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Original Article

Assessment of Diagnostic Value of Bronchoalveolar Lavage in Patients Suffering from Interstitial Lung Diseases: An Observational Study

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ABSTRACT

Background: Interstitial lung diseases (ILD) are a group of diffuse parenchymal lung disorders associated with substantial morbidity and mortality. Bronchoalveolar lavage plays a crucial role in diagnosing pulmonary infections, especially those caused by opportunistic pathogens in immunocompromised individuals. Hence; the present study was conducted to assess the diagnostic value of the bronchoalveolar lavage (BAL) in interstitial lung diseases.

Materials & Methods: A total of 100 patients suspected of ILD were enrolled. The diagnosis of interstitial lung disease (ILD) has relied on the integration of clinical, biological, and cyto-histological data. Bronchoalveolar lavage (BAL) was performed, and the collected fluids underwent cytocentrifugation followed by staining with Wright-Giemsa, Perls, and PAS stains to facilitate total and differential cell counts. The cytological analysis of BAL was conducted manually, with a differential cell count identifying various cell types, including alveolar macrophages, lymphocytes, neutrophils, and eosinophils, as well as other notable findings such as tumor cells, foreign bodies, mast cells, basophils, and red blood cells. The analysis and comparison of differential cell counts were conducted among the prevalent forms of ILD.

Results: A total of 100 patients were enrolled. Mean age of the patients was 47.3 years. Majority proportion of patients were males. Among suspected ILD cases, 41%, 29%, 21% and 9% of the patients were diagnosed with presence of sarcoidosis, IPF, CTD and other ILD. There was no statistically significant difference in the cellular count of bronchoalveolar lavage (BAL) among the various diseases examined. Furthermore, the prevalence of the diseases under study remained consistent despite fluctuations in BAL cellular count.

Conclusion: The analysis revealed no statistically significant differences in bronchoalveolar lavage (BAL) cytology among interstitial lung diseases (ILD). Consequently, BAL does not yield meaningful information that would assist in distinguishing between the various entities classified as ILD.

KEYWORDS: Bronchoalveolar Lavage, Interstitial Lung Disease.

INTRODUCTION

Interstitial lung diseases (ILD) are a group of diffuse parenchymal lung disorders associated with substantial morbidity and mortality. Knowledge achieved in recent years has resulted in the publication of the new classification of idiopathic interstitial pneumonias, according to which there are three groups: major, rare and unclassified. The interaction between environmental stressors and genetic predisposition seems to be the key to unlocking and activating the multiple pathogenetic pathways that drive the development of fibrosis.[1, 2] After alveolar epithelium injury there is increased activity of type II alveolar epithelial cells, which proliferate in order

to repair the damage. However, the repair process fails and leads to fibrosis. In the fibrotic lung it was observed that angiotensin converting enzyme-2, which showed a protective effect in bleomycin-induced fibrosis, is downregulated or absent in actively proliferating epithelial cells and presents a cell-cycle dependent regulation via a JNK mechanism.[3, 4]

ILD associated with systemic sclerosis (SSc) represents, together with pulmonary hypertension, the most common cause of death. Fibroblasts present altered characteristics in SSc and play an important role in the development of lung fibrosis by producing excessive amounts of extracellular matrix. It is believed that targeting lung fibroblasts may be an important step for future treatment.[5, 6] Bronchoalveolar lavage plays a crucial role in diagnosing pulmonary infections, especially those caused by opportunistic pathogens in immunocompromised individuals.[6] Hence; the present study was conducted to assess the diagnostic value of the bronchoalveolar lavage in interstitial lung diseases.

MATERIALS & METHODS

The present study was conducted to assess the diagnostic value of the bronchoalveolar lavage in interstitial lung diseases. A total of 100 patients suspected of ILD were enrolled. The diagnosis of interstitial lung disease (ILD) has relied on the integration of clinical, biological, and cyto-histological data. Bronchoalveolar lavage (BAL) was performed, and the collected fluids underwent cytocentrifugation followed by staining with Wright-Giemsa, Perls, and PAS stains to facilitate total and differential cell counts. The cytological analysis of BAL was conducted manually, with a differential cell count identifying various cell types, including alveolar macrophages, lymphocytes, neutrophils, and eosinophils, as well as other notable findings such as tumor cells, foreign bodies, mast cells, basophils, and red blood cells. The analysis and comparison of differential cell counts were conducted among the prevalent forms of ILD. All the results were recorded in Microsoft excel sheet and were subjected to statistical analysis using SPSS software.

RESULTS

A total of 100 patients were enrolled. Mean age of the patients was 47.3 years. Majority proportion of patients were males. Among suspected ILD cases, 41%, 29%, 21% and 9% of the patients were diagnosed with presence of sarcoidosis, IPF, CTD and other ILD. There was no statistically significant difference in the cellular count of bronchoalveolar lavage (BAL) among the various diseases examined. Furthermore, the prevalence of the diseases under study remained consistent despite fluctuations in BAL cellular count.

Table 1: Prevalence of studied ILD according to lymphocyte count

ILD	≤ 20	21 to 40	> 40	p-value
Sarcoidosis	36.5%	23.7%	39.8%	0.912
IPF	48.3%	39.4%	12.3%	
CTD	58.1%	18.9%	23%	
Other ILD	51.3%	33.7%	15%	

Table 2: Prevalence of studied ILD according to neutrophil count

ILD	<5	5 to 20	> 20	p-value
Sarcoidosis	41.3%	38.1%	20.6%	0.458
IPF	29.4%	48.4%	22.2%	
CTD	52.9%	22.9%	24.2%	
Other ILD	23.7%	57.8%	18.5%	

Table 3: Prevalence of studied ILD according to eosinophil count

ILD	≤1	2 to 5	> 5	p-value
Sarcoidosis	78.3%	12.8%	8.9%	0.162
IPF	24.3%	75.7%	0%	
CTD	49.2%	49.5%	1.3%	
Other ILD	63.8%	36.2%	0%	

DISCUSSION

Interstitial lung disease (ILD) refers to a diverse range of pulmonary fibrotic disorders that affect the alveoli of the lungs. Approximately two-thirds do not have a known cause (idiopathic), while one-third result from known endogenous or exogenous causes, including environmental/occupational factors, infections, drugs and radiation. Variation in the classification of ILDs, both historically and internationally, has not aided diagnosis, but recent consensus guidelines to both diagnosis and classification, together with a new nomenclature, offer an opportunity for greater precision.[7]

Bronchoalveolar lavage serves as a valuable technique for evaluating various pulmonary elements and may prove particularly beneficial when integrated with innovative methods for analyzing inflammatory responses, such as polymerase chain reaction techniques that measure the expression of inflammatory cytokines and growth factors.[8- 10]

Hence; the present study was conducted for assessing the diagnostic value of the bronchoalveolar lavage in interstitial lung diseases.

A total of 100 patients were enrolled. Mean age of the patients was 47.3 years. Majority proportion of patients were males. Among suspected ILD cases, 41%, 29%, 21% and 9% of the patients were diagnosed with presence of sarcoidosis, IPF, CTD and other ILD. There was no statistically significant difference in the cellular count of bronchoalveolar lavage (BAL) among the various diseases examined. Furthermore, the prevalence of the diseases under study remained consistent despite fluctuations in BAL cellular count.

Schildge J et al investigated whether the recovery rate affects BAL results relative to the instilled volume. Six hundred and eighteen patients with the following diagnoses were included into the study: 236 with sarcoidosis, 85 with idiopathic pulmonary fibrosis, 83 with cryptogenic organizing pneumonitis, 64 with connective tissue disease affecting the lungs, 54 with respiratory bronchiolitis with interstitial lung disease, 51 with extrinsic allergic alveolitis and 45 control patients. BAL was performed during flexible bronchoscopy with an irrigation volume of 100 ml 0.9% saline solution in 5 aliquots of 20 ml each. Only patients with a recovery of at least 30 ml were evaluated. Initially, the entire patient population was analysed, followed by an analysis within the different diagnostic groups and a comparison between patients with a high (>50 ml) and low (< or =50 ml) recovery rate. The recovery rate varied between the diagnostic groups ($p < 0.001$) and was negatively correlated with age ($r = -0.21$, $p < 0.001$) and smoking history ($r = -0.11$, $p < 0.035$). There were no correlations with inspiratory vital capacity (%pred.; $p = 0.26$) and forced expiratory volume in 1 s (%pred.; $p = 0.15$), but a positive correlation with the index (forced expiratory volume in 1 s/inspiratory vital capacity) x 100 ($r = 0.23$, $p < 0.001$). The cellular and non-cellular constituents of BAL were not affected by the recovery: cells/millilitre BAL ($p = 0.71$), relative proportion of macrophages ($p = 0.92$), lymphocytes ($0 = 0.33$), neutrophils ($p = 0.14$) and eosinophils ($p = 0.11$), albumin concentration ($p = 0.13$), and proportion of albumin in total protein ($p = 0.06$). The same applied for the lymphocyte surface markers CD4 and CD8. In the group with a high recovery rate, patients with sarcoidosis had a lower proportion of eosinophils and patients with cryptogenic organizing pneumonitis a higher concentration of albumin and lymphocytes. Otherwise, no further differences were detected. The recovery rate hardly affected the cellular and non-cellular constituents of BAL at a lower limit of 30% of the instilled volume.[11]

Animal models recently suggested that the disease is characterized by a Th1-type response. Schuyler et al. reported that a Th1CD4+ cell line could adoptively transfer experimental HP in mice, and Gudmundsson et al reported that interferon is necessary for the development of HP, as IFN knockout mice are resistant to development of the disease. In addition, the exposure to IL-12 enhanced interferon- production, whereas IL-10 ameliorated the severity of experimental HP in mice.[12- 15]

Bronchoalveolar lavage studies should not be limited to counting the cell differentials. At least as important as examining cell differentials is observing the morphologic appearances of cells and particles. Examples are the different morphology in extrinsic allergic alveolitis (foamy macrophages, heterogenous macrophage size, presence of plasma cells) versus that of sarcoidosis (more monomorphous appearance of macrophages, less activated lymphocytes), the presence of malignant cells, the characteristic features of alveolar proteinosis, or the detection of dust particles such as asbestos bodies in occupational exposure conditions. In some of the rarer lung diseases BAL has a high diagnostic value and can replace lung biopsy (Kantrow SP et al).[16]

CONCLUSION

The analysis revealed no statistically significant differences in bronchoalveolar lavage (BAL) cytology among interstitial lung diseases (ILD). Consequently, BAL does not yield meaningful information that would assist in distinguishing between the various entities classified as ILD.

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