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Correlation of Ultrasound Guided (USG) Fine Needle Aspiration Cytology (FNAC) With Postoperative Histopathology in the Diagnosis of Thyroid Swelling

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Abstract **Original Research Article**

Background: Thyroid swelling is a common problem in Bangladesh. Early and systematic evaluation of a nodular thyroid swelling is necessary as it is a frequent presentation of thyroid neoplasia. USG Guided Fine needle aspiration cytology (FNAC) is one of the diagnostic tools for early evaluation of thyroid nodules. USG Guided FNAC is considered as a cost-effective, simple, minimally invasive and easily repeatable procedure for preoperative screening in the diagnosis for most of the thyroid lesions. The objective of this study is to determine the sensitivity and specificity of USG Guided fine needle aspiration cytology (FNAC) and compare the efficacy with histopathology in diagnosis of thyroid swellings. ***Objective:*** To evaluate the sensitivity and specificity of USG Guided fine needle aspiration cytology (FNAC) and histopathology for the diagnosis of thyroid swelling. ***Method:*** This Observational Prospective Study was performed in the department of Otolaryngology & Head Neck Surgery, Dhaka Medical College Hospital. Dhaka over 6 month's duration from January 2019-June 2019. Total 50 patients with thyroid swelling was selected after taking informed written consent and fulfilling the inclusion criteria. Smears was taken by standard procedure and then was stained with papanicolaou stain and haematoxylin and eosine stain. The smears was classified into categories like benign, indeterminate, malignant and unsatisfactory. Sensitivity, specificity, positive and negative predictive value and accuracy of USG Guided FNAC was calculated and compared to already available data. Appropriate statistical analysis was done to make comparison between final histopathological findings with initial USG Guided FNAC findings. ***Result:*** During the study period a total 73 were found eligible for USG Guided FNAC. Most of the patients (52%) were from 20-39 years age group. Among them 67.12% were female and rest (32.87%) were male. In this government hospital 75.34% were from low income group. According to the findings of USG Guided FNAC nearly half (43.83%) of the patient had Multinodular goiter, Followed by colloid goiter (16.43%). Only 18(24.66%) Patients had carcinoma. From histopathological diagnosis, 55 patient had benign lesion and 18 patients had carcinoma. So the efficacy of USG Guided FNAC of diagnostic tool of solitary thyroid nodule where the sensitivity, specificity, PPV, NPV, PLR, NLR of USG Guided FNAC were 94.73%, 100%, 100%, 98.18%, 0 and 0.052 respectively. ***Conclusion:*** This study revealed that this minimal invasive procedure USG Guided (FNAC) had the highest level of specificity which is 100%. The hypothesis of the study was that USG Guided FNAC is the most useful preoperative diagnostic tool in thyroid swelling diagnosis. In this study sensitivity of USG Guided FNAC was found to be 94.73%. Thus we can suggest that in maximum cases the diagnosis is accurate.

Keywords: Swelling, USG Guided FNAC, Histopatholgy, Benign, Malignant.

INTRODUCTION

Thyroid Swelling is defined as any kind of abnormal growth that causes mass in thyroid, [1] which is more common in aged women, people with iodine deficiency, people with radiation contact and in the people with family history of thyroid disease [2]. Diet containing goitrogenic material also increases the risk of formation of thyroid Swelling [3].

Prevalence of thyroid Swelling is 4% to 7% of the adult population [4]. However fewer than 5% of adult thyroid Swellings are malignant [5].

The highest prevalence of thyroid Swelling in Bangladesh is in the district of Jamalpur & Rangpur; the range varies from 21-30% [6] Nodular thyroid disease is more prevalent than diffuse goiter. In s report from thyroid clinic, BSMMU, Dhaka, 32.67% of all thyroid patients had solitary Swellings [6].

The usual presentation of thyroid disease is - swelling, pressure symptoms or signs of toxicity [7]. In presence of malignancy and invasion to neighbouring organs like trachea, larynx, oesophagus, recurrent laryngeal nerve, pain symptoms at inferior and anterior neck region cough or dyspnea, dysphasia or odynophagia are found [8].

However fewer than 5% of adult thyroid are malignant [9]. But several clinical criteria might provide a clue to the nature of thyroid Swelling. Solitary Swelling, in general, are more likely to be neoplastic than are multiple Swellings; Swellings in younger patients are more likely to be neoplastic than are those in older patents; Swelling in males are more likely to be neoplastic than are those in families; A history of radiation treatment to the head and neck region is associated with an increased incidence of thyroid malignancy, nodules that take up radioactive iodine in imaging students (hot nodules) are more likely to be benign than malignant.

The vast majority of these Nodules are non-neoplastic lesions or benign neoplastic. It is preferred to operate only on those patients with suspicion of cancer, thereby avoiding unnecessary surgery and possible injury to the recurrent laryngeal nerve, hypo-parathyroidism and thyroid hormone dependence in patients with benign thyroid nodule. However the distinction of these benign lesions from a malignant nodule can't be based reliably on the clinical presentation alone [10-12].

Presently available tools to know the nature of thyroid Nodule are thyroid function tests, thyroid antibody titers, isotope scans, ultrasonography and FNAC [13]. USG Guided FNAC is an integral part of selected patient management but comprises only part of overall evaluation [14].

The radio-nucleotide scan and ultrasound examination were used to evaluate thyroid nodule but those were only suggestive of malignancy and not diagnostic. Finally the performance of USG Guided FNAC test with such here needles made the procedure acceptable [15].

USG Guided FNAC has the ability to determine the nature of the lesion preoperatively and is considered as the "gold standard" diagnostic test for the evaluation of thyroid nodule [16,17].

Moreover USG Guided FNAC has some other advantages which are summed up in the acronym SAFE i.e. it is Simple, Accurate, Fast, Economic and indeed safe, performed on an outpatient. This technique has the best safety record for a histopathology diagnosis. In contrast surgical biopsy has potential risks associated with anesthesia and surgery, alone with the additional time required for healing [18].

There are few limitations of this method. It is very difficult to diagnose various types of thyroid pathology with USG Guided FNAC. The problems of interpretation are largely due to the small amount of cellular material available for examination and the loss result of aspiration [19].

For this reason USG Guided FNAC has now became the prime investigation in the assessment of the patient with a thyroid Nodule and is employed routinely. It is capable of providing critical information which is obtainable by any other investigations short of surgical resection. The availability of FNAC has eliminated the requirement for isotope scanning and ultrasonography. There are substantial financial savings. USG Guided FNAC is a minimally invasive procedure for preoperative assessment of patients with a thyroid swelling.

USG Guided FNAC has high sensitivity in picking up malignancy in thyroid and also has high diagnostic accuracy in the evaluation of other thyroid lesions. The present study was aimed to compare USG Guided FNAC with histopathology in thyroid nodule diagnosis.

OBJECTIVE

To evaluate the sensitivity and specificity of USG Guided fine needle aspiration cytology (FNAC) and histopathology for the diagnosis of thyroid nodule.

MATERIALS AND METHODS

This Observational Prospective Study was performed in the department of Otolaryngology & Head Neck Surgery, Dhaka Medical College Hospital. Dhaka over 6 months duration from January 2019-June 2019. Random sampling method was followed. Total 73 patients with thyroid swelling was selected after taking informed written consent and fulfilling the inclusion criteria. Smears was taken by standard procedure and then was stained with papanicolaou stain and haematoxylin and eosine stain. The smears was classified into categories like benign, indeterminate, malignant and unsatisfactory. Sensitivity, specificity, positive and negative predictive value and accuracy of USG Guided FNAC was calculated and compared to already available data. Appropriate statistical analysis was done to make comparison between final histopathological findings with initial USG Guided FNAC findings. After

compilation of data they were arranged and presented in simple ways in tablets, graphs and figures. Data were analyzed with help of SPSS-22 for windows.

Ethical Issues

- Ethical clearance for the study was taken from the institutional Review Board and concerned authority of DMCH.
- Permission for the study was taken from the concerned department from where we have collected our study subjects.
- The entire study subjects were thoroughly about the nature, purpose and implications of the study, as well as entire spectrum of benefits and risks of the study.
- Interests of the subjects were not compromised to safeguard their rights and health.
- All study subjects were assured of adequate treatment of any complication developed in relation to the study purpose.
- Subjects were assured about their confidentiality and freedom to withdrawn them from the study anytime.
- Written consent of all the study were free of duress and without exploiting any weakness of the subjects.

Study Procedure

- Pre tested questionnaire will be filled up based on the history given.
- Clinical examination of patient.
- Thyroid profile
- Routine investigations
- Ultrasound of the neck.
- Fine needle aspiration cytology with hypodermic needle of 21-24 gauge in department of Pathology, Dhaka Medical College, Dhaka.
- Indirect laryngoscopy will be done to rule out a symptomatic paralysis of vocal cords & also for medico legal purpose.
- Surgery and collection of specimen will be conducted at the Department of ENT and Head-Neck Surgery, Dhaka Medical College Hospital, Dhaka as per the diagnosis made.
- Histopathology of resected specimen at the Department of Pathology, Dhaka Medical College, Dhaka.
- USG Guided FNAC will be compared with post operative histopathology to determine the accuracy.
- Age sex distribution, symptomatology.

RESULTS

Table- 1 shows that out of 73 patients 28.76 % patients were from 30-39 years age group whereas 23.28 % were from 20-29 years age group. 19 - 65 years with a mean of 35.36 ± 11.86.

Table-1: Distribution of patients according to age (n=73)

Age group (in years)	Frequency (%)
< 20	12 (16.43 %)
20-29	17 (23.28 %)
30-39	21 (28.76 %)
40-49	14 (19.17 %)
50-59	5 (6.84 %)
≥ 60	4 (5.47%)
Mean age (in year)	35.36 ± 11.86
Age range (in years)	19-65

Figure-1: Shows that out of 73 patients 49(67.12%) were female and rest 24(32.87%) were male. The male to female ratio was 1:2.04.

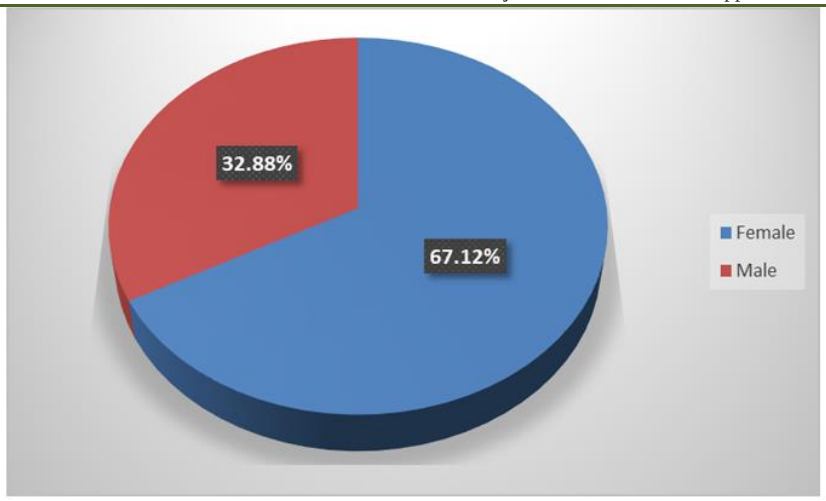

Figure-1: Distribution of patients according to sex (n=73)

Table-2 shows the overall cytology of the sample population. Nearly half (43.83%) of the patients had Multinodular goiter, Followed by colloid goiter (16.43%). Only 18 patients (24.66%) were diagnosed as carcinoma.

Table –2: Distribution of patients according to FNAC diagnosis (n=73)

FNAC diagnosis (n=73)	Frequency (%)
Multinodular goiter	32 (43.83%)
Colloid goiter	12 (16.43)
Colloid cyst	2 (2.74%)
Hashimoto's thyroiditis	
With MNG	2 (2.74%)
Without MNG2	2 (2.74%)
Follicular adenoma	5 (6.85%)
Follicular variant of papillary carcinoma	7 (9.59%)
Papillary Carcinoma	11 (15.07%)

Table-3: shows that out of 55 benign finding of USG Guided FNAC only 1 was turned into malignancy after histopathology, otherwise all results of USG Guided FNAC were accurate as like as histo-diagnosis.

Table-3: Relationship of USG Guided FNAC and histopathological diagnosis (n=73)

Diagnosis	USG Guided FNAC finding (n=73)	Histopathology diagnosis	
		Benign	Malignant
Benign	55	54	1
Malignant	18	00	18
Total	73	54	19

Table 4 shows the efficacy of USG Guided FNAC of the diagnostic tool of solitary thyroid nodules where the sensitivity, specificity, PPV, NPV, PLR, NLR of FNAC were 94.73%, 100%, 100%, 98.18%, 0 and 0.052 respectively.

Table-4: Distribution of efficacy of USG Guided FNAC (n=73)

		Malignancy	Non- malignant	Total
FNAC	Malignancy	18 (True positive)	0 (False positive)	18
	Non- malignant	1 (False negative)	54 (True negative)	55
Total		19	54	73`

Here non-malignant cases includes benign, suspicious etc.

$$\text{Sensitivity of USG Guided FNAC} = \frac{\text{True Positive}}{\text{True Positive} + \text{False Negative}} \times 100$$

$$= \frac{18}{18+1} \times 100$$
$$= 94.73\%$$

$$\text{Specificity of USG Guided FNAC} = \frac{\text{True Negative}}{\text{True Negative} + \text{False Positive}} \times 100$$

$$= \frac{54}{54+0} \times 100$$
$$= 100\%$$

$$\text{Positive predictive value} = \frac{\text{True Positive}}{\text{True Positive} + \text{False positive}} \times 100$$

$$\text{(PPV) of USG Guided FNAC} = \frac{18}{18+0} \times 100$$
$$= 100$$

$$\text{Negative predictive value of (NPV)} = \frac{54}{54+1} \times 100$$
$$= 98.18$$

$$\text{Positive likelihood ratio} = \frac{\text{sensitivity}}{100 - \text{Specificity}}$$

$$\text{(PLR) of USG Guided FNAC} = \frac{94.73}{100-100} \times 100$$
$$= 0$$

$$\text{Negative likelihood ratio} = \frac{100 - \text{Sencitvity}}{\text{Specificity}}$$

$$\text{(NLR) of USG Guided FNAC} = \frac{100-94.73}{100} \times 100$$
$$= 0.052$$

DISCUSSION

Thyroid swellings are common entities that a thyroid surgeon must evaluate. Swellings are found through physical examination, or incidentally through imaging modalities performed for other reasons. The majority of thyroid swellings are benign, but they warrant surgical excision when they are large enough to be symptomatic or if there is concern for malignancy. Ultrasound is the primary study by which the thyroid gland is imaged.

USG Guided Fine needle aspiration cytology is regarded as the gold standard initial investigation in the diagnosis of thyroid swellings [46]. The technique is safe simple and quick with a low complication rate and helps to select people preoperatively for surgery. Carcinoma of the thyroid is the most common malignancy of endocrine system comprises 0.6% and 1.6% of all cases of malignant neoplasm in men and women respectively.

In the present study, the patients ranged from 19 - 65 years with a mean of 35.36 ± 11.86 years. This age range and mean incidence is slightly lower as compared with previous studies [47]. We found that majority of patients in our study (48%) were in their third to fourth decade of life while in the study by Dorairajan and Jayashree 44% were in the third decade of life [45]. In this study, out of 73 patients 49(67.13%) were female and rest 24(32.87%) were male. The male to female ratio was 1:2.04. Another study by Md. Shafiqul Islam, [6] most of the patients were between 21 to 40 years age group (60%). Mean age 37.70, (SD±10.05) years. Lower limit of age was 18 years and the highest age was 60 years. Twenty six (28.88%) male and sixty four (71.12%) female. Representing Male: Female 1:2.46 [6]. So, the previous study results agreed with our study.

In a similar study at Bihar, USG Guided FNAC was done in 178 patients with thyroid swelling and they found colloid goitre in 75.84% cases, and Thyroiditis in 8.43% cases [48]. whereas in our study multinodular &

colloid goiter was found in 60.265 and 5.5% respectively which is nearly similar to their finding.

In a another study of USG Guided FNAC finding of thyroid swelling in a large study group over 5 years shows that, Malignancy was found only in 128 cases out of 1488 cases, that is 7.8%. In our study we found 24.66% malignancy – which is much higher than their findings.

The sensitivity of USG Guided FNAC in our study was 94.73% while the specificity was 100% as all malignancies reported of USG Guided FNAC were confirmed by final histopathological evaluation. The sensitivity and specificity of USG Guided FNAC were 71.43% and 100% respectively according to Alta villa *et al.,* [49] 78% and 100% respectively according to Al-rikabi *et al.,* [50] 98% and 99% according to Goellner *et al.,* [51].

In previous study, Chin-En Tseng *et al.,* showed sensitivity is 81%, specificity is 98.7%, positive predictive value is 94.4%, negative predictive value is 95%. In our study sensitivity is 94.73%, specificity is 100%, negative predictive value is 98.18% thus the result of that previous study is slightly lower as compared to our study.

In another previous study, Gupta *et al.,* stated that sensitivity specificity, accuracy, false positive rate, false negative rate, positive predictive value, and negative predictive value of USG Guided FNAC to be 80%, 95%, 92%, 5%, 205, 80%, and 95% respectively. But, in our study sensitivity is 94.73%, specificity is 100%, positive predictive value is 100%, negative predictive value is 98.18% thus the result of that previous study is also slightly lower as compared to our study.

In previous study, in the journal of Egyptian national cancer institute Sharma *et al.,* showed sensitivity is 49.5%, specificity is 96% which slightly lower than our study as previously mentioned; positively predictive value is 84,6% which is slightly lower than our study as previously mentioned; negative predictive is 98.6% that is similar to study.

In previous study, Al-Rakabi *et al.,* showed sensitivity is 78.1%, negative predictive value is 93% which slightly lower than our study; specificity and positive predictive value is 100% that is the similar study.

Various Factors contribute to this wide range of sensitivity and specificity. It depends on the adequacy of samples, technique of sample collection, and the experience of the pathologist interpreting the smears, presence of overlapping cytological findings between some benign and malignant thyroid lesions. USG Guided FNAC has an overall accuracy rate of around 90-100% in the detection of thyroid malignancy [52].

Accuracy of USG Guided FNAC was 99% in our study, wherever in various other studies it varied from 79% to 98%, depending on the experience of the person performing USG Guided FNAC and the experience of the cytologist interpreting the cytology findings [49].

CONCLUSION

The study tried to find out the accuracy of USG Guided the Needle Aspiration Cytology (FNAC) in thyroid swelling diagnosis. The study revealed that this minimal invasive procedure had the highest level of specificity which is 100%. The hypothesis of the study was that USG Guided FNAC is the most useful preoperative diagnostic tool in thyroid swelling diagnosis. In this study sensitivity of USG Guided FNAC was found to be 94.73%. Thus we can suggest that in maximum cases the diagnosis is accurate. From the above discussion we can assumed that USG Guided FNAC is the most useful preoperative diagnostic tool for thyroid swelling diagnosis.

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