

Morphological Spectrum of Fine Needle Aspiration Cytology Findings of Breast Lesions With Histopathology Correlation

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Abstract

Background: The presence of a breast lump is a prevalent issue that can affect individuals of all ages, from adolescence to old age. The lump can range in severity from benign to malignant. Among the malignant tumours that affect females, breast carcinoma is a leading cause of death worldwide. An early and correct diagnosis of a breast lump is crucial for saving a person's life. In resource limited settings, managing breast lumps can be a difficult task. The purpose of this study is to evaluate the prevalence of breast lumps among patients and to assess the accuracy of fine needle aspiration cytology (FNAC) as a diagnostic tool for identifying benign and malignant diseases by comparing its results with histopathology findings.

Objective: This study aims to analyse the cellular characteristics in samples obtained from breast lumps using FNAC, to determine the value of FNAC in enhancing the accuracy of diagnosis by comparing it to histopathological results, and to differentiate malignant tumours that necessitate more aggressive treatment from benign tumours that can be managed conservatively.

Materials and Methods: The results obtained from FNAC of palpable breast lumps examined at our department's FNAC from January 2020 to December 2022 were collected and compared to the findings from the excisional biopsies of the same lumps.

Result: A total of 325 patients had FNAC of breast lumps during the 2 years period, among which 276 were females and 49 were males. Fine needle Aspiration cytology was performed on 325 cases, and out of these, 270 cases were received in the department for histopathological examination. Out of the total of 325 cases of fine needle aspiration, benign cases were 284 (87.38%), malignant and suspicious were 33 (10.15%) and 8 (1.54%), respectively. The sensitivity, specificity, positive predictive value, negative predictive value, and accuracy of the present study were 98.36%, 96.77%, 91.84%, 91.84%, and 97.27%, respectively.

Conclusion: FNAC is a vital initial diagnostic test for palpable breast lumps. The results of breast FNACs are highly comparable to the histology of excisional biopsies, and when performed by an experienced pathologist, it is extremely valuable in managing breast lumps. FNAC is a safe, straightforward, and cost-effective outpatient procedure that is associated

with minimal complications. When used in conjunction with histopathological correlation, it improves diagnostic accuracy, which enables physicians to make an early diagnosis and provide specific treatment, thus reducing morbidity and mortality.

Keyword: Fine needle aspiration cytology, fibroadenoma, Malignant, histopathology

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INTRODUCTION

Breast lumps are a common condition that can occur in individuals of all ages, from adolescence to old age. They make up a significant proportion of surgical cases in both developed and developing countries, and frequently, it is necessary to differentiate benign from malignant lesions before final treatment is determined. While 90% of breast lumps are benign, there is a growing awareness and associated anxiety and stress, particularly among women who view any breast swelling as cancer, which prompts them to seek immediate medical advice. However, it can be challenging to determine whether a lump is benign or malignant based on clinical examination alone. Therefore, a definitive diagnostic method is needed for patients who present with breast lumps in order to provide reassurance to the patient and to ensure the best possible treatment is provided. A definitive diagnosis can be made by combining clinical examination, imaging (such as mammography or ultrasound), and fine needle aspiration cytology, often referred to as triple assessment. Ahmed et al, 2007.¹ Fine needle aspiration cytology is a sensitive, straight forward, cost-effective, less traumatic and fast method for diagnosis. (Nastui et al, 2002).² Additionally, it can be easily repeated if an adequate sample is not obtained. This study aims to evaluate the pattern of disease present in patients with breast lumps and to determine the accuracy of fine needle aspiration cytology as a diagnostic tool for identifying benign and malignant diseases by comparing its results to histopathology findings. Many countries have breast cancer screening programs to detect early disease in asymptomatic women. However, aspiration cytology is not a substitute for conventional surgical histopathology as a definitive diagnosis. However, it is not always possible by cytology, but it can provide categorization of disease and differential diagnosis in most cases. With this in mind, an attempt was made to evaluate the breast lesion's FNAC material subjectively and to compare it with histopathological details. FNAC is, therefore, an extremely vital tool in the evaluation of palpable breast lumps in resource limited settings. The objective of this study is to determine the diagnostic accuracy of FNAC in the evaluation of palpable breast masses, especially when performed by experienced cytopathologists, who have a high diagnostic accuracy.

MATERIAL AND METHOD

This retrospective study was conducted at the

Department of Pathology, ESIC hospital in Delhi, for a period of two years, from January 2021 to December 2022. Patients with breast lumps during this time period were included in the study. A detailed clinical history was taken, including symptoms related to the breast, such as mastalgia, nipple discharge, retraction, and their relation to menstruation. Information was also gathered on family history, menstrual history, and any history of malignancy in any organ. The breast was examined, including the nipple, areola, and details of the lump, such as size, site, surface, margins, mobility, consistency, fixity to underlying structures, skin and chest wall. The axilla of the same side was also examined for lymph nodes. The local examination was completed only after examination of the opposite breast and axilla. FNAC were performed by a pathologist using all necessary aseptic precautions, using a 10 mL syringe attached to a 23G needle. The needle was inserted into the lesion, and a vacuum was created by gently pulling the syringe's plunger. The needle was moved back and forth within the lesion, and the negative pressure was released before the needle was withdrawn. Samples were smeared onto glass slides and stained with May-Grunwald-Giemsa (MGG) after being air-dried. Two independent cytopathologists reviewed the FNAC. Special stains, such as Ziehl-Neelson (ZN) stain for acid fast bacilli, were used whenever necessary.

The International Academy of Cytology Yokohama System is a 5 stage system that is used to report the results of FNAC.³ It is a widely accepted system that is used to classify the cytological findings of breast lesions and guide the management of patients.

The 5 categories in the system are:

- Class 1: Unsatisfactory or insufficient material.
- Class 2: Benign
- Class 3: Atypical cell, mostly benign
- Class 4: suspicious for malignancy
- Class 5: Malignant

This system allows cytopathologists to provide a clear diagnosis and recommendations for further management.

Histopathological examination was performed on Tru-cut biopsies, excisional biopsies, and surgical specimens received in the department of pathology. The specimens were fixed in 10% buffered formalin. Tissue sections were processed in an auto processor to prepare paraffin blocks. The sections were cut and stained using hematoxylin

and eosin stains. The diagnostic accuracy of FNAC was determined by comparing the results with histopathology and calculating the sensitivity, specificity, positive predictive value, negative predictive value, and overall accuracy.

Sensitivity, specificity, positive predictive value, negative predictive value, and accuracy were calculated. Sensitivity = true positive/true positive + false negative × 100 Specificity = true negative/true negative + false positive × 100.

RESULTS

In this retrospective study comprising 325 cases with complaints of breast lumps, the age of the patients ranged between 12 to 70 years, among which 276 were females, and 49 were males. Fine needle Aspiration cytology was performed on 325 cases, and out of these, 270 cases were received in the department for histopathological examination. 248 cases were benign, and 22 cases were diagnosed malignant on histopathology. Out of the total of 325 cases of fine needle aspiration, benign cases were 284 (87.38%), malignant and suspicious were 33 (10.15%), and 8 (1.54%) were diagnosed on cytopathology. The Maximum number of cases was in the age group of 12-31 years, which comprises of benign breast lesions and in the age group of 42-81 years comprises malignant breast lesions. Among 49 cases of males, 44 had a benign lesion, and 5 cases showed malignancy. 276 were female, with benign conditions seen in 248 cases and 28 cases showing malignancy. All the Cases presented with chief complaints of a lump in the breast, pain, skin redness, nipple retraction, nipple erosion, and nipple discharge.

The anatomical and topographical distribution revealed that most of the lesions were in the left breast (50.21%). Maximum distribution of the lesions was noticed in the upper outer quadrant (40.04%). Malignant lesions were more in the right breast (7.19%) than benign ones in the left breast (29.65%).

In the current study, fibroadenomas were the most frequently observed benign lesion, with a total of 158 cases. On examination of the aspiration smears, they were found to be cellular in nature, with a bimodal cell population consisting of epithelial and stromal fragments. The smears revealed large, branching sheets of benign epithelial cells with a high number of single bare bipolar nuclei, along with fragments of fibromyxoid stroma. Our study also found that the peak incidence of fibroadenomas occurred in the second and third decades of life. (Table 2). In

our study, the next most common disease after fibroadenomas was an abscess, which was more prevalent in the second and third decades of life. Clinically, it presents as an indistinct thickening or lump. Aspiration smears reveal a dense acute inflammatory exudate composed of neutrophils. Additionally, the fibrocystic disease was found to be more common in the third and fourth decade. There were some cases that were characterized by the presence of benign ductal epithelial cells mixed with myoepithelial cells in the absence of fibromyxoid stromal fragments, apocrine cells, and macrophages and in the background of naked bipolar myoepithelial cells. Such cases were grouped together as benign breast disease. The present study found that gynecomastia, which is a benign proliferation of ducts and stroma in the male breast, is characterized by cellular aspiration smears that typically show uniform cells in tight clusters and groups. Some nuclear overlapping can be observed, and the background is characterized by a high number of myoepithelial cells. Gynecomastia tends to develop as a result of increased estrogen levels. This study also found that there is an increased incidence of gynecomastia in teenage men and older age groups. In teenage men, it is usually caused by hormonal imbalances, whereas in older age groups it is more likely to be caused by hormone producing tumors such as Leydig cell tumors, hepatomas, feminizing adrenal tumours, and small cell carcinomas. Additionally, exogenous estrogens, such as those used in the treatment of prostate cancer and applications of estradiol to the scalp, can also result in gynecomastia. Certain drugs, such as spironolactone, have also been implicated in the development of gynecomastia.

The present study found that patients with granulomatous mastitis typically present with an ill-defined and sometimes rapidly enlarging mass. Aspiration smears are moderately cellular and reveal abundant epithelioid cells in combination with a mixture of inflammatory cells, including neutrophils. The smears also show the presence of multi-nucleated giant cells, karyorrhectic nuclei and debris in the background. It is important to note that, on cytological grounds, granulomatous mastitis is indistinguishable from Tuberculous mastitis. In order to provide a firm diagnosis, the identification of acid fast bacilli on direct smear and culture should be attempted, although histopathological examination will usually be necessary. In our study, we labelled patients as having Tuberculous mastitis in cytology only when both caseous necrosis and acid fast bacilli were positive. In our study granulomatous mastitis was

more common in the second and third decades of life, with a total of 18 cases, out of which 3 cases showed caseous necrosis and acid fast bacilli and were labelled as Tuberculous mastitis. The study also found that the aspirates from Phyllodes tumour differ from fibroadenoma by having a greater stromal to epithelial ratio. The present study found that fibromyxoid stromal fragments that are large in size and the background are significant features in distinguishing fibroadenoma from Phyllodes tumour. The stromal nuclei in fibroadenoma are wavy and thin, whereas, in Phyllodes tumour, they are plump and spindle shaped. The study found that Phyllodes tumours were more common in individuals over the age of 40, whereas fibroadenomas were rare in that age group. Clinical features are also useful in distinguishing between the two types of tumours. Fibroadenomas tend to occur in younger individuals and are characterized by less stromal cellularity and a history of rapidly growing breast mass. Aspiration smears from proliferative breast disease are cellular and reveal large sheets of cohesive epithelial cells with few single cells. In the current study, there were 33 cases of malignancy, out of which 8 cases showed suspicion of malignancy. Aspiration shows cellular smears with marked anisonucleus, high N:C ratio, and pleomorphism with occasional prominent nucleoli. Eight cases show Epidermal inclusion cyst. On aspiration, anucleated squames are seen. So in our study, we observed a sensitivity of 98.36%, a specificity of 91.84%, a positive predictive value of 98.36%, a negative predictive value of 91.84%, and an accuracy of 97.27%. (Table 6)

Table 1: Age Wise distribution of all cases of breast lesions

Age group	Benign	Malignant	Total
12-21	82		82
22-31	94	1	95
32-41	64	7	71
42-51	34	16	50
52-61	14	4	18
62-71	3	3	6
72-81	1	2	3
Total	292	33	325

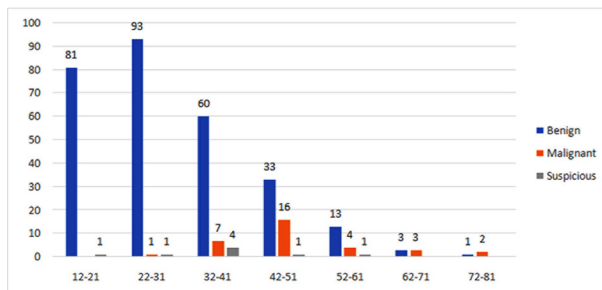


Table 2: Cytomorphological diagnosis of breast lesions on FNAC.

Diagnosis	Number of Cases	% of Cases
Abscess	49	15.08
Epidermal Inclusion Cyst	8	2.46
Fibroadenoma	158	48.62
Fibrocystic Disease	14	4.31
Galactocele	7	2.15
Granulomatous Mastitis	18	5.54
Gynecomastia	2	0.62
Infiltrating Duct Carcinoma	33	10.15
Phyllodes	24	7.38
Tubular adenoma	4	1.23
Suspicious for Malignancy	8	2.46
Grand Total	325	100.00

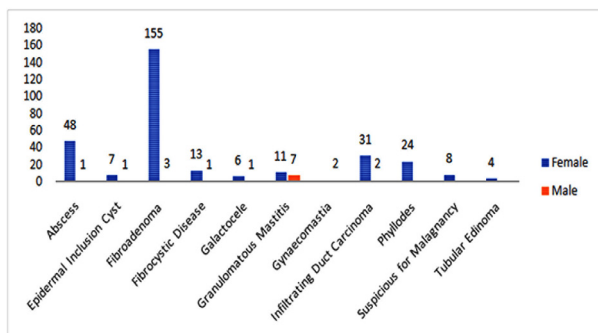


Table 3: Sex-wise distribution of cases of breast lesions

Sex	Benign	Malignant
Female	248	28
Male	44	5
Total	284	33

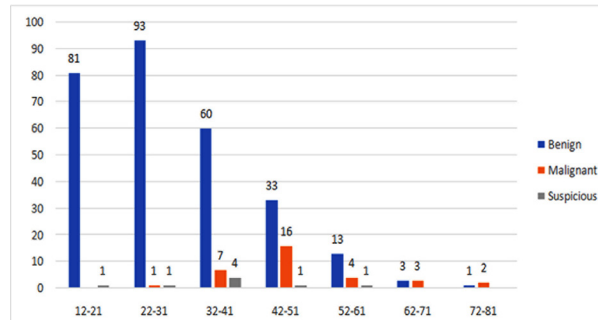


Table 4: Histopathological and Cytopathological Correlation of Cases

Cytological Diagnosis	No. of Cases	Consistent with Histology
Benign	284	270
Malignant	33	22
Suspicious of Malignancy	8	0

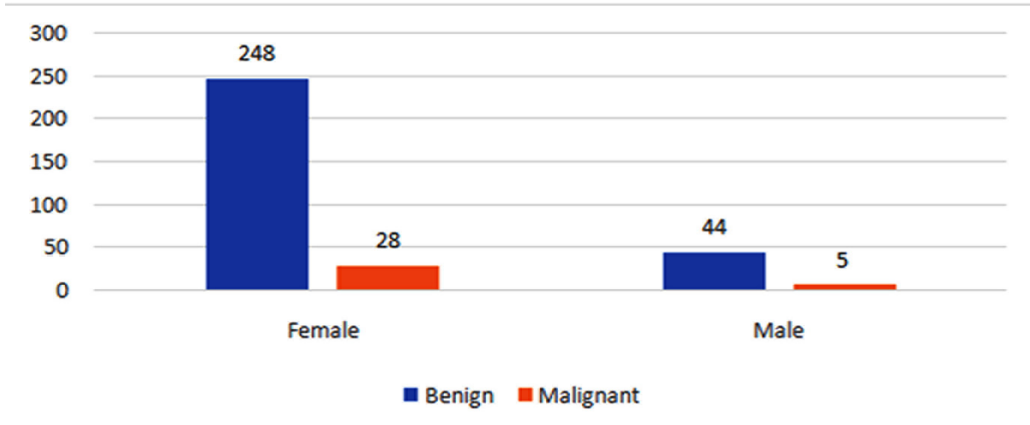


Table 5: Statistical Analysis for Detection of Malignant Lesions by various studies

Name of Study	Sensitivity	Specificity	Positive Predictive Value	Negative Predictive Value
Muhammed et al (2005)	90.60%	100.00%	100.00%	99.00%
Rubin et al	87.00%	100.00%	100.00%	89.00%
Our study	98.36%	91.84%	98.36%	91.84%

Measures of Diagnostic Accuracy

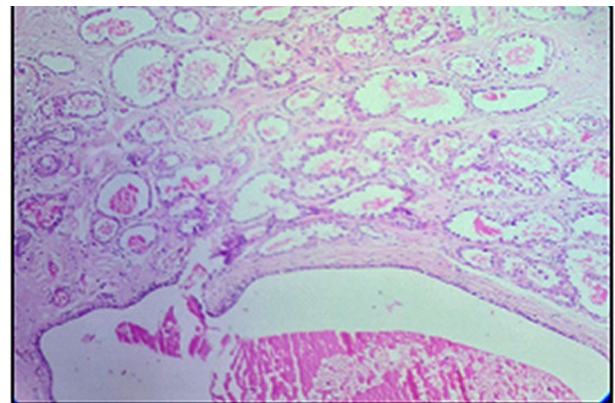
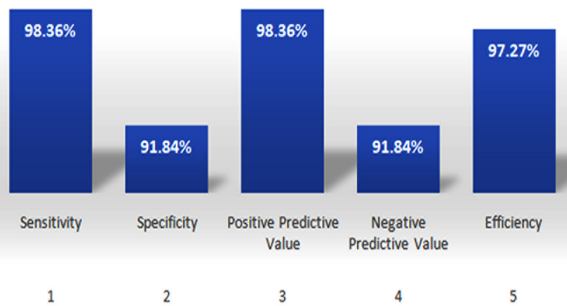


Fig. 1: Apocrine change 400X

Table 6: Statistical analysis of fine needle aspiration cytology of breast lumps

Parameter	Percentage (%)
Sensitivity	98.36%
Specificity	91.84%
Positive Predictive Value	98.36%
Negative Predictive Value	91.84%
Accuracy	97.27%

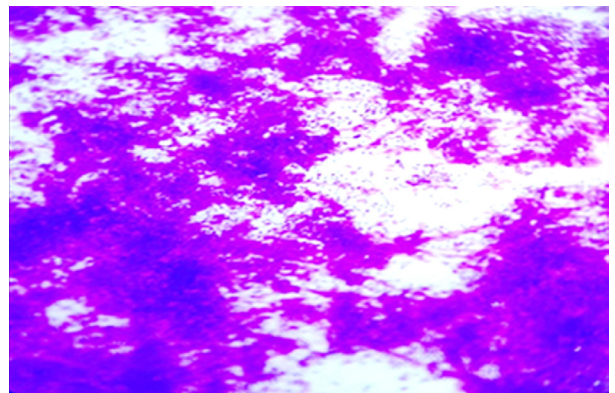


Fig. 2: Abscess 400X

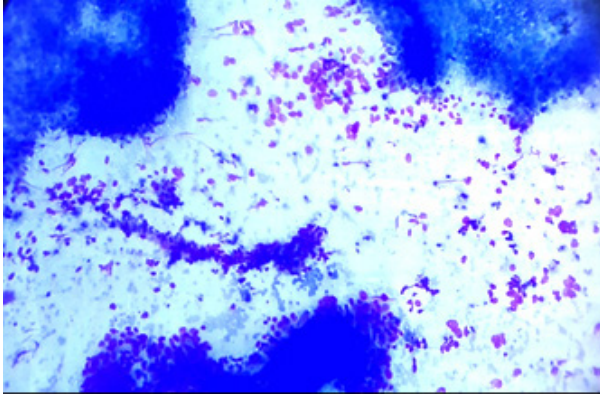


Fig. 3: Infiltrating Duct Carcinoma 100X

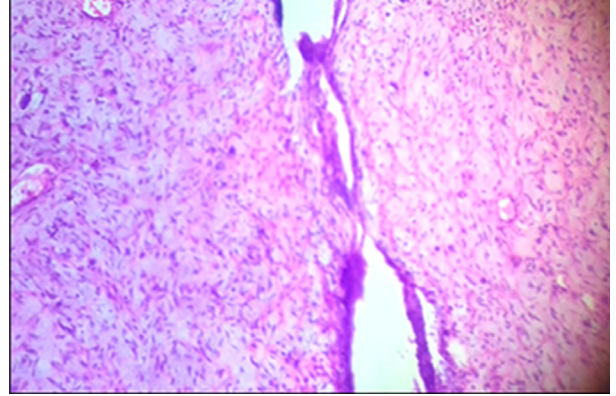


Fig. 7: Phyllodes Tumour 400X

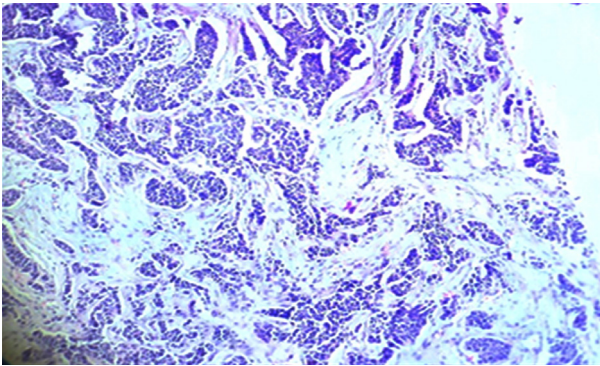


Fig. 4: Infiltrating Duct Carcinoma 400X

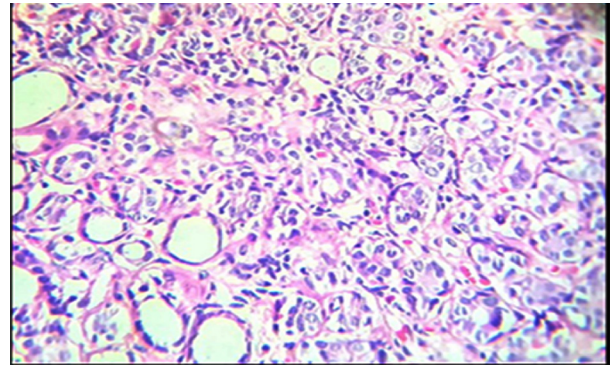


Fig. 8: Tubular adenoma 400X

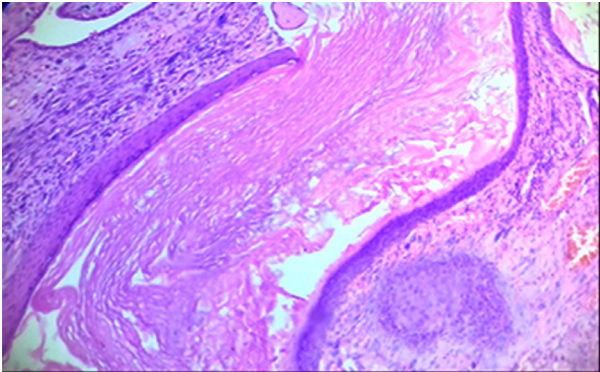


Fig. 5: EIC 400X

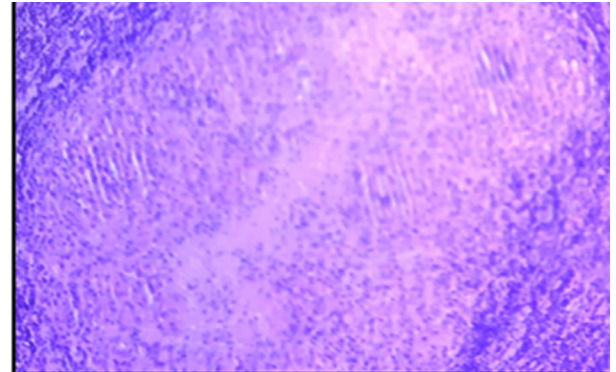


Fig. 9: Necrotizing granuloma 100X

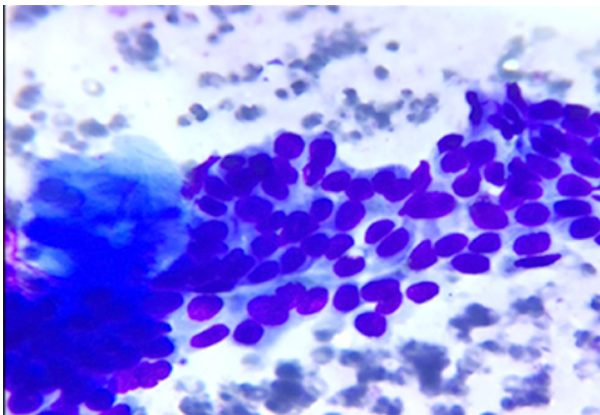


Fig. 6: EIC 400X

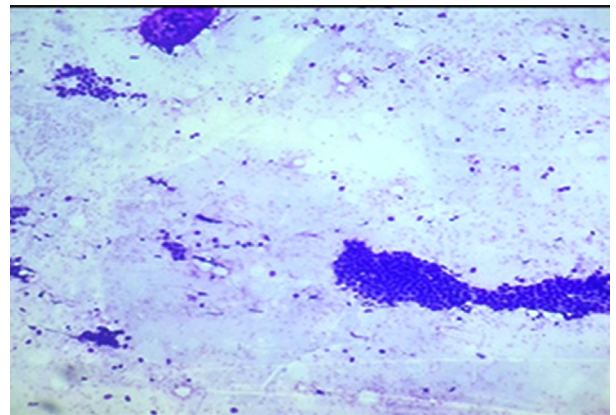


Fig. 10: Fibroadenoma 100X

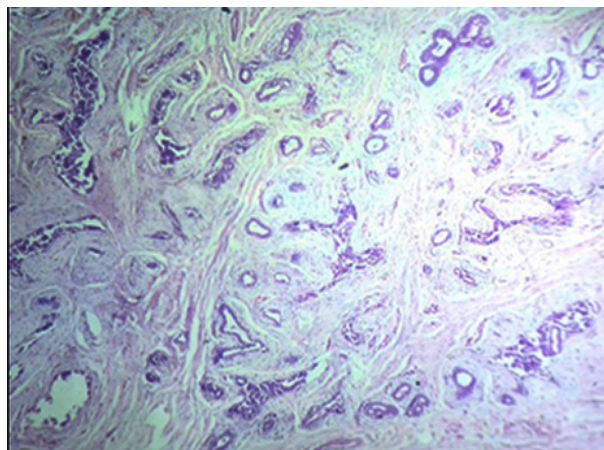


Fig. 11: Fibroadenoma 100X

DISCUSSION

Breast cancer is a prevalent condition worldwide, and early detection is crucial for effective treatment. An early and Precise diagnosis can be made by triple assessment, which includes clinical examination, imaging, and histopathological examination of the lump, for all patients with a discrete breast lump. The importance of correlating cytological examination of fine needle aspiration samples with histopathological examination for accurate diagnosis is of paramount importance. Many countries have implemented screening programs to identify the disease in asymptomatic women, and fine needle aspiration cytology (FNAC) is a key diagnostic tool used in these programs, specifically as a part of the triple test examination.¹ There are several other studies in the literature on fine needle aspiration cytology, and a good correlation between FNAC and histology has been documented in many other series.

In the current study, fibroadenomas were found to be prevalent in the age group of 21-30 years. This is consistent with the findings of several previous studies, including those by Khanzada et al. (2009)⁴, Iyer (2000)⁵, Ochicha (2002)⁶, and Siddiqui (2003)⁷, which also found that fibroadenomas are most commonly diagnosed in this age range. Additionally, abscesses and fibrocystic disease were the next most common conditions in our study, with the majority of patients in these groups falling within the third and fourth decades. However, it should be noted that the incidence of these conditions may vary depending on location. Studies such as those by, Khanzada et al. (2009)⁴, and Khemkha et al. (2009)⁸ have also reported similar findings, with abscesses and fibrocystic disease being the second most common breast conditions. In addition, Singh et al. (2011)⁹ reported that invasive ductal carcinoma

is the most common type of breast cancer and is typically diagnosed in the age group of 41-60 years. The current study shows similar findings, and ductal carcinoma is one of the most common breast malignancies in the age group of 41-60 years of age. Fine needle Aspiration Cytology has been proven to be a highly efficient method in the diagnosis of palpable breast lesions in our study. The sensitivity of 98.07% and specificity of 100% obtained in our study were in accordance with the sensitivity of 86-99% and specificity of 92-100% reported in various studies (Rubin et al., 1997¹¹; Muhamed et al, 2005)¹⁰.

CONCLUSION

The present study endorses the use of Fine Needle Aspiration Cytology (FNAC) as a reliable diagnostic technique for breast lesions. This method is known for its safety, ease of use, and cost-effectiveness and is commonly performed as an outpatient procedure with minimal side effects. The early detection and targeted management provided by FNAC can lead to a reduction in morbidity and mortality rates. The present study highlights that Fine Needle Aspiration Cytology (FNAC) is an ideal initial diagnostic tool for breast lumps due to its rapid analysis and reporting and the lack of false positive results. However, it is important to note that it can be difficult to subcategorize the lesions using only cytological methods and that clinical and mammographic information should be taken into account. The Triple test principle, which involves acquiring technical, observational and interpretative skills, can further improve the diagnostic accuracy of breast lesions. The study also compared the diagnostic accuracy of FNAC to that of histopathology as the gold standard method with a sensitivity of 98.36%, specificity of 91.84%, positive predictive value of 98.36%, the negative predictive value of 91.84%, and accuracy of 97.27%. So FNAC has been found to be highly comparable to histology for excisional biopsies, and when performed by experienced practitioners, it proves to be an invaluable tool in the evaluation of breast lumps.

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