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A Comparison of Clinical, Laboratory and Radiological Imaging in Assessing Prevalence of Pulmonary Tuberculosis among Adults in Rural Kancheepuram, Tamil Nadu, India.

Sunilkumar Jada^{1*}, Karthika Jayakumar¹, Sundara Murthy², and Sri Vidhya².

¹Department of Microbiology, Shri Sathya Sai Medical College and Research Institute, Kancheepuram, Tamilnadu-603108, India.

²Department of TBCD, Shri Sathya Sai Medical College & Research Institute, Institute, Kancheepuram, Tamilnadu-603108, India.

ABSTRACT

Tuberculosis (TB) is one of the most ancient diseases of mankind. Tuberculosis remains a global public health problem. India has a major share of the global incidence of tuberculosis (TB) including MDR-TB and TB related mortality. The prevalence of TB disease is an important epidemiologic index to measure the burden in a community. To estimate the prevalence of pulmonary tuberculosis among adults in rural Kanchipuram and to compare clinical, laboratory and radiological imaging in assessing prevalence. Type of study: cross-sectional study. We collected samples from individual family clusters randomly, having cough for more than two weeks. All the symptomatic and anti-TB treatment (ATT) subjects are subjected for X-ray chest. Sputum samples are collected early morning in a sterile container for diagnosis, Acid fast staining and culture in Middlebrook 7H10 are done. Total study subjects were 1510, 126 were having the symptoms of pulmonary tuberculosis. 34 were Positive for pulmonary tuberculosis. Middlebrook 7H10 agar media, the positive percentage being 31 (2.05%), and 20 were radiological positive. Among the 919 of males screened 25 (1.65%) were positive, compared to females 591 of them 9 (0.59%) were positive. The prevalence of our study reveals that TB is still a major problem. Rapid detection by the culture media we have used will ensure early institution of ATT & early recovery. This will reduce the morbidity & mortality of the patients. As the study shows low prevalence rate it can be further reduced to zero prevalence.

Keywords: Tuberculosis, prevalence and Middlebrook.

**Corresponding author*

INTRODUCTION

Tuberculosis (TB) is one of the most ancient diseases of mankind (1689) [1]. TB was not identified as a single disease until the 1820s and was eventually named “tuberculosis” in 1839 by J. L. Schonlein [2].

Tuberculosis (TB) is a disease of the past, present with persisting drug resistance & mismanagement of drugs making it thrive for decades, transmitted from an infectious source to susceptible persons primarily through the air, through coughing [3]. Most infected persons do not experience clinical illness, but are usually asymptomatic and non-infectious. However, infection can persist for years and infected person can remain at risk for developing clinical TB, especially when the immune system becomes impaired [4].

Tuberculosis remains a global public health problem. India has a major share of the global incidence of tuberculosis (TB) including MDR-TB and TB related mortality [5]. It has been estimated that someone in the world is newly infected with TB every second, nearly 1% of the world population is infected with TB every year and overall, one third of the world population is infected with Mycobacterium TB [6]. In March 1993, the WORLD HEALTH ORGANISATION (WHO) took an unprecedented step & declared TB as a “Global Emergency [7]. According to estimates in 2010, TB incidence was 185 per 100,000 with 320,000 TB related deaths where as under nutrition; smoking and diabetes are considered more important risk factors [5].

National Tuberculosis Programme (NTP) based on a cost effective operational strategy was implemented all over India from 1962; after a nation-wide survey during 1955–1958 revealed that tuberculosis (TB) was highly prevalent throughout the country [8]. India is the second populous country in the world; India has more new cases annually than any other country [9]. In 1993, the world health organization in an unprecedented step declared tuberculosis is a global emergency. Newly acquired infections between 2002 and 2020 are projected of 1 billion persons of these, 150 million will get sick and 36 million will die of tuberculosis [10].

Tuberculosis continues to be a major public health problem in India. With an estimated 2.3 million new cases annually, making it the highest TB burden country in the world. In 2010, India alone accounted for an estimated one quarter 26% of all TB cases worldwide [11].

The prevalence of TB disease is an important epidemiologic index to measure the burden in a community and if measured periodically, will enable trends in disease prevalence to be observed over a time.

The Governmental efforts at intervention through Revised National Tuberculosis Control Programme (RNTCP) and at monitoring the epidemiology of intervention through organizing routine reporting are highlighted and data are presented and evaluated on these. RNTCP needs to be used as an effective instrument to bring a change in epidemiological situation, through fast expansion and achievement of global target. Tuberculosis is still major cause of morbidity and mortality worldwide [12].

Diagnostic method employs microscopic examination of sputum smear & culture, culture is more sensitive than smear microscopy. Therefore it becomes very important diagnostic tool for tuberculosis.

The conventional LJ medium culture media requires 8-12 weeks of incubation, while the media which will be used in our study Middlebrook 7H10 agar has variety of inorganic salts provides substances essential for the growth of mycobacterium enhances the rate of growth in the form of colonies as early as 1 week. This is used for the isolation and cultivation of mycobacterium.

The purpose of this study is to know about the prevalence of TB disease by clinical, laboratory and radiological imaging in rural Kancheepuram, which will help in the planning of control strategies and service delivery systems.

Aims and Objectives

- To estimate the prevalence of pulmonary tuberculosis among adults in rural Kancheepuram.
- To compare clinical, laboratory and radiological imaging in assessing prevalence.

Study Population and Design

The present study was done to know the prevalence of TB among adults. We screened the three Taluks of Tiruporur, Tirukazhukundrum and Kelambakam in Kancheepuram district over a period of six months with prior permission from the institutional ethical committee and written consent form from patient.

Type of study: cross-sectional study, Statistical analysis used: SPSS 20 statistical software and windows Excel-2007.

Determination of sample size

$$n = 4pq / L^2$$

Sample size

According to "National ARTI survey 2009-2010 prevalence (5-7%) in Tiruvullar, District⁽⁹⁾.

Therefore the subjects taken under study = 1510. The study was conducted in rural kancheepuram District.

The smear positive tuberculosis is usually rare in people younger than 15 years, and it is difficult to collect sputum samples from children. Therefore the population eligibility for the survey included all residents aged ≥ 15 years in the selected clusters who will present during survey.

Processing of samples

Inclusion criteria

Clinically suspected cases having Cough ≥ 2 weeks with one of the following symptoms like Fever, Loss of weight, Hemoptysis, Household contacts & smoking.

Exclusion criteria

Patients who are not willing to participate.

METHODS

We collected 1510 samples from individual family clusters randomly, having cough for more than two weeks. Written informed consent was obtained at homes, followed by questionnaire about the related symptoms of TB. Cough ≥ 2 weeks, hemoptysis, weight loss, fever > 7 days, night sweats, history of TB treatment, house hold contacts with TB patient and smoking [8].

A total of 126 patients had symptoms of cough, fever, loss of weight, hemoptysis & smoking; sputum samples were collected early morning in a sterile, disinfectant free container and labeled, transported to the lab immediately for diagnosis of pulmonary tuberculosis. If there was a delay, the samples were stored in the refrigerator. All the procedures were done in class II biological safety cabinet as per standard protocol. All the symptomatic and anti-TB treatment (ATT) subjects were subjected for X-ray chest.

Once the sample was received in the lab, it was decontaminated with N-acetyl-L-cysteine sodium hydroxide as per standard protocol. then it was concentrated by centrifugation 3000 rpm for 30 minutes, the sediment was used for inoculation on to 7H10 Middle brook plates [13,14], kept in a candle jar at 35°C and another 0.1ml to LJ medium, which was incubated at 37°C.

The plates were observed twice weekly for 6 weeks for micro colonies. LJ media was observed on the third day and then on weekly basis for 8 weeks. Further confirmation was done by niacin and catalase tests.

RESULTS

Total duration of study was six months, study subjects were 1510 . 126 were having the symptoms of pulmonary tuberculosis based on inclusion criteria. The commonest symptom observed was cough 66 cases; least observed symptom was fever-6 cases (Table-1). 34 were Positive for pulmonary tuberculosis. 27 were smear and culture positive, 4 smear negative and culture positive & 20 were radiological positive, includes smear positive & culture positive and smear negative + culture positive and clinically suspected cases (Flow chart-1).

Out of 126 samples processed for smear and culture, 27 (1.78%) were smear positive (Figure-1), 31(2%) positive for culture, giving a growth on Middlebrook 7H10 agar media and LJ medium and the remaining did not have growth even after incubating the media for six weeks (Figure-2) & 20 (1.32%) positive by X-ray(Figure-3).

Figure 1: ZN- staining Acid fast bacilli

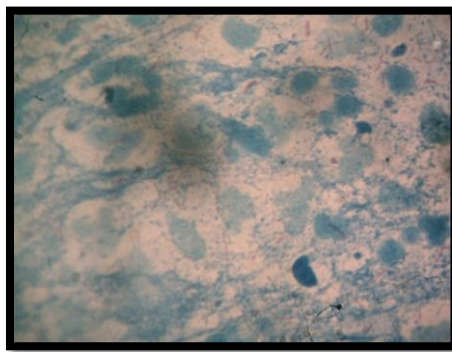


Figure 2: Middlebrook 7H10 Agar showing rough, white, cream or buff colonies

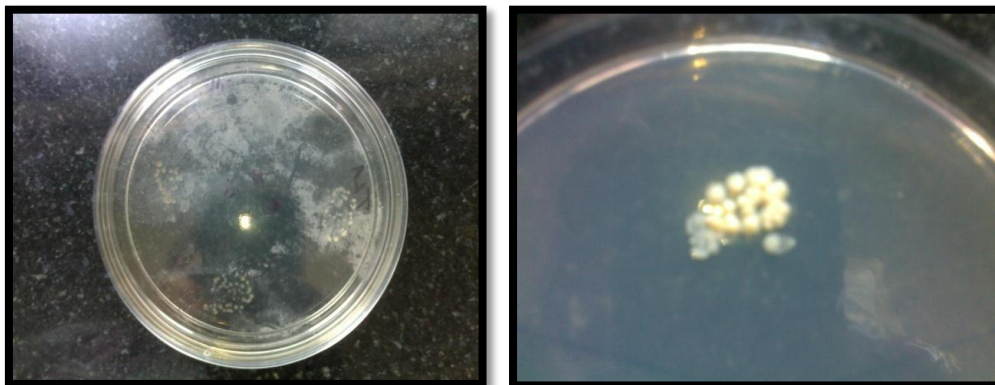


Figure 3: Chest X-ray: Primary TB Cavitation

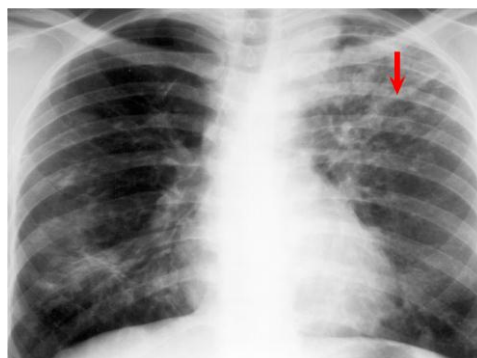


Table 1: Distribution of pulmonary symptoms among study population (n: 126)

Symptoms	No
Cough \geq 2 weeks	66(49.2%)
Fever	6(5%)
Haemoptysis	9(7.1%)
Chest pain	16(12.6%)
Combination of other symptoms with cough	29(28%)
Total	126(100%)

Table 2: Gender wise prevalence of pulmonary tuberculosis among adults (n=1510)

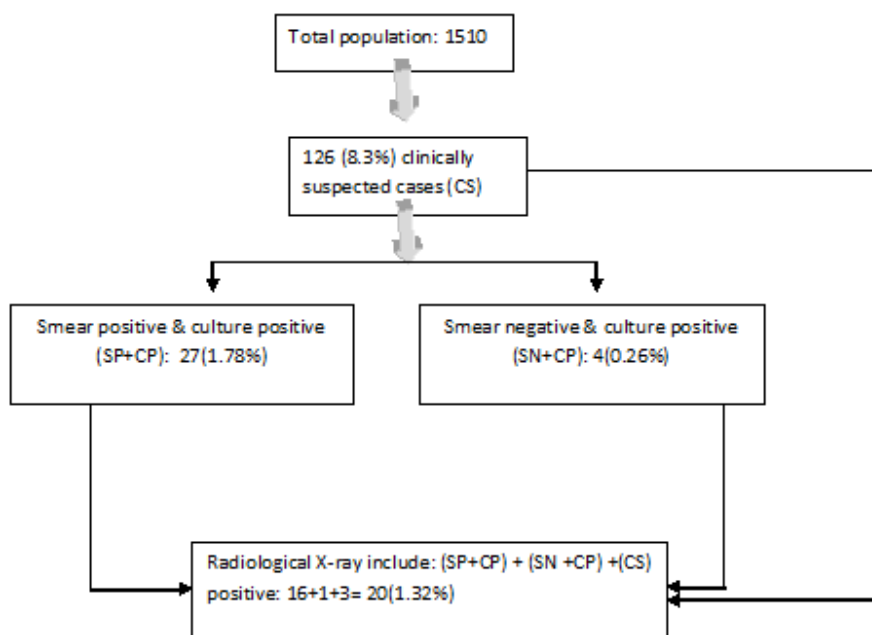
Gender	No. positive for pulmonary tuberculosis	No. negative for pulmonary tuberculosis	Total
Male	25(1.65%)	894(59.2%)	919(61%)
Female	9(0.59%)	582(38.5%)	591(39%)
Total	34(2.25%)	1476(97.74%)	1510(100%)

Significant relationship among the male and female positive cases ($p=0.000$). Mann-whitney $U= 5.329$, Kolmogorov-smirnov $Z= 1.782$.

Table 3: Age wise distribution of pulmonary tuberculosis among study subjects (n=1510)

Age (years)	No. screened	Positive for pulmonary tuberculosis (%)
15 – 24	163	1(0.6%)
25 – 34	187	2(1%)
35 – 44	312	8(2.56%)
45 – 54	418	15(3.58%)
55 – 64	232	5(2.15%)
65 – 74	198	3(1.5%)
OVERALL	1510	34(2.25%)

Flow chart 1: Showing screening results among total population.



SP: Smear positive, CP: Culture positive, SN: Smear negative & clinically suspected.

The growth in 31 specimens, micro colonies appeared as early as fifth day in nine specimens, 8th day in 14 specimens, 10th day in 6 and on 14th day 2 specimens. The samples which showed micro colony was subjected for acid fast staining, niacin test and catalase test for confirmation of the TB bacilli, which was also positive.

Among the 919 of males screened 25 (1.65%) were positive, compared to females 591 of them 9 (0.59%) were positive. There were more males who were positive when compared to females (Table-2). From this table Applying Kolmogorov-smirnov Z test and Mann-whitney U test which was seen that there is a significant relationship among the male and female positive cases ($p=0.000$). Mann-whitney U= 5.329, Kolmogorov-smirnov Z= 1.782.

The age groups ranged from 15 to 74 years, the positive results were observed more among the 45-55 years. Least common was seen in the age group of 15-24 yrs (Table-3). From this table it was observed that from chi-square test there is a significant difference among age groups $p=0.002$.

DISCUSSION

Our study analysis showed that Prevalence of pulmonary tuberculosis in adults was 34(2.25%). which was high when compared with the Anna H et al. Prevalence of tuberculosis is more among the males than females (Table- 2) as our study also proved when compared with the data on tuberculosis prevalence from SAARC countries, the age group commonly affected are more than 45-54yrs –adults (Table- 3).

This can be due to the associated factors like occupation hazards, personal habits like smoking which will precipitate the disease more frequently in this group. Excessive work, peer pressure, demands on the earning member of the family are added factors to make an individual prone for this life threatening Reemerging illness. These factors are making more demands on the individual not only emotionally, psychologically but also physically making the person more dependent on unwanted social behavior like alcohol & smoking making him miss healthy food.

This eventually makes him deprived of essential nutrients & making him malnourished, prone for the tuberculosis disease. Joint family with more members & low income are other obvious reasons for the malnourished status of the person. This is commonly seen in rural area.

The study exhibits that culture with smear positive was found in 27/1510, giving a positive rate 1.78% which was low when compared with study of Bogen (1957) used age specific prevalence rates of infection for his estimate of 5.3 % per year for all ages. The culture positive & smear negative was 4/1510, 0.26%. The above data reconfirms the specificity of culture method when compared to smear.

Total surveyed population of 1510 in rural Kancheepuram, of Chennai. Persons having strongly positive symptoms were 126, out of these 20 cases (1.32%) were diagnosed also by x-ray. Which was low when compared with Benjamin et al (1939), may be due to less population screened in the areas.

Our analysis shows that culture technique is more specific giving more positive results & yielded a clue even in smear negative cases as proved in our study. This culture can be made rapid by utilizing media like Middlebrook which produced results as early as 5th day unlike the conventional media LJ which requires long incubation period like 6-8 weeks.

The smear positive (1.78%) rate is the second highest, to culture 31 (2%), this may be attributed to the proper sample collection & effective staining technique, proper screening of the slide. When compared with the study in 1947, Frimodt Moller surveyed a population of 10,000 in Madanapalle town and reported a prevalence of 0.7% bacillary disease.

CONCLUSION

The prevalence of our study reveals that TB is still a major problem. , lower level (2.25%) of prevalence has been observed in our study. This may be due to good TB control programs existing in rural kanchipuram district.

Our study has positivity of 2% by culture method (Middlebrook agar). Which will help in diagnosing the disease & culture media used in our study aids in rapid detection & issue reliable evidence based management for the infected patient.

This will reduce the morbidity & mortality of the patients. As the study shows low prevalence rate it can be further reduced to zero prevalence, zero incidence by conducting health education programs to the families and encouraging vaccination for the children. This contributes immensely to the health authorities in planning preventive measures and awareness among the public against the TB infection.

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