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RESEARCH ARTICLE

BRONCHOALVEOLAR LAVAGE, A CONCISE REVIEW

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ABSTRACT

Bronchoalveolar Lavage (BAL), is a minimally invasive method performed via bronchoscopy, and has been essential to obtain samples which may provide information about the inflammatory status, and infectious conditions of the alveoles. BAL is very substantial procedure for diagnosing especially interstitial lung diseases but also important other pulmonary diseases such as pulmonary alveolar proteinosis, alveolar hemorrhage, malignancy, Langerhans cell histiocytosis. The most important issue regarding a BAL procedure is the qualification and adequacy of the sample. Cell counting and culture, pathologic evaluation should be performed in every sample by certain staining methods.

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INTRODUCTION

Bronchoalveolar lavage (BAL), is a minimally invasive method performed via bronchoscopy, and has been essential to obtain samples which may provide information about the inflammatory status, and infectious conditions of the alveoles with a similar quality as open lung biopsy (Meyer *et al*., 2012). It is easily performed in immunocompromised hosts with an indication of the determination of opportunistic infections as well as direct diagnosis in certain lung diseases such as eosinophilic pneumonia or hemorrhage (Stoller *et al*., 1987; King, 1995). It is usually well tolerated by a continuous oxygen supplementation and may be performed by the bedside of the patient, bringing comfort and lacking the necessity of transport.

Technique

The usual procedure begins with the preparation which includes monitoring, oxygen supplementation and proper sedation of the patient. With a flexible bronchoscopy, the initial step is the tracheobronchial tree inspection. BAL should not be regarded as the synonym of a bronchial washing which is composed of aspiration of secretions and/or infusion of saline and aspiration. Likewise, BAL is quite different from whole lung lavage, which is solely used not for diagnosis but for treatment of alveolar proteinosis. The timing of BAL depends on the status and indication of the patient. Preferred timing is guided radiologically. In diffuse diseases, the right middle lobe is the most commonly used region for lavage due to the anatomical advantage of the patient's position and in localized diseases, the involved region is preferred for lavage. Regarding the amount of lavage to be obtained, a total volume of at least 100 mL is estimated to be a sufficient representation of the whole alveoli (Baughman, 2007). Likewise, the localization of the lavage depends on the radiological guidance. Sterile saline is the commonly preferred solution for instillation and the temperature of the solution depends on the team's experience and preferrence. After the infusion of saline, it is sucked back with a constant speed with certain pauses, enough to increase the retrieval and prevent alveolar collapse. The pause between the instillation and retrieval of the fluid is not fixed. Certain factors like age, volume instilled, patient's underlying pulmonary disease and smoking status affect the retrieval of the fluid. After the collection of the lavage in a single container, the amount and the macroscopic properties of the fluid are recorded. To obtain a homogeneously mixed fluid, single container method is preferred before the separation for cell counting and cultures. The storage of the specimen depends on the processing. If the specimen is processed within an hour, it can be kept in room temperature while if it will be processed afterwards, in may be kept up to 24 hours at 4°C. The most important issue regarding a BAL procedure is the qualification and adequacy of the sample. If the sample show less than 10 macrophages per field, less than 2 million cells in total, increased number of epithelial cells, exceeding the macrophages, have purulent exudative appearance, have increased number of erythrocytes due to iatrogenic traumatic procedure or already degenerated till the processing, the sample may be called as inadequate. The specimen is first filtrated and centrifuged for cell counting. By a hemocytometer, total white

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cells per mL separately from epithelial cells or erythrocytes and with a differential of white cells like lymphocytes or neutrophils and even macrophages should be determined and reported. For the determination of subpopulations of white cells or monoclonality, flow cytometry may be used. Specific stating methods may be used for specific diagnostic suspicions. Normally, 100-150.000 cells/mL are observed in healthy and nonsmoker individuals while smoking increases the number by almost five fold (Karimi *et al*., 2012; Jain *et al*., 2004). Based on the clinical indication of the procedure, the specimen is also cultured routinely for bacteria, and opportunistic viral and fungal infections as requested. Besides cell counting and culture, pathologic evaluation should be performed in every sample by certain staining methods.

Complication

BAL performed with a flexible bronchoscopy under an oxygen supplementation is generally well tolerated. It may be performed either in a special operating room or by the bedside of the patient with a portable flexible bronchoscope. The major complications of BAL are hypoxemia, transient and easily managed, fever, bronchoconstruction and rarey, pneumothorax. Routine post procedural radiographical evaluation is not indicated unless there is a clinical suspicion of such complications (Karimi *et al*., 2012; Jain *et al*., 2004).

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