

Cytopathologic Evaluation of Image-Guided Fine-Needle Aspiration Cytology and Cell Block Correlation for Lung Neoplasm in a Tertiary Care Hospital VIMSAR, Burla - A Cross-Sectional Study

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ABSTRACT

BACKGROUND

Fine-needle aspiration cytology (FNAC) is an easy, minimally invasive and useful investigation, and is considered important next to imaging in the rapid diagnosis of lung neoplasm for the last few decades. The purpose of this study was to evaluate the role of image-guided FNAC in pulmonary neoplasm, analyse the results and correlate with cell block histopathological findings.

METHODS

This is a cross sectional study conducted over a period of two years, involving fifty patients. All the clinical and radiological data were studied from the consenting patient. Then they underwent image-guided FNAC. The cytology smears and cell blocks were evaluated simultaneously to stick out a definitive diagnosis.

RESULTS

Out of all the 50 cases, we found the necessary FNAC smears and cell block material only in 41 cases. The age range varied from 18 to 90 years with a peak in the fifth to sixth decades. Benign lesions were 4 and malignant were 23 as shown by cytology study. Malignancy was proved in 27 cases in histopathology. The most common tumour was adenocarcinoma (41 %) followed by squamous cell carcinoma (19.5 %). Complications after the procedure were minimal and were noted only in two cases.

CONCLUSIONS

Image-guided fine needle aspiration cytology of lung tumours provide uncomplicated, cost effective, and a rapid method, for reaching a reliable diagnosis for lung neoplasms with minimum complication.

KEYWORDS

FNAC, Histological Correlation, Pulmonary Neoplasm

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DOI: 10.18410/jebmh/2021/362

How to Cite This Article:

Sahu A, Gudaganatti S, Pandey S. Cytopathologic evaluation of image-guided fine-needle aspiration cytology and cell block correlation for lung neoplasm in a tertiary care hospital VIMSAR, Burla - a cross-sectional study. J Evid Based Med Healthc 2021;8(23):1927-1931. DOI: 10.18410/jebmh/2021/362

*Submission 25-08-2020,
Peer Review 04-09-2020,
Acceptance 19-04-2021,
Published 07-06-2021.*

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BACKGROUND

Image-guided fine-needle aspiration cytology from radiologically demonstrated lung lesion is an easy, rapid, and useful investigation for the diagnosis of pulmonary neoplasm. Image-guided fine needle aspiration cytology of suspicious lung masses is a simple cost-effective method. FNAC helps to distinguish the benign and malignant lesions and also in classification of lung cancer. In the patients with lung cancer which is inoperable owing to local factors or the patient's general condition, FNAC helps to confirm the diagnosis. It aids in the commencement of specific treatment modalities like chemotherapy or surgery that can be done without unnecessary delay.

Lung cancer is now currently the most frequently diagnosed major cancer throughout the world (estimated 1.6 million new cancer in 2008) and the most common cause of cancer death worldwide (1,380,000 deaths in 2008). In India, approximately 63,000 new lung cancer cases are reported each year. Lung cancer is relatively more common culprit in the developed than developing countries as it accounts for 22 % versus 14.6 % of cancer deaths, respectively. This dreadful death rate makes early diagnosis and treatment essential for improvement in the morbidity and mortality. Now fine needle aspiration cytology of lung mass has obtained worldwide acceptance and increased the diagnostic utility of cytology in pulmonary and mediastinal cancer diagnosis.^{1,2} FNAC has also utilised for the non-invasive corroboration of primary as well as metastatic thoracic lesions. Another additional benefit of FNAC is the classification of tumour types like lymphoma, small cell carcinoma that are more pertinently treated by chemotherapy rather than surgery. Many works of literature proved that image-guided FNAC is a sensitive and specific way to diagnose the pulmonary malignancy.^{3,4}

This is useful in deciding the therapeutic approach in patients in whom results of bronchoscopy and sputum cytological study are not helpful. In candidates for surgery with indeterminate solitary pulmonary nodule without clear radiologic signs of malignancy or benignity, findings from FNAC may be diagnostic. This method of diagnosis is a less risky, non-invasive procedure when compared with biopsy for diagnosis of lung cancer, only with a major rare complication of pneumothorax.⁴

Objectives

The present study was undertaken to evaluate image-guided FNAC accuracy for lung malignancy and to correlate cytological findings with cell block features.

METHODS

This is a cross sectional study done over two years from September 2013 to September 2015 in the Department of Pathology, VIMSAR, BURLA. Forty-one clinically and radiologically suspected pulmonary neoplastic cases with adequate samples for cytology and cell block were included

in our study. Few cases were excluded for inadequate specimens.

Image-guided fine needle aspiration cytology of pulmonary mass was performed in all cases as out-patient department (OPD) procedure. Thirty-eight ultrasound sonography (USG) guided and twelve computerised tomography (CT) guided FNAC was done after proper history, clinical examination and assessment of lung functions. After localizing the exact position of the mass, the assessment of the site and angle of entry of the needle, and the distance of the lesion from skin on the CT scan/USG monitor, we introduce 21 G - 88 mm long spinal needle into the lesion through percutaneous/transsthoracic route. When CT/USG findings were confirmed and required target was reached, stellate was withdrawn. The syringe fitted with a FNAC gun was then attached to the needle hub. Mild negative pressure was created and maintained in the syringe and the needle was moved quickly back and forth in a cutting motion within the lesion to chisel and suck the material within the syringe. The needle was withdrawn as soon as blood was seen to cross the needle hub. Needle was detached from the syringe and was kept.

From the material aspirated, cytosmears were made immediately, both air-dried and fixed smears (fixed in 95 % alcohol). Air-dried smears were stained with Diff-Quik stain, whereas Papanicolaou (PAP) stain was done for alcohol fixed smears for rapid cytopathological evaluation of the lesions. The residual material was fixed in 10 % neutral buffer formalin for 12 hours, followed by standard tissue processing. Subsequently, paraffin-embedded blocks were made, cut into 5-micron thick sections and stained with haematoxylin & eosin stain. Cell block in few cases was not done due to non-availability of specimens, because the patients were unwilling for re aspiration or as the aspiration was too scanty that only smears could be made and not leaving any residual material for cell block. The slides were then examined under a light microscope and reviewed for cytohistological correlation. Photographs of the slides were taken with Olympus cx 21i led microscope. In some cases, aspirated material on smear examination showed only blood elements with no suspicious cells. Proper tabulation of data and statistical analysis using IBM SPSS Statistics 22 (License Authorization Wizard) software done.

Statistical Analysis

Proper tabulation of data and statistical analysis using IBM SPSS Statistics 22 (License Authorization Wizard) software was done using chi-square test and Spearman's Rank Correlation coefficient. P values < 0.05 were considered to be statistically significant.

RESULTS

A total of 41 cases were considered in the study where we found sufficient FNAC smear and sample for histopathology of the masses. [Table - 1] Out of 41 cases, 28 cases (68.2 %) were male and 13 (31.7 %) were female with a male: female ratio of [2.1 : 1]. The patients in our study were of

age group varied from 18 - 90 years. The highest incidence was observed between the ages of 51 to 60 years, followed by 61 to 70 years. The upper age limit in females was 75 years and in the case of males 79 years. There was no case that was studied below 18 years. Of the 28 males, 23 cases were smokers and 5 cases were non-smokers. Of the 13 female cases, 2 were smokers and 11 were non-smokers. History of smoking is a common finding in male cases subjected to study.

Total Number of Samples	50
Cases included in study	41
Cases excluded due to non-availability of specimen	05
Unsuitable smears	04
Table 1. No. of Cases Studied	

Radiological findings in 41 cases of which 8 cases show solitary pulmonary nodule (male - 6, female - 2), 7 cases show consolidation and effusion (male - 4, female - 3), 4 cases show pulmonary lobe sequestrations (male - 3, female - 1) and 22 cases show bronchogenic mass (male - 14, female - 8).

Cytological examination of conventional smear studied in 41 cases, out of which 4 were benign, 14 cases were suspicious of malignancy, and 23 cases were malignant. Smears from the adenocarcinoma cases showed cell clusters with acinar pattern of arrangement. The cells were medium to large size having round to oval eccentric nuclei and moderate amount of delicate cytoplasm. Few cell clusters were having prominent nucleoli. Rosettes, acinar formation or cohesive cell cluster represent anatomical structures removed from the tumour by the needle. The larger the gland formations, the less likely they are to be removed intact and when partly removed, deposit on the slide as flat sheets as monolayer: a useful indicator of glandular formation. [Figure-1] Cytosmears of squamous cell carcinoma showed nests and sheets of keratinized and non-keratinized atypical squamous cells with pleomorphic, hyperchromatic nuclei. [Figure-2] Cytosmear of small cell carcinoma showed small dark cells in poorly cohesive loose clusters with scanty cytoplasm, dispersed cell pattern with nuclear moulding, coarsely granular nuclear chromatin and small nucleoli. Large cells in cohesive clusters with nuclear atypia and mild to moderate pleomorphism suggested the diagnosis of poorly differentiated non-small cell carcinoma. All cytological and histological diagnoses were correlated.

Morphological details obtained with the cell block method, which include preservation of the architectural pattern like cell balls and papillae and three-dimensional clusters, excellent nuclear and cytoplasmic details, and individual cell characteristics. On the other hand, fragments of tissue can easily be interpreted in a biopsy-like fashion. Histological correlation in cell block showed 2 cases were benign, 12 cases were suspicious of malignancy, and 27 cases were malignant. Spearman's Rank Correlation Coefficient (RHO) $r_s = 0.76399$, P value = 0.001 [Table-2].

Out of 27 malignant cases, 17 were adenocarcinoma (male - 11, female - 6), 8 cases were squamous cell carcinoma (male - 7, female - 1), 1 case was of small cell carcinoma (male) and 1 case was of poorly differentiated non-small cell carcinoma (male). [Figure - 3,4,5] In our study, HPE reports of lung tumours showed that the

maximum number of cases belonged to adenocarcinoma (62.9 %) followed by squamous cell carcinoma (29.6 %).

Total No. of Cases	Cytological Diagnosis (Cases - 41)	Histological Diagnosis (Cases - 41)
Benign	04	2
Suspicious of malignancy	14	12
Malignancy	23	27
Table 2. Comparison between Cytological Study and Histopathological Study		

	Adenocarcinoma	Squamous Cell Carcinoma	Small Cell Carcinoma	Poorly Differentiated Non-Small Cell Carcinoma
Male	11	7	1	1
Female	6	1	0	0
Total	17 (62.9 %)	8 (29.6 %)	1 (3.5 %)	1 (3.5 %)
Table 3. Histological Typing of Lung Cancer				

The chi-square statistic = 2.1004, df = 3, p - value = 0.551838. The result is not significant at $p < .05$.

Male were more commonly involved in both squamous cell carcinoma (7:1) and adenocarcinoma (1.8:1). Squamous cell carcinoma was the usual tumour type found in smokers (70 %). Bronchogenic carcinoma had diagnostic sensitivity 98 % and specificity 91 %, positive predictive value 99 %, negative predictive value of 78 % for fine needle aspiration cytology in our study. After assessment of final histopathological report, the diagnostic accuracy of image-guided fine needle aspiration comes out to be 96 %. We found that as compared to radiological diagnosis, image-guided fine needle aspiration cytology showed almost impeccable agreement with histopathological diagnosis.

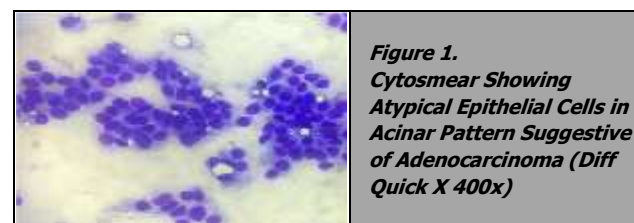


Figure 1.
Cytosmear Showing Atypical Epithelial Cells in Acinar Pattern Suggestive of Adenocarcinoma (Diff Quick X 400x)

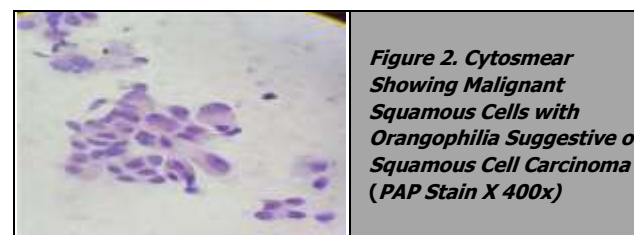


Figure 2.
Cytosmear Showing Malignant Squamous Cells with Orangophilia Suggestive of Squamous Cell Carcinoma (PAP Stain X 400x)

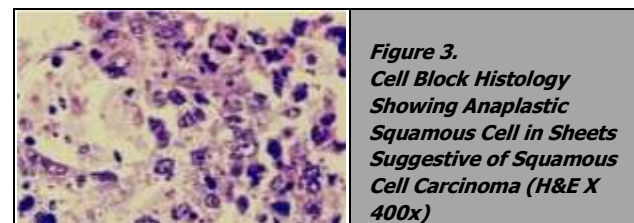


Figure 3.
Cell Block Histology Showing Anaplastic Squamous Cell in Sheets Suggestive of Squamous Cell Carcinoma (H&E X 400x)

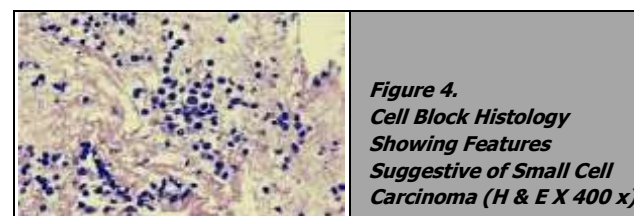
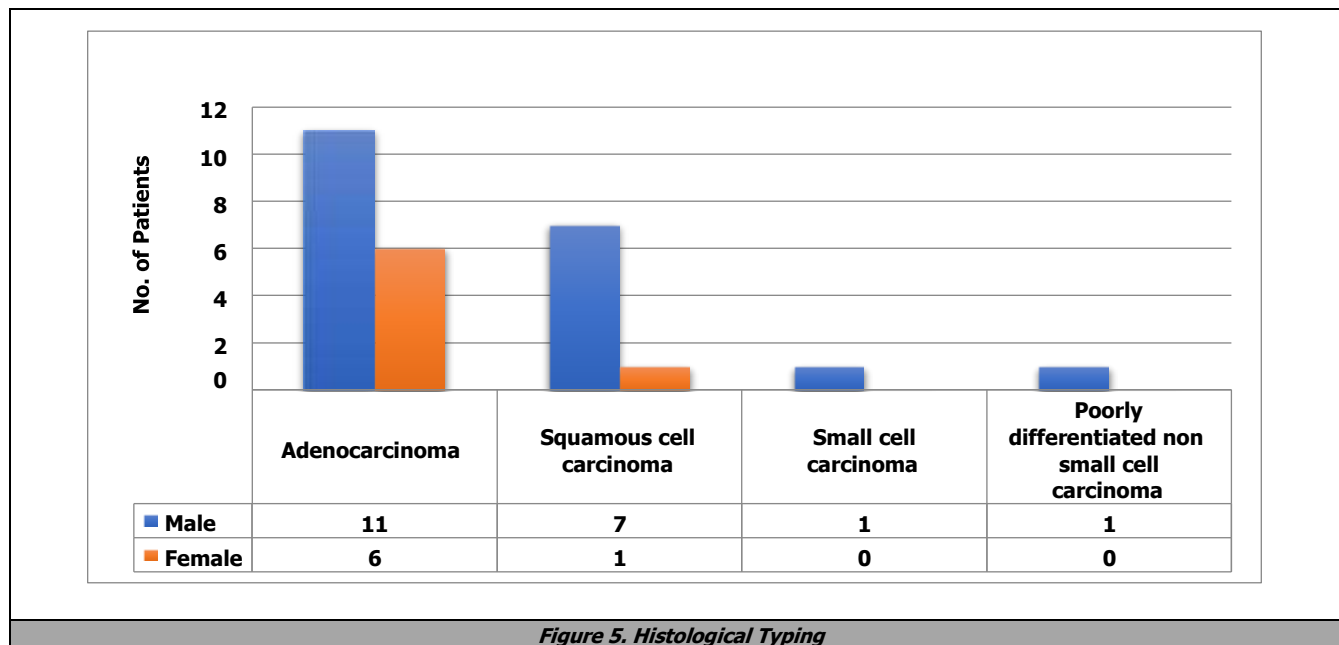


Figure 4.
Cell Block Histology Showing Features Suggestive of Small Cell Carcinoma (H & E X 400 x)



DISCUSSION

In the beginning of the twentieth century, lung neoplasms were considered to be rare. But now it has reached epidemic proportions. It is the leading cause of cancer deaths in developed countries and is rising at alarming rates in the developing countries. Lung cancer remains the leading cause of cancer mortality for both men and women in the worldwide and also in India. Its incidence is highly correlated with cigarette smoking, and about 10 % of long-term smokers will eventually be diagnosed with lung cancer. Among the 10 % of patients who develop lung cancer without smoking history, potential environmental or inherited causes of lung cancer are unclear.

Fine needle aspiration cytology assisted with image intensifiers is now a days the first choice of investigation for the lesions that are located in the mediastinum, pulmonary apex, medial upper lobe or peripheral lung. The cytology of the respiratory tract has been revolutionized by a combination of two factors: Evolution of highly sophisticated radiologic imaging techniques, making possible the precise visualization and localization of masses in the lungs and reintroduction of a sampling technique of such visualized lesions by inserting a fine bore needle into them. A fine needle attached to a syringe is passed through the chest wall or bronchial wall into the pulmonary mass visualized by fluoroscopy, CT or bronchoscopy. Among the imaging modalities, CT is the most popular. CT or, less commonly, ultrasound is used to guide the direction and depth of insertion of the needle. The technique is used with increasing frequency to investigate pulmonary infiltrates as well as more discrete masses in the lung. After recognition of high accuracy rate, FNAC has become the main indication for the diagnosis of localized intrathoracic lesions suspected of being malignant, peripheral mass and do not desquamate cells into the bronchial tree, particularly when the less invasive investigations like sputum cytology prove to be negative.

Image-guided fine needle aspiration cytology is a sensitive, specific and useful procedure for the assessment of lung mass. The typing of pulmonary malignancy can also be done using it in the vast majority of cases. Fine needle aspiration cytology is a cost-effective diagnostic method that can lead to shorter hospitalization and reduction in the number of diagnostic thoracotomies.

In the present study, all cases encountered were adults with the peak age of incidence (51 - 60 years) which was also observed in other studies.^{5,6} The mean age in our study was 56.5 years, which is nearly similar to the studies by Singh et al.⁷ and Saha et al.⁶ respectively. There was a male preponderance (68.2 %) in our study compared to females which is quite lower than that is documented in some studies i.e., 71.1 %, 8 78.9 % 6 respectively. Among the patients, 56.67 % were active smokers. Out of all cases, FNAC showed 18 [43.9 %] benign and 23 [56.0 %] malignant lesions. Histopathology study showed 14 [34.1 %] cases were benign and 27 [65.8 %] cases were malignant. Among all 27 cases of malignant lung tumours, the most common (41 %) was adenocarcinoma followed by 19.5 % squamous cell carcinoma. In many studies i.e. Tan et al.⁸ Madan et al.⁹ the squamous cell carcinoma had lower incidence than adenocarcinoma. Adenocarcinoma had less prevalence than squamous cell carcinoma which was also noted in certain research.^{10,11} In the current study, fine needle aspiration cytology effectively diagnoses the pulmonary masses and accurately classifies adenocarcinoma, squamous cell carcinoma and small cell carcinoma. Cytology is helpful in those cases where facilities of histological confirmation is not available. The sensitivity of FNAC in the diagnosis of malignant pulmonary neoplasms varies according to both size and site of mass, as well as the experience of the radiologist and the pathologist. A non-specific negative result does not exclude malignancy. Therefore, repeated aspiration, careful clinical follow up, or additional diagnostic procedure may be required to reach as definite diagnosis. In our study, the rate of complications (4 %) was less as

compared with other series where it is about 6 to 50 %. In some studies, pneumothorax was the major complication but is not found in any case of our study.⁸ In our study, only two cases have mild chest pain as appreciable complication which was managed smoothly. In present study, image-guided fine needle aspiration cytology showed nearly accurate accordance with histological diagnosis that is 96 % in comparison to radiological opinion for lung mass that was also found in some studies.^{9,10}

CONCLUSIONS

Image-guided fine needle aspiration cytology is an easy, authentic investigation with less complications procedure and high diagnostic specificity and sensitivity for the detection and subtyping of lung neoplasms. It can be used alone with confidence to select treatment modalities and to avoid unnecessary surgeries in patients with suspected pulmonary malignancies. Complications are rarely encountered and occasionally require active management.

Data sharing statement provided by the authors is available with the full text of this article at jebmh.com.

Financial or other competing interests: None.

Disclosure forms provided by the authors are available with the full text of this article at jebmh.com.

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