



ORIGINAL RESEARCH PAPER

Surgery

A STUDY ON DIAGNOSTIC ACCURACY OF ULTRASOUND GUIDED FINE NEEDLE ASPIRATION CYTOLOGY FINDINGS WITH HISTOPATHOLOGY FINDINGS IN NODULAR GOITER OF THYROID

KEY WORDS:

Dr Sudhansu Sarkar*

Associate Professor, B.S.M.C&H, Bankura. *Corresponding Author

Dr Mintu Mallick

Senior Resident, B.S.M.C&H, Bankura.

INTRODUCTION

The word 'Thyroid' originated from 'Thyreos', a Greek word meaning shield. It was first used by Thomas Wharton (1614-1673) of London, UK. He named it as Glandularis thyroideis in 1656 in his book "Adenographia." In old times, it was called Struma (Latin word of swollen gland), bronchocele (a cystic mass in the neck) and goiter (Latin word-gutter meaning throat). The last name is in use even today [1].

Diseases of the thyroid gland are common and comprise a spectrum of entities causing systemic disease (Grave's disease) or a localised abnormality in the thyroid gland such as nodular enlargement (goitre) or a tumour mass. After diabetes mellitus, the thyroid gland is the most common organ to cause endocrine disorders [2]. Thyroid disorders are the most common endocrine diseases particularly in countries where iodine intake through diet is low.

Nodular thyroid disease is found in approximately 5% of the population at palpation screening. Routine ultrasound screening of thyroid in clinically normal individuals suggests a prevalence rate of 50% for thyroid nodules [3,4]. Fine needle aspiration cytology (FNAC) of the thyroid gland is over 50 years old [5] and is the single most important methods of establishing a diagnosis in both adults and children. Recent guidelines published by the British Thyroid Association/Royal College of Physicians and the American Association of Clinical Endocrinologists (AACE)/Association of Clinical Endocrinology (AME) emphasize that FNAC should be considered as the early investigation of choice for thyroid nodules and specifically for thyroid cancer [6,7].

FNAC require careful aspiration technique and meticulous interpretation of the findings by a skilled cytologist. Studies have suggested a sensitivity and specificity for predicting thyroid malignancies averaging 83% and 92% respectively [7, 8-11]. Unfortunately, FNAC can miss malignancies with a false-negative rate of approximately 5% [7]. Current guidelines recommend the usage of ultrasound guided FNAC (US- FNAC) to reduce this error [3,7].

Studies have shown that US- FNAC significantly reduces the number of inadequate fine -needle aspirates and improves the diagnostic yield for malignancies [3,12]. US-FNAC also improves the yield of cancer found at surgery [13].

The aim of this study is to investigate the role and accuracy of ultrasound guided fine needle aspiration cytology in the management of patients with thyroid nodules.

AIMS & OBJECTIVES

A. General:

To determine the diagnostic accuracy of ultrasound guided FNAC of the thyroid in daily cytology practice.

B. Specific:

(1) To estimate the sensitivity & specificity as well as positive & negative predictive values of ultrasound guided FNAC.

MATERIALS AND METHODS

Study Design: Institution based cross sectional

Observational evaluation study

Study Setting: Department of General Surgery, Bankura Sammilani Medical College, Bankura.

Place Of Study: Surgery wards of Bankura Sammilani Medical College, Bankura.

Period Of Study: One and half year, between March, 2018 to August, 2019.

Sample Size:

sample size will be calculated using the following formula :

$$n = \frac{(Z_{\alpha} + Z_{\beta})^2 \cdot S_n (1 - S_n)}{L^2 \times P}$$

Where Z_{α} = 1.96 (Two tailed) at 95% confidence interval.

Z_{β} = 0.84 at 80% power of test

S_n = sensitivity of the test in previous study, ie. 80% (0.8) [50].

L = Absolute error which was assumed to be 20% (0.2)

P = Prevalence = 0.5 as per existing literature [3,4].

$$\text{Therefore } n = \frac{(1.96 + 0.84)^2 \cdot 0.8 \times 0.2}{(0.2)^2 \times 0.5} = 62.72 \approx 62$$

Revised sample size considering 20 % non respondent will be - 62 + 12.4 ≈ 75

Study Population: Patients getting admitted in the in-patient department of General Surgery, BSMC&H with thyroid swelling.

Inclusion Criteria:

Patients having single or multiple thyroid nodules on examination or imaging irrespective of thyroid hormone profile undergoing thyroidectomy.

Exclusion Criteria -

1. Patients with diffuse /non nodular enlargement of thyroid
2. Patients with inoperable thyroid malignancy.
3. Patients with a previous history of thyroid surgery.
4. Patients with co-morbidities and unfit for surgery.
5. Patients who refuse surgery.
6. Patients not willing to participate in this study

Method Of Data Collection

- Patients attending in patient department of General Surgery with nodular lesions of thyroid were included in this study.
- A short history followed by physical examination was done for all of them.
- Only very essential investigations including a baseline thyroid function tests followed by ultrasound examination and guided FNAC were done for all of them.
- The details of the technique of ultrasound guided fine needle cytology were explained to the patient and an appropriate consent was obtained from each case before performing the procedure.
- Cytological evaluation and reporting was done by

pathologist All those patients with nodular thyroid lesion who was assessed by ultrasound guided fine needle aspiration cytology (US-FNAC) followed by thyroidectomy was identified.

- The final histopathology report of patients who had undergone thyroidectomy with their pre-operative US-FNAC retrieved from the institutional data base.
- The correlation between ultrasound guided fine needle aspiration cytology and final histopathology was studied to determine the accuracy with which US-FNAC diagnosed thyroid disorders.

RESULTS AND OBSERVATIONS

Data regarding 75 patients who had undergone US-FNAC of the thyroid nodules followed by thyroidectomy were retrospectively analyzed. The following observations were made in the study.

Table-1: Distribution Of Participants According To Their Few Baseline Characteristics. (N=75)

Age (year) [mean +/- SD]	36 ±11
Men (%)	12 (16.0)
Women (%)	63 (84.0)
Male :Female	1:5.25
Solitary nodule (%)	72 (96.0)
Multinodular goiter (%)	03 (4.0)

Analysis revealed that there were 12 (16.0%) men and 63 (84.0%) women participated in the study with age ranging from 17 to 61 years. The mean age was 36 years with male to female ratio of 1:5.25. (Table 1)

Table-2: Distribution Of Study Subjects As Per Thyroid Lesions Based On Cytological Study. (N=75)

Thyroid Lesions	No. of Patients	Percentage
Non-neoplastic	45	60
Neoplastic	30	40
Total	75	100

It was reflected from the analysis of collected data that 60% patients had non-neoplastic lesions (colloid goiter, multinodular goiter, and adenomatoid goiter) and 30 (40%) had neoplastic lesions on cytological examination. (Table 2)

Table-3 : Distribution Of Respondents According To US-FNAC Report Of Non-neoplastic Lesions

Cytological report	No. of patients	Percentage
Colloid goiter	27	60.00
Multinodular goiter	03	06.66
Adenomatoid goiter	15	33.33
Total	45	100

Colloid goiter constituted the majority (60%) in the non-neoplastic category.

Table-4 : Distribution Of Respondents According To US-FNAC Report Of Neoplastic Lesions

Cytological report	No. of patients	Percentage
Papillary carcinoma	25	83.33
Follicular neoplasm	03	10.00
Medullary carcinoma	01	03.33
Hurthle cell neoplasm	01	03.33
Total	30	100

Table-4 indicates that papillary carcinoma was the commonest (83.33%) cytological diagnosis in the neoplastic group.

Table-5: Correlation Of US-FNAC With Histopathology (HPE) Report For Non- Neoplastic Nodules

Cytological report	Histopathological findings				
	Colloid goiter	Adenom atoid goiter	MNG	Papilla ry CA	Hashimoto's thyroidities

Colloid goiter (n=27)	24	-	-	02	01
MNG (n=3)	-	-	03	-	-
Adenomatoid goiter (n=15)	-	14	01	-	-

On comparing the US-FNAC reports of the 45 non-neoplastic nodules with the final histological diagnosis, it was observed that 41 patients had same cytological diagnosis, 2 had papillary carcinoma (false negative), 1 had Hashimoto's thyroiditis and 1 had multinodular goiter (MNG) [Table 5]

Table-6: Correlation Of US-FNAC With Histopathology (HPE) Report For Neoplastic Lesion

Cytological report	Histopathological report				
	Papillary CA	Follicular adenoma	Med ular y CA	Hashimoto's thyroidities	MNG
Papillary CA (n=25)	24	-	-	-	01
Follicular neoplasm (n=3)	-	03	-	-	-
Medullary CA (n=1)	-	-	01	-	-
Hurthle cell neoplasm (n=1)	-	-	-	01	-

The US-FNAC results for the 30 neoplastic lesions were compared with the corresponding histological diagnoses. 1 patient had medullary carcinoma confirmed by histological study and Out of 25 cases of papillary carcinoma, 24 patients had papillary carcinoma confirmed by histological study and 1 had MNG (false positive). Out of 3 cases of follicular neoplasm, 3 were confirmed as follicular adenoma. One patient diagnosed as Hurthle cell neoplasm by US-FNAC turned out to be Hashimoto's thyroiditis on final histological study (false positive). (Table 6)

Table- 7 : Comparison Of US-FNAC With Histopathological Diagnosis For Neoplasm

US-FNAC (neoplasm)	Histopathology (neoplasm)		Total
	Positive	Negative	
Positive	28	02	30
Negative	02	43	45
Total	30	45	75

True positives:28 False positives:2
False Negatives:2 True Negatives:43

False positive and false negative were found to be 6.67% and 4.44%, respectively.

Table-8 : Statistical Parameters For US-FNAC Diagnosis Of Neoplastic Lesions

Parameters	Value
Sensitivity	93.33
Specificity	95.55
Positive predictive value	93.33
Negative predictive value	95.55
Diagnostic accuracy	94.66

The sensitivity and specificity of US-FNAC for diagnosing neoplastic lesions were 93.33% and 95.55% respectively. The diagnostic accuracy was 94.66%, positive predictive value (PPV) was 93.33% and negative predictive value (NPV) 95.55%. (Table 7 and Table 8)

Table-9: Comparison Of US-FNAC With Histopathological Diagnosis For Non-neoplastic Nodule

US-FNAC (non-neoplastic)	Histopathology (non-neoplastic)		Total
	Positive	Negative	
Positive	41	04	45

Negative	02	28	30
Total	43	32	75

True positives: 41 False positives: 4
False Negatives: 2 True Negatives: 28

False positivity and false negativity rate were estimated to be 4.65% and 12.50%.

Table-10: Statistical Parameters For US-FNAC Diagnosis Of Non-neoplastic Lesions

Parameters	Value
Sensitivity	95.34
Specificity	87.50
Positive predictive value	91.11
Negative predictive value	93.33
Diagnostic accuracy	92.00

The sensitivity and specificity of US-FNAC for diagnosing non-neoplastic nodule were 95.34% and 87.5% respectively. The diagnostic accuracy was 92%, positive predictive value (PPV) was 91.11% and negative predictive value (NPV) 93.33%. (Table 9 and Table 10)

DISCUSSION

FNAC is considered as the gold standard in the evaluation of thyroid nodules. Major problems associated with free hand FNAC are significant false negatives (missed neoplasms) and difficulties in accurate identification of follicular lesions leading to wrong FNAC diagnoses [21].

Result in the present study showed a sensitivity and specificity of US-FNAC for diagnosing neoplastic lesions as 93.33% and 95.55% respectively, PPV 93.33%, NPV 95.55% and the diagnostic accuracy was 94.66%. And results shown a sensitivity and specificity of US-FNAC for diagnosing non neoplastic nodules as 95.34% and 87.5% respectively, PPV 91.11%, NPV 93.33% and the diagnostic accuracy was 92%.

A recent review of studies that evaluated the role of US-FNAC in the detection of thyroid cancer revealed a sensitivity of 76%-98%, specificity of 71%-100%, false negative rate of 0%-5%, false positive rate of 0%-5.7%, and overall accuracy of 69%-97% [55-65]. Another report based on a systematic review of 12 studies had shown a median sensitivity and specificity of 88% and 90.5% [22]. A large prospective cohort study had reported a marked increase in the diagnostic accuracy of FNAC from 85% to 95% when FNAC was combined with US guidance [23].

In my analysis, there were two patients who had cytological picture of colloid goiter whereas the histological study showed papillary carcinoma (false negative-4.44%). The accuracy of FNAC depends crucially on the technique, operator performing the aspiration and the cytopathologist analysing it. Even under optimal conditions, the false negative rate for thyroid neoplasms can vary from 1% to 6% due to wrong diagnosis or sampling errors [24]. Danese et al in their study have observed the false negative rate much lower for US-FNAC when compared with free hand FNAC [25].

The majority of thyroid FNAC is now performed under US guidance and this has become mandatory at some of the centers. The major benefit of this technique is accurate sampling of small or multiple nodules [26-28]. Certain sonologic features of thyroid lesions are predictive of malignancy and hence such lesions can be accurately biopsied [29].

CONCLUSION

It is evident that US-FNAC greatly facilitates the precise and adequate sampling of tissues from thyroid lesions thus enabling the cytopathologists to make an accurate diagnosis. This may lead to the elimination of cost and potential morbidity of unnecessary thyroidectomy.

Ultrasound guidance helps in the selection of the most suspicious focus within the nodule especially with a background of multinodularity.

It is therefore desirable that practice guidelines recommend universal use of ultrasound guided FNAC for all nodular thyroid lesions, for small or nonpalpable nodules and multinodular goiters. US-FNAC is the most accurate and cost effective method for diagnostic evaluation of thyroid nodules.

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