The Performance of High-Volume Bronchoalveolar Lavage for the Evaluation and Diagnosis of Interstitial Lung Disease

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Although high-volume bronchoalveolar lavage (BAL) is an excellent research tool, its use in the evaluation of interstitial lung disease remains controversial, particularly in the age of lung biopsy in video-assisted thoracic surgery. Recently, a new practice guideline made several important recommendations for the performance of the procedure and the handling, processing, and analysis of samples. Here we describe this recommended technique, our experience performing BAL in 42 patients, and the usefulness of our differential cell count results. We demonstrate that BAL is straightforward and safe to perform and conclude that it may offer valuable data in evaluating interstitial lung disease, particularly in patients with an acute presentation or who are not fit for lung biopsy.


Technique

Performance and Safety

In individuals who are fit for bronchoscopy, BAL should be performed at a site chosen from the HRCT appearance. The bronchoscope should be wedged into the segment, and 100 to 300 mL room temperature saline solution should be instilled in three to five aliquots (Fig 1). With use of a negative suction pressure below 100 mm Hg, a pooled retrieval of at least 5% but ideally 30% or more of the total instillate should be sought; returns of less than this can give misleading differential cell counts, particularly if less than 10% is returned [1].

The BAL sample should be at least 5 mL but ideally 10 to 20 mL (the rest of the retrieved volume can be used for other analyses if indicated) [1].

The current guidelines highlight the safety of this procedure. Serious adverse events, including pneumothorax and hemorrhage, are rare. The most frequent sequelae are self-limiting fever and hypoxia, which are associated with larger volume instillations [1]. If less than 5% of each aliquot instilled is retrieved, the procedure should be stopped because the retained saline may lead to segmental distension, resulting in the release of proinflammatory mediators [1].

Interpretation of Results and Existing Controversies

The BAL differential cell count may point to a certain diagnosis once infection has been ruled out. Elevated differentials are taken as 15%, 3%, 1%, and 0.5% for lymphocytes, neutrophils, eosinophils, and mast cells, respectively [1]. Elevated differential counts can be highly suggestive if not diagnostic of some diseases; their discussion is outside the scope of this article.

The new ATS guideline also attempts to address many of the existing BAL performance controversies such as patient position, optimal BAL site, suction pressure, and pooling of samples.

We are unaware of any studies on the positioning of patients during BAL. The guideline recommends that patients be placed in a position that best suits the clinical situation, and this should be recorded in the procedure notes [1].
The guideline recommends that all samples should be pooled to facilitate standardization of the procedure [1]. The amount of lidocaine given to patients should be just enough to keep them comfortable and control cough, given that excessive amounts may contaminate BAL and affect cell lifespan [1].

**Our Results**

The bronchoscopists were updated through oral presentation of the ATS guidelines published in May 2012. We had previously analyzed our BAL performance before implementing these exact guidelines [3]. From September 2012 to February 2013, 42 high-volume lavages were performed for the evaluation of ILD in 20 men and 22 women. The mean age of this group was 61 ± 13 years (median, 63 years). The mean volume of instilled fluid was 145.5 ± 46.6 mL, and the mean volume retrieved was 53.1 ± 19.2 mL. The mean percentage of return was 37.8 ± 10.2%. The mean oxygen saturation before the procedure was 97.8 ± 2.2%; the lowest recorded saturations during the procedure were 92.9 ± 5.6%. The mean oxygen desaturation during the procedure was 4.6 ± 4.5%. No postprocedure complications were experienced by any of the patients, and none required ventilation. Satisfactory return of instillate was observed in all patients. The mean dose of midazolam administered was 2.5 ± 0.8 mg.

Differential counts were retrieved from patient charts in 38 patients (Fig 2). The mean macrophage level ± standard deviation was 60.61 ± 22.4% (median 64% IQR 47% to 78%). The mean neutrophil level was 18.21 ± 18.78% (median 12% IQR 5% to 25%), the mean lymphocyte level was 17.18 ± 19.52% (median 10.5% IQR 4% to 24%), and the mean eosinophil level was 3.73 ± 7.74% (median 1% IQR 0% to 5%).

**Comment**

In general, BAL differential counts are insufficient to diagnose a specific ILD apart from some extremely rare ones. They may support a diagnosis in the right clinical setting, especially in frail patients who are too unfit for a surgical lung biopsy or those with an acute presentation. Our data indicated that in this group of patients, there
was no lavage differential count in the normal range. According to the advice in the ATS guidelines on interpretation of BAL results, 16 patients had elevated lymphocyte counts, but only 2 of them had a differential level above 50%—a level extremely suggestive of cellular nonspecific interstitial pneumonia or hypersensitivity pneumonitis [1]. Seven others had less specific levels above 25% but below 50%, with differential diagnoses including drug reaction, cryptogenic organizing pneumonia, nonspecific interstitial pneumonia, lymphocytic interstitial pneumonia, berylliosis, sarcoidosis, and hypersensitivity pneumonitis [1].

Thirty-six patients had elevated neutrophil differentials; only 2 of them had levels above 50%—a finding observed in acute lung injury, infection, or aspiration [1]. Twenty-two patients had raised eosinophil differentials; one was over 25%, in keeping with a diagnosis of eosinophilic pneumonia if other clinical findings correlate [1].

These data indicate that in apart from one case of eosinophilic pneumonia, BAL performance did not result in an exact diagnosis. It narrowed the differential diagnosis to some degree in 11 cases and considerably so in 4 of these, improving the pathway of diagnosis in patients too frail for VATS biopsy; it is here that its optimal use lies.

In summary, these data confirm the key role of VATS lung biopsy in the diagnosis of interstitial lung disease and the potential use of BAL in frail patients too unfit for biopsy or those with extremely rare disease.

Our experience also highlights the ease of performing this procedure with safe outcomes. Larger studies using this standardized technique may contribute to a better understanding of the different ILDs, potentially reducing the need for biopsies and allowing therapeutic response to be monitored.

References