

Evaluation of Bronchoalveolar Lavage Cytology and Comparison with Endobronchial Biopsy

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ABSTRACT

Introduction: Early diagnosis of infective etiology and lung cancer plays a vital role in reducing mortality rate of lower respiratory tract disease. Different modalities can be applied for early diagnosis e.g. bronchoalveolar lavage and endobronchial biopsy. Cytological and histopathological diagnostic techniques are safer, economical and provide appropriate results. **Aims:** To find out diagnostic yield of bronchoalveolar lavage cytology in diagnosing lung pathology and to determine its sensitivity, and specificity in malignant cases considering endobronchial biopsy as the gold standard. **Methods:** This hospital based analytical study was carried out in the Department of Pathology at Nepalgunj medical college, Nepalgunj during the period from January 2023 to September 2023 with a total of 50 participants. **Results:** 29(58%) patients were male and 21(42%) female; the mean age was 53.16 ± 19.9 years. Considering histopathological findings, maximum patients of malignant cases had squamous cell carcinoma 3(6%), then adenocarcinoma 1(2%). The sensitivity, specificity, positive and negative predictive value of bronchoalveolar lavage in malignant cases were 75%, 100%, 100% and 50% respectively. **Conclusion:** Bronchoalveolar lavage fluid cytology is a useful tool for diagnosis of lung cancer. It has good sensitivity, and specificity, and shows nearly identical information as biopsy.

Keywords: Bronchoalveolar lavage, Carcinoma, Endobronchial lesion

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INTRODUCTION

Bronchoalveolar lavage (BAL) is minimally invasive procedure in which introduction of a flexible bronchoscope into sub segment portion of lung is done. Fiberoptic bronchoscopy has dramatically transfigured pulmonary medicine and is preferred diagnostic procedure for various pulmonary diseases¹⁻³ and is used for sampling technique like bronchoalveolar lavage and endobronchial biopsy.⁴ BAL is performed in cases where clinical, radiological and routine laboratory investigations cannot confirm diagnosis.⁵ BAL is usually safe diagnostic method for assessment of cases with lung disease and is well tolerated by patient.⁶ Recently BAL procedure is popularized as initial diagnostic as well as therapeutic method of lower respiratory tract diseases. Therapeutic purpose is for aspiration of endobronchial secretion and management of foreign body removal.⁷⁻⁹ BAL reveals more diagnostic yield for targeted sampling of the lower respiratory tract with scant microbial contamination from the upper respiratory tract.¹⁰ Endobronchial biopsy is obtained from proximal airway generally taken from sub segmental and segmental subcarine areas from second to fifth generation of airway branching.¹¹ Only few studies have attempted to correlate the yields of

bronchoalveolar lavage and endobronchial biopsy as well as comparing these diagnostic methods in lower respiratory tract pathology especially in midwestern region of Nepal. The aim of this study was to evaluate the diagnostic utility of bronchoalveolar lavage cytology and to compare with bronchoscopically visible lesion through endobronchial biopsy and to determine the sensitivity, and specificity of BAL fluid cytology in malignant cases considering the bronchial biopsy as the gold standard.

METHODS

After obtaining ethical clearance from institutional review committee, this hospital based analytical study was conducted over a period of 9 months (January 2023 to September 2023) at Nepalgunj Medical College, Nepalgunj to determine and evaluate diagnostic utility of bronchoalveolar lavage cytology followed by comparison with endobronchial biopsy sample received in cases with visible lesions in lower respiratory tract. Bronchoalveolar lavage and endobronchial biopsy received in Pathology department during study period were included for the study. Bronchoalveolar lavage procedure was done under sterile conditions using 5mm flexible fiber optic

bronchoscope after spraying 10% lignocaine locally. BAL fluids were collected in 15ml tubes and were placed at 4 degree Celsius until staining. This step is followed by centrifugation and staining with air dried smear as Giemsa stain, alcohol fixed smears as Papanicolaou method, Ziehl Neelsen method and Gram staining method. Endobronchial biopsy obtained in histopathology department were further processed and stained with Hematoxylin and Eosin stain. During the study period, there were only 20 cases who underwent endobronchial biopsy thus sensitivity, specificity, positive predictive value and negative predictive value for malignant cases were only calculated. Data were collected in Microsoft Excel 2007 and were further analyzed using SPSS version 23.

RESULTS

During the period of nine month, 50 bronchoalveolar lavage specimens were submitted for cytological examination. Among 50 cases; 29(58%) were male and 21(42%) were female. The mean age for bronchoalveolar lavage cytology cases was 53.16 ± 19.9 years. Least age was of 19 years and highest was of 96 years.

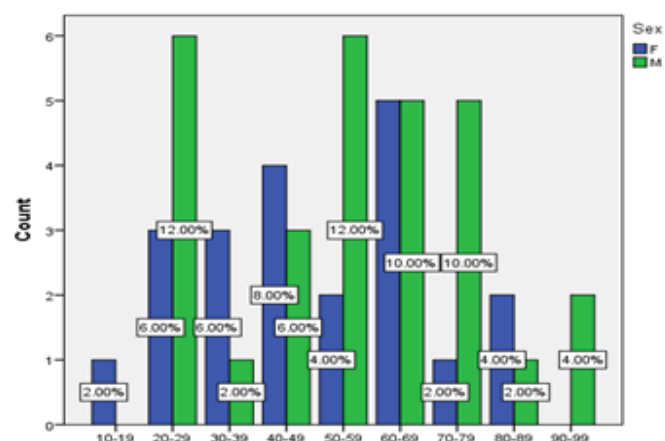


Figure 1: Distribution of cases among different age group and gender

Among 50 bronchoalveolar lavage cases, 29 patients were cytologically diagnosed as small airway inflammatory disorder. 13 cases were diagnosed as negative for malignancy with bronchoalveolar lavage cellularity within normal range while 5 cases were of pulmonary tuberculosis. 3 cases were diagnosed as suspicious for non-small cell lung carcinoma as shown in Table I.

| Bronchoalveolar Lavage Cytology Diagnosis | Frequency (Number Of Cases) | Percent (%) |
|---|-----------------------------|-------------|
| Negative for malignancy, bronchoalveolar lavage cytology cellularity within normal range. | 13 | 26 |
| Pulmonary tuberculosis | 5 | 10 |
| Suggestive of small airway inflammatory disorder | 29 | 58 |
| Suspicious for non small cell lung carcinoma | 3 | 6 |
| TOTAL | 50 | 100 |

Table I: Distribution of bronchoalveolar lavage cases among different cytology diagnosis

Out of 50 bronchoalveolar cytologically diagnosed cases, 3 cases were suspected for malignancy as nonsmall cell lung carcinoma in BAL cytology and were confirmed as nonsmall cell lung carcinoma in histopathological examination. Among small airway inflammatory disorders cytological diagnosis in bronchoalveolar lavage, predominant inflammatory cell was found to be neutrophils. Negative for malignancy revealed predominantly alveolar macrophages in differential count. Table II.

| Differential count | Minimum differential cell count | Maximum differential cell count | Mean | Standard deviation |
|---|---------------------------------|---------------------------------|------|--------------------|
| Differential cell count in BAL – Neutrophils | 5 | 90 | 46.7 | 28.5 |
| Differential cell count in BAL - Alveolar macrophages | 10 | 95 | 47.5 | 27.9 |
| Differential cell count in BAL – Lymphocytes | 0 | 70 | 5.80 | 17.9 |

Table II: Differential count in Bronchoalveolar lavage cytology

In 4 patients (8%) out of 5 pulmonary tuberculosis cases in BAL cytology revealed neutrophilic predominance but in one case it was with lymphocytes (2%). Suspicion of malignancy in BAL cytology could be made out only in 3 cases. One case which was diagnosed as suggestive for small airway inflammatory disorder in BAL cytology, was diagnosed and confirmed as nonsmall cell lung carcinoma in histopathological examination. Morphology of atypical squamous cells with features suggestive of squamous cell carcinoma in bronchoalveolar lavage cytology is shown in Figure 2.

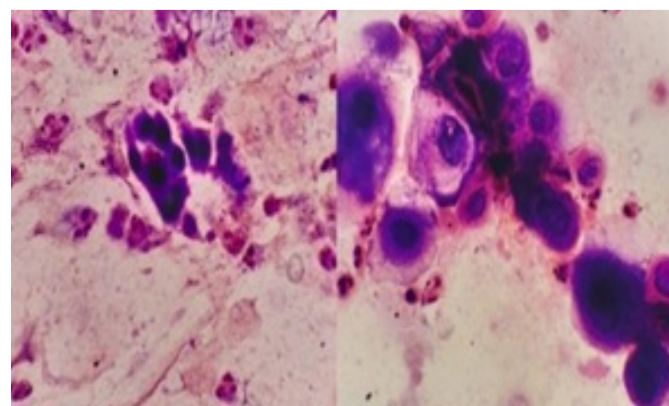


Figure 2: Bronchoalveolar lavage cytology with atypical squamous cells (Pap stain X 100)

Out of 50 bronchoalveolar lavage sample, only 20 patients were further biopsied. Morphological features were observed and 3 cases were diagnosed as squamous cell carcinoma and one case was diagnosed as adenocarcinoma in morphology. Morphological features of squamous cell carcinoma with Hematoxylin and Eosin (H&E stain) are shown in figure 3.

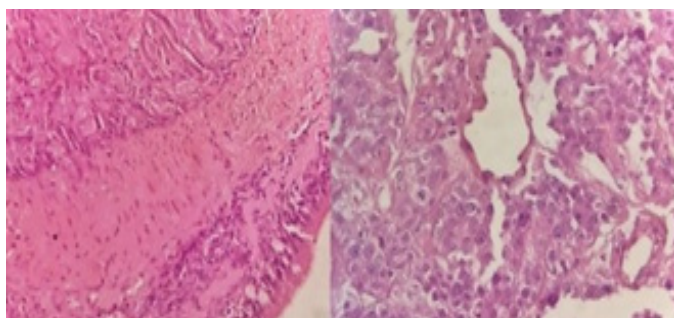


Figure 3: Endobronchial biopsy with morphological features of squamous cell carcinoma (H&E X 100)

Among 20 biopsy cases, 4 were of malignancy in histopathological examination, 15 were of chronic nonspecific bronchitis and one case was nonspecific chronic inflammation with squamous metaplasia. Comparison of twenty histopathological findings with bronchoalveolar lavage is shown in Table III.

| Endoscopic biopsy | Bronchoalveolar lavage cytology diagnosis | | | |
|--|---|------------------------|--|--|
| | Negative for malignancy – Bronchoalveolar lavage cytology cellularity within normal range | Pulmonary tuberculosis | Suggestive of small airway inflammatory disorder | Suspicious for non small cell lung carcinoma |
| | 13 | 5 | 12 | 0 |
| Chronic nonspecific bronchitis | 0 | 0 | 15 | 0 |
| Non small cell lung carcinoma suggestive for squamous cell carcinoma | 0 | 0 | 1 | 2 |
| Non small cell lung carcinoma - suggestive for adenocarcinoma | 0 | 0 | 0 | 1 |
| Squamous metaplasia with reactive atypia | 0 | 0 | 1 | 0 |

Table III: Distribution of cases in bronchoalveolar lavage and biopsy

One of the cases diagnosed as non small cell lung carcinoma in BAL cytology also revealed features suggestive of fungal infection morphologically resembling with *Candida* species as shown in Figure 4.

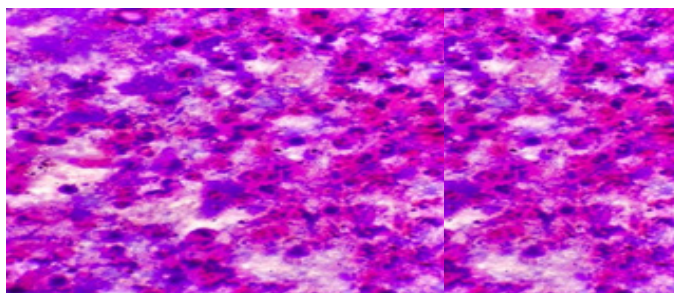


Figure 4: Budding spores morphological resemblance with *Candida* species (Pap stain X 100 with arrow)

Sensitivity of bronchoalveolar lavage cytology for diagnosis of malignant lung pathology was 75% whereas specificity was found to be 100%. Positive predictive value for malignancy was 100% while negative predictive value was found to be 50%.

DISCUSSION

Among 50 cases present study revealed 29 cases were male and similar findings with male predominance in bronchoalveolar lavage cytology was noted by Siddiqui A et al.¹² As neutrophilic predominance was found in small airway inflammatory disorder, most common causes of neutrophilia in bronchoalveolar cytology was found to be in pulmonary infections, acute interstitial pneumonia, diffuse alveolar damage, acute exacerbation of interstitial pulmonary fibrosis as suggested by Meyer KC and Midulla F et al.^{13,14} Present study revealed macrophages predominance with more than 80% differential cell count in bronchoalveolar lavage cytology cases which were diagnosed as bronchoalveolar lavage cytology cellularity within normal range and similar findings were observed by Ratgen F et al in children and Ernst A et al in adults as predominance of alveolar macrophages in normal bronchoalveolar lavage.^{15,16}

Neutrophilic predominance is seen in cases diagnosed as pulmonary tuberculosis in present study and similar findings were observed by Ozaki T et al.¹⁷ The sensitivity of bronchoalveolar lavage cytology to diagnose malignant lung etiology in various other literature studies varies from 21 to 78%.¹⁸ In present study, sensitivity of BAL cytology for diagnosing malignant cases fall within this range comparing with gold standard technique of histopathology among pathological lesion noted in bronchoscopic examination. Present study revealed squamous cell carcinoma followed by adenocarcinoma as most common malignancy in endobronchial forceps biopsy and similar findings were observed by Karcioğlu O et al.¹⁹

One case which was misdiagnosed as small airway inflammatory disorder in cytology was further corrected and confirmed as squamous cell carcinoma. Similar observation as pitfall in cytology were observed by Idowu MO et al and Saad RS et al and recommended to clinical and radiological correlation with cytomorphological findings in patient with pathological lesion in lower respiratory tract.^{20,21} In this study sensitivity, specificity, positive predictive value, negative predictive value of BAL cytology for diagnosing malignant cases were 75%, 100%, 100% and 50% respectively. Similar findings were observed by Sarkar SM et al revealing sensitivity of BAL with 70.59%, specificity as 100%, positive predictive and negative predictive value as 100% and 28.57% respectively.²²

LIMITATIONS

As limited cases only presented with suspected pathological lesion in lower respiratory tract; only few cases of endobronchial biopsy could be compared with bronchoalveolar lavage cytology.

CONCLUSION

Among developing country like Nepal where there is excessive burden of Tuberculosis in general population, there is higher chance of missing other etiology of lower respiratory tract like infection and malignancy; therefore it is reasonable and judicious to use lung cytology. BAL is useful in diagnosis of lower respiratory infections and malignancies. If pathological lesion is noted in fiberoptic bronchoscopy observation, it is recommended for histopathological examination technique as an initial diagnostic observational approach for confirmation. A combination of clinical information (history, examination), bronchoalveolar lavage analysis and endobronchial biopsy may help the clinician for definite diagnosis and management of lower respiratory tract pathology. Thus, BAL fluid cytology is a useful tool for the diagnosis of lung cancer. It has good sensitivity, and specificity, and shows nearly identical information as biopsy.

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