Original Article

Comparative Evaluation of Diagnostic Efficacy of Cell Block versus Aspiration Cytology

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Abstract

Introduction: Fine-needle aspiration cytology (FNAC) has certain disadvantages despite being the most commonly used procedure in the initial diagnosis of any swelling. In such cases, a cell block (CB) study can be a valuable adjunct to smears for establishing a more definitive cytopathological diagnosis. Therefore, this study was conducted to evaluate the efficacy of CB with FNAC and to compare the findings of the CB and FNAC with histopathology as the gold standard. **Materials and Methods:** The study was conducted in the department of pathology at our institute. All the cystic/solid lesions sent for fine-needle aspiration, which yielded sufficient material for the CB, were studied along with detailed clinical history. **Results:** Out of 66 cases of FNAC and CB, 35 cases were sent for histopathology. The mean age of the patients was 41.36 years, and female patients were more in number (73%). Benign lesions (71.4%) were more than malignant ones (29.6%). The CB section had more thyroid lesions (31%). The diagnostic accuracy of FNAC was found to be 94.28%, while that of CB was 97.14%. **Conclusion:** Although FNAC is the first line of investigation for mass lesions, and still, to make the best possible use of an aspirate, smears should be used together with CB preparation to provide the best possible morphological and histological diagnosis.

Keywords: A cell block, fine-needle aspiration cytology, histopathology

Introduction

Although fine-needle aspiration cytology (FNAC) is the most routinely performed and widely accepted diagnostic procedure for an initial diagnosis of any swelling, we often come across difficulties in diagnosis if the material obtained is scanty, haemorrhagic or fluid in nature. The most accepted technique for the diagnosis is FNAC.[1] In this method, the concerned cells are obtained by using a thin bore needle and immediately, the smears are made for cytopathy diagnosis.[2] This method of diagnosis is ultra-fast and minimally invasive.[3] It is also cost-effective and straightforward to perform. Having stated all the advantages, it has certain disadvantages too. Its limitations include its dependence on proper smearing to visualise the cells and preserve cell architecture.[4] Another constraint of the conventional FNAC smear is the limited material available for adjuvant diagnostic investigations, including immunocytochemistry.[5] In FNAC, at times, the quality of smears is also variable, as one would encounter thick clumps of cells or poor cell distribution.[6] In such times, cell block (CB) surmounts over FNAC.

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CB cytology is an equally effective alternative method for FNAC.[7] CB cytology offers a more apparent tissue pattern than FNAC.[8] In CB cytology, small tissue fragments can be retrieved from the fine-needle aspiration specimens embedded in the paraffin CB. The diversity of CB methods has been used to complement fine-needle aspiration smears. CB also provides additional insights by assigning the patterns which can provide additional clues for the diagnosis. Keeping this in view, the present study was conducted to evaluate the role of FNAC and CB with histopathology as a gold standard.[5]

The study aimed to evaluate the efficacy of the CB technique as a reliable diagnostic aid. It also aimed to evaluate the combined effectiveness of the CB technique along with FNAC and to compare the findings of the CB technique and

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FNAC with histopathology as a gold standard whenever possible.

Materials and Methods

Study population

The present study was conducted on 101 patients in the department of pathology after approval from the Institutional Ethics Committee IEC/SDUMC/KLR/52/2022. CB s were prepared, and biopsies were taken from the suspected cases. In addition, informed consent of the patients was taken. The samples included were (a) smears prepared from FNAC, (b) sections prepared from biopsied material and (c) CB s prepared from FNAC material.

Sample size calculation

Sample size is estimated based on the final scores for two methods, FNAC and Cellblock, as per the study done by Bhatia P *et al*.[9] based on the following formula.

$$\text{Sample size} = \frac{\left\{ Z_{1-\frac{\alpha}{2}} \sqrt{2\bar{P}(1-\bar{P})} + Z_{1-\beta} \sqrt{P_1(1-P_1) + P_2(1-P_2)} \right\}^2}{(P_1 - P_2)^2}$$

Where,

- P1: Proportion of the first group
- P2: Proportion of the second group
- a: Confidence interval (95%)
- 1 − b: Power (80%), based on this, a sample size of 100 cases was selected.

Inclusion criteria

Haemorrhagic and fluid aspirates were obtained from the cystic and solid lesions by FNAC. Availability of adequately cellular smears and cellblocks of optimal quality. Cases whose clinical and radiological features were available.

Exclusion criteria

Improperly prepared CB s and inadequate cytology smears were excluded from the study.

Fine-needle aspiration technique

After taking a detailed clinical history, the procedure was explained briefly to the patient, and informed consent was taken. The swelling was palpated (in cases of palpable lesions), and the area was cleansed with a spirit swab. The swelling was immobilised with the non-dominant hand. A 23–25 G needle attached to a 10 ml syringe was introduced into the lesion. The syringe plunger was pulled back to create negative pressure, and the needle was moved back and forth. Negative pressure will be released when the needle remains in the swelling. After 8–10 rapid passes, the needle was withdrawn, and the syringe detached. The aspirate was blown onto glass slides from the syringe. The smears were fixed in 95% ethanol and stained with Haematoxylin–Eosin (H and E) or Papanicolaou stain. The air-dried smears were stained with May Grunwald Giemsa stain and studied. Ziehl − Neelsen staining was done to look for acid-fast bacilli if they are suspected to be present. For CB preparation (plasma thromboplastin method)[9] the test tube with aspirated material was centrifuged at 3000 revolutions/min for 10 min. The supernatant fluid was decanted. To the sediment, an equal amount of normal plasma and thromboplastin was added and mixed and then allowed to stand for 10–15 min. The cell ball formed was submitted to the histopathology section for processing as a routine biopsy specimen. 4–5 µ thick sections were made and stained with H and E stain. Special stains like peroidic acid-schiff, Congo red, Masson's Trichrome and Reticulin were used wherever applicable. Stained sections were reported under the microscope.

Results

It is a retrospective study conducted at the department of pathology for 2 years and 10 months, from January 2018 to October 2021. The history of all the patients coming to cytology was collected on the spot, and other investigations such as ultrasonography findings and physical examination were done. FNAC was done after taking proper consent, and conventional smears were made, and the remaining material was given for CB preparation. The smears and CB were interpreted by two pathologists independently and were charted in an excel sheet. Table 1 shows age-wise distribution in all the lesions maximum patient (28.8%) were in the age group of 41–50 years. Gender distribution with females being predominantly involved (60.3%).

Table 2 shows a comparative evaluation between FNAC, CB and histopathology in thyroid cases according to the nature of the lesion. Lesions belonging to the benign category (51.4%) were the predominant finding in FNAC, whereas lesions belonging to the malignant category (50.4%) were predominant in CB findings and in histopathology, predominant lesions noted were benign (75%). Correlation between FNAC and

Table 1: Age-Gender wise distribution

	n (%)
Age group (years)	
1-10	0
11-20	10 (9.61)
21-30	2 (1.9)
31-40	25 (24.03)
41-50	30 (28.8)
51-60	23 (23.07)
61-70	9 (9.61)
71-80	2 (2.8)
81-90	0
Total	101 (100)
Sex	
Gender	61 (60.3)
Male	40 (39.6)
Total	101 (100)

histopathology diagnosis in thyroid lesions non-consistent results was noted in 1.92% cases in the benign category and 1.92% cases in the malignant category, both showing identical results and consistent results in FNAC were noted in 36 benign cases (69.2%), and 14 cases (26.9%) were noted in the malignant category. Correlation between CB and histopathology diagnosis in thyroid lesions. Correlation between CB and histopathology diagnosis in thyroid lesions. [Figure 1] In benign category 1 (1.9%), lesions showed non-consistence, whereas, in the malignant category, no non-consistence was noted.

Table 3 shows a correlation between FNAC and histopathology diagnosis in breast lesions. In malignant category 2 (7.1%) showed non-consistence, whereas in benign category 4 (14.2%) and also a correlation between CB and histopathology diagnosis was evaluated in breast lesions which demonstrated y no non-consistence in benign category breast cases, whereas in malignant category 1 (3.5%), cases were noted.

Table 4 shows a correlation between FNAC and histopathology diagnos is in the liver lesion. In benign category 2 (11.7%), lesions showed non-consistent, whereas in malignant category, 5 (29.4%) showed non-consistence.

Table 5 shows a comparison study between CB and FNAC. The comparison was statistically significant in relation to breast lesions

Table 6 compares our study to different other studies related to the comparison of the accuracy of FNAC with positive predictive value (PPV) and negative predictive value (NPV).

Discussion

The main challenge to a cytopathologist in the present era of personalised treatment is to be able to devise techniques that can provide more information with less tissue available. FNAC is a simple, rapid, non-operative procedure which has proven to show high sensitivity and specificity in various lesions.[16] However, some drawbacks are encountered due to cellular overlapping, delaying artefact, suboptimal processing and preparatory cyto-technique.[17] Shivakumarswamy *et al*. states that the cytological examination of fluids by means of smears, however carefully prepared, leaves behind a large residue that is not further investigated but that might contain valuable diagnostic material.[18] This residual material can be very useful in increasing the diagnostic yield by the CB method. CB technique is one of the oldest

Table 2: Comparative evaluation between fine-needle aspiration cytology, cellblock, and histopathology in thyroid cases along with correlation between fine-needle aspiration cytology and histopathology diagnosis and correlation between cell block and histopathology diagnosis in thyroid lesions

Nature of lesion	FNAC, *n* (%)	Cell block, *n* (%)	Histopathology, *n* (%)	FNAC		Cell block		Histopathology, *n* (%)
				Consistent, *n* (%)	Non-consistent, *n* (%)	Consistent, *n* (%)	Non-consistent, *n* (%)	
Benign	52 (51.4)	50 (49.5)	39 (75)	36 (69.2)	1 (1.92)	38 (73)	1 (1.9)	39 (75)
Malignant	46 (45.5)	51 (50.4)	13 (25)	14 (26.9)	1 (1.92)	13 (25)	0	13 (25)
Inadequate	3 (2.9)	0	0	0	0			0
Total	101	101	52 (100)	50 (96.1)	2 (3.8)	51 (98)	1 (1.9)	52 (100)

FNAC: Fine-needle aspiration cytology

Table 3: Depicting correlation between fine-needle aspiration cytology and histopathology diagnosis in breast lesions also a correlation between cell block and histopathology diagnosis

Nature of the lesion	FNAC		Histopathology, *n* (%)	Cell block		Histopathology, *n* (%)
	Consistent, *n* (%)	Non-consistent, *n* (%)		Consistent, *n* (%)	Non-consistent, *n* (%)	
Benign	14 (50)	4 (14.2)	18 (64.2)	18 (64.2)	0	18 (64.2)
Malignant	8 (28.5)	2 (7.1)	10 (35.7)	9 (32.1)	1 (3.5)	10 (35.7)
Total	22 (78.5)	6 (21.4)	28	27 (96.4)	1 (3.5)	28

FNAC: Fine-needle aspiration cytology

Table 4: Correlation between fine-needle aspiration cytology and histopathology diagnosis in the liver lesion and also a correlation between cell block and histopathology diagnosis in the liver lesion

Nature of the lesion	FNAC		Histopathology, *n* (%)	Cell block		Histopathology, *n* (%)
	Consistent, *n* (%)	Non-consistent, *n* (%)		Consistent, *n* (%)	Non-consistent, *n* (%)	
Benign	0	2 (11.7)	2 (11.7)	2 (11.7)	0	2 (11.7)
Malignant	10 (58.8)	5 (29.4)	15 (88.2)	13 (76.4)	2 (11.7)	15 (88.2)
Total	10 (58.8)	7 (41.1)	17	15 (88.2)	2 (11.7)	17

FNAC: Fine-needle aspiration cytology

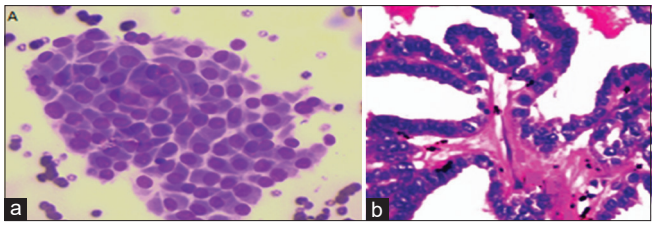

Figure 1: (a) Papillary thyroid carcinoma; (MGG, ×400) stained, enlarged, ovoid cells showing pale nuclei and nuclear grooves, (b) cell block, ×400, cells arranged in papillary pattern and lined by cuboidal to columnar epithelium. H and E: Hematoxylin–Eosin.

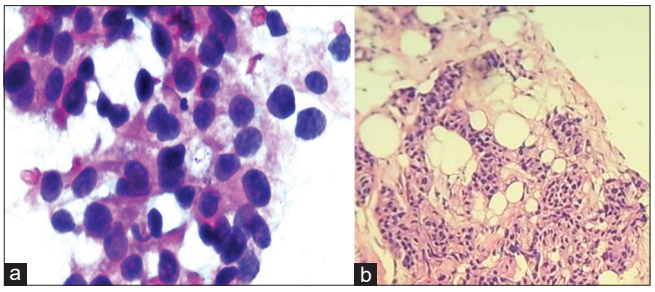

Figure 2: (a) Infiltrating ducal carcinoma (H and E, ×400) single population of epithelial cells without myoepithelial cells, (b): Cell block (H and E, ×400) showing cluster of pleomorphic ductal cells. H and E: Hematoxylin–Eosin.

and complementary methods for the evaluation of body cavity fluids, and this technique is a mini formalin-fixed paraffin-embedded biopsy obtained from fine-needle aspirate or fluid sediment.[19,20] Preservation of cytological material in the CB for immunohistochemistry (IHC) and molecular studies adds to its diagnostic accuracy and enables long-term archiving for future analysis.[10,11,21] Breast FNAC is a very useful test, relatively rapid and inexpensive, minimally [Figure 2] invasive owing to fine needle size, and safer in certain lesions such as very small lesions, lesions just under the skin or very close to the chest wall in comparison to core biopsy.[5] In addition, FNAC maintains tactile sensitivity; and allows multidirectional passes enabling a broader sampling of the lesion and immediate reporting whenever necessary, along with the decreased risk of infection, pain, and seeding of the biopsy track.[12] FNAC is a gold standard in the screening of thyroid nodules and plays a vital role in triaging thyroid lesions[13] but FNAC has its own limitations, such as inadequate sampling and scant cellularity in the obtained sample.[14] However, some pathologists prefer the histological evaluation of core biopsies because they can be analysed relatively quickly and easily. They allow IHC to be applied and also provide sufficient diagnostic material for deep-seated, non-palpable lesions.[15,22] However, core needle biopsy (CNB) is not widely used because it takes more time, often necessitates anaesthesia, and requires many staff members who are familiar with certain techniques.[23] Hence, the current study was done to investigate the use of combining both the breast FNAC with CB instead of CNB to evaluate whether the combined approach has any advantages or not.[5] A major limitation of fine-needle aspiration compared with CNB is the inability to determine whether a cancer is invasive.[24] CB complement smears and monolayers and appear to overcome the major limitations of breast FNAC. One of the benefits of combining CBs with smears or monolayer preparations is the ability to see the histologic correlates of cytological findings.[15] Some cytological criteria cannot be translated into the histologic criteria used by surgical pathologists. Since there are separate criteria used by surgical pathologists and cytologists, CB sections tend to complement FNAC smears.[25] Hence, complementary nature of CB and FNAC smears/ monolayers could be expected to help avoid the pitfalls of using either cytology or histology alone.[14,26] Hence, concept is supported by studies that have shown that combining CNB with FNA improves diagnostic accuracy compared to either

Table 5: A comparison study between cell block and fine-needle aspiration cytology

Sites	Cell block	FNAC	*Z*	*P*
Thyroid	51/52	50/52	0.5978	0.5485
Breast	27/28	22/28	5.0974	<0.00001*
Liver	15/17	10/17	1.9422	0.5238

*Statistically significant. FNAC: Fine-needle aspiration cytology

Table 6: Comparison of accuracy of fine needle aspiration cytology in various studies

Authors	Sensitivity (%)	Specificity (%)	Positive predictive value (%)	Negative predictive value (%)
Shidham VB, *et al*.[10]	95.2	100	100	95.
Shidham VB. *et al*.[11]	90.9	100	-	-
Nathan NA, *et al*.[12]	83	100	-	-
Ammendola S, *et al*.[13]	99	99	99	99
Pandey A, *et al*.[14]	93.10	100	100	90.47
Mallick S,[15]	77.7	99.2	98.4	-
Present study	96	100	100	100

test alone. Thapar *et al*.[19] conclude that the CB technique not only increases the positive results and demonstrates better architectural patterns that can be of immense help in reaching the correct and accurate diagnosis. Current research suggests that combining a smear preparation of breast FNA with the CB can also combine the advantages of both approaches, as the present study demonstrated sensitivity of 96%, specificity of 100% with a PPV and 100%, the NPV of 100% which was nearly comparable to the study done by Rosell *et al*.[27]

Limitation of the study

The limitation of the study was a small sample size.

Conclusion

The combined use of FNAC smear and CB can be useful for

establishing a more definitive cytopathologic diagnosis. It is suggested to perform CB as a supplementary diagnostic mode along with FNAC, wherever feasible, to decrease the pitfalls and to improve the diagnosis and management of various lesions.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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