

To study the Broncho alveolar Lavage fluid analysis for AFB Smear Examination for MTB in clinically suspected case of Pulmonary Tuberculosis having no sputum production

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Abstract:

Background: Sputum smear test is the quickest way of detecting acid fast bacteria, but a very large sample is required for accurate sensitivity and so this test has a reason for low sensitivity. The Sputum smear test stands as an accurate prognosis for pulmonary tuberculosis also called PTB. Although sputum staining is the appropriate detection for PTB, more than 45-50% of the smears results as negative. The main aim of this study is to analyze the Broncho alveolar lavage fluid in sputum smear negative patients with strong suspicion of pulmonary tuberculosis clinically and radiologically in X- Ray chest.

Materials and Methods: The design of the study was prospective cross-sectional study. A total of 145 patients were selected for this study. Participants who underwent a negative sputum smear and were suspected of pulmonary tuberculosis were included. All the participants encountered fiberoptic bronchoscopy and broncho alveolar lavage, and then the samples of broncho alveolar lavage were stained separately.

Results: Among the 145 patients, 87 were male and the remaining 58 were females. The average age of the patients in this study was 52.5 ± 19.2 years. In the total 145 samples, 55 were positive for acid-fast bacteria.

Conclusion: Broncho alveolar lavage associated with fiberoptic bronchoscopy is an accurate and convenient method of detecting pulmonary tuberculosis with decreased risk factors.

Keywords: Broncho Alveolar Lavage, Fiberoptic Bronchoscopy, Pulmonary Tuberculosis, Sputum Smear Test, Low Sensitivity.

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Introduction

Globally Tuberculosis is a widespread disease that affects the respiratory system (especially lungs) of the patients [1]. Tuberculosis, also called TB, is caused by Mycobacterium tuberculosis bacteria and is a single infectious agent. TB is considered the top modality causing disease worldwide [2]. In the year 2013, TB has caused over 1.2 million deaths all over the world [3]. The transmission of TB by mycobacterium takes place by inhaling or getting in contact with the affected droplet or fluid that are capable of entering the alveoli of lungs and affecting the patient [4].

Pulmonary tuberculosis is the major spreading type of TB which accounts for about 80% of the total cases [5]. Pulmonary tuberculosis, also called PTB, can be controlled if detected earlier and an accurate diagnosis is given. Sputum smear test stands as an accurate prognosis for pulmonary tuberculosis [6]. The Sputum smear test is the quickest way of

detecting acid fast bacteria, but a very large sample is required for accurate sensitivity and so this test has a reason for low sensitivity [7].

Direct sputum smear microscopy is the well-known type of screening test to quickly identify and diagnose PTB all over the world. Many studies suggest that the two following sputum smears with adequate quality are enough to detect the positive smears for tuberculosis affected individuals [8, 9]. Additionally, the WHO has suggested that the screening of the required two sputum smears can be conducted consequently on a single day [10]. Hence this confirms that acid-fast bacilli microscopy provides high quality results and so this may prevent the chances of defects during the procedure. However direct sputum microscopy is the best option for PTB it also has a few disadvantages that includes more than 45-50% of the smears results as negative and also it has low sensitivity.

With all the developments in bronchoscopic methods, bronchoalveolar lavage (BAL) is an accurate and good diagnostic tool for pulmonary tuberculosis. The diagnostic range is between 85-87% with decreased risk factors and complications when performed by professionals [10]. The main aim of this study is to analyze the Broncho alveolar lavage fluid in sputum smear negative patients with strong suspicion of pulmonary tuberculosis clinically and radiologically in X-Ray chest.

Materials and Methods

The design of the study was a prospective cross-sectional study conducted at the Department of Respiratory Medicine of Patna Medical College & Hospital in Patna, Bihar, India. A total of 145 patients were selected for this study. Participants who underwent a negative sputum smear and were suspected of pulmonary tuberculosis were included. All the participants encountered fiberoptic bronchoscopy and broncho alveolar lavage, and then the samples of broncho alveolar lavage were stained separately.

The selected participants were above 21 years of age and were found negative for all the three morning sputum specimens for acid fast bacilli by "Ziehl-Neelsen stain". The patients did not show any action or response to the antibiotics that were prescribed for respiratory tract infection for about two weeks. The culturing of the sputum smears was done on "Lowenstein-Jensen growth medium."

Individual consent from the participants were obtained and they were made well aware of the safety measures and the steps in procedure. The exclusion criteria were the participants with bronchoscopy contraindications (such as increased level of blood urea, low platelets count, coagulation

disorders) and those with "moderate massive pleural effusion".

The participants went through bronchoscopy by flexible fiberoptic bronchoscope along with sedation that was administered intravenously. All the participants encountered fiberoptic bronchoscopy and broncho alveolar lavage, and then the samples of broncho alveolar lavage were stained separately.

The participants were on continuous monitoring for ECG, BP and oximetry. Once the examination of the bronchial tree was completed, Broncho alveolar lavage was performed at the end of bronchoscopy along with normal saline (100 ml) in the suspicious part of lesion. Finally, the samples of broncho alveolar lavage were given for staining (Ziehl-Neelsen stain and gram staining, cytopathology and histopathology and mycobacterium culture).

Results

Among the 145 patients, 87 were male and the remaining 58 were females. The age of the patients was between 21-77 years and so the average age of the patients in this study was 52.5 ± 19.2 years. The majority of patients affected were between 51-60 years of age. The staining of samples with Ziehl-Neelsen showed positive results in 55 patients and the samples of broncho alveolar lavage was detected with the presence of mycobacterium tuberculosis on Lowenstein-Jensen growth medium.

Of the remaining 90 patients who showed a negative result in Ziehl-Neelsen staining of broncho alveolar lavage samples, 32 samples were detected with the presence of mycobacterium tuberculosis on Lowenstein-Jensen growth medium. The sensitivity, specificity, Positive prediction value, negative prediction value for broncho alveolar lavage, LR+ and LR- values are tabulated in Table 1.

Table 1: Diagnostic validity of sputum smear-negative TB for BAL examination

	BAL Examination (n)	Confidence Intervals
Sensitivity	87	53 to 68
Specificity	132	86 to 96
Positive Prediction Value	129	83 to 95
Negative prediction value	93	57 to 71
LR+	94	3.71 to 11.22
LR-	1	0.36 to 0.53

Among the 145 patients included in this study, 55 individuals were found positive for mycobacterium tuberculosis. The histopathological examination for the broncho alveolar lavage specimens showed no huge differences with sputum smear positive and negative specimens. Details of histopathological examination for the broncho alveolar lavage specimens are listed in Table 2.

Table 2: Histopathological findings of all Broncho alveolar lavage specimens

Histological Findings	N	%
Strongyloidosis	2	1.3
Aspergilosis	2	1.3
Adenocarcinoma	5	3.4
Squamous cell carcinoma	8	5.5

Dysplasia	5	3.4
Inflammation	123	84.8
Total	145	100

Discussion

In places where the pulmonary tuberculosis being widespread and detection of pulmonary tuberculosis is negative for acid fast bacilli sputum smears or if there is no production of sputum from the affected individuals and when the time is running out for additional examination, treatments based on experience with continuous monitoring of patients is important [11].

The main disadvantage about the Ziehl-Neelsen sputum smear staining is that it cannot identify the acid fast bacilli in every patient attempting for testing [12]. Also, quick and initial treatment is required for the diagnosis of tuberculosis, and it can also decrease the complications and risk factors. Hence the broncho alveolar lavage and fiberoptic bronchoscopy comes in rescue for providing quick treatment despite time delaying with low death rates [13].

In this current study, fiberoptic bronchoscopy was conducted in 145 negative sputum smear patients that were suspected of pulmonary tuberculosis. When compared to this study the result of positive Ziehl-Neelsen sputum smear was low. With all the developments in bronchoscopic methods, bronchoalveolar lavage (BAL) is an accurate and good diagnostic tool for pulmonary tuberculosis. The diagnostic range is between 85-87% with decreased risk factors and complications when performed by professionals. The staining of broncho alveolar lavage samples with Ziehl-Neelsen showed positive results in 55 patients and the samples of broncho alveolar lavage was detected with the presence of mycobacterium tuberculosis on Lowenstein-Jensen growth medium.

Of the remaining 90 patients who showed a negative result in Ziehl-Neelsen staining of broncho alveolar lavage samples, 32 samples were detected with the presence of mycobacterium tuberculosis on Lowenstein-Jensen growth medium.

Many studies have been made that show the advantages of bronchoscopy for the treatments and diagnosis of pulmonary tuberculosis [14, 15]. A study conducted by Worodria et al. states that an increased speed and sensitivity was observed with broncho alveolar lavage associated with bronchoscopy in the diagnosis of pulmonary tuberculosis in HIV patients [16]. Furthermore, a study conducted by Kumar et al. states that fiberoptic bronchoscopy is the reliable and accurate treatment for identifying pulmonary tuberculosis [17].

A study by Jacomelli et al. revealed the percentage of sensitivity and specificity of broncho alveolar lavage in their research was found to be 60% and 100% [6]. When compared to our study the sensitivity was low, but the specificity was high. This shows that bronchoscopy is a useful procedure. Fiberoptic bronchoscopy and broncho alveolar lavage are not only used as a treatment for pulmonary tuberculosis but are also useful in detecting many other pulmonary pathologies. The patients did not show any action or response to the antibiotics that were prescribed for respiratory tract infection for about two weeks. The culturing of the sputum smears was done on "Lowenstein-Jensen growth medium" in this study.

Additionally, fiberoptic bronchoscopy has a very less rate of risk factors and complications and the need for post bronchoscopy hospitalization is also not needed and in our study no complications were observed in the selected patients. When comparing the positive sputum smear patients and negative sputum smear patients, the positive smear patients have a very high rate of infection. And so, the negative sputum smear patients act as a significant source to the spread of tuberculosis in the region [18].

Conclusion

To conclude with the findings of this study broncho alveolar lavage and fiberoptic bronchoscopy stands as a reliable and convenient procedure with considerable accuracy, positive predictive value, negative predictive value, sensitivity and specificity for the proper and quick diagnosis for pulmonary tuberculosis in negative sputum smear patients. Furthermore, future studies are to be made for a cost effective method of fiberoptic bronchoscopy in negative sputum smear patients mainly in well developed countries.

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