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FNAC OF THYROID NODULE;
DIAGNOSTIC ACCURACY OF FINE NEEDLE ASPIRATION CYTOLOGY (FNAC)

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ABSTRACT... Introduction: Clinically, solitary thyroid nodules are common, being present in up to 50% of the elderly population. The majority are benign with thyroid cancer representing an uncommon clinical problem. If euthyroid, then fine needle biopsy provides direct specific information about the cytology of the nodule from which the histology can be inferred. **Objectives:** To determine the accuracy of fine needle aspiration cytology (FNAC) in the diagnosis of solitary thyroid nodule and to avoid unnecessary surgery. **Material and Method: Setting:** This study was conducted in the Department of Surgery, Sheikh Zayed Medical College/ hospital Rahim Yar Khan. **Duration of Study:** September 2008 to August 2009 (one year). **Sample Size:** Fifty patients were included in the study. **Study design:** Prospective analytical study. **Results:** The results obtained were compared with histopathology and efficacy of FNAC was checked by calculating sensitivity, specificity, positive predictive value and negative predictive value. Out of 50 cases, FNAC showed 43 cases as benign and 7 cases as malignant lesions, while histopathological examination revealed 42 benign and 8 malignant lesions. FNAC was able to correctly pick 41 benign lesions, while 2 cases of benign lesion turned out to be malignant on histopathology (False negative).Out of total 8 cases which turned out to be malignant on histopathology, FNAC was able to pick 6 cases, while one benign lesion was misdiagnosed as malignant (false positive). The analysis of study showed a sensitivity of 75% and specificity 97.6% of FNAC in detecting malignancy in solitary thyroid nodule. **Conclusions:** This study concluded that FNAC is highly effective in detecting thyroid malignancy in solitary thyroid nodule with a sensitivity of 75% and specificity of 97.6%.

Key words: Fine needle aspiration cytology, Solitary thyroid nodule, Biopsy.

INTRODUCTION

FNAC is a safe, sensitive and specific technique in the initial evaluation of thyroid nodules. A correct cytological diagnosis can be achieved in a majority of cases, thus obviating the need for a second surgical intervention[1].

Clinically, solitary thyroid nodules are common, being present in up to 50% of the elderly population. The majority are benign with thyroid cancer representing an uncommon clinical problem. If euthyroid, then fine needle biopsy provides direct specific information about the cytology of the nodule from which the histology can be inferred[2].

FNAC as a procedure has a central role in the management of thyroid swellings and is recommended as an excellent screening test for thyroid swellings[3].

The majority of solitary thyroid nodules are benign; the incidence of malignancy being only 5-20% of surgically excised thyroid nodules on histopathology. In the management of solitary thyroid nodule, the primary challenge is to separate benign nodules (the majority) from malignant lesions (the minority). About 50% clinically apparent solitary thyroid nodules turn out to be dominant nodule of multi-nodular goiter. Solitary toxic nodules accounts for 4-7% of all solitary thyroid nodules.

Percentage of malignancy is rare in hot nodules. Overall incidence of malignant hot nodules is 0.2%[4].

Percentage of solitary thyroid nodule increased linearly with age along with increased prevalence of malignancy in third, fourth and fifth decades of life. Thyroid tumors are more prevalent in females and papillary carcinoma is the most common histological type of thyroid tumors followed by follicular carcinoma, medullary carcinoma, anaplastic carcinoma, non Hodgkin's lymphoma and unclassified tumors in order of frequency[5].

A major advance in the diagnosis of thyroid nodule has been achieved with the perfection and common use of fine needle aspiration cytology which can obviate a lot of unnecessary surgery in thyroid lesions[6,7].

Fine needle aspiration cytology is now believed to be most effective method available for distinguishing between benign and malignant thyroid nodules. It is recommended when suspicion of cancer is very high because fore knowledge of cancer cell type aids in the planning of surgical procedure[8].

FNAC is easily performed, accepted by the patients and has low cost benefit ratio. If the sample is not diagnostic, it can be easily repeated[9]. Moreover fine needle aspiration cytology is also safe and highly accurate in the evaluation of thyroid nodules in childhood[10].

The main purpose of this study was to know the results of FNAC in evaluating the solitary thyroid nodule in Sheikh Zayed Hospital Rahim Yar Khan where cytopathological and histopathological examination was done by consultant histopathologist in a relatively newly established pathology department. The main idea was to avoid missing malignant nodules and to be more conservative in selecting patients with solitary thyroid nodules for surgical treatment.

AIMS AND OBJECTIVES

1. To determine the accuracy of fine needle aspiration cytology (FNAC) in the diagnosis of thyroid nodule.
2. To avoid unnecessary surgery.

HYPOTHESIS

This study is based on the hypothesis that “fine needle aspiration cytology is highly sensitive and specific in detecting thyroid malignancies in solitary thyroid nodules and can be used as sole investigation for deciding management protocol in solitary thyroid nodule”.

MATERIAL AND METHODS

Study Setting

This study was conducted in the department of surgery, Sheikh Zayed Medical College /hospital, Rahim Yar Khan which is a tertiary care 1300 bedded hospital.

Duration of Study

One year from September 2008 to August 2009.

Sample Size

Fifty patients were included in the study.

Study Design

Prospective analytical study.

Inclusion Criteria

- Patients admitted through outpatient department having solitary thyroid swelling.
- Both sexes and all ages were included.

Exclusion Criteria

- Patients having multi nodular or diffuse thyroid disease.
- Patients having associated medical illness e.g. hypertension, hepatic or renal failure.

DATA COLLECTION PROCEDURE

All patients presenting in surgical OPD with thyroid swellings were properly scrutinized for solitary thyroid nodule. After detailed history and examination, a comprehensive Performa was completed. (See annex 1)

Then FNAC was performed after proper patient counseling and with closed collaboration of consultant histopathologist according to following technique.

Skin was cleaned with antiseptic solution. After careful palpation, nodule was stabilized with one hand and 22 gauge needle mounted on 20 cc sterilized plastic syringe was inserted into the mass. Local anesthesia was not necessary. When the tip of the needle was in the centre of the lesion to be sampled, suction was applied to the

syringe and tip of needle was moved within the mass. The suction on the syringe was then released and needle removed from the mass. After the needle was removed from the lesion, the syringe was detached and filled with air and reattached with needle, using the air to express small specimen on slide. A second glass slide was dipped in 95 percent alcohol solution and wet slide was place on the top of the specimen on the first slide and with slight pressure the two slides were pulled apart. The alcohol in 2nd slide assists in both spreading the specimen and fixing it. Both slides were immersed in alcohol solution. Then Slides were stained according to the guidelines of papanicoloau society[11].

DATA ANALYSIS

Demographic data, symptoms, examination and investigation variables were described by simple statistical manners, e.g. mean, S.D, operational variables were described by percentages.

STATISTICAL ANALYSIS

Diagnostic value of the fine needle aspiration cytology was checked by calculating the sensitivity, specificity, positive predictive value, negative predictive value and by calculating the percentage of false positive and false negative results (Annex-II).

The histopathology of the biopsy was taken as gold standard and the results of fine needle aspiration cytology, which were matching with the histopathology, were taken as positive cases. Analysis was done 2 x 2 tables for sensitivity and specificity. Kappa statistic is used to measure the agreement between FNAC and histopathology results by statistical analysis software SPSS version 17.0 P-values less than or equal to 0.05 consider significant.

RESULTS

In this study of 50 cases there were 36 females and 14 males. Age range was 15 to 66 years and mean age and standard deviation of 37.64±13.19 years. Majority of patients belonged to 15-45 years age group.

Painless swelling in the neck (60%) was the commonest complaint and patients presented due to cosmetic reason. Another common presentation was cancer phobia (34%) due to better awareness (Table-I).

(Table-II) showed the sites of solitary thyroid nodule. In most of cases it was the right lobe (52%).

FNAC results are shown in table-III. On histopathology majority of cases turned out to be nodular goiter. Out of malignant lesions papillary carcinoma was most common. (Table-IV).

(Table-V) showed interpretation errors of FNAC. Two cases were false negative and one case was false positive.

Table-VI gives summery of results of 50 cases of FNAC with histopathology. It showed a sensitivity of 75% and specificity 97.6% of FNAC in detecting malignancy in solitary thyroid nodule.

There is satisfactory strong agreement between the results of FNAC with histopathology (Kappa = 0.765, $p<0.001$) shown in (table-VII).

Majority of patients under went surgery, lobectomy was done in 42 (84%) patients, subtotal thyroidectomy in 4(8%) patients, total thyroidectomy in 2(4%) cases and excision was done in 2(4%) cases (Table-VIII). Few complications were noted after surgery, ARI in 5(10%) patients, RTI, seroma of wound and hyperparathyroidism in 2(4%) patients and subcutaneous haemotoma was seen in 1(2%) patient each (Table-IX).

DISCUSSION

The utility of diagnostic procedures mainly depends on three foundations, sensitivity, specificity and practical success. Sensitivity means ability of a procedure to detect disease when it is present. Specificity means the ability of the procedure to rule out the disease when not present. While fraction success includes the production of satisfactory material enough for diagnosis, ease in carrying out the procedure, patient acceptability and cost.

This study was carried out to evaluate the usefulness of FNAC in detecting malignancy in solitary thyroid nodule.

Table-I. Symptoms of solitary thyroid nodule (STN) (n=50)

Presenting complaints	No. of Patients	%age
Painless swelling and cosmetic	30	60%
Swelling and cancer phobia	17	34%
Swelling and obstructive symptoms	02	4%
Symptoms of hyperthyroidism	01	2%

Table-II. Sites of solitary thyroid nodule (STN) (n=50)

Presenting complaints	No. of Patients	%age
Isthmus	06	12%
Left lobe	18	36%
Right lobe	26	52%

Table-III. FNAC results (n=50)

Colloid goiter	20	40%
Follicular lesion	21	42%
Colloid cyst	03	6%
Subacute thyroiditis	02	4%
Papillary carcinoma	02	4%
Medullary carcinoma	01	2%
Lipoma	01	2%

Table-IV. Histopathology

Results	Frequency	%age
Colloid goiter	20	40%
Follicular adenoma	16	32%
Colloid cyst	02	4%
Subacute thyroiditis	02	4%
Nodular goiter	01	2%
Lipoma	01	2%
Follicular carcinoma	05	10%
Papillary carcinoma	03	6%

Table-V· Interpretation errors of FNAC

FNAC Diagnosis	Histological diagnosis	Interpretation
Thyroid cyst	Papillary carcinoma	False -Ve
Follicular lesion	Follicular carcinoma	False -Ve
Medullary carcinoma	Nodular goiter hyperplasia	False +Ve

Table-VI. Summery of 50 cases of FNAC with histopathological

Sensitivity	75%
Specificity	97.61%
Overall accuracy	94%
Positive predictive value	85.71%
Negative predictive value	95.34%
False positive rate	2.39%
False negative rate	25%
Percentage of carcinoma	12%

Table-VII. Histopathology

	Malignant (Disease)	Benign (Not Disease)	P-value
FNAC +ve	06	01	<0.001
FNAC +ve	02	41	

Kappa = 0.765

Table-VIII. Procedure done

Procedure	No. of Patients	%age
Excision	02	4%
Right lobectomy	25	50%
Left lobectomy	17	34%
Subtotal thyroidectomy	04	8%
Total thyroidectomy	02	4%

The results obtained from this study revealed that FNAC is highly useful in detecting thyroid malignancies in solitary thyroid nodules with sensitivity 75% and specificity 97.6%. When analyzed by 'Kappa test' there was statistically satisfactory strong agreement between FNAC and histopathology in detecting malignancy in solitary thyroid nodule (P vale <0.001).

The comparison with the previous studies showed similar results regarding the efficacy of FNAC in detecting malignancy in solitary thyroid nodule. In a study conducted by T Aravinthan on the use of fine needle aspiration cytology on thyroid lumps, sensitivity was 80.2% and specificity was 97.2%[12]. In another study FNAC of thyroid nodule is reported to have a sensitivity range from 65% to 98% and a specificity of 72% to 100%[13].

Out of 50 cases of STN in our study, FNAC was able to pick 41 cases of benign lesion correctly while 2 cases of benign lesion turned out to be malignant on histopathology. In a study conducted by Fernando in 2007 on 100 cases of STN revealed benign lesion in more than 90 cases, out of which colloid nodule was the most common pathology. Rest of the benign lesions was follicular adenoma, adenoma with cystic changes and sub acute thyroiditis[14]. So results were similar in both studies.

Most of the malignant lesions picked up by FNAC in our study were papillary carcinoma. In another study conducted in 2006 on 100 patients of STN revealed,11 cases of papillary carcinoma and one case of medullary carcinoma on FNAC which were proved by histopathology afterwards but most of the lesion which turned out to be follicular carcinoma on histopathology were not picked up by FNAC[15].

The type of operative procedure performed was based on the clinical manifestations and cytological report of FNAC. Out of different diagnostic parameters like clinical examination, ultrasound and thyroid function test, FNAC was found to be most simple, cost effective and reliable in differentiating between benign and malignant and type of malignant lesion in case of STN. So the combination of clinical examination and FNAC remains the mainstay in selecting patients for thyroid surgery[16].

The procedure was found to be simple as compared to other available means for establishing histological diagnosis. Little equipment and experience was needed for aspiration cytology. The only equipment needed was ordinary 20cc plastic syringe with 22 gauge needle. During this procedure little preparation was needed as compared to the open biopsy, where surgical instruments and suitable anesthesia is required.

In the present study no difficulty was found in localizing the site for aspiration and in majority first attempt was successful. Only in few cases second attempt was made to obtain the material. However, complications such as excessive bleeding or haematoma as reported by other workers were not found in this study[17].

In addition to be easy, this procedure was found to be time saving as well. Total time required for this entire procedure was 5 to 10 minutes and patient does not have to undergo preoperative investigations or hospitalization. Apart from that this procedure was found to be cost-effective and efficient method of differentiating benign and malignant nodules[18]. In this way hospital expenses, theater charges, anesthesia charges and medicine charges are saved.

As far as patients were concerned, there was no difficulty encountered in obtaining their consent. This procedure was well accepted because it did not require any hospitalization or psychological trauma. On the other hand the open biopsy needs a mental preparation, selection of surgeon and post operative complications. Hence all these render the procedure risky.

Another advantage of the procedure is that it can be done in patients unfit for general anesthesia. However the utility of FNAC depends on the skill of the person performing the procedure and on the experience of the cytopathologist[19].

Aspiration cytology is also valuable method for follow-up

of patients waiting or not willing for surgery. It is also useful in cancer patients to be treated by chemotherapy or radiotherapy. Aspiration cytology may be of great help in differentiating a recurrent carcinoma from inflammation, post operative haematoma and foreign body granuloma. Currently FNAC is viewed as the gold standard for diagnosis in most cases and it plays a crucial role in the selection of patients for surgery.

There are few complications and limitations of fine needle aspiration cytology. It has been suggested that tumor may grow along the needle tract. A search of literature has revealed that FNAC is both diagnostic and therapeutic in a cystic swelling and there is no evidence of spread of tumor through the skin track.[20].

The other limitations of fine needle aspiration cytology were errors of diagnosis in the form of false negative and false positive reporting of tumor, which can be overcome by improving the technique of aspiration and experience in interpretation.

CONCLUSIONS

This study showed that fine needle aspiration cytology is a valuable adjunct to the careful physical examination and evaluation of patients with solitary thyroid nodule. It enables clinician to obtain a diagnosis in high percentage of cases with minimal expenditure of time and money and often to avoid unnecessary surgery. It is safe, easy, fast, accurate and cost effective. It requires a minimal amount of practice to learn the aspiration technique and skill to interpret the cytological findings. FNAC is highly useful in detecting thyroid malignancies in solitary thyroid nodules with sensitivity 75% and specificity 97.6%. However, a close cooperation is mandatory between clinician and pathologist. It can provide valuable information and in most cases a correct diagnosis. We encourage our clinicians to embrace this investigative procedure in the management of solitary thyroid nodule patients.

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"Obstacles are those frightful things you see when you take your eyes off your goal."

Henry Ford (1863-1947)

ANNEXURE-I

Case No: _____ Date: _____

Patient's Name: _____

Age: _____ Sex: _____ Occupation: _____

Address: _____

Presenting complaints: _____

_____

Clinical findings: _____

_____

Investigations: _____

Thyroid Profile: _____ Thyroid Scan: _____

Ultrasound: _____

Chest X-ray: _____

FNAC: _____

Surgical Procedure: _____

Histopathology Report: _____

Complication: _____

Follow up

One month: _____ two months _____ three months_____

Remarks: _____

ANNEXURE-II

In this study there were;

True positive (TP)	=	06
True negative (TN)	=	41
False negative (FN)	=	02
False positive (FP)	=	01

Following analytic values were studied.

Sensitivity =

95% confidence interval = 35.58 - 95.56

Specificity =

95% confidence interval = 82.94 - 99.19

Overall accuracy =

Positive predictive value =

Negative predictive value =

False positive rate = 100% - specificity = 100-97.61 = 2.39%
False negative rate = 100% - sensitivity = 100-75 = 25%

Percentage of carcinoma =

=

Chi square = 0.07
P value = **0.678**

PREVIOUS RELATED STUDIES

Raza S, Saeed Z, Raza H, Ahmed M. FNAC in the management of solitary thyroid nodule. Professional Med J Dec 2006; 13(4): 596-603.