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Efficacy and Utility of Bronchial Cytology in diagnosing Lung Lesions and its Histopathological Correlation

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Abstract

Introduction: The advent of flexible fiberoptic bronchoscopy has revolutionized pulmonary cytology. In the recent past emphasis has been given to bronchial cytology which is as effective as histopathology in diagnosing the pulmonary lesions. Cytology aids in diagnosing the patients with advanced malignancies, risk of hemorrhage, and lesions at inaccessible sites. Bronchial cytology can be used in detecting lesions of non-neoplastic and infective etiology also.

Objectives:

1. To determine the sensitivity, specificity and efficacy of bronchial cytology in detecting neoplastic and non-neoplastic lung lesions.
2. To study the utility of bronchial cytology in diagnosing lung lesions.
3. To compare and correlate cytological diagnosis with corresponding histopathology.

Materials and Method: A retrospective and prospective study of 60 patients who underwent flexible fiberoptic bronchoscopy from January 2011 to December 2015 in our institution was done. Out of the 60 cases, 40 cases had cytological and histopathological correlation. The utility and efficacy of cytology in detecting neoplastic and non-neoplastic lung lesions has been studied.

Results: Overall sensitivity and specificity of bronchial cytology is 93.75% and 83.33% respectively. Positive predictive value in detecting the lesions is 78.95%.

Conclusions: Bronchial cytology is a valuable and useful tool, which can be used for establishing diagnosis in advanced cases, in patients with risk of hemorrhage or when the lesion is inaccessible for biopsy. Bronchial cytology yields almost the same information as that of histopathology.

Keywords: Fiberoptic bronchoscopy, Bronchial cytology, Histopathological correlation, True Positive, True Negative.

Introduction

Neoplastic and non-neoplastic pulmonary lesions account for majority of mortality and morbidity worldwide. Currently lung cancer is the most frequently diagnosed cause for cancer related deaths. Tuberculosis is still the leading cause of death in developing countries.(1) Early and accurate diagnosis of both the diseases is required to treat them successfully. Cytology of pulmonary lesions provides valuable diagnostic information by non/minimally invasive procedures. It is of good significance in situations where biopsy procedure cannot be attempted due to high risk of hemorrhage or when the lesion is at a peripheral location.(2) Alternative methods for obtaining diagnosis are required in such cases. Bronchoscopic washings, brushings and fine needle aspirations may complement tissue biopsies in the diagnosis.(3) Cell yield in a Bronchial brushings (BB) is better than aspirate and washings. Bronchio Alveolar Lavage (BAL) clears the alveolar spaces and can reach the alveoli beyond the site of obstruction.(4) Bronchial wash technique can sample the areas beyond the reach of brush.(4) Bronchial wash

cytology is a widely accepted safe, simple, and minimally invasive technique to evaluate cell morphology.[5]

Our study aims at comparing the bronchial cytological techniques (Bronchial Wash, Bronchial Brush, and Bronchioalveolar Lavage) with histopathology and assessing the sensitivity, specificity and positive predictive value of bronchial cytology in diagnosing neoplastic and non-neoplastic lesions of lung.

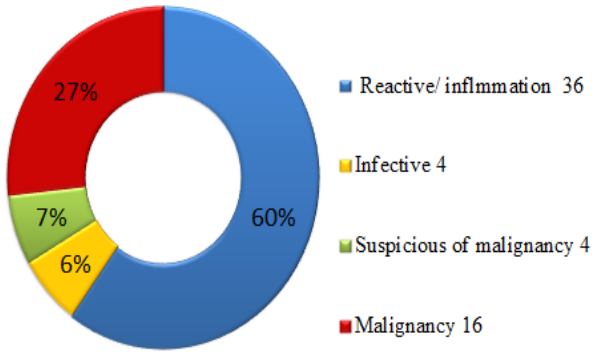
Materials and Methods

The present study was done in the department of Pathology at our institute from January 2011 to December 2015. The study group consisted of 60 samples where fibreoptic bronchoscopy was done. Out of the 60 samples studied for cytology, 40 samples had simultaneous bronchial cytological procedure and biopsy. The samples were obtained by a pulmonologist using flexible fiberoptic bronchoscopy. Bronchial brushings was performed using disposable straight brushes. The brushing material was smeared on to five to six clean slides, three to four slides were fixed in alcohol and the rest were air dried. Bronchial washings and lavages were then collected and centrifuged. Smears were prepared from sediments of BW and BAL. Alcohol fixed slides were stained with Hematoxylin and Eosin and air dried smears were stained with MGG. Special stains for Acid Fast Bacilli and fungal elements were done where ever required and were reported by two different pathologists in a blind folded manner.

Results

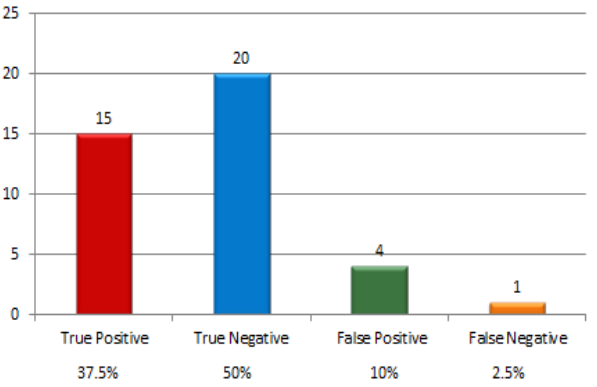
The age of the patients in the study group ranged between 18 years to 80 years with male preponderance. M: F ratio is 2.3:1. Out of the 60 samples, majority 36 (60%) were inflammatory, four cases were of infective etiology, four cases were reported as suspicious for malignancy and 16 cases were diagnosed as malignancies. (Graph 1)

Graph 1: Category on Cytology = 60



A case was considered True Positive (TP) where both the cytological and histological examination revealed malignancy. True Negative (TN) means negative for malignancy on both cytology and histopathology. Samples where malignancy was reported on cytology but histopathology did not show malignancy were reported as False Positives (FP) and cases where malignancy was not reported on cytology but were malignant on histopathology were grouped as False Negative (FN). In the 40 cases where cyto - histopathological correlation was done 15 cases were TP, 20 were TN, four were FP, and one case was FN. (Graph 2)

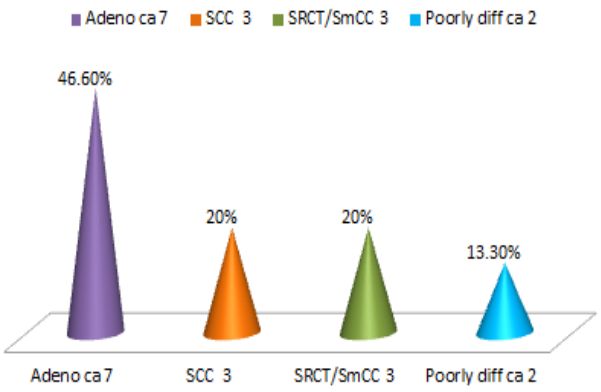
Graph 2: Categories in cases with Histopathological correlation (40)



Neoplastic lesions: Out of all the 60 samples, 16 cases were reported as malignancies where majority were diagnosed as adenocarcinoma (50%) followed by three cases each of squamous cell carcinoma and small cell carcinoma and two cases of poorly differentiated carcinoma.

In the cases (40 cases) where cyto-histo correlation was done, 15(37.5%) cases were TP. Out of the TP cases majority were adenocarcinoma 7/15(46.6%) followed by squamous cell carcinoma 3/15(20%), small cell carcinoma 3/15(20%) and poorly differentiated carcinoma 2/15(13.3%). (Graph 3). Fig. 1 (a, b)

Graph 3: Categories in True Positive cases



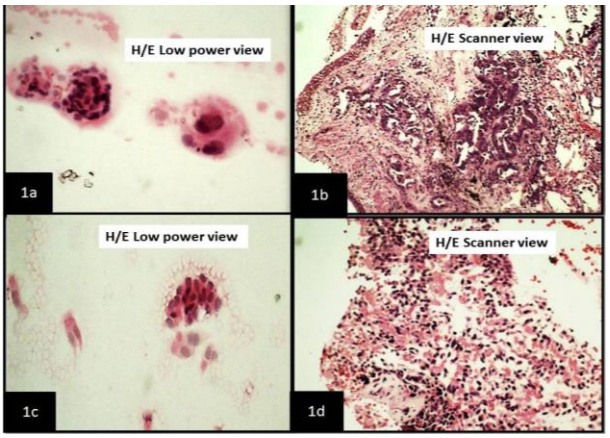


Fig. 1: True Positive -a,b; and False Positive - c,d. a) Bronchial brushings showing clusters of atypical cells with vague acinar formation; b) Corresponding biopsy showing adenocarcinoma; c)Bronchial brushings showing a cluster of atypical cells admixed with normal bronchial epithelial cells; d) Corresponding biopsy is superficial showing only inflammatory infiltrate

Non neoplastic lesions: On cytology 36 cases (60%) were non neoplastic, where majority were of inflammatory / reactive type. Four cases (6.6%) were of infective etiology and detected on BAL.

In the 40 samples where cyto- histo correlation was done 20 (50%) cases were TN. 15 inflammatory, one tuberculosis, three cases of interstitial lung disease and, one case of actinomycosis Fig. 2 were reported. (Table 1)

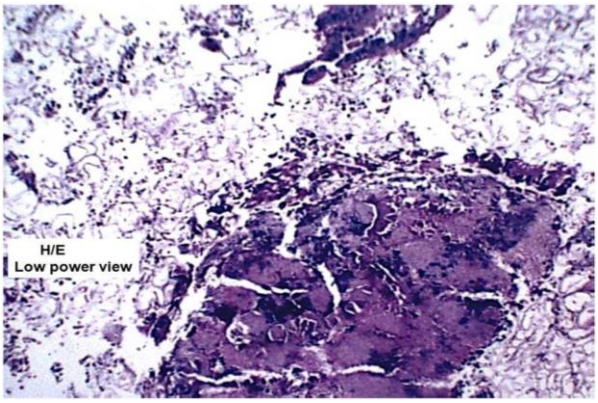


Fig. 2: Microphotograph of a case of actinomycosis on bronchial biopsy

Table 1: Categories in True Negative cases

Category	No. of cases	Percentage
Inflammation / Reactive	15	37.5 %
Granulomatous	1	2.5%
Actinomycotic	1	2.5 %
ILD	3	7.5 %

Four cases showed FP results (10%). In the FP cases three showed smears where cells were admixed with dense inflammatory infiltrate and one biopsy sample was superficial and inadequate. Fig. 1 (c, d)

Only one case in our study was FN false where the cytology sample was inadequate and the smears were made from bronchial washings. Fig. 3

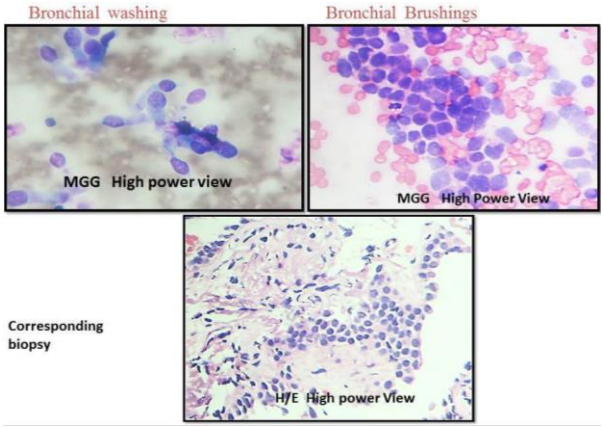


Fig. 3: Comparison of cell yield in bronchial wash and bronchial brushings. a) Bronchial wash – low cell yield; b) Bronchial brush showing more cell yield with features of Small round cell tumor; c) Corresponding biopsy

Discussion

Neoplastic and non-neoplastic pulmonary lesions have a high rate of morbidity and mortality. Lung cancer is the frequently diagnosed cause for cancer related deaths and tuberculosis is still the leading cause of death in developing countries. The increasing incidence of various lung lesions could be attributed to smoking, occupational hazards, increased environmental pollution. Early and accurate diagnosis is required to effectively manage these diseases.[1] The advent of Flexible fiber-optic bronchoscopy revolutionized the access to the pulmonary cytological specimens and in turn aided in effective diagnosis of pulmonary lesions via respiratory cytology. Cytological assessment of specimens of the respiratory tract is one of the important initial diagnostic techniques carried out in a patient with suspected lung lesion. The utilities of cytology are extensive and help in planning the treatment without the requirement for an open biopsy.[6] Flexible fiber optic bronchoscopy aids in sampling of bronchial wash, bronchial brushing, broncho-alveolar lavage and transbronchial needle aspiration, yielding significant amount of material.[7] Bronchoscopic guided techniques became accessible and popular, shifting the emphasis from biopsy to the use of cytology as a first line diagnostic and management tool in patients with advanced or inoperable malignancy.[1]

The present study was done to compare and evaluate the efficacy of bronchial cytology with histopathology and the utility of bronchial cytology in diagnosis of lung lesions. Bronchial cytology is of great use for diagnosis in patients where biopsy is contraindicated or biopsy site is not reachable.[2]

The age group of the patients included in this study ranged from 18 years to 80 years. The age group of patients in the non-neoplastic lesions ranged between 30 years to 60 years with male preponderance. Out of the 40 cases where cyto-histopathological correlation was done, 20 (50%) cases were true negative. Tuladhar et al[8] in their study observed nonspecific inflammation in 53.3% of cases. In our study nonspecific inflammation was seen in 37.5% of True Negative cases and 60% of all cases.

3 cases of tuberculosis were diagnosed in our study, one TN and two cases of BAL on cytology showed Acid Fast Bacilli (AFB) positivity.

Baughman et al[9] in their study found that BAL is more sensitive in detecting Tuberculous bacilli (TB). Altaf Bach A et al[10] in their study had 35% of cases of bronchial washings positive for AFB. Purohith et al[11] demonstrated AFB in 42% cases and Kulpati et al[12] demonstrated AFB bacilli in 40% of cases.

In the present study 2 cases showed features of lung abscess/ bacterial origin. Shroff CP et al[13] and Tuladhar A et al[8] found 1.5% and 13.3% cases of lung abscess respectively in their series.

In the whole study 16 cases (TP 15 + 1 FP) were labeled as lung malignancies with slight male preponderance and M: F ratio being 1.4:1 and age ranged between 40 years to 80 years. Many studies showed similar findings like male preponderance and elderly age.[1,14]

Out of 40 samples where cytological and histopathological examination was done 15 cases were TP (malignancies). In the 15 TP cases, adenocarcinoma was the predominant (46.6%), followed by small cell carcinoma (26.6%), small round cell tumor (20%) and poorly differentiated carcinoma (13.3%).

Our study is similar to the studies done by Vivekanand et al[14] and Anupama sharma et al,[15] where adenocarcinoma cases were more in number compared to small cell carcinoma. The results in our study are different from the study by Razia et al,[1] where small cell carcinoma dominated the picture.

The incidence of adenocarcinoma has significantly increased in the last two decades and this tumor is the most common form of lung carcinoma in women and in men as well.[16]

Various studies showed that small cell carcinoma and poorly differentiated carcinoma usually form a minor part of all the malignancies and in our study they accounted for 26.6% and 13.3% respectively which correlated with the study done by Pradeep et al.[17]

Four FP cases accounting for 10% were detected in our study. One case had only superficial biopsy and other 3 cases had severe inflammation and the atypia might be attributed to inflammation. Similar findings were observed in a study done by Tanwani AK.[18]

These false positive cytological results may have serious consequences in patients where biopsy is not possible. Therefore atypia in inflammatory smears should be reported only after clinical and radiological correlation.

Only one case in our study was FN where smears were made from BW and is lesser than other studies.[1,18] The reasons for false negative results could be non-representative sample or hypocellular aspirates.

Comparison of cytological characters of bronchial brushings and washings showed that cellularity was greater in brush specimens compared to bronchial washings. This is proved in many studies.[19] Fig. 2

Over all sensitivity of bronchial cytology is 93.75% and specificity is 83.33%. The Positive Predictive value is 78.95% and negative predictive value is 95.24%. The diagnostic efficacy is comparable to a study by Jay and colleagues.[20]

Truong et al[21] and Chaudhary et al[22] concluded from their studies that the accuracy of bronchial cytology was 75% and 75.4% respectively. This correlation was 80.5 % in study by Naryshkin and Daniel.[23]

In another 2 studies the correlation was 88.4% and 80.5%.[1,18]

Comparison with other studies Table 2.

Table 2: Comparison with other studies

Study	Sensitivity	Specificity	Positive Predictive Value
Present study	93.75%	83.33%	95.24%
Jay SJ et al	87%	90%	79%
Ahmad M et al	80.5%	96.6%	97%
Razia D et al	87.5%	92.85%	
Truong et al	B B - 80% BW – 60%		
Chaudhary et al	BW - 80.9% BB - 47.6%	85.7% 71.4%	
DS Gaur et al	BB - 87.3% BAL- 9.4%	97.6% 89.6%	

Conclusions

Bronchial washings and brush cytology has very good sensitivity, specificity, and accuracy. Compared to bronchial lavage, cell yield is more in bronchial brushings and can be used in diagnosing malignant lesions. BAL is superior to bronchial brushings in detecting TB bacilli.

The information yielded by bronchial cytology is almost the same as that of biopsy and can be used for diagnosing malignancies where only cytological sample is available. It is economic, safe and is of great use in patients with evidence of obstruction, risk of hemorrhage or lesion at an inaccessible site.

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