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Medicine



Role of Sputum Induction in Diagnosis of Pulmonary Tuberculosis

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To study the role of sputum induction by 3% hypertonic saline and sputum samples subjected to ZN staining method.110 cases having clinico-radiological features of pulmonary tuberculosis with sputum smear negative for AFB were studied. Total of 110 cases were studied. The present study revealed that sputum induction is safe, simple and cost effective method. It also helps in obtaining adequate amount of quality sputum in patients who are smear negative on spontaneously produced sputum or are unable to produce sputum.

KEYWORDS Sputum induction (si) , 3% Hypertonic saline , Pulmonary tuberculosis , Zeini Neelsen staining.

Introduction -

Despite the advent of new tests for the diagnosis of tuberculosis with greater sensitivity than smear microscopy of appropriate sputum samples, about 20-30% of TB patients will not have microbiologic confirmation. This figure may be much higher in children and patients with extra-pulmonary TB or PL-HIV. Although it is recommended that any sample from a suspected TB patient that is initially negative by a rapid diagnostic test be cultured for TB growth and confirmed diagnosis, there will be a group of patients that have TB but without microbiologic confirmation.

Overall 1/3rd of tuberculosis still remains undiagnosed. Rapid and precise diagnosis will reduce the risk of nosocomial &community transmission of TB. Direct sputum smear microcopy remains a fundamental tool of diagnosis, but may be negative up to 50% case of active pulmonary TB⁽¹⁾. Alternative methods of obtaining sputum specimens are frequently needed in those patients with radiological suspicion of TB who are unable to expectorate or are smear negative. The methods include – sputum induction (SI), bronchoalveolar lavage (BAL) and gastric washings (GW) specimens⁽²⁾. These methods have their own advantages and disadvantages and diagnostic yield vary so also safety and tolerability, and feasibility in different set-ups.

GW is reported to reveal the organism only in 25-50% of children with active TB, when a set of three samples are subjected to both microscopy and culture ⁽³⁾. Bronchoscopy is an invasive procedure, only available in the large hospitals, needs experts for performance, costly and may not be feasible if the large numbers of patients are to be tested. SI is a cheap and non-invasive alternative with a diagnostic yield "same if not better" than bronchoscope⁽⁴⁾. SI with hypertonic saline has been used in the diagnosis of various respiratory disorders. The present study was performed to evaluate the use of SI in establishing the diagnosis in patients with suspected pulmonary TB, who are unable to produce adequate sputum or are found negative on smear examinations.

Aims and objectives -

To study the role of sputum induction in determining the diag-

nostic yield of the test in diagnosis of pulmonary tuberculosis.

To detect the sputum positive cases in patients who have clinic-radiological evidence of pulmonary tuberculosis.

Methodology -

110 patients with clinical and radiological features suggestive of pulmonary tuberculosis both on Outpatient & Inpatient basis in Mahatma Gandhi Mission Institute Of Health Sciences, Kamothe, Navi Mumbai were involved in the study. Patients aged 18-80 years with features of pulmonary tuberculosis and having spontaneously produced 2 sputum smear negative samples and not able to expectorate or having dry cough/ scanty sputum were included.

Inclusion Criteria:-

Patients between the age group 18-80 years with

- Persistent cough for 3 weeks or more, with or without one or more of the following symptoms are suggestive of pulmonary tuberculosis. ^[20]
- Weight loss, tiredness, fever particularly with rise of temperature in the evening, night sweats, chest pain, loss of appetite, coughing up of blood and presence of dry cough or scanty sputum radiological pulmonary tuberculosis.

Pattients in whom cough induction was considered hazardous like those with Haemoptysis .,Acute respiratory distress. Unstable cardiovascular status, (arrhythmias, angina).Thoracic, abdominal or cerebral aneurysms.Hypoxia (SaO2 less than 90 % on room air). FEV1 less than 1.0 Litre.Pneumothorax and pulmonary emboli.Fractured ribs or other chest trauma.Recent eye surgery.

Following informed consent, in a well ventilated room reservoir device of nebulizer was filled with 20ml of 3 % hypertonic saline and subjects were asked to inhale mist until 2 ml of sputum is obtained or for a maximum of 20 to 30 minutes. The patient could expectorate the quality sputum within 2 hours. If the patient requires assistance, the health professional wore a TB respiratory protection device (N95 mask) before entering the room and remove it after leaving the room. The

procedure was stopped when: The patient has produced 1-2 ml of sputum for each specimen or15 minutes of nebulization was reached or the patient complained of dyspnea, chest tightness or wheeze.

The sample selected for the study belong to different age groups and it includes males and females as per the following distributions in Table 1, 2 & 3

Table 1: Gender wise frequency distribution of the sample selected.

Gender	Number	Percent
Male	73	66.4
Female	37	33.6
Total	110	100.0

Males in the study are 73 (66.4 %) and females are 37 (33.4 %). The distribution is depicted in the following figure.

Table 2: Age Wise Frequency Distribution of the sample.

Age Group	Number	Percent	
18-30	31	28.2	
31-40	26	23.6	
41-50	18	16.4	
51-60	12	10.9	
61-70	16	14.5	
71-80	7	6.4	
TOTAL	110	100.0	

Total number of cases in the study is 110,among which 57 (51.81 %) cases were in the age group of 18-40 years ,29 (26.36 %) cases were in the age group of 41-60 years ,24 (21.74 %) were in the age group of 61 -80 years.

RESULTS -

Microbiology results-In all 110 patients suspected to have pulmonary tuberculosis on clinical & radiological basis underwent sputum induction (330 samples). Nearly 2/3rd patients [71 out of 110] had productive cough & remaining 39 had dry cough in whom induced sputum was the only sample available for microscopy. Sputum induction did not yield any sample in 6 patients.

- 1st Sample positive 63
- 2nd Sample Positive 86
- 3rd Sample Positive 87
- All Sample Negative 94

Only 1 Patient was Smear Positive and Culture Negative and 22 patients were Smear & Culture Negative.

Twenty three patients were categorized as 'Probable TB ie patients with symptoms suggestive of TB without microbiological confirmation (sputum smear microscopy, culture and molecular diagnosis), but with but strong clinical and other evidence (e.g. X-ray) may be diagnosed as "Probable TB".ALL 23 had satisfactory clinicoradiological response to empirical antiTB therapy.

From the above data it is clear that there are no positive cases identified through the two trials of testing the spontaneous sputum and in the testing after induction of the same patient, the number of negative cases is substantially reduced to 47 from 110 first, then to 24 and finally in the third testing the number of negative cases is 23.

Table: 3 – Distribution According to Respiratory Pathology

Sr. No	Respiratory Involvements	No. of Patients	Percentage
1	Cavitatory lesion	21	19.09
2	Pleural effusion	10	9.09
3	Consolidation	79	71.81
	Total	110	100.00

Of the 110 study population,23 cases were sputum negative for acid fast bacilli after Ziehl Nelson staining and 11 patients were started on empirical anti TB drugs due to the very clear radiological clues and clinical manifestation ,and 12 were asked to follow up after 15 days if the symptoms persists, of the 8 patients who returned 6 were started on empirical anti tuberculosis drugs and 2 were asked to come back for review after 1 month if the respiratory symptoms persists, when the 4 patients returned for review they were started on empirical anti TB drugs

Discussion -

SI has performed well both in resource-poor and resource-rich countries (5,6). In these studies, SI provided adequate samples for diagnosis &was cost-effective and about 29-33% patients were smear positive on SI samples. Its usefulness has also been confirmed in children⁽⁷⁾ & extrapulmonary tuberculosis⁽⁸⁾. However, few studies in developed countries showed that SI added little to overall diagnosis and was deemed costly (9). However, Mc Williams et al ¹⁰ et al found that (2002) the culture yield of Fiberoptic Bronchoscopy was only 52 percent and the cost was three times that of doing three sputum induction studies..The authors preferred strategy was to employ SI followed by FOB only in those patients who were negative on sputum induction but had features of pulmonary tuberculosis on chest radiograph. This approach is more practical taking into consideration the cost of missing the diagnosis. Naseem (2006) (11) et al in their comparative study of diagnostic yield of AFB with sputum induction to spontaneous sputum examination in suspected pulmonary tuberculosis found out that in expectorating patients, AFB smear and culture positivity results remain comparable with spontaneous and induced sputum sampling .Sputum induction improves the diagnostic yield for AFB in patients unable to expectorate adequate sputum sample. Biswas ⁽²⁾et al --118 (2013).Overall, 32% of patients were found positive on smear examination after sputum induction. Out of 58 patients who were smear negative with spontaneous adequate sputum, 21 (34 %) were found positive on induced sputum culture examination.SI culture was successful in confirmation of diagnosis in 14 (33 %) out of 42 patients with no / adequate sputum. The sensitivity of smear and culture of induced sputum in diagnosis of pulmonary TB were 80 % and 87 % respectively.

In our study, out of 110 patients undergoing SI, 71 had cough with inadequate sputum while 39 patients had adequate sputum. SI successful in 95 % of patients who could expectorate adequate sputum similar to Gupta et al ⁽¹²⁾.Overall, 74 .54 % of patients were found positive on smear examination after SI.

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 produced sputum. The number of negative cases substantially reduced from 110 to &47 to 24 and finally in the third testing the number of negative cases were 23. From this it is clear that after induction it is possible to identify more cases.

Our study is not without limitations. Patients suffering from extrapulmonary tuberculosis &HIV were not assessed. Children were not part of our study .Microbiological samples are more difficult in these groups. Study was carried out in a tertiary-care cantre.The smear yield could have been higher if LED microscopy was used which was introduced later in our institute.Larger studies are needed to assess its utility in different settings so as to include it in RNTCP.

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