Original Article

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Pathology Section

Cytological Profile of Solid and Cystic Lesions Arising from Various Sites in the Body: A Cross-sectional Study

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ABSTRACT

Introduction: Fine Needle Aspiration Cytology (FNAC) is a minimally invasive, cost-effective, and efficient technique for obtaining diagnostic cellular material with minimal discomfort and a low patient complication rate.

Aim: To study various solid and cystic lesions in the body using FNAC, followed by histopathological examination for definitive diagnosis.

Materials and Methods: The present cross-sectional Study was conducted on 383 patients who underwent surgery for cystic and solid lesions in the Department of Pathology at Chengalpattu Medical College, Chengalpattu, Tamil Nadu, India. over a period of one year from June 2022 to June 2023. Patients with various solid lesions (breast, thyroid, salivary gland lesions, lymphoma, etc.) and cystic lesions (epidermal cysts, ganglionic cysts, fibro-cystic breast disease, etc.) referred for cytopathological analysis were included. FNAC results were tabulated, and histopathological examination of surgically removed tissues was performed for definitive diagnosis.

Results: The study shows that FNAC is useful for diagnosing solid and cystic lesions, with a concordance rate of 83.66% for solid lesions and 90.90% for cystic lesions when compared to histopathology. However, it also highlights difficulties in distinguishing between benign and malignant thyroid and breast lesions, emphasising the need for further testing in uncertain cases.

Conclusion: The FNAC is a simple, non traumatic, safe, cost-effective outpatient procedure. It provides high diagnostic accuracy for many conditions related to both solid and cystic lesions, especially when combined with imaging guidance and expert cytological interpretation.

Keywords: Cystic and solid lesions, Fine needle aspiration cytology, Histopathological examination

INTRODUCTION

The FNAC is a medical procedure used to obtain tissue samples from masses or lumps in the body for diagnostic evaluation. It is a cost-effective, simple, quick, and minimally invasive technique where a thin needle is inserted into the suspicious area to collect cells or fluid for examination under a microscope. FNAC can provide valuable diagnostic information by obtaining cellular material from the lesions for microscopic examination. It is commonly used to investigate lumps or swellings in organs such as the thyroid, breast, lymph nodes, salivary glands, and other superficial or accessible glands [1]. FNAC provides rapid results, allowing for quick diagnosis and subsequent treatment planning. It can help differentiate between benign and malignant lesions, aiding in the management of various diseases, including cancer [2].

Although FNAC is considered a highly accurate procedure for differentiating cystic and solid lesions, specific cytological diagnosis may require a characteristic architectural pattern. The diagnosis of aspirates from cystic lesions may be less specific than that from solid lesions due to the lack of specific cells in the former and the potential for superimposed infections [3]. However, it is essential to note that FNAC of cystic lesions may sometimes yield inconclusive results, particularly if the aspirated fluid is not representative of all lesions. In such cases, a definitive diagnosis may require additional imaging studies or further diagnostic procedures, such as ultrasound-guided FNAC for superficial lesions and Computed Tomography (CT)-guided FNAC for deep-seated lesions.

The FNAC of cystic lesions can aid in distinguishing between benign and malignant cysts. Benign cysts often contain clear or straw-colored fluid and may show no abnormal cellular components. Malignant cysts, on the other hand, may include blood, pus, or other discolored fluids, and may also exhibit abnormal cells indicative of cancer [4]. FNAC of solid lesions can help differentiate between benign and malignant conditions, aiding in the diagnosis and subsequent management of various diseases, including cancer. Benign lesions typically show normal or mildly abnormal cellular features and are often composed of well-differentiated cells that resemble normal tissue. In contrast, malignant lesions may exhibit cellular atypia, increased nuclear-to-cytoplasmic ratios, pleomorphism, and abnormal mitotic figures [5]. The main objective of the study is to investigate the cytopathology of solid and cystic lesions through histopathological examination and to assess the accuracy of FNAC in diagnosing solid and cystic lesions.

MATERIALS AND METHODS

The present cross-sectional study was proposed and conducted in the Department of Pathology at Chengalpattu Medical College, Chengalpattu, Tamil Nadu, India. for one year, from June 2022 to June 2023 (IEC No- 7342/2022).

Inclusion and Exclusion criteria: Patients presenting to the Outpatient Department (OPD) with solid and cystic lesions referred from the Department of Surgery to cytopathology were included in the study. The cystic lesions that are routinely encountered in our hospital include epidermal cysts, ganglionic cysts, colloid goiter with cystic degeneration, galactocele of the breast, fibrocystic disease of the breast, mucoepidermoid cysts, abscesses in various parts of the body, thyroglossal cysts, and Warthin's cysts, among others. On the other hand, the frequently encountered solid lesions include benign and malignant lesions of the breast, thyroid, and salivary glands, lymphoma, lymphadenitis, and soft tissue tumors. Vascular lesions are excluded from the study.

Study Procedure

The FNAC procedure used a 22-24-gauge needle with a 5 to 10 mL syringe for better suction. Each patient was provided with a detailed explanation before the procedure began. The aspirated material was smeared on a slide and was immediately fixed with 99.9 percent isopropyl alcohol for ten minutes, followed by haematoxylin and eosin staining. If the fluid was aspirated in excess (more than 1 mL), the liquid was centrifuged, and the smears were made from the sediment. More than two pathologists reviewed the cytology smear; their opinions were obtained separately. For the histopathological examination of the surgically removed tissues from both solid and cystic lesions, the tissues were fixed with ten percent formalin and processed. Tissue sections of four microns were taken and stained with haematoxylin and eosin, and the histopathology slides were reviewed to determine the accuracy of FNAC in diagnosing solid and cystic lesions.

STATISTICAL ANALYSIS

The statistical analysis of the data was conducted using Statistical Package Social Sciences (SPSS) software version 24.0. Data is presented in numbers and percentages.

RESULTS

The study data was obtained from 810 patients who visited the FNAC OPD. Among the cases, the percentage of female patients (580) was found to be higher (71.60%) than that of males (230), which accounted for 28.40%. Interestingly, it was observed that irrespective of gender, the majority of patients (470 cases) were grouped in the age category of 21 to 50 years, representing 58.03%. The details are provided in [Table/Fig-1].

Age distribution n (years)	Males	Females
<20	40 (4.94%)	160 (19.75%)
21-50	130 (16.05%)	340 (41.98%)
51-70	60 (7.41%)	80 (9.87%)
Total cases (n=810)	230 (28.40%)	580 (71.60%)

[Table/Fig-1]: Total number of cases age-wise distribution.

The present study observed that the number of patients who reported solid lesions at the FNAC OPD was greater (n=590%), (n=72.84%) than those with cystic lesions (n=220%), (n=27.16%). Among the reported cases, more patients presented with skin and soft tissue lesions (both solid and cystic), totaling n=305, which is 37.67%. The details of other reported lesions and their percentages has been depicted in [Table/Fig-2].

S. No.	System	Solid	Cystic lesion	Total
1	Breast	140 (17.28%)	32 (3.95%)	172 (21.23%)
2	Thyroid	170 (20.98%)	40 (4.94%)	210 (25.92%)
3	Lymph node	65 (8.03%)	22 (2.71%)	87 (10.74%)
4	Salivary gland	22 (2.72%)	14 (1.72%)	36 (4.44%)
5	Skin and soft-tissue	193 (23.83%)	112 (13.84%)	305 (37.67%)
	Total	590 (72.84%)	220 (27.16%)	810

[Table/Fig-2]: Number of cases of solid and cystic lesions system-wise in FNAC.

It was noted that, among the total of 810 FNAC cases, specimens for histopathological examination were received for 383 cases (47.28%). This is because lesions such as galactocele of the breast, Hashimoto's thyroiditis, and acute infective lesions can be treated with medical management, without the need for surgical procedures. Moreover, many patients are not willing to undergo surgery, and for elderly patients, surgical removal of lesions may not be possible due to systemic complications.

The categories of solid and cystic lesion specimens reported for histopathological examination after the surgical procedure has been depicted in [Table/Fig-3]. The table indicates that the number of lesions in the solid group 251 (65.53%) is comparatively higher than that of cystic lesions 132 (34.46%). It also indicates that lesions associated with skin and soft tissues are more prominent 270 (70.49%). Lesions related to the breast 63 (16.44%), salivary gland 22 (5.74%), thyroid 18 (4.69%), and lymph node 10 (2.61%) were also reported.

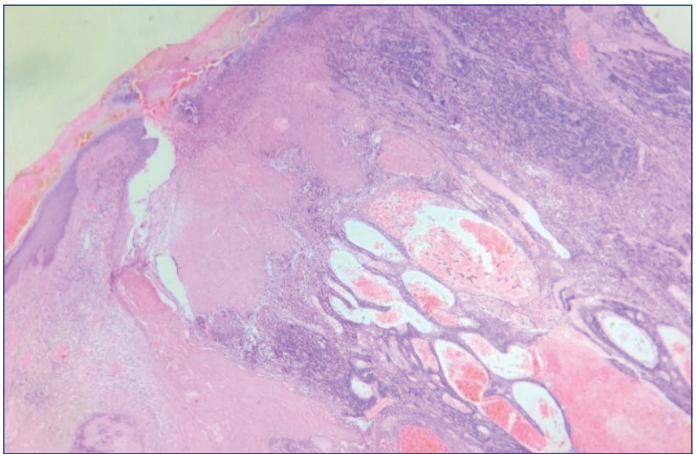
S. No.	System/site	Solid	Cystic lesion	Total specimens received for HPE
1	Breast	47 (18.72%)	16 (12.12%)	63 (16.44%)
2	Thyroid	11 (4.48%)	7 (5.30%)	18 (4.69%)
3	Lymph node	9 (3.58%)	1 (0.75%)	10 (2.61%)
4	Salivary gland	16 (6.27%)	6 (4.54%)	22 (5.74%)
5	Skin and soft-tissue	168 (66.93%)	102 (77.27%)	270 (70.49%)
	Total	251 (65.53%)	132 (34.46%)	383

[Table/Fig-3]: Number of cases of solid and cystic lesion system wise received after surgery.

The concordance and discordance of both histological and FNAC aspirate data among cystic lesions has been depicted in [Table/Fig-4]. Specifically, among the 61 cases of epidermoid cysts in FNAC, 58 cases were diagnosed as epidermoid cysts, while the other three cases were nodular hidradenoma, calcinosis cutis, and gout [Table/Fig-5-7]. Among the 12 ganglionic cysts, one case was noted with a fungal abscess. Among the three cases of bursal cysts, one was identified with traumatic effusion. Among six cases of acute suppurative lymphadenitis, one was noted to have metastatic carcinomatous deposits of squamous origin.

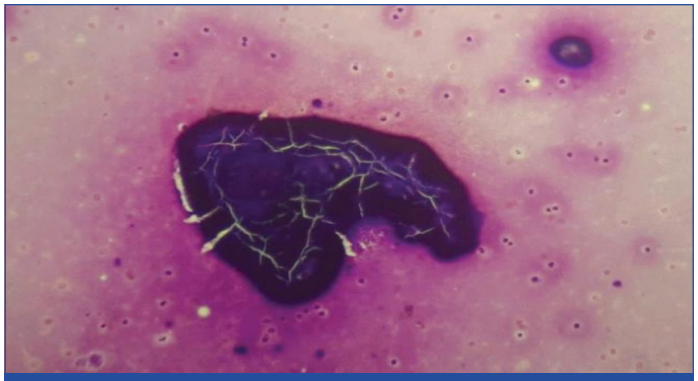
Cystic lesions	No. of cases concordant with histopathology	No. of cases discordant with histopathology	Total no. of cases
Epidermoid cyst	58	3	61
Ganglion	11	1	12
Bursal cyst	2	1	3
Colloid goiter with cystic changes	21	2	23
Fibrocystic change breast	12	2	14
Breast abscess	6	1	7
Cystic lesions of the salivary gland	5	1	6
Acute suppurative lymphadenitis	5	1	6
Total	120	12	132

[Table/Fig-4]: Concordance and discordance of cystic lesions of cytology with histopathological examination.

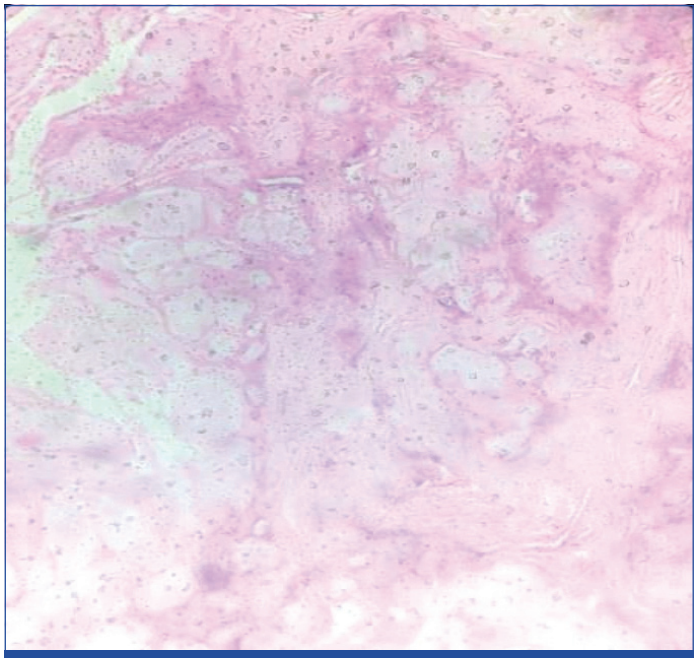


[Table/Fig-5]: Cystic mass with nests of epithelial cells within dermis. (Nodular Hidradenoma H&E, 40X).

Among the 14 cases of cystic lesions of the breast reported in this study, 12 showed fibrocystic changes, and two were diagnosed as infiltrating ductal carcinoma of the breast [Table/Fig-8]. This information could not be identified through FNAC because, in breast cystic lesions, it is challenging to differentiate between cyst



[Table/Fig-6]: Degenerated amorphous calcified material (Calcinosis Cutis H&E, 40X).



[Table/Fig-7]: Amorhphous eosinophilic material surrounded by histiocytes and multinucleated giant cells (Gout H&E, 40X).

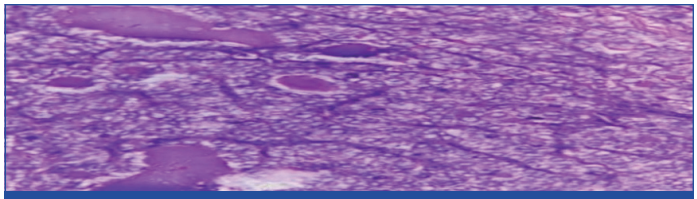
macrophages and malignant epithelial cells, as they can closely resemble one another [Table/Fig-9].

[Table/Fig-8]: Pleomorphic ductal epithelial cells (Infiltrating ductal carcinoma breast).

[Table/Fig-9]: Cyst macrophages in proteinaceous fluid background (Fibrocystic change H&E, 40X).

It is always a challenging task for the pathologist to provide an appropriate diagnosis for thyroid lesions because of colloid or cystic degeneration. The cystic lesions may be incorrectly identified as malignant lesions in the thyroid. In the present analysis found that out of 23 cases reported with thyroid cystic lesions, one case was identified as papillary carcinoma [Table/Fig-10] and another as Hurthle cell carcinoma, according to histopathological examination.

Among the six cases reported as cystic lesions of the salivary gland, one was found to be mucoepidermoid carcinoma, while the others were mucocele and abscess. [Table/Fig-11] depicts the FNAC of solid lesions with histopathological examination. The data indicate that one case was identified as liposarcoma among the 30 cases of lipoma. Among five cases of calcinosis cutis, three were pilomatrixoma, gout, and epidermoid cyst. This occurred because of calcification, which was commonly observed among these three lesions.



[Table/Fig-10]: Shows papillary carcinoma of thyroid with cystic degeneration (H&E, 40X).

Solid lesions	No. of cases concordant with histopathology	No. of cases disconcordant with histopathology	Total no. of cases
Lipoma	29	1	30
Fibrosarcoma	4	0	4
Fibrous histiocytoma	5	0	5
Giant cell tumour of tendon sheath	4	0	4
Calcinosis cutis	2	3	5
Pilomatricoma	7	2	9
Endometriosis	2	0	2
Schwannoma	9	1	10
Neurofibroma	12	4	16
Squamous cell carcinoma	2	0	2
Malignant melanoma	1	0	1
Nodular hidradenoma	4	0	4
Fibroadenoma	115	3	118
Benign phyllodes	7	0	7
Ductal carcinoma of breast	13	2	15
Papillary carcinoma of breast	1	0	1
Medullary carcinoma of breast	1	0	1
Follicular neoplasm	6	0	6
Hurthle cell adenoma	3	0	3
Colloid goiter	16	5	21
Papillary carcinoma of thyroid	6	1	7
Anaplastic carcinoma of thyroid	2	0	2
Medullary carcinoma of thyroid	1	0	1
Follicular neoplasm	4	2	6
Proliferative breast disease without atypia	1	0	1
Pleomorphic adenoma	20	4	24
Sialadenosis	5	1	6
Basal cell adenoma	3	2	5
Granulomatous lymphadenitis	10	1	11
Non-Hodgkin's lymphoma	7	2	9
Hodgkin's lymphoma	2	2	4
Total	210	41	251

[Table/Fig-11]: Concordance and discordance of cytopathology of solid lesion with histopathological examination.

Among the reported 10 cases of Schwannoma, one case was found to have nodular fasciitis. Among the 16 cases of neurofibroma, four were identified as Schwannoma. In nine cases of pilomatricoma, one case was reported as a pilar cyst, and another was found to be calcinosis cutis due to excessive amorphous material in both cases.

Among the reported 118 fibroadenoma cases in cytology, three cases were found to be phyllodes due to their low grade. Among the proliferative breast diseases without atypia, two cases turned out to be breast carcinoma in histopathology. Out of 21 reported cases of colloid goiter in cytology, one was found to be papillary carcinoma, and one case was identified as Hashimoto's thyroiditis. One out of seven

cases reported as papillary carcinomas of the thyroid turned out to be colloid goiter with adenomatous hyperplasia. Among the six cases of follicular neoplasm identified through cytology, two were follicular variants of papillary carcinoma and adenomatous hyperplasia.

Out of 24 reported cases of pleomorphic adenoma, one turned out to be mucoepidermoid carcinoma, two cases were identified as mucocele, and one case was a Warthin tumor. One out of six cases reported as sialadenosis turned out to be acinic cell carcinoma. Out of five reported cases of basal cell adenoma, two were identified as pleomorphic adenoma. Among 11 cases of granulomatous lymphadenitis, one turned out to be Hodgkin lymphoma. Among four cases of Hodgkin lymphoma and 11 cases of Non-Hodgkin lymphoma, two cases in each category were found to be reactive lymphadenitis in histopathology.

Altogether, among the total number of 251 cases of solid lesions in cytology, 210 cases showed concordance in Histopathological Examination (HPE), resulting in a rate of 83.66%. In contrast, among the 132 cases of cystic lesions in cytology, 120 cases were concordant in HPE, yielding a concordance rate of 90.90% [Table/Fig-12].

Type of lesion	No. of cases concordant with HPE	No. of cases discordant with HPE	Total no. of cases
Solid	210 (83.66%)	41 (16.33%)	251 (65.53%)
Cystic	120 (90.90%)	12 (9.09%)	132 (34.46%)
Total	330	53	383

[Table/Fig-12]: Cytopathological association of solid and cystic lesion with histopathological examination.

DISCUSSION

The findings of present study provide significant insights into the diagnostic capabilities and limitations of FNAC when identifying various solid and cystic lesions. The predominance of female patients (71.60%) aligns with recent studies indicating a higher prevalence of certain types of lesions, particularly in breast and thyroid conditions, among women [6]. The notable concentration of patients within the 21 to 50 age group reflects a higher incidence, which is consistent with the study conducted by Gupta T et al., [7].

The FNAC's role in distinguishing solid from cystic lesions is emphasised by its high usage rate, with 72.83% of cases involving solid lesions and 27.16% involving cystic lesions. This distribution is supported by recent findings of underscore FNAC's diagnostic utility in superficial lesions (Kumar D and Jain M, 2020) [8]. The concordance rate of 83.66% for solid lesions and 90.90% for cystic lesions demonstrates FNAC's efficacy but also highlights its limitations. These figures align with other studies reporting concordance rates ranging from 80% to 92% in similar clinical settings [9,10].

The challenge of accurately diagnosing certain lesions is particularly evident in the differentiation between benign and malignant thyroid conditions. Colloid and cystic degeneration often present a diagnostic dilemma, as noted by recent analyses showing potential misidentification of malignant lesions [11]. In present study, one case of papillary carcinoma and one case of Hurthle cell carcinoma among the 23 reported thyroid cystic lesions were confirmed histologically, supporting prior observations that FNAC alone may have limitations in complex thyroid lesions [12].

The discrepancies observed in breast lesion diagnosis, where two out of 14 cystic cases were identified as infiltrating ductal carcinoma upon histopathological review, echo findings that demonstrate FNAC's limitations in distinguishing between benign and malignant proliferative lesions [13]. This outcome is compounded by the morphological similarity between cyst macrophages and malignant epithelial cells, as described by Singh A et al., (2024) [14].

Cases involving skin and soft tissue lesions demonstrated a high rate of diagnostic concordance (70.49%), further affirming FNAC's reliability in these areas, which has been extensively documented in the literature [15]. However, the occurrence of atypical results, such as identifying liposarcoma among cases initially diagnosed as lipoma or finding pilomatrixoma in cases reported as calcinosis cutis, highlights the importance of histopathological examination for confirmation [16].

The present study also underscores the complexity of salivary gland lesions, with one case of mucoepidermoid carcinoma identified among six reported cystic cases. Similar findings were reported in studies where FNAC showed limited sensitivity in certain glandular neoplasms [17]. The high concordance observed overall, especially in cystic lesions, reaffirms FNAC's role as a frontline diagnostic tool. Yet, the study reinforces the need for complementary histopathological examination in cases where FNAC results are ambiguous or where clinical suspicion persists.

Limitation(s)

Although FNAC is a highly advisable method for diagnosing cases, there are repetitive and technical errors. In malignant cystic lesions, there are possibilities of false negative results.

CONCLUSION(S)

In conclusion, present study highlights the effectiveness of FNAC in diagnosing a wide range of solid and cystic lesions. FNAC is particularly valuable for superficial lesions, showing high diagnostic concordance with histopathological examination in both solid and cystic lesions. However, the study also reveals the limitations of FNAC, especially in differentiating between benign and malignant thyroid and breast lesions, where overlap in cellular morphology can complicate the diagnosis. Histopathological examination remains essential for confirming diagnoses in challenging cases. Therefore, while FNAC serves as a reliable first-line diagnostic tool, it should be supplemented with other diagnostic methods when clinical suspicion persists or when complex lesions are present.

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