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ORIGINAL ARTICLE

CORRELATION OF FINE NEEDLE ASPIRATION CYTOLOGY WITH BRONCHOALVEOLAR LAVAGE AND BRUSH SMEAR CYTOLOGY IN PULMONARY LESIONS

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ABSTRACT: BACKGROUND: Fine Needle Aspiration Cytology (FNAC), Bronchoalveolar Lavage (BAL) and Brush Cytology are important diagnostic tools for evaluation of pulmonary lesions. Considering the limitations of these procedures correlation of these cytological techniques may help in improving accuracy and increasing the diagnostic yield. **AIM**: To determine the role of FNAC, Brush and BAL Cytology in pulmonary lesions and to correlate the efficacy of FNAC with Brush and BAL Cytology. **MATERIALS AND METHODS**: This prospective study was conducted on 78 patients with radiologically demonstrable pulmonary lesions in the department of pathology and Dr ML Chest Hospital, GSVM Medical College, Kanpur over a period from nov2011-july2013. The cases selected had to give consent for the procedure. Bronchoalveolar lavage, bronchial brush sample were taken and FNAC was done in the cases. **RESULTS**: In present study 78 cases of pulmonary lesions were subjected to FNAC and/ or Bronchoalveolar lavage and brush cytology. Among them 49 cases were selected in which all three procedures were done. The sensitivity and specificity for detecting lung tumors by FNAC was 96.29% and 95.45% which was more than that of BAL cytology (84.61%, 91.30%) and Brush cytology (81.48%, 95.45%). FNA correlates with Brush and BAL cytology in 78.57% of malignant lesions. Among malignant lesions 84.61% of BAL and Brush cytology correlates with FNA for diagnosis of squamous cell carcinoma. FNA correlates with 66.67% of brush and 83.37% of BAL fluid cytology for diagnosis of adenocarcinoma. BAL and Brush both correlates with FNA in 83.33% cases of small cell carcinoma. Overall 85.71% of BAL and 82.14% of brush smear cytology correlates with FNA cytology for diagnosis of lung cancers. **CONCLUSIONS**: FNA, BAL and Brush cytology provide a high yield for evaluation of pulmonary lesions. BAL fluid and brush cytology correlated well with FNAC for diagnosis of lung cancers.

KEYWORDS: Fine Needle Aspiration Cytology, Bronchoalveolar Lavage, Brush Cytology.

INTRODUCTION: Percutaneous needle aspiration of the lung has been recognized since the 1970s as a critically important diagnostic technique, and is particularly valuable in the diagnosis of space occupying lesions located in periphery of the lung and in the mediastinum. The technique is used with increasing frequency to investigate pulmonary infiltrates as well as more discrete masses in the lung.

Bronchial Brushing: With the introduction of flexible bronchoscopes capable of reaching sub-segmental bronchi, the cytological diagnosis of lung cancer relies heavily on direct bronchial brushings. The method permits sampling of a visualized mucosal abnormality or systemic sampling of all segmental bronchi to confirm and localize occult in situ or early invasive carcinomas detected by sputum cytology or suspected radiologically.

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Bronchoalveolar Lavage was introduced initially as a therapeutic procedure to clear the alveolar spaces of accumulated secretions blocking gaseous exchange, for example, in alveolar proteinosis and bronchial asthma. Subsequently, the technique has been used for diagnostic purposes primarily in suspected Pneumocystis carinii pneumonia, replacing open lung biopsy, and in the diagnosis of interstitial lung disease.

It has been used to identify various other bacterial, fungal, parasitic, and sometimes viral agents causing pulmonary infections, particularly in patients with Acquired Immunodeficiency Syndrome (AIDS) and in children with chronic granulomatous disease, an inherited defect of phagocytic oxidative enzymes. A recent and important application of BAL is in detecting rejection and or infection by increase in percentage of polymorphonuclear leucocytes in recipients of lung transplant.

Therefore correlation of these cytological techniques certainly improves accuracy and decreases both false negative and false positive cases. Considering the advantages of these cytological techniques and the fact that still much work is to be done in the field, an attempt is being made here to show the efficiency and importance of these procedures in diagnosis and evaluation of pulmonary lesions.

MATERIAL AND METHODS: In present study 78 cases of pulmonary lesions were subjected to FNAC and/ or Bronchoalveolar lavage and brush cytology over a period from Nov 2011-july 2013. Among them 49 cases were selected in which all three procedures were done. In every case detailed clinical history was taken and a thorough physical and examination was done. Final diagnoses were established using data from fibreoptic bronchoscopy, microbiology, clinico-radiological impression and response to treatment. In each instance the clinical diagnosis, X-ray findings, CT findings and other relevant investigations are taken into consideration while reporting the cytopathology.

RESULTS: Of the total cases maximum number of patients aspirated was in age group between 51-60 years (44.8%). Lung lesions were mostly seen in 5th and 6th decade of life. 61.22% of patients had central lesion whereas 18.36% patients had peripheral lesions. 55.10% of patients had history of smoking.

The diagnostic yield of FNA cytology was 71.43% for non-neoplastic cases and 96.42% for neoplastic cases. Diagnostic yield of BAL fluid cytology was 80.95% for non-neoplastic lesions which was more than that for FNA cytology. However diagnostic yield for brush smear was 66.67% which was less than that of FNAC. The diagnostic yield of FNA (96.42%) was more than that for BAL (92.86%) and Brush (78.57%) cytology for malignant lesions.

10% patients had acute inflammatory lesion and 25% patients were of chronic non-specific inflammatory lesion and with 65% chronic granulomatous lesion. Among chronic granulomatous lesions Zeil Nelson staining for Acid Fast Bacilli was done in 10 cases of which 6 are positive. The present study showed highest number of patients i.e. 48.14% of squamous cell carcinoma followed by adenocarcinoma (22.22%), small cell carcinoma (22.22%), bronchoalveolar carcinoma (3.70%) and poorly differentiated carcinoma (3.70%).

FNA correlated with Brush and BAL cytology in 47.62% of non-neoplastic lesions and in 78.57% of malignant lesions. Among malignant lesions 84.61% of BAL and Brush cytology correlated with FNA for diagnosis of squamous cell carcinoma. FNA correlated with 66.67% of brush and 83.37% of BAL fluid cytology for diagnosis of adenocarcinoma. BAL and Brush both correlated with

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FNA in 83.33% cases of small cell carcinoma. Squamous cell carcinoma (92.3%) was seen mostly in central part whereas adenocarcinoma was seen mainly as peripheral lesion.

Sensitivity of FNA for diagnosis of lung cancer was 96.29% along with 95.45% specificity. BAL cytology showed 84.61% sensitivity, 91.30% specificity, 91.66% positive predictive value and 84% negative predictive value. Brush cytology showed 81.48% sensitivity, 95.45% specificity, 95.65% positive predictive value and 80.77% negative predictive value.

The sensitivity and specificity for detecting lung tumors by FNAC was more than that of BAL and Brush cytology. Accuracy of FNAC (95.91%) was more than that of BAL and Brush cytology (both 87.75%). Overall 85.71% of BAL and 82.14% of brush smear cytology correlated with FNA cytology for diagnosis of lung cancers.

FNA correlated with Brush and BAL cytology in 47.62% of non-neoplastic lesions and in 78.57% of malignant lesions.

Correlation of BAL and Brush cytology are summarized in table 1 and 2 as follows:

Cytological diagnosis	Total number of cases	BAL cytology correlate with FNA	%	Brush cytology correlate with FNA	%
Inflammatory lesion					
Chronic	18	11	61.10%	10	55%
Malignant					
Squamous cell carcinoma	13	11	84.61%	11	84.61%
adenocarcinoma	6	5	83.37%	4	66.67%
Small cell carcinoma	6	5	83.33%	5	83.33%
Bronchoalveolar carcinoma	1	1		1	
Poorly differentiated carcinoma	1	1		1	
Metastatic carcinoma	1	1		1	

TABLE 1: CORRELATION OF FNA WITH BAL AND BRUSH CYTOLOGY

Cytological diagnosis	FNA correlating with BAL and Brush cytology	FNA correlating with BAL only	FNA correlating with Brush only	BAL and Brush only(not correlating with FNA)	FNA only (not correlating with brush and BAL)	BAL only (not correlating with FNA and Brush)
Inflammatory lesion						
Acute					2	
Chronic	10(55.55%)	1(5.55%)		3 (16.7%)	1 (5.55%)	3 (16.7%)
Suspicious for malignancy					1	
Malignant						

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Squamous cell carcinoma	10(76.92%)	1(7.69%)	1 (7.69%)		1 (7.69%)	
Adenocarcinoma	4 (66.67%)	1 (16.7%)				1 (16.7%)
Small cell carcinoma	5 (83.33%)				1 (16.7%)	
Bronchoalveolar carcinoma	1					
Poorly differentiated carcinoma	1					
Metastatic carcinoma	1					

TABLE 2: CORRELATION OF FNA WITH BOTH BAL AND BRUSH CYTOLOGY

DISCUSSION: The use of cytological methods in the diagnosis of lesions of the respiratory tract has been generally acclaimed as one of its most successful applications. Flexible fiber-optic bronchoscope revolutionized respiratory cytology, as techniques like broncho-alveolar lavage, bronchial brushings and bronchial biopsy became more easy, accessible and popular, shifting the emphasis from diagnosis of advanced malignancy in patients to the use of cytology as a first line diagnostic and management tool. Today respiratory tract cytology is well established throughout the world as a vital diagnostic procedure in the evaluation of any patient with suspected lung lesions.

In pursuing the tissue diagnosis of suspected lung cancer, there is a range of procedure to choose from. The principal goals are ideally to diagnose and pathologically stage the patients with lung cancer at the same time, preferably by using safest, least invasive and least costly tests. If there is clinical or radiological evidence of extrapulmonary spread of disease, including supraclavicular nodal involvement or malignant pleural effusion, then radiology guided FNA/Biopsy will confirm the cell type and stage the patient as unresectable for visible endobronchial lesion. For visible endobronchial lesion endobronchial needle aspiration may provide immediate diagnosis, thus obviating additional, possibly morbid procedures such as bronchial biopsy.

For submucosal lesions endobronchial needle aspiration is superior. For central lesions that are peribronchial, transbronchial needle aspirations are performed. [Yung (2003)].[1]

In this study the diagnostic yield of FNA cytology was 71.43% for non-neoplastic cases and 96.42% for neoplastic cases. Among non-neoplastic cases diagnostic yield was 70% for inflammatory lesions.

The distribution of malignant lesions according to diagnostic yield by FNA shows 100% yield for adenocarcinoma, small cell carcinoma, bronchoalveolar carcinoma and poorly differentiated carcinoma followed by 92% yield for squamous cell carcinoma. The reason for low yield for squamous cell carcinoma by FNA may be its location near the hilum which is difficult to reach by FNA needle and depends largely on the skills of cytopathologist and chest physician.

Diagnostic yield of BAL fluid cytology was 80.95% for non-neoplastic lesions which was more than that for FNA cytology (71.43%). However diagnostic yield for brush smear was 66.67% which was less than that of FNAC. This is may be due to the reason that BAL explores large surface area as compared to FNA and Brush cytology.

On comparing the diagnostic yield of FNA for neoplastic lesion with BAL and Brush cytology, it was found that yield of FNA (96.42%) was more than that for BAL (92.86%) and Brush (78.57%)

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cytology. The results were similar with Wahyuni et al who found 80%of FNA and 50% of Brush smear cytology positive for malignancy.[2] Raphel et al found BAL has overall diagnostic yield of 84%.[3] The reason for high yield of FNA may be that yield of bronchoscopic sampling procedures were dependent on tumor visibility during bronchoscopy and location of bronchoscopically visible tumors.

Among the lung tumors FNA showed highest yield for adenocarcinoma, small cell carcinoma, bronchoalveolar carcinoma, poorly differentiated carcinoma and metastatic adenocarcinoma followed by 92.3% for squamous cell carcinoma.

The yield of FNA was equal to BAL fluid but more than Brush smear for squamous cell carcinoma and adenocarcinoma. For small cell carcinoma the yield of FNA was same as of Brush but more than that of BAL fluid (83.33%).

FNA correlates with Brush and BAL cytology in 47.62% of non-neoplastic lesions and in 78.57% of malignant lesions. 55% of Brush and 61.10% of BAL cytology correlate with FNA for diagnosis of chronic inflammatory lesions. Among malignant lesions 84.61% of BAL and Brush cytology correlates with FNA for diagnosis of squamous cell carcinoma. FNA correlates with 66.67% of brush and 83.37% of BAL fluid cytology for diagnosis of adenocarcinoma. BAL and Brush both correlates with FNA in 83.33% cases of small cell carcinoma. Overall 85.71% of BAL and 82.14% of brush smear cytology correlates with FNA cytology for diagnosis of lung cancers.

The results were different from Pederson et al who found 69% of brush and 58% of BAL fluid cytology correlates with FNA.[4] The differences may be due to differences in case selection criteria and demographical, ethnical and cultural differences and largely depends on technical skills of cytopathologist and chest physician.

One patient show peripheral lung lesion in radiology with normal bronchoscopic findings, diagnosis of adenocarcinoma was made by cytology of BAL fluid alone. This is similar to Tartar et al who found BAL cytology alone diagnostic for one case in his study.[5] The reason for negative FNA may be inappropriate localization of lesion during FNA procedure.

One case of squamous cell carcinoma and small cell carcinoma Brush and BAL fluid cytology showed extensive necrotic material only but FNA showed malignant cells. This is may be due to the reason that brush and BAL fluid aspirate removes superficial exfoliated cells while FNA obtain material from depth of lesion showing greater yield of viable cells.

On comparing the complications of FNA out of 78 aspirations only one case showed one episode of blood tinged sputum, requiring no treatment. No case of pneumothorax or bleeding from site was found. So complications were even less than Munshi et al where hemoptysis occurs in 3.8% of cases and in 5% cases of pneumothorax were seen.[6] The reason of fewer complications may be due to the presence of expert cytopathologist and chest specialist at the site of aspiration.

Sensitivity for FNA for the diagnosis of lung cancer ranged from 56 to over 90% whereas specificity is close to 100%.[7] In our study sensitivity of FNA for diagnosis of lung cancer was 96.29% and specificity was 95.45%. Our study showed 84.61% sensitivity, 91.30% specificity, 91.66% positive predictive value and 84% negative predictive value.

There were two false positive cases. In our study bronchial brush cytology showed sensitivity of 81.48% which was close to that found by Rangdaeng et al who compared the sensitivity of BAL(36%) and Brush cytology(80%) and found it to be superior for diagnosis of lung cancer.[8]

The cytomorphologic diagnosis of lung malignancies is fraught with numerous mimics and pitfalls that may lead to false positive or false negative diagnoses. A zero false positive rate may be

unattainable as a false positive rate of approximately 1% was observed even with experienced cytopathologists in a study by Thivolet-Bejui.[9] It is critical to be familiar with the potential pitfalls and mimics in respiratory cytopathology since false positive diagnoses may result in a significant morbidity or even mortality; while false negative diagnosis may result in delayed diagnosis and treatment.

There should be hesitation to make a diagnosis of malignancy in an acutely ill patient, patients without a mass and who have undergone therapy or prior procedures. As always, common sense and correlation of the cytomorphologic features with the clinical presentation of the patient (including radiologic imaging) are absolutely critical in the accurate interpretations of respiratory cytology specimens.[3]

CONCLUSION: In this study Lung lesions were mostly seen in 5th and 6th decade of life. Majority of patients were smokers. Tuberculosis was most common benign lesion and squamous cell carcinoma was most common malignant lesion. FNA provided maximum yield of material and showed maximum sensitivity and accuracy for diagnosis of lung lesions.

Brush cytological analyses together with BAL fluid cytology were valuable diagnostic tool for evaluation of pulmonary lesions at flexible bronchoscopy. All three methods i.e. FNA, BAL and Brush cytology provide a high yield for evaluation of pulmonary lesions. BAL fluid and brush cytology correlated well with FNAC for diagnosis of lung cancers.

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Figure 1: FNAC Squamous cell carcinoma- Cell showing deeply eosinophilic cytoplasm & large hyperchromatic nuclei. [400x Hematoxylin & Eosin].

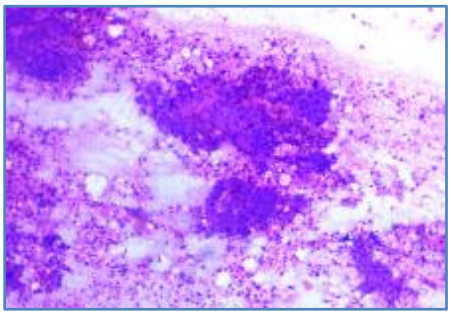

Figure 1

Figure 2: Brush smear Adenocarcinoma- papillae showing medium to large cells with moderate cytoplasm, fine chromatin and inconspicuous to prominent nucleoli. Intranuclear cytoplasmic inclusions are also seen. [400x Hematoxylin & Eosin].

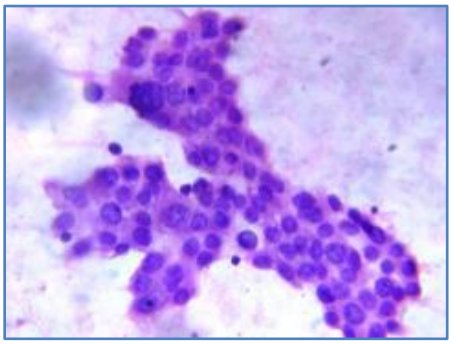

Figure 2

Figure 3: Brush smear small cell carcinoma- small cluster of loosely coherent cells showing nuclear moulding which is highly characteristic differentiating it from lymphocytes.
[400x Hematoxylin & Eosin].

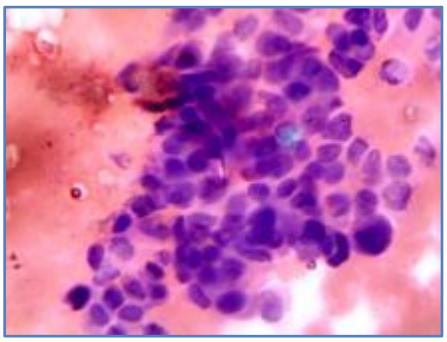

Figure 3

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