4% of women between the ages of 30 and 59.2 years. Prevalence of thyroid nodules increases from near zero at age 15 years to 50% by about age 60–65 years.^[1]

Thyroid nodule is the most common surgical disease of the thyroid gland in most centers. About 5–10% of the solitary nodules are malignant. Hence in the past, excision of every solitary nodule was advocated. However, during the past

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decade, with a better understanding of the pathology and with refinements in the investigations and interpretation, only solitary nodules which are at high risk for malignancy are identified and excised.^[2,3]

Among the others, only a small number with specific indications for surgery are ablated. A plethora of investigations has evolved over the past 25 years. However, from the diagnostic angle, only ultrasonography (USG)-color Doppler and fine-needle aspiration cytology (FNAC) are commonly required.^[4,5] This study aims to correlate the results of sonography, color Doppler flowmetry, and FNAC and evaluate their effectiveness in detecting thyroid malignancies in clinically palpable solitary thyroid nodules.

Aim

The aim of this study is to correlate the results of sonography, CFD, FNAC, and histopathology of solitary thyroid nodule.

MATERIALS AND METHODS

This study was conducted by randomly selecting 50 patients with a clinically palpable solitary nodular goiter who were admitted to the wards under various units in the Department of General Surgery, Tirunelveli Medical College. All patients who had confirmed solitary nodule by ultrasound were included in the study after signing informed consent. Patients with multiple nodules and coexistent neck nodules were excluded from the study.

Data regarding the age and sex of the patients were recorded, the patients were examined, after which FNAC of the nodule was performed using a 25-gauge needle with or without negative pressure. All the patients were subjected to a thorough clinical evaluation and underwent routine investigations such as thyroid profile, X-ray neck-AP, and lateral. Ultrasonogram was performed using a high-resolution sonography by an experienced radiologist. Color flow Doppler (CFD) was performed with a VIVID 3 pro. All the patients who underwent surgery (hemi-thyroidectomy) were followed up in the post-operative period. Their histopathological reports were also reviewed and used to correlate with the FNAC, sonography, and CFD reports. In surgical patients, the post-operative complications were documented. The reports were evaluated, and the results were statistically analyzed and discussed.

RESULTS

Out of the 50 patients, 92% were female (46 patients) and 8% were male (4 patients). Eighteen patients (36%) were in the age group of 31–40 years, 15 patients (30%) between 41

and 50 years, 6 patients (12%) between 21 and 30 years, 5 patients (10%) between 51 and 60 years, 3 patients (6%) <20 years, and 3 patients (6%) greater than 60 years [Table 1].

Based on FNAC examination, 32 patients presented with colloidal nodular goiter (64%) followed by simple colloidal goiter in 10 patients (20%), thyroiditis in 3 patients (6%), follicular adenoma in 2 patients (4%), follicular neoplasm in 2 patients (4%), and cystic lesion in 1 patient (2%) [Table 2].

Based on echogenicity, 43 patients (86%) showed hypoechogenicity, 6 patients (12%) showed hyperechogenicity, and 1 patient (2%) showed isoechogenicity [Table 3].

Based on vascular flow, absent flow was noticed in 8 nodules (16%), perinodular flow in 33 nodules (66%), and intranodular flow in 9 nodules (18%) [Table 4].

Histopathology showed that 25 patients (50%) had a nodular colloidal goiter, 13 patients (26%) had a simple colloidal goiter, 9 patients (18%) had follicular adenoma, and 3 patients (6%) had thyroiditis [Table 5].

DISCUSSION

Thyroid enlargement, whether diffuse or nodular, leads to a battery of investigations, mainly to rule out the

Table 1: Age distribution

Age	Number of patients	Percentage
<20	3	6
21–30	6	12
31–40	18	36
41–50	15	30
51–60	5	10
>60	3	6

Table 2: Fine-needle aspiration cytology (FNAC) distribution

FNAC report	Number of patients	Percentage
Simple colloidal goiter	10	20
Colloidal nodular goiter	32	64
Follicular adenoma	2	4
Follicular neoplasm	2	4
Thyroiditis	3	6
Cystic lesion	1	2

Table 3: Cross-tabulation between echogenicity and number of patients

Echogenicity	Number of patients	Percentage
Hypoechogenicity	43	86
Hyperechogenicity	6	12
Isoechogenicity	1	2

Table 4: Cross-tabulation between vascularity pattern

Vascularity pattern	Number of nodules	Percentage
Absent flow	8	16
Perinodular flow	33	66
Intranodular flow	9	18

Table 5: Histopathology distribution

Histopathology report	Number of patients	Percentage
Simple colloid goiter	13	26
Nodular colloid goiter	25	50
Follicular adenoma	9	18
Thyroiditis	3	6

possibility of neoplastic or non-neoplastic lesions. Timely intervention in nodular lesions of thyroid can significantly reduce morbidity and mortality.^[6] Solitary thyroid nodules are most commonly seen in adults aged between 21 and 50 years. In our study, the youngest patient was 16 years and the oldest was 65 years. This difference in the age at peak incidence could be due to geographic variation and prevalence of endemic goiter. The highest incidence was in the 3rd and 4th decades and they accounted for 36% of cases. The present study compares favorably with the study reported by Rao and Rao (peak incidence 47% in the 3rd decade) and Sachdeva *et al.* (peak incidence 39% in the 3rd decade).^[3]

All the 50 cases in our study underwent FNAC. Of these, there was no “inadequate cytology” report which is quite striking because Van Herle, in his study reported in adequacy rate of 5–12% with at least six aspirations. FNAC reported two cases as malignancy which turned out to be benign on histopathological examination (HPE), which gives a false-positive rate of 4% according to our study. Hence, it can be concluded that FNAC is of definite help in planning the mode of treatment but much reliance cannot be placed on a negative FNAC report.

About 86% of the nodules were hypoechoic and 12% were hyperechoic. In a study by Iannuccilli *et al.*, hypoechoogenicity was a common sonographic feature in both benign and malignant nodules and hyperechoogenicity was rare in both groups.^[5]

Doppler study of the vascular pattern of the nodules showed absent flow in 16% an increased perinodular flow in 66% and an increased intranodular flow in 18%. Iannacuilli's study says that the grade of internal blood flow in color Doppler analysis is not a statistically significant criterion to suggest benign or malignant nature of a lesion. In a study by Frates *et al.*, it has been concluded that

solid, hypervascular (grade 4) thyroid nodules had a high likelihood of malignancy.

Another study by Kang *et al.*^[7] found that the margin, echo structure and the presence of calcification showed significant differences between benign and malignant nodules. In our study, hypoechogenicity was the predominant feature in benign nodules which does not compare with the results of this study.

Shimamoto *et al.*, in their study with 42 patients, have concluded that color Doppler sonography would not improve the ability to differentiate benign from malignant nodules significantly. As this study was also a small series as in ours, probably, our results are also comparable to this study.^[8] The histopathological reports of all cases correlate well with the FNAC report in our study.

No single feature was found to be enough alone, to correlate with malignancy. A combination of features has been described by various studies to correlate with malignancy of these the most consistent feature has been a “solid hypervascular pattern” that has been known to associate well with malignancy.

CONCLUSION

Our study had no malignant nodules as seen by histopathological report after surgery. Hence, no positive correlation could be established between the various sonographic and CFD criteria with malignancy. However, FNAC reports correlated remarkably well with HPE reports. Hence, ultrasonogram and CFD study of thyroid nodules when used in conjunction may be used to screen nodules that are suspicious of malignancy which need to be subjected to scintigraphy and biopsy further to determine the nature of the lesion accurately. FNAC remains the most sensitive method to detect malignant lesions. However, as it cannot distinguish between follicular adenomas and follicular carcinomas, USG and CFD being non-invasive may help to detect malignancy in such cases.

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