European Journal of Molecular & Clinical Medicine

ISSN 2515-8260 Volume 10, Issue 3, Winter 2023

ORIGINAL RESEARCH

Study of diagnostic yield of induced sputum & bronchoscopic sample in sputum smear negative tuberculosis in tertiary health care centre

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Received: 14 January, 2023 Accepted: 18 February, 2023

ABSTRACT

Aim: *Study of diagnostic yield of induced sputum & bronchoscopic sample in sputum smear negative tuberculosis in tertiary health care centre.*

Material and methods: *50 patients >18 years of age admitted to Chest ward with features of TB were included in this study. All the sample was sent to Intermediate Reference Laboratory, M.R.T.B. Hospital/Chest Centre, Indore. Subjects were included on the basis of their diagnosis of TB as per NTEP guidelines. Patients with sputum smear negative for MTB by ZN staining, clinically symptomatic patients suspected of pulmonary TB, cough more than 14 days, willing to participate and willing to give written consent and age more than 18 year were included in this study.*

Results: *In present study, most of the participants 23(46%) belong to age group 18-40 years. Out of 50 participants 31(62%) were male and 19(38%) are female. 19(38%) participants are educated and 31(62%) participants are uneducated. Most of the participants 39(78%) are Hindu by religion followed by Muslim 07(14%). Majority of the participants in present study 35(70%) reside in rural area, 23(46%) of the participants belong to lower middle economic social class. Out of 50(100%) AFB negative sample, 4 sample found positive in inducedsputum sample, were as 35(70%) sample was positive in BAL CBNAAT. The sensitivity and specificity of induced sputam(10.25% and 24.59% and BAL-CBNAAT(89.74% and 75.40%).*

Conclusion :*According to the present study, as compared to sputum induced for AFB detects 4(8%) positive cases and BAL CBNAAT detects 35 (70%) positive cases. In a large proportion of cases, fiber optic bronchoscopy (BAL) aids in the early detection of pulmonary tuberculosis that's produces negative smear tests. Fiberoptic bronchoscopy is crucial in the diagnosis of patients with tuberculosis who were unable to generate sputum or whose sputum smears was negative. In some circumstances, it is both helpful and required.*

Keywords: *BAL CBNAAT, AFB, Fiberoptic bronchoscopy*

Introduction

Mycobacterium tuberculosis, a highly contagious bacterial illness, is what causes tuberculosis (TB). Any part of the body affected by tuberculosis. Pulmonary Tuberculosis is the commonest form of TB.(1) Usually, TB bacillus spreads through the air. When a pulmonary tuberculosis patient sneezes or coughs, tiny droplets containing TB bacilli are spread in the air. A Healthy person who got an infection with tuberculosis when she/he inhaled these droplets. The lifetime risk of developing tuberculosis in these infected people will have a 10%.10-15 healthy persons infected by a smear-

positive pulmonary tuberculosis patient in the general population in a year. If these smear-positive patients are left untreated, they remain infectious for 2 to 3 years.(2)

In 2021, COVID-19 dislodged TB as the top infectious disease cause of mortality globally. Globally, an estimated 10.0 million people developed active TB disease in 2019, with 1.4million TB deaths. The WHO regions of South-East Asia, Africa, and the Western Pacific had the most cases of TB. Progress in achieving the United Nations (UN) General Assembly End TB targets remains slow. Increased TB services are required, as well as attention to the disease's underlying causes.(3) 88% of TB patients were adults, whereas 12% were children. The highest numbers of TB cases were found in the WHO regions of South-East Asia (44%), Africa (25%), and the Western Pacific (18%). Two-thirds of the global total were made up of eight nations: Bangladesh (3.6%), India (26%), Indonesia (8.5%), China (8.4%), the Philippines (6.0%), Pakistan (5.7%), Nigeria (4.4%), and South Africa (3.6%). The five-year aim of 3.5 million children treated for tuberculosis was only met to a mere 30%. Novel all- oral regimens for MDRTB and new preventative therapy regimens have been developed, both of which represent significant advancements.(4)

TB is the second most common infectious killer, behind COVID-19, and the 13th largest cause of death overall (behind HIV/AIDS). Globally, 10 million cases of tuberculosis (TB) are anticipated in 2020. 1.1 million children, 3.3 million women, and 5.6 million men. TB exists in all nations and among all age groups. (5) In 2020, TB claimed the lives of 1.5 million persons worldwide (including 214000 people with HIV). Globally, an estimated 10 million people will contract tuberculosis (TB), with 75% of TB deaths in 2012 occurring in South-East Asia and Africa. One- third of global TB deaths occurred in India and South Africa. Globally in 2012, the number of TB deaths per 100 000 population averaged 13 and 17.6 whenTB deaths among HIV- positive patients were included. (6)

In India, tuberculosis is a serious health issue that results in 220,000 annual deaths. The Indian government said in 2020 that its National TB Elimination Program (NTEP) would eradicate tuberculosis from the nation by 2025. Efforts to end TB in India through the implementation of the National Strategic Plan (2017- 2025) have completed the first three years of implementation. The programme has experienced great success during this time and is now better prepared to achieve the ambitious goal set by our Honorable Prime Minister at the Delhi End TB Summit in March 2018 of ending the TB epidemic in the nation by 2025, five years before the SDG goals for 2030. In response, some States and UTs have made commitments to end TB even before 2025. (7) The programme has made significant progress toward almost total online notification of every TB case in the nation via the NIKSHAY portal. 6.7 lakh patients from the private sector were among the 24.04 lakh patients who had been notified through the system, an increase of 11% from the previous year. The Programme has expanded both the laboratory network as well as WHO endorsedrapid molecular diagnostic facilities to cover the entire country. The laboratory network includes 6 National Reference Laboratories, 31 Intermediate Reference Laboratories, 50certified laboratories for Liquid Culture and DST services and 64 certified laboratories for LPA services, and 20,356 Designated Microscopy Centers. In addition, 15 additional TB containment laboratories with liquid culture facility have been established across the country under the New Funding Model (NFM) of The Global Fund Grant and 8 additional TB Culture& DST Laboratories have been sanctioned through State PIPs. (8)

Pulmonary tuberculosis is most commonly diagnosed by sputum smear examination. Sputum microscopy is a low-cost, high-specificity test. It is an essential component of the DOTS strategy of the WHO. But not all patients with the clinical picture of tuberculosis revealed acid-fast bacilli in their sputum. In 22% to 61% of the patients smear negative – culture positive were observed. Sputum smear-negative pulmonary tuberculosis still remains a common problem, particularly in retreatment patients, faced by clinicians. If the diagnosis and treatment of these patients are delayed, the community will continue to be infected.(9) In our investigation, fibre optic bronchoscopy was the main method used to diagnose smear-negative retreatment pulmonary tuberculosis. Prompt treatment renders patients non-contagious, stops the spread of TB, and lowers the likelihood that they may develop MDR-TB.

Material and methods

The study was carried out in the department of Respiratory Medicine in Index Medical College Hospital & Research Centre, Indore under approval of the Institutional Ethics Committee. 50 patients >18 years of age admitted to Chest ward with features of TB between MARCH 2021 to

SEPTEMBER 2022 were included in this study. All the sample was sent to Intermediate Reference Laboratory, M.R.T.B. Hospital/Chest Centre, Indore. Subjects were included on the basis of their diagnosis of TB as per NTEP guidelines.'

Sample collection: Collect 1 -4 ml *specimen,* Collect the sample in the tube called FALCON tube, Specimen should be held at 2-8C wherever possible and Do not leave the specimen at room temperature for more than 3 days.
Induced sputum by: Nebulized with 3% hypertonic saline and Nebulized with N-Acetylcysteine
Fiberoptic bronchoscopy: Bronchoalveolar lavage fluid (BAL)

Inclusion criteria:
Patients with sputum smear negative for MTB by ZN staining, clinically symptomatic patients suspected of pulmonary TB, cough more than 14 days, willing to participate and willing to give written consent and age more than 18 year were included in this study.

Exclusion criteria:
Patients with sputum smear positive for MTB by ZN staining, Blood & stool, Inadequate sample, Indeterminate result of test and age <18 year were excluded from the study.

Results
Table 1. Demonstrate the socio-economic status of the study participants. In present study, most of the participants 23(46%) belong to age group 18-40 years. Out of 50 participants 31(62%) were male and 19(38%) are female. 19(38%) participants are educated and 31(62%) participants are uneducated. Most of the participants 39(78%) are Hindu by religion followed by Muslim 07(14%). Majority of the participants in present study 35(70%) reside in rural area, 23(46%) of the participants belong to lower middle economic social class.

Table 1.Socio-economic status of the study participants

		Frequency	Percentage (%)
Age group	18-40 years	23	46
	41-60 years	20	40
	61-80 years	7	14
Gender	Male	31	62
	Female	19	38
Education	Educated	19	38
	Uneducated	31	62
Occupation	Unemployed	0	0
	Laborer	16	32
	Service	12	24
	Other	22	44
Religion	Hindu	39	78
	Muslim	7	14
	Sikh	0	0
	Christian	1	2
	Jain	3	6
Residence	Rural	35	70
	Urban	15	30
Socioeconomic status	Upper	4	8
	Upper middle	11	22
	Middle	12	24
	Lower middle	23	46
	Lower	0	0

TABLE -2 Distribution of study participants according to age group

Age Group	Total Participants (%)	Positive for MTB (%)
18 – 40 year	**23** (46%)	**18** (78.26 %)
41 – 60 year	**20** (40%)	**16** (80.00 %)
61 - 80 year	**7** (14%)	**5** (71.42 %)

TABLE -3 Male and female distribution of study participants

GENDER	TOTAL FREQUENCY(%)	POSITIVE FOR MTB(%)
MALE	31(62%)	27(87.09%)
FEMALE	19(38%)	12(63.19%)

TABLE -4 Distributions of study participants according to their educational status

QUALIFICATION	TOTAL FREQUENCY(%)	POSITIVE FOR MTB(%)
EDUCATED	19(38%)	12(63.15%)
UNEDUCATED	31(62%)	27(87.09%)

TABLE -5 Occupational distribution of study participants

OCCUPATION	TOTAL FREQUENCY(%)	POSITIVE FOR MTB(%)
LABOURER	16(32%)	14(87.50%)
SERVICE	12(24%)	09(75.00%)
OTHER	22(44%)	16(72.72%)
UNEMPLOYED	00	00

TABLE -6 Locality wise distribution of study participants

LOCALITY	TOTAL FREQUENCY(%)	POSITIVE FOR MTB(%)
RURAL	35(70%)	29(82.85%)
URBAN	15(30%)	10(66.66%)

Table 7. Distribution of study participants according to their socio economic status

SOCIOECONOMIC STATUS	TOTAL FREQUENCY(%)	POSITIVE FOR MTB(%)
UPPER CLASS	4(8%)	3(75.00%)
UPPER MIDDLE CLASS	11(22%)	9(81.81%)
MIDDLE CLASS	12(24%)	8(66.66%)
LOWER MIDDLE CLASS	23(46%)	19(82.60%)

Table 8. Induced Sputum sample/BAL CBNAAT sample positivity (%)

Sample	Positive	Negative
AFB	0	50 (100%)
Sputum Induced for AFB	4(8%)	46(92%)
BAL CBNAAT	35(70%)	15(30%)

Table -8 shows that out of 50(100%) AFB negative sample, 4 sample found positive in induced sputum sample, were as 35(70%) sample was positive in BAL CBNAAT.

TABLE -9 – Sensitivity & Specificity of Induced Sputum and BAL- CBNAAT

Tests	Sensitivity(%)	Specificity(%)
INDUCED SPUTAM FOR AFB	10.25%	24.59%
BAL-CBNAAT	89.74%	75.40%

TABLE 9- Shows sensitivity and specificity of induced sputam(10.25% and 24.59% and BAL-CBNAAT(89.74% and 75.40%).

Discussion

Due to the inconsistent diagnostic yields of any one test, diagnosing pulmonary TB in individuals with negative expectorated sputum results remains difficult. In the diagnosis of pulmonary TB, sputum induction, gastric lavage, and bronchoscopy have all been shown to boost diagnostic yield and play useful and frequently complementary roles. In patients with suspected pulmonary TB and negative results on smear and sputum – induced AFB, we describe the yield of bronchoscopy. In our investigation, induced sputum collection was performed on every patient at least twice. Only 4 (8%) of the negative sample in our investigation tested positive for sputum – induced AFB , whereas 35 (70%) of the sample tested positive for BAL CBNAAT. (10). The study depicts the sensitivity of BAL CBNAAT and Induced sputum AFB as 89.74% and 10.25% respectively, while the specificity of both the tests were 75.4% and 24.59% respectively.

Similar to our study In an immigrant population with suspected pulmonary TB , Schoch et al compared the yield of regular sputum, induced–sputum, and bronchoscopy in the diagnosis of TB. When compared to several induced – sputum sample, they discovered that the diagnostic yield of bronchoscopy was much higher. (11) Brown et al. found no increased yield from doing bronchoscopies in 21 patients who had negative induced – sputum result, which is in contrast to our finding. (12) Similar findings were also reported by McWilliams, who found that BAL produced only 14/27 culture- positive instances compared to induced 26/27 .sputum (13) Our study confirms the diagnostic value of Bronchoscopy BAL in TB confirmation even when multiple induced -sputum sample yield negative results.

Conclusion

According to the present study, as compared to sputum induced for AFB detects 4(8%) positive cases and BAL CBNAAT detects 35 (70%) positive cases. When smears of expectorated sputum do not show mycobacteria, fiber - optic bronchoscopy can provide great information for the identification of suspected cases of pulmonary tuberculosis. In a large proportion of cases, fiber optic bronchoscopy (BAL) aids in the early detection of pulmonary tuberculosis that's produces negative smear tests. Fiberoptic bronchoscopy is crucial in the diagnosis of patients with tuberculosis who were unable to generate sputum or whose sputum smears were negative. In some circumstances, it is both helpful and required.

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