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Role of Gastric Lavage And Induced Sputum in Diagnosis of Childhood Tuberculosis: A Study in A Rural Medical College Hospital; west Bengal; India

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Abstract: *Diagnosis of childhood tuberculosis continues to be surrounded by considerable uncertainty. The main disadvantage is sample collection in children. An institution-based cross-sectional observational study was conducted in B. S. Medical College& Hospital, Bankura, West Bengal, India. A total of 50 children, who were suspected of having tuberculosis were recruited. All of them were subjected to collection of gastric aspirate as well as induced sputum. 8 children (16%) showed AFB positively in gastric aspirate whereas 6 children (12%) were AFB-positive in induced sputum. Different clinical parameters and radiological findings were also studied. This study helps us to know the diagnostic role of gastric lavage and induced sputum in this part of the country.*

Keywords: *Diagnosis of tuberculosis; gastric aspirate; induced sputum; observational study; cross-sectional study; India.*

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I.Introduction

Tuberculosis is one of the most ancient ailments of human being accounting for millions of deaths annually worldwide. In the recent times epidemiology, clinical profile, diagnostic modalities and treatment have undergone phenomenal change. There is a continual increase in incidenceof tuberculosis in children. In developing countries the annual risk of tuberculosis infection in children is 2.5%. Nearly 8-20% of deaths caused by tuberculosis occur in children. Childhood tuberculosis account for almost 1.3 million cases and 4,50,000 deaths occurring each year worldwide[1,2].

The diagnosis of childhood tuberculosis is complicated by absence of a practical gold standard test due to difficulty in sample collection and reportedly low bacteriological yield. Inspite of advent of various recent diagnostic modalities like fluorescence LED microscopy, improved culture techniques, antigen detection, nucleic acid amplification, line probe assays, serodiagonosis and IGRAS ; none of these have desirable sensitivity and specificity[2].

Till date most children can be diagnosed by using a combination of clinico-epidemiological features, tuberculin skin testing and chest radiography as represented by different scoring system. However bacteriogical confirmation may have particular value in highly endemic zone whereas epidemiological indicators like known exposure to proven Mycobacterium Tuberculosis infection and disease, contribute little diagnostic value[3].

Accurate microbiological diagnosis, speciallymycobacterial culture confirms the diagnosis and drug susceptibility data but is not available in resource-poor settings where there is high TB prevalence. Moreover culture has poor sensitivity in children who usually have paucibacillary disease[4].

Since children swallow the sputum rather than expectorating it out, traditionally consecutive gastric lavages have been recommended. According to the revised WHO and RNTCP policies 2 instead of traditionally recommended 3 gastric lavage samples have been advocated as sufficient. New sputum smear positive pulmonary TB case has been defined as presence of at least one acid-fast bacillus (AFB) in at least one sputum sample[5].

There has been considerable interest in hypertonic saline induced sputum collection as this is less invasive than gastric lavage[6]. Adequate trials are needed before it can be conclusively stated that induced sputum is a better source of sample for AFB smear/culture than gastric aspirate.

Gastric lavage (GL) collects the respiratory secretions which are swallowed at night and induced sputum (IS) collects sample coming out from lower respiratory tract.

This study was conducted with an intention to determine the diagnostic role of gastric lavage and induced sputum in a setting with high incidence of tuberculosis. It is hoped that the present study will add to the knowledge available in this area.

Aims and Objectives

1. To evaluate the diagnostic role of gastric lavage and induced sputum is suspected childhood tuberculosis.
2. To compare the yield of mycobacterium tuberculosis from repeated induced sputum with that of gastric lavage in children in an area with high incidence of tuberculosis.

I. Materials and methods

This prospective study was conducted in the department of Pediatric Medicine, B. S. Medical College, Bankura ; a rural Medical College in West Bengal ; India. The study was done in collaboration with the Department of Microbiology and the Department of Radio diagnosis. The period of study was from June 2016 to October 2016. Total fifty (50) children with suspected tuberculosis were recruited in the study. The age of the study population was between 6 months to 7 years.

Suspicion of tuberculosis was made on the following grounds (inclusion criteria):

a. Abnormal radiological features suggestive of tubercular disease like intrathoracic adenopathy, segmental consodilation and/or collapse, milliary mottling, cavitory lesions and/or unresolving pneumonia for more than three weeks.

b. Positive tuberculin skin test (TST) which is taken as >10mm induration at 72 hours following ITU of PPD injected intradermally ; and/or

c. Positive history of contact with tuberculosis patient.

Total 50 (fifty) cases were selected consecutively based on abovementioned inclusion criteria. Detailed history taking and clinical examination was done on every child. After collecting two gastric lavage samples and repeated induced sputum from each patient, the samples were concentrated and processed by modified Petroffs' method. Collected samples was examined for detection of acid fast bacillus.

Gastric lavage was performed early morning on every child after an overnight fast. Twenty (20)ml of Normal Saline was introduced via a nasogastric tube, left for 3 minutes and then aspirated. An additional 5-10 ml of Normal Saline was introduced and then aspirated, so that a minimum of 20 ml of aspirate was obtained. The lavage specimen was collected in a container with sodium bicarbonate and sent to the Department of Microbiology for staining by Zeihl-Neelson technique and auraminerhodamine staining smear for AFB.

Sputum induction was performed 6 hours after gastric lavage, prior to lunch. Five (5) ml of 3% sterile saline was nebulized for 15 minutes at a flow rate of 5 Litres/minute. Prior to that the children were pre-treated with nebulized Salbutamol (0.03 ml/kg); maximum of 1 ml to prevent bronchospasm induced by hypertonic saline. After saline-nibulization, percussion was done on the front and back of the chest wall to induce expectoration. If spontaneous expectoration was not achieved by this, sputum was obtained by nasopharyngeal suctioning by using a sterile mucous extractor of catheter size 6 or 7. Oxygen saturation was monitored throughout. A thorough physical examination was performed at the end of the procedure to exclude bronchospasm.

Necessary permission was obtained from the Institutional Ethics Committee,BankuraSammilani Medical College; Bankura; to perform the study and to publish the results obtained from the study.

II. Result and Analysis

Out of total fifty children (n = 50) recruited; 23 children were below the age of 1 year, 16 children between age group 1 – 4 year and 11 children were between age group of 4 – 7 years.

Out of 50 children 32 were males and 18 were females; making a ratio of 1.78 males per females.

Major clinical manifestations among the study population (n = 50) were cough (48 cases), low-grade fever in 38 cases, breathlessness in 26 cases, failure to thrive in 11 children. Haemoptysis was present in 1 case only. So cough came out to be the most common presentation. Among the study population 2 children were found to be suffering from associated HIV infection. Two (2) children had past history of measles. One very important observation was presence of malnutrition in 39 children (78%).

Mantoux test positivity was found in 25 cases (50%). Among them 9 children were below the age of 1 year, 11 children between 1 to 4 years and 5 children were between 4 to 7 years of age.

History of contact was present in 33 cases in our study meaning that the children were exposed to open cases of tuberculosis in their home or neighbourhood.

Major radiological findings observed in this study were consolidation in 20 cases (40%) ; bronchopneumonia in 13 cases (26%) ; consolidation with collapse in 7 cases (14%) ; Cavitary lesions in 3 cases (6%) and intrathoracic lymphadenopathy in 2 cases (4%). Other radiological findings included 1 case of milliary tuberculosis and 3 cases of pleural effusion. Only one case had no evident radiological abnormality.

Based on the clinical settings, Mantoux positivity, contact positivity and characteristic chest x-ray findings gastric lavage (GL) and induced sputum (IS) was collected as sample for microbiological diagnosis of mycobacterium tuberculosis.

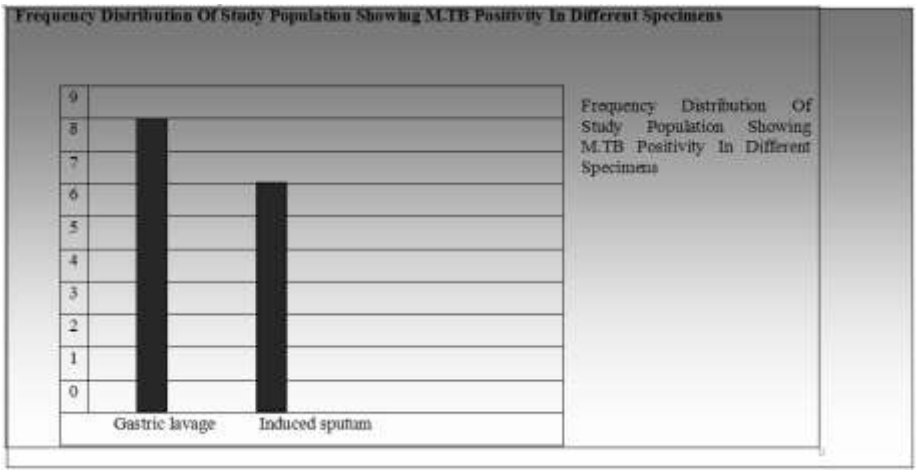

Figure - 1

Figure 1 shows that in the present study, out of 50 children recruited, 8 cases (16%) were positive for AFB in gastric lavage (GL) and 6 cases (12%) were found to be positive in induced sputum (IS).

Most of the cases which showed positivity on gastric lavage were below the age of 1 year as collection of induced sputum was not easy in this age-group. Based on the above, statistical analysis was done to compare the efficacy of gastric lavage and induced sputum as a preferred method for sample collection for bacteriological diagnosis of mycobacterium tuberculosis. On Chi-square (X^2) test, the value came out to be 0.39 and was found to be less than the value for null hypothesis. Hence the null hypothesis could not be rejected ($p = 0.99$). Therefore gastric lavage was not proved to be better than induced sputum for detection of AFB. Rather both may be considered as complementary to one another.

Table No. 1 : Demographic Data

Total number of cases50	
Male	32(64%)
Female	18(36%)
Age group	
< 1 years	23(46%)
1-4 years	16(32%)
4-7 years	11(23%)
Clinical presentation	
Cough	48(96%)
Low grade fever	38(76%)
Breathlessness	26(52%)
Failure to thrive	11(22%)
Haemoptysis	1(2%)
Malnutrition	39(78%)

Table No. 2 : Characteristics of Children with Suspected Pulmonary Tuberculosis

Age (yrs)	**Mantoux test**		**Contact History**		**Radiology (CXR)**							**GL**	**IS**
	Pos.	Neg.	Pos.	Neg.	Cons.	Cons. With collapse	Cavity	Broncho pneumonia	Intra Throacic adenopathy	Mil. TB	Pl. Eff.	Pos.	Pos.
<1	9	14	18	5	11	2	-	8	-	1	1	5	1
1-4	11	5	9	7	7	3	1	3	1	-	1	2	2
4-7	5	6	6	5	2	2	2	2	1	-	1	1	3

III. Discussion

Out of total 50 children recruited in our study 32 (64%) were boys and 18 (36%) were girls. 39 children (78%) were below the age of 4 years and 11 children (22%) were between 4 and 7 years of age. This findings is consistent with observation of previous workers like B. J. Maris et all who noted age distribution of 75% below the age of 5 years and 25% between 5 to 12 years of age[7].

Positive history of contact in our study was identified in 66% and a positive Mantoux test was observed in 50% of patients. Mantoux reactors were equally distributed between smear-positive and smear-negative patients. These findings are consistent with the findings of Guillermo et al where 51% patients demonstrated positive Mantoux Test [8]. Meenu Singh et all also showed positive Mantoux Test in 68.9% of patients and history of contact in 55% of patients in her study[9].

Major clinical manifestations were cough (96%) ; low grade fever (76%) ; breathlessness (52%) and failure to thrive (22%). Hemoptysis was the presenting complaint in 2% of cases and 78% children were found to be malnourished. These findings are consistent with previous studies in this field [9].

Chest x-ray findings in our study included consolidation (40%) ; bronchopneumonia (26%) ; consolidation with collapse (14%) ; cavitary lesions (6%) and intrathoracic lymphadenopathy (6%). Miscellaneous other radiological findings included 1 case of millary TB and 3 cases of pleuraleffusion. Only one case did not show any radiological change in chest x-ray.These findings are consistent with those of previous researchers working in this area [9].

Out of 50 children in our study 8 cases (16%) were found to be positive for AFB in gastric lavage whereas 6 cases (12%) were AFB-Positive in induced sputum. Isolation rates for AFB from gastric lavage sample has ranged from 28% to 40% in children with suspected PTB in various series ; although rates as high as 75% has also been documented by some other workers [2,10,11,12].

In our series the diagnostic yield from gastric lavage (GL) was 16% and that from induced sputum (IS) was 12%. The low yield was probably due to the fact that we used only smear microscopy for both types of samples. Culture and other advanced methods of confirmation could not be done in our set up. The duration of time that elapses between sample collection and microbiological study is a determining factor for obtaining positive results.

In similar previous studies where culture from gastric aspirate was done, the yield was 25.5% to 33.3% (in culture) and diagnostic yield from induced sputum was variable [13].

In a prospective study by Shata et al microbiological isolation for induced sputum (IS) by staining or culture was 28%. Gastric lavage was not evaluated in this study however [14].

Another study from a National Tuberculosis Centre in Yemen reported higher isolation rate from induced sputum (13/82 i.e. 16%) than that of gastric aspirates (19/203 i.e. 9%) [15].

In two other studies performed by Zar et al isolation rates from induced sputum and gastric lavage was 10% vs 22% and 11% vs 19% respectively [16, 17].

In another study by Hatherill et al the diagnostic yield of gastric lavage (GL) was 6.8% and that from induced sputum (IS) was 5.8% and there was no statistically significant difference between the bacteriological isolation rate obtained from a single sample of induced Sputum versus gastric aspirate [18].

This finding in consistent with that obtained from our study.

The differences in observations found in different studies may be due to the fact that not all studies performed three sample collections by induced sputum (IS) and the different characteristics of population included in the studies with inherently varying degrees of risk of tuberculosis.

In the present study the higher isolation rate achieved by Gastric Lavage (GL) [16%] than in case of induced sputum (IS) [12%] may be due to the fact that three samples each were obtained. And in addition majority of GL positive cases were infants, where sputum induction was difficult making IS positivity naturally less.

In another study conducted at a Madrid Hospital microbiological (Smear positivity) yield by Gastric Lavage was 30.8% and that by induced sputum was 7.7%. Culture positivity rate was also higher in GL samples (24.77%) than in IS samples (4%) with a statistically significant difference ($p = 0.03$) [19].

The difference in findings (between GL and IS) may be due to variable sampling technique and difficulty in obtaining valid induced sputum [18].

The findings in this study is consistent with that of ours where we also found better yield in GL than IS (though the difference was not statistically significant).

IV. Conclusions

In spite of the fact that tuberculosis stands as one of the most ancient illness of mankind, there is considerable controversy regarding diagnosis and management. Till date there is no quick and easy diagnostic

modality and the recently recommended diagnostic tests are not available in resource-poor setting like that of ours. Gastric Lavage and induced sputum has been studied by many workers as a diagnostic tool since long time. This present study will definitely help us to know the diagnostic value of these tests though further large-scale studies in this regard is needed ; because there is a pressing need and ample scope of continual research in this field.

Limitation of our Study

The small sample-size was the main limitation in the present study. The validity of our results may not be extrapolated to other setting. Moreover culture of MTB could not be done due to technical constraints.

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Conflict of interest – No conflict of interest

Contributions :

DR De actually planned and conducted the study. She collected the datas and compiled them.
DR Pal drafted the final manuscript and added many intellectual contents.
DR Ghosh revised the manuscript and also contributed in adding important contents.
DR Bandyopadhyayactively participated in the study at all steps. He performed the statistical analysis.
DR (Prof) Chakraborti gave necessary help, guidance and supervision during the entire study period.
DR (Prof) Mandal provided technical supervision and also added some intellectual contents.

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