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COMPARATIVE EVALUATION OF LIQUID-BASED CYTOLOGY FOR BREAST LESIONS AND CONVENTIONAL SMEARS' DIAGNOSTIC ACCURACY

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ABSTRACT

Background: Utilising liquid-based cytology (LBC) extensively has become more common in recent years for the evaluation and assessment of both gynaecologic and non-gynaecologic tissues. The monolayer cell suspension makes a better morphological evaluation feasible. Moreover, LBC enables evaluation of nucleolar prominence, smaller or lost background material, fractured cell clusters, and smaller or lost cell size.

Aim: The purpose of this study was to determine if Liquid-Based Cytology is a more useful and effective method for assessing breast lesions than traditional smears, as well as whether it may be used in place of conventional preparation.

Methods: A total of 374 female individuals with palpable breast lesions underwent fine-needle aspiration cytology (FNAC) for this prospective clinical research. While the first pass was utilised for either an LBC or a standard smear, the second pass was administered. A number of parameters were employed to contrast the conventional smear with the representative LBC. Every criterion was scored individually, and then a statistical analysis was conducted.

Results: The analysis revealed that while there was a statistically significant difference in background blood-debris and informative background, there was a statistically non-significant difference in nuclear and cytoplasmic details, monolayer presence, cytoarchitectural pattern, and cellularity between LBS and conventional.

Conclusion: The current study finds that liquid-based cytology (LBC) can be a promising tool for the cytology sector. It has the potential to decrease the number of slides evaluated for each case and also to shorten turnaround times.

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Keywords: Breast lesion, conventional smear, cytology, fine-needle aspiration cytology, liquid-based cytology

INTRODUCTION

Breast lumps are becoming more and more prevalent presentations for female patients attending outpatient departments worldwide, particularly in India, as more people become aware of them. Typically, aberrant imaging results, nipple discharge, and/or palpable breast masses are used to identify breast lesions. Breast lesions on the cytologic examination play a crucial role in the diagnosis and screening of various lesions since they may be observed in a variety of ways utilising cytology.[1]

FNAC (fine-needle aspiration cytology) is a semi-routine clinical test performed for breast lumps and is an essential component of the triple evaluation used to evaluate the palpable breast masses. It is a quick, simple, accurate, and economical method for assessing breast lesions and tumours.[2]

Conventional smears are time-consuming and laborious for screening, even if they are helpful for diagnosis because of the uneven fixation and slide preparation. The characteristics of conventional smears, such as air and blood drying artefacts, concealing inflammation, overlapping cellular regions, and thick cellular areas, are linked to poor cellular and nuclear preservation.[3]

The broad use of liquid-based cytology, or LBC, has become more and more common in recent years for the examination and assessment of both gynecologic and non-gynecologic specimens. The monolayer cell suspension makes a better morphological evaluation feasible. Moreover, LBC enables evaluation of nucleolar prominence, smaller or lost background material, fractured cell clusters, and smaller or lost cell size. Despite creating a smear that permits the cell suspension on a monolayer, LBC employs cell rinsing in a liquid media preservative and automates sample processing. In terms of uniform cell dispersion and quick attachment in a limited region on the slide, LBC is also better. As a result, less time is required for screening and cytopathology employing screeners. Additionally, the material that was left in the fixative liquid can be used for ancillary immunocytochemistry research.[4]

As the prevalence of breast lesions rises worldwide, particularly in India, Given their potential for recovery, the current clinical investigation was carried out to compare the usefulness and effectiveness of liquid-based cytology to traditional smears for the evaluation of breast lesions and to determine whether they may be used in place of the traditional preparation.[5]

The study also sought to see whether LBS might be used to evaluate breast lesions instead of traditional smears.

MATERIALS AND METHODS

The goal of the current prospective clinical trial was to compare the usefulness and effectiveness of liquid-based cytology to traditional smears in assessing breast lesions and to

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determine whether or not they could replace the traditional preparation. The study also sought to see whether LBS might be used to evaluate breast lesions instead of traditional smears. The participants in the research were those who came to the Institute's outpatient clinic complaining of breast lesions.

374 female participants with breast FNAC determined by palpable breast lesions were included in the current research. Following each subject's final participation in the research, a thorough history was taken and a clinical examination was conducted. Following a thorough explanation of the study's methodology, each participant provided their informed permission.

Using a 23-gauge needle, fine-needle aspiration was performed under stringent aseptic and sterile conditions for the breast lump. Each participant underwent two passes, with the first being utilised for the customary smear preparation. Adequacy for one air-dried smear was assessed at the location during toluidine production. One moist smear was immediately fixed in 95% ethanol for at least thirty minutes, and then Papanicolaou (Pap) stain was applied. May-Grunwald-Giemsa (MGG) stain was applied to the remaining slides.

With regard to LBC, a second pass was made, and the aspirate was washed in a 5–7 ml tube containing CytoRich preservative fluid before being assessed in a lab. Prior to processing, the sample was allowed to fix for at least an hour. It was then centrifuged at 600 g for 10 minutes, and the supernatant was then decanted. Additionally, Tri's buffer was added to the centrifuge tube, vortexed for 25 seconds, and then centrifuged for five minutes.

A number of parameters were applied to compare the LBC smear with the traditional smear. These comprised: Background cell debris and blood Relevant background information (such as tumour diathesis in malignant situations, bare nuclei in benign ones, and stromal fragments), The existence of monolayer cells, nuclear characteristics (such as nuclear size, membrane irregularity, chromatin pattern, and nucleoli visibility), and cytoplasmic details (such as cytoplasmic boundaries, vacuolization, granularity, pigment presence, etc.) are examples of cytomorphological details. The features of cellular architecture include cellularity and the existence of cell clusters, branching sheets, papillary pieces, etc.

A separate score was assigned to each characteristic. Using SPSS software version 21 (Chicago, IL, USA) for statistical assessment and one-way ANOVA and t-test for result formulation, the gathered data were examined. The data were expressed in percentage and number, and mean and standard deviation. The level of significance was kept at $p<0.05$.

RESULTS

The purpose of the current prospective clinical investigation was to compare the usefulness and effectiveness of liquid-based cytology to traditional smears in assessing breast lesions and to determine whether or not they could replace the conventional preparation. A total of 374 female participants with breast FNAC determined by palpable breast lesions were included in this investigation. According to the research subjects' lesion type, the case distribution showed that 4.01% (n=15) of the patients had unclear or inconclusive findings on the LBC, and 5.08% (n=19) of the individuals had inconclusive results on the conventional

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smear. 40.90% (n=153) of the participants had malignant lesion on LBC, while 37.16% (n=139) of the subjects had it on a conventional smear.

Atypical findings suggesting malignancy were seen in no subject on LBC and conventional smear in 3.47% (n=13) subjects. Atypical findings suggesting benign state was seen on LBC and conventional smear in 8.02% (n=30) subjects and 5.08% (n=19) subjects respectively. Benign lesion on LBC and conventional smear were seen in 47.05% (n=176) and 49.19% (n=184) subjects respectively as shown in Table 1.

Inadequate findings for LBC and traditional smear were observed in 4.01% (n=15) and 5.08% (n=19) of the research individuals, respectively, when comparing the two methods for evaluating breast lesions. On both LBC and conventional smears, cancer was detected in 40.90% (n=153) and 37.16% (n=139) of the subjects. Atypical results indicating malignancy were detected in 3.47% (n=13) of the subjects, while atypical results indicating benign lesion were detected in 8.02% (n=30) and 5.08% (n=19) of the subjects, respectively. On LBC and conventional smears, gynecomastia and fat necrosis were observed in 2.94% (n=11) of the individuals, respectively. On an LBC and a conventional smear, galactocele was observed in 1.06% (n=4) of the individuals, respectively.

On liquid-based cytology and traditional smear, 14.97% (n=56) of the participants showed an inflammatory lesion, while 1.06% (n=4) of the subjects showed fibrocystic disease. Table 2 shows that 24.06% (n=90) of participants using LBC and 26.20% (n=98) of subjects using a traditional smear had fibroadenoma.

When cytologic features were assessed using LBC and conventional smear on study subjects, background blood-debris (LBC) and blood debris (conventional smear) yielded better results, with background blood debris being statistically significant ($p<0.001$) and having a z-score of -7.246. Comparable outcomes were seen for the background information, where LBC demonstrated noticeably superior performance with corresponding z and p-values of -6.254 and <0.001, respectively. With $p=0.975$, cytoplasmic detail did not reveal a significant difference between an LBC and a conventional smear. On the LBC and conventional smear, nuclear details showed a statistically non-significant difference ($p=0.436$). Table 3 illustrates a comparable non-significant difference in cellularity, cytoarchitectural pattern, and monolayer between LBC and traditional smears, with corresponding p-values of 0.672, 0.117, and 0.469.

DISCUSSION

The purpose of the current prospective clinical investigation was to compare the usefulness and effectiveness of liquid-based cytology to traditional smears in assessing breast lesions and to determine whether or not they could replace the conventional preparation. A total of 374 female participants with breast FNAC determined by palpable breast lesions were included in this investigation.

According to the research subjects' lesion TYPE, the case distribution showed that 4.01% (n=15) of the patients had unclear or inconclusive findings on the LBC, and 5.08% (n=19) of

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the individuals had inconclusive results on the conventional smear. 40.90% (n=153) of the participants had malignant lesion on LBC, while 37.16% (n=139) of the subjects had it on a conventional smear. Atypical results indicating malignancy were observed in 3.47% (n=13) of the individuals on conventional smear and in none of the subjects on LBC. On an LBC and conventional smear, atypical results indicating a benign condition were observed in 8.02% (n = 30) and 5.08% (n = 19) of the individuals, respectively. 47.05% (n=176) and 49.19% (n=184) of the individuals had benign lesions on the LBC and conventional smear, respectively.

These results were in line with those of Ryu HS et al. (2013)[5] and Singh P et al. (2016),[6] whose authors demonstrated a case distribution comparable to the current study's depending on the kind of lesion.

Regarding the comparison of LBC and conventional smear for evaluating breast lesions in research participants, 4.01% (n=15) and 5.08% (n=19) of individuals, respectively, had insufficient findings for LBC and conventional smear. On both LBC and conventional smears, cancer was detected in 40.90% (n=153) and 37.16% (n=139) of the subjects. Atypical results indicating malignancy were detected in 3.47% (n=13) of the subjects, while atypical results indicating benign lesion were detected in 8.02% (n=30) and 5.08% (n=19) of the subjects, respectively.

On LBC and conventional smears, gynecomastia and fat necrosis were observed in 2.94% (n=11) of the individuals, respectively. On an LBC and a conventional smear, galactocele was observed in 1.06% (n=4) of the individuals, respectively. On liquid-based cytology and traditional smear, 14.97% (n=56) of the participants showed an inflammatory lesion, while 1.06% (n=4) of the subjects showed fibrocystic disease. 24.06% (n=90) of the participants using LBC and 26.20% (n=98) of the subjects using a traditional smear showed fibroadenoma. These findings were consistent with research conducted in 2011 by Kumar N et al[7] and Liew PL et al,[8] which found a comparable comparison between LBC and traditional smear for evaluating breast lesions.

Background blood-debris (LBC) and blood debris (traditional smear) had a z-score of -7.246 for evaluating the relevance of cytologic characteristics in the research individuals. Background blood debris produced superior results and was statistically significant with $p<0.001$, according to the data. Comparable outcomes were seen for the background information, where LBC demonstrated noticeably superior performance with corresponding z and p-values of -6.254 and <0.001, respectively. With p=0.975, cytoplasmic detail did not reveal a significant difference between an LBC and a conventional smear. On the LBC and conventional smear, nuclear details showed a statistically non-significant difference (p=0.436). For monolayer, cytoarchitectural pattern, and cellularity, there was a comparable non-significant difference between the LBC and traditional smear, with corresponding p-values of 0.469, 0.117, and 0.672.

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These results were similar to those of Tripathy K et al. (2015)[9] and Muddegowda PH et al. (2011),[10] who demonstrated that LBC produced substantial and superior background and blood debris outcomes than traditional smears.

CONCLUSION

The current study suggests, within its constraints, that liquid-based cytology (LBC) can be a promising technique in the cytology industry. It has the potential to decrease the amount of slides tested for each case and also to shorten turnaround times. The current study did, however, have several drawbacks, such as a limited sample size, a short monitoring time, and biases related to geographic areas. Therefore, further long-term research with bigger sample sizes and longer observation periods will aid in coming to a conclusive result.

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TABLES

Lesion	LBC (Liquid-based cytology)		Conventional Cytology	
	%	n	%	n
Indeterminate/inconclusive	4.01	15	5.08	19
Malignant	40.90	153	37.16	139
Atypical pointing malignancy	-	-	3.47	13
Atypical pointing benign state	8.02	30	5.08	19
Benign	47.05	176	49.19	184
Total	100	374	100	374

Table 1: Case distribution based on nature of the lesion in the study subjects

Lesion	LBC (Liquid-based cytology)		Conventional Cytology	
	%	n	%	n
Inadequate	4.01	15	5.08	19
Carcinoma	40.90	153	37.16	139
Atypical pointing malignancy	-	-	3.47	13
Atypical pointing benign state	8.02	30	5.08	19
Gynecomastia	2.94	11	2.94	11
Fat necrosis	2.94	11	2.94	11
Galactocele	1.06	4	1.06	4
Inflammatory lesion	14.97	56	14.97	56
Fibrocystic disease	1.06	4	1.06	4
Fibroadenoma	24.06	90	26.20	98
Total	100	374	100	374

Table 2: Comparison of LBC and conventional smear for assessing breast lesion in the study subjects

Cytologic features	z-scores	p-value
Background blood-debris (LBC) and blood debris (conventional smear)	-7.246	<0.001
Informative background LBC and Informative background conventional smear	-6.254	<0.001
Cytoplasmic details LBC and conventional smear	-0.036	0.975
Nuclear details LBC and conventional smear	-0.7777	0.436
Monolayer LBC and conventional smear	-0.726	0.469
Cytoarchitectural pattern LBC and conventional smear	-1.577	0.117
Cellularity LBC and conventional smear	-0.428	0.672

Table 3: Assessing the significance of cytologic features using LBC and conventional smear in the study subjects