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Original Research Article

Retrospective Study of the Utility of Bronchoalveolar Lavage Fluid Cytology in Diagnosis of Broncho Pulmonary Diseases

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Abstract:

Background & Methods: Despite radiographic and clinical examinations, laboratory testing and function studies some bronchopulmonary disorders can prove to be a diagnostic challenge .A minimally invasive diagnostic technique called bronchoalveolar lavage (BAL) involving the collection of cells for cytology from the bronchial and alveolar spaces performed using a flexible fibreoptic bronchoscope as a day care technique can provide an accurate diagnosis, which helps with patient management.

Results: This study included 60 patients investigated for non-neoplastic and neoplastic lung diseases based on the clinical and radiological findings. The median age of these cases was 51.5±15.75 years, including 44 (73.3%) males and 16 (26.7%) females. BAL was done in all the cases. The chi-square statistic is 45.4789. The *p*-value is < 0.00001. The result is significant at $p < .05$.

Conclusion: The data from the current study suggest that differential cell counts and cytological examination for malignant cells in BAL provide diagnostic information of fundamental importance in frequently occurring Neoplastic and non-neoplastic lung diseases in the community.

Keywords: bronchoalveolar, lavage, cytology & broncho pulmonary diseases.

Study Design: Observational Study.

Introduction

Worldwide, a great number of people suffer from lung disorders both neoplastic and non-neoplastic. They are the reasons of notable morbidity. Lung disorders frequently pose a diagnostic challenge to both physicians and pathologists. Among the aetiologies included in this category are infectious, granulomatous, neoplastic, and interstitial lung disorders [1]. The respiratory system's nterstitial lung illnesses are fibrosing and inflammatory disorders that primarily affect the alveolar parenchyma and alveolar spaces, with bronchi and bronchioles being less frequently affected [2]. The illnesses known as pulmonary granulomatous lung disorders are diverse, exhibiting a wide range of pathologies, inconsistent clinical manifestations, and unpredictable consequences [3]. All stages of life are affected by infectious respiratory disorders, which are more prevalent than infections of other organs [4]. A modest but considerable fraction of cases have lung cancers.

Lung function tests and haematological examinations supplement radiographic evidence, which is the main source of diagnosis for both neoplastic and non-neoplastic lung illnesses [5]. BAL has emerged as a promising means for harvesting the cellular and noncellular elements of the distal bronchioles and alveoli for cytology [6-9]. The prevalent cellular pattern in BAL analysis continually supports a diagnosis or helps narrow the differentials when it is supported by patient history, systemic examination, and radiographic results

The objectives of this study were to study the cell types in BAL fluid, classify the findings on BAL based on cellular patterns and find the concordance between BAL cellular pattern and radiological diagnosis in cases of non-neoplastic and neoplastic lung diseases [10-13].

Material and Methods

A retrospective and descriptive study was undertaken in the cytology section Department of Pathology, Bundelkhand Medical College Sagar MP India. All the bronchoscopy procedures done from February 2022 to November 2023 were reviewed. The cytological and radiological findings were compiled and statistical analysis was made in this study.

Inclusion Criteria: The data of total of 60 patients who were clinically and radiologically diagnosed with non-neoplastic and neoplastic lung disease and underwent combined BAL between February 2022 to November 2023 at BMC Sagar were included in this study.

Exclusion Criteria: Data of patients with severe coagulopathy and haemodynamics instability were excluded from the study.

The need for bronchoscopy was decided by the pulmonologist after reviewing the clinical and radiological discoveries. Informed consent was taken by pulmonologists before the bronchoscopy procedure, followed by asepsis. Anaesthetic medications, inhalation of 2% lignocaine through nebulisation and application of 2 mL lignocaine gel through the nostrils was administered before the procedure [14]. Trans-nasal flexible fibreoptic bronchoscopy was performed, using olympus bronchoscope. Around 100 mL of 0.9% saline was instilled which was followed by retrieval. The recovered volume of 10-20 mL was considered as optimum.

This fluid was sent to the lab in different containers for total and differential counts, cytology and microbiological examinations. Total count was done in Neubaeur chamber. Differential count was done on air-dried slide stained by Leishmans stain .Stains for acid fast bacilli (AFB) were done on all BAL samples, and fungal stains were done when there was a clinical and cytological suspicion and in all samples from immunosuppressed patients. Adequacy of samples was assessed based on definite criteria. A 400 cells on two separate cytology smears were observed and recorded to recognise the BAL nucleated cell profile

Chamberlain et al. criteria were used to reject samples. The criteria are:

1. Paucity of alveolar macrophages <10/10 hpfs.
2. Extensive epithelial cells.
3. Mucopurulent exudates.
4. Numerous red blood cells.
5. Degenerating changes.

to classify all the samples as lymphocytic, neutrophilic, eosinophilic and normal cellular pattern [15]. The differentials given for the distinct cellular pattern was noted. The predominant cellular pattern with its respective differential diagnosis is shown in the. The final diagnoses in all cases were made keeping the clinical presentation and radiological diagnosis in mind.

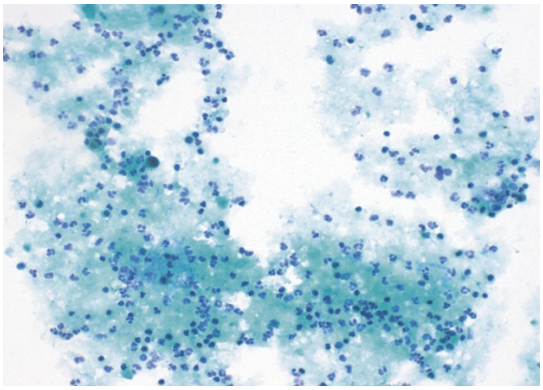

Figure 1: Inflammatory background with acute inflammation.

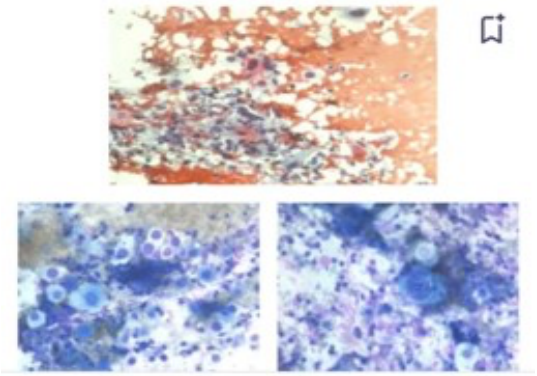

Figure 2: Positive for Malignancy Squamous Cell Carcinoma H&E-stained preparations showing malignant squamous cells

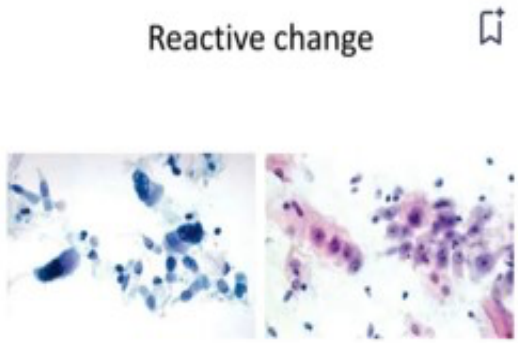

Figure 3: H&E-stained preparations showing atypical cytology consistent with reactive changes.

Figure 4: Lymphocytes

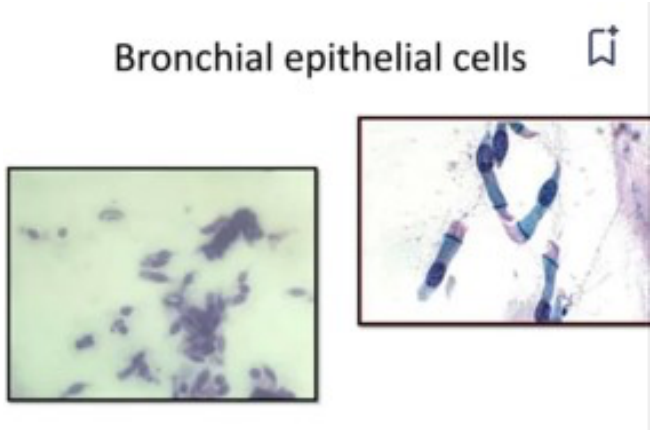

Figure 5: Bronchial epithelial cells

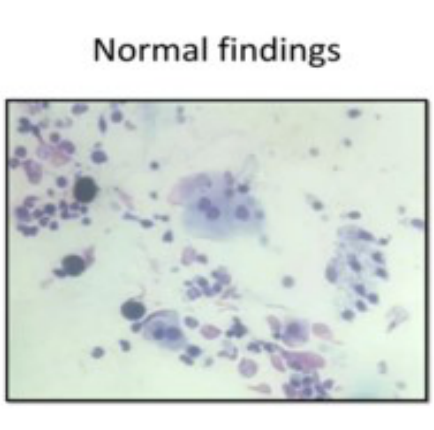

Figure 6: Normal findings

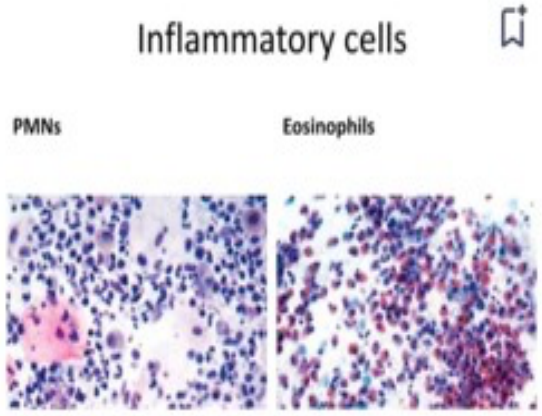

Figure 7: Inflammatory cells

Result

Table 1: BAL cellular pattern in normal adults BAL: Bronchoalveolar lavage

Cells in BAL	
Alveolar macrophages	>85%
Lymphocytes	10-15%
Neutrophils	<3%
Eosinophils	<1%
Squamous epithelial cells/ciliated columnar epithelial cells	<5%

Table 2: Disorders associated with increased percentage of specific BAL cell types [12].

Lymphocytic cellular pattern	Eosinophilic cellular pattern	Neutrophilic cellular pattern
>15% lymphocytes	>1% eosinophils	>3% neutrophils
Sarcoidosis	Eosinophilic pneumonias	Collagen vascular diseases
Nonspecific interstitial pneumonia	Drug-induced pneumonitis	Idiopathic pulmonary fibrosis
Hypersensitivity pneumonitis	Bone marrow transplant	Aspiration pneumonia
Bronchiolitis obliterans organising pneumonia	Asthma, bronchitis	Infection: bacterial, fungal
Drug induced pneumonitis	Churg-strauss syndrome	Bronchitis
Collagen vascular disorders	Allergic bronchopulmonary aspergillosis	Asbestosis
Radiation pneumonitis	Bacterial, fungal, helminthic infections	Acute Respiratory Distress Syndrome (ARDS)
Lymphoproliferative disorders	Hodgkin's disease	Diffuse Alveolar Damage (DAD)

Table 3: Sex distribution of BAL cytology in our study

BAL cytology	Male	Female
Normal cytology	02	01
Neutrophilic predominance	34	12
Lymphocytic predominance	16	06
Eosinophilic predominance	02	04
Reactive	02	01
Malignant	01	00

The chi-square statistic is 45.4789. The *p*-value is < 0.00001. The result is significant at $p < .05$.

Table 4: Age distribution of BALF Cytology

BAL cytology	<15years	15-30years	30-45years	45-60years	>60years
Normal cytology	-	01	01	01	
Neutrophilic	-	18	12	14	02
predominance	-	-	-	-	-
Lymphocytic	01	04	06	05	-
predominance	-	-	-	-	-
Eosinophilic	01	01	01	-	-
predominance	-	-	-	-	-
Reactive	-	-	01	-	01
malignant	-	-	-	-	-

The chi-square statistic is 25.3849. The *p*-value is .00029. The result is significant at $p < .05$.

Table 5: Comparative analysis of BAL fluid cytology with clinical and radiological findings in our study

S. No.	CLINICAL FINDINGS	RADIOLOGICAL FINDINGS XRAY /HRCT	BALF CYTOLOGY
1.	Fever, chest pain, cough	Consolidation Unilateral pleural effusion	Inflammatory smears Neutrophilic predominance
2.	Fever low grade with cough	Pleuroparenchymal fibrotic opacities seen in both upper lobes Pleural effusion unilateral with underlying collapse lung	Inflammatory smears Lymphocytic predominance
3.	Known and treated case of carcinoma breast	Heterogenous soft tissue lesion seen in upper chest wall. mild free fluid in right pleural cavity	Reactive mesothelial cells seen
4.	Cough with hemoptysis, weight loss	Heterodense area seen in left peri hilar area	Positive for malignancy (squamous cell carcinoma)
5.	Fever on and off, cough without expectoration exacerbated with exposure to dust and cold air	Diffuse Fibrotic opacities in both lungs	Inadequate for diagnosis

This study included 60 patients investigated for non-neoplastic and neoplastic lung diseases based on the clinical and radiological findings. The median age of these cases was 51.5±15.75 years, including 44 (73.3%) males and 16 (26.7%) females. BAL fluid cytological analysis was done in all the cases.

Statistical Analysis

The categorical data with respect to age and gender based distribution of cytomorphology of BAL fluid were expressed in proportions and the continuous data like age and gender of patients, percentage of alveolar macrophages, neutrophils, lymphocytes and eosinophils were studied . The data analysis was conducted in SPSS version 18.0. A p-value of <0.05 was taken as statistically significant.

Discussion

BAL is a helpful and safe method for examining cell components of lung. In focuses having bronchoscopic office [16]. distinguishing proof of cell design in BAL cytology is useful both to the pulmonologist and pathologist as it tightens the rundown of differential finding. Presence of dysplastic cells supports the finding of little and non-little cell lung growths.

In patients with positive tuberculin test and unusual chest radiographs represent a demonstrative quandary to clinicians. Bronchoscopy is helpful in

such cases to get lavage, where different modalities are not contributory .Bronchoalveolar lavage can be an exceptionally valuable in the determination of contagious diseases. BAL has a responsiveness of 98%. It is practically equivalent to bronchial biopsy in awareness and specificity[17]. parasitic staining was acted in lavages from immunosuppressed patients and when there is clinical or cytological doubt. In contagious sores, morphological examination on Gomori's Methenamine Silver and PAS stained spreads helps in diagnosing different organisms. BAL furthermore gives material to culture and sensitivity[18-20].

The finding of neoplastic sores of the lung is an indicative issue for pulmonologists since a few threatening injuries emulate irresistible or fiery circumstances. In such a clinical setting, BAL plays a significant part in distinguishing neoplastic cells or can likewise preclude threatening lesions.[21]The job of BAL depends on development design, cytological qualities and connection of morphology with imaging highlights and demonstrative worth added by new investigations.[22] Utilization of BAL in diagnosing lung danger was first detailed in mid 1980s. Demand et al.[23] analyzed the yield of different symptomatic methods and presumed that yield of BAL was high (66%) when contrasted with washings (57%), brushings (40%), transbronchial biopsy (44%). Bronchoalveolar lavage is lacking to analyze the particular kind of interstitial lung infections (ILDs). BAL has no prognostic worth and can't anticipate reaction to treatment.

Conclusion

The data from the current study suggest that differential cell counts and cytological examination for malignant cells in BAL provide diagnostic information of fundamental importance in frequently occurring Neoplastic and non-neoplastic lung diseases in the community.

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