Role of Bronchoscope Utilization in Sputum AFB & Gene Xpert Negative individuals at Kathmandu Medical College Teaching Hospital.

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ABSTRACT

Background: Respiratory diseases are among the top most cause of mortality globally as per World Health Organization data with chronic obstructive pulmonary disease (COPD), Lung Cancer, Lower Respiratory tract infection and Tuberculosis (TB) among the top ten causes of mortality. Bronchoscope is still in growing phase in our setting despite its significant utility in establishing diagnosis and treatment of patient. Bronchoscope has pivotal role in various benign (Eosinophilic pneumonia, tuberculosis, Interstitial Lung Disease etc.) as well as Malignant (Lung Cancer) Respiratory diseases etc.

Objective: To find out the efficacy of bronchoscope in detecting tuberculosis among sputum smear acid-fast bacilli (AFB) and GeneXpert negative individuals.

Method: A single center, prospective, cross sectional study design was conducted which included all patients seen by Pulmonary Medicine department of Kathmandu Medical College Teaching Hospital (KMCTH). Patients were offered bronchoscopy if clinical history, examination, sputum microbiology and imaging findings demanded.

Results: A total of 111 cases underwent Fiberoptic bronchoscopy (FOB) at our center during the study period for various indications. Out of which 62 (55.86%) were male and 49 (44.14%) were Female. Among a total of 45 cases with strong clinical suspicion of pulmonary tuberculosis but sputum AFB and GeneXpert-negative tuberculosis who underwent FOB, a total of 30 (66.67%) individuals were confirmed to have tuberculosis in bronchoalveolar lavage (BAL) GeneXpert, out of which 17 (56.67%) were male and 13 (43.33%) were female.

Conclusion: FOB is very useful in establish diagnosis of Tuberculosis in selected patients with negative Sputum AFB and GeneXpert result.

Keywords: Bronchoscopy, Bronchoalveolar lavage, GeneXpert, TB-polymerase chain reaction.

INTRODUCTION:

Tuberculosis is amongst the oldest communicable disease present globally having significant burden on the health of an individual as well as the economy of the nation. It is a leading cause of morbidity and mortality globally with an estimated 9 million cases and 1.5 million deaths each year[1]. As per global TB report 2024, Nepal estimated 68000 TB cases and 16000 deaths in 2023. Almost half of the Nepal's population is infected with TB (Latent TB). Unfortunately, despite various steps taken by government to detect and treat TB Cases, 40% of the cases in Nepal are still missing and freely moving in the community and transmitting to them.

The most commonly used tools to diagnose PTB are sputum smear for acid-fast bacilli (AFB) and the chest radiography to look for any radiological signs suggestive of Pulmonary tuberculosis. In fact, Local as well as international guidelines require and emphasize on having bacterial confirmation of tuberculosis rather than using clinical decision alone to diagnose and begin treatment for tuberculosis. As per World

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Health Organization (WHO), detection of AFB in respiratory specimen i.e., sputum (at least two samples collected, one hour apart, preferably one empty stomach and one on the spot or after an hour) using acid-fast staining or Ziehl-Neelsen (ZN) staining is a must for the confirmation of PTB[1]. AFB smears of respiratory specimens, specifically sputum (at least two or more specimens), are important for the prompt diagnosis of PTB. AFB smears have 30–70% sensitivity and 98–99% specificity. However, sputum smear has limitations and fails to identify active tuberculosis in significant cases, i.e., having a false negative report. About 40–60% of patients with suspected active PTB, either clinically or radiologically, may fail to produce sputum, or when it is available AFB may be negative on repeated smear examinations which could be because of various factors related to the quality and quantity of the sputum specimen collection, storage, processing[1]. Even though the Gold standard test for tuberculosis diagnosis is mycobacterial cultures, its utilization is limited due to the amount of time culture results usually requires to be labelled as negative, 3–8 weeks[2]. The test can be positive within 2-3 weeks, but in order to label it as negative, it requires at least 8weeks. In addition, Sputum AFB requires more than 5000 bacilli to be detected compared to less than 10 live bacilli for culture to be positive. Chest x-ray is often used as initial test for individuals who presents with a history of Cough, fever, night sweat, weight loss etc., but many cases with sputum smear-negative TB shows atypical x-ray patterns or normal findings[3]. Sputum smear-negative PTB may have mild or no respiratory symptoms and clinical manifestations[4]. Strategies to control TB include prompt early diagnosis, notification, and successful treatment of patients with active, transmissible disease. Early diagnosis of active PTB is critical for breaking the chain of transmission as well as the initiation of treatment timely, which in turn would help in curtailing the mortality and morbidity of the disease.

As current Respiratory practice has evolved significantly in the last couple of decades due to increasing detection trend of communicable diseases like Tuberculosis, Pneumonia of various etiology as well as non–communicable diseases like Sarcoidosis, Malignancy etc., and the growing threat of tuberculosis detection and transmission to public health is challenging, its timely detection using bronchoscope is of paramount significance, so is true for common non communicable disease. Unavailability of skilled human resources, as well as unavailability of a bronchoscope, even at a major tertiary care center, prevents individuals from reaping its benefits and leads to unnecessary travel and expenditure. Hence, emphasizing its benefits might bring some changes that will aid in patient care.

Hence timely intervention in highly suspected individual will not only help in reaching to early diagnosis but also helps in halting / breaking chain of transmission of Infectious bacilli in the community.

METHODS:

This was a single-center, prospective, longitudinal study conducted in the Pulmonary Medicine outpatient Department of Kathmandu Medical College for one year (May 2024 to May 2025). An ethical clearance was taken from Institutional Review Committee of KMC (REF: 25032024/01). The study included patients evaluated by the Pulmonary medicine team of doctors, whos were highly suspicious of Pulmonary tuberculosis based on Risk factors, clinical history, examination and imaging findings in whom sputum AFB and Gene Xpert was negative. Individuals who presented with signs and symptoms suggestive of tuberculosis and having sputum smear and or TB PCR negative for Tuberculosis were counselled about the utilization of a bronchoscope to inspect the tracheobronchial tree and get a specimen from the lungs for AFB, and after they were ready, consent was obtained. These samples were subjected to Microscopy and Molecular analysis (PCR-geneXpert). Patient who had hypoxemia (SPo2 <90% at room air), hemodynamically unstable (Blood pressure less than 90/60 mm of Hg, Pulse rate more than 100 beats per minute), recent Myocardial infarction, and those who did not give consent for Bronchoscopy were excluded from the study.

Fiberoptic Bronchoscope procedure

Patients who consented to participate in the study were counselled about the pros and cons of the procedure and were given instructions to come to bronchoscopy suite at the given time empty stomach, with closest relative. Once they reported to the bronchoscopy suite, they were explained about the procedure and then were subjected to a Diagnostic Fujifilm Fiberoptic Bronchoscope BL-7000 Model (FOB) under mild sedation using Fentanyl 50mcg and Midazolam 1mg and local anesthesia using lignocaine Spray into oral cavity and topical lignocaine at Vocal cord, carina through working channel of the FOB. About 100-150ml of normal saline at room temperature was instilled into different segment of the lung through working channel and was sucked into the mucus extractor. Once the sample was taken scope was withdrawn, inspecting the tracheobronchial tree for any active bleeding, and was sterilized. Patients were advised to have nothing per oral for the next 2 hours before the procedure and were asked to come back with a report.

Statistical analysis

Data were recorded in Microsoft Excel sheet. The frequency and percentage were measured.

RESULTS

A total of 111 cases underwent Fiberoptic bronchoscopy. Out of which 62 (55.86%) were male and 49 (44.14%) were female. Among a total of 45 cases (26 Male, 19 Female) with strong clinical suspicion of Pulmonary tuberculosis but sputum AFB and Gene Xpert-negative for Mycobacterium tuberculosis who underwent FOB, a total of 30 (66.67%) individuals were confirmed to have tuberculosis in BAL GeneXpert, out of which

17 out of 26 (65.38%) were male and 13 out of 19 (68.4%) were female as shown below in Table 1.

Table 1: Summary Table of Findings

Total Bronchoscopy done	111	
Suspected PTB	45	
	Male	Female
	26 (57.7%)	19 (42.22%)
Proven PTB	30	
	Male	Female
	17 (65.38%)	13 (68.4%)

DISCUSSION

In high TB-Burden, resource-limited nations like ours, where a significant percentage of TB cases are missing, using all feasible means to early bacteriological diagnosis of tuberculosis is a key to successful management of tuberculosis. Sputum smear AFB has limitations due to sputum quality, smear preparation technique. Several studies, both at the national and international level, showed the significant result of the Utilization of bronchoscope and Bronchoalveolar lavage in yielding diagnosis of tuberculosis.

In our study, a total of forty-five cases having strong suspicion for tuberculosis whose initial sputum analysis was negative for Tubercle bacilli were evaluated using bronchoscopy and BAL, and 30 cases, i.e., 66.66% of cases, were positive for BAL TB PCR, 22 cases, and BAL AFB 8 cases were positive.

Bronchoscopy evaluation for establishing the diagnosis of PTB in sputum microscopy and TB PCR is a quick and safe procedure. In the present study, bronchoscopy led to the diagnosis of TB in 30 (66.67%) of 45 sputum-negative patients, a diagnostic yield that is lower than the study by Imtiaz S et. al[5,6]. The current study's prevalence of 66.67% was higher than our previous study, with a prevalence of 44.82%. We found that BAL TB PCR had the highest diagnostic yield, 22 (73.33%), followed by BAL AFB 8 (26.6%). Also, early diagnosis of PTB cases prevents the spread of the disease.[7] A study by Kumar et al. concluded that FOB is useful to detect PTB and allows initiating appropriate treatment[8]. Also, our result is comparable with the study by Altefet et al., where FOB and BAL had an 83.3% yield in detecting tuberculosis[9]. However slight decrease in yield in our study could potentially be due to not sending BAL for AFB Culture, as in these studies. Among various bronchoscopic procedures like BAL, Bronchial washing, brushing, and biopsy, BAL TB PCR has the highest yield[10]. The authors believe that the utilization of bronchoscopic procedures in patients with signs, symptoms, and contact history, as well as comorbid conditions like diabetes, immunosuppressed individuals, etc., will have a significant impact on establishing diagnosis and initiating treatment, thereby contributing to the national goal of TB-Free Nepal.

LIMITATION

Our study was a single-center study. We did not use BAL AFB culture, the GOLD standard test for TB diagnosis, as it takes 2-8 weeks for the report to arrive, as well as due to resource limitations.

CONCLUSION

Fiberoptic bronchoscopy is a safe, rapid, affordable, and effective method for diagnosing TB in selected patients with negative sputum AFB and GeneXpert results, enabling timely intervention and potentially reducing TB transmission.

FUNDING

None

DATA AVAILABILITY STATEMENT

The data of this study are available from the corresponding author upon request.

CONFLICT OF STATEMENT

The authors declare no conflict of interest.

ETHICS CONSIDERATIONS

An ethical clearance was taken from KMC-IRC: REF: 25032024/01.

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