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Original Article

Diagnostic Yield of Fiber Optic Bronchoscopy Washings among Patients of Sputum Smear-Negative Pulmonary Tuberculosis

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Abstract

Objective: To assess the diagnostic efficacy of fiber-optic bronchoscopy (FOB) in identifying smear-negative pulmonary TB.

Methods: This cross-sectional study was carried out at Institute of TB & Chest Medicine, Mayo Hospital Lahore from 15-7-2024 to 15-1-2025. Before FOB, patients were instructed to abstain from eating for 6 hours. The FOB was performed with local anesthesia. The BF type Olympus bronchoscope was used. The bronchi were washed using normal saline & recovery of up to a quarter of the fluid by suction was judged adequate. The hospital lab confirmed the presence or absence of Mycobacterium Tuberculosis by staining bronchial washings for AFB. Direct microscopy showing between 1 and 9 AFB/HPF in a bronchial washings smear indicates positivity. This data was gathered in a hypothetical scenario

Results: FOB had a 57.5% diagnostic yield for identifying PTB patients that were positive despite a negative sputum smear. Patients between the age of 16 and 32 and those between the age of 49 and 60 had the greatest diagnostic yield (37%). However among patients of 33-48 years, diagnostic yield was 26.1% only. For both genders diagnostic yield for FOB was 50%. Diagnostic yield of FOB increases with increasing duration of symptoms. However patient's age, gender and duration of symptoms was not significantly associated with diagnostic yield of FOB.

Conclusion: Our findings support the use of FOB for the quick and accurate identification of MTB in sputum smear negative patients who have clinical and/or radiological features of Pulmonary TB

Keywords: Diagnostic yield, Fiberoptic Bronchoscopy, Smear Positive, Smear Negative, Pulmonary tuberculosis.

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Introduction

As a highly contagious infectious illness, tuberculosis (TB) poses serious risks to the general public. It is projected that in 2013, 9.0 million individuals were diagnosed with tuberculosis and 1.5 million people died from the illness; of these deaths, 360,000 were HIV-positive.[1,2] Pakistan has the fifth highest rate of tuberculosis in the world with a yearly increase of almost 0.5 to 0.6 million new cases, Pakistan has a TB prevalence rate of 264/100,000.[3]

Isolating Mycobacterium tuberculosis (MTB) may be time consuming, so only about a third of individuals with active PTB will have a positive sputum smear.[4,5] Smears of expectorated sputum are stained to look for Acid Fast bacilli, which are used to make an early diagnosis of pulmonary tuberculosis (PTB). Even in well-equipped facilities, the positive yield of sputum smear remains between 30 and 70% in clinically and radiologically suspected cases of PTB.[6,7] Reduced morbidity and mortality from PTB may be achieved with early and prompt diagnosis. When acid fast bacilli are cultured from sputum, the findings don't come back for 6-8 weeks, delaying both diagnosis and therapy. There is not yet a serological test that can quickly diagnose PTB.[7]

Although clinical and radiological data are used most often in the diagnosis and treatment of sputum smear-

negative PTB, around 20% of PTB patients are entirely asymptomatic, whereas 42%-86% of PTB patients may be symptomatic. Sputum smear-negative TB is characterized by abnormal or unusual chest x-ray results. Previous PTB infection may lead to a significant false positive rate for chest x-rays in countries with an intermediate or high TB prevalence, such as Pakistan.[8,9]

In smear-negative pulmonary tuberculosis (PTB) patients, fiberoptic bronchoscopy (FOB) has been tested for early diagnosis. It would be easier to diagnose tuberculosis (TB) in such individuals if they have undergone FOB. Collecting bronchial secretions and washings from a potential anatomical region through FOB is a study. Jacomelli M. et al. showed that AFB smears made from FOB washings had a 19% sensitivity and a 96% specificity.[10] The diagnostic yield of FOB samples was shown to be 85% by Soto et al.[11] As Khara et al. shown, 55% of smear-negative PTB patients may be diagnosed with illness using FOB.[12]

The purpose of this research is to determine the diagnostic yield of fiberoptic bronchoscopy for sputum-negative pulmonary TB. Our findings will aid in the confirmation of PTB diagnoses and the prevention of the inappropriate use of anti-tuberculosis drugs. Previous studies have been conducted on Indian and Western population, so this study is planned to be conducted on local patients of sputum smear negative pulmonary tuberculosis. Therefore aim of this study is to assess the diagnostic efficacy of fiberoptic bronchoscopy in identifying Smear-negative pulmonary TB.

Methods

This cross-sectional study was carried out at Institute of TB & Chest Medicine, King Edward Medical University / Mayo Hospital Lahore in six months i.e. from 15th July 2024 to 15th January 2025. Sample size of 80 cases was statistically calculated using 85% of diagnostic yield of fiberoptic bronchoscopy[11] for the detection of AFB on Bronchial washings smear in patients of sputum smear negative PTB. Non probability, consecutive sampling technique was used to select study subjects. All male and female aged 16 years and above, with two sputum smears negative for AFB diagnosed during last 1 month were included. Smear negative pulmonary tuberculosis was labeled as a case with no AFB detected via smears (Ziehl Neelson staining) in two consecutive sputum samples and Chest radiograph suggestive of pulmonary tuberculosis (consolidation, cavitation or military shadowing any one of these). Patients with bleeding diathesis (platelet <20,000/microL) or severe dyspnea (Spo2<92%), history of myocardial infarction or arrhythmia, history of anti-tubercular treatment (ATT) for >1 month, HIV-positive were excluded.

After receiving clearance from the hospital's ethical committee (IRB letter No. 468/RC/KEMU Dated 13-07-2024), the outpatient clinic's department of chest medicine recruited 80 patients who met the study's selection criteria. After taking consent from the patients, their personal information (name, age, gender, and duration of symptoms) and written informed permission were collected on a proforma before the FOB procedure began. After that, no eating or drinking was allowed for six hours before procedure. Local anesthesia 2% & 4% lignocaine solution was used during the FOB procedure. A bronchoscope of the BF type from Olympus was utilized. The bronchi were washed by injecting 0.9% isotonic saline via the FOB's internal channel and then sucking it up into a mucous collector chamber with the use of a suction tube. Each washing required the addition of 15-30 ml of fluid, and only around 1/4 to 1/2 of this amount was recovered in the suction trap. Successful recovery was defined as up to one-quarter of the initial dose administered. The bronchial washings were sent for AFB staining (Ziehl Neelson) to the lab of the hospital for confirmation of presence or absence of Mycobacteria Tuberculosis. Bronchial washing smear was considered positive if 1-9 AFB/HPF are seen on direct microscopy. All the results were confirmed through expert microbiologist. All this information was collected on pre-structured proforma. Data was entered and analyzed through SPSS version 21. Diagnostic yield was presented as frequency and percentage.

Results

Gender distribution of patients showed that there were 39(48.8%) male and 41(51.3%) female patients. As per AFB smear test results 46(57.5%) patients were positive while 34 (42.5%) were negative. FOB washing smear detects AFB in 46(57.5%) patients while in 34 (42.5%) it was negative. (Table-1)

Patients with positive AFB on FOB washing smear among them 17(37%) were in the age group 16-32 years, 12(26.1%) patients were in the age group 33-48 years and 17(37%) patients were in the age group 49-60 years. No statistically significant association was seen between ages for positive AFB cases on FOB washing smear i.e. p-value= 0.988. Among male patients, FOB had diagnostic yield of 23 (50%) while among females, FOB had diagnostic yield of 23 (50%). No statistically significant association was seen between gender for positive AFB cases on FOB washing smear i.e. p-value= 0.796. In patients who had duration of symptoms, 7-14 days, diagnostic yield of FOB was 13 (28.3%), with duration of symptoms 15-21 days, diagnostic yield of FOB was 15 (32.6%), with duration of symptoms 22-30 days, diagnostic yield of FOB was 18 (39.1%). Duration of symptoms was not significantly

associated with positive AFB cases on FOB washing smear i.e. p-value= 0.214. (Table-2)

Table 1: *Frequency distribution of Gender, AFB smear and Diagnostic Yield (N=80)*

Characteristics		n (%)
Age (years)	Mean ± SD	38.64 ± 14.56
Gender	Male	39 (48.8)
	Female	41 (51.3)
AFB Smear	Positive	46 (57.5)
	Negative	34 (42.5)
Diagnostic Yield	Yes	46 (57.5)
	No	34 (42.5)

Table 2: *Comparison of diagnostic yield stratified for effect modifiers*

Variable		Diagnostic Yield		Total
		Yes n (%)	No n (%)	
Age	16-32	17(37)	12(35.3)	29
	33-48	12(26.1)	9(26.5)	21
	49-60	17(37)	13(38.2)	30
Gender	Male	23(50)	16(47.1)	39
	Female	23(50)	18(52.9)	41
Duration of symptoms	7-14 days	13(28.3)	16(47.1)	29
	15-21 days	15(32.6)	9(26.5)	24
	22-30 days	18(39.1)	9(26.5)	27

Discussion

Despite the fact that the tubercle bacilli were discovered over a century ago and that much has been learned about TB since then, the illness remains a significant threat to human health, especially in underdeveloped regions of the world. The finding of AFB in sputum samples is the gold standard for PTB diagnosis. When it comes to diagnosing PTB, sputum microscopy is a low-cost and highly specific option. It is a crucial part of the World Health Organization's (WHO) short-course plan for directly monitored therapy.

However, Sputum smear results are not always definitive. Upwards of 22% to 61% of SSN-PTB patients are characterized by a smear-negative, culture-positive condition[13]. In the case of smear-negative pulmonary TB, bronchoscopy is a crucial diagnostic tool. For smear-negative PTB patients, FOB has been tested as a fast diagnostic method. It would be easier to diagnose TB in such individuals if they have FOB. Collecting bronchial secretions and washings from a potential anatomical region through FOB is a study.

The diagnostic yield of FOB in this research was 57.5% for the discovery of positive patients in Smear-negative PTB. Patients aged 16–32 years and those aged 49–60 years had the best diagnostic yield (37%). However, in patients aged 33–48, diagnostic yield was just 26.1%. Fifty percent of male and female patients were correctly diagnosed with FOB. The more time passes after symptoms began, the higher the diagnostic yield of FOB. The diagnostic yield of FOB was not substantially influenced by patient age, gender, or illness duration.

Among sputum-negative pulmonary tuberculosis suspects, the overall yield of FOB in diagnosing active PTB ranges substantially from 35.7% to 95%, depending on the study[1,14]. The yield of FOB in this investigation for diagnosing active PTB among smear-sputum-negative pulmonary tuberculosis suspects is between the previously described range reported in the literature. Jacomelli M. et al. showed that AFB smears made from FOB washings had a 19% sensitivity and a 96% specificity.[10] The diagnostic yield of FOB samples was shown to be 85% by Soto et al.[11] In smear-negative PTB patients, Khara et al. found that the overall diagnostic yield of FOB was 55%.[12]

Foos et al. discovered that the yield of diagnosing PTB using FOB was 27%.[15] A further prospective research by Conde in Brazil found that the FOB was positive for PTB in 56% of cases.[16] When compared to the diagnostic yield given by Foos and Conde, FOB performed substantially better. In his study, Indian researcher Sameer Singhal found that altogether, only 35.7% (15/42) of patients who had bronchoscopic procedures for TB were correctly diagnosed.[17] Nonetheless, Sameer Singhal found a somewhat lower diagnostic yield for FOB than was seen in this investigation. However, this discordance is a consequence of the number of patients treated and the diversity of study populations.

Bronchoscopy might be difficult to implement in high TB incidence areas because of the lack of available resources. Additional studies on the viability and cost-effectiveness of bronchoscopy for TB diagnosis in resource-limited settings are required before it can be recommended as an effective method. However, at tertiary care facilities in high TB incidence regions, bronchoscopic procedures should be conducted when other diagnosis, such as malignancy, foreign body, etc., must be checked out. If a patient is suspected of having tuberculosis but a sputum smear is negative or the patient is unable to produce sputum, then flexible bronchoscopy may play a significant role in making the diagnosis.

Conclusion

This study's findings imply that bronchoscopy is a reliable and effective tool to quickly & effectively obtain bronchial samples for microscopy in sputum smear negative patients for diagnosing PTB. In patients without sputum production / expectoration, it may also help a

quick and accurate diagnosis of PTB.

Ethical Approval: The IRB/EC approved this study via letter no. IMBB/BBBC/22/271 dated February 4, 2022.

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Authors' Contribution

AWG: Conception.

BM, AH: Design of the work.

AJ, MN, FK: Data acquisition, analysis, or interpretation.

BM, AJ, MN, FK, NS: Draft the work.

AWG, AH: Review critically for important intellectual content.

All authors approve the version to be published.

All authors agree to be accountable for all aspects of the work.

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