

# Diagnostic Value of Gastric Aspirate for Microbiological Confirmation in Adult Pulmonary Tuberculosis Suspected Cases Who Are Not Expectorating Sputum

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**Abstract:** *The study aims to identify suspected cases of pulmonary TB who cannot produce sputum and to assess the diagnostic value of gastric aspirate in such cases. Conducted prospectively on 60 adult patients at Kanti Devi Medical College Hospital and Research Centre between December 2022 and March 2023, the study evaluated the efficacy of gastric lavage fluid analysis for AFB and CBNAAT. **Results:** Acid - fast bacilli were positive in 43.3 of the cases, and CBNAAT detected MTB resistance in 3.3 and sensitivity in 51.7 of the cases. **Conclusion:** Gastric lavage seems to be an appropriate tool to obtain samples for mycobacteriologic confirmation of TB in patients with suspected TB who cannot produce sputum, especially in resource limited areas.*

**Keywords:** Mycobacterium tuberculosis; Gastric aspiration; Unable to expectorate; CBNAAT; Suspected

## 1. Introduction

Tuberculosis (TB) is caused by the slow - growing bacteria Mycobacterium tuberculosis (MTB) and can manifest as pulmonary or extrapulmonary disease. TB continues to infect millions of people annually and is the top infectious agent leading to death worldwide. In 2017, there were over 10.0 million cases of TB globally, with 5.8 million men, 3.2 million women, and 1.0 million children being affected. [1, 2]

Those who exhibit symptoms indicative of tuberculosis, such as a persistent cough lasting more than two weeks, fever, decreased appetite, night sweats, haemoptysis, or any abnormality in a chest radiograph, are considered to have presumptive pulmonary tuberculosis. [3] Infected people have a 5 - 10% lifetime risk of falling ill with TB, and this risk is increased in immunocompromised individuals, those with Human Immunodeficiency Virus (HIV), malnutrition, diabetes, or cigarette smoking. [4, 5]

As the prevalence of TB and drug resistance have grown in recent decades, there has been a greater need than ever before for early microbiological confirmation of TB and drug sensitivity testing. [6] However, a sputum smear for acid - fast bacilli (AFB) comes out negative in about half of individuals with active tuberculosis (TB), or they are unable to generate any sputum at all. In these cases, it is essential to find other ways to collect sputum samples, such as sputum induction (SI), bronchoalveolar lavage (BAL), or gastric lavage (GL). [7]

## Aims and Objectives

- 1) To identify suspected cases of pulmonary TB who are unable to expectorate sputum.
- 2) To assess the diagnostic value of gastric aspirate in such cases.

## 2. Literature Review

### Epidemiology

#### Global Burden of Tuberculosis

Tuberculosis (TB) is a major global health problem, ranking alongside HIV/AIDS in terms of global mortality and morbidity. In 2020, there were 10 million people affected by TB globally, with 5.5 million males, 3.3 million females, and 1.1 million children. About two - thirds of the world's total TB cases came from just eight countries, with India being the country with the highest TB burden. While the global TB incidence rate decreased by 11% from 2015 to 2020, there were still 1.5 million TB - related deaths in 2020, down from 2.4 million in 2000 [5].

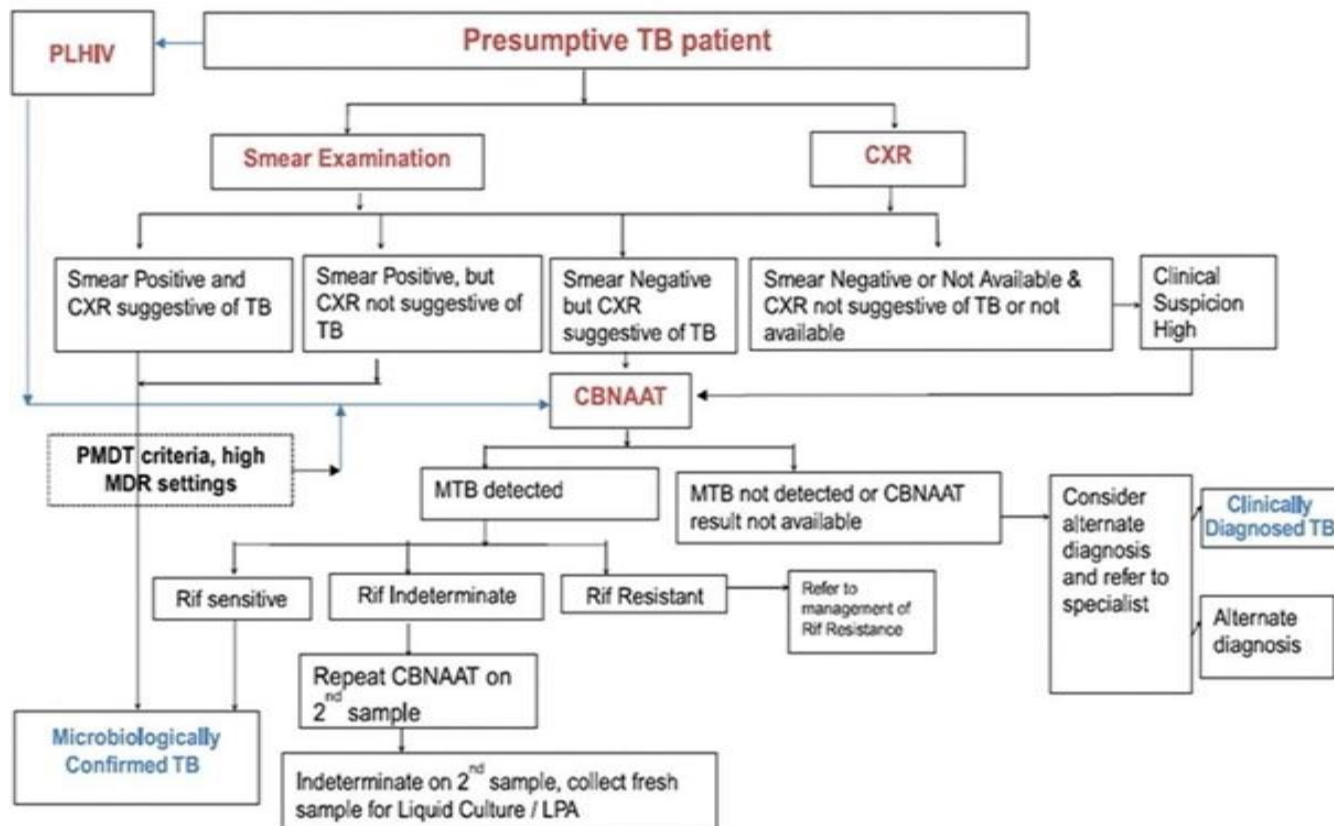
#### Tuberculosis Burden in India

In India, the prevalence of microbiologically proven pulmonary tuberculosis was 316 per 100,000 population aged 15 and above in 2022, with a peak of 534 per 100,000 in Delhi and a minimum of 115 per 100,000 in Kerala. In 2020, 16,28,161 TB patients were reported, and this number increased to 19,33,381 in 2021. The National TB Prevalence Survey Report released in 2020 also showed an 11% increase in the TB death rate between 2019 and 2020 [14].

**Diagnostic Algorithm of Pulmonary Tuberculosis**

Early detection of pulmonary tuberculosis is crucial for reducing TB transmission. The National Tuberculosis

Elimination Programme (NTEP) in India follows a diagnostic algorithm for suspected TB cases, as shown in the figure below [15]:

**Diagnostic algorithm for pulmonary TB****Techniques of Obtaining Specimens**

There are various techniques for obtaining representative of pulmonary specimens for AFB smear and culture. Most common and prime sample to be collected in patients with pulmonary tuberculosis is sputum sample. However, the problem arises when we strongly suspect pulmonary tuberculosis but still obtain sputum for AFB to be negative and there are subset of population having no sputum production at all in spite of exhibiting symptoms of pulmonary tuberculosis.

The various other techniques employed to obtain samples are:

- 1) Induced Sputum
- 2) Laryngeal Swab
- 3) Bronchoscopy
- 4) Gastric Lavage Specimen

**Diagnostic Challenges in Patients Unable to Expectorate Sputum**

Sputum smear microscopy and culture are the standard diagnostic methods for pulmonary tuberculosis. However, in about half of the individuals with active TB, the sputum smear for acid - fast bacilli (AFB) is negative, or they are unable to generate any sputum at all. In these cases, alternative methods for collecting sputum samples are necessary, such as sputum induction (SI), bronchoalveolar lavage (BAL), or gastric lavage (GL) [7].

Bronchoscopy for BAL is not widely available, and not all patients are suitable candidates due to the invasive nature of

the procedure [8, 9]. Sputum induction (SI) requires specialized facilities with negative pressure isolation rooms, which are not present in many healthcare settings [8–10].

Gastric lavage (GL) is a method that can be performed in hospitals, but it increases the diagnosis costs as the patient needs to stay in the hospital for an average of three days. GL is intended to collect a sample of respiratory secretions that were swallowed during the night. The procedure involves inserting a nasogastric tube into the stomach and aspirating its contents early in the morning after an overnight fast. The collected samples are then processed and examined for the presence of acid - fast bacilli (AFB) and Mycobacterium tuberculosis (Mtb) using techniques like Ziehl - Neelsen (ZN) staining and Cartridge - Based Nucleic Acid Amplification Test (CBNAAT) [11].

While GL is an established method for diagnosing tuberculosis in children who swallow their sputum, its effectiveness in adults has been variable across different studies [7, 12, 13]. Therefore, the current study aims to assess the diagnostic value of gastric aspirate in adult patients with suspected pulmonary tuberculosis who are unable to expectorate sputum.

Gastric lavage can be administered to individuals who do not produce sputum before undergoing more complex procedures such as bronchoscopy. This method is both simple and cost-effective for collecting a representative sample for AFB.

When more advanced methods, such as bronchoscopy, are not available due to a lack of resources, this method can be useful.

### 3. Materials and Methods

This was a prospective study of 60 adult patients, suspected to be affected from pulmonary tuberculosis who did not expectorate sputum were admitted to Kanti Devi Medical College Hospital and Research Centre between December 2022 and March 2023. Cases were selected according to inclusion and exclusion criteria. Gastric lavage fluid was analysed for AFB and CBNAAT.

#### Inclusion criteria:

- Suspected cases of Pulmonary Tuberculosis (Clinico - radiologically) who are unable to expectorate sputum.

#### Exclusion criteria:

- Age < 18 years
- Patients who are hemodynamically unstable
- Patients who are critically ill
- Extra pulmonary TB
- Pregnant & lactating females
- Seropositive Patients (HIV, HBsAg, HCV positive)
- Patient not giving consent for the procedure

#### Investigations Required:

- Chest X ray
- HIV, HbsAg, HCV
- RBS
- CBC
- LFT
- RFT
- UPT (If applicable)
- Gastric aspirate for AFB smear and CBNAAT

### 4. Methodology

Gastric aspirate is a safe method of collecting samples to detect tubercle bacilli and has minimal risk of complications. The aspirated material was subjected to direct smear examination. The results of gastric aspirate procedure are highly accurate in children.

The gastric aspirate sample was sent for direct smear examination for AFB and CBNAAT to detect the presence of M. tb and rifampicin resistance.

### 5. Results

#### Age Distribution

Maximum subjects were from age group of >60 years (35%) followed by 51 - 60 years as well as 18 - 30 years (21.67%).

#### Gender Distribution

Males and females comprised of 61.7% and 38.3% of the subjects respectively. Hence there was male dominance in the present study.

#### Risk Factors

Smoking, alcohol and drug abuse was revealed in 38.3%, 23.3% and 1.67% of the subjects respectively.

#### Chief Complaints

Most common complaint among the study subjects was fever (88.3%) followed by cough (66.7%) and significant weight loss (40%).

#### Chest X - ray Findings

According to x ray findings; minimal, moderate and advance lesion was reported in 43.3%, 33.3% and 23.3% of the subjects respectively. Most common infiltrate was RUZ followed by LUZ and RMZ.

#### Investigative Profile

All the parameters viz. Hemoglobin (Hb), Total Leucocyte Count (TLC), Total Bilirubin, Serum Creatinine, Serum Sodium (S. Na) and Serum potassium (S. K) were found to be in normal range.

#### Gastric Aspirate Findings

According to gastric aspirate testing; AFB was positive in 43.3% of the cases. According to CBNAAT; MTB detected was resistance and sensitive in 3.3% and 51.7% of the cases respectively.

Out of 27 negative CBNAAT cases; AFB was found to be negative in 27 cases while out of 33 positive CBNAAT cases; AFB was found to be positive in 25 cases. Kappa test revealed significant good correlation between AFB and CBNAAT.

The sensitivity, specificity, positive predictive value, negative predictive value and accuracy of AFB considering CBNAAT as gold standard was 97.15%, 76.80%, 76.10%, 97.50% and 84% respectively.

### 6. Discussion

The results of this study indicate that gastric lavage (GL) can be a useful tool for microbiological confirmation of pulmonary tuberculosis (PTB) in adult patients who are unable to expectorate sputum. In our study, acid - fast bacilli (AFB) were detected in 43.3% of the gastric aspirate samples, and Mycobacterium tuberculosis (MTB) was detected by CBNAAT in 51.7% of the samples.

These findings are consistent with previous studies that have reported the diagnostic value of GL in adult PTB patients. A systematic review and meta - analysis by Sachdeva et al. found that the pooled sensitivity of GL for the diagnosis of PTB was 52%, with a specificity of 98%. Another study by Singh et al. reported that GL had a sensitivity of 45% and a specificity of 100% for the diagnosis of PTB in adults.

The high diagnostic yield of GL in our study suggests that this technique can be a valuable alternative to sputum induction or bronchoscopy for the diagnosis of PTB in patients who are unable to produce sputum. The use of GL for the diagnosis of PTB in adults has several advantages, including its non - invasive nature, low cost, and ease of performance. Additionally, GL can be performed in outpatient settings, making it accessible to a larger number of patients.

The detection of MTB by CBNAAT in 51.7% of the GL samples highlights the importance of using molecular diagnostic techniques in conjunction with traditional

microbiological methods. CBNAAT not only provides rapid and accurate detection of MTB but also allows for the identification of rifampicin resistance, which is crucial for the management of drug-resistant TB.

Our study also underscores the need for standardization of GL protocols to ensure consistent and reliable results. Factors such as the timing of the procedure, the volume of the aspirate, and the laboratory techniques used for analysis can all influence the diagnostic yield of GL. Further research is needed to optimize the implementation of GL and to better understand its role in the overall diagnostic algorithm for PTB.

## 7. Conclusion

Gastric aspirate for AFB smear and CBNAAT is an effective diagnostic tool for pulmonary tuberculosis in patients who cannot produce sputum or are smear-negative. This study confirms the utility of gastric lavage in resource-limited areas, highlighting its potential for broader implementation. Further research is required to standardize the procedure and compare its accuracy with other diagnostic methods like sputum induction and bronchoalveolar lavage, particularly in adult populations.

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