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Article

Palpable breast lumps: A correlation of diagnostic accuracy between FNAC and histopathology

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Abstract: Introduction: Breast masses can have various causes, including inflammatory, benign, or malignant conditions. Although most masses are benign, breast cancer is the most common cancer and the second leading cause of cancer deaths in women. Breast lumps pose a diagnostic dilemma for both general practitioners and surgeons. Fine needle aspiration cytology (FNAC) is increasingly used for preoperative diagnosis of breast cancer to determine various prognostic parameters and offer the best therapy to patients.
Objectives: The objectives of this study were to determine the common causes of breast mass in the population in and around our district, assess the diagnostic accuracy of FNAC in differentiating benign from malignant masses, and assess the diagnostic accuracy of correlation between FNAC and histopathological examination.
Materials and Methods: The study included patients presenting with palpable lumps in the breast and attending the Department of Surgery at VIMS Ballari. A detailed history and thorough physical examination were carried out, and FNAC of the breast lump was performed at the Cytology section of CDL. Only cases with subsequent excision/mastectomy for histopathological examination were included in the study.
Results: In the present study, Fibroadenoma was the most commonly detected lesion on both FNAC and histopathological examination, and invasive Ductal carcinoma -NOS was the most common malignant lesion. The diagnostic accuracy of FNAC was 94%. The overall specificity of FNAC in diagnosing palpable breast lumps in this study was 100%, sensitivity was 94%, positive predictive value was 100%, and negative predictive value was 93%. The false-negative rate in our study was 7.6%.
Conclusions: Breast lumps cause immense anxiety among patients and their families. To address this issue promptly, FNAC has been found to be a reliable tool. It is simple, cost-effective, accurate, and provides rapid diagnosis, which helps alleviate fears. Additionally, it gives good histopathological correlation, thus eliminating the need for surgical intervention for definitive diagnostic purposes.

Keywords: Palpable breast lumps; FNAC; Histopathology.

1. Introduction

Breast cancer is the most common cancer among women worldwide and the second most common cancer in women in India [1–8]. It represents 25% of all cancers diagnosed and has seen a significant increase in incidence and associated morbidity and mortality in the Indian subcontinent [8]. While cervical cancer was previously the most common cancer in Indian women, breast cancer has now surpassed it and is the leading cause of cancer death, though cervical cancer still remains most common in rural India [3].

A woman who lives to the age of 90 years has a one in eight chance of developing breast cancer. It is both ironic and tragic that a neoplasm arising in an exposed organ readily accessible to self-examination and clinical examination continues to exact such a heavy toll [1].

Diseases of the breast constitute a significant proportion of surgical cases seen in both developed and developing countries [6,9,10]. They typically present as palpable masses or inflammatory lesions, nipple discharge, or imaging abnormalities [9]. A palpable lump in the breast is a common diagnostic problem for both general practitioners and surgeons.

Most breast lumps are benign, but due to the heightened anxiety of patients and their families, specialist assessment and eventual reassurance have become essential [9]. In the past, invasive methods such as excision

biopsy requiring a hospital stay, anesthesia, and a waiting period before the results were declared were needed [11]. However, it is sometimes difficult to determine if a mass is benign or malignant on clinical examination, so a method of definitive diagnosis of breast lumps on an outpatient basis was needed. Fine needle aspiration cytology (FNAC) is an accepted and established method of assessment [6].

FNAC is reliable, rapid, easy, cost-effective, and virtually painless outpatient procedure [2]. With a high percentage of true positives, nearly no false negatives, no complications, and no need for anesthesia, FNAC has established itself as an important preoperative assessment tool [11]. It has been shown that FNAC can reduce the number of open breast biopsies [3,5,6,9].

2. Materials and Methods

2.1. Study Design

This is a prospective descriptive study.

2.2. Sample Size

A total of 50 patients were included in the study.

2.3. Inclusion Criteria

Patients presenting with a palpable lump in the breast undergoing FNAC followed by excision biopsy, lumpectomy or mastectomy were included in the study.

2.4. Exclusion Criteria

The following patients were excluded from the study:

1. Those with acute surgical conditions such as mastitis/abscess.
2. Patients with recurrent breast lump in the previously operated area.
3. Patients who were unwilling to participate in the study.
4. Those under the age of 12 years.

3. Data Collection Method

3.1. Source of Data

In patients presenting with a palpable lump in the breast, a detailed history was taken, and a thorough physical examination was carried out. The information obtained was recorded in a proforma. The patient was informed about the procedure, and informed consent was obtained before subjecting them to FNAC of the breast lump at the Cytology section of the Central Diagnostic Lab VIMS, Ballari.

A standard procedure was followed, making use of a 10ml syringe bearing a 23-gauge needle (external diameter of 0.6mm). The mass was located clinically and fixed in position with a free hand. The skin over the puncture site was sterilized with spirit. The needle was placed over the skin, and its direction was determined before it was introduced into the mass in one swift motion. This minimized discomfort to the patient.

Once the mass was engaged (as indicated by resistance to the needle), the needle was moved back and forth in the mass with short strokes. The needle hub was observed for the appearance of any material. The needle was attached to the syringe filled with air by pulling back the plunger. The specimen was then expressed onto glass slides, and it was immersed in a fixative 95% ethyl alcohol/air-dried. The slides were stained with H&E and Leishman stain, respectively. The interpretation of the slide was made by a cytopathologist.

The cytological diagnosis was based on inspection, palpation of the mass, degree of resistance at the aspiration biopsy, combined microscopic examination of the aspirated cells. The cytological report was described as malignant, suspicious, benign or unsatisfactory (inadequate) due to insufficient cells being present.

The clinician was informed about the cytological diagnosis. If the lump on the cytological examination was reported as malignant, mastectomy or modified radical mastectomy was performed, and benign

lesions were excised. The specimen was immediately fixed in 10% formalin and sent for histopathological examination. The cytological diagnosis was compared with histopathology findings. Since the needle aspiration cytology was done for palpable tumors, ultrasound guidance was not followed.

4. Results

The 50 cases were in the age range of 17-65 years. The most common age group was 21-30 years, with 15 patients (30%), followed by 14 patients (28%) in the 31-40 years age group. The mean age was 36.4 years (graph shown in Figure 1).

In this study of 50 patients, the age incidence of benign lesions ranged from 17 to 60 years and the most common age group was 21-30 years (39%). The incidence for malignant lesions ranged from 30-65 years, and the most common age group was 41-50 years (50%) (graph shown in Figure 2).

Of the 50 patients with palpable breast lumps, 38 patients (76%) were diagnosed with benign lesions and 12 patients (24%) were diagnosed with malignant disease on FNAC.

Of the 50 patients, 38 patients were diagnosed with benign lesions, and in benign diseases, fibroadenoma was the most common (21 patients, 42%), followed by fibrocystic disease (4 cases, 8%). 12 patients were diagnosed with malignancy, all of which were infiltrating ductal carcinoma.

Of the 50 patients, on histopathological examination, the most common benign lesion was fibroadenoma (23 cases, 46%), and the second most common benign disease was fibrocystic disease (6 cases, 12%). The most common malignant lesion was infiltrating ductal carcinoma - not otherwise specified (13 cases, 26%).

The correlation between FNAC and histopathological examination for benign breast lumps was 97% and for malignant lumps was 92%. Two cases diagnosed as having a benign cytological pattern on FNAC turned out to be fibroadenoma on histopathological examination, possibly due to inadequate sampling. Two cases of benign cystic disease on FNAC were confirmed as fibrocystic disease. One case of atypical ductal hyperplasia on FNAC turned out to be well-differentiated infiltrating ductal carcinoma.

The diagnostic accuracy of fine needle aspiration cytology was 94%. The overall specificity of fine needle aspiration cytology in diagnosing palpable breast lumps in this study was 100%, sensitivity was 94%, positive predictive value was 100%, and negative predictive value was 93%. The false-negative rate in our study was 7.6%.

The area under the curve was 97%.

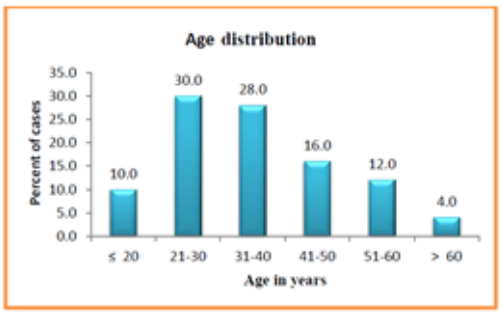

Figure 1. Distribution of cases according to age

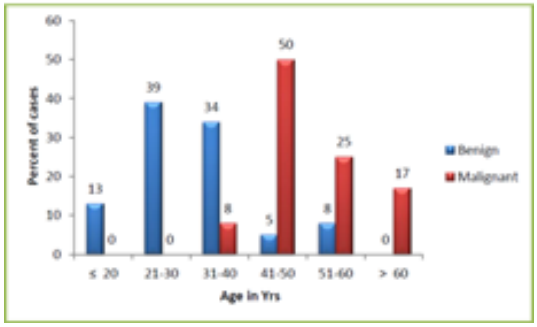

Figure 2. Age wise distribution of benign and malignant lesions

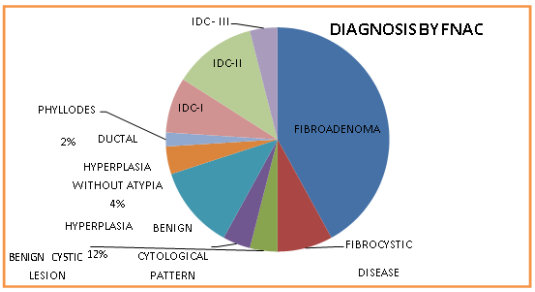

Figure 3. Diagnosis based on FNAC

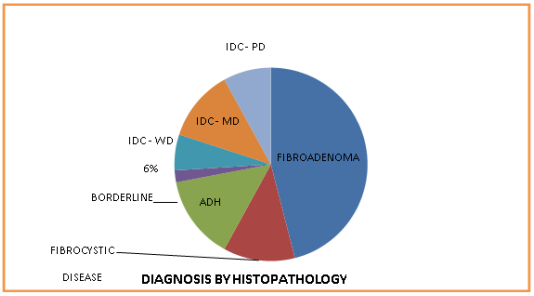

Figure 4. Diagnosis based on Histopathology

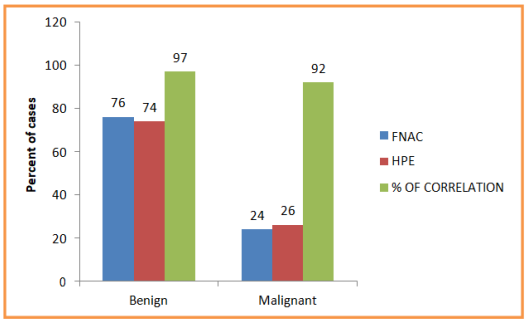

Figure 5. Correlation of FNAC and Histopathological examination

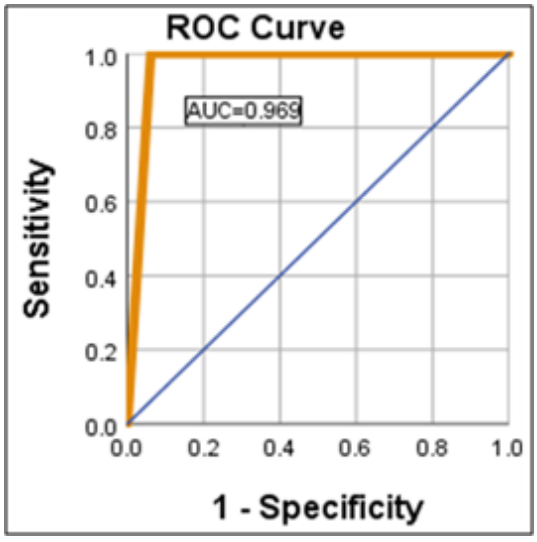

Figure 6. ROC curve

Table 1. Distribution of patients based on FNAC findings

Nature of the lesion on FNAC	No of cases	Percent
Benign	38	76.0
Malignant	12	24.0
Total	50	100.0

Chi Square test $P<0.001$, significant

5. Discussion

In this study, cases of breast lumps were observed to range from 17 years to 65 years of age, with an average of 36.4 years. The age of onset for benign lumps ranged from 17 to 60 years, while that of malignant lesions ranged from 30 to 65 years. The most common age group for benign lesions was between 21 and 30 years, while that of malignant lesions was 41 to 50 years. Studies conducted by Khemka et al. [11], Aziz et al. [13], Tiwari et al. [6], and Alam et al. [14] have shown similar age distribution patterns.

In this study, Fibroadenoma was the most common lesion identified through FNAC (42% of patients), which was comparable to the study conducted by Tiwari et al. [6] and Khemka et al. [11]. However, in the study conducted by Handral & Akhtar [12], Fibroadenoma cases accounted for only 30%, which contrasted with our findings. This could be due to the number of cases studied, population considered, and other confounding factors.

From Table 2, it is evident that our study has a correlation of 97% between FNAC and HPE for benign lesions, which is similar to other studies.

From Table 3, it can be seen that the present study has a correlation of 92% between FNAC and HPE for malignant lesions, which is slightly better than other studies. This could be due to repeat sampling in cases of inadequate samples, which gave better yield, or due to the population of cases attending the OPD during the pandemic.

In this study, the false positive cases on FNAC were zero, and the false negative cases were one, reported as Atypical Ductal Hyperplasia on FNAC and turned out to be Infiltrating Ductal Carcinoma, well-differentiated on Histopathology.

On FNAC, four cases were misclassified under the benign category itself. Two cases diagnosed as a benign cytological pattern on FNAC turned out to be Fibroadenoma on Histopathological examination, while the other two cases diagnosed as benign cystic disease on FNAC were diagnosed as Fibrocystic disease on HPE.

In the study conducted by Khemka et al. [11], two cases did not match with Histopathological examination, one being Atypical Ductal Hyperplasia, which turned out to be Ductal carcinoma, which was similar to our study. Another case was benign proliferative disease, which turned out to be Ductal carcinoma.

In the study conducted by Hussain [15], 20 patients out of 50 were diagnosed as a malignant lesion on FNAC, while on Histopathological examination, 22 malignant cases were diagnosed, so two cases were missed on FNAC.

In the study conducted by Handral & Akhtar [12], four cases were diagnosed as false negative, i.e., two cases of benign proliferative disease on FNAC turned out to be Infiltrating Ductal Carcinoma.

In the study conducted by Aziz et al. [13], out of 89 patients, 29 patients were diagnosed as malignant, whereas 34 patients were malignant on Histopathological examination. In his study, five cases were misinterpreted as benign on FNAC.

This could be due to inadequate sampling, missing the lesional site, or cystic lesions being aspirated, among other reasons.

The risk of false positive results is higher in papillary lesions, atypical epithelial hyperplasia, regenerating epithelial atypia, and atypia of ductal epithelium in a cyst. False negative results may occur in cases of low-grade malignancy or small or complex proliferative lesions, such as tumors with central necrosis or small cell carcinoma.

Overall, the present study's findings are comparable to those of the majority of previously conducted studies. Atypical ductal hyperplasia and well-differentiated IDC can sometimes be difficult to distinguish on FNAC, but repeat aspirates could help overcome this issue.

The diagnostic accuracy of FNAC in the present study was 94%, with a sensitivity of 94%, specificity of 100%, positive predictive value of 100%, and negative predictive value of 93%. These results are similar to those of many other studies, as shown in Tables 2–6.

Table 2. Correlation of FNAC and HPE in Benign lesions

Study	Total no. ofPatients	Number of benign lesions		% ofCorrelation
		FNAC	HPE	
Khemka et al. [11]	50	39	37	94%
Tiwari et al. [6]	91	85	84	98%
Aziz et al. [13]	89	60	55	91%
Alam et al. [14]	76	47	43	91%
Present study	50	38	37	97%

Table 3. Correlation of FNAC and HPE for malignant lesions

Study	Total no. ofpatients	Number of malignant lesions		% of correlation
		FNAC	HPE	
Khemka et al. [11]	50	11	13	84%
Tiwari et al. [6]	91	6	7	85%
Aziz et al. [13]	89	29	34	85%
Alam et al. [14]	76	29	33	87%
Present study	50	12	13	92%

Table 4. Comparison of FNAC and HPE correlation in malignant cases

Study	Total no. of patients	Number of malignant lesions		No. of false negative
		FNAC	HPE	
Khemka et al. [11]	50	11	13	2
Hussain [15]	50	20	22	2
Aziz et al. [13]	89	29	34	5
Handral & Akhtar [12]	100	54	58	4
Present study	50	12	13	1

Table 5. Comparison of False negative and false positive cases

Study	False negative (%)	False positive (%)
Ariga et al. [16]	9%	<1%
Hussain [15]	9.1%	0
Aziz et al. [13]	14.1%	0
Present study	7.6%	0

Table 6. Validity tests by various studies

Name of the study	Sensitivity	Specificity	Positive Predictive value	Negative Predictive value
Hussain [15]	90.9%	100%	_	_
Aziz et al. [3]	85.29%	100%	100%	98.79%
Ariga et al. [16]	98%	99%	99%	86%
Homesh et al. [17]	66.6%	81%	100%	90%
Khemka et al. [11]	96%	100%	100%	95.12%
Tiwari et al. [6]	83%	100%	_	_
Present study	94%	100%	100%	93%

6. Conclusion

FNAC is a widely accepted, simple, cost-effective, and reliable technique for evaluating breast lumps. It has additional favorable factors, such as rapid diagnosis, minimal pain, the ability to take multiple attempts and sample multiple sites in one sitting.

This study reaffirmed the fact that benign breast lesions are the most common lesions. The increase in their incidence is probably due to increased patient awareness, early detection, and the ease of availability of minimally-invasive/non-invasive modalities for diagnosis in the present era. In such cases, reassurance is the main line of management, although close follow-up is mandatory. FNAC can also act as a therapeutic procedure in the case of benign cysts.

In our study, FNAC played a significant role in a few cases where radiological and clinical diagnoses were not coinciding. Cytologic diagnosis showed significant correlation with histological diagnosis, thus obviating the need for unnecessary surgical interventions.

Since false positive diagnoses are very rare (in our study it was zero), in centers where surgical staff is accustomed to performing mastectomy based on FNAC for diagnosing malignant breast lumps, there is a necessity for a higher level of confidence and rapport with cytopathologists.

7. Limitations

The present study is limited in its sample size due to the decrease in patient load during the corona pandemic.

Author Contributions: All authors contributed equally to the writing of this paper. All authors read and approved the final manuscript.

Conflicts of Interest: The authors declare that they have no conflicts of interest.

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Appendix images

Figure 7. Gross specimen of Fibroadenoma. Cut section: Well demarcated solid gray white mass, whorled areas with slit like spaces

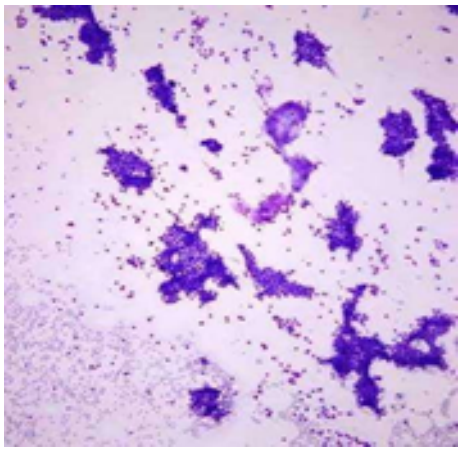

Figure 8. FNAC of Fibroadenoma. Cellular smears show tightly cohesive clusters of ductal epithelial cells, few in papillary pattern. Singly scattered myoepithelial cells seen in the background Leishman's 100x

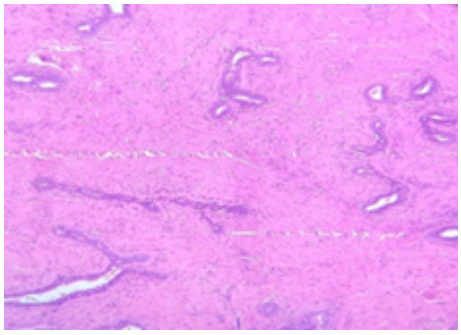

Figure 9. HPE of Fibroadenoma. Compressed ducts lined by benign cells surrounded by dense stroma composed of myoepithelial cells & myofibroblasts H&E 40x

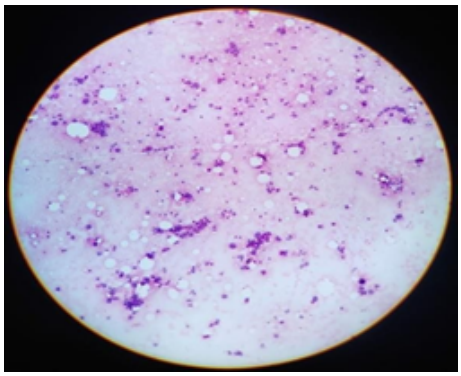

Figure 10. FNAC of Fibrocystic disease. Scantily cellular smears show scattered small clusters of ductal cells, many cyst macrophages in a proteinaceous background H&E 40x

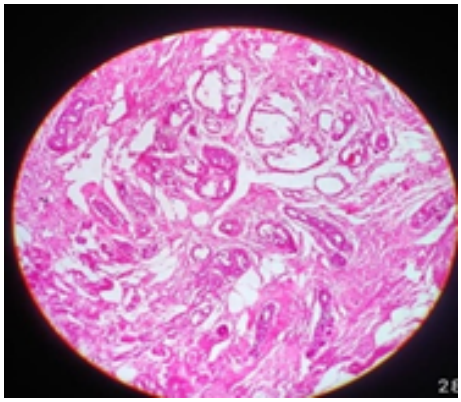

Figure 11. HPE of Fibrocystic disease. Cystically dilated ducts lined by cuboidal cells with abundant cytoplasm. Focal adenosis calcification & fibrosis noted H&E 100x

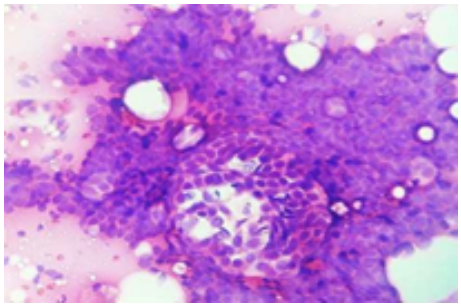

Figure 12. FNAC of a typical Ductal Hyperplasia. Cellular smears show sheets of ductal cells with lumina/spacing. Small nuclei, at times with indistinct nucleoli H&E 100x

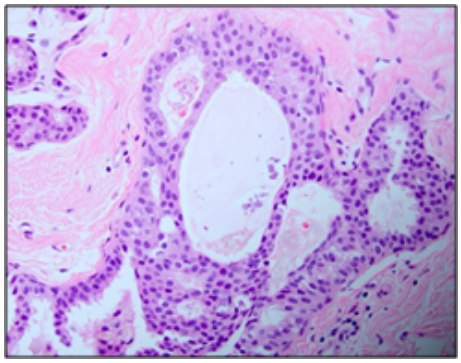

Figure 13. HPE: A typical Ductal Hyperplasia. Monomorphic cells with evenly spaced small round nuclei, forms Roman bridges H&E 100x.

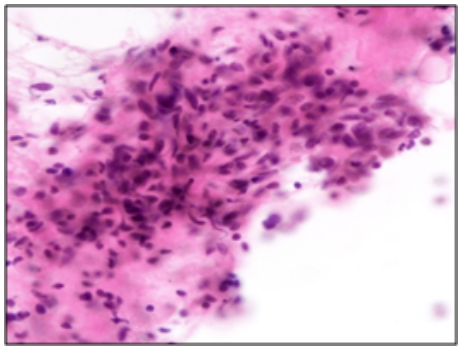

Figure 14. FNAC of Benign Phyllodes: Cellular smears show fibromyxoid stroma with entrapped cells. The cells have spindle to wavy nucleus

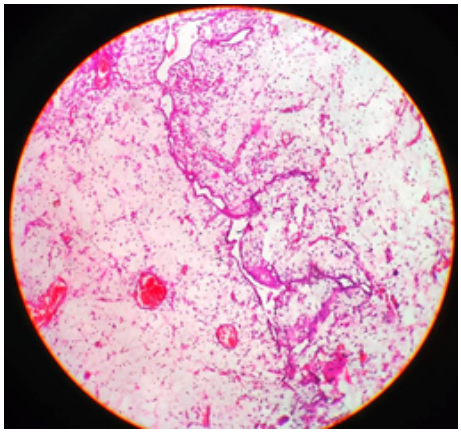

Figure 15. HPE of Benign Phyllodes: Leaf like epithelial pattern with stromal overgrowth . No mitosis or atypia noted. H&E 40x

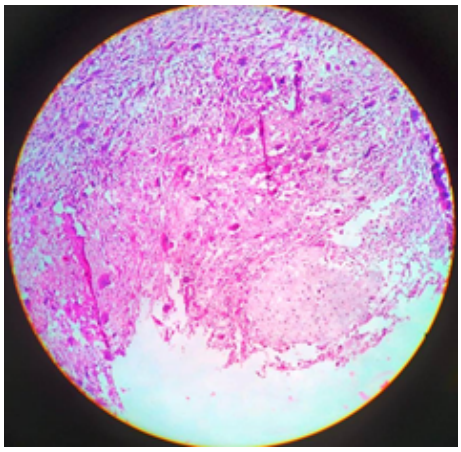

Figure 16. HPE of Malignant Phyllodes: Marked stromal atypia with chondromyxoid areas, giant cells & myxoid change(heterologous elements). H&E 40x

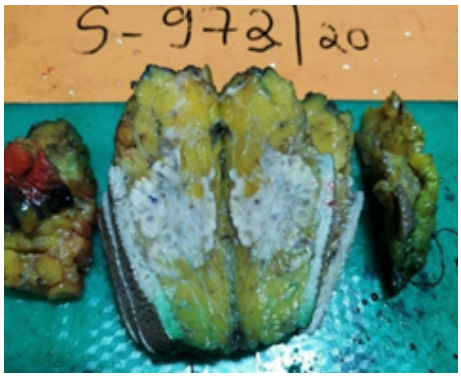

Figure 17. Carcinoma breast: Cut section shows grayish white tumour extending from superior margin to surgical resected margin

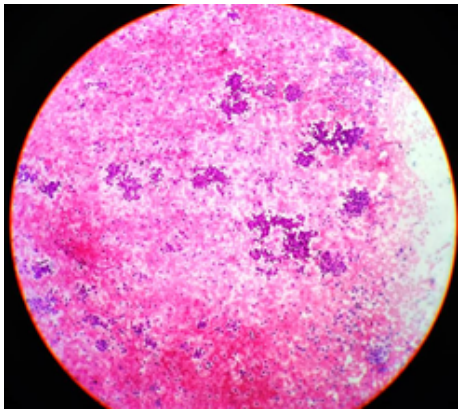

Figure 18. FNAC of carcinoma breast. Cellular smears show clusters of pleomorphic cells in a hemorhhagic background H&E 40x

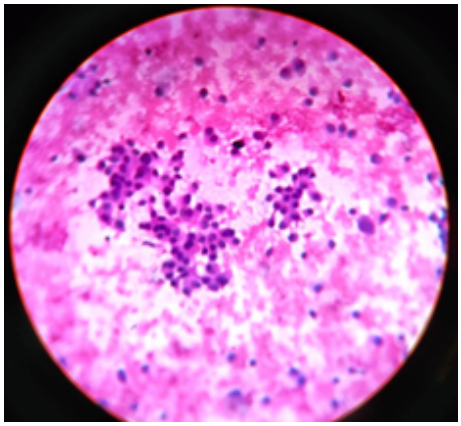

Figure 19. FNAC of carcinoma breast. Cellular smears show clusters of pleomorphic cells with moderate cytoplasm, eccentric vesicular nucleus, prominent nucleous forming acinar pattern. H&E 100x

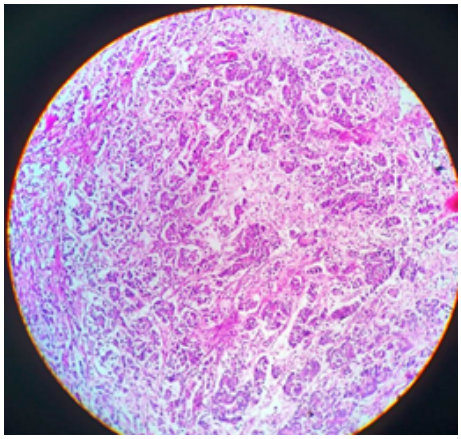

Figure 20. HPE of Carcinoma breast: Nests & cords of tumor cells seen infiltrating the stroma. H&E 40x

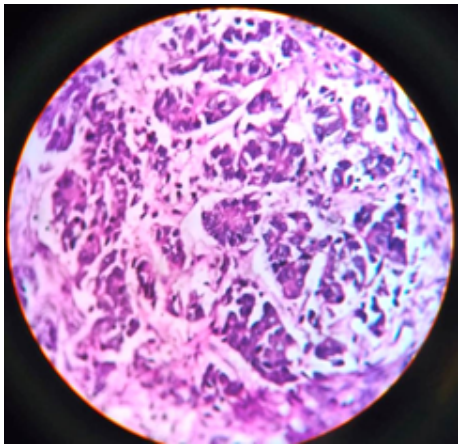

Figure 21. HPE of Carcinoma breast: Acini & short papillae lined by pleomorphic cells with large vesicular nucleus seen infiltrating the stroma. H&E 100x