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ORIGINAL RESEARCH

Role of Bronchoalveolar Lavage in Undiagnosed Lung Diseases

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Abstract

Introduction: Bronchoalveolar lavage (BAL) is a diagnostic procedure by which cells and other components from bronchial and alveolar spaces are obtained for various studies. One of the main advantages of BAL is that it can be done as a day care procedure. Material obtained by BAL can give a definite diagnosis in conditions such as infections and malignancies.

Aim: To assess the utility of BAL as a tool to determine the diagnostic accuracy of the material obtained from BAL in various infections and neoplastic lesions and to study the limitations of BAL in certain lung disorders.

Material and Methods: This study was done in a tertiary care center and teaching college in North India. Bronchoscopy was done in 120 cases and lavage fluid was obtained. Microbiological examination and cytological evaluation was done for each case.Cases selected included non-resolving pneumonias, diffuse lung infiltrates, and ventilator-associated pneumonias.It is an observational and cross-sectional study with intent to look for findings in bronchoalveolar lavage in suspected lung disease. During our study, BAL was done in 120 patients and results were analyzed by calculating percentage, proportion and mean. Analysis was done using the SPSS version 20. Descriptive statistics and diagrammatic representation were performed to describe the studied variables.

Results: Bronchoalveolar lavage was done in 120 cases over a period of 1 year. Tuberculosis was diagnosed in 10 cases, fungal infections in 7 cases. Twenty-two cases of bacterial pneumonias were diagnosed; Klebsiella, Streptococcus and Pneumococcus were the most common organism. Malignancy was diagnosed in thirty-six cases. Adenocarcinoma was the most common type identified.

Conclusion: Definite diagnosis can be made in tuberculosis, fungal infections, bacterial pneumonias and in malignancies. It is not only used as a useful diagnostic tool in diagnosing bacterial pneumonias, tuberculous lesions, fungal infections but also malignancies and diffuse lung diseases (DLDs).Its role is limited in diagnosing and prognosticating DLDs. The number of lesions with a definite diagnosis outnumber the lesions that cannot be diagnosed hence we opine that BAL is a useful diagnostic modality not only for routine diagnosis, butals of orancillary techniques and research purpose.

Keywords: Bronchoalveolar Lavage, Pneumonia, Lung Cancer

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Introduction

By definition BAL (Bronchoalveolar lavage) is a method for the recovery of cellular and non-cellular components from the lower respiratory tract (e.g. alveoli). It is minimally invasive and a safe technique, with very few complications. Since the introduction of the rigid bronchoscope by Dr. Jackson [1] in 1904, bronchoalveolar lavage (BAL) had become an increasingly important tool in pulmonary diseases. Primary, BAL was used as a treatment for patients who suffered from diseases associated with accumulation of purulent secretions such as alveolar proteinosis, cystic fibrosis and bacterial pneumonia.

Bronchoalveolar lavage is a valuable means of accurately evaluating the inflammatory and immune processes of the human lung. Although lavage recovers only those cells and proteins present on the epithelial surface of the lower respiratory tract, comparison with open lung biopsies shows that these constituents are representative of the inflammatory and immune systems of the alveolar structures. With the use of these techniques, sufficient materials are obtained from normal individuals to allow characterization of not only the types of cells and proteins present but their functions as well. Such observations have been useful in defining the inflammatory and immune capabilities of the normal lung and provide a basis for the study of lung disease. Lavage methods have been used to characterize inflammatory and immune processes of the lower respiratory tract in destructive, infectious, neoplastic, and interstitial disorders[2].

In the past three decades, BAL has proven a most valuable clinical as well as research tool[3]. Nonetheless, BAL has gained widespread acceptance as a clinical procedure that allows sampling of respiratory secretions with its leukocytes, other cellular components such as invading bacteria, and acellular components such as cytokines, viral particles, and microbial signatures (e.g., proteins and nucleic acids). Analysis of BAL fluid can lead to the diagnosis of pulmonary infection as well as provide WBC differential cell counts and other findings that can aid in the diagnosis and management of a variety of lung diseases, but the results of BAL analysis must always be interpreted in the context of clinical presentation, radiographic imaging studies, and other pertinent testing.

If BAL is used with a thorough understanding of its limitations, it may provide information that can establish a diagnosis. Even if it is not diagnostic, BAL can provide findings that are inconsistent with suspected diagnoses and help focus attention on pursuing alternative diagnosis[4].

BAL can play a very important role in the diagnosis of respiratory infection, and it is useful in monitoring the lung allograft and in evaluating pediatric lung disease. Examination of BAL cells or acellular components of BAL via gene microarray technology or proteomic analyses may allow BAL to assume a more prominent role in diagnosis and management of lung disease in the near future [4].

With an increasing incidence of risk factors worldwide like smoking, occupational hazards, pollution there is an increment in respiratory diseases. This is the basis of our study which is designed to evaluate the role and importance of bronchoalveolar lavage in diagnosis of neoplastic and non-neoplastic cases. This will provide important information about the disease pattern and its management.

Aim and objectives

Aim

To assess usefulness of cell cytology and differential count in BAL specimen in order to clinch the diagnosis in undiagnosed lung diseases.

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Objectives

1. To determine the co-relation between clinical/radiological /pathological and microbiological findings in BAL.
2. To study the cell cytology and differential count in cases of Interstitial lung diseases, eosinophilic lung diseases and pneumoconiosis.
3. To study the diagnostic yield of BAL fluid in lung malignancy.
4. To study AFB, gram stain, pyogenic culture sensitivity, and fungal hyphae.

Material and method

The study titled "Role of Bronchoalveolar Lavage in Undiagnosed Lung Diseases" was conducted in our institute for a duration of 1 year from 1st February 2018 till 1st February 2019 after approval by hospital ethics and research committee and with due consent of patients.

Inclusion Criteria

- Pneumonia
- Diffuse lung infiltrates(interstitial and/or alveolar)
- Suspected alveolar hemorrhage.
- Quantitative cultures for ventilator associated pneumonia.
- Mass lesions

Exclusion Criteria

- Children
- Dyspneic patients
- Bleeding disorders
- Diagnosed or sputum positive patients.
- Patients not willing to participate in study.
- Cardiac instable patients.

Statistical Analysis

It is an observational and cross-sectional study with intent to look for findings in bronchoalveolar lavage in suspected lung disease. During our study BAL was done in 120 patients and results were analyzed by calculating percentage, proportion and mean.

Analysis was done using the SPSS version 20. Descriptive statistics and diagrammatic representation were performed to describe the studied variables.

Initial Evaluation of the Patients

History taking, clinical examination, Basic investigations like ECG, complete blood count, bleeding time, sputum examination, clotting time, chest X-ray, liver function test, renal function test, blood sugar, serum electrolytes, HIV testing, HBsAg.

Preparation and Anesthesia

1. Written and informed consent was taken.
2. To the accompanied attendant side effects of the procedure and the procedure was explained.
3. Bronchoscope (sterilized by putting in glutaraldehyde), collection trap, and tubing were prepared.
4. Supplemental oxygen and monitoring equipment were prepared.
5. Pulse-oximetry, BP cuff was kept ready.

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6. Premedication with bronchodilators in case of bronchospasm.
7. Patient Positioning was done (supine position).

Collection of BAL Samples

Bronchoscope was inserted transnasally after nebulizing the patient and spraying 2% lignocaine on posterior pharyngeal wall. Thereafter, putting the 2% lignocaine jelly in the nostril through which the bronchoscope was introduced. Bronchoscope was wedged into the segment to be lavaged. Two aliquots of 20ml saline used for the return fluid collected in mucous trap bottle. A minimum of 20ml sample sent to the laboratory for AFB, Gramstain, pyogenic culture and sensitivity, fungal staining, malignant cells and differential count.

Observation & results

120 patient's bronchoalveolar lavage was collected and sent for evaluation, therefore, n=120 and following results wwere observed.Out of 120 (100%) cases 85 (70.83%) patients were male and 35 (29.17%) were female (Table 1).

Patients were in age range of 18-94 years, where minimum age was 18 years and maximum was 94 years. Most of the patients i.e., 60(50%) were in age group of 51-94 years, 45 (37.5%) were in the age group of 31-50 years and rest 15 cases (12.5%) were less than 31 years of age group. Overall mean age was 56 years. Mean age of Non-neoplastic patients was 50.84 and of neoplastic patients was 51.67 years(Figure 1).

In our study 120(100%) cases were taken in which 84 (70%) cases showed non-neoplasticdiseases and 36 (30%) cases came out to be malignant.Majority of patients were smokers 60.83% (ex or current), out of current smokers 24(20%) were non-neoplastic and 19(15.83%) were neoplasticcases, while ex-smokers were 20(16.67) and 10(8.33%) cases under non-neoplastic and neoplastic group respectively. 47(39.1%) were non-smokers out of which40(33.33%) cases were having Non-neoplastic disease and 7(5.83%) cases were neoplastic.

Since malignant cases were less than Non-neoplastic, hence out of total neoplastic (36) cases, 29 (80.56%) were (ex or current) smokers, similarly out of 84 Non-neoplasticcases44 (52.38%) were (ex or current) smokers.

Complete blood count was done in 120(100%) cases among these patients 35(29.17%) had leucocytosis, but polymorphs >5% in BALF were in 79 (65.83%) cases. Eosinophilia was seen in 25(20.83%) cases in CBC report while 23(19.17%) patients had eosinophils >1% in BAL. Lymphocytosis was seen in 10(8.33%) patients in CBC and 25(20.83%) patients had lymphocytes>15% in BAL (Figure 2).

These were different diseases that comprises of whole Non-neoplastic group in our diagnosis in which out of 84(70%) cases in41 (34.17%) cases infectious organism was isolated and in 43(35.83%) cases no organism was isolated. The diseases were further subcategorized as mycobacterial consisted 10(8.33%) of patients, other bacterial infections were 19(15.83%) whereas fungal and parasitic comprised 8(6.67%) and 1(0.83%) cases respectively (Figure 3).

Total 8 (6.67%) cases of fungal infection were identified in BALF out of which Aspergillosis in 3 (2.25%) patients, mucormycosis in 1(0.83%) case and candida in 4(3.33%) patients were seen.

Among organisms isolated, apart from Mycobacterium there were 22(15%) cases of Bacterial infection. From these 4(3.33%) were of streptococcus, Pneumococcus and Klebsiella, 3(2.5%) each of Pseudomonas and MRSA, E-coli isolated from 2(1.67%) cases, Enterococcus and Staphylococcus 1(0.83%) each (Figure 4).

Non-infectious were 46 (38.33%) in number among this Eosinophilia 8(6.67%), chronic granulomatous diseases were 4(3.33%) and rest 34(28.33%) were those in which diagnosis was made on the clinical basis with abnormal radiographic findindings but BAL was

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normal(Table 2).

Among 36(30%) neoplastic cases 31(25.83%) were true positive in BALF in which 89(74.17%) were negative cases 4(3.33%) were reported as squamous cell ca 12(10%) were adenocarcinoma, and in rest 15(12.5%) cases malignancy was reported but typing was not possible, histopathology was needed. Out of 89(83%) negative cases 1(0.83%) showed blood and its component while 3(2.5%) were inadequate. Among these 31(25.83%) cases post-biopsy/brush/TBNA was collected only in 4 cases and all 4(3.33%) were positive for adenocarcinoma. The false negative cases were 4 cases, sensitivity of BALF is 86.11% (n=36)

(Table 3).

An amalgamation of clinical, radiological, and laboratorial along with cell cytology of the lavage 8 cases were labeled as eosinophilic lung diseases and 4 cases as chronic granulomatous diseases in which 2 patients were treated as sarcoidosis. Diagnosis in 31 cases through BALF was not ascertained as no organism or atypical cells were reported.

Sl. No.	Gender	No. of Patients (n=120)
1	Male	85 (70.83%)
2	Female	35 (29.17%)
	Total	120 (100%)

Table 1- Gender distribution in the study

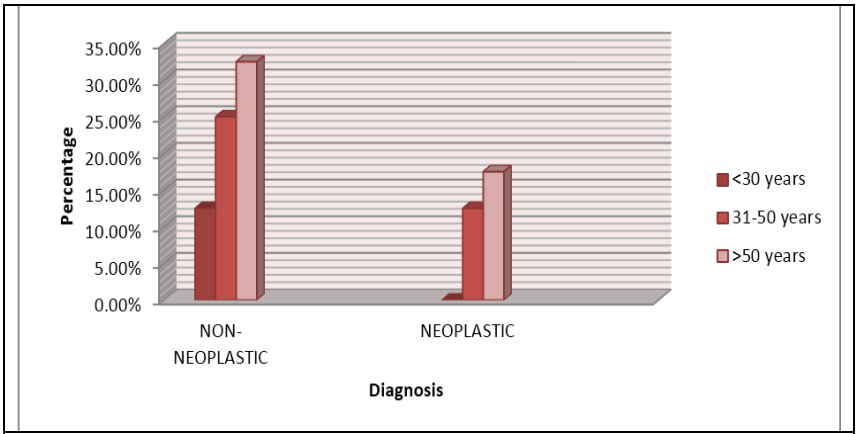

Fig. No. 1 - Age-wise distribution of patients

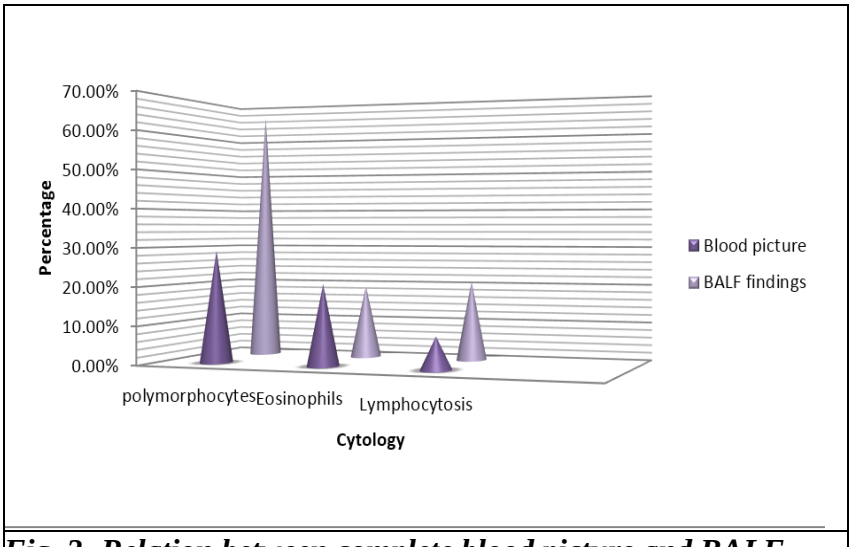

Fig. 2- Relation between complete blood picture and BALF

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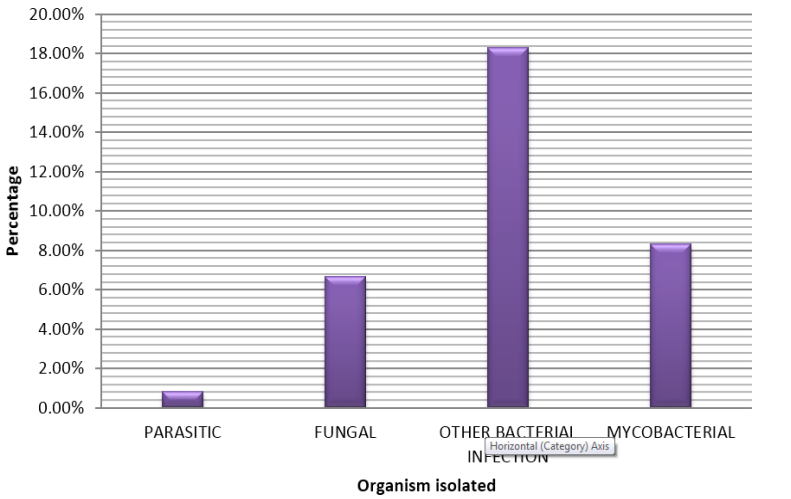

Fig. 3-Pathogenic organisms isolated in inflammatory pattern

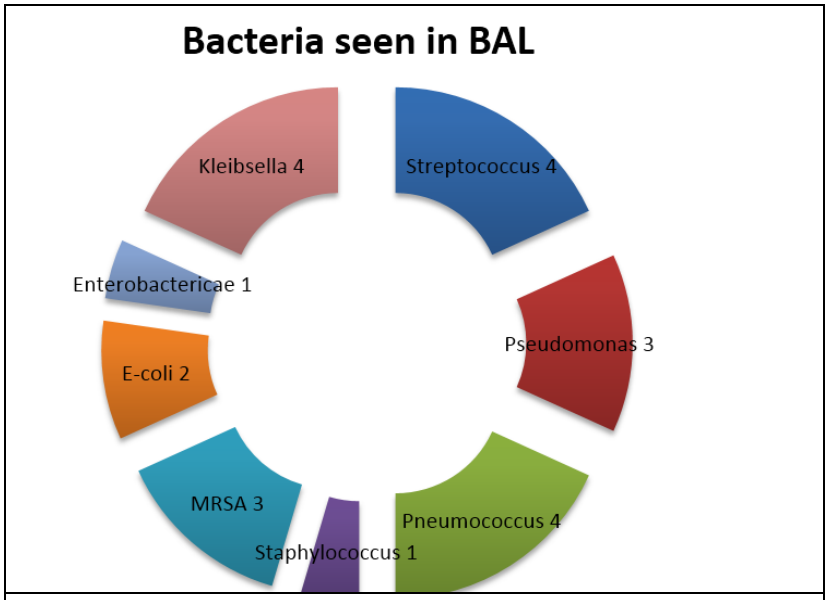

Fig. 4- Bacteria seen in BAL

Sl.No	No Growth in culture	No. of Cases (n=120)
1	Eosinophilia	8 (6.67%)
2	Chronic Granulomatous	4(3.33%)
3	Unremarkable	31(25.33%)
	Total	43(35.83%)

Table 2- Non-infectious cases in non-neoplastic group

S.NO.	Balf results	NO. of Cases (n=120)
1.	Negative for malignancy	89 (83%)
2.	Squamous cell carcinoma	4 (3.33%)
3.	Adenocarcinoma	12 (10%)
4.	Positive for malignancy	15 (12.5%)
	Total	**120 (100%)**

Table 3 -BAL fluid results in malignancy cases

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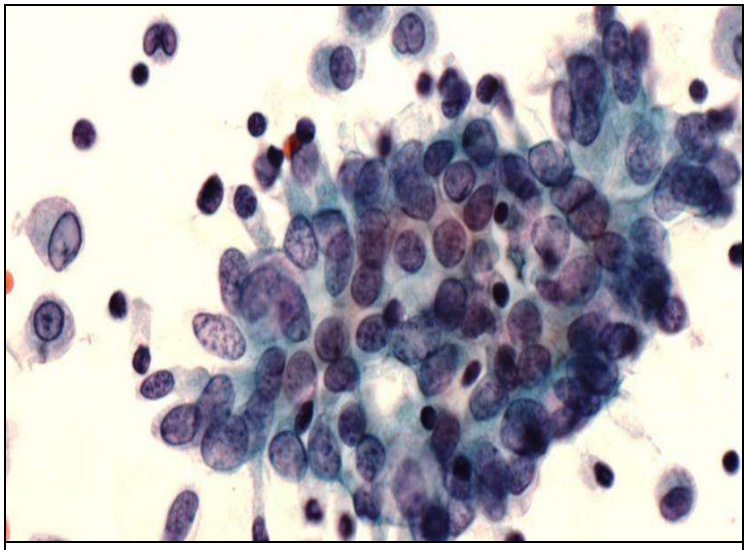

Image 1 - BAL showing Squamous Cell Carcinoma ((Papanicolaou stain x 40)

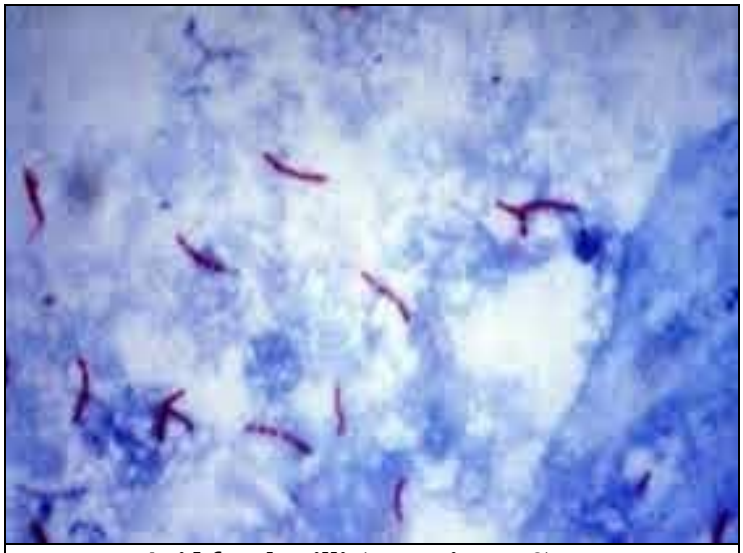

Image 2 - Acid fast bacilli (Zn stain X 40)

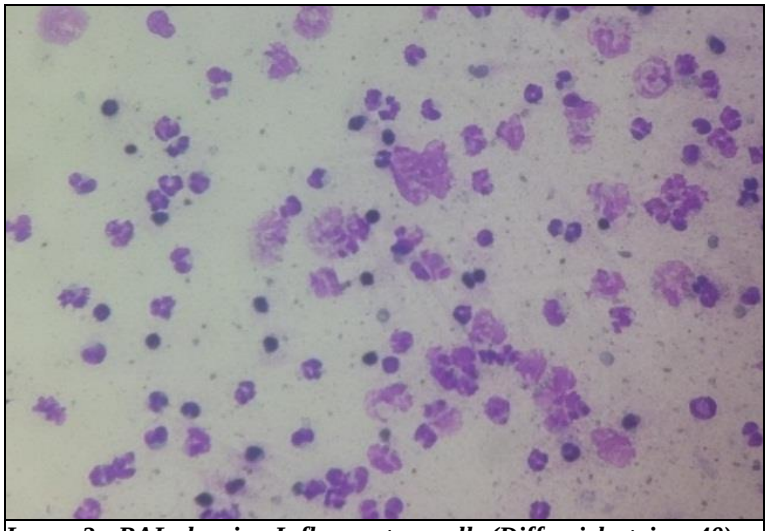

Image 3 - BAL showing Inflammatory cells (Diff quick stain x 40)

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Discussion

Bronchoalveolarlavage(BAL)isausefulandsafeprocedureforsamplingcellularelementsof lung. It often provides valuable diagnostic information when clinical history, physical exam, routine laboratory testing, pulmonary function testing and radiographic imaging are insufficient to reach a definitive diagnosis.

In our study we collected BALF from 120 hospitalized patients with various respiratory diseases for early diagnosis and specific treatment. It is a preferred investigative tool over invasive techniques like needle biopsies and thoracoscopy. Meyer P et al. evaluated the diagnostic performance and safety of combined blind nasotracheal suctioning and non-bronchoscopic mini-bronchoalveolar lavage (mini-BAL) to obtain respiratory secretion specimens from spontaneously breathing, non-intubated patients with infectious pneumonia in intensive care [5]. Newer diagnostic techniques including polymerase chain reaction (PCR) and other molecular assays enhance the role of BAL for identifying specific microbial infections.

Associated clinical manifestations were pallor 21(17.5%), cyanosis 7(5.83%), clubbing in 18(15%) cases, LN in 8(6.67%) cases, edema in 4(3.33%), 6(5%) cases showed raised JVP and 5(4.17%) cases had SpO_2 <90%in inflammatory lung diseases. Similarly, in neoplastic 12(10%) cases had pallor, 6(5%) had cyanosis, 13(10.83%) had clubbing, 15(12.5%) had palpable LN, 1(0.83%) patient had edema, 6(5%) and 3(2.5%) patients had raised JVP and SpO_2<90% respectively. Maximum cases had pallor 33 (27.5%) present more in non-neoplastic cases than in neoplastic group, due nutritional deficiency. In neoplastic group maximum cases had clubbing and palpable LN Palpable lymphnodes were seen more in neoplastic cases also clubbing was present in ILD cases. This clinical background gave us a basis of initial diagnosis and when correlated with BALF final diagnosis was made. Similar findings were present in study done by Prasad et al.

Out 120(100%) patients 25(20.83%) had consolidation among these 22(18.33%) were non-neoplastic and 3(2.5%) were neoplastic cases. 26(21.67%) total cases had collapse out of which 16 (13.33%) were non-neoplastic and 13(13.83%) were neoplastic. Pleural effusion cases were total 20 (10%) out which maximum cases 13(13.83%) were neoplastic and 7(5.8%) were non-neoplastic. Mass lesion were in 39(32.5%) cases amongs them 30(25%) cases were neoplastic while 9(7.5%) cases were from non-neoplastic group. In CXR of 20(10%) cases from non-neoplastic group cystic lesions were observed and only 1(0.83%) case from malignant group which sums up to 21(17.5%) cases.35(29.2%) cases had cavitory lesions and all were non-neoplastic cases. Bullae in CXR were observed in total 35(29.17%) cases from which 19(15.8%) and 16 (13.3%) were non-neoplastic and neoplastic respectively. The most important finding in our study were that total 19(15.83%) CXR which were not matching with the findings of BALF 1(0.83%) normal X-ray showed fungal growth in BAL, 9(7.5%)cases were suspected to have mass lesion but 5(4.16%) had non-specific inflammatory lesion, fungal growth in 1(0.83%) case, mycobacterium in 2(1.67%) and 1(0.83%) was unremarkable. Plain consolidation was seen in 3(2.5%) cases which turned out to be neoplastic. Similarly, PLEF was only present in 6(5%) cases while these cases were neoplastic. Hence, BALF helped in making accurate and early diagnosis. The yield is better if the lesions are intra-alveolar or endobronchial, as we observed in case of sputum negative for AFB patients 10(8.3%) cases came out to be positive in BALF. Similarly this, was seen in study done by Kyle R. Brownback and Steven Q. Simpson.

The patients coming to us were from low economic status therefore, out of 120(100%) patients CT-chest was done only in 72(60%). 4(3.33%) cases had consolidation among these 1(0.83%) were non-neoplastic and 3(2.5%) were neoplastic cases. 14(11.67%) total cases had collapse out of which 4(3.33%) were non-neoplastic and 10(8.33%) were neoplastic. Pleural effusion cases were total 14(11.67%) out which maximum cases 11(9.17%) were neoplastic

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and 3(2.5%) were non-neoplastic. Mass lesion were in 33(27.5%) all were neoplastic. In CXR of 20(10%) cases from non-neoplastic group cystic lesions were observed and only 1(0.83%) case from malignant group which sums up to 21(17.5%) cases. 35(29.2%) cases had cavitory lesions and all were non-neoplastic cases. Bullae in CT-scan were observed in total 19(15.83%) cases from which 10(8.33%) and 9 (8.33%) were non-neoplastic and neoplastic respectively. CT scans gave us the exact location of the lesions. It was more reliable than CXR and few lesions which were mistaken to be mass lesion on CXR turned out to be plain consolidation.

This was again confirmed by BALF as we isolated organism from these cases. Kyle R. et al. in his study has shown a statistically significant association between diagnostic yield from FOB with BAL in patients whose radiographic infiltrates on CT scan involve the airways or alveoli.

Complete blood count was done in all the cases as a routine investigation. 35(29.17%) patients out of 120(100%) had leucocytosis, but polymorphs >5% in BALF were in seen in 79 (65.83%) cases. Eosinophilia was seen in 25(20.83%) cases in CBC report while 23(19.17%) patients had eosinophils >1% in BAL. Lymphocytosis was seen in 10(8.33%) patients in CBC and 25(20.83%) patients had lymphocytes>15% in BAL. High cellular components in BALF was seen because most of our patients were smokers. Therefore true infectious cases were 35 cases, as correlated clinically and by investigations. Thus, 44 cases were reported as false positive. Relative neutrophil number in BAL was higher in patients with pneumonia (100% of the having leucoytosishad 20% or more neutrophils in BALF).

The same results were obtained by Marquette et al. Papazian et al. found no differences in neutrophil numbers between groups.

However, Kirtland et al. found that 50% of neutrophils in BAL is a good cut-off value to exclude pneumonia. In all these cases pneumonia was diagnosed through culture and blood count.

Bronchoalveolar lavage can be a very useful in the diagnosis of infections. The different infectious diseases that comprises of whole non-neoplastic group in our diagnosis were 41(34.17%) cases. The infectious diseases were further subcategorized as mycobacterial consisted 10(8.33%) of patients, other bacterial infections were 22(18.33%) whereas fungal and parasitic comprised 8(6.67%) and 1(0.83%) respectively.

In a study by Baughman et al. 87% of bronchoscopy specimens were positive for tuberculosis. In a study by Radha S et al. Tuberculosis was diagnosed in 22 cases, fungal infections in 7 cases and 38 cases of bacterial pneumonias were diagnosed.

In the same way out of 84 (70%) non-neoplastic cases Non-infectious in which no organism was isolated were 46 (38.33%) among these, Eosinophilia were 8(6.67%), chronic granulomatous diseases were 4(3.33%) and rest 34(28.33%) were those in which diagnosis was made on the clinical basis with abnormal radiograph but BAL was normal (unremarkable). Radha S et al. included 91 cases in her study out of which 11 cases showed unremarkable results.

The bacterias isolated in BALF were Streptococcus 4(3.33%), Pseudomonas 3 (2.5%), Pneumococcus 4 (3.33%), Staphylococcus 1(0.83%), MRSA 3(2.5%), E-coli 3(2.5%), Enterobactericae 1(0.83%), Kleibsella 3(2.5%) in our study.

Blau H et al. compared bacterial yield from IS and BAL Stenotrophomonas maltophilia[1], Staphylococcus aureus[3], and upper respiratory tract flora [4] in BAL. Radha S et al found Klebsiella as the most common organism in BALF.

Pulmonary fungal infections remain the most important cause of morbidity specially in old treated tuberculosis patients and in immunocompromised and also in lung transplant/ organ transplants etc. In this study we diagnosed Aspergillosis 3 (2.25%), Mucormycosis1(0.83%), Candida 4(3.33%). Mucormycosis and Aspergillosis were ICU patients and thus after starting

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anti-fungal patient improved, there was no growth in the sputum in these patients. Hence, in our study also role of BAL in early diagnosis changed the prognosis of the patient.
Tepeoğlu M et al evaluated the diagnostic use of bronchoalveolar lavagein liver transplant recipients with pulmonary infections. Including Aspergillusfumigatus in 3 patients and Candida albicans in 2 patients. They concluded that Bronchoscopy with bronchoalveolar lavage is a useful, noninvasive diagnostic tool for the rapid diagnosis of infections in solid-organ transplant recipients. Radha S. et al. found fungal infections in 7 cases in BALF. De Mol M et al. analyzed retrospectively, 72 bronchoscopies for GM. They all concluded Bronchoalveolar lavage can be a very useful in the diagnosis of fungal infections. BAL has a sensitivity of 98%. It is almost equal to bronchial biopsy in sensitivity and specificity.

Ploymorphonuclear cells (PMN)
As already discussed above influx of PMNs in the lungs of patients is seen after traumatic insertion of a bronchoscope, in ventilated patients and patients with infectious disorders. Polymorphs less than 5% are seen in 20(16.67%) cases and 21(17.5%) cases in non-neoplastic and neoplastic cases respectively and more than 5% in 64(53.33%) cases and 15(12.5%) cases respectively. Polymorphs more than 5% denotes infection and various other conditions. The degree of increase in BAL neutrophils has been correlated with disease severity and prognosis for both HP and IPF

Lymphocytosis
Bronchoalveolar lavage is insufficient to diagnose the specific type of interstitial lung diseases (ILDs). BAL does not have any prognostic value and cannot predict response to therapy. Since CD4/CD8 ratios were not available at our centre but high levels of lymphocytes in BALF was noted incases of chronic granulomatous diseases (sarcoidosis, silicotic tuberculosis, and mycobacterial tuberculosis, lymphoma, mesothelioma, few bacterial infections, chronic smokers). These results were clinically and radiologically correlated and then the diagnosis was made. This was also compared with study done by Radha et al. However it was different from the studies done by Oda K et al.

Eosinophils
Eosinophils >1% was seen in 2(1.67%) cases of fungal infections, 1(0.83%) case each in hyadatid cyst and malignancy, in 15(12.50%) cases of Obstructive lung diseases, in 2(1.67%) cases of hypersensitivity pneumonitis and in 2(1.67%) cases of bacterial infection.
Allen JN et al reported The most common causes for increased BAL eosinophils were interstitial lung diseases (40% of patients), acquired immunodeficiency syndrome (AIDS)-associated pneumonia (17% of patients), idiopathic eosinophilic pneumonia (15% of patients), and drug-induced lung disease (12% of patients). There are few other studies showing similar findings.
Bronchoalveolar lavage can be a very useful in the diagnosis of lung infections. BAL has a sensitivity of 98%. It is almost equal to bronchial biopsy in sensitivity and specificity. In fungal lesions, morphological analysis on Gomori's Methenamine Silver stained smears helps in diagnosing various fungi. BAL in addition provides material for culture and sensitivity.
The incidence of tuberculosis is on the rise specially in developing countries. Furthermore, it is important to avoid delayed diagnosis and treatment specially in those patients who are having difficulty in producing sputum or are sputum negative to reduce the burden of Tuberculosis. Patients with positive tuberculin test and abnormal chest radiographs pose a diagnostic dilemma to clinicians. Bronchoscopy is useful in such cases to obtain lavage, where other modalities are not contributory. In a study by Baughman[6], 87% of bronchoscopy specimens were positive for tuberculosis. In our series, 8.33% of the cases

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were diagnosed as tuberculosis on the basis of ZN staining(Fig.2).
Diff-Quik is a commercially Romanowsky stain variant used to rapidly stain and differentiate a variety of pathology specimens and allows for selective increased eosinonophilic or basophilic staining depending upon the time the smear is left in the staining solutions(Fig.3).
The diagnosis of neoplastic lesions of the lung is a diagnostic problem for pulmonologists because some malignant lesions mimic infectious or inflammatory conditions. In such a clinical setting, BAL has a relevant role in detecting neoplastic cells or can also rule out malignant lesions[7].The role of BAL Is based on growth pattern, cytological characteristics and correlation of morphology with imaging features and diagnostic value added by new investigations[8]. The sensitivity of BAL in various other studies from literature varies from 21% to 78%[9]. This reported a wide range of sensitivity may be due to difference in case selection. Some investigators discard the first aliquot which is relatively enriched in the bronchial material. For malignancies originating in the bronchial tree, this may represent material with the highest diagnostic yield. Some clinicians filter the BAL specimen through loose weave gauze to remove mucous. Malignant cells often present in clumps may get in advertently removed by this procedure. Application of BAL in diagnosing lung malignancy was first reported in mid 1980s[10]. Levy*etal.*[11] compared the yield of various diagnostic procedures and concluded that yield of BAL was high(66%) as compared to washings(57%), brushings (40%), transbronchial biopsy(44%).
Thus, to conclude yield of different procedures were BALF showed positivity among 36(30%) cases 31 (86.11%) cases, whereas brush cytology were positive in 23(74.19%) cases, TBNA in 8(22.22%) cases, biopsy came out to be malignant in 30(83.33%) cases, FNAC were reported positive in 16(44.44%) cases and trucut in 23(63.89%) cases. When post procedure BALF was collected and sent for evaluation in 4(3.33%) cases all of them were positive for malignancy and the pre-procedural BAL among these 4 cases 1(0.83%) case was positive for malignancy. However, this was only done in a very small proportion of cases.
Bronchoalveolar lavage is insufficient to diagnose the specific type of interstitial lung diseases (ILDs), however certain studies report that when performed with a standardised technique, expertly examined, and combined with clinical and imaging data, BAL differential cell counts and other characteristics may provide important information and may help to differentiate various DLDs (Diffuse lung diseases)[12,13]. BAL does not have any prognostic value and cannot predict response to therapy.
In addition therapeutic uses of BAL, include removal of tenacious mucous plugs in asthma and cystic fibrosis. Whole lung lavages are helpful in silicosis and alveolar microlithiasis.
One major clinical limitation of BAL is a large range of normal values. Various soluble constituents like cytokines or other inflammatory mediators and collagen metabolism markers are used for research purpose. None of these markers have diagnostic utility.

Conclusion

Bronchoalveolar lavage (BAL) is a common and relatively safe diagnostic procedure forthe evaluation of patients with lung disease. It often provides valuable diagnostic information when clinical history, physical exam, routine laboratory testing, pulmonary function testing and radiographic imaging are insufficient to reach a definitive diagnosis. Compared to sputum analysis, BAL allows for targeted sampling of the lower respiratory tract with less microbial contamination from the upper aero-digestive tract. It is not only used as a useful diagnostic tool in diagnosing bacterial pneumonias, tuberculous lesions, fungal infections butal so malignancies and diffuse lung diseases(DLDs). Its role is limited in diagnosing and prognosticating DLDs. The number of lesions with a definite diagnosis out number the lesions that cannot be diagnosed hence we opine that BAL is a useful diagnostic modality not

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only for routine diagnosis, butals of orancillary techniques and research purpose.

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