



COMPARISON OF ASPIRATION VS NON ASPIRATION TECHNIQUES IN FINE NEEDLE CYTOLOGY OF BREAST LESIONS.

K Bharathi^{MD*1}, Sudha Venkatesh^{MD}²

1. Department of Pathology, Sri Satya Sai Medical College & Research Institute, Chennai, India.
2. Department of Pathology, Madras Medical College, Chennai, India.

Abstract:

Objective of the study is to compare the efficacy of fine needle non- aspiration cytology (FNNAC) with that of fine needle aspiration cytology (FNAC) in breast lumps. Applying both FNAC and FNNAC techniques, samples were obtained from breast lumps of 50 patients. All the sampling procedures were done by a single operator after getting a written consent. The slides were studied and reported by an expert cytologist, thus bias was avoided in all stages of the study from sampling to reporting. Slides obtained from FNAC and FNNAC techniques were compared using a objective scoring system developed by Mair et al in 1989 based on the background blood or clot, amount of cellular material, degree of cellular degeneration, degree of cellular trauma and retention of appropriate architecture. Wilcoxon signed rank test was performed using SPSS14 software. Differences between FNAC and FNNAC based on the background blood or clot, amount of cellular material, degree of cellular degeneration, degree of cellular trauma and retention of appropriate architecture were analyzed. In our study we find that FNAC is the best choice for the fibrous lesions of breast like fibro adenoma & phyllodes tumour and cystic lesions, as it yield adequate material than FNNAC. For the malignant lumps of breast both the techniques are comparable and yielded adequate material. The number of unsuitable smears and failure rate is lower for FNAC technique. The diagnostic adequacy of FNAC (98%) is more than FNNAC technique (88%).

KEYWORDS: Breast lumps, FNAC, FNNAC.

*Corresponding Author: Bharathi K, Department of Pathology, Sri Sathya Sai Medical College, Chennai, India. Email: bharathi.pathos@gmail.com

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INTRODUCTION:

Fine needle cytology (FNC) has gained tremendous popularity in recent times among the clinicians and the pathologists. It is easy to perform, quick and has a high degree of specificity and sensitivity. [1] FNAC and FNNAC are the two techniques of fine needle cytology (FNC). FNC is used to sample all superficial mass lesions and even deeply seated lesions. Deeply seated lesions can be sampled with the aid of imaging techniques. The basic principle underlying fine needle aspiration cytology is the aspiration of cellular material from the target masses often utilizing fairly high suction pressure. The procedure requires a needle and a syringe advisedly held in a syringe

holder enabling single handed suction to be exercised. This technique depends on the suction and is painful, traumatic and can cause hematomas, necrosis as well as yield hemorrhagic material. [2] In more recent times a modified technique called fine needle non-aspiration cytology (FNNAC), pioneered in France came into vogue in 1981.[3,4] It eliminates active aspiration by syringe, replacing it by the principle of capillary suction of fluid or semi fluid material into a thin channel (fine needle). It is less painful, less traumatic, and patient-friendly. Smears obtained by FNNAC are of "text book" quality. In the present study 50 cases, an attempt is made to compare both the techniques FNAC and FNNAC with reference to diagnostic adequacy of the material obtained and diagnostic accuracy in 50 patients with breast lumps.

MATERIALS AND METHODS:

The study was conducted at Goschen Institute of Pathology, Madras Medical College during the year January 2009 - February 2010. This study included 50 samples obtained from patients who attended the cytology department for FNC of breast lumps. Institutional ethical committee clearance was obtained. A clear explanation was given to the patient about the procedure, number of pricks that would be made, complications of the procedure and a written consent was obtained.

Fine Needle Aspiration Cytology – Procedure:

The procedure was normally carried out with the patient lying supine on the examination couch. The swelling was located, palpated. Two fingers of the left hand firmly grasp the nodule. Then the needle was rapidly inserted through the skin into the nodule. A 10 ml plastic syringe attached with a needle (22 gauge or 25 gauge) was held in the right hand. Once the needle tip is in the nodule, gentle suction was applied while the needle is moved back and forth in the nodule vertically. This manoeuvre allows the dislodging of cellular material and easy suction into the needle. During this period of 5-10 passes, suction was maintained and as soon as fluid or aspirate appears in the hub of the needle, the

suction was released and the needle was withdrawn. The appearance of fluid suggests that nodule is cystic. Once the material is seen in the hub of the needle, the needle is taken out of the swelling and detached from the syringe. 5 ml of air was drawn into the syringe and the needle was reattached to the syringe and with the level pointing down, drop of aspirated material was forced onto each of the several glass slides. The suction pressure is maintained to aspirate all the fluid and then FNAC was to be done in the residual lesion or mass.

Fine Needle Non Aspiration Cytology – Procedure:

With all sterile precautions, patient preparation is similar to that of FNAC. However no syringe or suction is necessary for FNNAC. The hub of the needle is held in the pencil grip fashion in the right hand and the needle was gently inserted into the swelling and then moved in and out over 5-10 seconds rapidly. Aspirate flows into the needle through capillary action. As soon as the aspirate appears in the hub, the needle is withdrawn and it was attached to the syringe with air inside. Next the plunger was used to expel the material from the needle onto the glass slides. Slides were prepared as that of the FNAC. After the procedure was over, firm pressure was applied to the aspirated site of the swelling with cotton to stop the bleeding.

Preparation of Smears: The aspirate contained in the needle was expelled on to a clean glass slide using air in a syringe, taking care to avoid splashing. The smears were prepared by using a second glass slide exerting a light pressure to achieve a thin, even spread, in a manner similar to that of making blood smears. Too firm pressure produces crush artefacts. The slides were fixed in 85% of the Isopropyl alcohol in Coplin jars for 20 -30 minutes. The slides were stained with Harris Hematoxylin & Eosin. All the slides were objectively analysed using a point scoring system to enable comparison between FNAC and FNNAC techniques as shown in Table 1. On the basis of five criteria tabulated, a cumulative score was obtained for each case which was then categorized accordingly to one of the 3 categories, category

Table 1:

Scoring system According to Mair to classify quality of cytological aspirate

Criterion	Quantitative description	points
Amount of cellular material	Minimal to absent; diagnosis not possible	0
	Sufficient for cyto diagnosis	1
	Abundant	2
Retention of appropriate architecture	Minimal to absent ; diagnosis not possible	0
	Moderate ; some preservation of architecture	1
	Excellent ; architecture display closely resembling histology , diagnosis obvious	2
Degree of cellular degeneration	Marked; diagnosis impossible	0
	Moderate; diagnosis possible	1
	Minimal diagnosis obvious	2
Degree of cellular trauma	Marked; diagnosis impossible	0
	Moderate; diagnosis possible	1
	Minimal diagnosis obvious	2
Background blood or clot	Large amount ; great compromise to diagnosis	0
	Moderate amount ; diagnosis possible	1
	Minimal; diagnosis easy; specimen of textbook quality	2

1: Unsuitable for cytological diagnosis- (0-2), category 2: Diagnostically Adequate- (3-6), category 3: Diagnostically superior - (7-10).

Wilcoxon signed rank test was performed using SPSS14 software. Differences between FNAC and FNNAC based on the above mentioned five parameters were analysed. All the results were

analysed considering the statistical significance at a level of P = 0.05.

RESULTS:

Out of 50 cases sampled from breast lumps, 31 were from Fibroadenoma, 4 were from Fibrocystic disease, 10 cases were from

Ductal carcinoma, 3 from Phyllodes tumour and 1 each from gynaecomastia and granulomatous mastitis [Table 2]. On the basis of total score obtained, smears obtained from FNAC & FNNAC were graded. It was found that diagnostically superior quality smears were more from FNAC technique than FNNAC (33 vs. 28) and the number of unsuitable smears or the failure rate was also lesser from FNAC technique (1 vs. 6) [table 3].

Table 2:

Frequency of various lesions of breast:

Diagnosis	Total Cases	Percentage
Fibrocystic disease	4	8
Fibroadenoma	31	62
Phyllodes tumor	3	6
Gynaecomastia	1	2
Granulomatous mastitis	1	2
Ductal carcinoma breast	10	20
Total	50	100

The total average score obtained by FNAC technique was greater than FNNAC technique (7.2 vs. 6.64). The average score for each parameter like diagnostic adequacy, retention of architecture, degree of degeneration, trauma and background blood in FNNAC and FNAC of breast lesions was also calculated and it was found that the scores were numerically higher for FNAC technique [Table 4]. The diagnostic adequacy of FNAC is 98% and that of FNNAC is 88%. But the difference was statistically insignificant [table 5].

DISCUSSION:

FNC and mammography as complements to clinical examination (triple diagnosis) have become the standard approach to the investigation of palpable breast lumps. The trend towards more conservative surgery and individualised treatment has increased the

importance of triple diagnosis. The aspirated material can also be used for hormone receptor analysis by IHC methods. The main purpose of FNC of breast lumps is to confirm the cancer and to avoid the unnecessary surgery in specific benign conditions. The sensitivity of FNC in the diagnosis of breast cancer is 90 – 95 %.

During Medieval times, the Arabian physician Abul Casim (1013 – 1107AD) described a method of needle puncture of thyroid to diagnose different types of goitre. Needle aspiration biopsy was first recorded by Kun in 1847. In 1884, Kronig was the first to diagnose lung cancer by aspirating tissue through a transthoracically inserted cannula. In 1904 Greig and Gray performed aspiration of lymph nodes to isolate causative agents of trypanosomiasis. During this aspiration he noticed that the cells aspirated from lymph nodes might help in diagnosis. After that the growth of FNB remained dormant.

During the late 1920s, Papanicalou made his greatest contribution to the field of exfoliative cytopathology, presented his paper “new cancer diagnosis”, later known as pap smear. A screening test for cervical cancer. In 1930, Martin, Stewart and Ellis from United States described the diagnosis of Thyroid nodules by needle biopsy. They used a thicker needle (18 gauge) for aspiration. This technique did not gain wide acceptance because of fear of malignant implant along the needle tract and the other complications. [5]

Table 3:

Grading of smears based on total score:

Grading of smears	FNNAC	FNAC
Diagnostically unsuitable	6	1
Diagnostically adequate	16	16
Diagnostically superior	28	33
Total	50	50

After World War II, the Europeans particularly Scandinavians re-introduced a special aspiration biopsy for diagnosing thyroid lesions. But they performed the aspiration with a finer needle i.e. 22 – 25 gauge. The FNAC technique which was described by Lowhagen et al from Karolinska Institute is generally employed now.[6] In 1955, Franzen et al introduced a special aspiration syringe holder for fine needle cytology of breast and prostate tumors in 1960s.[7,8] However FNAC came into wide acceptance in North America and India in 1980s. Since 1981, a new modified technique of FNC termed as FNNAC pioneered in France by Zajdela et al came into vogue. [3] The same procedure was called as “cyto puncture” by Brifford et al in 1982.[4]

According to Thomson et al the function of the negative pressure in FNAC is not to tear cells but to hold the tissue against the sharp cutting edge of the needle which scrapes or cuts the tissue as it advances through the tissue. [9] FNNAC technique has gained popularity nowadays for its various advantages and has been used widely. In a study by Layfield et al six clusters of benign epithelial cells were used as the threshold for a satisfactory sample. [10]

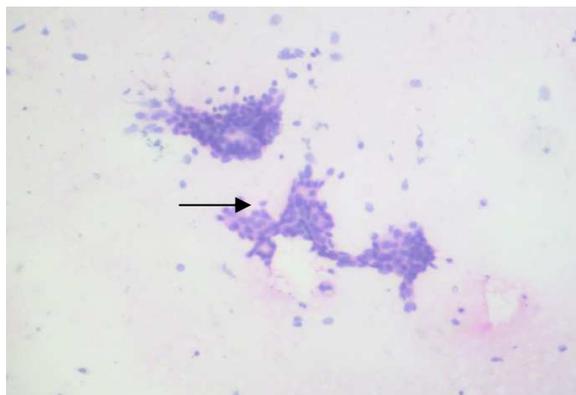


Figure 1: Scanty smear from FNNAC shows cohesive clusters of ductal epithelial cells in fibroadenoma (H&E, 40X).

Santos and Leiman were the first to compare the FNAC and FNNAC smear in thyroid nodules. They observed that the number of unsuitable specimens in their study was not different with both the techniques. They compared the two techniques and graded them

on the basis of certain criteria i.e., **Unsuitable** – If the smears consisted mainly of blood or if cellular material was absent. **Diagnostically adequate** - If the smears were adequate enough to render the diagnosis, but the cellularity is suboptimal and if there were degenerative changes or specimen entrapment in clots. **Diagnostically superior** - If the cells or cell groups are concentrated, well preserved, unobscured by background blood and excellently displayed with retention of such architectural structures such as follicles, papillae and flat sheets. [11]

Sharon Mair and Fiona Dunbar et al in 1989 did their comparative study of FNAC and FNNAC and the smears were scored on the basis of following five objective parameters diagnostic adequacy, retention of architecture, degree of trauma, degree of cellular degeneration and background blood or clot obscuring the background as shown in Table 1. They concluded that there was no statistical difference between FNAC and FNNAC, but they observed that FNNAC smears were diagnostically superior and of text book quality and it allows for greater ease of sampling and a more sensitive probing of the mass to be sampled. FNAC was diagnostic for fibrous lesions and cystic lesions and suggested that the technique of fine needle sampling employed for cyto diagnosis could be left to the personal preference of the operator. [12]

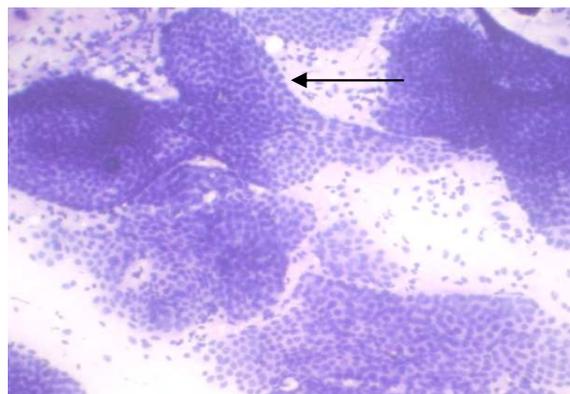


Figure 2: Highly cellular smear from FNAC in a fibroadenoma shows monolayered sheets of

ductal epithelial cells in a background of bare nuclei (H&E, 40x)

This study was undertaken to compare the efficacy of both FNAC and FNNAC techniques in breast lumps. In our comparative study we observed that FNNAC offered several advantages. Without aspiration, trauma to cells was reduced. Less blood in the samples resulted in higher quality of the cytological smear which made it easier for the pathologist to comment accurately on the cytological findings. The handling of the needle was practised with a wrist movement and not from the shoulder joint as in aspiration method using the Cameco syringe holder. This allowed for a more sensitive puncture technique touching the lesion during sampling with the finger tips. The puncture caused less pain than the aspiration technique.

It was also found in our comparative study that diagnostically superior quality smears were more from FNAC technique than FNNAC and the unsuitable smears were also lesser from FNAC technique [Table 3]. The total average score obtained by FNAC technique is greater than FNNAC technique. The average score for each parameter in FNNAC and FNAC of breast lesions was calculated and it was found that the scores were numerically higher for

FNAC technique [Table 4] and the difference was statistically insignificant.

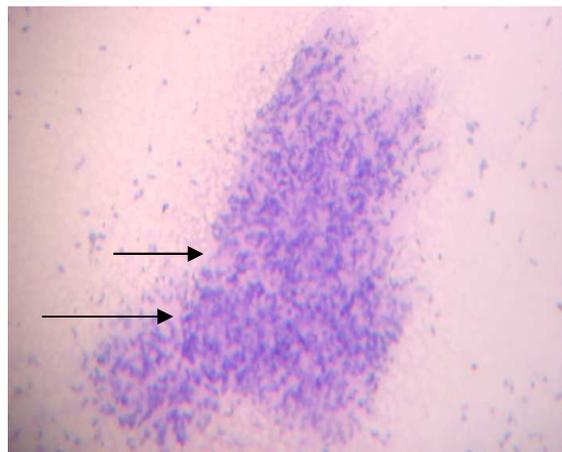


Figure 3: FNNAC smear from Phyllodes tumor shows clusters of spindle cells with bare stromal nuclei in the background (H&E, 40X).

In benign breast diseases like Fibroadenoma and Phyllodes tumor, FNAC is the most suitable method since the number of superior quality smears is more from FNAC [Figure 1,2,3&4]. The number of unsuitable smears or the failure rate is lower for the FNAC technique. On analysing the mean score under the sub categories like diagnostic adequacy, retention of architecture, degree of

Table 4:

Average score and P value obtained by FNNAC & FNAC under each sub category in breast lesions:

S. No	Technique	Adequacy	Architecture	Cellular degeneration	Cellular trauma	Background blood
1	FNNAC	1.62	1.38	1.26	1.26	1.28

2	FNAC	1.8	1.56	1.32	1.27	1.3
3	P Value	P>0.05	P>0.05	P>0.05	P>0.05	P>0.05

degeneration, trauma and background blood, scores obtained by FNAC are numerically higher than FNNAC . The diagnostic adequacy of FNAC was 98% whereas for FNNAC it was 88%. But the difference was statistically insignificant [Table 5].

In the cystic lesions of the breast like fibrocystic disease, FNAC was the procedure of choice and it allows the drainage of the fluid and can be re-attempted in the residual lesion. In case of the malignant lumps of the breast, both the techniques yielded adequate material and the average scores are comparable. [Figure 5&6]

The results of this study were similar to the study conducted by Baksh S et al in 2004 which was designed to assess the diagnostic utility of FNNAC and FNAC in breast masses and found that differences between all the individual parameters as observed in FNAC and FNNAC smears were insignificant.[13]

However in a similar study, Yasub E Al Khattab et al., in 2004 observed that each sampling technique has its own advantages and disadvantages and to choose one of them was based on personal preference. They suggested that if only one needle pass was to be performed or to minimize the patient discomfort or to reduce the screening time, FNAC probably has

the greater chance of producing a diagnosis than FNNAC. [14]

Stefano Ciatto et al., in 2006 observed in breast lumps that reducing the rate of inadequate sampling from benign masses seemed to be the major advantage of aspiration. Double sampling, independent of the specific techniques, reduced inadequacy rates to very low levels (1.2% for cancers; 5.9% for benign masses) and may be useful as a routine policy. [15]

Whereas FNAC was found to be superior by Kumarasingh M et al., in their comparative study in benign lesion of breast and in case of malignant lumps of breast both the techniques was comparable.[16] Amrita Ghosh et al., found that regarding amount of cellular material obtained by FNAC, statistically significant better results were found in breast lesions. However the number of inadequate smears was also more by FNNAC technique than by FNAC technique. Therefore it was concluded by them that by combining both the techniques better diagnostic accuracy can be achieved. [17]

Rajasekhar A and Sundaram C et al., observed that efficiency of obtaining adequate material was 80% for both the techniques. FNNAC was more cost effective, less painful

Table – 5

Diagnostic Adequacy and the number of superior quality smears obtained by FNNAC & FNAC in breast lumps:

S. No	Technique	Average Score	Diagnostic adequacy	No. of Superior quality smears
1	FNNAC	6.64	88%	28

2	FNAC	7.2	98%	33
3	P Value	P> 0.05	P>0.05	P>0.05

And correlated well with FNAC and histopathology. They also concluded that malignant lesions were sampled more easily and anatomic site had no influence on the yield. Most of the negative cases were small swellings, less than 1.5 cm in diameter. [18]

In the head and neck region Braun H et al., in 1997 demonstrated that fine needle capillary technique was the better method.[19]

In thyroid lesions, C V Raghuvver et al., and S A Ali Rizvi et al., observed in their comparative study that FNNAC was superior in quality and in diagnostic accuracy than FNAC.[20,21] Meherbano M Kamal found a statistically significant difference in favour of FNNAC was observed for the parameter amount of cellular material.[22] Maurya et al have done a comparative study of FNAC and FNNAC in thyroid lesions and found that greater number of diagnostically superior smears were obtained from FNNAC and more number of diagnostically adequate smears were obtained from FNAC, but the differences between all the individual parameters were insignificant. [23]

In the salivary gland lesions, C V Raghuvver et al observed that both FNNAC and FNAC fared equally well and concluded that FNNAC technique was much more patient friendly and gave high class "text book" quality smears while FNAC smears gave quantitatively more adequate material. [20]

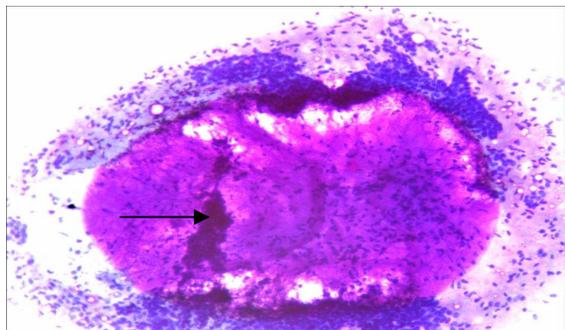


Figure 4: FNAC smear from Phyllodes tumor shows dispersed singles and groups of spindle cells in a myxoid background (H&E, 40X).

CONCLUSION:

This prospective study observed that FNAC is the best choice for the fibrous lesions of breast like fibro adenoma & phyllodes tumor and cystic lesions, as it yielded adequate material than FNNAC. But in the malignant lumps of breast both the techniques are comparable and both yielded adequate material. The number of unsuitable smears and failure rate was lower for FNAC technique. The diagnostic adequacy of FNAC (98%) was more than FNNAC technique (88%) but the difference was statistically insignificant ($p>0.05$). The decision to use either FNNAC or FNAC may be decided on the basis of site, size and nature of lesion (solid or cystic). Each technique has its own advantages and disadvantages. Both the techniques can be combined to obtain a high quality material and to lower the failure rates.

References:

1. Frable WJ. Needle Aspiration Biopsy: Past, Present and Future. *Human Pathol* 1989; 20: 504-7.
2. Lee KC, Chan JK, Ho LC : Histologic changes in the breast after fine needle aspiration. *Am J Surg pathol* 1994;18:1039-7.
3. Zajdela A, Zillhardt P, Voillemot N. Cytological diagnosis by fine needle sampling without aspiration. *Cancer* 1987;59:1201-5.
4. Brifford M, Gentile A, Hebert H. Cytopuncture in the follow-up of breast carcinoma. *Acta Cytol* 1982;26:195-0.
5. Martin H E, Ellis E Biopsy. Needle puncture and aspiration. *Ann Surg.* 1930; 92:169-1.

6. Lowhagen T, Willems JS, Lundell G, Sundblad R, Granberg P. Aspiration Biopsy Cytology in Diagnosis of Thyroid Cancer. *World J Surg*. 1981;5:61-3.
7. Franzen S, Giertz G, Zajicek J. Cytological diagnosis of prostatic tumours by Trans rectal aspiration biopsy, a preliminary report. *Br J Urol* 1960;32:193 – 6.
8. Zajicek J, Franzen S, Jacobsson P. Aspiration biopsy of mammary tumors in diagnosis and research: A critical review of 2200 cases. *Acta Cytol* 1967;11:169-5.
9. Thomson. Thin needle aspiration Biopsy. *Acta Cytol* 1982;26:262-3.
10. Layfield LJ, Glasgow B, Coogan A. What constitutes an adequate smear in fine needle aspiration cytology of breast? *Cancer* 1997;81:16-1.
11. Santos JEC, Leiman G. Non aspiration Fine Needle Cytology. Application of a new technique to nodular thyroid disease. *Acta Cytol* 1988;32:353-6.
12. Mair S, Dumbar F, Becker PJ, Plessis WD. Fine Needle Cytology -Is Aspiration Suction Necessary? A study of 100 masses in various sites. *Acta Cytol* 1989;33:809-3
13. Baksh S, Masih K, Singh S, Das S. Diagnostic utility of fine needle non aspiration cytology Vs Fine needle aspiration cytology in breast masses. *Indian J Pathol Microbiol* 2004;47(3): 319-1
14. Al Khattab YE, Hussain AG. Fine needle capillary technique. Is aspiration suction necessary? *Iraqi J Med Sci* 2004;3:128-1.
15. Stefano ciatto MD, Salvatore milano italy, : *Diagnostic Cytopathology*, Vol 7, 185-2 page 125-7
16. Kumarasinghe MP, Sheriffedeem AH. Fine Needle Sampling without aspiration. *Pathology* 1995;27:330-2
17. Ghosh A, Misra RK, Sharma SP, Singh HN, Chaturvedi AK. Aspiration Vs Nonaspiration Technique of Cytodiagnosis - A critical evaluation in 160 cases. *Indian J Pathol Microbiol* 2000;43:107-2
18. Rajasekhar A, Sundaram C, Chowdhary T, Charanpal M, Ratnakar KS. Diagnostic utility of Fine Needle Sampling without aspiration: a prospective study. *Diagnostic Cytopathology* 1991;7:473-6.
19. Braun H, Walch C, Beham A. FNAC in head and neck region swellings. *Laryngotologie* 1997;76(6):358-3.
20. Raghuveer CV, Leekha I, Pai MR, Adhikari P. Fine needle aspiration cytology versus fine needle sampling without aspiration. A prospective study of 200 cases. *Indian J Med Sci* 2002;56:431–9.
21. Ali Rizvi SA, Husain M, Khan S, Mohsin M. A comparative study of fine needle aspiration cytology versus non-aspiration technique in Thyroid lesion. *The surgeon* 2005; 3:273-6
22. Kamal MM, Arjune DG, Kulkarni HR: Comparative study of fine needle aspiration and fine needle capillary sampling of thyroid lesions. *Acta Cytol* 2002;46:30–34
23. Maurya AK, Mehta A, Mani NS, Nijhawan VS, Batra R. Comparison of aspiration vs non-aspiration techniques in fine needle cytology of thyroid lesions. *J Cytol* 2010;27:51-4.

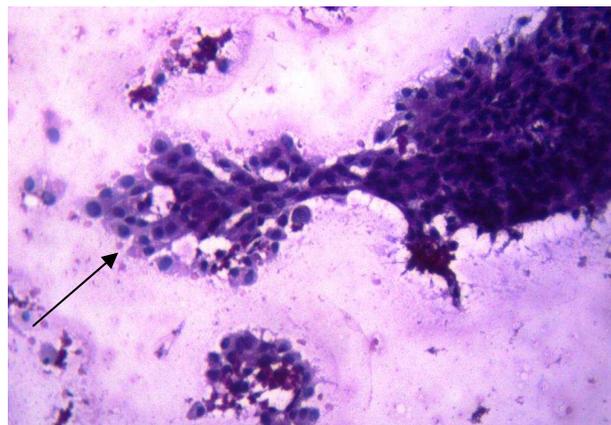


Figure 5: FNNAC Smear from carcinoma breast shows loosely cohesive clusters of malignant ductal epithelial cells (H&E, 40X).

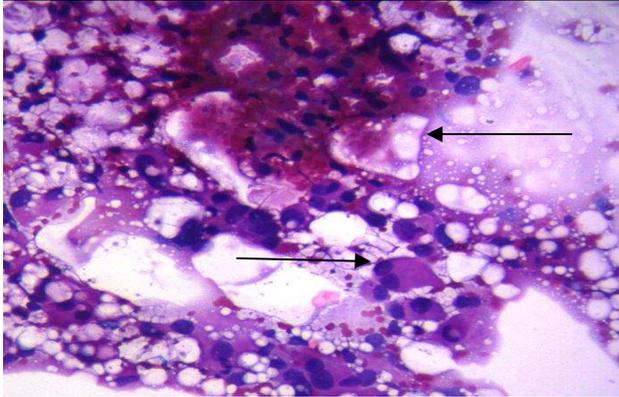


Figure 6: FNAC smear from carcinoma breast shows more cellularity with scattered singles and loose clusters of malignant ductal epithelial cells in a hemorrhagic background.

(H&E,40X).