Comparison between induced-sputum and bronchoalveolar lavage fluid in diagnosis of pulmonary tuberculosis

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ABSTRACT

Background: Diagnosis of pulmonary tuberculosis in patients with negative smear result or sputum culture and patients who are unable to produce sputum requires other tough techniques. This study compares the smear and culture results obtained by induced-sputum as a non invasive method with samples taken by bronchoalveolar lavage (BAL).

Patients and methods: A total of 82 patients subjected for bronchoscopy were enrolled. They had 3 negative sputum samples, or were unable to produce sputum. Induced-sputum specimens were taken from all patients before performing bronchoscopy.

Results: A total of 18 BAL culture samples were positive, among whom 16 had positive culture in induced-sputum sampling (kappa test: 0.92, p=0.0001). There was a significant relation between radiologic findings and smear and culture results.

Conclusion: Induced-sputum is a non-invasive method when compared with BAL. It is a reassuring alternative of BAL which is a semi-invasive and expensive approach. If the radiologic findings are compatible with pulmonary TB, possibility of positive induced-sputum samples can be increased.

Keywords: Induced-sputum, Tuberculosis, Bronchoalveolar lavage, Sampling.

INTRODUCTION

Tuberculosis (TB) is one of the most common infections in the world, especially in developing countries (1). Recently, TB prevalence is increased in developed countries due to HIV infection. The mortality rate of TB differs from 50-80% in untreated positive smear patients to less than 5% in well supervised areas (2). Pulmonary TB is generally diagnosed by detection of TB bacillus in sputum sample. It can be also diagnosed by study of gastric contents, however, this technique is only applicable in individuals unable to produce sputum (1).

In patients who are unable to produce sputum or have negative sputum sample but are highly suspected of TB, sputum specimen can be achieved via induced-sputum method or alveolar lavage technique (3). Each of these two methods has some advantages and disadvantages; TB can be transmitted by application of induced-sputum method although the possibility is really low. Induction of coughing and bronchospasm are other defects in this technique (3,4). The most prominent
advantage of induced-sputum technique is its availability and cheapness (5).

Bronchoscopy, as an invasive method, needs special equipment. It has limited application in advanced pulmonary diseases. This method is expensive but has a unique property which is taking direct sample from lesions and also evaluation of possible malignancy at the same time (5).

A study performed on 250 hospitalized children in South Africa to compare the gastric lavage with induced-sputum revealed that children tolerate induced-sputum easily. Positive result of smear and culture were 54 cases in induced-sputum (21.6%) and 40 cases in gastric lavage (16%) while the diagnostic potency of induced-sputum is 3 times more than gastric lavage (6).

Chest X-ray in patients suspected of TB is a helpful but not a diagnostic method. Lung CT-scan has more sensitivity but is not specific (2).

In Canada, Anderson and colleagues compared samples achieved by induced-sputum and alveolar lavage in 101 patients. They concluded that induced-sputum technique is more economic, is well tolerated and also is as diagnostic as bronchoscopy (5).

This study was conducted to compare the smear and culture results obtained by induced-sputum as a non invasive method with samples taken by bronchoalveolar lavage (BAL).

PATIENTS and METHODS

This descriptive study was conducted between February 2006 and 2007. Suspected TB cases that had negative sputum specimen or were unable to produce sputum and were subjected for bronchoscopy were included.

One hour before bronchoscopy, all individuals inhaled 5cc of saline hypertonic solution by nebulizer and then were asked to cough. Having explained the technique for patients, they inhaled hypertonic saline in an isolated well-ventilated room. Specimens achieved by this method (induced-sputum) were collected. Since induced-sputum samples are very similar to the salivation fluid, the laboratory was notified. Then, bronchoscopy was performed during which 200cc of saline fluid was injected into the airway and alveolar lavage samples were dispatched to the laboratory of Masih Daneshvari Hospital in Tehran.

Results were analyzed by SPSS software (Version 11.0, SPSS Inc., USA). The confidence level between alveolar lavage and induced-sputum was estimated by Kappa test. Chi square test was used to assess the association between radiologic pattern and results of smear and culture.

RESULTS

The study population included 52 males and 30 females with their age ranged 25-88 years.

A total of 18 (21.9%) cases revealed to have positive BAL smear and/or culture. Meanwhile, 10 patients had positive induced-sputum smear (12.2%), and 16 had positive induced-sputum culture (19.5%). In 8 patients smears of induced-sputum and alveolar lavage were positive, however, 10 patients had positive smear of lavage and only 2 had positive smear of induced-sputum specimen. Kappa test calculated a confidence level of 44% for these two techniques (table 1).

<table>
<thead>
<tr>
<th></th>
<th>Positive</th>
<th>Negative</th>
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<tbody>
<tr>
<td>Smear</td>
<td>18(21.9)</td>
<td>64(78.1)</td>
</tr>
<tr>
<td>Induced-sputum</td>
<td>10(12.2)</td>
<td>72(87.8)</td>
</tr>
<tr>
<td>Culture</td>
<td>18(21.5)</td>
<td>64(78.5)</td>
</tr>
<tr>
<td>BAL</td>
<td>16(19.5)</td>
<td>66(80.5)</td>
</tr>
</tbody>
</table>

Of 18 patients who had positive lavage samples, 16 had positive induced-sputum results. Chi-Square test demonstrated a significant relationship between these two methods (p<0.00001). However,
kappa test revealed a confidence level of 88% for culture in both methods.

Cavitary lesions were appeared in CXR of 12 (14.6%) patients at lung apex, however, 24 (29.3%) showed infiltration in anterior lobes. Others had no specific radiologic changes. Table 2 represents CXR findings according to BAL and induced-sputum smear and culture results.

<table>
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<tr>
<th>CXR findings</th>
<th>BAL</th>
<th>Induced-sputum</th>
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<tbody>
<tr>
<td>Apical lobe cavities</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>(n=12)</td>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td>Anterior lobe infiltration (n=24)</td>
<td>8</td>
<td>6</td>
</tr>
</tbody>
</table>

There was a significant association between presence of apical lobe cavities and induced-sputum culture results (p<0.004). Meanwhile, a significant association was noted between radiologic pattern and lavage smear (p<0.002).

DISCUSSION

Of 18 patients with positive lavage smear, 8 had positive induced-sputum smear. This discrepancy could be in part explained by the fact that only one induced-sputum sample was taken, however, diagnostic potency could increase by increasing number of samples.

In Brazil, Conde et al compared the efficacy of these two methods in patients with HIV infection and negative sputum sample. They concluded that induced-sputum is a safe and reliable diagnostic tool (4). Similar results were reported by Saglam et al (5).

In New Zealand, Mc Williams et al compared induced-sputum and bronchoscopy sampling with radiologic findings and concluded that the induced-sputum sampling is positive with higher prevalence in patients with radiologic pattern of active TB, despite the fact that expenses of induced-sputum is one-sixth of bronchoscopy (7).

Schoch and colleagues demonstrated that clinical signs and radiologic findings are not sensitive enough for TB diagnosis. They also showed that bronchoscopy is more accurate than induced-sputum technique (8).

In Canada, Al Zahrani and associates found out that intermittent repeats of induced-sputum technique (up to three times) would increase its specificity from 64% to 97%. Repeating would also augment the culture sensitivity from 70% to 99% (9).

Parry and colleagues proposed induced-sputum approach for patients who can not produce sputum or have negative smear TB (10). Kartaloglu et al made it clear that gastric lavage fluid is not a diagnostic method but its culture is helpful (11).

In our setting, of 18 patients with positive BAL culture, 16 had positive induced-sputum culture. Thus, a strong correlation exists between these two sampling methods, as approved by chi square test.

We believe that sampling via induced-sputum method as a non-invasive approach is a good alternative for bronchoscopy and BAL sampling. Weak correlation between induced-sputum and radiologic findings could be interpreted by few sample size. The most vivid role of radiologic pattern is in highly suspicious TB cases, like infiltration of the lung apex or cavitary lesion that are accompanied with TB compatible clinical signs and symptoms. For these cases, induced-sputum technique has priority to the other techniques. Nevertheless, repeating sampling would increase the diagnostic accuracy.

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Comparing induced-sputum and BAL

REFERENCES


