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Research Article

Diagnostic Yield of Sputum Induction Using 3% Hypertonic Saline Nebulisation in Smear Negative Suspected Pulmonary Tuberculosis

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Abstract: Tuberculosis has become the most important communicable disease in the world, with over 8 million cases of pulmonary tuberculosis occurring each year, 95% of which are in developing countries. Sputum smear examination is an important modality of diagnosis of pulmonary tuberculosis Smear negativity with clinical and radiological features of pulmonary tuberculosis is a common problem, sputum induction with 3% hypertonic saline helps in obtaining adequate yield of sputum and more chances of smear positivity. To find out the yield in diagnosis of smear negative suspected pulmonary tuberculosis by sputum induction using 3% hypertonic saline nebulisation. The study was carried out in Sri Adhi chunchungiri institute of medical science the study period was of 18 months from August 2011 to February 2013. 50 patients admitted with clinical and radiological features suggestive of pulmonary tuberculosis was studied and investigations like blood routine, including ESR, ECG, chest X-ray, sputum induction, smear study by Zeil Neilson staining and sputum culture were be done to all the cases after sputum induction using 3% hypertonic saline nebulisation. Among 50 cases, 30(60%) cases were in the age group of 30 –60 years, 34(68%) cases were Males and 16 (32%) cases were females. 19 (38%) cases had no other associated diseases and 31(62%) cases had associated diseases like diabetes mellitus 12(24%), hypertension-15(30%), HIV-1(2%), IHD-2(4%), AF-1(2%). Cutaneous stigmata like lymph adenopathy, erythema nodosum, and lupus vulgaris were present in 10(20%) cases and absent 40(80%) cases. Out of 50 patients 14 patients had chest infiltrated, 33 patients had consolidation, 5 patients had cavity,8 had COPD and 1 patient had loculated empyema Induced sputum from 50 cases 8 cases were positive in Z-N staining and showed growth in L-J medium, thus giving yield of 16% both in staining and culture positivity. In conclusion the present study shows that sputum induction is safe, simple and cost effective method of obtaining adequate amount of quality sputum in patients, who are smear negative on spontaneously produced sputum or are unable to produce sputum. Most of the cases who were unable to produce adequate quantity of sputum have non-cavitatory lesions on chest X-ray.
Keywords: Diagnostic Yield, Sputum Induction, Smear Negative Pulmonary Tuberculosis.

INTRODUCTION

Tuberculosis is a disease of great antiquity. It has enchanted the imaginations of writers, artists, musicians, philosophers, scientists, and recently news reporters. One third of population is estimated to be infected by this infectious disease and it is different from most infectious diseases in the world wide magnitude of its effects and has been termed "the captain of the men of death," by John Bunyan.

Today, tuberculosis has become the most important communicable disease in the world, with over 8 million cases of pulmonary tuberculosis occurring each year, 95% of which are in developing countries. WHO estimates, by 2020 nearly one billion people will be infected with tubercle bacillus, 200 million people will develop clinical tuberculosis and 35 million will die from it. The advent of HIV infection has had a substantial impact on incidence of tuberculosis, particularly in developing countries. With this dual epidemic of TB/HIV, smear negativity is a common problem.

Sputum smear examination is an important modality of diagnosis of pulmonary tuberculosis, bacteriological diagnosis of sputum smear negative pulmonary tuberculosis is a must as 50-70 % of patients become smear positive within one year. Smear negativity with clinical and radiological features of pulmonary tuberculosis is a common problem, sputum

induction with 3% hypertonic saline helps in obtaining adequate yield of sputum and more chances of smear positivity. This study is undertaken to find out yield in diagnosis of smear negative pulmonary tuberculosis by sputum induction with 3% hypertonic saline.

OBJECTIVES

To find out the yield in diagnosis of smear negative suspected pulmonary tuberculosis by sputum induction using 3% hypertonic saline nebulisation.

METHODOLOGY

Source of data

Patients admitted with clinical and radiological features suggestive of pulmonary tuberculosis in Adichunchanagiri Institute of Medical Sciences, Bellur

Type of Study

Descriptive Study

Study design

Case series study.

Sample size

50

Study Period

This study conducted for duration of 18 months from August 2011 to February 2013

Sampling Technique

Non Probability purposive sampling

Inclusion Criteria

Patients aged more than 18 years with features of pulmonary tuberculosis and having spontaneously produced 2 sputum smear negative samples or having dry cough/scanty sputum were included.

Exclusion criteria

Patients with smear positivity and on anti-tubercular drugs were excluded from the study.

Method of data collection

In patients with clinical and radiological features suggestive of pulmonary tuberculosis routine investigations like blood routine, including ESR, ECG, chest X-ray, sputum induction and smear study by Zeil Neilson staining and sputum culture were done.

Protocol for sputum induction

Following informed consent, in a well ventilated room reservoir device of nebuliser was filled with 5ml hypertonic saline and subjects are asked to inhale mist until 2ml of sputum is obtained or for a maximum of 30 minutes. Inhalation was interrupted every 5 minutes, so that patient could expectorate the sputum.

Plan of Analysis / Statistical Tools

The data will be entered in excel and analyzed using Epi-info Software version 3.4.3. Descriptive statistics like frequencies and percentages were calculated. Ethical clearance certificate was obtained by Ethical Committee of the Sri Adichunchanagiri Institute of Medical Sciences before the study is started.

RESULTS

Total number of cases in the study is 50, among which 30(60%) cases were in the age group of 30 –60 years. Males in the study were 34(68%) and females were 16(32%) (Table-1).

19 (38%) cases had no other associated diseases and 31(62%) cases had associated diseases like diabetes mellitus-12(24%), hypertension-15(30%), HIV-1(2%), IHD-2(4%), AF-1(2%). Cutaneous stigmata like lymphadenopathy, erythema nodosum, and lupus vulgaris were present in 10(20%) cases and absent 40(80%) cases (Table-2).

Out of 50 patients 14 patients had chest infiltrated, 33 patients had consolidation, 5 patients had cavity, 8 had COPD and 1 patient had loculated empyema(Table-3).

Out of 50 patients 14 patients had chest infiltrated, 33 patients had consolidation, 5 patients had cavity, 8 had COPD and 1 patient had loculated empyema(Table-4)

Among 50 cases studied, 45(90%) cases had cough and 5(10%) cases did not have cough, out of 45 cases who had cough, 20(44%) had expectoration and 25(56%) had dry cough. Induced sputum from 50 cases 8 cases were positive in Z-N staining and showed growth in L-J medium, thus giving yield of 16% both in staining and culture positivity(Table-5).

Table-1: Age and Gender distribution of study subjects

Age (Years)	No. of Cases	Percentage
20-30	14	28
31-40	7	14
41-50	12	24
51-60	11	22
>60	6	12
Gender		
Male	34	68
Female	16	32

Table-2: Associated diseases among study subjects

Associated diseases	No. of cases	Percentage
Diabetes Mellitus	12	24
HIV	1	2
Others(HTN, IHD,AF)	18	36
None	19	38
Cutaneous Stigmata		
Present	10	20
Absent	40	80

Table-3: Respiratory findings among study subjects

Respiratory findings.	No of cases	Percentage
Fibrosis	14	28
Consolidation	33	66
Bronchiectasis	1	2
Pleural effusion	4	6
Cavity	5	10
COPD	8	16
Loculated Empyema	1	2

Table-4: Chest X-Ray findings among study subjects

Chest X-ray findings.	No of cases	Percentage
Infiltrates	14	28
Consolidation	33	66
Bronchiectasis	1	2
Pleural effusion	4	6
Cavity	5	10
COPD	8	16
Loculated Empyema	1	2

Table-5: Staining and Culture report among study subjects

Staining And Culture	Positive/ Present
Sputum staining	8
Sputum culture	8

DISCUSSION

Patients with clinical and radiological evidence of pulmonary tuberculosis but negative sputum for AFB is called smear negative disease, this is a common problem and seen more commonly among children, elderly and immuno-compromised. The low rate of smear positivity in these persons may be explained by the fact that they have either minimal disease or without extensive cavitation. Smear negative patients have minimal and non-cavitatory disease with low bacillary count as compared to smear positive patients with far advanced disease with heavy bacillary burdens. Achieving a microbiological diagnosis in cases of infection is one of tenets of good infectious disease management. Sputum induction by 3% hypertonic saline nebulisation has been found to improve bacteriological diagnosis and is a simple, cheap and safe method.

In the present study sputum induction procedure with 3% saline was carried out in 50 cases and it was successful in 41 cases, other 9 cases did not have cough and were not able to expectorate even after induction. A study conducted by K.B. Gupta *et al.;* 100 patients was subjected for sputum induction out of which 97 produced sputum [1]. Another study by A.M.A. Shata *et al.;* 30 patients were subjected for sputum induction out of which 29 produced sputum [2]. The results of present study are comparable to above studies.

To confirm the bacteriological diagnosis of the induced sputum, both staining and culture for AFB was done in the present study. Sputum smear staining was done by Z-N technique for all 50 cases. In K.B. Gupta *et al.;* 100 cases were studied and 38% cases were positive by Z-N staining after sputum induction [1].In MC Williams *et al.;* 50 cases were studied and 26% cases were positive by Z-N staining after sputum induction [3]. In Hartung *et al.;* 50 cases were studied and 29% cases were positive by Z-N staining after sputum induction [4]. In the present study, 50 cases were studied and 16% cases were positive by Z-N staining after sputum induction.

Sputum culture was done by L-J medium for all the 50 cases. In the present study, out of 50 cases subjected for culture after sputum induction, 8 cases (16%) were positive who were also positive for smear staining. In Frederick L. Jones *et al.;* culture results from induced sputum and gastric lavage specimen were studied, out of 155 cases, 40% were positive for culture after sputum induction [5].

Radiologically, all 8 cases (16%), which were positive for AFB on smear and culture after induction showed non-cavitatory lesions on chest X-ray, explaining the fact that patients with non-cavitatory lesions have high probability of smear negativity before sputum induction. In K.B. Gupta *et al.;* 100 cases were studied and 39% had non-cavitatory lesions on chest X-ray, who were positive for smear and culture after induction [1].

CONCLUSION

The present study shows that sputum induction is safe, simple and cost effective method of obtaining adequate amount of quality sputum in patients, who are smear negative on spontaneously produced sputum or are unable to produce sputum and can be done easily done in a rural hospital like ours. Most of the cases that were unable to produce adequate quantity of sputum have non-cavitatory lesions on chest X-ray. Achieving the microbiological diagnosis in smear negative cases helps in the early diagnosis and treatment.

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