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Correlation between bi-rads categories and cytological findings of breast lesions

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Abstract
The Triple Assessment in breast lump diagnosis includes a combined approach by clinical examination, mammosonography and Fine Needle Aspiration Cytology. Correlation between BI-RADS categories & cytological findings are useful approach to establish an accurate preoperative diagnosis and for planning treatment. The present study included 100 patients with palpable breast lesions. Detailed history of patients and mammosonography findings (BI-RADS category) were noted. Fine Needle Aspiration Cytology (FNAC) smears were stained by Pap stain, H & E stain and Giemsa stain. Microscopic examination & reporting were done in correlation with BI-RADS categories. In present study majority of patients were between 41-50 years age with right side predominance. In FNAC findings, 45 patients had malignant lesions (predominantly Ductal carcinoma) & 55 patients had benign lesions (predominantly Fibroadenoma). It showed overall 93% concordance with BI-RADS categories.

Keywords: Fine Needle Aspiration Cytology, Breast lesions, Mammosonography, BI-RADS categories.

Introduction
The clinical presentation of breast lesions encompasses a wide range of symptoms, the most common being palpable lumps [1]. As approximately 10% of breast masses ultimately lead to a diagnosis of breast cancer, it is important for women with a breast lump to receive appropriate evaluation [2]. In Indian women breast cancer is leading cause of cancer related deaths preceded by cervical cancer [1]. The worldwide accepted protocol for diagnosis of breast lumps is the "Triple Assessment" which encompasses the triad of clinical examination, mammosonography and pathological diagnosis [1]. FNAC is useful for rapid diagnosis of a malignant tumors of breast [3]. The procedure may be used in the diagnosis of palpable breast lesions that may be either solid or cystic, or non-palpable breast lesions detected by mammography & ultrasonography [3]. Fine Needle Aspiration Cytology is particularly valuable when the level of clinical suspicion for malignancy is low, either because of the type of abnormality involved or the young age of the patient [3]. Breast Imaging Reporting and Data System (BI-RADS) is a widely accepted risk assessment procedure for carcinoma breast in clinical practice [4]. The BI-RADS categories described the overall structure of the breast imaging report, which included a summary of breast density, a description of significant findings (using appropriate descriptors as well as size and location), and a final assessment and management section [5]. Correlation between BI-RADS categories & cytological findings are useful approach to establish an important and accurate preoperative diagnosis as well as for planning therapeutic protocol in carcinoma of breast [2].

Aims& objectives:
- To analyze the cytomorphological findings of palpable breast lesions by FNAC.
- To compare and correlate the FNAC findings of breast lesions with BI- RADS category on Mammography / ultrasonography or both.
- To find out the concordance/ discordance in various breast lesions between FNAC findings and BI- RADS category.

Materials and methods
Samples
The study was conducted in the department of pathology, B.J. Medical College, Ahmedabad

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in patients with breast lump. It included total 100 patients with palpable breast lesions. Inclusion and Exclusion criteria of present study were as followings:

- Inclusion Criteria:
1. Female patients of all ages with complain of breast lump.
2. Patients who have underwent breast imaging and reported as mass lesion.
- Exclusion criteria:
1. Pregnant and lactating ladies
2. Male patients

Clinical History
The detailed history of patient including age, site, mobility, pain and duration of palpable breast lump with any other significant findings like nipple discharge, nipple retraction, redness over swelling, associated axillary swelling etc were noted. The mammography/ultrasound findings (BI-RADS category) were also noted.

Sampling techniques:
For FNAC, first written consent with patient signature was obtained. During, the procedure patient was in supine position. Local part examination was carried out. The overlying skin disinfection was done with spirit swabs. Grasp the lesion to be biopsied with two fingers or push the mass into a position where it seems fixed & stable. Then insert 23 gauge needle fitted with 10 cc plastic disposable syringe into the mass. Then multiple passes at different angles were made in the lump till sufficient material was obtained in the needle hub. The axillary lymph node if present and palpable were also aspirated in the similar manner. The aspirated material was smeared on the properly labeled glass slides and submitted for staining. Immediately smears were wet fixed with 95% alcohol while for MGG stain smears were air dried.

Staining
The smears were stained by Papanicolaou stain (PAP stain), haematoxylin and eosin (H& E stain). Air dried smears were stained by May-Grunwald Geimsa stain (MGG stain).
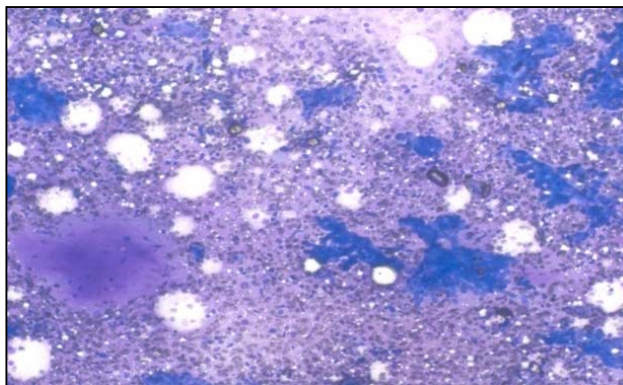
Reporting
- Microscopic examination was done to study cytological features of breast lesions.
- Cytological categories for reporting of breast lesions were as follows [6].
1. Unsatisfactory
2. Benign- non specific
3. Benign – specific
4. Atypical/ indeterminate
5. Suspicious for malignancy
6. Malignant

- The following general cyto-morphological characteristics were used to distinguish benign from malignant [7].
1. Cell yield
2. Cell cohesiveness
3. Variation in size and shape of cells
4. Nuclear features- size, shape, chromatin and nucleoli
5. Mitoses
6. Bare bipolar nuclei in background

Main cytomorphological Feature of common breast lesions are as following
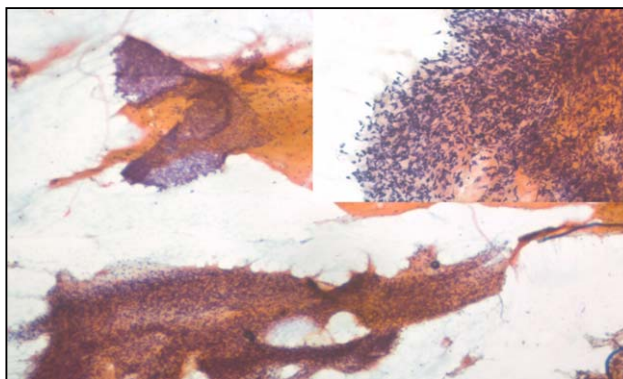**Fibroadenoma:** (fig: 1)
Cellular smears with a bimodal pattern containing epithelial and stromal fragments. Epithelial fragments of regularly arranged, cohesive cells are large, elongated and branching, stag-horn-like. Large, monolayered branching sheets of bland epithelial cells, Numerous single, bare bipolar/oval nuclei, Fragments of fibromyxoid stroma [8].
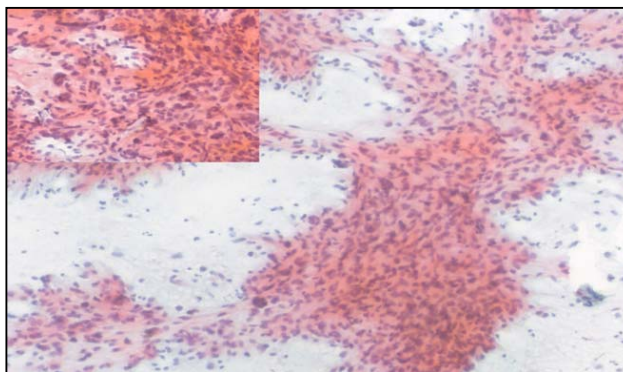

Fig 1: Fibroadenoma; MGG stain; 10X

Phyllodes tumor: (fig: 2, 3)
Biphasic cellular smears, both plump and slender spindle cells, single and in loose tissue fragments with fibrous stroma; a few sheets of bland ductal epithelium [6].
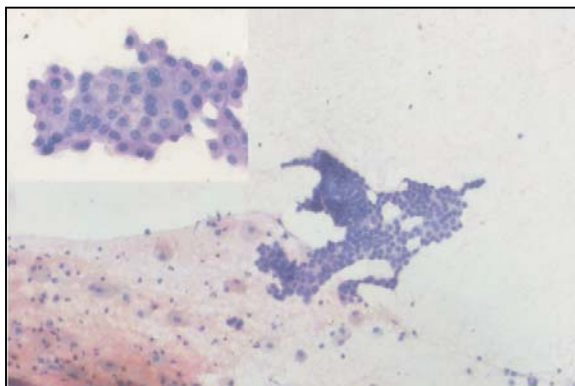

Fig 2: Benign Phyllodes Tumor; PAP stain; 10 X; Inset: Fibrous stroma; 40 X

Fig 3: Malignant Phyllodes tumor; PAP stain; 10 X; Inset: Malignant stromal cells; 40 X

Fibrocystic disease (fig:4)

Cellularity of smears is variable or low. Epithelial cells are arranged in loose cohesive honey comb groups. Apocrine cells, benign monomorphic ductal cells and foam cells with varying amount of stromal fragments are seen. The presence of stripped (naked) nuclei of myoepithelial cells are seen [8].
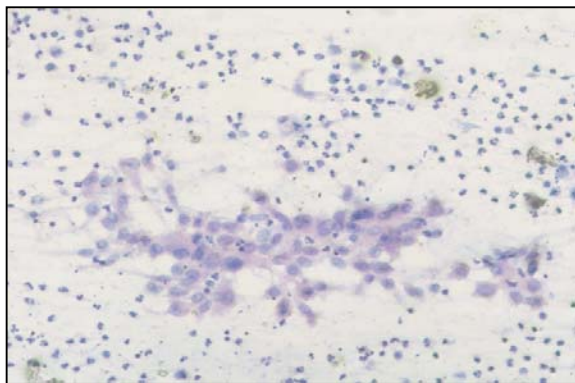

Fig 4: Fibrocystic Disease; PAP stain; 10 X; Inset: Apocrine cells; 40 X
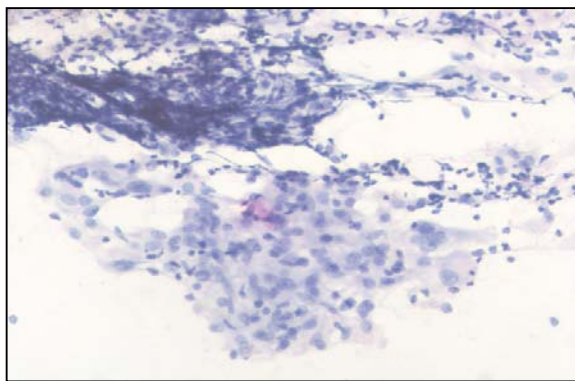
Inflammatory (non-neoplastic) lesions: (Fig: 5, 6)

A benign bimodal component of non-neoplastic cells are seen. In acute mastitis the smears show polymorphs, necrotic debris and occasional ductular cells.

In granulomatous mastiis the smears show epithelioid cells and multinucleated giant cells. Regenerative epithelial atypia are also seen. (6)
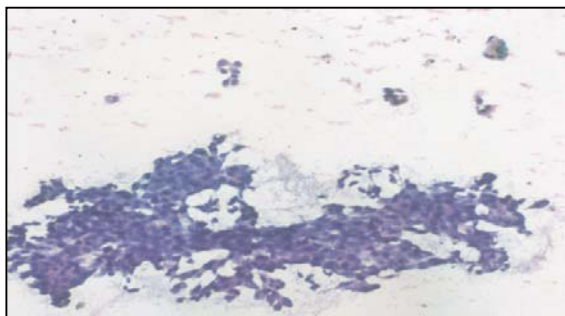

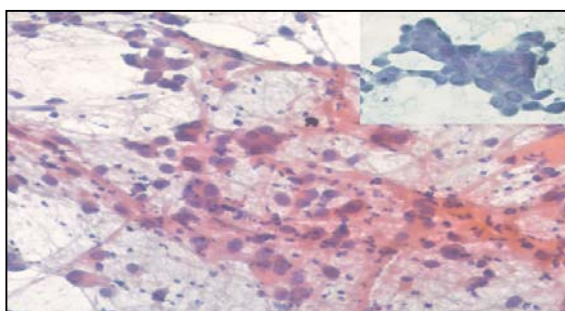**Fig 5:** Acute Mastitis; PAP stain; 20 x

Fig 6: Granulomatous Mastitis; PAP stain; 20 X

Ductal Carcinoma (fig: 7, 8)

Cellular smears, loosely cohesive and single epithelial cells with intact cytoplasm, moderate to severe nuclear atypia: enlargement, pleomorphism, irregular nuclear membrane and chromatin. Bipolar naked nuclei are rarely seen [6].

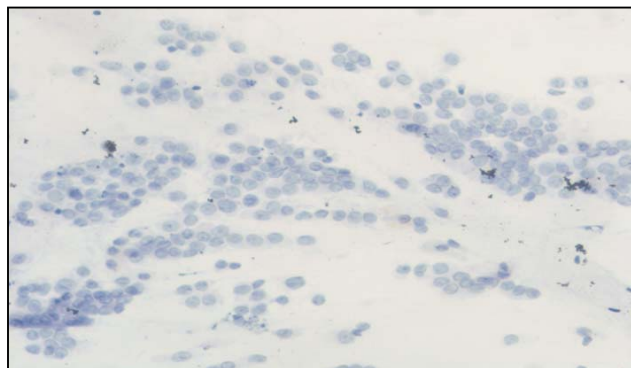**Fig 7:** Atypical Ductal Hyperplasia; PAP stain; 20 X

Fig 8: Ductal carcinoma; PAP stain; 20 X; Inset: Malignant epithelial cells; 40 X

Lobular Carcinoma (fig: 9)

Variable, often poor cell yield and consist of monomorphic population of mildly atypical cells arranged in individually or in a small aggregates (Indian File arrangement), cells are relatively small with high N\C ratio and irregularity of nuclear shape with angular, triangular, indented or budding nuclei [6].

The Breast Imaging Reporting and Data System (BI-RADS) initiative, instituted by the American College of Radiology, was begun in the late 1980s to address a lack of standardization and uniformity in mammography reporting practice [5]. BI-RADS ASSESSMENT CATEGORIES are as following [9].

- Category 0: Mammography: Incomplete – Need Additional Imaging Evaluation and/or Prior Mammograms for Comparison Ultrasound & MRI: Incomplete – Need Additional Imaging Evaluation
- Category 1: Normal
- Category 2: Benign
- Category 3: Probably Benign
- Category 4: Suspicious Mammography & Ultrasound:
- Category 4A: Low suspicion for malignancy
- Category 4B: Moderate suspicion for malignancy
- Category 4C: High suspicion for malignancy
- Category 5: Highly Suggestive of Malignancy
- Category 6: Known Biopsy-Proven Malignancy
- Finally, microscopic findings data were correlated with that of BI-RADS Category for each cases.

Fig 9: Lobular carcinoma (arrow: Indian file pattern); H & E stain; 40 x

Results
- The present study included total 100 patients undergone for FNAC and mammography of breast lesions and following observations were noted:
1. **Age**: The youngest patient was 15 years of age and the oldest was 76 years of age. The Maximum number of cases were seen in 41-50 years age group as shown in Table 1.
2. **Site of lesion:** There was slight preponderance in right breast involvement with 52 cases followed by left breast involvement in 48 cases Breast lumps were commonly seen in upper outer quadrant in 69 cases followed by upper inner quadrant 23 cases as shown in Table 2.
3. **Clinical symptoms:** Most common clinical presentation in present study was painless and mobile breast lump with 92 cases followed by nipple retraction(19 cases), nipple discharge(14 cases), redness of skin over swelling(8 cases) and palpable axillary lymph node(4 cases). as shown in Table 3.
4. **Radiological findings:** Results of mammosonography according to BIRADS categories were as follows. There were no patients in categories 0. There was 1 patients in category 1 (normal), 25 patients in category 2 (benign), 22 patients in category 3 (probably benign), 24 patients in category 4 (suspicious abnormality), 23 patients in category 5 (high suggestive of malignancy) and 5 patients in category 6 (proved malignancy). In present study, most common BI-RADS category was BI-RADS 2.
5. **Cytomorphological findings**: Benign breast lesions (55 cases) were more common than malignant breast lesions (45 cases). Ductal carcinoma was predominant lesion among malignant lesions and Fibroadenoma was predominant lesion among benign lesions. In malignant lesion, 43 cases were of ductal carcinoma out of which 4 cases showed axillary lymph node metastasis. One case of lobular carcinoma and one case of malignant phyllodes were noted in our study. In benign lesions, fibroadenoma (26 cases) was most common followed by Fibrocystic disease (8 cases). In the inflammatory category of breast lesions, 6 cases of acute mastitis and 4 case of granulomatous mastitis were noted. One case of duct ectasia was also noted in our study. 2 cases of benign phyllodes tumors were noted in our study.
6. Case wise correlation of BIRADS categories with FNAC showed that results were in concordance in 93 cases out of 100 cases as in table 4.

Table 1: Age group wise distribution of the breast lesions.

Age group	No. of cases
11-20	6
21-30	6
31-40	26
41-50	**29**
51-60	16
61-70	14
71-80	3
Total	100

Table 2: Breast lesions FNAC: Site wise distribution.

Site	No. of cases
Right breast	52
Outer quadrant	31
Inner quadrant	16
Subalveolar	2
Retroalveolar	3
Left breast	48
Outer quadrant	29
Inner quadrant	15
Subalveolar	2
Retroalveolar	2

Table 3: Presenting complain of patients with duration

Presenting complain	Duration				Total
	<1 month	1-6 months	6 month- 1 year	>1 year	
Breast lump, mobile, painless	28	32	9	23	92
Breast lump with pain	1	3	2	2	8
Palpable axillary lymph node	0	1	2	1	4
Nipple discharge	1	9	1	3	14
Nipple retraction	1	13	3	2	19
History of trauma	0	3	1	1	5
Redness of skin over swelling	4	3	1	0	8

Tables 4: Show case wise correlation of BIRADS categories with FNAC findings.

Breast lesions	BI-RADS CATEGORY								FNAC findings	Correlated cases
	I	II	III	Iva	IVb	IVc	V	VI		
Unsatisfactory	0	0	0	0	0	0	0	0	0	0
Benign lesions-specific										
Fibroadenoma	1	12	10	1	1	1			26	23
Fibrocystic disease		4	3			1			8	7
Acute mastitis		3	2			1			6	5
Granulomatous masititis		2	2						4	4
Duct ectasia		1							1	1
Benign Phyllodes tumor			1	1					2	1
Benign lesions- Non specific										
Benign cystic lesion		2	2	1			1		6	5
Atypical/ indeterminate										
Atypical ductal hyperplasia		1					1		2	1
Total	1	25	20	3	1	3	2	0	55	47
	I	II	III	IVa	IVb	IVc	V	VI	FNAC findings	Correlated cases
Suspicious for malignancy				2	2				4	4
Malignant lesions										
Ductal carcinoma						12	22	5	39	39
Lobular carcinoma			1						1	0
Malignant Phyllodes tumor					1				1	1
Total	0	0	1	2	3	12	22	5	45	44

Discussion
In present study, 100 cases of breast lesions were evaluated by FNAC in correlation with BI-RADS categories. We compared results our study with several other studies as follows:

a) **Clinical presentation:**
1. **Incidence of Age:** In our study, Out of 100 cases, maximum number of cases (29%) were between 41 to 50 years of age group which was correlated with other study: by Arpita Pandia et al. [10] maximum number of cases (28%) were between 40-50 years of age group.
2. **Anatomical location:** In our study, there was slight preponderance in right side breast involvement (52%) followed by left breast involvement (48%). This was comparable with other studies: by Jayawant Mahadani et al. [11] showed right side involvement (53.08%) more common than left side involvement (31.75%). The common site in present study was upper outer quadrant (60%) which was comparable with Rocha P D et al. [12] (57%).
3. **Presenting symptoms:** Most common clinical presentation in our study was painless and mobile breast lump(92%) which was comparable with other study by Ken Munene Nkonge et al. [13] (96%).

b) **Cytomorphological findings**
- In present study, out of 100 cases, benign breast lesions (55%) were more common than malignant breast lesions (45%) which was comparable with other studies: by Arpita Pandia et al. [10] 55.43% & 38% cases reported as a benign & malignant respectively, by Ramesh S. Waghmare et al. [14] 56.25% & 31.50% cases reported as a benign & malignant respectively and by Anto J. Richie [7]. 57.5% & 42.5% cases reported as a benign & malignant respectively.
- In present study, 47.27% cases of Fibroadenoma was more common among benign lesion and 95.56% cases of Ductal carcinoma was more common among malignant lesions which was comparable with other

study: by Jayawant Mahadani et al. [11] 49.15% cases of fibroadenoma among benign lesions and 94.11% cases of ductal carcinoma among malignant lesions.
- In benign lesions, specific diagnosis was given on cytological findings in 49 cases out of 55 cases. In 6 cases low cellularity associated with few benign epithelial cells over fluid background were present and diagnosis of benign cystic lesion was given. In malignant category, 4 cases were diagnosed as suspicious for malignancy due to low cellularity, subtle atypia or obscuring background.

c) **Correlation and sensitivity of BI-RADS & FNAC findings:**
- All cases were correlated with histopathology final diagnosis and it showed sensitivity as follows:
1. Sensitivity of BI-RADS category:-
- On mammography findings, 8 false positive cases out of 6 cases were diagnosed as benign lesion in which three cases of fibroadenoma, one case of fibrocystic disease, one case of benign cystic lesion of breast & one case of acute mastitis diagnosed by FNAC and histopathology. Remaining 2 cases were diagnosed as a benign lesion by FNAC & malignant lesion by histopathology. One false negative case which was diagnosed as malignant lesion- lobular carcinoma by FNAC and histopathology. The other studies: by Arpita Pandia et al. [10] showed 10 false positive cases and 4 false negative cases and by Rahman MZ et al. [15] showed 8 false positive cases and 5 false negative cases.
- In present study, mammosonogram showed 91% sensitivity which was comparable with other studies: by Bak et al. [16] with 91% sensitivity and by Arpita Pandia et al. [10] with 88.57% sensitivity.
2. Sensitivity of FNAC:-
- In present study, on FNAC findings there were 2 false negative cases which were diagnosed as malignant lesion by histopathology in which one case of atypical ductal hyperplasia diagnosed as ductal carcinoma and

one case of benign phyllodes tumor diagnosed as malignant phyllodes tumor. The other studies: by Rahman MZ *et al*. [15] with 1 false negative cases and by Arpita Pandia *et al*. [10] with 2 false negative cases.

- In present study, FNAC showed 98% sensitivity which was comparable with other studies: by Rahman *et al*. [15] with 97.2% sensitivity, by Bukhari *et al*. [17] with 98% sensitivity and by Panjvani SI *et al*. [18] with 97.82% sensitivity.

3. The correlation of BI-RADS & FNAC were 91% in present study.

Conclusion
We conclude that most common age group in our study was 41-50 years. Benign breast lesions (predominantly Fibroadenoma) were more common than malignant breast lesions (predominantly Ductal carcinoma). The correlation between Fine Needle Aspiration Cytology and BI-RADS categories were 91%. The cytology cases which were not correlated with BI-RADS categories, further follow up and biopsy were advised.

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