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ACCURACY OF FINE NEEDLE ASPIRATION CYTOLOGY AS PRIMITIVE DIAGNOSTIC TOOL IN LOCAL POPULATION OF PAKISTAN

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Abstract

Objective: To determine the diagnostic accuracy of fine needle aspiration cytology (FNAC) in thyroid neoplasm among patients with thyroid swelling in population of Pakistan.

Method: It was a retrospective study conducted in ENT and endocrinological department of JPMC Karachi and Khuzdar district between 1st august 2018 to 20th march 2019. The current study was performed to collect data for last five years. FNAC in all these patients was performed either by residents or consultants without local anesthesia, using a 23-gauge needle. Smears were immediately fixed with 95% ethyl alcohol solution, and staining was performed using Papanicolaou, Hemacolor, and Haematoxylin and Eosin (H and E) stain. The results were classified into four groups: inadequate, benign, suspicious, and malignant.

A pro-forma was used for data collection, including registration number, age, gender, FNAC opinion, FNAC category, biopsy number and histology opinion. Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) and diagnostic accuracy of FNAC were calculated using the standard formulae

Results: The overall evaluation of FNAC technique as primitive tool reflected the accuracy of method up to 87.7%, sensitivity 87.5% and specificity of 88% in local population of Pakistan. The presented study showed the safe use of FNAC with low rate of false negative results and few complicated cases.

Conclusion: FNAC helped to reduce the unnecessary surgery in the subjects with benign lesions and to produce better follow up investigations, therefore, improve the quality of life of the patients with thyroid lesions.

Keywords: Fine needle aspiration cytology (FNAC), specificity, sensitivity, accuracy, thyroid lesions.

INTRODUCTION

Thyroid nodule is one of the common problems all around the world in ear, nose and throat pathology. Many risk factors but particularly the extra exposure to different radiations may contribute the development of thyroid carcinoma (1). Although 5 % of the solitary nodule reported to be malignant but majority of thyroid nodules are malignant (2, 3). A number of tests is being employed to these cases such as scanning (isotopic), fine needle aspiration cytology (FNAC), FNAC combined with isotopic scanning and the most important histology of the specimen (4). The important role of isotopic scanning is to differentiate the cold or non-functioning nodule from the functioning or hot one. It can be technetium Tc99m pertechnetate or iodine 123 isotopic scanning (1).

FNAC is one of the most sensitive, accurate as well as cost effective with high percentile of specificity techniques being commonly used as the investigation tool. The use of FNAC based information is helpful in pre-operative decisions by the surgeons but it still has some limitations particularly in the differentiation between follicular adenoma and carcinoma (2, 5). In spite of its limitations, FNAC technique is the most commonly used and best technique (with scan) for preoperative diagnosis. Its result is compared with the biopsy/histopathological findings to confirm its sensitivity and accuracy (6). FNAC is helpful in primary management of the thyroid cancer, therefore, commonly being applied in Pakistan just like other countries of the world (7).



The objective of the presented study is to evaluate the diagnostic specificity, sensitivity and accuracy of pre-operative FNAC by comparing to the post-operative histopathology in local population of Pakistan.

METHODS

It was retrospective study conducted in departments of endocrinology and ear, nose and throat department in tertiary care hospitals of Karachi (Jinnah Postgraduate Medical center) and Khuzdar and data of last five years was collected during 1st march 2018 to 20th September, 2019 and in both hospitals of Karachi and Khuzdar (Government Hospital Khuzdar), patients from different ethnic groups from different parts of Pakistan were admitted.

In the presented study, n=217 patients were enrolled using Dr. Lin Naing based (2x2 table), taking sensitivity 95.2% and margin of error 10% (8- 10).

Patients between 15 years to 60 years of age, patients present with thyroid swelling for ≥ 3 months, assessed by history were included in the study. Thyroid nodule of 1-2cm with only euthyroid functions of either gender was also included.

Serious underlying medical conditions that restrict diagnostic testing or therapy such as renal failure (GFR < 30 ml/min), congestive cardiac failure (EF $\leq 25\%$) or active coexisting non-thyroid carcinoma, assessed by history & clinically. Patients who have suspicious ultrasonographic features such as microcalcifications, marked hypoechogenicity, irregular margins and/or taller than wide and intranodular vascularity on transverse view on Doppler USG that warrant a FNAC or with nodule size > 2.0 cm, clinically & u/s neck were excluded. FNAC in all these patients was performed either by residents or consultants without local anesthesia, using a 23-gauge needle. Smears were immediately fixed with 95% ethyl alcohol solution, and staining was performed using Papanicolaou, Hemacolour, and Haematoxylin and Eosin (H and E) stain. The results were classified into four groups: inadequate, benign, suspicious, and malignant.

A proforma was used for data collection including registration number, age, gender, FNAC opinion, FNAC category, biopsy number and histology opinion. Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) and diagnostic accuracy of FNAC were calculated using the standard formula.

RESULTS

Patients with thyroid nodules fulfilling the inclusion criteria were enrolled in the presented study. Out of 217 enrolled subjects, only 53 underwent surgical excision of the lesion and provided histopathological diagnosis in which 6 cases of false negative, 1 of false positive, 35 true positive and 11 of true negative were observed. Table 1 reflected the distribution of malignancies on FNAC basis while table 2 on histopathological diagnosis among four FNAC categories. The overall evaluation of FNAC technique as primitive tool in the field of surgery is presented in table 3 which presented the accuracy of the method up to 87.7%, sensitivity 87.5% and specificity of 88% in local population in the given sample size of 217.

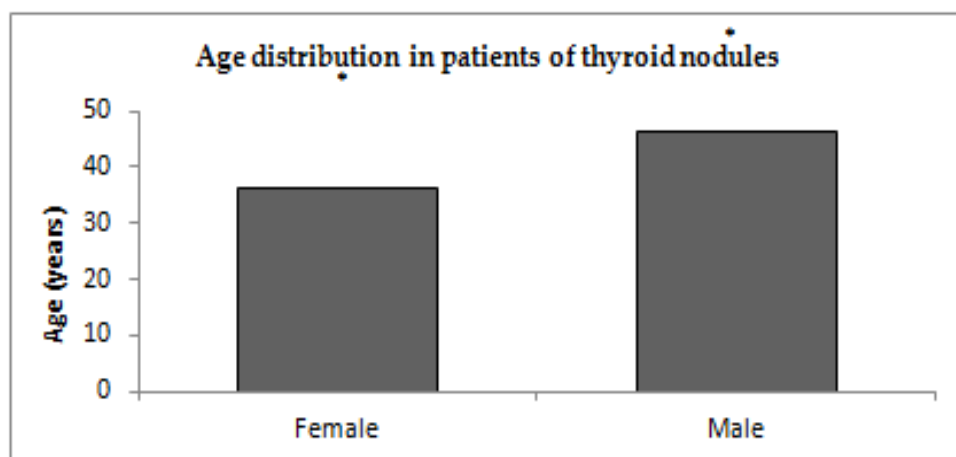


Fig. 1. Age distribution presented as mean age (36.43 years female and 46.53 male) with significant difference (< 0.05).

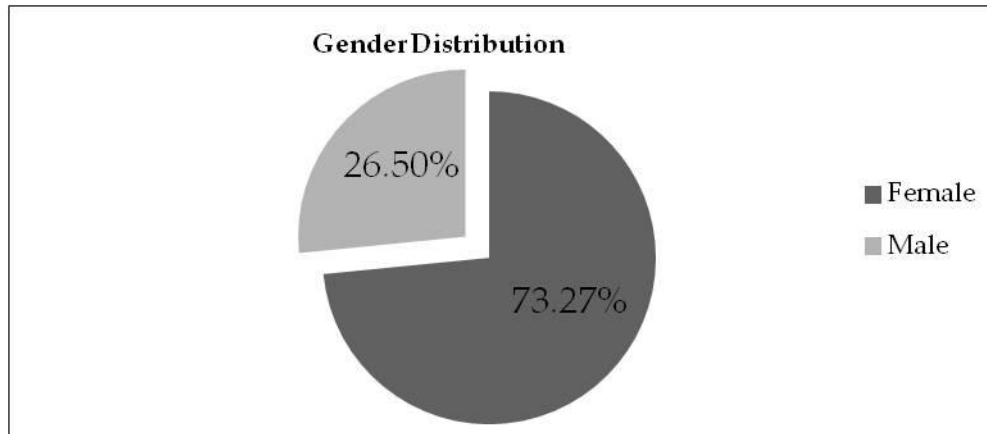


Fig. 2. Gender distribution presented as percentage (73.27% female and 26.50 male) with significant difference (< 0.05).

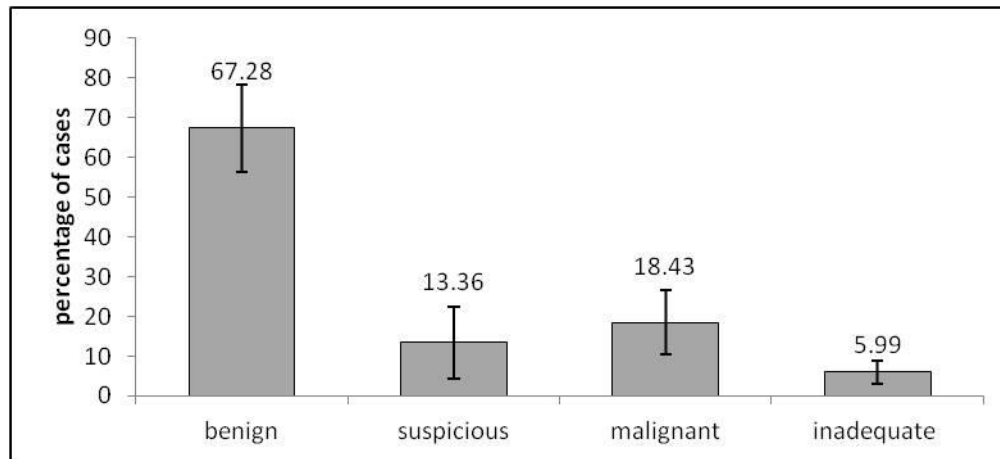


Fig.3. Distribution cases presented as percentage on the basis of FNA cytology.

Table I. Distribution of cases on the results of FNAC (n=217)

Cases	Frequency	Percentage
Benign lesions(n=135)		
Adenomatous Colloid	117	53.91
Thyroiditis	16	7.37
Benign cyst	2	0.921
Suspicious lesions (n=29)		
Follicular neoplasm	18	8.29
Adenomatous nodule	9	4.147
Thyroid neoplasm	2	0.921
Malignant lesions (n=41)		
Follicular carcinoma	12	5.52
papillary carcinoma	18	8.219
Medullary carcinoma	4	1.84
Lymphoproliferative Disorder	4	1.84
Anaplastic neoplasm	2	0.921
Inadequate (n=12)		

Table II. Stratificatoin of malignancies on the basis of histopathological diagnosis (n=41)

FNAC diagnosis	Papillary cancer	Follicular cancer	Medullary cancer	Other malignancies	Total
Benign	2	3	—	—	5
Suspicious	—	1	—	—	1
Malignant	17	8	4	6	35
Inadequate	—	—	—	—	—
Total	19	12	4	6	41

Table III. Evaluation of FNAC in thyroid lesions

Category	No. of cases
True positives	35(61.40%)
True negatives	8(14.0%)
False positives	1(1.75%)
False negatives	5(8.77%)
Sensitivity	87.5%
Specificity	88%
Positive predictive value	97.2%
Negative predictive value	61.53%
Accuracy	87.7%

DISCUSSION

Literature reported that thyroid nodules are present in adult population from 4% to 10%. However, the risk of malignancy to be developed from thyroid nodule may vary from 5% to 30% (11, 12). In the light of these facts and results, FNAC is a useful assessment tool of investigation which is cost effective, safe and easy to repeat in the case of recommendation by cytopathologist for out and in patients. Moreover, accuracy and sensitivity of FNAC have increased its application in examination of thyroid lesions.

In the presented study, 217 patients of different units of a tertiary care hospital were enrolled. All underwent FNAC, in which higher female population showed high susceptibility of thyroid nodule development in female population as compare to male. Several studies conducted in different population reveals the same results with different percentile values showing higher number of female patients as compare to male to be subjected for FNAC in the presentation of thyroid enlargement. Kishan *et al.* (2018) revealed the same idea in the reported article that 86.7% of the total samples under focus consist of female patients and only 13.3% were of male patients (13, 14).

The mean age of female patients (36.43 years) was lesser than male patients (46.53 years) in total enrolled patients. Although, the age of both genders was significantly different from each other but the point of focus was higher age for malignancies observed in both cases to develop malignant lesion for female was 39.51±9.53 and 54.56±7.53 for male (15).

In the current study, 67.28% benign and 18.43% (41 out of 217) lesions were observed on the basis of FNAC interpretations. These benign tumors include adenomatous colloid (maximum number), thyroiditis and benign cysts. As most of the studies supported these results that 50% to 70% of FNAC interpretations supported benign lesion (16-19). 13.36% (29 out of 217) of the specimens were found to be suspicious in the current study. These statistical values are supported by different other research such as 22.41% of the lesions of thyroid were repeated for FNAC for suspicious samples. The present study showed 5.99% (13 out of 217 specimens) were inadequate, therefore, recommended for re-sampling (20).

Only 23.96% (52 cases out of 217) were subjected to the operation as usually happened (13). In addition to this 16.12% of the total patients were confirmed with final histopathological findings for malignancy. This is understood that all the patients who underwent FNAC were not subjected to the surgery and carcinoma couldn't be confirmed unless histopathology ruled out.

The most prevalent carcinoma found was papillary carcinoma which is also diagnosed the maximum (18 cases) in other studies of FNAC. Follicular carcinoma (12 cases) was the second common cancer in thyroid nodule while medullary cancer (4) was also reported. Some low prevalent cancers such as anaplastic (2 cases) and lymphoproliferative (4 cases) were also diagnosed. These results are supported by other studies in which papillary found in the maximum number (21). The evaluations of FNAC interpretation as initial tool revealed the sensitivity 87.5%, specificity 88%, positive predictive value 97.2% and negative predictive value 61.53% and accuracy of 87.7%. These results are comparable with the reported studies conducted all over the world.

In another study conducted on 75 patients with the clinical presentation of thyroid nodule, specificity was 86.6% and sensitivity was 80% (22). Another study carried out in Nigeria, much better results

were obtained with sensitivity of 88.9%, specificity of 96.1%, and diagnostic accuracy of 94.2% (1). These results of FNAC can be improved by excluding suspicious and inadequate specimen numbers (23).

CONCLUSION

Presented study showed safe use of FNAC with low rate of false negative results and minimum invasive errors in few complicated cases.

For the patients' benefit, the future work includes development of fully functional decentralized application (blockchain technology) to avoid any fraudulent and malicious attempt to the data and maintain metadata of medical history of patients with thyroid lesions which will be helpful for making critical decision to reduce the unnecessary surgery and better follow up.

Limitation of the study:

The limitations of FNAC limited the interpretations of authors as well because many cases reported as suspicious or neoplasm may be the cases of follicular adenoma or hyperplastic nodule but being reported as malignant or suspicious for papillary, follicular or another type of malignancy.

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