A Comparative Study Between Bronchoalveolar Lavage Cytology and Bronchial Biopsy in Diagnosis of Lung Malignancies

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Abstract:

Background: Currently lung malignancy is the commonest malignancy in the world and also the commonest cause of the malignancy related deaths. Different diagnostic methods available to diagnose lung malignancy are imaging study, different types of cytological studies (BAL cytology, bronchial brush cytology, TBNA etc.) and histopathological examination (HPE) of bronchial biopsy. This study was aimed to compare the results of BAL cytology with HPE of bronchial biopsies and to correlate results, as HPE is considered as gold standard for tissue diagnosis.

Materials and Methods: This study was carried out at C. U. Shah Medical College, Surendra Nagar in the pathology department from January 2018 to December 2022 (5 Years) including 122 patients attending the medicine OPD and was suspicious for lung malignancy. These all patients underwent bronchoscopy followed by collection of BAL fluid for cytology and biopsy for HPE. BAL cytology and HPE of biopsy were done in pathology department. Results of both were compared and correlated.

Results: In this study total 122 patients were clinically suspected for lung malignancy. Among which tumour was found in 74 cases on BAL cytology but on HPE 80 patients came out as malignancy. Total number of false positive and false negative cases was 4 and 6 respectively. Sensitivity of BAL cytology was found to be 92.5% and specificity was 90.4%

Conclusions: BAL cytology results and bronchial biopsy (HPE) reports are correlated well for the diagnosis of lung malignancy. Though specific diagnosis or exact typing was done on biopsy only. Sensitivity value of BAL cytology is quite good in our study so it is concluded that BAL cytology can be used as a screening tool for diagnosing lung malignancy and ultimately guide the treating clinician to guide the further management of the patient of lung malignancy.

Keywords: Bronchoalveolar Lavage (BAL) Cytology, Histopathological Examination (HPE), Bronchial Biopsy, Lung Malignancy.

Introduction

Lung malignancy is the commonest malignancy worldwide and the commonest cause of malignancy associated deaths worldwide [1]. Lung malignancy contributes 17% to the total incidence of malignancy in males and 23% of total malignancy related deaths are due to lung malignancy [2]. Now a day, the incidence of lung malignancy is increasing drastically in females also and has kept the breast malignancy behind. Increase in number of lung malignancy related deaths can be due to late presentation of the patient to the clinician as such patients remain asymptomatic until advanced stage. Morbidity and mortality due to lung malignancy can be decreased and prevented by early diagnosis and timely radical treatment [3]. Different diagnostic modalities available nowadays are 1. Radiology-imaging studies 2. Bronchoscopy 3. BAL cytology 4. Transbronchial needle aspiration 5. Bronchial brush cytology 6. Bronchial biopsy and histopathological examination. Histopathological examination is considered gold standard and confirmatory mode for the diagnosis and follows up but it requires expertise to collect biopsy from the representative area of tumour, it is

invasive procedure, HPE takes more time than cytology procedure. Diagnostic ratio of bronchoscopy is lower for peripheral lesion. However, in case of more peripheral lesion that cannot be seen on bronchoscopy, BAL sample/ Bronchial washing and brushing from affected lobar segment, cytological examination plays crucial role for diagnosis. BAL can also provide diagnostic information for primary and metastatic lung cancer [4,5,6].

BAL is easy to perform with good patient tolerance and it is used as a routine procedure for assessment of suspicious lung cancer. So, present study was aimed to compare the result of BAL cytology with bronchial biopsy histopathological examination and to correlate the above findings and ultimately to ascertain the role and diagnostic utility of BAL cytology and biopsy in diagnosing and further management of patient of lung malignancy.

Materials and Methods

This was a retrospective data analysis carried out in the department of pathology at C U Shah Medical College And Hospital, Surendra Nagar, Gujarat, India. Data were collected from the Department of Respiratory Medicine and from the Pathology Department from January 2018 to December 2022 (five years). We included 122 patients clinically suspected for lung malignancy and undergone bronchoscopy procedure followed by collection of bronchoalveolar lavage sample for cytology and bronchial biopsy for HPE.

 All the demographic data including age, gender, clinical history were collected from respiratory medicine department and results of BAL cytology and HPE of bronchial biopsy were collected from pathology department.

BAL cytology reports were were grouped into malignant, suspicious/atypical and negative for malignant cells. Bronchial biopsy reports were grouped according to 2021WHO classification of lung tumours. Data collected was analysed in detail including age and gender distribution of lung malignancy. Comparison between BAL cytology and bronchial biopsy reports were done. Statistical analysis including sensitivity, specificity, positive predictive value, negative predictive value, diagnostic accuracy and diagnostic yield of BAL cytology as compared to HPE were calculated. Results were compared with other similar studies.

Results

In our study of total 122 patients who undergone bronchoscopy followed by BAL cytological examination and HPE of bronchial biopsy were included in the study. The overall mean age of patients of lung cancer was 60.23 years with maximum number of cases are found between 60-69 years. The mean age for males was 61.02 years and for females, it was 57.63. All the suspicious for malignancy cases on BAL cytology, we have considered them as positive.

Out of 122 cases, 78 were positive for malignant cells on cytology among which 74(True positive) were confirmed as malignancy on HPE of biopsy and 04 (False positive) cases were diagnosed as negative for malignancy. 44 patients out of 122 were given Negative for malignancy on BAL cytology, out of which 38 (True Negative) patients were confirmed negative on HPE but 06 (False negative) cases were turned out as malignancy on HPE. (Table 1)

Table 1: Cyto Histo correlation of BAL fluid and Bronchial biopsy

BAL Cytology	HPE reports		Total
	Malignant	**Non-malignant**	
Positive for malignant cells	74 (TP)*	04 (FP)*	78
Negative for malignant cells	06 (FN)*	38 (TN)*	44
Total	**80**	**42**	**122**

*TP- True Positive, *FP- False Positive, *FN- False Negative, *TN- True Negative

False positive cases though very few in numbers but may be due to metaplastic cells, reactive atypia in bronchial epithelial cells due to severe inflammation followed by changes of fibrosis. False negative diagnosis may be explained by smaller tumour size, poorly visualized tumour on bronchoscopy, sample taken from nonrepresentative areas of tumour or excessive presence of mucous or blood which may obscure the few numbers of atypical cells. On BAL cytology, 7 patients were reported as unsatisfactory for evaluation on cytology, out of which 6 patients were, came out as negative for malignancy on biopsy and only one came out as positive. So, these

6 were counted among negative for malignancy and remaining one counted as false negative on Bal cytology.

Histopathological diagnosis is considered as gold standard for tissue diagnosis hence cases diagnosed as malignant on both cytology and histopathology were considered as true positive and those diagnosed negative on both as true negative. The cases diagnosed malignant on cytology and found negative on histopathology were considered as false positive and those diagnosed negative on cytology and turned out to be malignant on histopathology were considered as false negative.

Statistical analysis including Sensitivity and specificity were calculated, results of the same are as below. (Table 2)

Table 2: Statistical Analysis:

True positive (TP)	74 (60.65%)
True negative (TN)	38 (31.14%)
False positive (FP)	04 (3.27%)
False negative (FN)	06 (4.91%)
Sensitivity	92.5%
Specificity	90.4%
Positive predictive value (PPV)	94.8%
Negative predictive value (NPV)	86.3%
Diagnostic accuracy	91.80%
Diagnostic yield	88.09%

Discussion

In our study, most of the patients were presented with history of chronic cough with or without production of sputum; if the cough is productive then it was associated with haemoptysis in majority of the cases, history of loss of weight and mild fever and weakness. Majority of the patients were having history of smoking for longer duration.

In our study, 80 patients were diagnosed as lung malignancy on bronchial biopsy, out of which 70 were males and 10 patients were females. Male to female ratio is 7:1. Study done by Bhat N et al. found the male to female ratio 5.7:1[7]. In a study Faludi et al in their study found male to female ratio 6.22:1 [8]. Results of our study are consistent with above studies. whereas study by Bodh et al 2013 showed male: female ratio of 3.35:1 [9].

Total 80 patients diagnosed malignancy on HPE of bronchial biopsy, among which 18 were diagnosed as squamous cell carcinoma (22.5%), 11 patients (13.75%) were diagnosed as adenocarcinoma including mucinous signet ring cell carcinoma and Bronchoalveolar carcinoma. 6 patients (7.5%) were diagnosed as small cell carcinoma, one (1.25%) as neuroendocrine carcinoma. 27 patients (33.75%) diagnosed as poorly differentiated carcinoma, 16 patients (20%) diagnosed as non-small cell carcinoma and one (1.25%) patient diagnosed as round cell tumour. Exact typing cannot be done in cases of poorly differentiated carcinoma cases and non-small cell carcinoma cases, in which immunohistochemistry was suggested for confirmation. Bodh et al in their study found squamous cell carcinoma (38.70%) as the most common sub type followed by small cell carcinoma in (27.10%), and adenocarcinoma (23.87%).[9] From the above we conclude that squamous cell carcinoma is the most common histological type of lung cancer as is seen in our study also. Adenocarcinoma was second common cancer in our study while small cell carcinoma is the second common type of lung cancer in studies done by Bodh et al and Sheikh S et al. [9,10] In many cases exact typing could not be done, which can contribute to above variable results in our study. In western literature incidence of adenocarcinoma is more than squamous cell carcinoma. [11,12]

On BAL cytology exact typing of the malignancy was not possible due to scanty cellular smears, presence of mucoid material, blood and inflammatory cells overlapping the atypical cells. On cytology, due to centrifugation and spreading of material, pattern of the cells may not be preserved as in histopathology. So, we categorise finding of BAL cytology as positive for malignant cells, suspicious for malignant cells and negative for malignant cells.

Table 3: comparison of statistical values with other studies:

Author (year)	No. of cases	Sensitivity (%)	Specificity (%)	Diagnostic-Accuracy (%)
Pirozynski et al (1992) [13]	145	64.8		
de Gracia (1993) [4]	67	33		
Wongsurkait et al (1998)[14]	55	46.7		
Gaur DSetal (2007) [15]	196	39.4	89.6	71.4
Tuladhar et al (2011) [16]	55	66.7		
Present study (2023)	122	92.4	90.4	91.8

In the current study the sensitivity of BAL cytology was 92.5% and its specificity was 90.4%. The sensitivity of BAL in various other studies from literature varies from 21-78%. In study by Pradeep Kumar et al, BAL showed the sensitivity of (69.6%) [17]. Ahmed et al. (2004) found the sensitivity of BAL cytology to be 93.44% as compared with transbronchial biopsy and specificity was 100% [18]. Fariba et al.(2015) found the sensitivity of BAL 46.9% and its

specificity was 91.6%[19]. In study by Manish et al. (2018), he found sensitivity 76% and specificity 100% [20]. Pirozynski found in their study on 145 patients with biopsy proven lung cancer, BAL was diagnostic in 64.8% revealing malignant cells. In 35.9% of these patients, the cytologic diagnosis correlated with final diagnosis of resected specimen of tumour [13]. Wongsurkiat et al found that the cell type diagnosed by BAL correlated with final diagnosis in 50% of patients [14]. Gaur D S et al in their study noted that BAL was diagnostic in 17.9% cases (5/28) of squamous cell carcinoma, 7.1% cases (2/28) as small cell carcinoma and as many as 71.4% samples classified as poorly differentiated carcinoma [15].

Studies have shown that increasing the number of attempts at obtaining BAL sampling can improve its sensitivity, specificity and accuracy. In comparison to above studies, our study shows higher sensitivity and specificity which can be explained by the technical expertise for the collection of the sample of BAL and biopsy, use of adequacy check of the samples on site whenever possible, continuous feedback by the pathology department about the sample quantity and quality and corrective actions taken by the clinicians. Less number of false positive cases is strength of BAL cytology.

Conclusion

Bronchoscopic biopsies give better yield of the specimen then BAL fluid so that exact histologic diagnosis was made by biopsies only. Immunohistochemistry and molecular diagnosis is possible with paraffin block of the biopsy specimen. Sensitivity of BAL in our study was 92.5% and specificity was 90.4%.

BAL cytology is cheaper, rapid and reliable tool for diagnosing lung cancer. We concluded that BAL cytology can be used as screening tool for diagnosing lung malignancy preferably along with biopsy. A combination of both BAL and bronchial biopsy significantly increases the diagnostic accuracy.

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