Original Article

Correlation of Fine-needle Aspiration Cytology and Surgical Excision in the Diagnosis of Patients with Cancer

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Abstract

Background: Cancer is a generic term for a large group of diseases that can affect any part of the body. Other terms used are malignant tumors and neoplasms. Fine-needle aspiration cytology (FNAC) has been extensively used for many years in the diagnosis of cancers, especially breast cancers, but its use has gradually been reduced in some hospitals because of its controversial inadequate rates and suboptimal accuracy in inexperienced hands and in some cases conflicting reports when compared with the excised biopsy of the same lesion. This is a prospective study to correlate the cytological findings in patients diagnosed with cancer with the histological diagnosis on excision. **Materials and Methods:** This was a prospective study of 30 patients that attended the Department of Pathology, Federal Medical Centre, Birnin Kebbi, from July 2016 to June 2017. All patients who were diagnosed after FNAC as having a malignant lesion were followed up for surgery for their excision biopsy. FNAC of the 30 patients was performed using 23-gauge needle under direct palpation (27 cases) by the pathologist and by ultrasonographic guidance (3 cases) before the surgical excision. Specimen after excision was fixed in 10% buffered formalin and stained with routine hematoxylin and eosin. Diagnosis on FNAC was subsequently compared with diagnosis after excision. Immunohistochemistry studies using limited antibody panels (CD5, CD10, CD20, CD30, and Bcl-2) were used on some surgical tissues (mostly lymphoid tissues) using Genemed biotechnology protocol to arrive at a definitive diagnosis. **Results:** A total of 30 patients had FNAC of various cancers during the study period, and all patients had excision biopsy subsequently. The age range was 5–65 years, with the most common sites of FNAC been the breast 17 (56.7%), abdomen 5 (16.5%), and cervical lymph nodes 4 (13.3%). There was 100% concordance between the diagnosis on FNAC and the excised tissues. **Conclusion:** FNAC correlates very well with histology of the excised tissues and remains a useful tool to guide the clinician for better management of patients.

Keywords: Cancer, core needle biopsy, correlation, fine-needle aspiration cytology

Introduction

Cancer is one of the leading causes of morbidity and mortality worldwide, with approximately 14 million new cases in 2012.[1] Cancer is the second leading cause of death globally behind cardiovascular disease and was responsible for 8.8 million deaths in 2015.[1] Approximately 70% of deaths from cancer occur in low- and middle-income countries. Late-stage presentation and inaccessible diagnosis and treatment are common.[1,2] Much of the world's burden of cancer is in poor and developing countries, where there are often very limited screening measures, early diagnosis, and treatment facilities. There is a growing awareness that significant investment in cancer control measures is required to reduce the burden and suffering in low-resource settings.[2] In 2015, only 35% of low-income countries reported having pathology services generally available in the public sector. More than 90% of high-income countries reported that treatment services are available compared to <30% of low-income countries. Fine-needle aspiration cytology (FNAC) has been extensively used for many years in the diagnosis of cancers because it is simple, safe, economical, and accurate. Previously, the role of FNAC has been challenged by results obtained with core needle biopsy (CNB) that seems more robust than FNAC. In some settings, CNB is now preferred in the first line of diagnosis.[3] These last years, a new cytological technique, called liquid-based cytology (LBC), has evolved. LBC standardizes the cell fixation, concentrates epithelial cells,

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and discards blood cells and/or cell debris that obscure the smear. In a resource-limited setting such as ours, conventional cytological methods are readily available in most centers and give high diagnostic accuracy. The objective of this study is to do a cytological (FNAC) and histological correlation in patients diagnosed with cancer using conventional cytology methods and where possible use immunohistochemistry on biopsied tissue to arrive at a final diagnosis.

Materials and Methods

This was a prospective study that included FNAC patients who subsequently had surgical excision in the Department of Pathology, Federal Medical Centre, Birnin Kebbi, between July 2016 and June 2017. A total of 150 patients with various cancers had FNAC of which 30 subsequently had biopsy. FNAC was performed for all the cases using 23G needle attached to 20 mL disposable syringe smeared on labeled frosted microscope glass slides fixed with 95% alcohol and stained with Papanicolaou, Giemsa, and hematoxylin and eosin (H and E) stains.

Those patients who had excision biopsies had their specimen fixed in 10% buffered formalin, and sections were cut and stained with H and E. Cytology results were compared with final histology for correlation [Figure 1]. Results were also compared with the clinician (surgical outpatient department) initial diagnosis before FNAC [Figure 2]. In some cases, immunohistochemical stains were applied on the tissue biopsy using Genemed biotechnology protocol to arrive at a diagnosis. Immunohistochemical panel used in this study included CD5, CD10, CD20, CD30, and Bcl-2. Data were analyzed using SPSS version 20. Fisher's exact test was used to study the association between variables with level of significance at $P \leq 0.05$.

Results

A total of 30 patients had FNAC and subsequent excision biopsy of the same lesion. The age range of patients was 5–65 years with a mean of 35.97 and a SD of 21.99. The most common site for FNAC was the breast 17 (56.7%), followed by the abdomen 5 (16.6%) and cervical lymph node 4 (0.13%). Most cases were reported as malignant lesions with three cases reported on FNAC as Burkitt's lymphoma (2 cases) and neuroblastoma which presented as a suprarenal mass and sampled under ultrasound guidance. All breast lesions on FNAC were reported as malignant (C5).

Correlation of cytology and histology diagnosis as shown in Table 1 with 100% accuracy recorded. All FNACs from the breast were diagnosed malignant (C5) with subsequent mastectomy showing all cases to be invasive ductal carcinoma which were graded [Figure 3]. Two cases of Burkitt's lymphoma and a case of neuroblastoma were diagnosed based on their cytomorphology which correlates perfectly with the diagnosis on excised tissue biopsies [Figures 1 and 2]. Immunohistochemistry was performed on all cases of lymphoma. Pediatric follicular lymphoma was common (3 cases) which was positive for CD20 and Bcl-2. A single lymph node on FNAC showed few diagnostic Hodgkin Reed–Sternberg on a background of numerous lymphocytes, and on immunohistochemical staining, it was positive for CD30 and negative for CD5, CD20, and Bcl-2, hence diagnosed as lymphocyte-rich classic Hodgkin's lymphoma was made [Figure 4]. Two lymphomas could not be further characterized based on the limited immunohistochemical panels; however, they were released as non-Hodgkin's lymphoma (high grade). A single case of alveolar rhabdomyosarcoma was seen on microscopy, the deeply eosinophilic cytoplasm was readily appreciated and the alveolar pattern was seen on histology [Figure 5]. The clinician's correlation with FNAC and final diagnosis [Table 2] is about 77% accurate. Statistically, using Fisher's exact test [Table 3], there was a significant association between FNAC and final histology diagnosis (Fisher's exact test = 31.05, $P = 0.04$). However, no such significant association was found between FNAC and clinicians diagnosis [Table 4], Fisher's exact test = 29–10, $P = 0.59$.

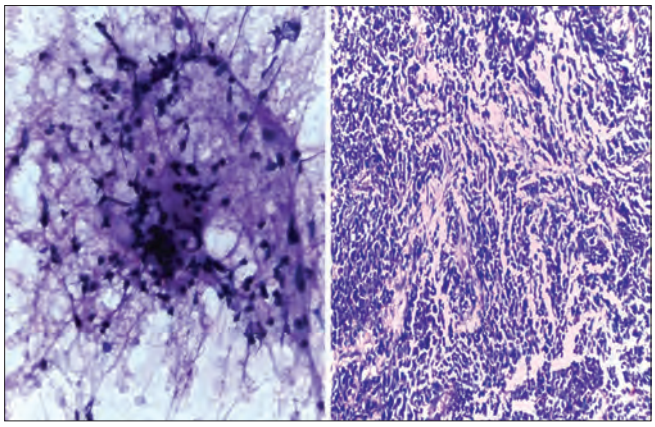

Figure 1: Fine-needle aspiration cytology of a suprarenal mass showing small round blue cells with fibrillary background on the left and histological correlate on the right (H and E, ×40)

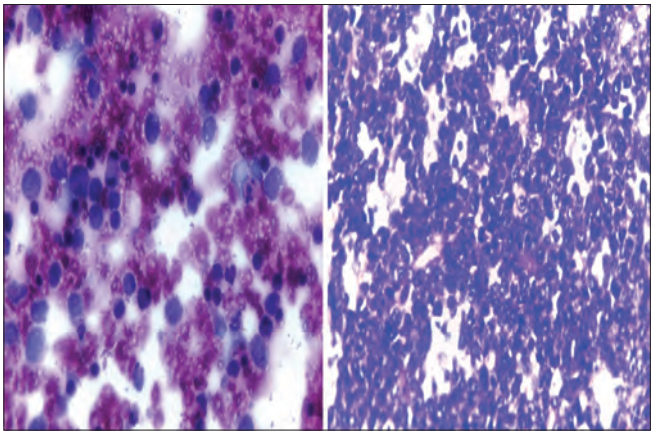

Figure 2: Fine-needle aspiration cytology of Burkitt's lymphoma showing sheet of monotonous medium-sized lymphocytes with basophilic cytoplasm on the left and its tissue correlate on the right showing starry-sky appearance (H and E, ×40)

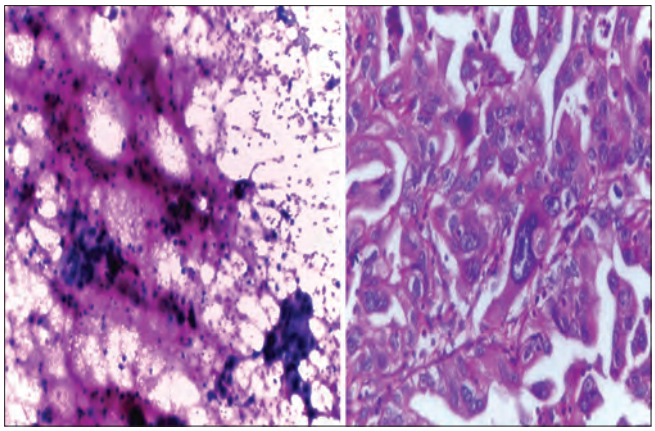

Figure 3: Fine-needle aspiration cytology of the breast showing clusters of pleomorphic epithelial cells with coarse chromatin distribution and irregular nuclear membrane on the left. Its correlate on the right showing invasive ductal carcinoma (H and E, ×40)

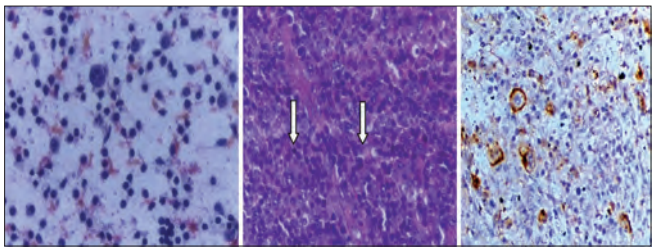

Figure 4: Fine-needle aspiration cytology of a lymph node (lymphocyte-rich classic Hodgkin's lymphoma) showing Reed–Sternberg cell with numerous lymphocytes on the background on the left. Histological correlates in the middle showing Reed–Sternberg cells (white arrow) and positive CD30 staining of Reed–Sternberg cells on the right (H and E, ×100)

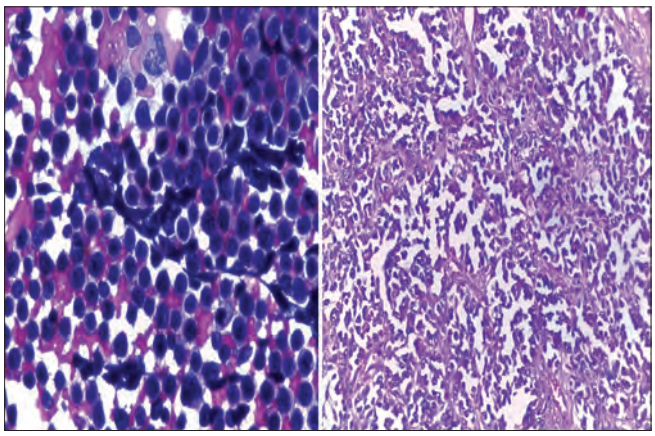

Figure 5: Fine-needle aspiration cytology of alveolar rhabdomyosarcoma on the left with the histology correlation on the right (H and E, ×100)

Discussion

FNAC is a cheap, easy, accurate, and less invasive procedure in the preoperative evaluation of cancers, especially in breast and lymphoid organs.[4] We are extremely excited with the level of accuracy we got with the FNAC results in correlation with histological results. Thus, cytologic/histologic correlation as used in our setting is a very important cytopathology quality assurance tool to access how accurate our diagnosis was and what impact it has on our clinicians and patient care in general. We are aware that the problems associated with the use of FNAC include inadequate rates and false-negative reports as reported in many studies.[5,6] Our study has shown that such fears of inadequate rates and false negative can be reduced in FNAC if handled with care and attention is given to the cytomorphologic details by the pathologist. Studies have also shown that FNAC if handled by experience cytopathologist has high diagnostic accuracy of about 99% although most of these studies were done on breast lumps.[7] Diagnostic accuracy of FNAC is further increased in some studies with cell block preparations.[8] These findings are similar to those reported by Manfrin *et al*. and Sang-Mo *et al*. although they both compared FNAC with core needle biopsies from the breast.[9,10] The use of conventional smear in this study enables us to identify the fibrillary background in the case of suprarenal neuroblastoma. Although LBC samples

Table 1: Correlation of cytological (fine-needle aspiration cytology) and histological diagnosis of various cancers

Age	Sex	FNAC diagnosis	Histological diagnosis
35.00	Female	Malignant	LRCHL
23.00	Female	Malignant	Dysgerminoma
70.00	Female	Malignant	AGCT
18.00	Female	Burkitt's	Burkitt's
7.00	Male	Malignant	Alveolar RHABDO
7.00	Male	Neuroblastoma	Neuroblastoma
55.00	Female	Malignant	IDC GR 3
50.00	Female	Malignant	IDC GR 3
50.00	Female	Malignant	NHL
60.00	Female	Malignant	IDC GR 2
50.00	Female	Malignant	IDC GR 2
49.00	Female	Malignant	IDC GR 3
30.00	Female	Malignant	IDC GR 3
36.00	Female	Malignant	IDC GR 2
25.00	Female	Malignant	IDC GR 2
62.00	Female	Malignant	IDC GR 3
55.00	Female	Malignant	IDC GR 2
45.00	Female	Malignant	IDC GR 2
65.00	Female	Malignant	IDC GR 2
45.00	Female	Malignant	IDC GR 2
65.00	Female	Malignant	IDC GR 3
60.00	Female	Malignant	IDC GR 3
53.00	Female	Malignant	IDC GR 2
8.00	Female	Malignant	NHL
5.00	Male	Malignant	FL
8.00	Male	Burkitt's	Burkitt's
8.00	Male	Malignant	Burkitt's
11.00	Female	Malignant	FL
12.00	Female	Malignant	Burkitt's
12.00	Male	Malignant	FL

IDC: Invasive ductal carcinoma, GR: Grade, NHL: Non-Hodgkin's lymphoma, FL: Follicular lymphoma, LRCHL: Lymphocyte-rich classic Hodgkin's lymphoma, AGCT: Adult granulosa cell tumor, FNAC: Fine-needle aspiration cytology

Table 2: Correlation of cytological (fine-needle aspiration cytology) diagnosis with that of the clinician and final histological diagnosis

Age	Sex	Site	FNAC	Clinician (SOPD)	Histology
35.00	Female	Cervical LN	Malignant	Lymphoma	LRCHL
23.00	Female	Abdomen	Malignant	Ovarian cyst	Dysgerminoma
70.00	Female	Abdomen	Malignant	Ovarian CA	AGCT
18.00	Female	Breast	Burkitt's	Metastasis	Burkitt's
7.00	Male	Jaw	Malignant	Rhabdomyosarcoma	Alveolar RHABD
7.00	Male	Abdomen	Neuroblastoma	TB	Neuroblastoma
55.00	Female	Breast	Malignant	Breast CA	IDC GR 3
50.00	Female	Breast	Malignant	Benign	IDC GR 3
50.00	Female	Cervical LN	Malignant	Lymphoma	NHL
60.00	Female	Breast	Malignant	Breast CA	IDC GR 2
50.00	Female	Breast	Malignant	Breast CA	IDC GR 2
49.00	Female	Breast	Malignant	Breast CA	IDC GR 3
30.00	Female	Breast	Malignant	Breast CA	IDC GR 3
36.00	Female	Breast	Malignant	Breast CA	IDC GR 2
25.00	Female	Breast	Malignant	Breast CA	IDC GR 2
62.00	Female	Breast	Malignant	Breast CA	IDC GR 3
55.00	Female	Breast	Malignant	Breast CA	IDC GR 2
45.00	Female	Breast	Malignant	Breast CA	IDC GR 2
65.00	Female	Breast	Malignant	Breast CA	IDC GR 2
45.00	Female	Breast	Malignant	Breast CA	IDC GR 2
65.00	Female	Breast	Malignant	Breast CA	IDC GR 3
60.00	Female	Breast	Malignant	Breast CA	IDC GR 3
53.00	Female	Breast	Malignant	Breast CA	IDC GR 2
8.00	Female	Cervical LN	Malignant	Lymphoma	NHL
5.00	Male	Submental LN	Malignant	TB	FL
8.00	Male	Jaw	Burkitt's	Burkitt's	Burkitt's
8.00	Male	Abdomen	Malignant	Burkitt's	Burkitt's
11.00	Female	Cervical LN	Malignant	TB	FL
12.00	Female	Abdomen	Malignant	TB	Burkitt's
12.00	Male	Supraclavicular LN	Malignant	TB	FL

LN: Lymph node, CA: Cancer, TB: Tuberculosis, IDC: Invasive ductal carcinoma, GR: Grade, NHL: Non-Hodgkin's Lymphoma, FL: Follicular lymphoma, LRCHL: Lymphocyte Rich Classic Hodgkin's Lymphoma, AGCT: Adult granulosa cell tumor, RHABDO: Rhabdomyosarcoma, SOPD: Surgical outpatient department

offer better clarity, uniform spread of cells, and better handling of inflammatory and hemorrhagic samples, the background in conventional smears often a times gives the pathologist clue on the nature of the lesion.[11] The clinician frequent diagnosis of tuberculosis in patients with neck and abdominal swelling is not surprising. Most clinicians at the surgical outpatient department are aware that tuberculosis is the most common cause of lymphadenopathy in our environment, hence the first differential diagnosis in any child or elderly presenting with lymphadenopathy. Furthermore, in our environment, cervical lymphadenopathy and abdominal swelling are a common presentation of extrapulmonary tuberculosis with reports showing consistent increase in tuberculosis over the years.[12,13] This study has shown that pediatric follicular lymphoma presenting as neck and abdominal swelling is also a common presentation in our environment. This is important because it will guide the clinician in our centers to send patients for FNAC for early diagnosis and optimal care for lymphomas as a common cause of lymphadenopathy, rather than given patients array of laboratory tests to rule out tuberculosis. Giving patients such array of tests may prolong the presentation of patients for FNAC and may entail poor outcome in patients subsequently diagnosed with lymphoma. The most common presentation of endemic (African) Burkitt's lymphoma in our environment is with a jaw mass.[14] The cytological features of monotonous sheet of medium-sized lymphocytes with basophilic cytoplasm with lipid vacuoles were readily evident on cytology. The starry-sky pattern was very prominent on tissue biopsy. However, what was not prominent in this study was a case of abdominal swelling in a pediatric patient whose FNAC showed small-to-medium-sized lymphocytes with no monotony of cells observed. Tissue correlation did not show classic starry-sky appearance either, hence immunohistochemistry using limited panels of Bcl-2 which was negative and positive CD10 and CD20 points to a tumor with a phenotype with a germinal center B-cell origin. With the help of the clinician guide (X-ray findings), suggests Burkitt lymphoma. This case points to the fact that

FNAC alone or with tissue biopsy correlation is not enough in the diagnosis of some cancers. The need for more ancillary techniques as advocated by Troxell *et al*. is very important for final diagnosis and to rule out differentials.[15] Majority of the patients in this study (17 cases) were women with breast cancer which is still a leading cancer among women all over the world and in developing countries present with late-stage disease.[16] FNAC is the preferred choice of investigation in evaluating breast lesions but most patients in our center undergo radical mastectomy after initial diagnosis with FNAC because they present with advance disease. Studies have shown that when FNAC is combined with CNB, excellent results are achieved and that the combination of FNAC and CNB can improve preoperative diagnosis of breast lesions.[9,17]

In Nigeria, studies on FNAC correlation with histological diagnosis were mostly done on a single organ mostly on the breast. In a 5-year retrospective study correlation of FNAC and histology for palpable breast masses by Daramola *et al*.[18] in Lagos, they concluded that breast FNACs compare very well with histology of excision biopsies and in experienced hands are extremely useful in the management of breast lumps. This is in keeping with an earlier study by Mohammed *et al*.[19] in Kano who showed that FNAC has high diagnostic accuracy and correlates very well with histological diagnosed palpable breast lesions.

This study had some limitations. Firstly, the small number of patients we had in this study was mainly due to the fact that we lost some patients to follow up and some declined surgery. Secondly, we had no ancillary techniques such as cell blocks, flow cytometry, FISH, and NGS facilities that could have helped the pathologist in narrowing the differentials for a more definitive diagnosis, especially in the lymphoid tumors.

Table 3: Cross tabulations of final diagnosis and fine-needle aspiration cytology for statistical significance $P \leq 0.05$

	FNAC			Total
	Burkitt's	Malignant	Neuroblastoma	
Final diagnosis				
AGCT	0	1	0	1
ALV R	0	1	0	1
BURKITT's	2	2	0	4
Dysgermin-oma	0	1	0	1
IDC GR 2	0	9	0	9
IDC GR 3	0	7	0	7
LRCHL	0	1	0	1
F/.LYMPHOMA	0	3	0	3
Neuroblas-toma	0	0	1	1
NHL	0	2	0	2
Total	2	27	1	30

Fisher exact test=31.05, *P*=0.04 AGCT- Adult granulose cell tumor, ALV R- Alveolar rhabdomyosarcoma, IDC- Invasive cuctal Carcinoma, GR- Grade, LRCHL- Lymphocyte rich classic Hodgkin lymphoma, NHL- Non-Hodgkin lymphoma, F- Follicular, Fine needle aspiration cytology

Conclusion

In conclusion. This study has shown that FNAC is a very reliable and efficient procedure in the initial diagnosis of some cancers and that it correlates very well with histological diagnosis. However, care must be given to cellular details, pattern recognition and experience in interpreting FNAC results.

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Conflicts of interest

There are no conflicts of interest.

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Table 4: Correlation of fine-needle aspiration cytology with clinician diagnosis for statistical significance $P \leq 0.05$

FNAC	Clinician									Total
	Benign	Breast CA	Burkitt's	Lymphoma	MET	OVA CA	OVA cyst	RHAB	TB	
Burkitt's	0	0	1	0	1	0	0	0	0	2
Malignant	1	15	1	3	0	1	1	1	4	27
Neuroblastoma	0	0	0	0	0	0	0	0	1	1
Total	1	15	2	3	1	1	1	1	5	30

Fisher's exact test=29.10, *P*=0.059. CA: Cancer, MET: Metastasis, OVA: Ovary, RHAB: Rhabdomyosarcoma, TB: Tuberculosis, FNAC: Fine-needle aspiration cytology

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