Diagnostic Accuracy of Fine Needle Aspiration Cytology in Benign and Malignant Breast Lesions

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Abstract

Background: Fine needle aspiration cytology (FNAC) or core biopsy form an integral component of the triple test which is being performed as a pre-operative test to evaluate breast lump.
Aim: To study the cytomorphological pattern of breast lesions in a tertiary care hospital of Central India and to find out the accuracy of FNAC in diagnosing benign and malignant lesions of breast.
Method: 200 patients presenting as breast lumps were evaluated by FNAC and correlated with histology.
Result: Fibroadenoma was most common benign lesion while Infiltrating duct carcinoma was most common malignant lesion reported. Sensitivity of FNAC was 99.25% for benign lesions and 95% for malignant lesions. Specificity and PPV of FNAC in diagnosing benign lesions were 95% and 97.79% respectively while that for malignant cases were 99.25% and 98.27% respectively. The diagnostic accuracy of FNAC was 97.94% in the present study.
Conclusion: FNAC serves as a rapid, economical and reliable tool for the evaluation of breast lumps.

Key words: Fine needle aspiration cytology, Benign breast lesions, Malignant breast lesions, FNAC.

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Introduction

Breast disease is one of the common clinical problem in India with cancer of breast being second most common cancer in the women.[1] The most common presentation of breast disease is a palpable mass; although breast diseases can also present as inflammatory lesion, nipple secretion and imaging abnormalities.[2] Increasing awareness, associated anxiety & stress among women who perceive every lump in breast as carcinoma, compels the patient to seek the medical advice. It is sometimes difficult to determine whether a suspicious lump is benign or malignant simply from clinical assessment and fine needle aspiration cytology (FNAC) is helpful in reaching definitive diagnosis. Accuracy in the diagnosis can be increased by multiple sampling of appropriate sites by ultrasonography guidance and/or mammographic localization.[3,4]

FNAC is highly sensitive, specific, rapid, easy to perform, cost effective and can be carried out at OPD level.[5] Molecular ancillary techniques for example progesterone receptor & estrogen receptor, proliferation antigen & DNA pattern analysis can be applied on aspirated material. FNAC is also useful as a follow-up procedure for post- mastectomy or lumpectomy[6] and in diagnosis of primary breast lymphomas so that an option of breast conservation can be offered. It can also be used to diagnose lesions of male breast such as gynaecomastia, accessory axillary breast tissue & carcinoma and to access status of axillary lymph nodes.[7,8]

Aim of study

The present study was carried out:

1. To study the breast lumps by FNAC so as to:
   a. Differentiate a neoplastic lesion from non-neoplastic lesion.
   b. Find out the incidence of various breast lesions in a tertiary health care centre.
2. To study various socio-epidemiological factors like age, sex, socio-economic status, menstrual status, marital status and parity in cases of palpable breast lumps.
3. To compare the cytological findings with histopathology so as to establish utility of FNAC in the diagnosis of breast lumps.
4. To find out the sensitivity, specificity, positive predictive value, negative predictive value and accuracy of FNAC in the diagnosis of benign and malignant breast lumps.

Material and Methods

200 patients presenting with palpable breast lumps in Surgery Department of our hospital were studied. A detailed history including age, marital status, socio-economic status, menstrual history, parity and duration of lump was elicited and recorded in the pretested

proforma. Clinical examination of patients was performed and record of findings was made. Consent was taken in each case after explaining the procedure of FNA to the patient. FNA was performed by the technique described by Orell *et al.*[9] Smears prepared were air dried and stained with Giemsa stain. The slides were reviewed. Subsequent histopathological examination of the excised breast lumps or mastectomy specimens was also done in each case. Cytohistological correlation was done. Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) and accuracy of FNAC in diagnosing breast lesions was calculated using the formulas.

Results

Out of total 200 cases, 94.5% (n=189) were female while 5.5% (n=11) were male. Maximum incidence (n=66, 33%) of breast lump was seen in 21-30 years age group both in males and females, followed by, in 41-50 years (n=41, 20.5%), and then, in 31-40 yrs (n=35, 17.5%). Youngest patient in the present study was of 10 years while oldest one was of 85 year.

There was no specificity for side of breast involvement by various lumps. 46.5% (n=93) cases were with right breast involvement, 43.5% (n=87) with left breast and 10.0% (n=20) with bilateral involvement. Maximum number (48.64%, n=107) of breast lumps involved upper outer quadrant both in benign (43.95%, n=69) and malignant (60.32%, n=38) case series followed by central region in 19.75% (n=31) benign cases and whole breast in 20.63% (n=13) of malignant cases. Few patients have more than one lump and few have lumps involving more than one quadrant of breast. 10% (n=20) cases in the present study were having bilateral breast lumps.

Out of 189 female patients in the present study, 86.77% (n=164) were married while 13.33% (n=25) were unmarried. 76.72% (n=145) were premenopausal while 23.28% (n=44) were postmenopausal. Maximum no. of benign cases were with 2nd parity (n=42, 32.31%) followed by 3rd parity (n=29, 22.31%), while maximum no. of malignant cases were with 5th parity (n=17, 28.81%) followed by 6th parity (n=14, 23.73%).

Out of total 200 cases, maximum 41.5% (n=83) cases of breast lumps were seen in lower socio-economic status followed by 22.5% (n=45) cases in middle and, 21% (n=42) in lower middle socio-economic status. There were 4.5% (n=9) cases from upper socio-economic status in the present study.

On FNAC of breast lumps, 64.5% (n=129) were categorized as benign, 25% (n=50) as malignant, 4% (n=8) suspicious for malignancy and 3.5% (n=7) as atypical [Figure 1, 2 & 3]. 3% (n=6) smears were unsatisfactory on microscopic examination due to scanty or no material aspirated. Subsequent histopathology of breast lumps revealed 69% (n=138) benign lesions, 1% (n=2) atypical and 30% (n=60) malignant lesions.

It is evident from Table 1 that sensitivity of FNAC was 99.25% in benign breast lesions while 95% in malignant ones. On the other hand specificity and positive predictive value of FNAC were more in malignant lesions as compared to benign. 99.25% (n=133) cases were true negative while 95% (n=57) were true positive for malignancy out of 194 cases. Accuracy of FNAC in diagnosing breast lumps was 97.94% in present study.

Table 2 shows that maximum number of benign cases (64) were in 21-30 years of age group while malignant ones (24) were in 41-50 years age group. Two youngest patients (10 years age) were found to have benign pathology while eldest (85 years age) one had malignant lesion. Table 3 shows cyto-histological correlation of various benign and malignant breast lesions.

Table 1: Accuracy of FNAC in breast lesions

S. No.	Diagnosis	TP	TN	FP	FN	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	% FN	% FP
1.	Malignant /suspicious malignant	57	133	1	3	95.00	99.25	98.27	97.79	5.0	2.20
2.	Benign/ atypia	133	57	3	1	99.25	95.00	97.79	98.27	2.20	5.0

TP – True positive
TN- True negative
FP- False positive
FN- False negative
PPV- Positive predictive value
NPV- Negative predictive value

Table 2: Distribution of histologically confirmed cases of benign and malignant breast lumps in different age groups

S. No.	Age group (in years)	Benign		Malignant	
		No. of cases	%	No. of cases	%
1.	0-10	2	1.42	0	0
2.	11-20	23	16.40	0	0
3.	21-30	64	45.71	2	3.33
4.	31-40	27	19.28	8	1.33
5.	41-50	17	12.14	24	40.00
6.	51-60	03	2.10	12	20.00
7.	61-70	04	2.85	11	18.33
8.	71-80	0	0	2	3.33
9.	81-90	0	0	1	1.66
Total		**140**		**60**	

Table 3: Cyto-Histological Correlation

	Histology													
Cytology ⇩	**IBD (19)**	**FA (51)**	**FAD (32)**	**FBD (17)**	**Galactocele (8)**	**PBD without atypia (16)**	**PBD with atypia (3)**	**Gynaecomastia (9)**	**Miscellaneous (12)**	**DC (50)**	**LC (4)**	**Medullary Ca (2)**	**Mucinous Ca(1)**	**Lymphoma / Sarcoma (1+1)**
IBD (20)	18	1	1	-	-	-	-	-	-	-	-	-	-	-
FA (56)	-	50	1	1	-	-	-	-	3	1	-	-	-	-
FAD (30)	-	-	30	-	-	-	-	-	-	-	-	-	-	-
FBD (16)	-	-	-	16	-	-	-	-	-	-	-	-	-	-
Galactocele (8)	-	-	-	-	8	-	-	-	-	-	-	-	-	-
PBD without atypia (13)	-	-	-	-	-	13	-	-	-	-	-	-	-	-
PBD with atypia (8)	-	-	-	-	-	3	2	1	-	2	-	-	-	-
Gynaecomastia (9)	1	-	-	-	-	-	-	8	-	-	-	-	-	-
Miscellaneous (9)	-	-	-	-	-	-	-	-	9	-	-	-	-	-
DC/Suspicious (48)	-	-	-	-	-	-	1	-	-	47	-	-	-	-
LC/Suspicious (4)	-	-	-	-	-	-	-	-	-	-	4	-	-	-
Medullary (2)	-	-	-	-	-	-	-	-	-	-	-	2	-	-
Mucinous (1)	-	-	-	-	-	-	-	-	-	-	-	-	1	-
Lymphoma/Sarcoma (1+1)	-	-	-	-	-	-	-	-	-	-	-	-	-	1+1

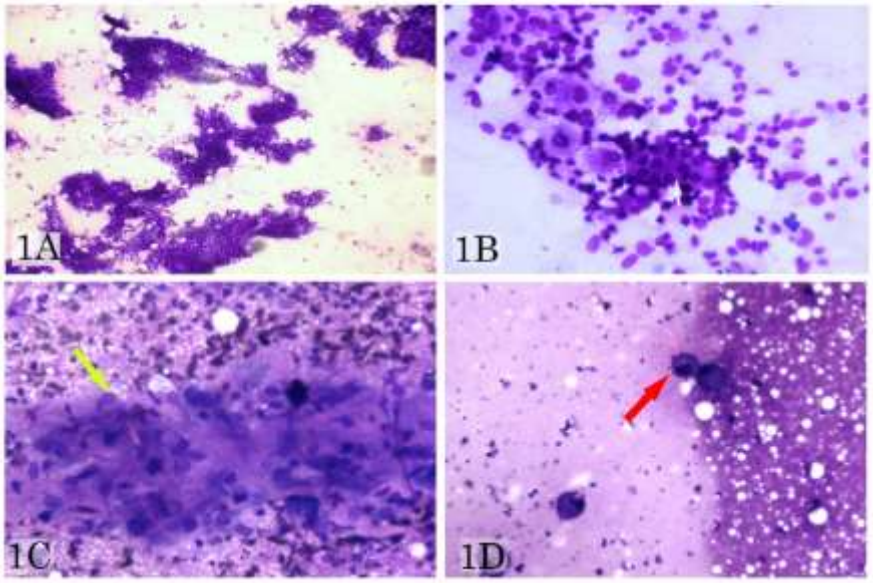

Fig. 1A: Photomicrograph of Fibroadenoma showing sheets of benign epithelial cells with staghorn branching and singly scattered bare bipolar nuclei in the background of fat (Giemsa, 40X)
Fig. 1B: Photomicrograph of Fibrocystic disease of breast showing numerous cyst macrophages along with sheet of ductal epithelial cells with apocrine change and scattered bare bipolar nuclei (Giemsa, 100X)
Fig. 1C: Photomicrograph of Granulomatous mastitis showing epithelioid cell granuloma in necrotic background (Giemsa, 400X)
Fig. 1D: Photomicrograph of Galactocele showing many cyst macrophages and granular debris in the background of fat droplets and proteinaceous material (Giemsa, 400X)

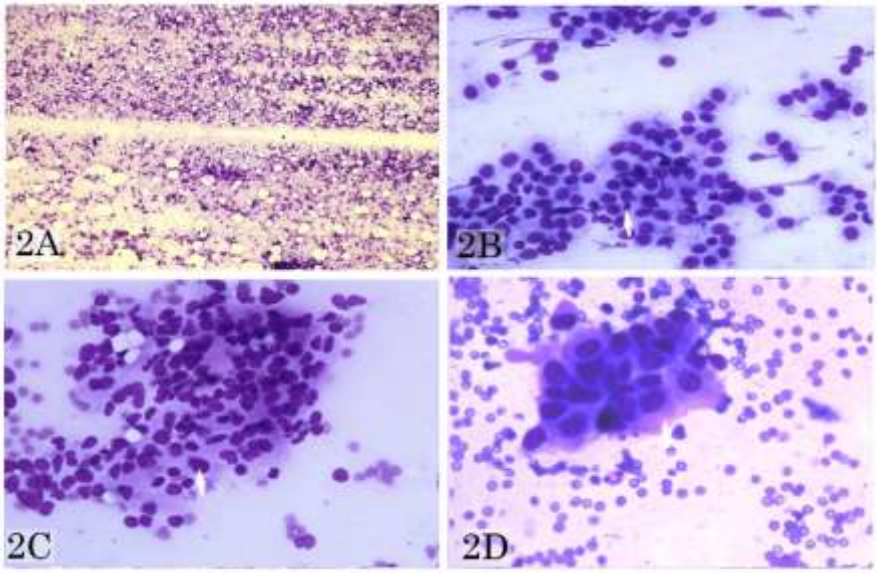

Fig. 2A: Photomicrograph of Fat necrosis showing dirty background of granular debris, fat droplets and fragments of adipose tissue. Epithelial cells are absent. (Giemsa, 40X)
Fig. 2B: Photomicrograph of Epithelial hyperplasia showing loose cohesive sheet of ductal epithelial cells without atypia along with myoepithelial cells (Giemsa, 400X)
Fig. 2C: Photomicrograph of Duct carcinoma showing loosely cohesive sheet of epithelial cells with nuclear pleomorphism, hyperchromasia and overlapping. Myoepithelial cells are absent. (Giemsa, 400X)
Fig. 2D: Photomicrograph of Apocrine metaplasia showing cohesive cluster of benign epithelial cells with abundant granular cytoplasm (Giemsa, 400X)

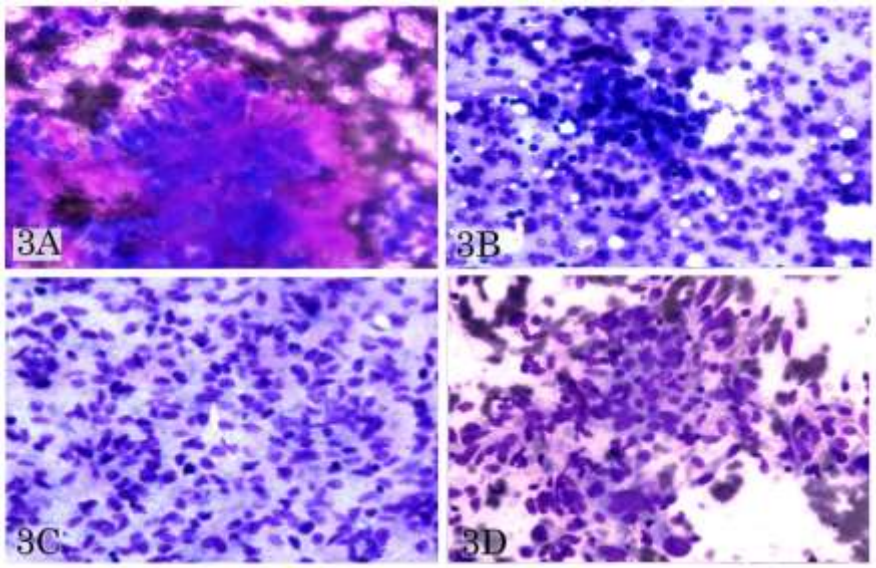

Fig. 3A: Photomicrograph of Mucinous carcinoma showing pool of mucin with entangled malignant cells (Giemsa, 400X)

Fig. 3B: Photomicrograph of Medullary carcinoma showing malignant cells in poorly cohesive cluster with many lymphocytes (Giemsa, 400X)

Fig. 3C: Photomicrograph of Benign Phyllodes tumor showing scattered stromal cells without atypia (Giemsa, 400X)

Fig. 3D: Photomicrograph of Malignant Phyllodes tumor showing cluster of proliferating stromal cells with atypia and pleomorphism (Giemsa, 400X)

Discussion

In the present study, there was maximum incidence of breast lumps reported in 21-30 years age group, both in male (36.3%) and female (32.8%) followed by 41-50 years age group (20%) and then 31-40 years (18%). This is consistent with the findings of Mahmood *et al*[10] who also reported maximum incidence in the 3rd decade. The findings of Hussain MT *et al*[11] varies who reported a maximum incidence of 30% of breast lumps in the age group of 31-40 years followed by 20% in 15-20 years. These studies as well as the present work indicate that the major burden of breast lesions is on the active and economically productive young age group. Thus, there is the need for early and accurate diagnosis and management of these patients.

In the present study maximum number of benign cases (n=64) belonged to 21-30 years of age group while maximum number of malignant cases (n=24) to 41-50 years age group. Shrestha *et al*[12] have also reported maximum cases of benign breast tumors in the age group of 15-30 years and showed a declining trend with advancing age. Ariga R *et al,*[13] Tiwari M *et al*[14] and Shrestha *et al*[12] have reported maximum cases of breast cancer in 5th decade of life. Freeman HP *et al*[15] have reported peak of breast cancer in 6th and 7th decade in their study.

In the present study out of 200 cases of breast lumps, 189 (94.5%) were females and 11 (5.5%) were males. Mahmood *et al*[10] have reported 6.6% male patients and Deshpande KA *et al*[16] reported 3.3% male patients in their study.

There was no specificity for the side of breast involvement by various lumps in the present study. Right breast was involved in 46.5% cases while left in 43.5% cases. 10% cases have bilateral breast involvement. Deshpande *et al*[16] and Rupom TU *et al*[17] have reported right breast involvement in 58.1% of cases in their studies. Upper-outer quadrant was most commonly involved (48.63%) both in benign and malignant series in the present study. The finding is in accordance with previous studies of Hussain MT *et al*,[11] Deshpande KA *et al*[16] and Rupom TU *et al.*[17]

On analyzing incidence of breast lumps according to parity, maximum cases (n=42, 32.31%) were with second parity and then with third parity (n=29, 22.31%). Incidence of breast lumps were relatively less in lower (0 and 1) and higher parities (4, 5, 6 and 7). However, maximum number of malignant cases were with 5th parity (28.81%) followed by 6th parity (23.73%). Similar findings were observed by Hussain MA *et al*[11] who reported that nulliparity or low parity accounts for lower percentage, while high parity accounts for higher percentage of breast cancers.

In the present series maximum (n=83, 41.5%) patients belonged to lower socio-economic status followed by (n=45, 22.5%) middle and (n=42, 21%) lower middle socio-economic status. Incidence in upper socio-economic status was low (n=9, 4.5%) in our study. These results are in compliance with the socio-economic setup of the population residing in nearby

rural areas of our hospital. Our findings correlate well with those of Hussain MA *et al*[11] who also reported maximum cases from lower socio-economic class. On the contrary, studies from western countries showed higher incidence of breast cancer in upper-socio-economic status.[18]

Out of 200 cases in the present study, 64.5% (n=129) cases were diagnosed as benign, 3.5% (n=7) as atypical, 4% (n=8) as suspicious for malignancy while 25% (n=50) as malignant lesions based on cytology. A wide variation was seen in incidence of benign and malignant breast lesions reported by various previous authors that could be due to age of patients at which cases were reported, duration of lump and variation in population screened. Shrestha A *et al*[12] have reported 87.5% lesions as benign/atypical while 12.5% lesions as malignant/suspicious for malignancy in a large study. Shazia A *et al*,[19] Deshpande KA *et al*[16] and Mahajan NA *et al*[20] have reported 55.35%, 69.8%, 64.15% lesions as benign/atypical and 42.85%, 22.0%, 29.24% lesions as malignant/suspicious for malignancy respectively.

It was evident in our study that sensitivity of FNAC was 99.25% for benign lesion and 95% for malignant ones. Specificity and PPV of FNAC in diagnosing benign lesions were 95% and 97.79% respectively while that for malignant cases were 99.25% and 98.27% respectively. The diagnostic accuracy of FNAC was 97.94% in the present study. Out of total 60 malignant breast lesions true positive cases were 57 (95%) and false negative were 3 (5%), while out of 134 benign lesions true negative were 133 (99.25%) and false positive was 1 (0.75%). Various previous authors have also reported good sensitivity and specificity of FNAC in diagnosing breast lesions. Ariga R *et al*[13] have reported both sensitivity and specificity of 98%, PPV of 99% and NPV 91%. Singh A*et al*[21] have reported efficacy of FNAC as 92.3% with sensitivity 84.6% and specificity 100%. Mahajan NA *et al*[20] have reported efficacy of FNAC as 98.11% with sensitivity, specificity, PPV and NPV of 96.66%, 98.66%, 96.77% and 98.66% respectively.

In the present study Fibroadenoma was found to be most common benign breast lesion followed by Fibroadenosis in females while Gynaecomastia in males. Infiltrating duct carcinoma was the most common breast malignancy in our study. Shrestha A *et al*,[12] Ariga R *et al*,[13] Tiwari M *et al*,[14] Deshpande KA *et al*,[16] Rupom TU *et al*,[17] Mahajan NA *et al*,[20] Khemka A *et al*[22] and Mohammad Q *et al*[23] have also observed similar findings.

Conclusion

The accuracy of FNAC approaches that of histopathology in providing unequivocal diagnosis in breast lesions. It is highly useful in screening large population as it is simple, rapid, cost effective and reliable. FNAC has few limitations and biopsy is must in cases with suspicious and atypical lumps. FNAC serves as a compliment and not a substitute to the histopathology in such cases. Histopathology remains the gold standard investigation for providing definitive diagnosis of breast lumps and for determining appropriate therapeutic regimen.

References

1. Sandhu DS, Sandhu S, Karwasra RK, Marwah S. Profile of breast cancer patients at a tertiary care hospital in North India. Indian J Cancer 2010;47:16-22.
2. Klin TS, Neal HS. Role of needle aspiration biopsy in diagnosis of carcinoma of breast. Obstetrics and Gynaecology 1975;46:89-92.
3. Phillips G, McGuire L, Clowes D. The value of ultrasound guided fine needle aspiration in the assessment of solid breast lumps. Australas Radiol 1994;38:187-92.
4. Bibbo M, Scheiber M, Cajulis R, Keebler CM, Wied GL, Dowlatshalu K. Stereotactic fine needle aspiration cytology of clinically occult malignant and premalignant breast lesion. Acta Cytol 1988;32:193-201.
5. Rimen DL, Stastry JF, Rimm EB, Ayer S, Frable WJ. Comparison of the costs of FNA and open surgical biopsy as methods for obtaining a pathologic diagnosis. Cancer 1997;81:51-56.
6. Ku NN, Mela NJ, Fiorica JV, Cox CE, Reintgen DS, Greenberg HM *et al*. Role of FNAC after lumpectomy. Acta Cytol 1994;l38:927-32.
7. Bhagat P, Kline TS. The male breast and malignant neoplasms; diagnosis by aspiration biopsy cytology. Cancer 1990;65:2338-41.
8. Dev P, Karmakar T. FNAC of accessory axillary breast and their lesions. Acta Cytol 1994;38:915-6.
9. Orell SR, Sterrett GF, Whitaker D. Fine Needle Aspiration Cytology.5th ed. Australia: Churchilll Living an Imprint of Elsevier, 2012.
10. Mehmood A, Ahmed M, Jamal S. Role of cytological grading in the management of breast lump. J Coll Physicians Surg Pak 2003;13:150-2.
11. Hussain MT. Comparison of fine needle aspiration cytology with excision biopsy of breast lumps. J Coll Physicians Surg Pak 2005;15:211-4.
12. Shrestha A, Chalise S, Karki S and Shakya G. Fine needle aspiration cytology in a palpable breast lesion .Journal of Pathology of Nepal 2011;1:131-135.
13. Ariga R, Bloom K, Reddy VB, Kluskens L, Francescatti D, Dowlat K, et al. Fineneedle aspiration of clinically suspicious palpable breast masses with histopathologic correlation; Am J Surg 2002;184:410-13.
14. Tiwari M. Role of fine needle aspiration cytology in diagnosis of breast lumps. Kathmandu University Medical Journal 2007;5(2):215-217.
15. Freeman HP, Wasfie TJ. Cancer of the breast in poor black women. Cancer 1989;63:2562- 69.
16. Deshpande KA, Bharambe BM, Ajmera AP. Diagnostic utility of aspiration biopsy of the breast lesions. Cibtech Journal of Bioprotocols 2012;1(2):14-21.
17. Rupom TU, Choudhury T, Banu SG. Study of fine needle aspiration cytology of breast lump: Correlation of cytologically malignant cases with their histological findings. Bangabandhu Sheikh Mujib Medical University Journal 2011;4:60-64.
18. Marshall E. Search for a killer; Focus shifts from fat to hormones. Science 1993;259:618.
19. Aslam S, Hameed S, Afzal T, Hussain A. Correlation of FNAC and histological diagnosis in the evaluation of breast lumps. JUMDC 2012;3(2):1-7.
20. Mahajan NA, Bhale CP, Mulay SS. Fine needle

aspiration cytology of breast lesions and correlation with histopathology – A 2 year study. International Journal of Health Sciences and Research 2013;3(2):55-65.
21. Singh A, Haritwal A and Murali BM. Pattern Of breast Lumps and Diagnostic Accuracy of Fine Needle Aspiration Cytology; A Hospital Based Study from Pondicherry, India. The Internet Journal of Pathology 2011;11(2):1-14.
22. Khemka A, Chakrabarti N, Shah S, Patel V. Palpable Breast Lumps: Fine –Needle Aspiration Cytology versus Histopatology: a correlation with Diagnostic Accuracy. The Internet Journal of Surgery.2009;18(1):1-20.
23. Mohammad Q, Akbar SA, Ali J and Mustafa S: Lump in breast; Role of FNAC in diagnosis. Professional Med J 2009;16(2):235-238.