Usefulness of BAL in the diagnostic work-up of interstitial lung diseases

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Introduction

Pulmonary diseases have traditionally been evaluated by laboratory tests, lung function tests, imaging procedures and tissue biopsies. Bronchoalveolar lavage (BAL) represents an additional tool in the assessment of the health status of the lung for pulmonologists that can facilitate the diagnosis of various diffuse lung diseases. BAL fluid (BALF) can be analyzed to determine white blood cell (WBC) profiles and to detect respiratory pathogens. Although BAL is seldom useful as a "stand-alone" diagnostic test for the diagnosis of diffuse infiltrative lung disease, when combined with clinical data and high-resolution computed tomography of the chest, BAL WBC profiles can contribute significantly to the diagnosis of specific forms of interstitial lung disease (ILD). Additionally, BAL can play a very important role in the diagnosis of respiratory infection, and it is useful in monitoring the lung allograft. 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 [1-3]. In the follow-up depicting prognosis and response to treatment BAL fluid analysis has less clinical relevance.

Diagnostic value of BALF analysis

The application of BAL for diagnostic purposes has significantly improved the diagnostic work-up of diffuse lung disease. Identifying the underlying disorder poses a significant challenge for the clinician because the aetiology is often unknown. It may be of infectious, non-infectious, immunologic, malignant, environmental or occupational aetiology. To establish the diagnosis, a thorough history is essential as it may identify a potential aetiological factor (*e.g.* drug reaction, environmental and/or occupational exposures) [4].

There are only some conditions where BALF analysis results are diagnostic and provide conclusive evidence of the cause of the infiltrates. In general, evaluation of BALF data is diagnostic in patients with acute symptoms. In a number of diseases such as alveolar proteinosis, pulmonary histocytosis X, extrinsic allergic alveolitis (EAA) or hypersensitivity pneumonitis (HP) and drug-induced pneumonitis, eosinophilic pneumonia, pulmonary haemosiderosis, occupationally-induced diseases, and infections which can mimic diffuse lung disease, lavage can be diagnostic. Lavage has probably achieved the most potential practical value in identifying infections including opportunistic infections such as *Pneumocystis jiroveci*, cytomegalovirus, fungal infections and *M. tuberculosis,* and, differentiating them from alveolar haemorrhage, pulmonary involvement by an underlying malignancy, and drug-induced pneumonitis.

BALF cell profile

There is no single cell type present in BALF that appears to be predictive for a certain ILD. A grouping of features, an elevated total cell count, predominantly lymphocytes, together with a nearly normal percentage of eosinophils and polymorphonuclear neutrophils and the absence of plasma cells, distinguish the most likely diagnosis sarcoidosis from the most common interstitial lung diseases extrinsic allergic alveolitis (EAA), non-specific interstitial pneumonia (NSIP) and idiopathic pulmonary fibrosis (IPF). In sarcoidosis the majority of cases have an increased number of lymphocytes and a normal amount of eosinophils and neutrophils (table 1). For an individual case the CD4/CD8 ratio is of less importance as it can be increased, normal and even decreased [5]. Disease presentation or activity at the time the BAL is performed as well as the smoking status and use of medication are crucial for interpretation of individual BAL fluid analysis results. Only in severe cases the number of neutrophils can be increased as well.

Table 1. Cellular BALF characteristics of the most common diffuse lung diseases.

	AMs	Lym	PMNs	Eos	PC	MC	CD4/CD8 ratio
Diseases							
Sarcoidosis		↑	=	=/↑	-	=/↑	↑/=/↓
Extrinsic allergic alveolitis	'Foamy' aspect	↑↑	↑	=/↑	+/-	↑↑	↓/=
Drug-induced pneumonitis	'Foamy' aspect	↑↑	↑	↑	+/-	↑↑	↓/=
Idiopathic pulmonary fibrosis		↑	↑/↑↑	↑	-	↑	=
BOOP/COP	'Foamy' aspect	↑	↑	↑	-/+	=/↑	↓
Eosinophilic pneumonia		↑	=	↑↑	+/-	=/↑	↓
Alveolar proteinosis	'Foamy' aspect	↑	=	=	-	?	↑/=
Connective-tissue disorders		↑	=/↑	=/↑	-	=/↑	↑/=/↓
Pneumoconiosis	Inclusion particles	↑	↑	=/↑	-	=/↑	↑/=/↓
Diffuse alveolar haemorrhage	Fe-staining:+++	=/↑	↑	=/↑	-	?	=
ARDS	Fe-staining:+	↑	↑↑	↑	-	=/↑	↓/=

?=not known. ↑: increased;=: normal; ↓: decreased; -: not present; + present; AMs: alveolar macrophages; Lym: lymphocytes; PMNs: polymorphonuclear neutrophils; Eos: eosinophils; PC: plasma cells; MC: mast cells; BOOP: bronchiolitis obliterans with organizing pneumonia; COP: crytogenic organizing pneumonia; ARDS: adult respiratory distress syndrome.

Summary

Bronchoalveolar lavage is competent to provide cells and solutes from the lower respiratory tract. BAL appears to be useful in the diagnostic work-up of diffuse lung inflammation. In selected cases, BAL has the benefit of avoiding more invasive diagnostic procedures. However, if despite this thorough clinical evaluation the diagnosis remains unclear, a biopsy should be considered as the final diagnostic step. It is to be expected that BAL will continue to serve as an important procedure for clinical purposes, as well as a method that facilitates the understanding of pathogeneses involved in inflammatory processes causing diffuse lung disease.

References

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