Value of Third Sputum Sample for the Diagnosis of Pulmonary Tuberculosis – A Retrospective Observational Study

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Tuberculosis is a disease caused by Mycobacterium tuberculosis (Koch's bacillus) which kills many victims than any infectious disease. Sputum smear microscopy is a simple, inexpensive and appropriate technology method which is relatively easy to perform and to read. In this study, an attempt has been made to assess the diagnostic yield of third sputum sample among suspected pulmonary tuberculosis patients so that a possible comment can be made to save time and resources. This was a retrospective observational study. The study place was the Department of Medicine of Sylhet MAG Osmani Medical College Hospital, Sylhet. The study duration was six months, from February, 2011 to July, 2011. Patients attended in the DOTS Corner, Sylhet M. A. G. Osmani Medical College Hospital, Sylhet for sputum examination and had positive results are the study population. In this study all the patients are sputum positive either in all three sputum tests or at least in one of the sample test from first, second or third. All the 1388 positive cases were identified with first and second sputum test but no case has been identified with only third sputum test. In our study 100% of cases were positive on the first two samples. The diagnostic process could be made much more efficient and convenient for patients if it could be completed by examining two sputum samples.

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Introduction

Tuberculosis (TB) remains one of the world's deadliest communicable diseases. In 2013, an estimated 9.0 million people developed TB and 1.5 million died from the disease, Of the estimated 9 million people who developed TB in 2013, more than half (56%) were in the South-East Asia and Western Pacific Regions. Among 22 HBC, Bangladesh ranked 6th position.[1] Proper identification of cases is the pillar of TB control programs.[2] Despite recent advances in early diagnosis of tuberculosis, microscopic examination of the sputum smear remains the most appropriate method particularly in the majority of countries which are endemic for this disease. Number for sputum samples to be examined for screening of TB remains one of the most frequent questions.[3] Sputum smear microscopy is a simple, inexpensive and appropriate technology method which is relatively easy to perform and to read. Under NTP conditions, the International Union Against Tuberculosis and Lung Diseases (IUATLD) recommends collecting three sputum samples "on the spot – early morning – on the spot", within two days, from each person presenting at health

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centers, out-patient clinics etc, with respiratory symptoms of more than 3 weeks duration. The microscopist need to take at least 5 minutes to read 100 fields, and should never be expected to process and read more than 25 ZN-stained sputum specimens per day when working full time. No more than 10 to 12 specimens should be processed at one time. However, this situation seldom occurs even in the peripheral laboratories of high incidence countries like Bangladesh where the real challenge is to face a high workload. In these circumstances testing proficiency and yield is often questioned.[4] In this study, an attempt has been made to assess the diagnostic yield of third sputum sample among suspected pulmonary tuberculosis patients so that a possible comment can be made to save time and resources.

Methods

Study institution and design of the experiment:

Sylhet MAG Osmani Medical College Hospital (SOMCH) is a 900 bed tertiary care teaching hospital in Sylhet, Bangladesh. The hospital averages 438000 patients admission and almost 730000 outpatient department and emergency room visits annually. This was a retrospective observational study. Patients attended in the DOTS Corner, Sylhet M. A.G Osmani Medical College Hospital, Sylhet for sputum examination and had positive results are the study population. All those, who diagnosed positive from January, 2006 to December, 2010 were included and all the patients became negative in three sputum examination were excluded from the study.

Microscopy procedure:

The first, second and third sputum samples of patients who had consented were pooled and divided into two. The first of this pooled sample was smeared directly and stained by the ZN technique. The second of the pooled samples was bleached, digested, centrifuged, supernatant discarded, sediment fixed and stained by the ZN technique.

Results

One hundred and thirty two (9.5%) patients were in the age group of 19 years and less, six hundred and eleven (44.1%) patients were in the age group of 20 to 39 years, four hundred and fifteen (29.9%) patients were in the age group 40 to 59 years, two hundred and two (14.6%) patients were in the age group 60 to 79 years and the age group of 80 to 99 years consist of 26 patients (1.9%).

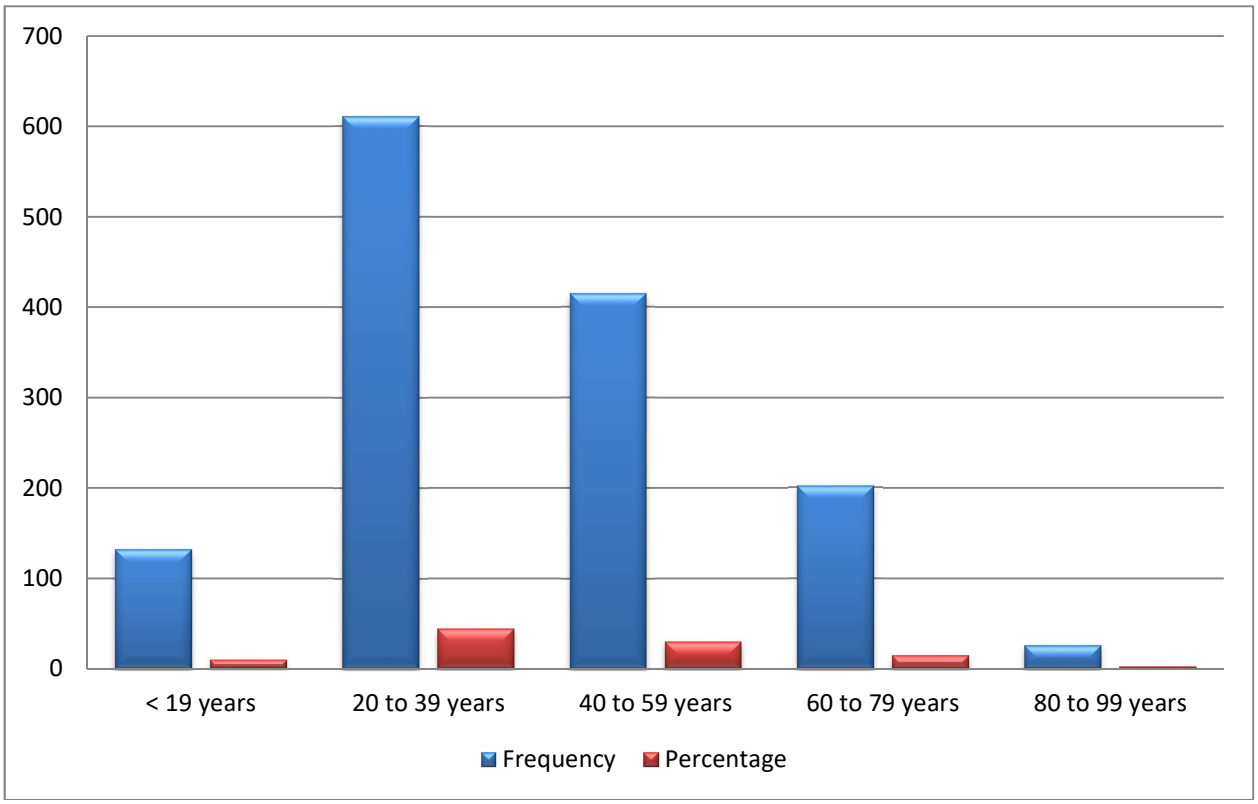

Figure 1.Distribution of patients by age group (n=1386)

Out of 1386 patients, 997 (71.9%) patients were male and 389 (28.1%) patients were female with a ratio of 1:2.56. Distribution of respondents according to sex is shown in figure 2.

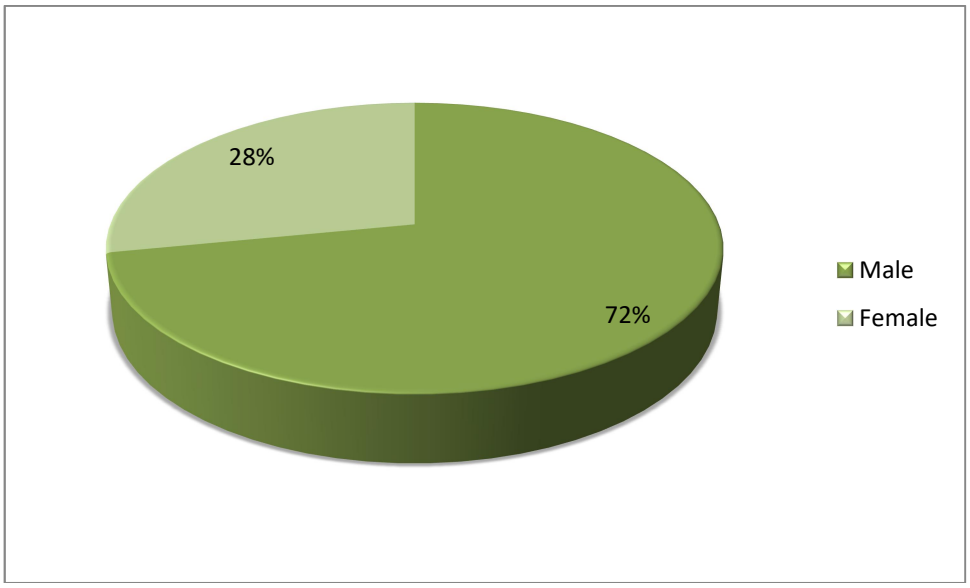

Figure 2. Distribution of respondents according to sex (n=1386)

All the 1386 positive cases were identified with first and second sputum test but no case has been identified with only third sputum test (fig 3) .

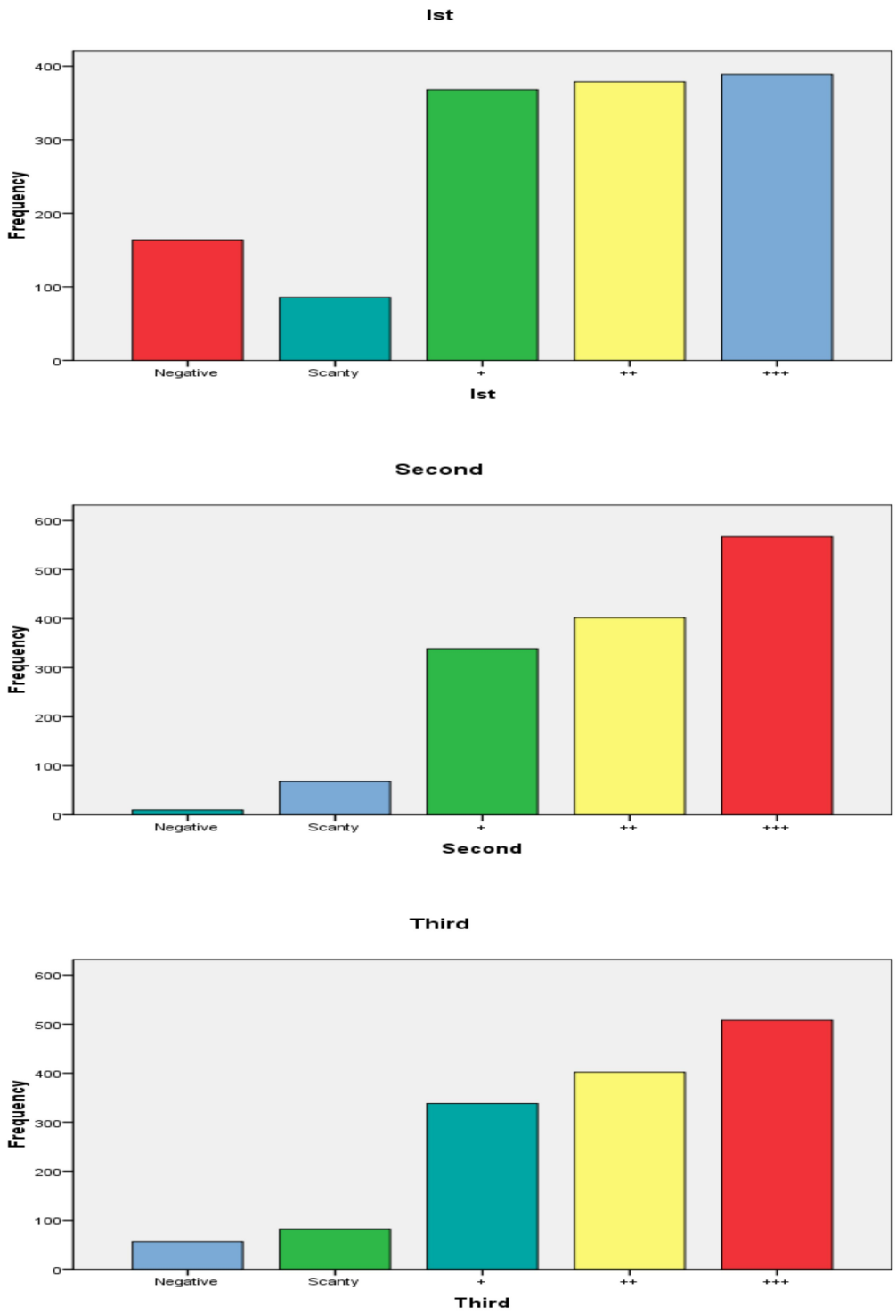

Figure 3. Distribution of respondents according to first, second and third sputum sample (n=1386)

In this study all the patients are sputum positive either in all three sputum tests or at least in one of the sample test from first, second or third. In first sample test 164 patients (11.8%) had negative

finding, 86 patients (6.2%) had scanty finding, 368 patients (26.5%) were '+', 379 patients (27.3%) were '++' and 389 patients (28.1%) were '+++'. In second sample test, 10 patients (0.7%) had negative finding, 68 patients (4.9%) had scanty finding, 339 patients (24.5%) were '+', 402 patients (29.0%) were '++' and 567 patients (40.9%) were '+++'. In third sample test, 56 patients (4.0%) had negative finding, 82 patients (5.9%) had scanty finding, 338 patients (24.4%) were '+', 402 patients (29.0%) were '++' and 508 patients (36.7%) were '+++'.

In the first sample 88% (1226 out of 1388) is positive, 99% in second sample and 95% in third sample. Only 162 patients were diagnosed negative in first sputum test, all of which become positive in second and third tests. All the 1388 positive cases were identified with first and second sputum test but no case has been identified with only third sputum test.

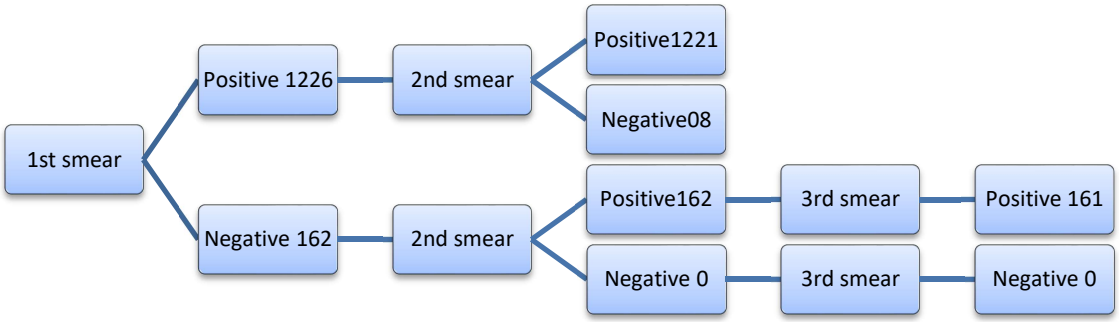

Figure 4. The flow chart for the results of the smear examinations.

Discussion

Sputum microscopy is a cornerstone in the diagnosis of pulmonary tuberculosis. All individuals who present to the general health services, likely to have TB are required to undergo a sputum smear examination. In this study, we looked at the necessity of the yield of third sample in our settings. We had a policy of 'spot-morning-spot' collection at the time of the study. It provides most of the essential laboratory-epidemiological indicators needed for the evaluation of NTP. The microscopist need to take at least 5 minutes to read 100 fields, and should never be expected to process and read more than 25 ZN-stained sputum specimens per day when working full time. No more than 10 to 12 specimens should be processed at one time. However, this situation seldom occurs even in the peripheral laboratories of high incidence countries like Bangladesh. In several studies it has been observed that with three serial smears, about 85% of ultimately positive suspects are positive on the first, an additional 10% on the second, and around 5% on the last sputum smear examination. This observation has nevertheless not been consistent, and deviations have not been uncommon. In our

study 100% of cases were positive on the first two samples. Similar study showed 99% of cases in Mongolia and 96% in Zimbabwe were positive on the first two samples. The high yield of the first two smears is consistent with findings from other studies done in China, India and Tanzania etc.[5-10] In a study done in various microscopy centres of the state of Chattisgarh, India in 2012, decreasing the number of sputum examinations during follow up can reduce the overall laboratory workload by 15%**.**[11]Conversely, the yield and incremental benefit of the third smear was very small. The very small yield from the third smear has two major possible explanations: it is possible that the technicians were diligently examining each smear and thus identified virtually all cases with two smears. Alternatively, as has been seen in other settings[12], the contrary could be the case, overburdened technicians may be much less diligent on examining a third smear following two negative smear. Examining more sputum samples may be counterproductive in the sense that the overburdened technician may examine too few fields or copy the result of the first smear examination into the result columns for the second and third sputum smears.[13] Concerns might be raised that a small proportion of cases may be missed by not examining the third serial smear. However, sputum smear-negative, symptomatic TB suspects are investigated further by radiography, trials of antimicrobial therapy for alternative diagnoses, and additional sputum smear examination if there is no clinical improvement. By examining two sputum specimens, the sensitivity of sputum smear examination might actually improve as the technician will have fewer slides to prepare and examine. Whether this will imply two morning specimens or one spot specimen plus one morning specimen will need to be discussed and decided by the authorities.

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