

# Comparison of Induced Sputum and Fibre-Optic Bronchoscopy (Fob) in the Early Diagnosis of Sputum Smear Negative Suspected Cases of Pulmonary Tuberculosis under Rntcp Settings-A Study Conducted in Southern Part of Rajasthan

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## Abstract

**Background:** FOB is an invasive procedure. It is costly, and is not widely available in the developing countries. In resource poor settings, where transmission of TB is high, sputum induction with hypertonic saline can be useful in adding to the diagnostic yield.

**Materials and Methods:** A prospective study conducted from 2015 to 2016, comprising of 100 patients fulfilling study criteria. Patients with respiratory symptoms and CXR showing suspicious of pulmonary tuberculosis and in whom two sputum smear samples ( Morning and Spot) were negative for acid fast bacilli were included and at randomly divided into 2 groups of induced sputum and bronchoscopy. Sputum induction was done by using 3 ml of 3% hypertonic saline through nebulizer and bronchoscopy was performed under local anesthesia.

**Results:** Out of 100 patients, 60 were in induced sputum group and 40 in bronchoscopy group. Induced sputum smear examination detected acid fast bacilli in 27 patients (45%) and acid fast bacilli detected from BAL in 26 patients (65%). Though the diagnostic yield with induced sputum was inferior to FOB, but looking to the cost effectiveness, safety and practical applicability of induced sputum, it can be used in patients of all age groups, new and retreatment suspected cases of initial sputum negative pulmonary tuberculosis for the diagnosis even at peripheral health centers.

**Keywords:** Sputum smears negative pulmonary TB (SSN-PTB); Induced sputum; Hypertonic saline; Fibre-optic bronchoscopy; BAL

## Introduction

Pulmonary tuberculosis (PTB) is a leading cause of morbidity and mortality worldwide. According to the recent estimates, there were 10.4 million and 2.84 million new cases of TB worldwide and in India respectively [1]. The diagnosis of pulmonary TB is based on sputum smear examination in Revised National TB control Program (RNTCP). Though Acid Fast Bacilli (AFB) smear is the most rapid, highly specific (98% to 99%) and low cost test but has poor sensitivity (30% to 70%) [2,3]. Mycobacterial cultures are more sensitive than AFB smears (80-85%) but cultures require 3 Weeks to 8 weeks [4,5]. Sputum smear and culture examination still remain the gold standard in the diagnosis of pulmonary TB. But about 30% of new cases of pulmonary TB may remain smear negative for AFB. Difficulties arise when a patient who is suspected of active pulmonary TB, both clinically and radiologically does not produce sputum particularly in HIV positive, miliary Tuberculosis or NTM disease situations. If these patients are left untreated then about 70% of them may develop active TB in next 12 months [6,7]. In these suspected sputum smear negative (SSN-PTB) cases, repeat sputum samples are examined after 10-14 days under RNTCP, but it may delay or miss the diagnosis. The various diagnostic methods [8-10] which can help in early diagnosis of suspected SSN – PTB cases are listed below. Out of these, sputum induction and bronchoscopic procedures appears to be practical and promising. The diagnostic methods in suspected SSN–PTB are:

- Sputum induction with hypertonic saline,
- Transtracheal needle aspiration,
- Radiologically guided transthoracic needle aspiration,
- Gastric lavage,
- Bronchoscopic procedures – Bronchial aspirate/BAL,

- Post Bronchoscopy sputum

After the availability of fibre-optic bronchoscope (FOB) in 1968, there has been many studies performed for early diagnosis of TB and many advances has occurred in FOB techniques [11,12]. The combined yield reported in majority of the studies varies from 48-100% as shown in [13,14] (Table 1).

Sputum induction using 3% hypertonic saline has also been very well studied in the diagnosis of SSN-PTB [15,16]. The various studies in this regard has reported the diagnostic yield varying from 35 to 95% [17]. There have been few studies reported in which the results of sputum induction and FOB related procedures have been compared and all have reported FOB superior to sputum induction [18-20]. But very few studies in this regard have been reported under RNTCP settings. So, we have carried out a study comparing the induced sputum and FOB related procedures (specimens) in the early diagnosis of SSN-PTB cases under RNTCP settings.

## Materials and Methods

100 patients aged 18 years and above with clinical and radiological features suggestive of pulmonary TB admitted in the department of

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respiratory medicine at Geetanjali Medical College and Hospital, with initial two sputum smear examination for AFB negative, were included in the study. New as well as retreatment cases both were included. Patient having frank Hemoptysis, respiratory distress, pneumothorax, hypotension, SpO<sub>2</sub><90%, and with poor general condition were excluded. The patients were randomly divided into 2 groups

- 1) Group A (Induced Sputum)
- 2) Group B (Fibre-optic Bronchoscopy)

The sputum induction was performed once using 3% hypertonic saline as per New South Wales (NSW) guidelines [21] after obtaining informed consent in group A patients. Fibre-optic bronchoscopy was performed in group B patients under 2% Lignocaine with Olympus video bronchoscope after obtaining informed consent from the patient. Bronchial washing and /or BAL were collected in a sterile container. Sputum sample obtained after Induced sputum procedure in group A and bronchial washing and /or BAL samples in group B were immediately examined for AFB smear by Ziehl-Neelsen stain [4]. In group B patients post bronchoscopy sputum was also examined for AFB smear. The patients who developed tachycardia, hypoxia etc. were given supplementary oxygen post bronchoscopy as and when required.

## Results

Out of 50 patients selected for group B, 10 patients did not give consent for FOB hence those 10 patients were also included in group A. Thus there were 60 patients in group A and 40 patients in group B for final analysis. There were 74 males and 26 females belonging to various age groups as shown in (Table 2).

References	Result
Danek et al. [8]	39/41 (95%)
Sarkar et al. [9]	22/30 (73%)
Stenson et al. [10]	8/12 (66%)
Kulpati et al. [11]	20/33 (60%)
Wongthim et al. [12]	54/71 (76%)
Zainudin et al. [13]	33/33 (100%)
Fujii et al. [14]	29/32 (91%)
Bachh et al. [15]	29/60 (48%)
Choudhary S et al. [16]	85/108 (78%)
Our study	26/40 (65%)

**Table 1:** Combined yield comparison of various studies.

Age groups	Group A			Group B			Total
	F	M	Total	F	M	Total	
<21	2	4	6	2	1	3	9
21-30	1	13	14	4	6	10	24
31-40	7	6	13	-	5	5	18
41-50	-	5	5	4	6	10	15
51-60	2	10	12	1	5	6	18
61-70	1	7	8	-	5	5	13
71-80	1	-	1	1	-	1	2
81-90	-	1	1	-	-	-	1
Total	14	46	60	12	28	40	100

**Table 2:** Male and female patients.

Treatment History	Group A (Induced sputum)	Group B(FOB)
New=59	17/31 (54%)	20/28 (71%)
Retreatment=41	10/29 (34%)	6/12 (50%)
Total=100	27/60 (45%)	26/40 (65%)

**Table 3:** Yield in new and retreatment cases.

Bronchoscopic features	Frequency (n=40)
Congestion and hyperemia	10 (25%)
Narrow segmental openings	2 (5%)
Bleeding from bronchus	2 (5%)
Caseous material/mucopurulent secretions seen	16 (40%)
Ulcer/Endo bronchial growth	4 (10%)
Normal study	6 (15%)

**Table 4:** Bronchoscopic findings.

Side Effects	Group A (induced sputum) N=60	Group B (FOB) N=40
Tachycardia	10 (16.6%)	35 (87.5%)
Respiratory distress	3 (5%)	12 (30%)
Fever	Nil	3 (7.5%)
Chest pain	1 (1.6%)	Nil
<90%SpO <sub>2</sub> (on room air)	2 (3.3%)	23 (57.5%)
Seizure	Nil	Nil

**Table 5:** Adverse effects.

Out of 60 patients in group A (31 new and 29 retreatment) their combined yield, for AFB smear positive was 45% (27/60), whereas in group B (28 new cases and 12 retreatment) cases, their combined yield positive for AFB smear was 65% (26/40). Thus the combined yield for diagnosis of pulmonary TB was significantly higher in group B patients using FOB as shown in (Table 3).

On bronchoscopy, the gross observations in most of the cases have revealed caseous material/mucopurulent secretions in bronchi in 40% of cases, while congestion and edema in 25% (10 cases) as evident from (Table 4).

The frequency of adverse effects was markedly low in group A patients as shown in (Table 5). Common adverse effects were tachycardia and hypoxia. The total costs incurred during sputum induction by group A patients was about 10% as compared to group B patients for bronchoscopy related procedure per patient.

## Discussion

Pulmonary tuberculosis is still a major health problem globally and in India also. Early diagnosis and treatment improves the prognosis and reduces transmission of the disease. Clinically and radiologically suspected cases of pulmonary tuberculosis that are not producing sputum adequately is frequently encountered situation in clinical practice where only saliva or scanty sputum is available for examination and reported as negative smear for AFB. In RNTCP these patients are given symptomatic treatment for 10 days to 14 days and then their sputum is re-examined for AFB smear, leading to delay in the diagnosis and increased chances of transmission of tuberculosis. In these kinds of patients, the induced sputum examination or BAL examination may help in early diagnosis.

The meta-analysis of sputum induction for diagnosis of PTB has shown that diagnostic yield in individual studies may range from 35% to 95% [17]. In our study the sputum induction has produced positive yield for tuberculosis in 45% patients which is matching with the range previously reported [22-24]. The diagnostic yield with induced sputum was same in new and retreatment cases therefore the induced sputum may be helpful even in treated cases of tuberculosis with scanty sputum.

The fibre-optic bronchoscopy is beyond doubt helpful in the early diagnosis of SSN-PTB cases but the availability, cost and cross transmission of tubercle bacilli are the limiting factors [25,26].

The positive yield for tuberculosis using FOB in our study has been found in 65% patients, which is comparable with the previously reported studies (67% to 90%) [11,27-30]. Further the positive yield was significantly higher in new cases (32%) as compared to retreatment cases (16%) of PTB using FOB. Thus FOB is more helpful in elderly new patients of suspected PTB.

## Conclusion

Sputum induction offers an alternative or additional approach to the diagnosis of smear-negative suspected pulmonary tuberculosis patients and would enhance sensitivity for the diagnosis of tuberculosis. Though the diagnostic yield for tuberculosis in SSN-PTB cases is better using FOB as compared to sputum induction as reported by other studies, and also found in our study (65% vs. 45%), but looking to the cost effectiveness, availability and safety, the induced sputum can be utilized for increasing the diagnostic yield of SSN-PTB cases under RNTCP settings [31]. It also has very less contra-indications and lesser risk of nosocomial infection as compared to BAL.

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