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Diagnostic Efficacy of Fine Needle Aspiration Cytology in Breast LesionsNavi Mumbai.

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ABBREVIATIONS

BA	Breast Abscess
CM	Chronic Mastitis
CNB	Core Needle Biopsy
CP	Cystosarcoma Phylloides
CS	Carcinosarcoma
DA	Diagnostic Accuracy
DCIS	Ductal Carcinoma in Situ
DE (PCM)	Duct Ectasia (Plasma Cell Mastitis)
DE, BA	Duct Ectasia with Breast Abscess
DE, DP	Duct Ectasia with Duct Papilloma
DP	Duct Papilloma
DPX	Dibutyylphthalate Xylene
FA	Fibroadenoma
FCD	Fibrocystic Disease
FN	Fat Necrosis
GM	Granulomatous Mastitis
FNAC	Fine Needle Aspiration Cytology
HPE	Histopathological Examination
IDC	Infiltrating Duct Carcinoma
ILC	Infiltrating Lobular Carcinoma
INADEQ	Inadequate
LA	Lactating Adenoma
LM	Lactational Mastitis
MGG	May Grunwald Giemsa
NPV	Negative Predictive Value
NS	Not Significant
OPD	Out Patient Department
PAP	Papanicolaou
PPV	Positive Predictive Value
S	Significant
SUS	Suspicious
WHO	World Health Organization

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I. Introduction

Breast is a modified sweat gland that develops into a complex functionalstructure in females but remains rudimentary in males.

Lesions of breast are preponderantly confined to females. In males breast is a rudimentary structure relatively insensitive to endocrine influences and apparently resistant to neoplastic growth. In females on the other hand the more complex structure, the greater breast volume and extreme sensitivity to endocrine influences all predispose this organ to a number of pathological conditions.

Most diseases of breast present as palpable masses, inflammatory lesions, nipple discharge or mammographic abnormalities. Although fortunately most are benign, cancer of breast is second most common cause of cancer deaths and one of the most dreaded diseases of women. In 1980s[1] the number of women dying of breast cancer remained constant, while the incidence of breast cancer was increasing. In females the detection

of lump in the breast causes an understandable fear of a cancer diagnosis. It is important that a careful assessment is undertaken so that appropriate management can be organized in a timely and efficient way.

Triple diagnosis refers to the concurrent use of clinical examination, mammography and FNAC for diagnosing palpable breast lumps. Among these FNAC plays a critical role in early diagnosis of any palpable breast lump.FNAC has become popular as a valuable tool in preoperative assessment of breast masses and it shows high accuracy, sensitivity and specificity. The procedure is safe, non-invasive, inexpensive and easy to perform,requires no advanced preparations and can be easily carried out in OPD with minimal complications.

FNAC is a diagnostic procedure where a needle is inserted in to your body and small amount of fluid is aspirated out for examination under a microscope. It is performed when a lump or any abnormality is detected on an imaging test such as x-ray, ultrasonography or mammography. It is a less painful and quicker method as compared to surgical biopsies.

Based on cytological findings it helps in differentiating benign from malignant lesions. Patients can be followed in cases of benign lesions and subjected to surgery in malignant cases thereby decreasing the rates of unnecessary surgery. In evaluating cystic breast lesion, it can be therapeutic if all the fluid is removed. There are instances where differentiation of benign and malignant is not possible. The problem arises when paucity of specimen sampling is encountered or there is morphological overlap between benign and malignant lesions. As a result to accommodate these problematic areas , a five tier system[2] is used cytological which includes inadequate (C1) , benign (C2) , suspicious probably benign (C3) , suspicious probably malignant (C4) , frankly malignant (C5). This categorization helps the cytopathologist to define the uncertain areas and the clinicians to offer further investigations like excisional biopsies judiciously.

FNAC of breast has improved decision making and selection of patients for biopsy and has contributed to saving time in the clinical management.
It is an indispensable diagnostic tool in various malignant breast lesions.

A preoperative diagnosis with the help of FNAC offers severaladvantages[3]:

- Immediate diagnosis relieves patient's anxiety and saves time.
- The definitive treatment can be planned in advance with the informed consent of the patient.
- If cancer is confirmed, staging investigation (Bone scan, liver scan etc.) can be done preoperatively.
- Many benign conditions can be confidently diagnosed by FNAC combined with radiological imaging and thus surgery can be avoided.
- Hospital facilities can be more economically used if the extent of surgery is known beforehand.

The use of FNAC[3] can be defined on an increasing scale to suit the local experience and requirements like:

- Diagnosis of simple cysts.
- The investigation of suspected recurrence or metastasis in cases of previously diagnosed cancer.
- The confirmation of inoperable locally advanced cancer.
- The preoperative confirmation of clinically suspected cancer.
- The investigation of any palpable lump, clinically benign or malignant, as a guide to clinical management
- .As a compliment to mammography in the screening situation.
- To obtain tumour cells for special analysis and research, e.g., hormone receptor studies, DNA analysis, immunohistochemistry, cell kinetics and molecular studies.

Despite its indisputable merits, FNAC has some limitations, like lack of experienced cytologist in many institutions, difficulty in distinguishing invasive from in situ carcinoma, difficulty in precisely equating cytomorphological features in breast aspirates with histological classification system used as gold standard and rare although occasional, false positive diagnosis of malignancy with FNAC.

Aims And Objectives

1) To study the diagnostic efficacy of fine needle aspiration cytology in breast lesions in our institution between January 2009 to December 2012**.**
2) To study correlation between FNAC and Histopathological diagnosis of breast lesions.
3) To study age distribution in breast lesions.
4) To recognize diagnostic difficulties and pitfalls related to FNAC diagnosis.

II. Review Of Literature

The technique of FNAC of breast was described by Kun[4] in 1847. It was introduce into clinical practice by Ellis and Martin in 1930's[5].

FNAC has become a method of choice in the investigation of breast lesions.Fine needle sampling(FNS) without aspiration can also be used.

O.N.Alema et al[6]studied the comparison of fine needle aspiration cytology and fine needle sampling without aspiration in 85 cases for diagnosis of palpable breast lumps in Mulago hospital. The study concluded that there was no difference in the diagnostic accuracy of FNAC and FNS in diagnosis of palpable breast lump.

Systematic pattern analysis in FNAC helps in diagnosing and subtyping breast lesions.

Prakash H Muddegowda et al[7] studied the value of systematic pattern analysis in FNAC of breast lesions in 225 cases with cytohistological correlation. Their study had a sensitivity of 94.5%, specificity of 98%, diagnostic accuracy of 97%, positive predictive value of 95.8%, and negative predictive value of 97.4%.

Breast lumps can be benign or malignant. Many studies have been conducted to find out the diagnostic efficacy of this procedure.

Sumit Giri et al[8] studied the diagnostic efficacy of FNAC of breast lumps. In his one year study, a total of 277 cases of breast lump were obtained out of which histopathology was available for 31 cases. The sensitivity, specificity, PPV and NPV were found to be 90.32%, 100%, 100% and 86.36% respectively.

Hikmatullah Qureshi et al[9] studied the diagnostic efficacy of FNAC in 50 females with breast lump by comparing them with their histopathological samples and found the sensitivity and specificity of 91.66% and 96.96% respectively.

Kuldeep Singh et al[10] studied the role of FNAC in diagnosis of breast lumps. In his study of 240 aspirations of breast lumps, when compared with histopathology 200 cases were benign, where percentage accuracy was 95.8%. Diagnostic accuracy was 100% in 40 malignant lesions.

Aditya Khemka et al[11] in his study of 'Palpable Breast Lumps: Fine-Needle Aspiration Cytology versus histopathology: a Correlation of Diagnostic Accuracy' found that out of 50 cases which were subjected to FNAC and its results were matched with those of histopathology showed that only 2 were false negative for malignancy. The sensitivity of the study was 96% & the specificity for malignant lesions was 100%

Garg et al[12] – out of 50 cases included in his study 32(64%) were malignant & 18 cases (36%) benign on final pathological diagnosis. The sensitivity and specificity of FNAC for malignant diagnosis was 78.15% and 94.44%, respectively, and of NCB was 96.5% and 100% respectively.

Francisco Dominguez et a[l3] performed an analysis of 1,398 patients in a community hospital where FNA and the histological diagnosis were compared in order to establish the accuracy, efficiency and safety of the FNA breast technique. The overall diagnostic accuracy was 94.84% and the sensitivity of cytological diagnosis was 98.75%.

MWM Suen et al[14] studied 'The role of FNAC in the diagnosis of breast lesions', where diagnostic accuracy for benign lesions was more than 95% and 92% for malignant lesions.

Rin Yamaguchi et al[15] Compared the Accuracy of Breast Cytological Diagnosis at Seven Institutions in Southern Fukuoka Prefecture, Japan5693 individuals who underwent breast cytological examination, analyses were conducted on 1250 individuals (22.0%) in whom cytological diagnoses were confirmed by histological diagnoses. Among these patients, cytological diagnosis had an absolute sensitivity of 71.9%, a specificity of 76.0%, a false-negative value of 6.7% and a false-positive value of 0.08%.

Breast / Mammary Gland

The class Mammalia is distinguished by the highly evolved modified skin appendages known as mammary glands or breasts that provide a complete source of nutrition and important degree of immunological protection for the offspring. The breasts are composed of specialized epithelium and stroma that may give rise to both benign and malignant lesions. Diseases of breast are best understood in context to its anatomy.

Embryology[16]

- The first indication of mammary gland is found in form of band like thickening of epidermis- the mammary line or mammary ridge.
- In the 7th week this line extends on either side of the body from the base of the forelimb to the region of the hindlimb.
- Although the major part of the mammary line disappears shortly after its formation, a small region persists in the thoracic region and penetrates the underlying mesenchyme.
- Here it forms 16 to 24 sprouts which in turn gives rise to small solid buds.
- By the end of prenatal life, epidermal sprouts are canalized and form the lactiferous ducts. Initially they open into small epidermal pit.
- Shortly after birth, this pit is transformed into nipple by proliferation of underlying mesenchyme.

Anatomy[17]

Breasts (mammary glands) are highly modified sweat glands. It is found in both sexes but it is rudimentary in males. The breast lies in superficial fascia of axillary region. The extension called axillary tail of Spence pierces the deep fascia and lies in the axilla.

It extends vertically from 2nd to 6th rib and horizontally from lateral border of sternum to midaxillary line. It lies on the deep fascia (pectoral fascia) which covers the pectoralis major muscle. It is separated from this fascia by loose areola tissue (retromammary space).

Structure of the breast may be studied by dividing it into skin, parenchyma and stroma.

Skin: it covers the gland and has a nipple and an areola. Nipple lies just below the centre of the breast at the level of fourth intercostal space. It is pierced by 15-20 lactiferous ducts and has a rich nerve supply. It contains circular and longitudinal muscle fibres and a few sweat and sebaceous glands. Areola is the pigmented skin surrounding the base of the nipple and is rich in modified sebaceous glands. Nipple and areola are devoid of hair.

Breast parenchyma: It is made up of glandular tissue which secretes milk. Each breast contains 15-20 lobes and each lobe is drained by lactiferous ducts which converges towards the nipple and opens on it. Near its termination each duct has a dilatation called lactiferous sinus. Within each lobe of breast, the main duct branches repeatedly to form a number of terminal ducts each of which leads to a lobule consisting of multiple acini. Each terminal duct and its associated lobe is called terminal duct lobular unit (TDLU).

Stroma: There are two types of stroma, one is interlobular stroma which is composed of dense fibrous connective tissue admixed with adipose tissue and the other is intralobular stroma which envelopes the acini of lobules and consists of breast specific , hormone responsive fibroblast- like cells admixed with scattered lymphocytes.

Blood supply: Breast is extremely vascular and is supplied by branches of internal thoracic artery, axillary artery and posterior intercostal arteries.

Venous drainage: Veins follow the arteries. They first converge towards the base of nipple where they form an anastomotic venous circle from where the veins run in superficial and deep sets. The superficial veins drain into the internal thoracic vein. The deep veins into internal thoracic, axillary and posterior intercostal vein.

Nerve supply: The breast is supplied by anterior and posterior cutaneous branches of fourth to sixth intercostal nerves.

Lymphatic drainage: Lymph of breasts drain into

- Axillary lymph node- chiefly the anterior group .The posterior, lateral and central and apical groups also receive lymph either directly or indirectly.
- Internal mammary nodes.
- Some of them reach supraclavicular, cephalic, posterior intercostal and subdiaphragmatic and subperitoneal lymph plexus.

Superficial lymphatics drain the skin over the breast except for the nipple and the areola. Lymphatics pass readily into surrounding lymph nodes.Deep lymphatics drain the parenchyma, nipple and areola. A plexus of lymphatics is present deep to areola (Subareolar plexus of sappy)

Development

Prepubertal period: In both males and females the larger duct system ends in terminal ducts with minimal lobule formation. After puberty the development of breast occurs under the influence of ovarian hormones.

Reproductive age group: During first half of reproductive age group, lobules are relatively quiescent. After ovulation under the effect of oestrogenand increasing progesterone level, cell proliferation increases as the number of acini per lobule and the intralobular stroma also becomes markedly oedematous. During menstruation the fall in hormone level induces the regression of lobules and disappearance of stromal oedema.

During Pregnancy: Only with the onset of pregnancy breast becomes completely mature and functional. Lobules progressively increase in size and number as does the number of acini per lobule. The acini are dilated and lined by cuboidal to low columnar cells with vacuolated cytoplasm. Acini may be filled with protein rich fluid called colostrum as pregnancy continues.

Lactation: After parturition the level of circulating hormones fall and prolactin stimulates milk production. The breast is entirely composed of acini distended with milk which is seen as eosinophillic material containing lipid droplets. The epithelial cells are flattened.

III. Classification Of Lesions Of Female Breast (Koss)

Inflammatory Lesions
-Acute and chronic inflammatory processes
Lesions Caused By Trauma
-Fat necrosis
-Reaction to foreign bodies
-Lesions resulting from breast augumentation or reduction procedures
Benign Proliferative Disorders
-Fibrocystic disease
- Cysts
-Fibrous mastopathy and other fibrous lesions of the breast
-Rare benign lesions
Classifications of tumours aim at defining entities with therapeutic, diagnostic, prognostic and biological relevance.

WHO histological classification of tumours of the breast[18]
A. Epithelial tumours
1. Invasive ductal carcinoma, not otherwise specified (NOS)
a) Mixed type carcinoma
b) Pleomorphic carcinoma
c) Carcinoma with osteoclastic giant cells
d) Carcinoma with choriocarcinomatous features
e) Carcinoma with melanotic features
2. Invasive lobular carcinoma
3. Tubular carcinoma
4. Invasive cribriform carcinoma
5. Medullary carcinoma
6. Mucinous carcinoma and other tumours with abundant mucin
a) Mucinous carcinoma
b) Cystadenocarcinoma and columnar cell mucinous carcinoma
c) Signet ring cell carcinoma
7. Neuroendocrine tumours
a) Solid neuroendocrine carcinoma
b) Atypical carcinoid tumour
c) Small cell / Oat cell carcinoma
d) Large cell neuroendocrine carcinoma
8. Invasive papillary carcinoma
9. Invasive micropapillary carcinoma
10. Apocrine carcinoma
11. Metaplastic carcinomas
a) Pure epithelial Metaplastic carcinomas
- Squamous cell carcinoma
- Adenocarcinoma with spindle cell metaplasia
- Adenosquamous carcinoma
- Mucoepidermoid carcinoma

b) Mixed epithelial / MesenchymalMetaplastic carcinoma
12. Lipid-rich carcinoma
13. Secretory carcinoma
14. Oncocytic carcinoma
15. Adenoid cystic carcinoma
16. Acinic cell carcinoma
17. Glycogen-rich clear cell carcinoma
18. Sebaceous carcinoma
19. Inflammatory carcinoma
20. Lobular neoplasia - Lobular carcinoma in situ
21. Intraductal proliferative lesions
a) usual ductal hyperplasia
b) Flat epithelial atypia
c) Atypical ductal hiperplasia

d) Ductal carcinoma in situ
22. Microinvasive carcinoma
23. Intraductal papillary neoplasms
a) Central papilloma
b) Peripheral papilloma
c) Atypical papilloma
d) Intraductal papillary carcinoma
e) Intracystic papillary carcinoma
24. Benign epithelial proliferations
a) Adenosis including variants
- Sclerosing Adenosis
- Apocrine Adenosis
- Blunt duct Adenosis
- Microglandular Adenosis
- Adenomyoepithelial Adenosis

b) Radial scar / complex Sclerosing lesion
c) Adenomas
- Tubular adenoma
- Lactating adenoma
- Apocrine adenoma
- Pleomorphic adenoma
- Ductal adenoma

B. Myoepithelial lesions
1. Myoepitheliosis
2. Adenomyoepithelial Adenosis
3. Adenomyoepithelioma
4. Malignant myoepithelioma

C. Mesenchymal tumours
1. Haemangioma
2. Angiomatosis
3. Haemangiopericytoma
4. Pseudoangiomatous stromal hyperplasia
5. Myofibroblastoma
6. Fibromatosis (aggressive)
7. Inflammatory myofibroblastic tumour
8. Lipoma - Angiolipoma
9. Granular cell tumour
10. Neurofibroma
11. Schwannoma
12. Angiosarcoma
13. Liposarcoma
14. Rhabdomyosarcoma
15. Osteosarcoma
16. Leiomyoma
17. Leiomyosarcoma

D. Fibroepithelial Tumors
1. Fibroadenoma
2. Phylloides tumour
a) Benign
b) Borderline
c) Malignant
3. Periductal stromal sarcoma, low grade
4. Mammary Hamartoma

E. Tumours of the nipple
1. Nipple adenoma
2. Syringomatous adenoma

3. Paget's disease of the nipple

F. Malignant lymphoma

1. Diffuse large B-cell lymphoma
2. Burkitt's lymphoma
3. Extranodal marginal-zone B-cell lymphoma of MALT type
4. Follicular lymphoma

G. Metastatic tumours

H. Tumors of the male breast

1. Gynaecomastia
2. Carcinoma

a) Invasive
b) In situ

Cytological findings : morphology of cells of breast[3,19]

Morphology of different types of cells is as follows:

1) Ductal epithelial cells:

- These are seen in cohesive groups or monolayered sheets, which represent terminal ductules.
- Lobular origin of a group is apparent from acinar shape.
- Nucleus is uniform, round to oval, 8 – 10 micron in diameter, dark with a granular chromatin and a very small nucleolus or no visible nucleolus. The cytoplasm is scant**.**

2) Myoepithelial cells :

- Generally recognized by their more compact, denser and more ovoid nuclei**.**

3) Apocrine cells:

- Clusters of apocrine cells of ductal origin are frequently found in breast aspirates. These cells have round often dark nuclei and abundant cytoplasm. The cytoplasm is finely granular and eosinophillic in PAP smears and slate gray in MGG smears.

4) Bipolar cell nuclei(stripped, bare, naked or stromal nuclei) :

- These are ovoid or elongated nuclei seen in background of benign breast aspirates.
- These are nuclei of fibroblast from specialized intralobular stroma although some say it to be a mixture of Myoepithelial cells and connective tissue nuclei.

Adipose tissue

- Sole component of breast aspirates and is a common finding with both benign and malignant aspirates.
- Fatty aspirates contain balloon – like fat cells in clusters of variable sizes, sometimes associated with strands of fibrocollagenous tissue or occasional capillaries.

5) Foamy cells (cystic macrophages):

- Foamy cells are found in cyst fluid and indicate fibrocystic disease. They have the appearance of foamy histiocytes (macrophages), but are believed to be of ductal epithelial origin. The nucleus is eccentric and the cytoplasm is heavily vacuolated**.**

6) Histiocytes and Giant cells:

- These cells show variation in cell size and mimic other cells. The nucleus is round, oval or indented with pale nuclear chromatin with a variable amount of pale gray/ blue cytoplasm often having frosted glass appearance. Cell borders are poorly defined but cells appear singly rather than in groups. Giant cells are formed due to fusion of histiocytes.

7) Blood cells :

- Leucocytes and red blood cells are mainly seen as a result of trauma.
- Red blood cells in small numbers are used as a scale to gauge the size of nuclei of epithelial cells.
- Large number of neutrophillic leucocytes is indicative of breast abscess.

8) Mucus producing cells

Mucus producing cells resembling goblet cells are occasionally found in breast aspirates, especially in fibrocystic disease.

9) Fluid component

Fluid component (greenish or bluish precipitate on smears) usually indicates the contents of benign cyst (e.g. fibrocystic disease).

Inflammatory lesions of breast:

1. Fat necrosis:it is a benign condition that affects perimenopausal females with an average age of 50 years[20].

Cytological findings:

- Aspirate is usually scanty
- Dirty background of granular debris, fat droplets and fragments of adipose tissue.
- Foamy macrophages, multinucleate giant cells and adipocytes with bubbly cytoplasm.
- Chronic inflammatory cells.
- Absence of epithelial cells.

Diagnostic pitfalls:

- Tuberculosis or other causes of panniculitides may be mistaken for fat necrosis.Meran Sen et al studied that in tuberculosis, the distribution of granulomas is diffuse and they are accompanied by caseous necrosis where as in fat necrosis the granulomatous reaction is limited only to the broken down fat globules.

Vidyavathi K et al[21] in their study said that abundance of foamy cells is a classic feature of fat necrosis but they are rarely seen in GM. In addition, epithelial cells which are seen in GM are not seen in fat necrosis.

- Macrophages mistaken for atypical epithelial cells.In such case multinucleate forms and foamy cells are helpful in preventing error[3].

Dalal Nemengani et al[22] in their study said that in suspected cases of malignancy the presence of fat necrosis in the smears does not completely excludes the possibility of malignancy. If the lesion begins to resolve in a brief period of < 1 month after FNA only then it may rule out the question of malignancy.

Prakash H Muddegowda[7] studied that fat necrosis is a mimicker of malignancy. The scantiness and cohesion of epithelial cells, which are devoid of significant pleomorphism, could prevent an error.

2) Mammary duct ectasia, Periductal mastitis, plasma cell mastitis, comedo mastitis:

Seen in premenopausal parous females[24].Clinically it is a well-defined lesion, centrally located and there can be retraction of nipple. In one – fifth of the cases nipple discharge can be seen.The basic abnormality is stagnation of secretions possibly due to loss of elastin support in duct walls leading to ectasia.

Cytological findings:

- Abundant, thick spreading pasty aspirate.
- Loss of much of the material on the smears because of dissolution in the methanol fixative.
- Amorphous debris in smears.
- Foamy macrophages, occasional giant cells and plasma cells.
- Scant epithelium which shows reactive atypia.

Diagnostic pitfalls:

- Clinical features and reactive epithelium may raise suspicion of malignancy.
- Necrotic carcinomas can be mistaken for duct ectasia.

3) Mastitis:

- Four types of mastitis have been recognized; acute, chronic, granulomatous and non-specific
- Acute mastitis or abscess: most commonly associated with lactation[24]but also independent of it.
- Chronic mastitis may be the result of persistence of acute mastitis, a reaction to retained secretions in fibrocystic diseases or duct ectasia or secondary to previous surgery.
- Granulomatous mastitis (GM): Etiology is variable ranging from tuberculosis, fungal, silicone, tumour related, sarcoidosis, fat necrosis, foreign body to non-specific. It mostly affects young parous females.[21,22]

Cytological findings:

- A benign bimodal component of non-neoplastic breast tissue.
- Inflammatory cells, chronic and/ or acute.
- Regenerative epithelial atypia.
- Histiocytes, epithelioid cells, multinucleated giant cells and plasma cells (granulomatous pattern). Langhans type giant cells may be identified.
- Microorganisms (infective mastitis).

Diagnostic pitfalls:

- GM can be mistaken for chronic mastitis or breast abscess.Vidhyavathi K et al[21] opined that in cases where GM is confused with chronic mastitis, the presence of single epithelioid cells even in the absence of granulomas would suggest a diagnosis of GM.

Prakash H Muddegowda[7] et al studied that the presence of neutrophils in smears of GM can be misdiagnosed as pyogenic abscess on FNAC. Thorough search for granulomas should be done in such a case.
Dalal Nemengani et al[23] studied that the diagnosis of idiopathic lobular granulomatous mastitis is a diagnosis of exclusion when all the other known cause are excluded.

Mimi Gangopadhyay[25] et al stated thatpredominance of neutrophils in the background and lack of caseous necrosis favours a diagnosis of granulomatous mastitis rather than tuberculosis. Granulomatous mastitis should also be distinguished from other chronic inflammatory breast diseases such as mammary duct ectasia, Wegener'sgranulomatosis, sarcoidosis and histoplasmosis when high numbers of epithelioid histiocytes are seen in smears.

- Epithelial atypia can be worrying and may mimic carcinoma
- Rarely carcinomas or lymphomas elicit a granulomatous response. Necrotic carcinoma can be misleading but large number of inflammatory cells is rarely seen in carcinoma which is a feature of GM[3]

Sevgi Bakaris et al studied that FNAC may not always be able to differentiate between Idiopathic Lobular Granulomatous Mastitis and other granulomatous diseases of the breast, and a confident diagnosis may require histological samples, negative microbiological investigations and clinical correlation. Adequate tissue specimens are therefore needed to differentiate Idiopathic GM from other pathologies, including cancer and other causes of GM, such as TB, sarcoidosis and ductular ectasis.

5) **Subareolar abscess; lactiferous duct fistula:**mostly affects young and nulliparous females[3].
Cytological findings:

- Purulent inflammation.
- Keratin flakes and debris; mature squamous cells.

Diagnostic pitfalls:

- An infected or ruptured epidermoid cyst produces a similar cytological picture, but occurs more laterally and superficially.

Jans F Silverman et al[27] stated that FNAC of epidermoid cyst is identical to that of Subareolar abscess. The only difference is peripheral rather than Subareolar location.

- Contamination by squamous epithelium from the skin or from dirty slides may be misleading. There should be abundant squamous cells intimately mixed with inflammatory cells to make a diagnosis[3].
- Significant reactive atypia in both the ductal and squamous cells may be misleading.

Alpha Tsui et al[28]stated that in cases of Subareolar abscess showing reactive atypia which is doubtful for carcinoma, presence of markedly inflamed background prevents a false positve diagnosis.

6) **Lipoma – Hypertrophic fat tissue:**mostly seen between middle age and fourth decade of life[29].
Criteria for diagnosis:

- A well-defined, rounded soft mass.
- 'Empty' sensation on needling.
- Fat only in multiple aspirates - fat vacuoles and/or fragments of adipose tissue.

M.O.A Samaila et al[29] stated that breast lipomas are a dilemma in diagnosis and causes diagnostic uncertainty because of the normal fatty composition of the breast, making it difficult to differentiate from other breast lesions. The triple test (TTT) which comprises medical history and breast examination, imaging studies (mammography and ultrasound) and non excision biopsy (fine needle aspiration cytology (FNAC) and core biopsy) is recommended for diagnosis

7)Ectopic breast tissue: seen during or before puberty and is often noticed during pregnancy[30].

- Breast tissue extending high up in the axilla commonly forms nodules or irregular lumps noted during pregnancy and lactation.
- The ectopic glandular tissue may take part in fibroadenoma, fibrocystic change or primary carcinoma.

Nirmala Jaget Lakhawar et al[30] did a case study of accessory breast tissue in axilla in a puerperal woman and stated that FNAC is a diagnostic tool in suspected cases of polymastia without nipple/ areola by demonstrating breast tissue in smears and thus helps in differentiating it from lipoma.Roy et al gave a case study of giant ulcerative lactating nodule of ectopic breast tissue mimicking malignancy on cytology due to hypercellulariy, cell discohesion and at least some nuclear atypia, potentially resulting in a false positive

diagnosis. In such cases macroscopic study of the excised specimen as well as histopathologic study is required to establish its true benign nature.

8) Postradiation/chemotherapy effects:

Cytological findings:

- Anisocytosis, anisonucleosis but preserved N: Cratio
- Smudged chromatin
- Abundant vacuolated cytoplasm.
- Preserved spatial arrangement of cells
- Little dissociation of epithelial cells.
- Presence of Myoepithelial cells.
- Clean background.

Diagnostic pitfalls:

- Post treatment atypia can mimic malignancy.M Murray et al studied a spectrum of non-neoplastic alterations of mammary epithelium that can mimic atypia.

Benign Neoplasm:

Fibroadenoma: Most common benign neoplasm that occur predominantly in young females in any age after puberty but most commonly in the third decade[24].

Cytological findings:

- A high cell yield.
- Large, cohesive sheets of benign ductal epithelial cells, sometimesarranged in staghorn pattern.
- Fragments of loose connective tissue stroma and abundant myoepithelial cells.
- Stroma appears as homogenous magenta coloured.
- Numerous single, bare bipolar nuclei of benign type.
- Multinucleate giant cellsmay be seen. Ng WK et al described multinucleate stromal giant cells in FNAC smears of breast lumps and commented not to misdiagnose this peculiar finding with more sinister conditions, such as Phylloides and Metaplastic carcinoma.
- Cystic macrophages & apocrine change may be seen.
- Fibroadenomas can be seen in young age and can be very large in size.

Madhumita Mukhopadhyay et al studied a case of juvenile giant Fibroadenoma of breast in an 11-year-old girl.

Diagnostic pitfalls:

- Fibroadenoma with epithelialatypia mimicking carcinoma.Myers T et al[33] stated that some cases of Fibroadenomas and papillary carcinomascan be very difficult, if not impossible,todistinguishonfine-needleaspiration cytology. Atleast occasional bipolar stromal cells should be searched for which goes in favour of fibroadenoma. The only appreciable difference between benign and malignant was more significant nuclear atypia in malignant cases.

Michael et al[34] stated that in some fibroadenoma series, up to 7% of cases were considered suggestive of or positive for malignancy at the time of FNA; single cells and prominent nucleoli were responsible for most problems. In such cases a search identification of the 2cell population prevents an inappropriate diagnosis of malignant neoplasm. Identification of two cell population prevents an inappropriate diagnosis of malignant neoplasm. Subtle degrees of apocrine metaplasia may be implicated as a source of atypia.

Michael W Stanley et al stated in their study that atypia, metaplasia and loss ofcohesion and prominent nucleoli may be responsible for most of the problems.

- Overlapping with other hyperplastic lesions, such as proliferative fibrocystic change and papilloma.Paulo Mendoza et al[32] studied that fibroadenoma need to be differentiated from papillomas as the latter shows small balls or clusters of cells, with either staghorn or papillary configurations in the smears.Papillomas don't contain numerous single bipolar nuclei and stroma is not Myxoid. Fibrovascular cores and detached columnar cells are usually present[3] in papillomas.

Bottles k et al[38] stated that stroma, antler horn clusters, and marked cellularity as the key cytologic criteria to differentiate fibroadenomas from fibrocystic disease.

They also said that stroma, antler horn clusters, and honeycomb sheets as the keycytologic criteria to fibroadenoma from ductal carcinoma which are present in the former.

Benoit J et al[39] gave false negative result of fibroadenoma on FNAC in their study due to under appreciation of single malignant cells present between epithelialgroupings typical of a fibroadenoma, while one was due to undersampling of the carcinoma.

- Distinction from Phylloides.

Paulo Mendoza et al[32] studied that a cellular aspirate with numerous plump and spindly nuclei, pronounced hypercellulariy of stromal fragments and presence of atypia support a diagnosis of phylloides over fibroadenoma.They also studied that Giant cells are more common in phylloides than fibroadenoma.
Ashutosh Nerukar et al[35] stated that distinguishing between cellular fibroadenoma and a Phylloides tumour can cause problems. Stromal cellularity and the presence of a number of long spindle cells goes more in favour of phylloides rather fibroadenoma.

- Myxoid Fibroadenoma: confusion with low grade mucinous adenocarcinoma.Fibroadenomas have a background of oval bare nuclei, vascular myxoid stromal fragments and absence of dissociated single atypical epithelial cells floating in mucin[3] which are seen in low grade mucinous carcinoma.
- Apocrine change is seen in 15% of fibroadenomas.[24]

IV. Galactocele And Lactating Adenoma:

Galactocele are cysts filled with droplets of collostrum or milk, and clusters of large epithelial cells with droplet filled cytoplasm that mimic foam cells.
Lactating adenoma - yields features of lactating breast: numerous, densely packed lobular units, either in clusters or as isolated spherical structures, with Myoepithelial cells at the periphery.

- During smearing clusters break up and flat sheets of cells with cytoplasm studded with large vacuoles , representing colostrum, and spherical nuclei of equal sizes, each containing one or more prominent, large, sometimes irregular nucleoli.
- In some cases nuclei stripped of cytoplasm are observed.

Diagnostic pitfalls:

- Prominent nucleoli may mislead for cancer diagnosis.

Roy et al studied a case in a 22 year old woman presented 3 months post-partum with a huge, rapidly growing and ulcerating axillary mass. Both the clinical impression and fine needle aspiration cytology features like hypercellulariy, dyscohesion with atypia suggested malignancy. However, resection followed by macroscopic and histopathologic study proved it to be a giant ulcerating but benign lactating nodule of ectopic breast. So they concluded that a careful histopathology is necessary for establishing an accurate diagnosis.

- Superficial similarities in cell distribution in smears and presence of large nucleoli exist between it and medullary carcinoma.

Intraductal Papilloma: Average age of presentation is 45 years

- Cellular smears having complex branching or folded epithelial sheets or finger like fragments with dense fibrovascular stroma.
- True papillary fragments with stromal cores
- Dispersed epithelial cells with nuclear atypia.
- Macrophages and variable amount of cystic fluid.

Diagnostic pitfalls:

- Low grade papillary carcinoma**.**
- Overlap with Fibroadenoma.
- Dispersed cells with atypia mimics malignancy.

Paulo Mendoza et al[32] stated that papillary fronds reminiscent of staghorn clusters can be seen in papillomas. Then presence of foam cells in association with these fronds is more specifically associated with papillomas than fibroadenoma.

They also studied that due to significant overlap of cytological and architectural atypia, benign and malignant papillary lesions cannot be distinguished cytologically[3].

Hamartoma:

- No specific diagnostic features
- Diagnosis not made on cytology
- Tends to have more intact rounded lobules
- Stromal fragments uncommon
- Abundant adipose tissue

Intraductal Proliferative Lesions:
Usual Ductal Hyperplasia

- Cell- rich smears, large sheets of cohesive epithelial cells, few single cells.
- Cells often in streaming pattern, focal crowding and overlapping of nuclei, rarely holes.
- Nuclear atypia absent or mild.
- Naked bipolar and myoepithelial nuclei present but may be few; clean background; calcium granules occasionally.

Atypical Ductal Hyperplasia:

- Cell- rich smears, large sheets of cohesive epithelial cells, few single cells.
- Focal crowding and overlapping of nuclei; holes suggestive of cribriform pattern in some cases..
- Mild to moderate nuclear atypia .
- Few naked bipolar and myoepithelial nuclei present but may be few; debris and calcium occasionally present.

Ductal Carcinoma In Situ

- Cell- rich smears, large sheets of cohesive epithelial cells, few single cells.
- Focal crowding and overlapping of nuclei; holes suggestive of cribriform pattern in some cases; some papillary cell groups.
- Mild to moderate nuclear atypia.
- Naked bipolar and myoepithelial nuclei absent; necrotic debris and calcium often but not invariably present.

Diagnostic pitfalls:

- UDH, ADH AND DCIS are difficult to distinguish from each other on cytology. So the term epithelial proliferations may be used[3].
- Mild atypia can be misdiagnosed as cancerOverdiagnosis of cancer in cases of atypia can be avoided by presence of more than a few clearly benign elements, both ductular epithelium and single bipolar nuclei[3].

Prakash H Muddegowda et al studied that features favouring DCIS over IDC include more single dyscohesive atypical cells, loosely arranged epithelial fragments, prominent anisonucleosis, coarser nuclear chromatin("clumped chromatin"), and background inflammatory cells.In their article they said that carcinoma in situ is more likely to be interpreted as suspicious or positive.

Benign Proliferative Diseases:-
Fibrocystic Disease:It is a premalignant condition. Commonly seen in between ages of 25 & 45 years.

C**ytological findings:**

- Epithelial fragments of usual epithelial cells.
- Scattered single bare bipolar / oval nuclei.
- Background of variable amount of cyst fluid, macrophages and apocrine metaplasticcells.

Diagnostic pitfalls:

- False results when sample is not from representative area.
- Apocrine atypia especially seen when the cells are degenerated could potentially be labelled as suspicious and should be avoided.[3,32]
- Apocrine cells showing multilayering and atypia are are differentiated from DCIS by the presence of necrotic debris in the latter.
- Inspissations/condensation of cyst contents, duct ectasia.the distinction between them is based on clinical findings. Duct ectasia presents as a Subareolar cord- like mass of thickened tissue and its condensed secretion show presence of chronic inflammatory cells , occasional sheet of duct epithelium and total absence of nuclear debris[3]

Prakash H Muddegowda[7] et al studied in their article on systemic pattern analysis of breast lesions thatmacrophage-rich pattern is seen predominantly in fibrocystic change and in cysts which usually showed foam cells, apocrine cells, and occasionally non-apocrine cells. Smears with apocrine cells showing degenerative atypia should be interpreted with caution, taking into consideration background patterns like proteinaceous background (for benign cystic lesion of breast) and hemorrhagic background (to rule out malignancy).

Paulo Mendoza et al[32] studied that proliferative fibrocystic disease is cytologically indistinguishable papilloma and fibroadenoma but papilloma is associated with a clinical history of nipple discharge and a palpable Subareolar mass and fibroadenoma with numerous bare bipolar nuclei.

Paulo Mendoza et al[32] also said that in case of fibrocystic change, the presence of large epithelial cells with enlarged nuclei, eosinophillic nucleoli one should always look for Lactational changes and presence of positive history of lactation and appearance of nodule during pregnancy and lactation.

- From simple cyst by complete disappearance of lump after aspiration and variable amounts of polymorphs in the latter[3].

Phyllodes tumour: median age of presentation is 45 years.

- Highly cellular smears.
- Sheets of epithelial cells and fragments of spindly or polygonal stromal cells, some showing nuclear atypia.
- Nuclei are monomorphic and identical to or slightly larger than those of Fibroadenoma.
- Stromal cellularity and overgrowth, nuclear atypia,.mitotic activity and invasive growth pattern at tumour periphery defines whether phylloides tumour is benign, low grade or high grade.[3]

Diagnostic pitfalls:

- Differentiation from fibroadenoma by stromal fragments which are larger and increased in number and hypercellular and single stromal cells in the background which are plumper as compared to the typical oval bare nuclei in the latter.[3]

Ranjana Bandyopadhyay[40] et al stated that Fibroadenomas and Phyllodes tumours share a dimorphic pattern with both epithelial and stromal components. The features in favour of phylloides are the presence of hypercellular stromal fragments..

Prakash H Muddegowda[7] et al studied that the presence of abundant stromal fragments and some benign ductal cells support the diagnosis of Phylloides tumour.

G Kojcan et al[41]Individual long spindle nuclei >30% amid the dispersed stromal cells in the background differentiates phylloides from fibroadenoma.

Primary Carcinomas Of Breast:

1) Infiltrating Ductal Carcinoma- No Special Type:

Cytological findings:

- Moderate to highly cellular smears.
- Single population of epithelial cells; no myoepithelial cell; no single bare bipolar nuclei.
- Variable loss of cell cohesion – irregular clusters and single cells
- Single epithelial cells with intact cytoplasm.
- Moderate to severe nuclear atypia; enlargement, pleomorphism, irregular nuclear membrane and chromatin.
- Fibroblasts and fragments of collagen (stromal desmoplasia) associated with atypical cells.
- Intracytoplasmic neolumina in some cases.
- Necrosis unusual, more suggestive of DCIS.
- Primary infiltrating ductal carcinoma can arise in aberrant breast tissue of axilla which can be diagnosed on FNAC and confirmed on histopathology.

Zafer Teke et al[43] reported a case in a 52 year-old woman who presented with a palpable nodule in the right axilla. FNAC of the mass revealed malignant epithelial cells which on Histopathological examination revealed an infiltrating ductal carcinoma.

Roy Ashikari et al[44] studied breast cancer presenting as an axillary mass in 42 patients.Muhammad Shamim et al[45] presented a case report of a 70-year-old female who presented with a painless mass in right axilla which was later diagnosed as IDC of ectopic breast tissue.

Diagnostic pitfalls:

- Sampling from non-representative sites can lead to missing of a malignant focus.
- Smearing artefacts due to crushing, artifactual disruption of cell aggregates, slow drying of MGG smears, drying artefacts in alcohol- fixed smears may render interpretation difficult. .
- Smears from low-grade carcinoma may simulate benign pattern. However the single cells are dispersed malignant which may have lost their cytoplasm but still differ from bare bipolar nuclei because of their irregular shape and some remnant of cytoplasm.
- Fibrosclerotic lesions due to low cellularity can cause diagnostic problems.

Michael W. Stanley[34] said that schirrous ductal carcinoma yields low cellularity and can result in false negative results.

Prashant Goyal et al stated that factors contributing to "false negative" results include small tumor size, hypocellularity and inadequate sampling during aspiration, and few histological tumor types such as low nuclear grade, lobular carcinoma, scirrhous carcinoma.

They also stated that in their study atypical benign lesions with moderate cellularity with cohesive clusters of epithelial cells showed on careful review, there were few dyscohesive clusters with nuclear atypia and nuclear crowding however the presence of naked nuclei in background, lack of discohesion, and apparent monolayered nature of majority of epithelial clusters led to underreporting of these cases in C3 cytology.

- In situ and low grade carcinoma.

Prakash H Muddegowda et al[7] said that distinguishing between invasive ductal carcinoma and DCIS is difficult because the two entities have similar features.

They also stated in their study that phylloides tumour can be mistaken for ductal carcinoma and results in false positive diagnosis. The presence of stromal fragments and some benign ductal cells could support the diagnosis.

- Nuclear atypia.
- Metastatic carcinoma.

2) Invasive Lobular Carcinoma:

Cytological findings:

- Cell yield is variable, but often poor.
- Cells singly scattered and in small clusters or in single files.
- Scanty and fragile cytoplasm with nuclear moulding.
- Nuclei are relatively uniform, but the outline is irregular and angulated.
- Intracytoplasmic neolumina / central droplet of mucin (target cell or bull's eye inclusion**).**

Diagnostic pitfalls:

- Sparse cellularity and resemblance to non-neoplastic lesions.
- Distinction from low grade carcinoma**.**
- Intracytoplasmic lumina in other lesion.

Prakash H Muddegowda[7] studied that in Lobular carcinoma cells are relatively small and their malignant nature can be overlooked. A high proportion of isolated cells, homogenous small malignant cells with minimal cytoplasm, large but non-pleomorphic nuclei are pointers of classic form of invasive lobular carcinoma differentiating them from benign lesions.

Nancy A Youngs[42] et al studied that invasive lobular carcinomas are responsible for high percentages of false negative results due to paucicellular smears and difficulty in distinguishing lobular carcinoma cells from normal and lymphoreticular elements. Their study showed 8%false negative results where as those reported in literature are between 7% and 22%.

Michael W Stanley et al[34] said that malignant tumours with highest potential for false negative diagnosis include lobular carcinoma.

3) Mucinous carcinoma(mucoid or colloid carcinoma):

Cytological findings:

- Abundant background mucin
- Cells distributed in singles, files or in moderately cohesive clusters
- Nuclear enlargement and pleomorphism are relatively mild.
- Background of'Chicken wire' blood vessels .

Diagnostic pitfalls:

- lack of nuclear atypia resembles a benign condition
- Mimics mucinous DCIS or ADH.
- Mucocele like lesions
- Mucinous Fibroadenoma
- Myxoid stromal matrix resembles mucin.
- Mimics Metastatic carcinoma

Prakash H Muddegowda[7] et al studied that absence of myoepithelial cells and distinctive features like thin-walled capillaries, either free floating or coursing through the thick mucin could help in making diagnosis.

4) Medullary carcinoma.

Cytological findings:
- Highly cellular smear
- Features of high grade carcinoma with cells having irregular coarsely granular nuclei and often very large nucleoli.
- Numerous lymphocytes in the background.

Diagnostic pitfalls:
- High- grade DCIS
- Metastatic carcinoma
- Malignant lymphoma
- High grade IDC

5). Invasive papillary carcinomapapillary lesion: ALPHA TSUI
- The term "papillary lesion" includes benign papilloma, papillary DCIS, encysted and invasive papillary carcinoma. It is often difficult to distinguish these entities on cytology. Further investigations are recommended for all papillary lesions.
- some lesions may appear "papillary" but turn out "non-papillary" on histology e.g. fibrocystic change, fibroadenoma, gynaecomastia

Cytological findings:
- Usually cellular
- Finger-like epithelial fragments with a structural border of a row of columnar cells without a stromal core suggest a papillary lesion.
- Palisades of columnar epithelial cells, even if only 4 or 5 in a row, is a useful sign of a papillary lesion
- 3-D papillary clusters with fibrovascular cores.
- Think papilloma if cellular aspirate with not many bare bipolar nuclei (contrast with that of a fibroadenoma)
- Cell dyscohesion combined with high cellularity, nuclear atypia and mitotic activity in a benign papilloma can lead to a false positive diagnosis.
- Nuclear atypia may be present (mild nuclear enlargement, small nucleoli), especially in infarcted papillomas.
- Often foamy macrophages in the background

Cytological findings favouring papillomas:
- Mild to moderate cellularity (less cellular as compared to papillary carcinoma.
- Papillary structures with fibrovascular cores and monolayered sheets, containing ductal cells with maintained polarity.
- Myoepithelial cells present within the cell groups and in the background.
- Occasional single ductal cells but not showing nuclear atypia .
- No single bare tumour nuclei .
- Apocrine cells present

Features favouring papillary carcinoma:
- Marked cellularity.
- 3D large complex papillary structures which may not have fibrovascular cores, containing multilayered ductal cells with loss of polarity and cellular crowding.
- Acinar and cribriform structures .
- Myoepithelial cells not present within the cell group.

It is a rare type of carcinoma affecting predominantly elderly post-menopausal women with an incidence rate of 0.3 to 2% and has a favourable prognosis.

6) Apocrinecarcinoma: Rare form of breast malignancy
Cytological findings:
- Large cells with eosinophillic, granular cytoplasm, large pleomorphic nucleoli.
- Complete absence of benign epithelial cells and single bipolar nuclei.

7) Secretory carcinoma: This rare form of breast carcinoma is seen primarily in children, but it can also occur in adults.

Cytological findings:

- It is characterized by the presence of large vacuolated cells seen against a background of secretory material.

7) **Granular cell tumour:**

Cytological findings:

- Cellular
- Scattered groups of cells with abundant granular cytoplasm and indistinct cell borders
- Nuclei are oval to round and uniform in size .
- Evenly dispersed chromatin pattern .
- Occasionally nucleoli may be present
- Cytoplasmic granules are red with Pap and PAS accentuates the granules.

8) **Metaplastic carcinoma:**tumour that has two distinctly different components.

Cytological findings:

- numerous malignant spindle cells
- Stromal fragments seen.
- Myxoid or chondromyxoid background
- Osteoclast-like giant cells.
- Features of adenocarcinoma may be present .
- Squamous cells may be seen**.**

Diagnostic pitfalls:

- Malignant phylloides.
- Duct carcinoma with squamoid differentiation.

10)Clear cell (Glycogen -rich) carcinoma:

Cytological findings:

- Hypercellular smears with loosely cohesive syncytial groups and singly scattered malignant cells.
- Abundant pale cytoplasm and moderate to marked nuclear pleomorphism with prominent nucleoli.
- 'Tigroid' background can be noted.
- PAS positive, diastase sensitive material compatible with glycogen can be seen.

11) Paget's disease of nipple:

Cytological findings:

- Background of keratin, squamous cells, inflammatory cells and debris.
- Large malignant cells singly and in small groups, closely associated with squamous cells and inflammatory cells.
- Abundant pale cytoplasm with distinct borders.
- Obvious nuclear features of malignancy.

Diagnostic pitfalls:

- Reactive changes in squamous cells secondary to inflammation from other causes may mimic malignancy which can be avoided as squamous cells are usually cohesive and donot show high grade of nuclear pleomorphism in paget's disease.
- Differentiated from Nipple adenomas/ Subareolar duct papillomatosis as the latter from cohesive aggregates of epithelial cells which are uniform in size and donot show malignant nuclear characteristics.
- In case of carcinoma arising from a major duct just below the nipple which has erupted into the nipple without infiltrating the epidermis in a pagetoid fashionshows numerous malignant cells in syncytial clusters and there is no intimate mixture of carcinoma cells and squamous cells.
- Differentiated from In situ squamous cell carcinoma and melanoma clinically, histopathologically and by immunohistochemistry.

Sample Size:

A retrospective & prospective study of 50 cases of FNAC of breast lesions in a 4years period (2009-2012) along with histopathological correlation in department of pathology was conducted.

The clinical details were obtained from the medical records department and from the cytology requisition forms, histopathology requisition forms accompanying the specimens.
The specimens were received in 10% buffered formalin and then 3 - 5 microns thick sections were cut and stained with haematoxylin and eosin.

Study Design:
Prospective and retrospective study

Place Of Study:
Department of pathology**,** MGM Medical College and Hospital, Kamothe, Navi Mumbai.

V. Material And Method

A retrospective & prospective study of 50 cases of FNAC of breast lesions in a 4years period (2009-2012) along with histopathological correlation in department of pathology was conducted. The clinical details were obtained from the medical records Department and from the cytology requisition forms, histopathology requisition forms accompanying the specimens. FNAC was carried out in all the patients in OPD with breast masses and were subjected to surgery. The specimens were received in 10% buffered formalin and then 3 - 5 microns thick sections were cut and stained with haematoxylin and eosin.

Equipment
The basic equipment needed to perform FNAC is simple and relatively inexpensive. The following material was used.

- Disposable 10 Ml Plastic syringes.
- Disposable 24 Gauge Needles 11/2 inches long.
- New glass slides, one end frosted on one side, 1.0 mm thin (Gold Seal, Beckton, Dickinson and company, Highland Park, IL)
- Gauge pieces
- Ether alcohol bottles for immediate wet fixation of smears.
- Surgical gloves – current regulations of the occupational safety and health administration require that the person performing FNAC wear surgical gloves.
- Containers for cystic fluid collection and transportation to cytology laboratory.
- Requisition form with patient's name, OPD number, FNAC site and other relevant clinical information.

Preparation of the patient

Patient may be in a seated or supine position. The site is prepped with alcohol or betadine. Reviewing the procedure with the patient prior to the aspiration usually appeases anxiety. Ultrasound-guided FNAC of breast is recommended, especially for sampling of a small, deep mass or solid remnant of a cystic lesion. The area of FNAC should be cleansed with spirit.

Aspiration Procedure (koss):
For Obtaining adequate samples target palpation, immobilization and proper needle tip placement and movement are required.

Palpable lesions:
Palpation of the target and planning of the procedure:

- The target should be carefully palpated and size and distance of the lesion from the overlying skin should be assessed.
- In small lesions(1 cm in diameter) the centre of the lesion and in very large lesions (>5 cm in diameter), the periphery is more likely to yield diagnostic material. In medium size lesions it is advantageous to collect samples from two different areas, one to the side of the centre and other in mirror image position of previous aspiration.

Immobilization of the target :

- The target should not move with the needle and particularly in lesions with dense stroma in order to facilitate penetration of the needle tip into the target.
- Lesions over 3 cm in diameter can be held in place with thumb and forefinger. Small lesions (1 to 2.5 cm) can be more efficiently immobilized between the forefinger and middle finger.
- Stretching of the overlying skin tightly across the lesion further immobilize the target.

Insertion of the needle:

- Needle tip is inserted to the target and suction is applied by retracting the syringe plunger to the 1-2 mm mark. Suction should be kept at this level throughout the sampling period.

Aspiration procedure:

- The needle is moved back and forth (or up and down) within the boundaries of target lesion.
- To collect sufficient material for at least two smears, typically 15 to 20 needle movements are required.
- If significant amounts of blood appear at the hub of the needle , it is best to limit the nimber of needle movements toto about 5 in order to avoid excessive dilution with blood.
- Needle should be moved in same plane in small targets. In larger targets, angle of needle ,the angle of the needle may be changed in small increments.
- Atleast one additional aspirations should be performed additionally to ensure representative sampling.

Withdrawal of the needle:

- Release the suction before withdrawing the needle.
- Remove the needle from the syringe and pull back on the plunger. Then reattach the needle and expel the material on to the glass slide by pushing the plunger swiftly through the syringe.To avoid splattering the tip of the needle should rest on the slide.
- Changing the direction of the needle during sampling may be required.
- The needle tip should be withdrawn from the target while it remains under the skin.the angle of the needle is changed before the needle is reinserted into the target.

Non palpable lesions: The aspirations are performed under stereoscopic imaging guidance.
Aspiration without a syringe:

- The target is identified and immobilized, the needle held by the hub , is placed within the target and moved back and forth to collect small fragments of tissue. The fragments are collected within the shaft of the needle the hub opening of the needle should be left uncovered during sampling.

At least two to four passes of the needle are required to harvest optimal diagnostic material.

Slide preparation:

Thiscomponent of the procedure is as important as the aspiration of the material. Errors in slide preparation can result in suboptimal or nondiagnostic specimen. Material should be placed on slides immediately to prevent clotting of the specimen in the needle hub. Clotting of the specimen in the needle hub results in difficulty in transferring the specimen to the slides. Rinsing the needles in a rinse or tapping the hub of the needle against the slide while holding the hub of the needle with a haemostat can aid in recovering the clotted material in the hub. With, prolonged clotting of the specimen, the diagnostic material gets enmeshed in the fibrin clot. When the clotted material is transferred to the slide the cells may be poorly visualized resulting in a suboptimal specimen.

After the aspirate is transferred to the slide it must be delicately smeared. Too much pressure can result in crushing of the cellular material rendering it nondiagnostic. Too little pressure will result in smears that are too thick. Thick smears hinder evaluation of nuclear detail and can result in an erroneous interpretation or a nondiagnostic aspirate. A combination of air dried and fixed smears should be prepared. Air dried smears are stained with May Grunwald Giemsa (MGG) stain while fixed smears are stained using PAP stain or an H&E stain. Air dried smears highlight cytoplasmic detail and background material while fixed smears highlights the nuclear details.

Fixed slides should be placed in fixative immediately to prevent air-drying artefact of the cells. Air-drying artefact can occur in less than one second after the aspirate is smeared across the slide. Air drying artefact results in artifactual enlargement of the cell and obscures nuclear detail, which hinders slide interpretation. The fixative most commonly used is alcohol. Other fixatives such as Carnoy's solution (a mixture of alcohol and acetic acid) can be used to help lyse the erythrocytes in the specimen. Material can remain in Carnoy's solution for only 5 to 10 minutes. After 15 minutes the cellular details becomes drastically distorted and renders the specimen noninterpretable. This fixative is not practical in the outpatient setting where material is subsequently transferred to the cytopathology laboratory after long periods of time. Under such circumstances the slides should be fixed in alcohol.

Modified PAP Staining Protocol:

1) Prepare PAP OG 6-EA stain combination by mixing equal portions of the PAP OG 6 stain and one of the EA stains.

2) Fix smear using your standard laboratory protocol (95% ethanol preferred).
3) Time = 1 minute

Wash fixed smears in running water.

Note: This step is necessary for removing spray fixatives. If slides were fixed in 95% ethanol, time may be reduced to a few seconds.

4) Time = 3 minutes

Stain in Hematoxylin Gill No.2; then wash in running tap water.

5) Time = 20 seconds

Immerse in Scott's Tap Water Substitute; then wash in running tap water.

6) Time = 20 seconds

Immerse in 95% reagent alcohol

7) Time = 1-3 minutes

Stain in PAP OG 6-EA stain combination (as prepared in step 1)

8) Time = 10 seconds

Rinse in two changes of 100% reagent alcohol.

9) Time = 10 seconds each

Rinse in two changes of Xylene

10) Blot and allow to dry
11) Put coverslip with the help of DPX mountant.

Results: nuclei are stained blue while cytoplasm displays varying shades of pink, orange, yellow and green.

Giemsa stain – Modified

1) Place thoroughly dried blood film on an appropriate staining rack.
2) Flood slide with 1-2 ml Wright-Giemsa stain.
3) After 1 minute, add an equal volume deionized water or phosphate buffer, Ph 6.8 – 7.2, and mix thoroughly by gently blowing on slide.
4) After 1-3 minutes, thoroughly rinse with deionized water and air dry.

Nuclei- will be varying shades of purple

Cytoplasmic staining- will be varying shades of blue to light pink. Fine reddish to lilac granules may be present in cytoplasm of some cell types.

Specimen Adequacy:(BREAST CYTOLOGY-ALPHA TSUI/koss)

- No consensus reached; requires clinical and radiological correlation
- For a suspected epithelial lesion, to exclude malignancy: at least 6 epithelial groups of 5-10 cells each.
- For suspected non-epithelial lesion: no minimal cell groups proposed
- Presence of atypical cells, even in small numbers, is never considered unsatisfactory

Complication[3]s:

- Hematoma
- Vasovagal reactions
- Pneumothorax
- Severe pain
- Subpleural hematoma
- Tumour implantation along the needle track
- Haematogenous dissemination of breast tumour cells
- Haemorrhage
- Infarction
- Epithelial implantation resembling invasion

ScalereportingsystemforFNACofbreastlumps

Categories	Descriptor
C 1	Inadequate
C 2	Benign
C 3	Likelybenignbutwithsomeatypia
C 4	Suspiciousofmalignancy
C 5	Malignant

Inthisstudy,categoriesC2andC3wereconsideredbenignandC4andC5 were consideredmalignantforstatisticalanalysis.

Allthecasesunderwentsurgeryandthespecimensweresentforhistopathologicalexamination. After fixing in 10% buffered formalin and noting down the gross appearance, representative tissues underwent routine histopathologic processing and paraffinembedding.Formicroscopicstudy,4-6µmthicksectionswerecutandstainedwithroutineH&Emethod.Alltheslideswereexaminedtodeterminethenatureofthelesion.

Thehistopathologicreport was consideredthe goldstandardandclinical andcytologicdiagnoseswerecomparedwithit.

Types of breast surgical specimens[24]:

- Tylectomy (lumpectomy, excisional biopsy) consists of removal of entire mass and variable amount of surrounding breast tissue.
- Quadrentectomy is a form of Tylectomy in which the area of excision roughly corresponds to an anatomical quadrant of breast.
- Subcutaneous mastectomy consists most of the mammary tissue, without overlying skin or nipple and often without axillary tail.
- Simple mastectomy consists of all or almost all of the mammary tissue, without overlying skin or nipple and often without axillary tail.
- Halsted radical mastectomy consists of removal of entire breast parenchyma, underlying and surrounding adipose tissue ,the pectoralis major and minor muscles and the axillary contents in continuity and en bloc.
- Modified radical mastectomy(also known as extended simple mastectomy and total mastectomy)consists of removal of all the mammary tissue including the axillary tail, together with the nipple, the surrounding skin and variable amount of lymph-node bearing fat from the lower axilla; the pectoralis muscles are preserved.

In our hospital three types of breast surgeries are carried out:

- Lumpectomy
- Simple mastectomy
- Modified radical mastectomy

Harris hematoxylin and eosin staining procedures:
(for FNAC staining –start from step 2)
Solutions:
Differentiating solutions :acid alcohol
0.25 ml cHCL
100 ml 70% ethanol
Scott's solution
1 litre tap water
10 g magnesium sulphate (anhydrous)
2 g sodium bicarbonate
Staining

1. Deparrafinize sections to water to fix and rinse frozen sections.
2. Stain in Harris Hematoxylin solution(sigma) 2 -30 minutes depending on section thickness.
3. Overstain a bit since the differentiating step will destain the tissue .filter harris Hematoxylin stain before each use.
4. Rinse in running tap water.
5. Differentiating solution, 1-6 dips.
6. Rinse in running tap water.
7. Blue in Scott's tap water substitute solution(sigma, or make as above), 5 seconds -2 minutes).
8. 95% ethanol,30 seconds – 2 minutes.
9. Alcoholic stain Y(Sigma),30 seconds to 20 minutes
10. 100% ethanol , 5 dips x3 changes.
11. Clear in Xylene and mount with DPX.

Inclusion Criteria

- Age > 10 years of age.
- Females who underwent fine needle aspiration cytology as well as histopathological examination of breast lesions (lumpectomy/ mastectomy specimen).

Exclusion Criteria

Males with breast lesions.

VI. Observation And Results

The present study comprises of 50 cases of females with breast lump who underwent FNAC. The study was over a period of four years from January 2009 to December 2012.Subsequentlysurgery was performed and the specimen was available for histopathological examination.

Table no. 1: Age distribution of all breast lesions

Age Groups	Number of cases	Percentage (%)
11-20	9	18
21-30	14	28
31-40	12	24
41-50	8	16
51-60	5	10
61-70	1	2
71-80	0	0
>80	1	2
Total	50	100

The age of the patients ranged from 15 to 85 years with a mean age of . The maximum number of lesions were in the age group of 21-30 years (28%) followed by 31-40 years (24%) and 11-20 years (18%). Least number of lesions were seen in the age groups of 61-70(2%) and above 80 years (2%) and no lesion was seen in the age group of 70 – 80 years .

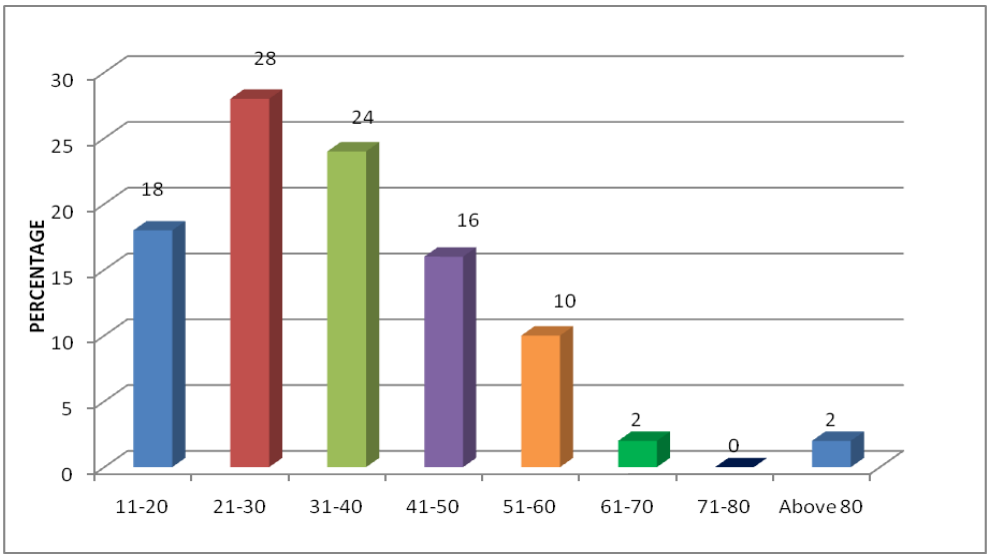

Fig no. 1: Age distribution of all breast lesions

Table no.2:Age wise distribution of benign breast lesions confirmed on histopathology

Age Groups	Number of cases for Benign breast lesions confirmed on Histopathology	Percentage
11-20	9	27.27
21-30	13	39.39
31-40	9	27.27
41-50	2	6.06
51-60	0	0.00
61-70	0	0.00
71-80	0	0.00
>80	0	0.00
Total	33	100

Out of 35 lesions diagnosed as benign on cytology, two cases were confirmed as malignant on histopathology.

In our study, the most common age group of benign lesion is 21-30 years (39.39%) followed by 31-40 years (27.27%).

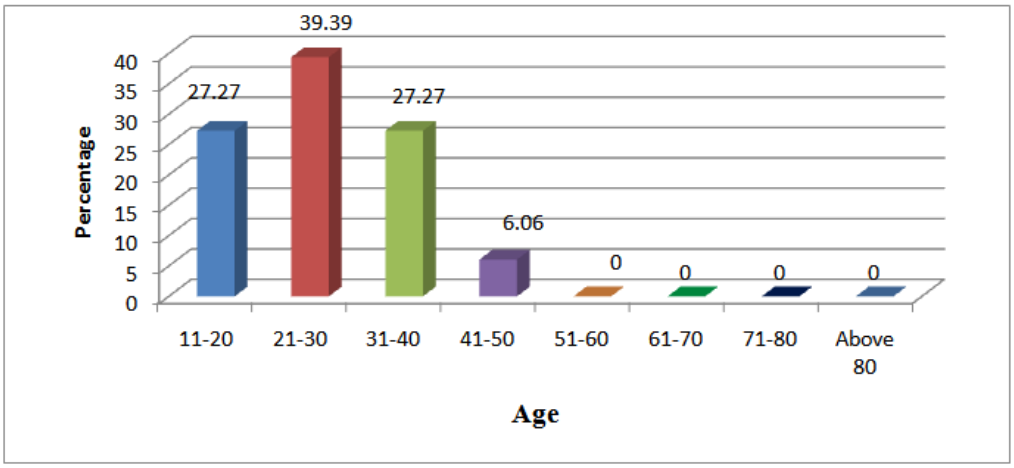

Fig no. 2: Age distribution of benign breast lesions

Table no. 3: Types of Benign lesions and their histopathological correlation

FNAC Dignosis	Number of cases	Histopathology confirmed
Granulomatous Mastisis	1	1
Breast Abscess	2	1
Fibroadenoma	2 5	2 1
Fibrocystic Disease	4	3
Ductal Hyperplasia	2	0
Others	1	0

The most common benign breast lesion seen in our study is Fibroadenoma (21cases).

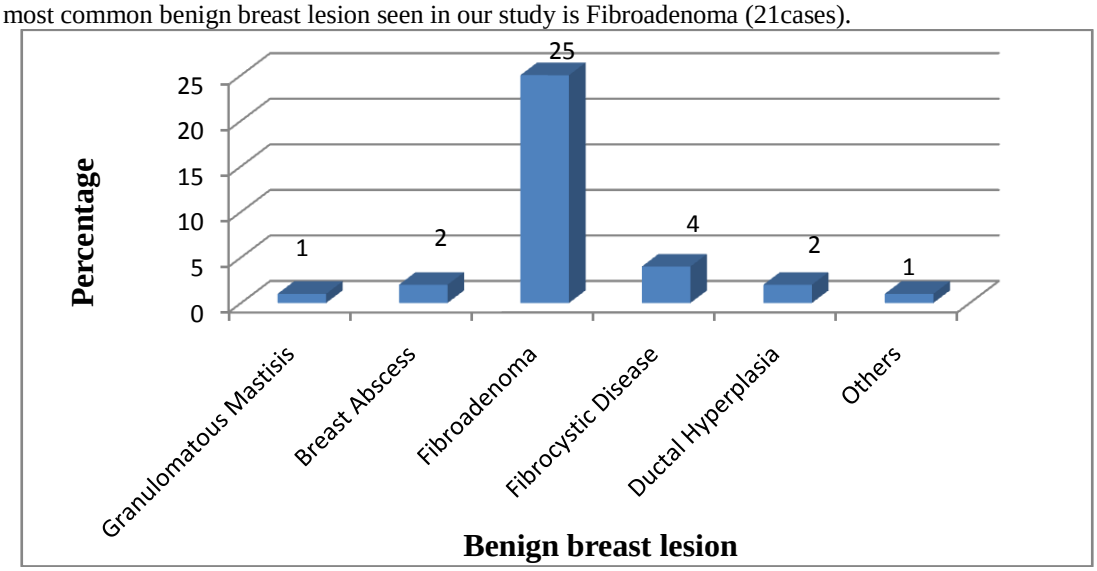

Fig no. 3: Commonest benign breast lesion

Table no. 4: Age wise distribution of Fibroadenoma:

Age Groups	Number of cases	Percentage
1 1 - 2 0	9	3 6
2 1 - 3 0	1 0	4 0
3 1 - 4 0	5	2 0
4 1 - 5 0	0	0
5 1 - 6 0	1	4

61-70	0	0
71-80	0	0
>80	0	0
Total	25	100

The most common age group of fibroadenoma in our study is 21-30 years (40%).

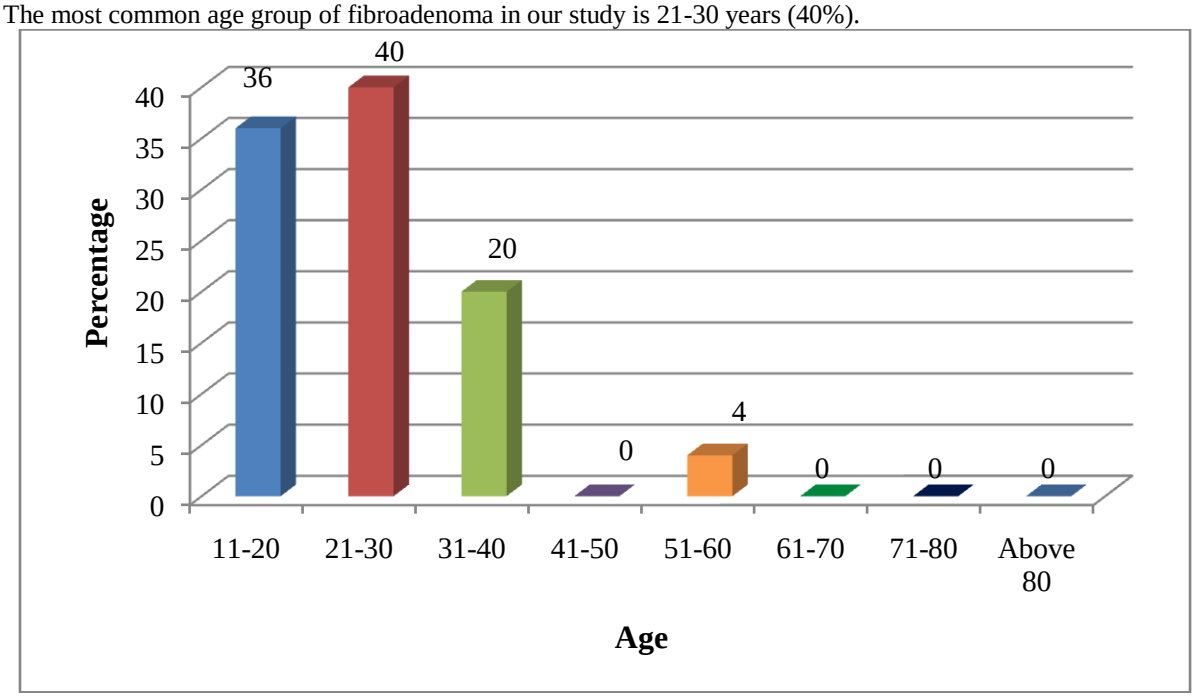

Fig no. 4: Age distribution of Fibroadenoma

Table no. 5: Age wise distribution of malignant breast lesions

Age Groups	Number of cases	Percentage
11-20	0	0.0
21-30	1	6.67
31-40	2	13.33
41-50	6	40.0
51-60	4	26.67
61-70	1	6.67
71-80	0	0.0
>80	1	6.67
Total	15	100.0

In the present study out of 15 malignant lesions which were confirmed on histopathology, age ranged between 30 and 85 years with the mean age of . Maximum number of lesions were seen in the age group of 41 to 50 years (40%) followed by 51-60 years (26.67%). Minimum numbers of cases were seen in the age groups of 21-30 years (6.67%) and above 80 years (6.67%).

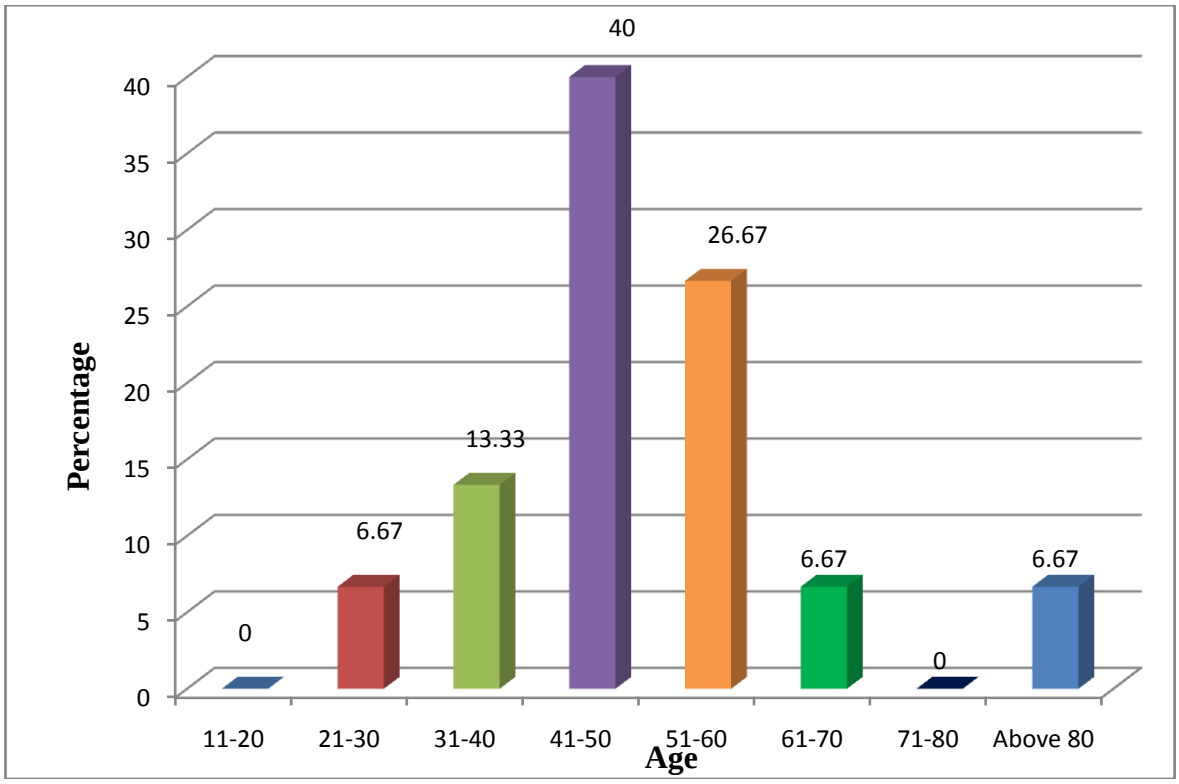

Fig no. 5: Age wise distribution of malignant breast lesions

Table no. 6: Types of malignant breast lesions

Malignant lesions	Number of cases	Percentage
IDC	13	86.66
Mucinous carcinoma	1	6.67
Sarcoma	1	6.67
Total	15	100

The commonest malignant lesion seen is infiltrating duct carcinoma (13 cases, 86.66%).

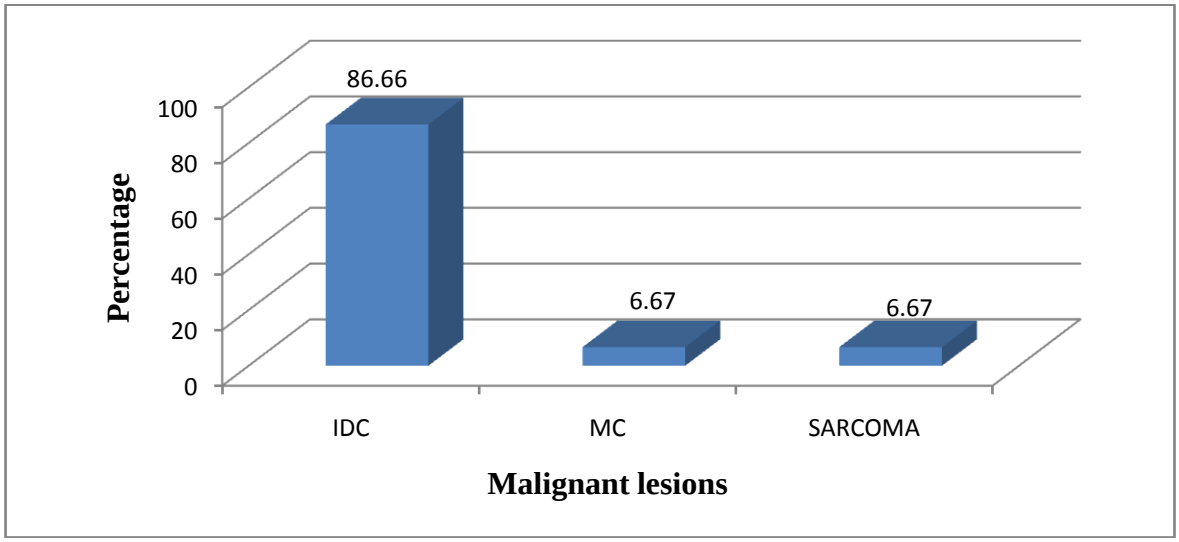

Fig no. 6: Types of malignant lesions

Table no.7: Age wise distribution of IDC

Age Groups	Number of cases	Percentage
11-20	0	0
21-30	1	7.14
31-40	1	7.14
41-50	6	42.86
51-60	3	28.57
61-70	2	14.29
71-80	0	0
>80	0	0
Total	13	100

In our study, the most common malignant lesion found is IDC and it is seen in age group of 41-50 years (46.15%) followed by 51-60 years (23.07%).

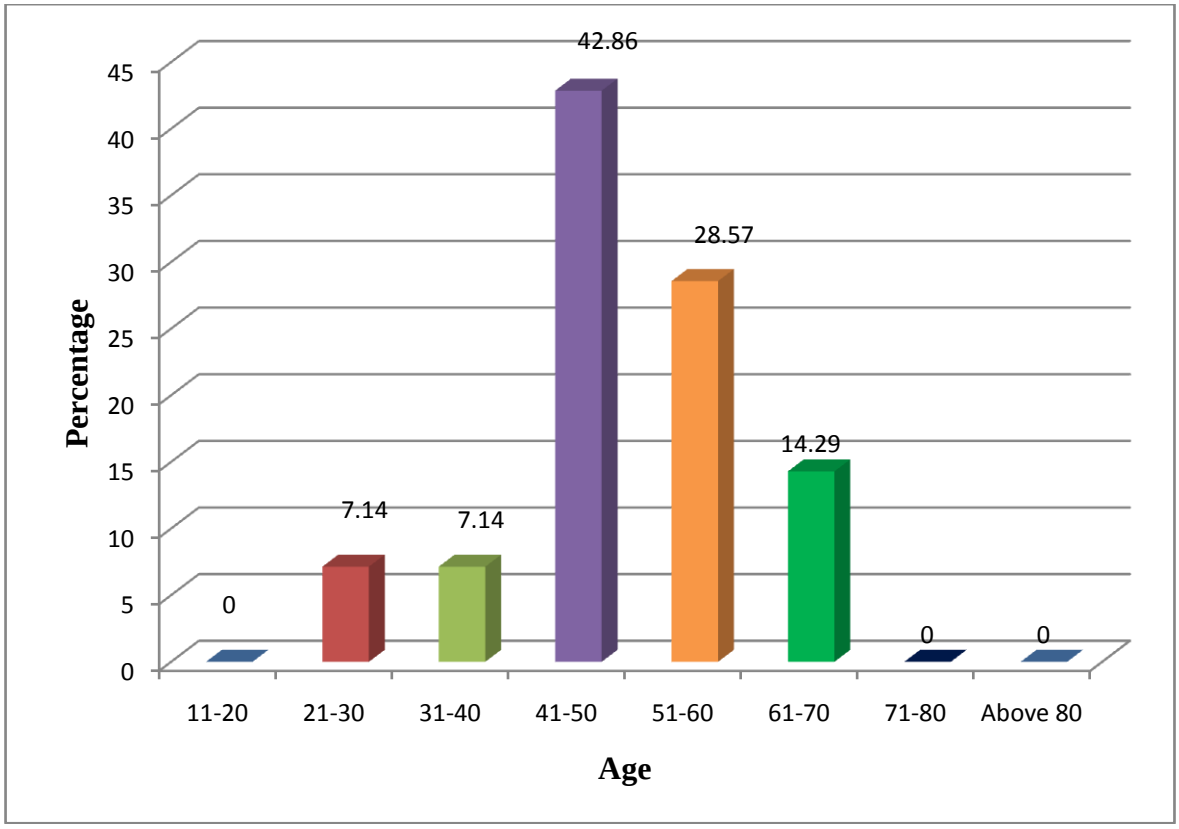

Fig no.7: Age wise distribution of IDC

Table no. 8: Location of breast lump in various lesions

Site of lesion	Number of cases	Percentage%
Axilla	2	4
Bilateral (B/L)	2	4
Lower inner –left breast (LIL)	3	6
Lower inner- right breast (LIR)	3	6
Lower outer-left breast (LOL)	8	16
Lower outer –right breast (LOR)	4	8
Subareolar	2	4
Upper inner- left breast (UIL)	5	10
Upper inner-right breast (UIR)	7	14

Upper outer left breast (UOL)	9	18
Upper outer right breast (UOR)	5	10
Total	50	100

In the present study, left breast is most commonly involved and common location is upper outer quadrant (18%) followed by lower- outer quadrant (16%).

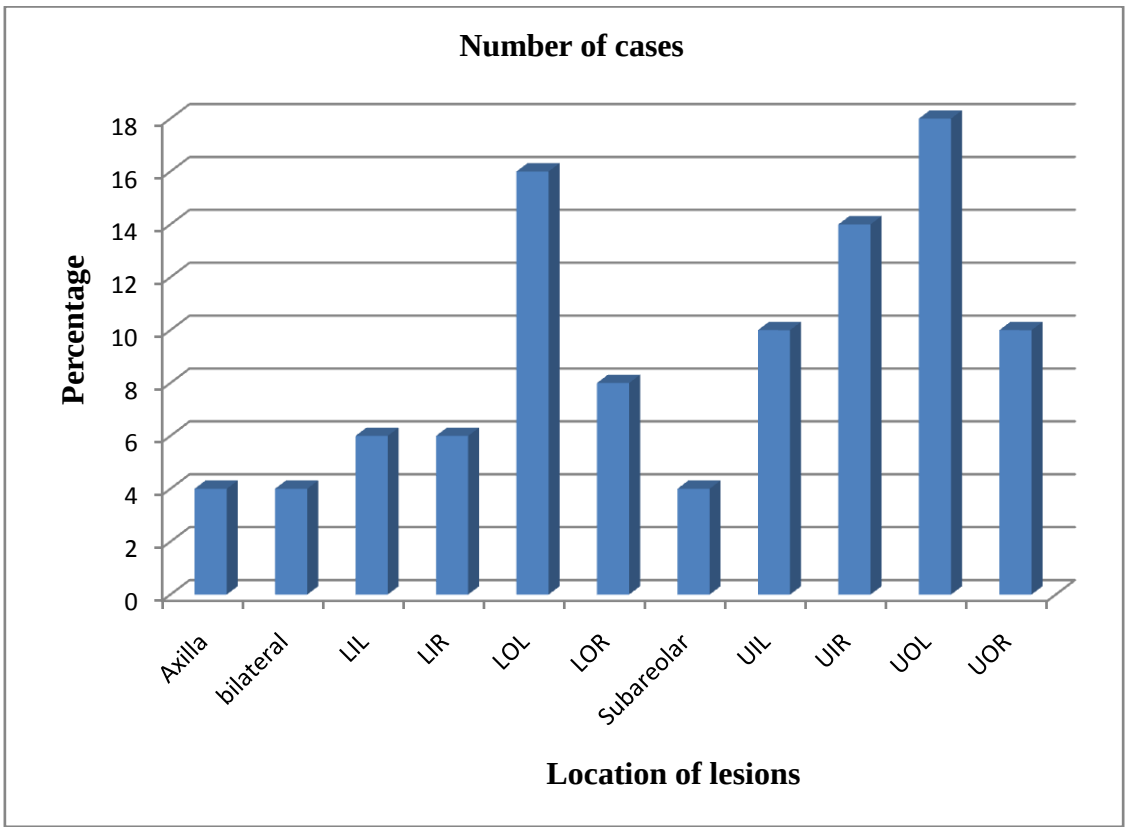

Fig no. 8: Location of breast lump in various lesions

Table no. 9: Cytological categories of breast lesions:

Cytological categories	**Number of cases**	**Percentage**
Inadequate (C1)	01	02
Benign (C2)	21	42
Atypical probably benign (C3)	13	26
Suspicious probably malignant (C4)	00	00
Frank malignant (C5)	15	30
Total	50	100

In our study the most common cytological category is C2 (benign, 42%) followed by C3 (atypical probably benign, 26%).

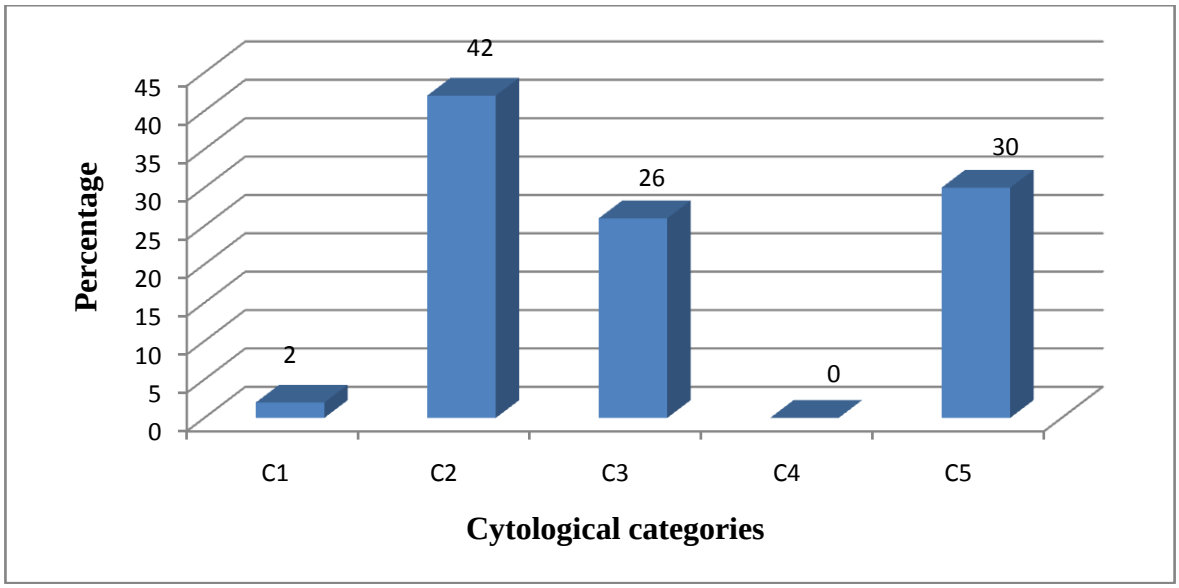

Table no. 10: Comparison of cyto-histopathological diagnosis

Cytological diagnosis	Number of cases	Histopathological Diagnosis			
		Consistent		Inconsistent	
Benign	3	4	3	2	0	2
Suspicious of malignancy	0	0	0	0	0	0
Malignant	1	5	1	5	-	-
Total	4	9	4	7	0	2

Out of the total 50 cases, 49 cases were correlated with histopathological diagnosis. However, one case was given inadequate (C1) on cytology which proved to be benign lesion on histopathology.

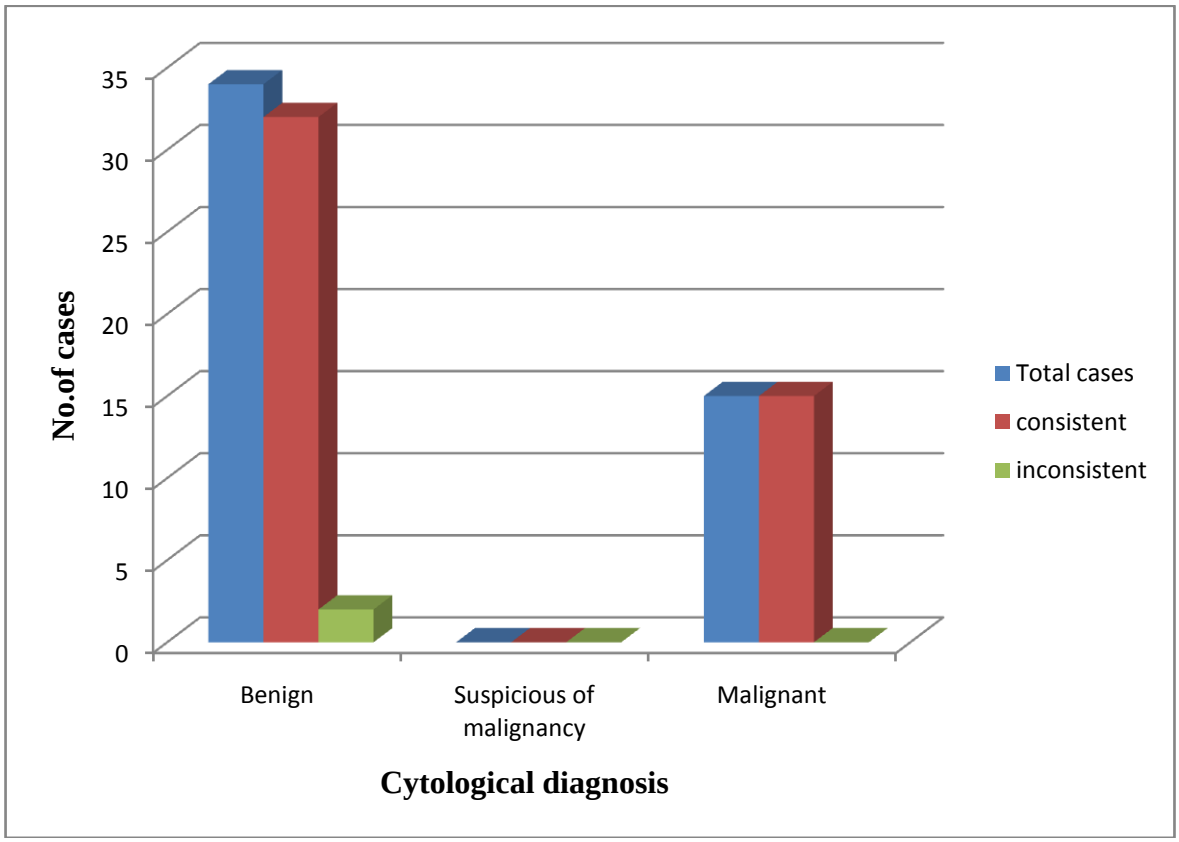

Fig no. 10: Comparison of cyto-histopathological diagnosis

Table no.11:

S n o .	Cytological diagnosis	Histopathological diagnosis	D i a g n o s t i c p i t f a l l
1	Atypical ductal hyperplasia	Infiltrating Ductal Carcinoma	Complex architecture and atypia misinterpreted as malignant
2	Unsatisfactory smear	F i b r o a d e n o m a	P a u c i c e l l u l a r i t y
3	Benign breast disease/ Fibroadenoma	Invasive Lobular carcinoma	Bland looking malignant cells misinterpreted as benign.
4	F i b r o a d e n o m a	F i b r o c y s t i c d i s e a s e	Apocrine change and absence of cystic component
5	Usual ductal hyperplasia	F i b r o c y s t i c d i s e a s e	only proliferative epithelial component
6	F i b r o c y s t i c d i s e a s e	Usual ductal hyperplasia	
7	Acute suppurative lesion	Granulomatous mastitis	A b u n d a n t n e u t r o p h i l s

The statistical tests used in the interpretation of the results obtained in our study were the determination of:Sensitivity of FNAC as a diagnostic procedure for the entire study.Specificity of FNAC in relation to the malignant lesions.Positive predictive value of FNAC as a diagnostic procedure for the entire study.Negative predictive value in relation to the malignant lesions.

In our study, of the 50 patients who underwent FNAC, in 48 the FNAC reports matched with the final histopathology report.

Table no.12

F N A C / H i s t o p a t h o l o g y c o r r e l a t i o n	D i s e a s e d	Not diseased
P o s i t i v e	4 8	-
N e g a t i v e	2	-
T o t a l	5 0	

Out of the 2 patients, in which FNAC did not match, one showed a benign breast disease (fibroadenoma) and the other showed atypical hyperplasia on FNAC. An excision biopsy of the lump was performed in both patients and both showed duct carcinoma. They then underwent surgery.

Thus there were 48 true positives, 2 false negative and no false positive and true negatives in our study.

The sensitivity of a test is the ability of a test to identify all those who have the disease. In our study the sensitivity would be:

$$\text{Sensitivity} = \frac{\text{True positive}}{\text{True positive + false negative}} \times 100 = \frac{48}{48+2} \times 100 = 96\%$$

The specificity of a test is the ability of the study to identify correctly the candidates who do not have the disease.

$$\text{Specificity} = \frac{\text{True negative}}{\text{True negative + false positive}} \times 100$$

In our study, only females with a lump in their breast were selected. Therefore, in purely statistical terms,, there were no normal individuals normal individuals i.e., those women with normal breasts were not selected. Hence, the ability of Fine-Needle Aspiration Cytology as to identify correctly not having disease (i.e., true negatives) could not be calculated since in every patient in our study, FNAC would reveal some result.

Hence the specificity of FNAC for malignant lesions that is how specific is FNAC as a test in the diagnosis of malignancy in the the breast lump.

Table no. 13

	Malignant	Non- malignant	Total
Malignant	15	0 0	15
Non- malignant	02	33	35
Total	17	33	50

So specificity = 39 x 100 = 100%
39+0

The positive predictive value of a test indicates the probability that the patient with a positive test has , infact , the disease in question.

Positive predictive value = true positive x 100
True positive + false positive

48 x 100 = 100%
48+0

Positive predictive value is for FNAC as a diagnostic test for all patients.

The negative predictive value of a test indicates the probability of a patient with a negative test not having the disease in question.

Negative predictive value = True negative x 100
True negative + False negative

33 x 100 = 33 x 100 = 94.28%
33+2 35

In the absence of true negative, the negativepredictive value of the test is zero but with calculation of specificity for malignant lesions, our negative predictive value of the test for malignant lesion is 94.28%.

Table no.14:

Name of the study	Senstivity	Specificity	Positive predictive value	Negative predictive value
Aditya Khemka et al	96%	100%	100%	95.12%
Hussain et al	90.9	100%	-	-
Tiwari et al	83%	100%	-	-
Pudaisini et al	93.3%	100%	-	-
Hiktamullah Qureshi et al	91.66%	96.96%		
Dominguez et al	93.49%	95.73%	93.49%	95.73%
Chol et al	77.7%	99.2%	98.4%	88%
Ahmed et al	85.29%	100%	100%	98.79%
Ariga et al	98%	99%	99%	99%

VII. Discussion

A lump in the breast is a common complaint in the surgical out – patient department of all major hospitals with anxiety regarding a possible malignancy being extremely common. Hence a quick diagnosis of lump in the breast is essential.

In our study breast lesions were more commonly seen in younger age groups with maximum of 12 patients in 21-30 age groups. In similar studies done by Pudassaini et al breast lumps were most commonly seen in age group 21 to 30 years.

In our study left breast was most commonly involved in 25 patients while right breast was involved in 19 patients. Bilateral breast involvement was seen in two patients.

In their series Aditya Khema et al studied left breast involvement in 28 patients while right breast involvement in 22 patients.

Similarly Hussain et al in their study showed left breast involvement in 27 patients and right breast involvement in other 23 patients.

No surgical importance can be attached to this observation since patient selection in no way was dictated by involvement of any particular breast.

In our study upper and outer quadrant was the commonest site of lump (14 patients) followed by upper inner and lower outer quadrant each with 12 patients followed by lower inner quadrant in six patients.

Similarly Aditya Khema et al in their study in series had 22 patients with lump in upper and outer quadrant, 10 patients in upper inner quadrant and 9 patients in lower inner quadrant.

In our study the most common pathology was Fibroadenoma in 21 patients followed by fibrocystic disease in 3 patients and malignancy in 15 patients.

In similar study on 50 patients Aditya Khema et al also reported fibroadenoma as the commonest pathology in 29 patients followed by fibrocystic disease in 4 patients and malignancy in 13 patients In their study on 91 patients, Tiwari et al also reported fibroadenoma as the commonest pathology. Other important conditions such as fibrocystic disease, Subareolar abscess, duct ectasia and galactocoele in their study ranged from 5.5% to 7.7%.

The most common age group for fibroadenoma in our study was 21-30 years with 10 patients out of 21 patients. Similar studies done by K Deshpande et al showed that the most common age group was 21-30 years.

The most common malignant lesion in our study was IDC with 13 patients' similar studies done by Pudasaini et al the most common carcinoma was Invasive Ductal Carcinoma (IDC) with 46.7% of all cases.

The most common age group of IDC in our study was 41-50 years with 6 patients. In similar studies done by Pudasani et al maximum number of malignancy (26%) was seen in age group 41 to 50 years.

The most common cytological category involved in our study was C2 with 21 patients. K Deshpande et alalso showed in their study that most common category was benign (68.4%)

The primary aim of our study was to determine the diagnostic efficacy of FNAC by correlating with the final histopathological report of the lump in other words how effective and reliable was FNAC in diagnosing breast pathology which could help us in proceeding towards definite excisional surgery without having an unpleasant surprise at the final histopathology report of the specimen.

The obvious advantages of FNAC are in the form of rapid and cost-effective, out-patientprocedure, not requiring anesthesia which can be easily repeated without much discomfort to the patient. Occasional complications like hematoma or post procedure pain and rare chances of tumour seeding along the needle track. With needles used now being quiet fine, this chance is even less likely. However some limitations in terms of its inability to diagnose lesions if the aspirate is either scanty either due to an inexperienced operator or a very small or deep lesion. Diagnosis is also not possible if the aspirate is from the centre of a necrotic tumour or in the diagnosis of unusual tumours.

In relation to breast pathologies there are obvious advantages (apart from the more general ones) in the form of very few false positives in differentiating between benign and malignant lesions, as well as of being diagnostic and therapeutic in most breast cyst. Recurrence of carcinoma of breast, too, can often be diagnosed. The condition which have a risk of false positive result are papillary lesions, atypical epithelial hyperplasia, regenerating epithelial atypia and atypia of ductal epithelium in a cyst.

A risk of false negative result exists in low grade malignancies, small or complex proliferative lesion as well as in tumours with central necrosis or a small cell carcinoma.

The sensitivity of a particular test is the statistical index of the diagnostic efficacy of the particular test. In the context of FNAC, it implies that if FNAC is positive, it is definitely means presence of disease but if it is negative, it does not rule out the disease. The specificity of a particular test, on the other hand, is the ability of the test to identify those individuals who donot have the disease. In purely statistical terms, there were normal individuals in our study that is women without a breast lump. Hence the ability of FNAC as a diagnostic test to identify correctly those individuals not having the disease that is true negatives could not be noted since in every patient in our study FNAC could reveal some result. Therefore, specificity of FNAC as a whole could not be calculated. To give a wider spectrum to our interpretation of the results, that is how specific is FNAC as a diagnostic test for malignant lesion. The positive predictive value of a test indicates the probability of the patient with a positive result to have the disease. Hence, it shows the diagnostic power of the test while the negative predictive value of a test, on the other hand, indicates the probability of a patient with negative result not to have the disease. As stated in our results, we had no true negatives. In the absence of true negatives, the predictive value of the negative test is actually zero, since the numerator becomes zero. As with the calculation of specificity for malignant lesions, we broadened the interpretation of our results by calculating the negative predictive value of the test for malignant lesions. This aspect has already been explained in the results.

Consent Form For Research Study
Title Of Project
Diagnostic Efficacy Of Fine Needle Aspiration Cytology In Breast Lesions
Name Of Student: Dr Sakshi Garg (First Year Pg Resident)
Name Of Pg Guide: Dr. Manisha. Y. Tambekar(Associateprofessor)

Tick to confirm

I confirm that i have read and understand the information sheets dated 09/12/2010 for the above study. ☐

I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily. ☐

I understand that my participation is voluntary and that I am free to withdraw at anytime , without giving any reason, without my medical care or legal rights being affected. ☐

I understand that relevant sections of any of my medical notes and data collected during the study, may be viewed by responsible individuals from MGM Medical College [IERC] and the regulatory authorities, as and when relevant. I give permission for these individual to have access to my records. ☐

I agree to take part in the above research study of my own will.

Name of patient
Date/Place

Signature/thumb impression

Student Name
Date/Place Signature

Witness Name
Date/Place Signature

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Morphology of different types of cells in breast FNAC (Fig no. 11a-d).

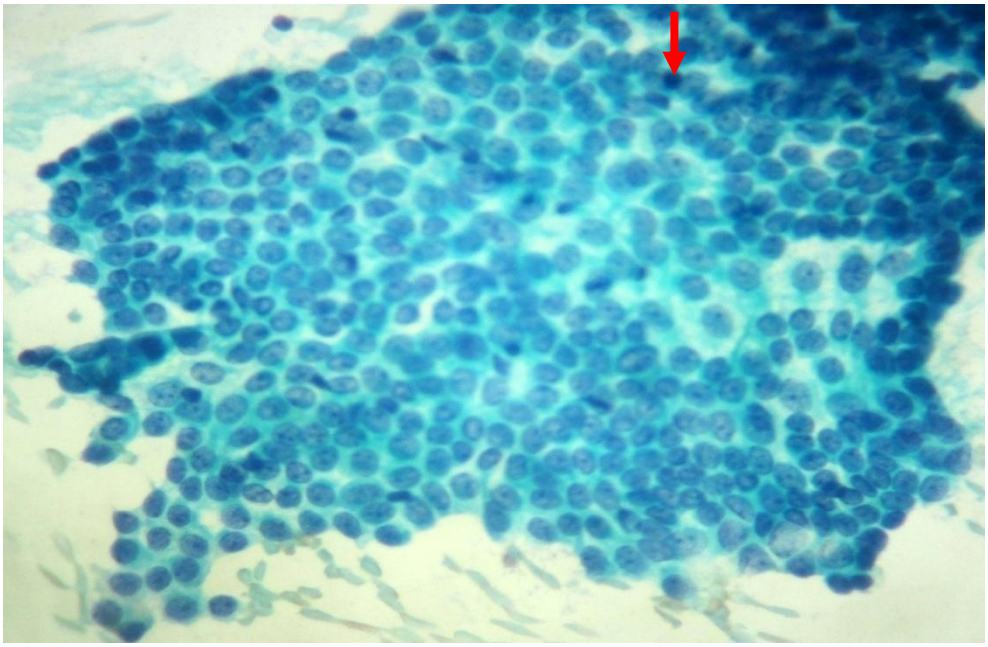


Fig no.11 (a) Normal ductal epithelial cells in monolayered sheets with myoepithelial cells having compact,denser and ovoid nuclei (arrow) (Pap x40).

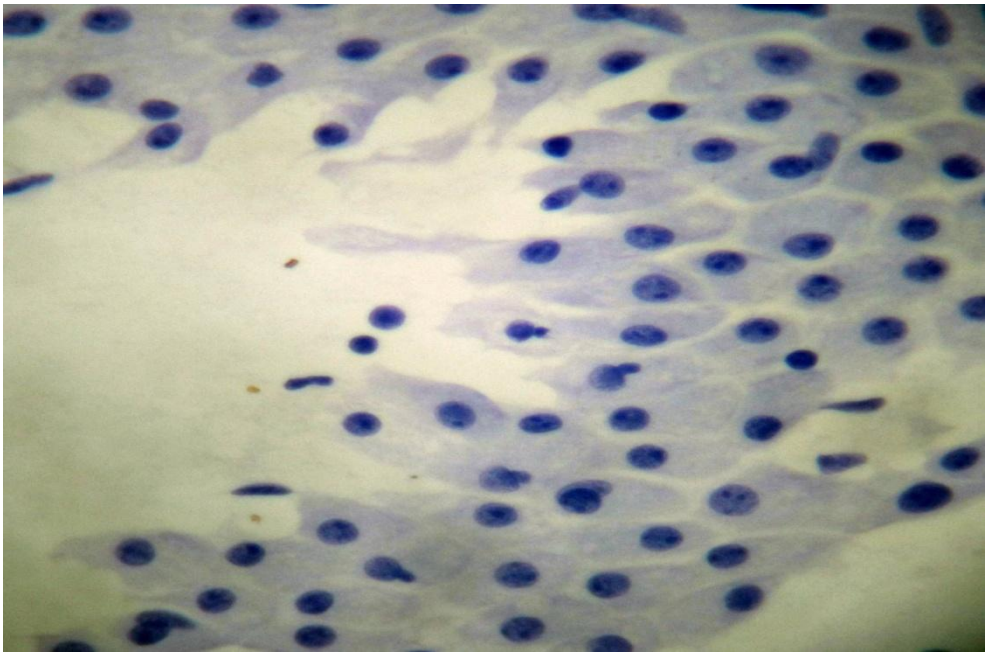


Fig no.11 (b) Clusters of apocrine cells with dark nucleus and abundant finely granular eosinophilic cytoplasm(Pap x40).

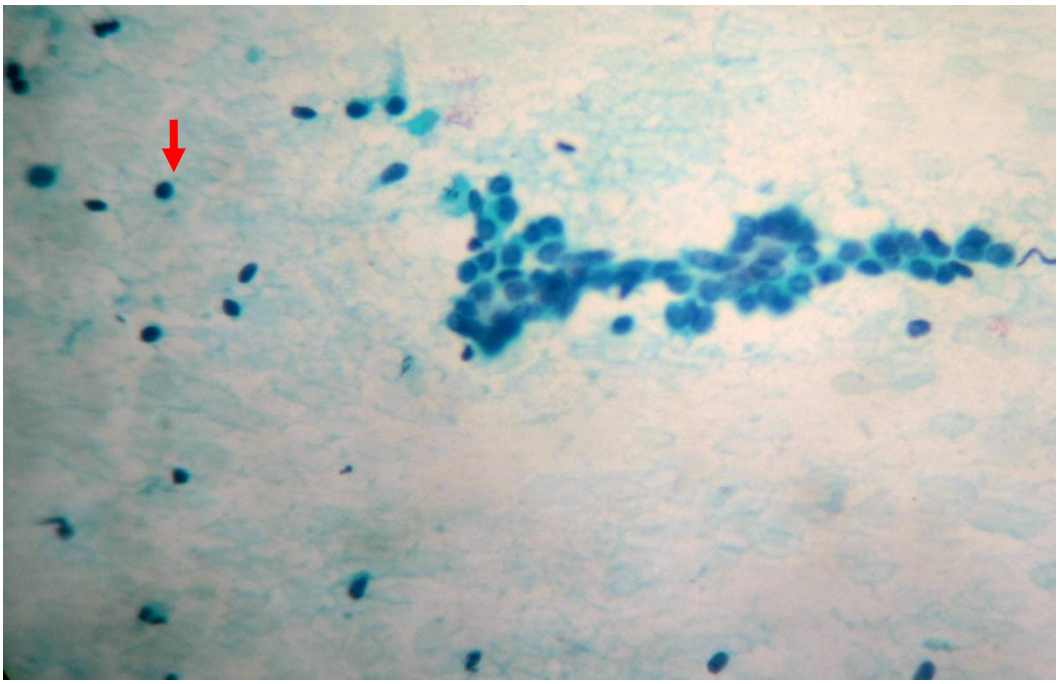
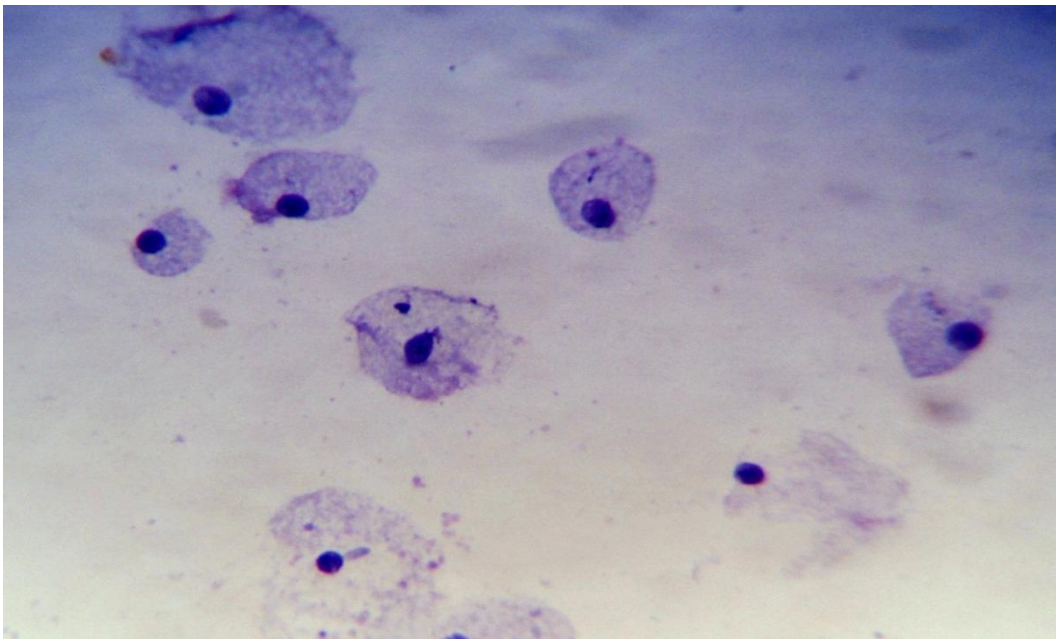


Fig no. 11(c) Ductal epithelial cells with numerous bare bipolar nuclei in the background (Papx10).



Figno. 11(d) Cystic macrophages with eccentricnucleus and vacuolatedcytoplasm (Pap x 40).

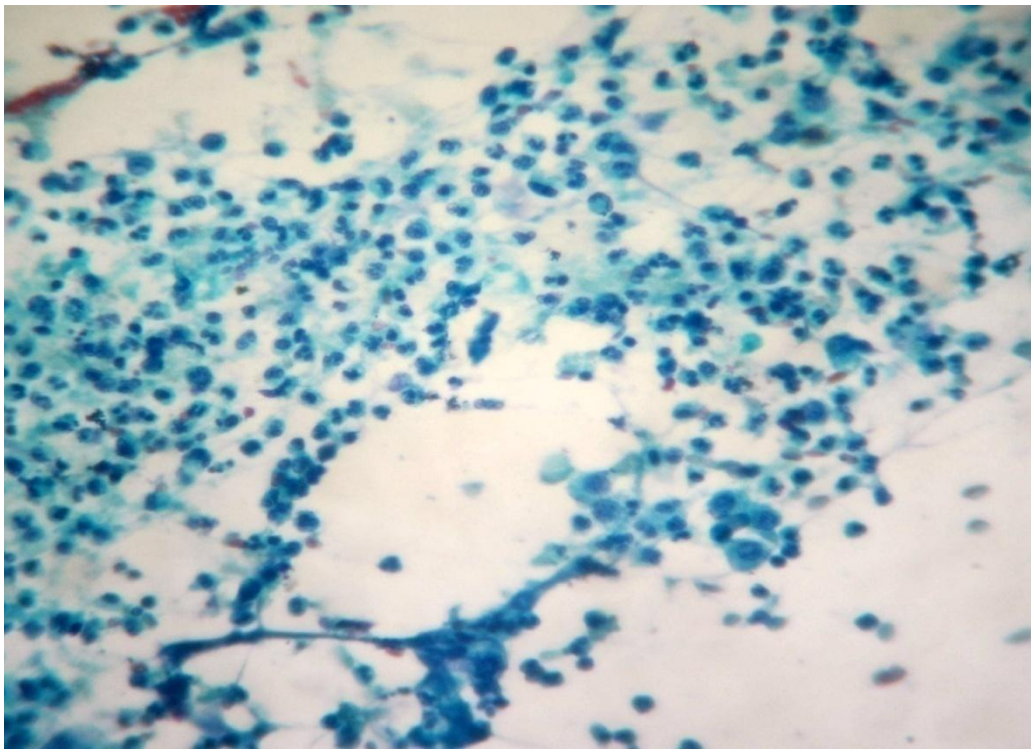


Fig no.12: Acute mastitis / Breast abscess.
Numerous inflammatory cells (neutrophils) and histiocytes (Pap x40).

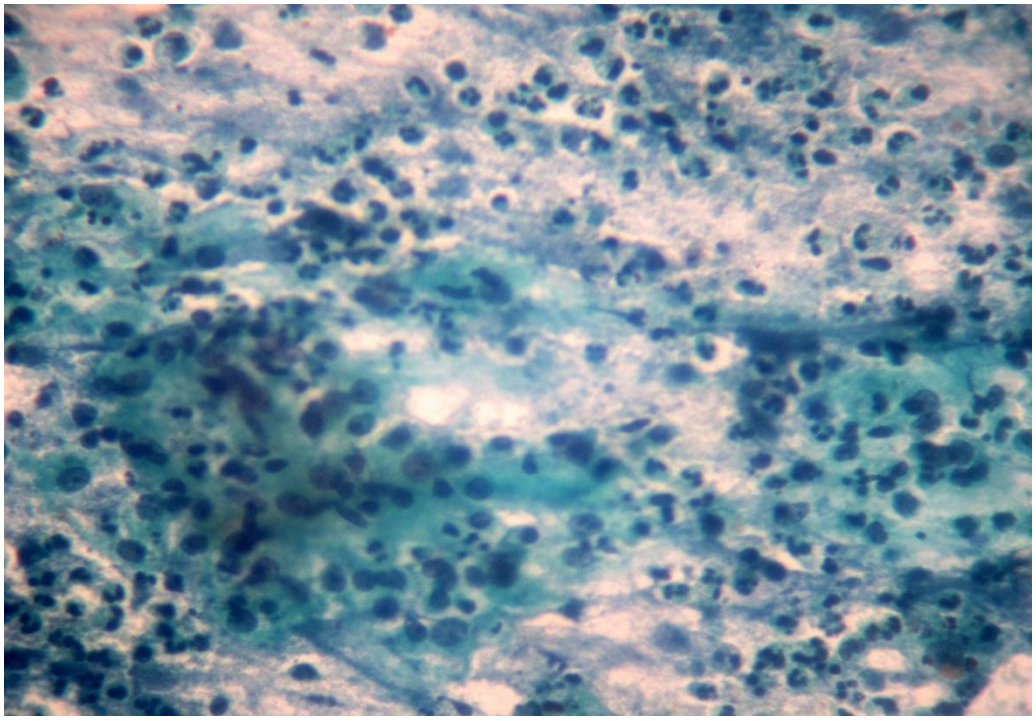


Fig no.13: Granulomatous mastitis.

Epithelioid cell granuloma along with plenty of neutrophils against a background of necrosis (Papx40).

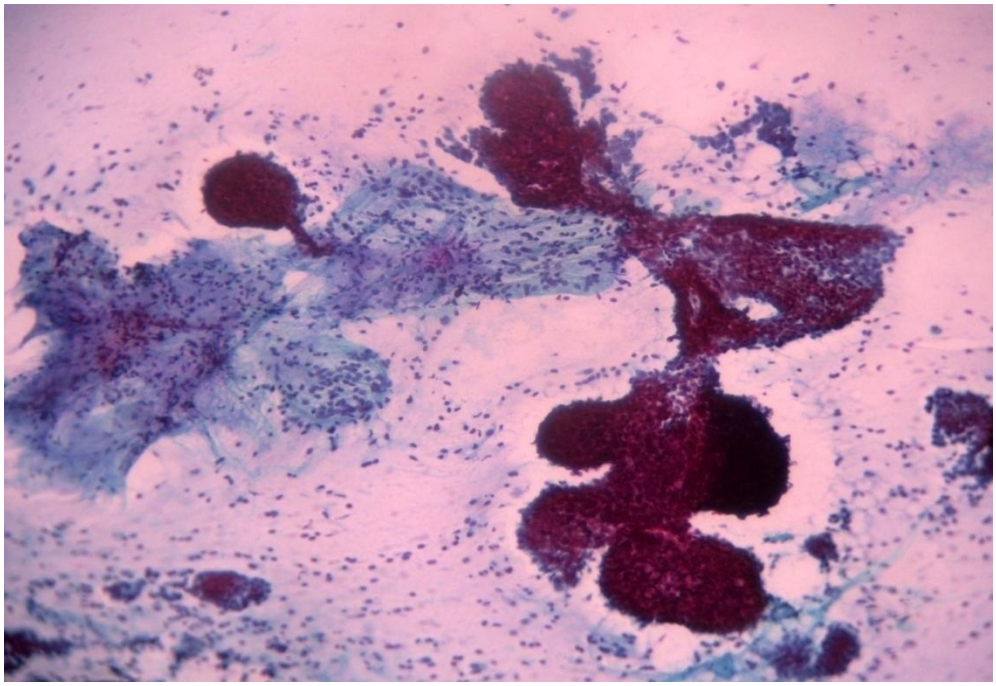


Fig no.14 (a):Fibroadenoma
Benign ductal group, stromal fragments and numerous single bare bipolar nuclei (Pap x10).

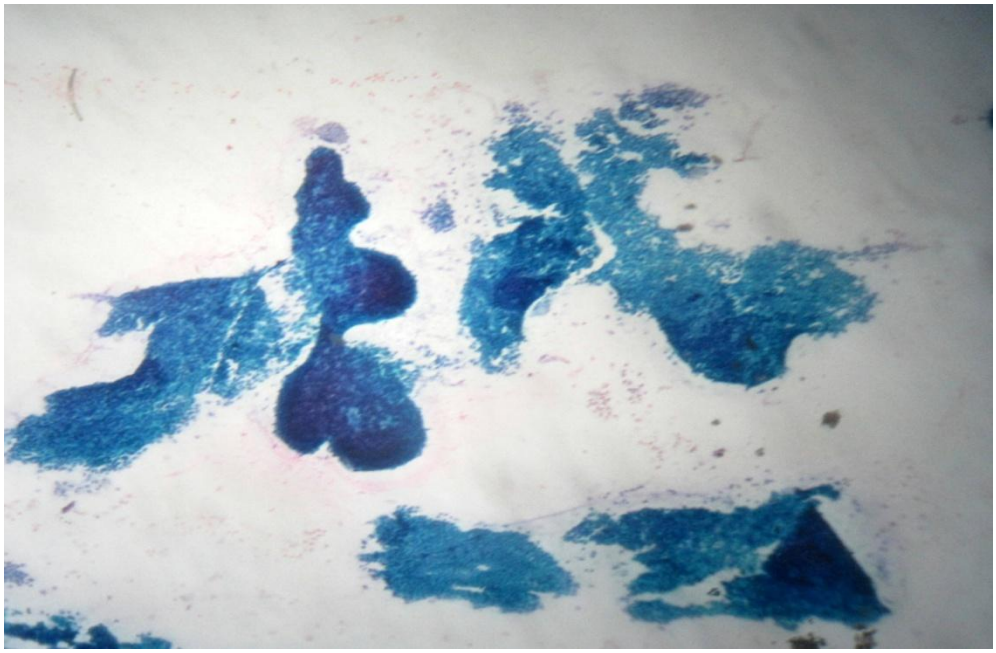


Fig no.14 (b):Fibroadenoma- highly cellular smears. (Pap x 4).

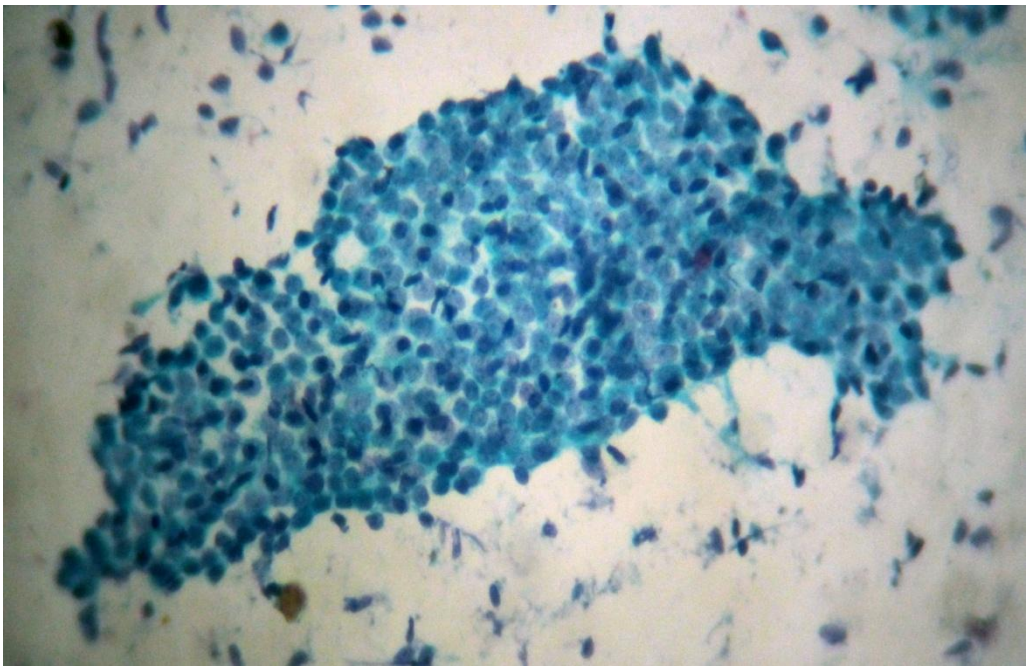


Fig no.14 (c): Fibroadenoma

Sheet of cohesive ductular epithelial cells, smaller and darker myoepithelial cells scattered between ductular cells withbipolar nuclei in background (Pap x 40).

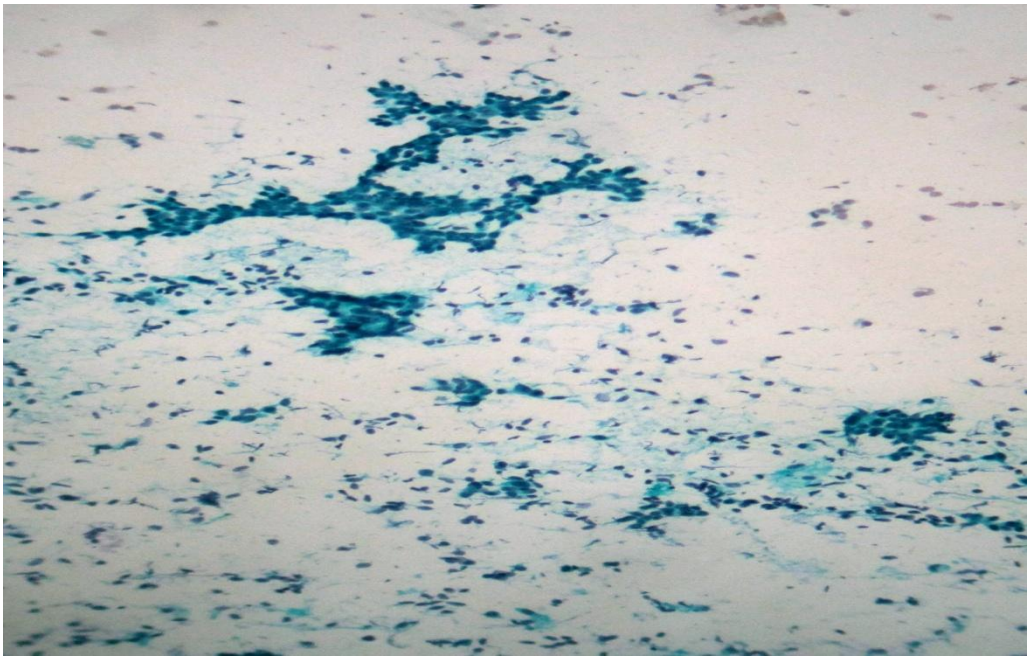


Fig no. 14 (d): Fibroadenoma

Elongated, branching fragments of duct epithelium and numerous single bipolar nuclei in the background (Pap x 4).

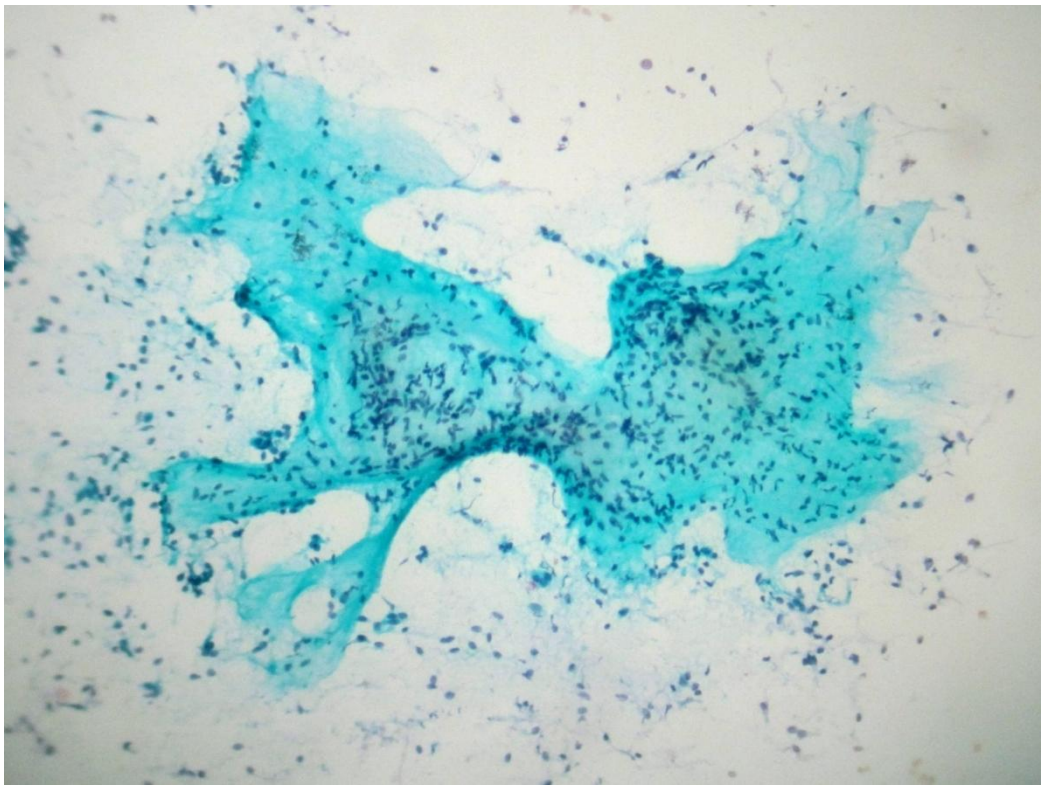


Fig no.14 (e): Fibroadenoma, stromal fragment (Papx40).

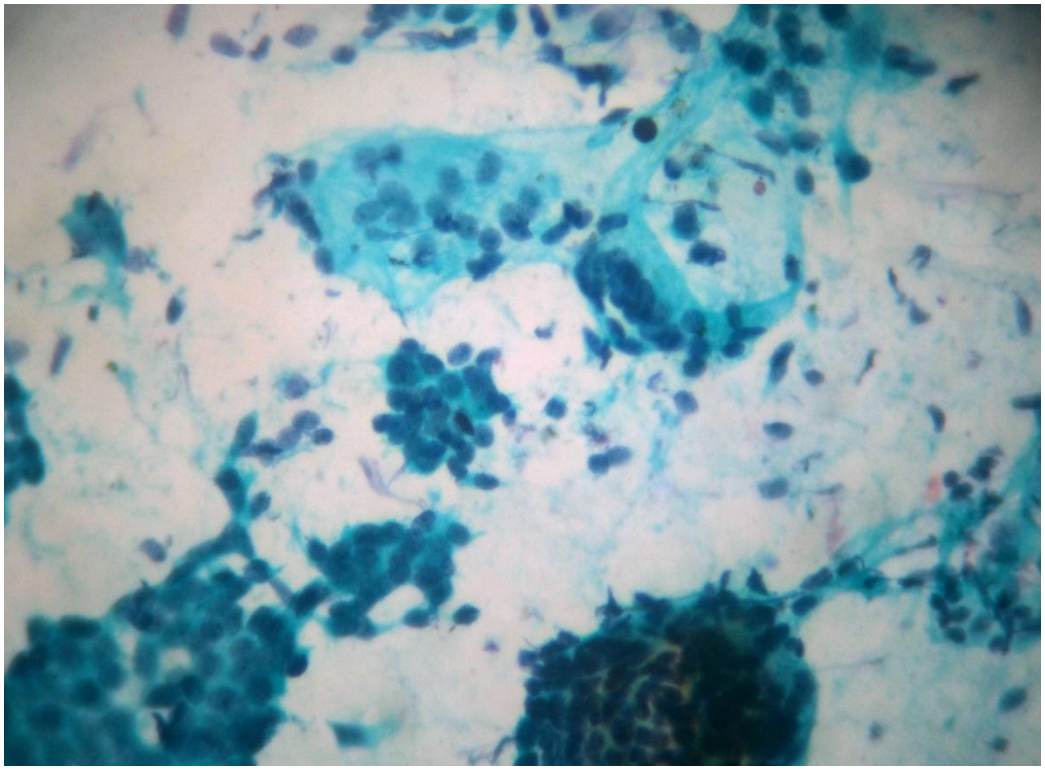


Fig no.14 (f): Fibroadenoma with giant cells.(Papx40)

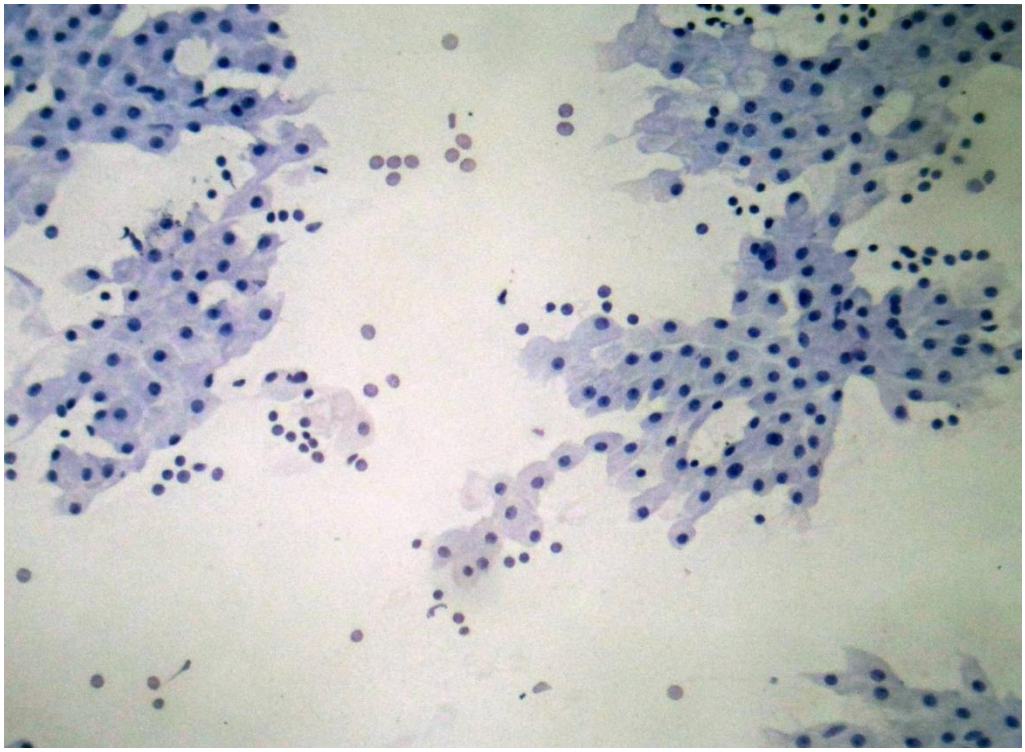


Fig no.15 (a): Fibrocystic disease
Sheets of apocrine cells with abundant eosinophilic granular cytoplasmand enlarged but bland nuclei (Papx 10).

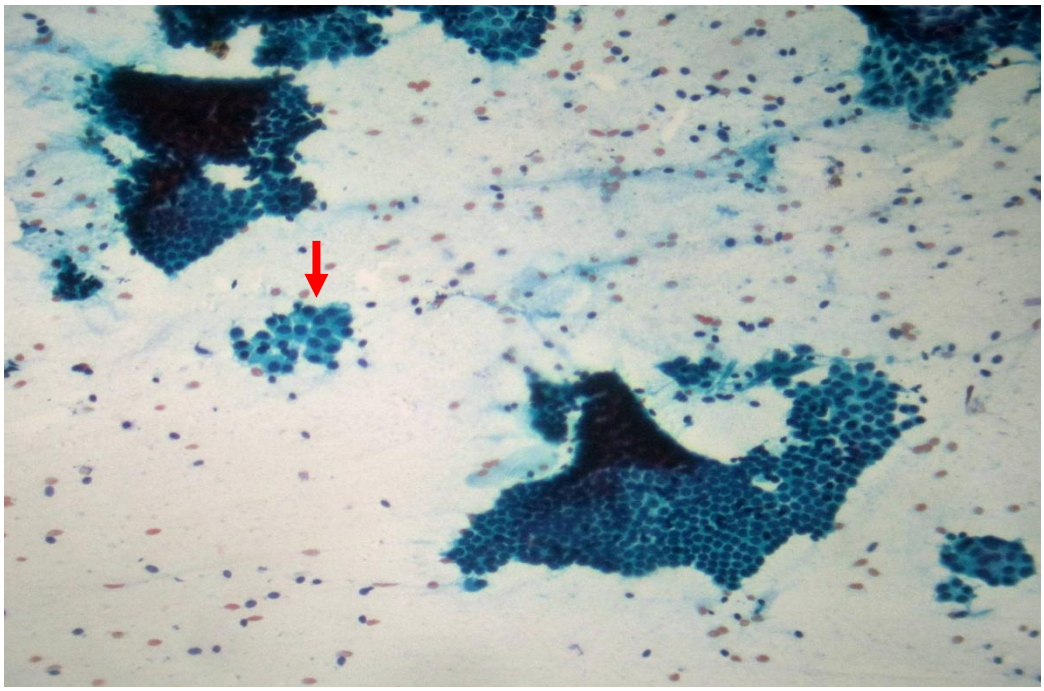


Fig no.15 (b): Fibrocystic disease
Sheets of normal ductal cells and apocrine cells (arrow)with bare bipolar nuclei in background (Papx10).

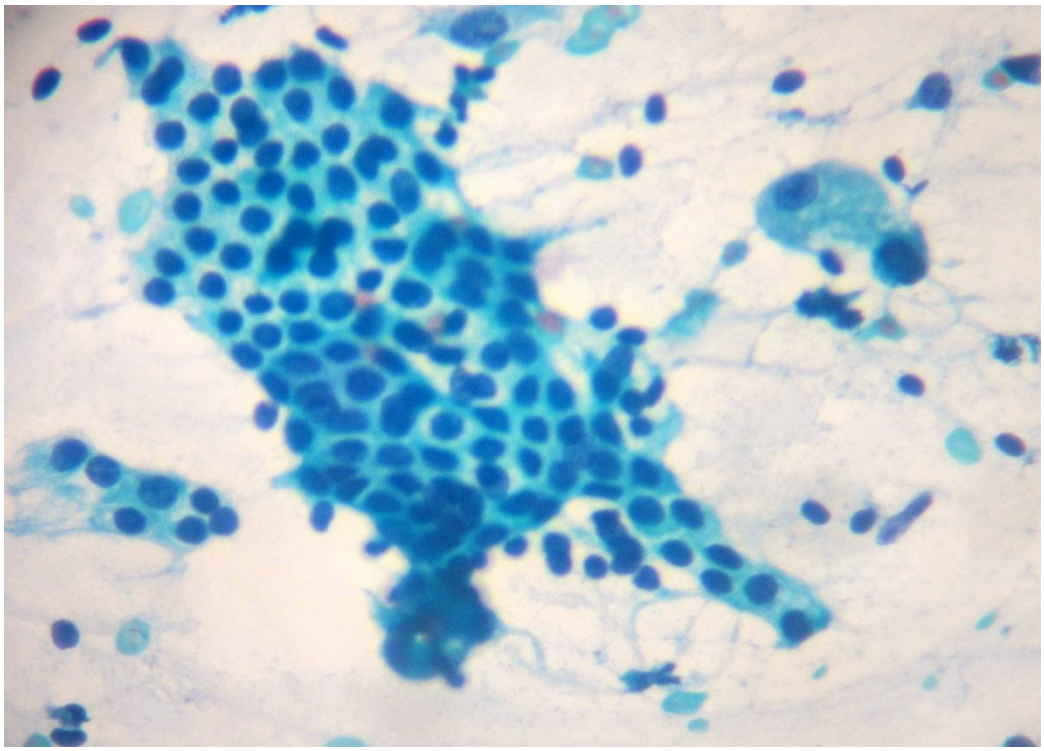


Fig no.15 (c): Fibrocystic disease
Sheet of apocrine cells and cystic macrophages (Papx40).

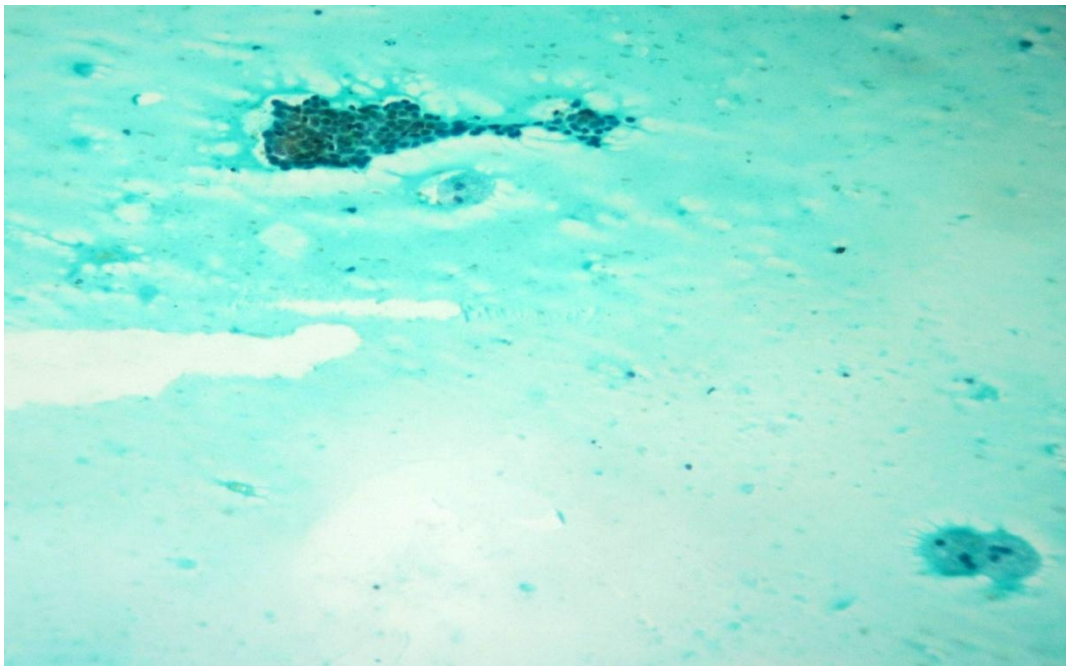


Fig no.15 (d): Fibrocystic disease
Sheet of duct epithelial cells and cystic macrophages against a background of cystic fluid (Papx 10).

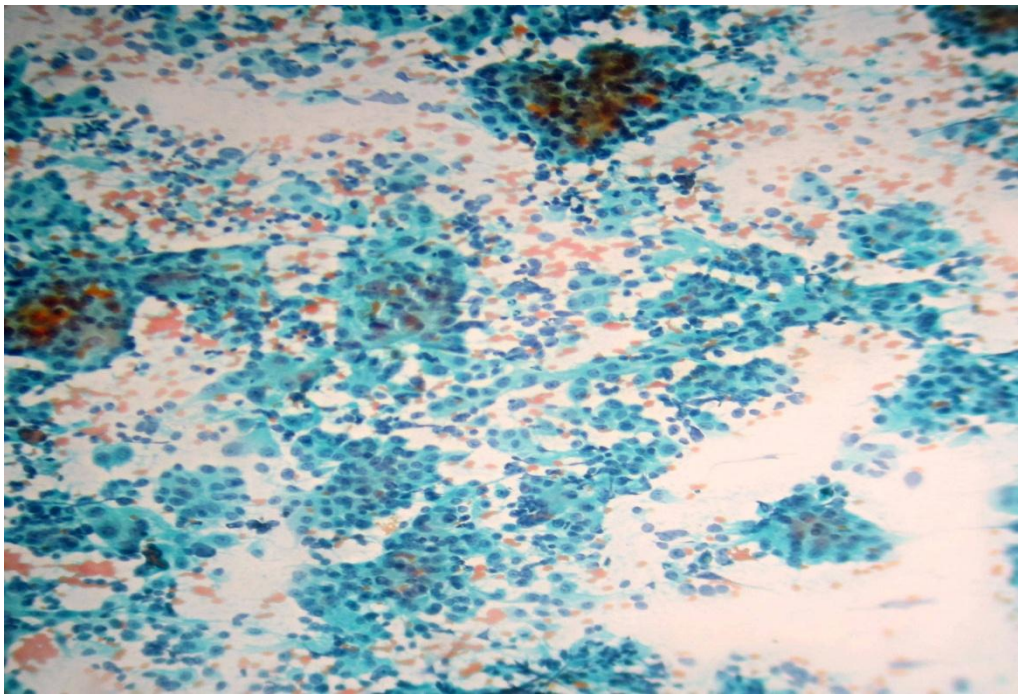


Fig no.16 (a): Infiltrating duct carcinoma, highly cellular smears (Papx10).

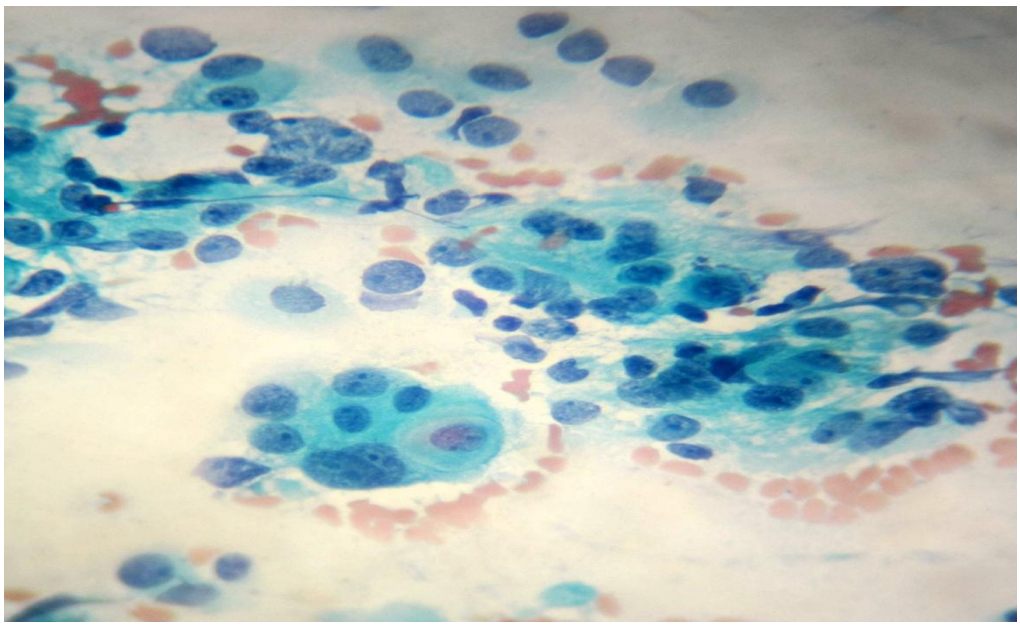


Fig no.16 (b): Infiltrating duct carcinoma
Malignant epithelial cells showing nuclear enlargement and atypia; absence of bipolar nuclei (Pap x 40).

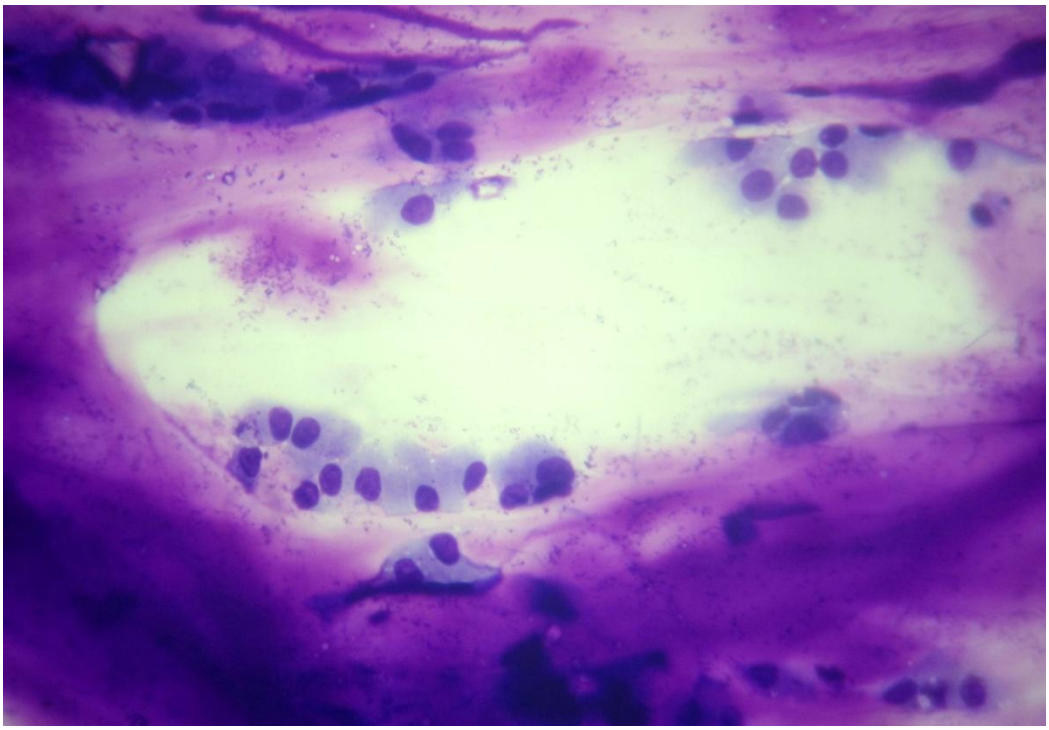


Fig no.17 (a): Mucinous (Colloid) carcinoma
Moderately cohesive epithelial cells with abundant cytoplasm, moderate nuclear enlargement and atypia suspended inmucin. Note single files of cells. (MGG x 40).

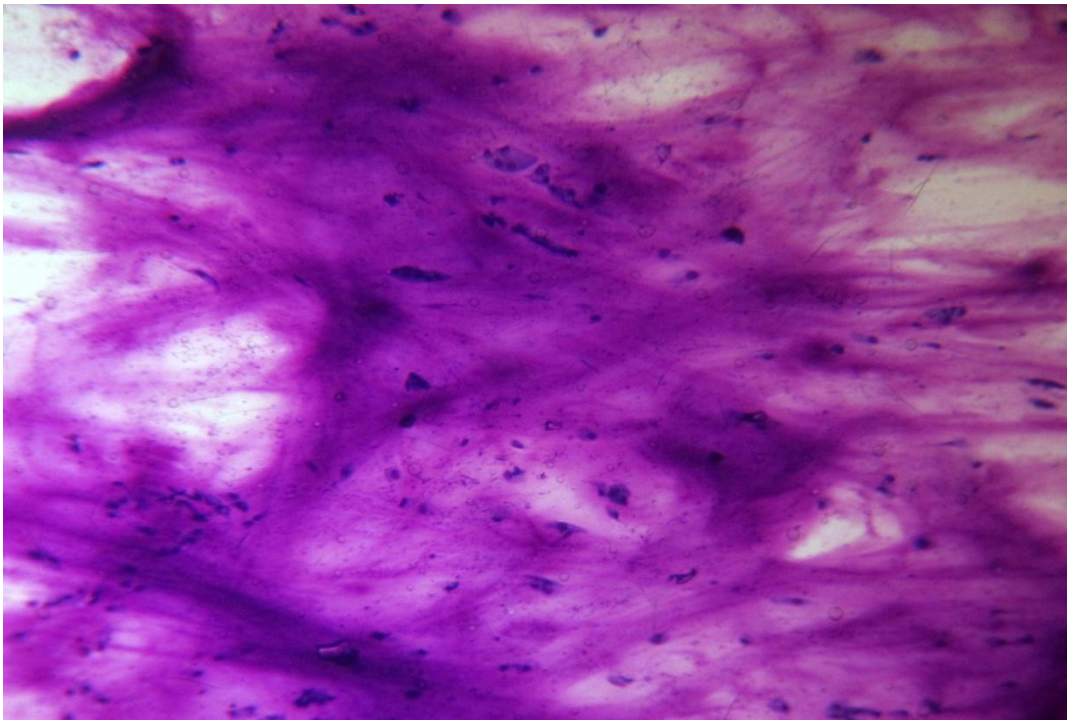


Fig no.17 (b): Mucinous (Colloid) carcinoma background of stringy mucin (MGG x 40).

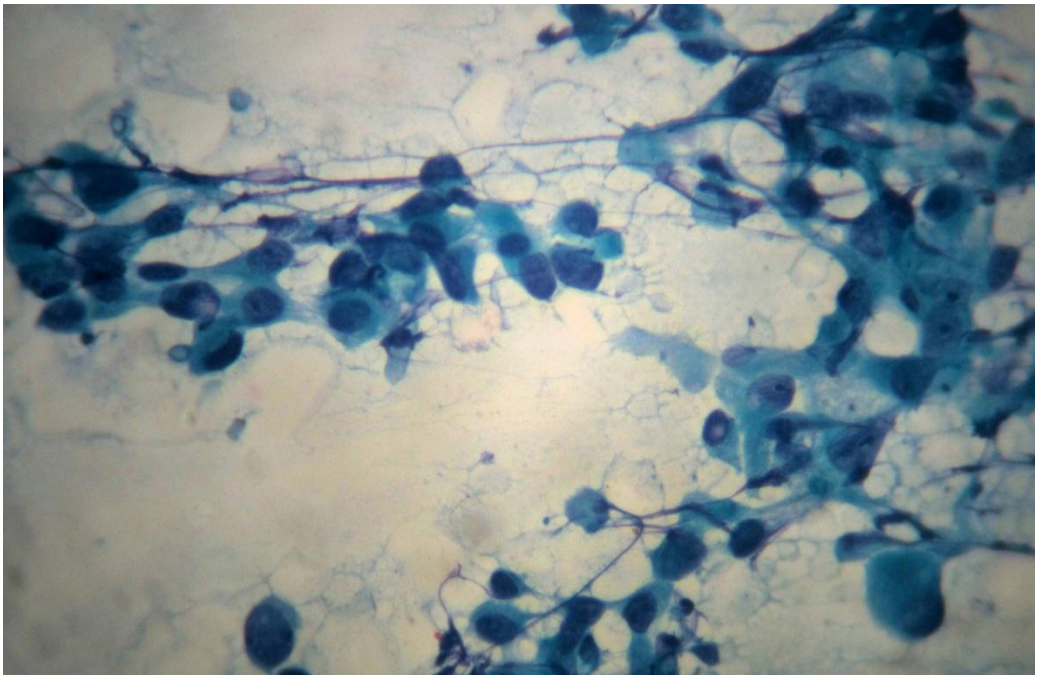


Fig no.18 (a):Malignant spindle cell lesion
Plasmacytoid to spindly cells showing variable degree of nuclear atypia and pleomorphism. (Pap x 40).

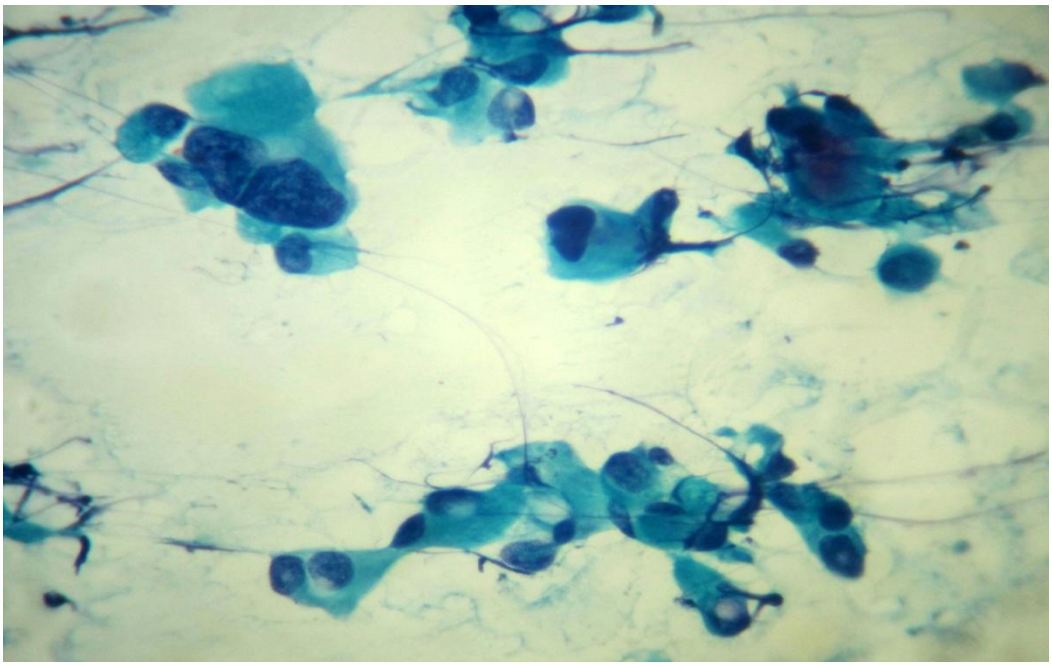


Fig no.18 (b):Malignant spindle cell lesion
Plasmacytoid to spindly cells showing variable degree of nuclear atypia and pleomorphism. (Pap x 40)
Diagnosed as high grade sarcoma on histopathology.

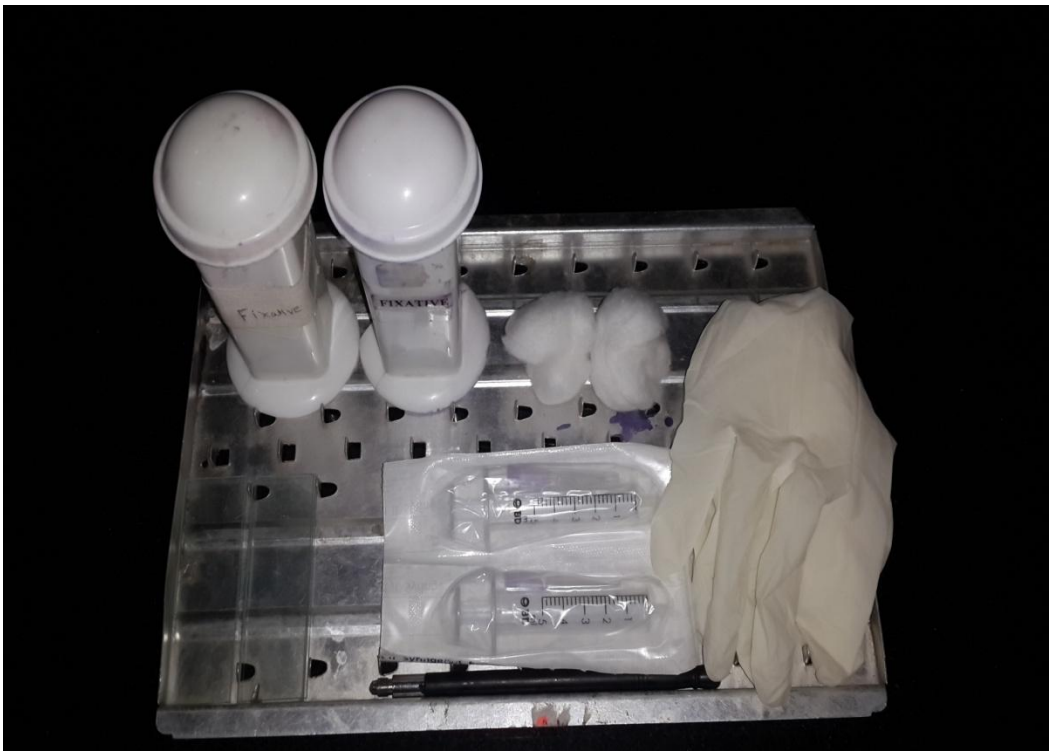


Fig no.19:Materials for FNAC procedure.