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Comparison of Fine Needle Aspiration Cytology and Ultrasonography in Solitary Thyroid Nodule

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Abstract
Background: *There is 4-5 % incidence of clinically apparent thyroid nodules in the general population. The majority (90%) of thyroid nodules are benign as malignancy occurs in only 1 in 10 thyroid nodules. The overall incidence of malignancy in solitary thyroid nodule ranges between 10% and 30%. Ultrasound and fine needle aspiration cytology are advocated as first-line examinations for the assessment of thyroid nodules.*
Aims and Objective: *To study cytological profile of thyroid lesions and correlate the results with Ultrasonography findings and clinical features.*
Material and Methods: *This prospective study was carried out on 50 patients with thyroid swelling who came to the department of Surgery and thyroid clinic. FNAC and thyroid USG was done in all patients and results were compared on the end of study.*
Result: *Out of 50 patients, 33 patients (66%) were of benign FNAC (09 colloid cyst, 02 multi-nodular goiter, 12 colloid goiter, and 04 chronic lymphocytic thyroiditis). Swelling in front of neck 50 (100%) was the most common clinical sign observed. About 76% patients were females and 24% were male. The statistically significant association was found only between in diagnosing multinodular swelling in USG in comparison to FNAC. In rest categories there was no significant differences were observed in both USG and FNAC in assessing thyroid swelling.*
Conclusion: *Study conclude that for proper diagnosis of thyroid lesion, FNAC is the main diagnostic initial modality. Along with Ultrasonography and Clinical examination it helps to come to the proper diagnosis.*
Keywords: *Thyroid swelling, Thyroid nodule, Fine needle aspiration cytology (FNAC), Thyroid Ultrasonography (USG).*

INTRODUCTION

The thyroid gland is unique among endocrine glands, being the first endocrine gland to appear in the fetus. It is the largest of all endocrine glands (weighing about 25 gm.) and is the only one which is amenable to direct physical examination because of its superficial location.[1] Thyroid nodular (TN) lesions are a common clinical problemin the world. These are more common in women and in areas of iodine deficiency. Exposure to ionizing radiation in childhood and adolescence increases the risk of solitary thyroid nodule and thyroid carcinoma.[2]

A solitary thyroid nodule is a palpable swelling in thyroid gland that has otherwise a normal appearance.[3] Palpable thyroid nodules occur in 4 to 7 percent of the population, but nodules found incidentally on ultrasonography suggest a prevalence of 19 to 67 percent. The majority of thyroid nodules are asymptomatic and only about 5 percent of all palpable nodules are found to be malignant. A variety of tests have been employed to separate benign from malignant thyroid nodules.[3-5] All "benign" and "malignant" FNAC findings were confirmed on final histology.[6]

Fine needle aspiration cytology of thyroid nodules is the single most sensitive, specific, and cost-effective method of investigation of thyroid nodules. FNAC is also advised for every patient for exclusionof cancer and in the initial management of patients. It isfrequently used because it is inexpensive, sensitive, specific,and an accurate procedure; therefore it is adapted as an initialinvestigation of thyroid diseases in all tertiary hospitals indeveloping countries.[5, 7]The major pitfall of this procedure is that fine needleaspiration cytology cannot differentiate between follicular adenoma and follicular carcinoma.[8]

Sensitivity and specificity of FNAC is upto 94% and 98% for diagnosis of malignant lesions and nearly 90% accuracy rate in the identification of malignancy, excluding follicular lesion.[9] The Ultrasonography is easily accessible, inexpensive, highly sensitive diagnostic modality.[10, 11]

METHODOLOGY AND PATIENTS

In this study we compared the individual efficacy of FNAC and Ultrasonography in the management of solitary thyroid nodules. This comparative cross-sectionalstudy was carried out on 58 patients who attended the OPD or IPD of a tertiary care teaching hospital, Haldia, West Bengal from April 2015 to December 2015. It was conducted on 50 patients of solitary thyroid nodule in 09 months. A nonprobability purposive sampling technique was used for these patients.

Inclusion Criteria

1) Age 10 to 75 Years
2) Both genders
3) Patient presenting with solitary swelling arising from any lobe of thyroid selected by clinical palpation.
4) Cooperative patients and willing for FNAC or USG

Exclusion Criteria

(1) Patients with diffuse thyroid swelling
(2) All toxic and multinodular goiters confirmed by clinical evaluation
(3) Patients with history of any type of thyroid surgery(lobectomy or total thyroidectomy)
(4) Uncooperative patients, not willing for FNAC

All patients presenting with solitary thyroid nodules in the OPDs of General Surgery, Thyroid Clinic (weekly) and fulfilling the inclusion criteria were included in this study. Informed consent from all the patients included in the study was taken. Institutional ethics committee permission was taken before starting this observational study. All the patients were recorded for their demographic features, that is, age and sex. History of present illness with regard to symptoms and duration was recorded. They were examined for the signs related to the solitary thyroid swelling. All routine investigations and serum T3, T4, and TSH Levels were performed by Radioimmu-noassay (RIA), (normal range of T3, 2.5–5.8 pmol/L, T4, 11.5–23.0 pmol/L, and TSH, 0.2–4.0mIU/L). Patients with solitary thyroid swelling underwent USG of thyroid gland. Solitary thyroid

nodules were selected and then FNAC was performed. The USG were performed and compared with FNAC. Sonographically the nodules were evaluated for size, location, echo texture, margins and presence of halo, calcification, and accessory nodules and associated cervical lymphadenopathy in order to differentiate between benign and malignant nodules.

Cytological diagnosis was categorized into four groups: negative for malignancy, indeterminate (suspicious) for malignancy, positive for malignancy, and inadequate. The cases were operated and evaluated for histopathological changes. The results of thyroid USG and fine needle aspiration cytology were compared.

All the data was analyzed with SPSS version 17. The variables included were demographic data, routine investigations, thyroid USG, and thyroidfunction tests. For quantitative data, that is, thyroid function tests, duration and size of thyroid nodule, mean, and standard deviation were calculated. For qualitative data, that is, results of thyroid USG and FNAC percentages was calculated. A 2×2 table was used to calculate sensitivity, specificity, positive predictive value, negative predictive value, and accuracy.

RESULTS

In the present observational study 50 patients with thyroid swelling was investigated with FNAC and USG thyroid region. The age of patients ranged from 10 to 75 years withmean age37.04 ± 14.88 years. About 38 patients (76%) were females, and 12 (24%) were males (male to female ratio 1: 3.16) [Table 1].Regarding thyroid function tests, 43 patients (86%) were euthyroid, 5 patients (10%) were hyperthyroid, and 02 (4%) patient was hypothyroid [Table 1]. The mean for serum T3, serum T4, and serum TSH were 4.22 ± 0.84, 17.42 ± 2.98, and 0.96 ± 0.81, respectively.

Table 1. Showing demographic, clinical and laboratory characteristics of cases [n=50]

Sex	No	Percentage [%]
Male	12	24%
Female	38	76%
Age		
10-30 yrs	9	18%
31-50 yrs	34	68%
51-70 yrs	6	12%
Above 70 years	01	2%
Total	50	100%
Clinical Signs/Symptoms		
Swelling in front of neck	50	100%
Dyspnea	2	4%
Pain	3	6%
Dysphagia	7	14%
Hoarseness of voice	3	6%
Size of nodule (cm)		
1–5	31	62%
6–10	18	36%
>10	1	2%
Total	50	100%
Thyroid function tests		
Euthyroid	43	86%
Hyperthyroid	5	10%
Hypothyroid	2	4%

The mean for size of thyroid nodule was 4.88 ± 1.59 cm. About 31 patients (62%) had 1–5 cm sized thyroid nodules, and 18patients (36%) had 6–10 cm thyroid nodules. Only 01 patient had thyroid nodule greater than 10 cm in size [Table 1].

Table 2: Distribution of subjects by classification of FNAC [*n* = 50]

Classification	No	Percentage
Benign	33	66%
Malignant	2	4%
Intermediate	14	28%
Inadequate	01	2%
Subtypes		
Benign		
Colloid cyst	09	18%
Multinodular	2	4%
Colloid goiter	12	24%
Thyroglossal cyst	2	4%
Chronic lymphocytic thyroiditis	4	8%
Hyperplastic thyroid	1	2%
Graves Disease	1	2%
Indeterminate		
Follicular Lesion	6	12%
Follicular Neoplasm	8	16%

Out of 50 patients, 33 patients (66%) were of benign FNAC (09 colloid cyst, 02 multinodular goiter, 12 colloid goiter, and 04 chronic lymphocytic thyroiditis) [Table 2/ Figure 2]. About 14 patients (28%) were of indeterminate including suspicious for malignancy FNAC of which 3 patients (6%) were males and 12 patients

(24%) were females, and 2 patients (4%) were of malignant FNAC [Table 2]. All the malignant cases were given as neoplastic on USG.Swelling in front of neck 50 (100%) was the most common clinical sign observed [Table 1].

Table 3. Showing distribution of cases depending on USG diagnosis

Characteristic	USG Diagnosis	No	Percentage
Benign	Multinodular goiter	15	30%
	Colloid goiter	11	22%
	Colloid Cyst	8	16%
	Follicular Adenoma	3	6%
	Thyroglossal cyst	2	4%
	Nodular Thyroid	2	4%
	Graves Disease	1	2%
Inflammatory	Thyroiditis	5	10%
Malignant	Neoplastic etiology	3	6%
Total		50	100%

Table 4: Showing association of FNAC categories and USG categories of lesion [N=50]

Classification	FNAC	USG	P Value
Benign	66%	84%	P = 0.0386
Malignant	4%	6%	P = 0.6480
Intermediate	28%	10%	P = 0.0225
Inadequate	2%	-	
Subtypes			
Benign			
Colloid cyst	18%	16%	P = 0.7911
Multinodular	4%	30%	P = 0.0006*
Colloid goiter	24%	22%	P = 0.8131
Thyroglossal cyst	4%	4%	P = 1.0000
Chronic lymphocytic thyroiditis	8%	10%	P = 0.7281
Hyperplastic thyroid	2%	-	-
Graves Disease	2%	2%	P = 1.0000
Indeterminate			
Follicular Lesion	12%	-	-
Follicular Neoplasm	16%	-	-

*Statistically significant

Ultrasonography examination was done in all 50 cases. About 42 (84%) cases were diagnosed as benign. Multinodular goiter 15 (30%) being the most common [Figure 1], followed by colloid goiter 11 (22%). There were 8 (16%) cases of colloid cyst, 3 (6%) cases of follicular adenoma, 2 (4%) cases of thyroglossal cyst and 1 (2%) case of graves' disease and nodular thyroid each [Table 3, 4].

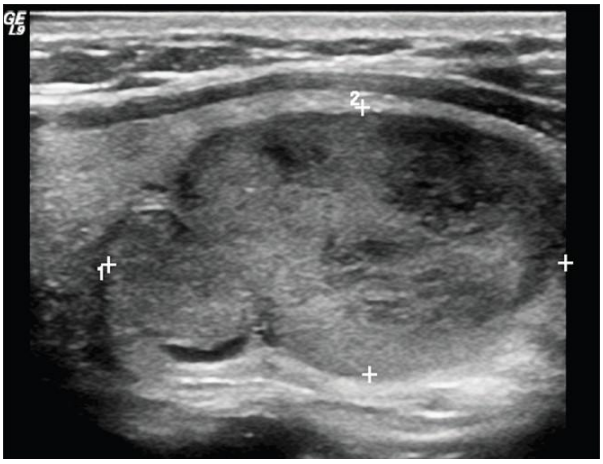

Figure 1: USG of thyroid showing swelling

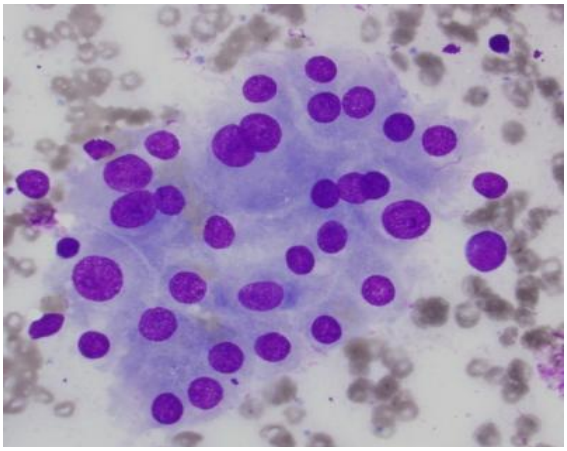

Figure 2 Cytologic features of the ''lymphocytic'' pattern of Hashimoto thyroiditis.

DISCUSSION

The management of thyroid nodules has become acontroversial issue with the increasing incidence of thyroid carcinomas. The prevalence of thyroid nodules is 2–6% with palpation, 19–68% with ultrasonography (US), and 8–65% in autopsy specimens. [12-14] The rate of malignancy was approximately 5–15% among the nodules detected by palpation or US.[15,16] The rate of malignancy was 8–12% of the non-palpable nodules evaluated by fine-needle aspiration (FNA)[16] and 1.6% among the patients with thyroid nodules in a population-based study[17].

The size of a thyroid nodule should be measured in all three dimensions; however, only the maximal diameter of the nodule may be documented in small nodules (≤ 5 mm). The correlation between the nodule size and the risk for malignancy remains controversial. Although a

recent systemic review suggested that the larger nodules present a higher pretest probability of malignancy[18], whether the malignancy risk is higher in the larger nodules and whether the nodule size could be a predictor for malignancy are still controversial[19-21].

High-resolution thyroid ultrasonography is a sensitive and specific diagnostic tool used in clinical evaluation and epidemiological studies of nodular thyroid disease.[22] Ultrasound guided FNAC of the thyroid nodule can diagnose most thyroid nodules and differentiate between malignant and benign ones.[23] However, this approach has limitations with regard to the detection of tumors less than 5 mm in size and the cytological interpretation of cases involving regression and microfollicular proliferation.[24] Another limitation of applying ultrasound and FNAC for diagnosing thyroid nodules is that it cannot differentiate between benign and malignant follicular neoplasms.[25-27] In the present study maximum number of cases was between 31 to 50 years of age, followed by 10 to 30 years of age. The mean age was 37.04 ± 14.88 years. Study by Chavan et al[10] also showed more cases in age groups of 28-47 yrs.

In the similar study by Afroze N et al.[28], the age range was 16 to 78 years with median age was 40.2 years. In a study by Manoj Gupta et al.[29]and Sinna E et al.[30]median age was 38.72 years and 44 years respectively.

In the present study, 76% patients were females and 24% were male. The male to female ratio was 1:3.16. So, females were commonly affected than males. In a study by Chavanet al[10] and Uma Handa et al[31] male to female ratio was 1.626 and 1: 6.35 respectively.

In a study by Sarunyakantasuebet al.[32]and Paarthipan N et al.[33]male to female ratiowas 1:5.12 and 1:4 respectively which is almost matching with our study result. All the 50 patients presented with swelling in front of neck (100%), pressure effect from thyroid swelling was seen in 2 (4%) cases presented with dyspnea, 3 (6%) cases with pain in swelling, dysphagia seen in 7 (14%) cases and hoarseness of voice in 3 (6%) cases, which is slightly higher than the result of Chavan et al[10]. In a study by Ankush Dhanadia et al.[11], swelling in front of neck was seen in 100 (100%) cases, pressure symptom was seen in 13 (13%) cases and pain in the swelling was seen in 15 (15%) cases.

About 2 (4%) cases were diagnosed as thyroglossal cyst on FNAC and Ultrasonography as well. Ultrasonography examination was done in all 50 cases. About 42 (84%) cases were diagnosed as benign. Multinodular goiter 15 (30%) being the most common, followed by colloid goiter 11 (22%). There were 8 (16%) cases of colloid cyst, 3 (6%) cases of follicular adenoma, 2 (4%) cases of thyroglossal cyst and 1 (2%) case of graves' disease and nodular thyroid each. The nodular thyroid was described as features having benign thyroid nodule.

In a study by Kaur K et al.[34]USG findings were benign cases were 38 (76%), malignant cases were 5 (10%) and indeterminate cases were 7 (14%). In FNAC majority, that is 33 (66%) cases were diagnosed as benign which included the following lesions: 12 (24%) cases of colloid goiter, which was the most common of these benign cases, colloid cyst 9 (18%) cases, 2 (4%) cases of thyroglossal cyst, 2 (4%) cases of multinodular goiter, 1 (2%) case of graves' disease and hyperplastic thyroid each. Four (8%) cases were diagnosed as inflammatory lesion. The statistically significant association was found only between in diagnosing multinodular swelling in USG in comparison to FNAC. In rest categories there was no significant differences were observed in both USG and FNAC in assessing thyroid swelling.

Statistically significant correlation was found between cytological examination of thyroid lesions and USG examination in a study by Sehovic S et al.[35]Thyroid nodules with a maximum diameter greater than 1 cm should be evaluated because they have a greater potential to be clinically significant carcinomas. Nodules less than 1 cm in diameter with suspicious ultrasound

findings or associated lymphadenopathy, a history of head and neck irradiation, or a family history of thyroid cancer require evaluation.[27] Watters et al. (1992)[36] found that the sensitivity and specificity of USG in suggesting a malignant lesion were 74% and 83% respectively. They interpreted an USG report as suggestive of malignancy if the nodule was solid or of a mixed solid-cystic variety and a hypoechoic and non haloed lesion. They emphasized that the USG has added advantage of allowing the whole gland to be examined rather than the dominant nodule but was limited by the fact that no features were pathognomonic for malignancy so that it should be regarded as a complementary rather than an alternative investigation to FNAC in the management of solitary thyroid nodules. Jones et al. found that the sensitivity and specificity were 75% and 61%.[37]It has been observed that for a thyroid nodule to be detected by palpation, it must be at least 1 cm in diameter while USG can detect nodules as small as 3 mm in diameter.[38]

FNAC has certain limitations because of scanty sample and suspicious diagnosis. The incidence of malignancy in clinically solitary thyroid nodule was (12.6%) in study conducted by Taylor S.[39]In our study the incidence of malignancy in clinically solitary thyroid nodule was 4%.

The reasons for low sensitivity may be following reasons like small sample size, use of conventional method of FNAC and experience of pathologist and radiologists. No investigation was found to be 100% accurate in diagnosing malignancy in nodular goitre but a combination of various diagnostic modalities (ultrasonography and FNAC) rather than any single modality will give optimal results and avoid unnecessary surgery in a great number of patients without missing any malignancy.

Therefore, FNAC should beadapted as an initial investigation of thyroid diseases in all tertiary hospitals. The information provided by thyroid scan has no significant bearing in the management of solitarythyroid nodule. FNAC provides useful information and maybe used along with other clinical information to decide best form of treatment in a solitary thyroid nodule. The use of FNAC has reduced the number of patients with solitary thyroid nodules undergoing unnecessary surgery and has led to proper planning of surgery in malignant cases.

CONCLUSION

Fine-needle aspiration has been established as a safe, reliable, and effective method for the diagnosis of the thyroid malignancies. The decision to perform FNA needs to be based on the malignancy and prognostic risks of a thyroid nodule.Thyroid Ultrasound (US) is a noninvasive imaging techniquethat should be performed on all patients with nodules suspected clinically or incidentally noted. The present study was undertaken to evaluate the usefulness of USG and FNAC in the management of nodular goitre. Thyroid ultrasonography with FNAC is a cost effective way of managing thyroid nodules in India.Ultrasound will help confirm the thyroid nodule/s, assess the size, location and evaluate the composition, echogenicity, margins, presence of calcification, shape and vascularity of the nodules and the adjacent structures in the neck including the lymph nodes. If there are multiple nodules, all the nodules should be assessed for suspicious US characteristics.

On FNAC, benign category constituted the major cause of thyroid swelling. The commonest benign lesion was colloid goitre and the commonest malignant lesion was papillary carcinoma.

On USG also benign thyroid lesions were common and goiter constituted the majority of cases which were correlated with those of FNAC findings.

From our study we can conclude that for proper diagnosis of thyroid lesion, FNAC is the main diagnostic modality. Along with Ultrasonography and Clinical examination it helps to come to the proper diagnosis.

Conflict of Interests

The authors declared that there is no conflict of interests.

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