

Seroprevalence of human immunodeficiency virus (HIV) infection among tuberculosis patients in Tamil Nadu

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Received July 3, 2002

Background & objectives: The dual epidemic of HIV and tuberculosis is a cause for concern in those countries where these two infections are prevalent in epidemic proportions. We undertook a survey at two sites in North Arcot district of Tamil Nadu in 1992-1993, to know the seroprevalence of HIV infection among tuberculosis patients. The objective of this study was to re-examine the prevalence of HIV infection among tuberculosis patients in a repeat survey.

Methods: The study was undertaken in four centres: District Tuberculosis Centre (DTC), Vellore, Tuberculosis Sanatorium, Pennathur (Vellore), District TB Centre (DTC), Kancheepuram and the Government Thiruvotteswarar Tuberculosis Hospital (GTTH), Chennai in the northern part of Tamil Nadu during 1997-1998. A total of 2361 newly diagnosed TB patients were registered in this study. HIV serology after pre-test counseling was done along with sputum examination for acid-fast bacillus by smear and culture for mycobacteria for all patients.

Results: The overall HIV seroprevalence among TB patients was 4.7 per cent. The highest HIV seropositivity rate was found among patients aged 30-39 yr (10.6%). HIV seroprevalence showed a wide variation among the different centres ranging from 0.6 per cent in DTC, Kancheepuram to 9.4 per cent in Pennathur Sanatorium, Vellore. Sputum smear positivity was 88 per cent among the HIV-negative and 83 per cent among HIV-positive tuberculosis patients.

Interpretation & conclusion: HIV infection is on the rise among TB patients in Tamil Nadu. Acid-fast smear microscopy is adequate for the diagnosis of pulmonary tuberculosis, and drug resistance among HIV positive patients is not a major problem at this point of time; hence antituberculosis regimens recommended by the Revised National Tuberculosis Control Program (RNTCP) can be used to treat HIV positive patients with tuberculosis.

Key words HIV seroprevalence- *Mycobacterium tuberculosis* - Tamil Nadu- tuberculosis patients

The advancing epidemic of infection with human immunodeficiency virus (HIV) has increased the burden of tuberculosis, especially in populations where HIV has become common, and where the prevalence of tuberculosis infection is high. It is estimated that worldwide, nearly two billion people are infected with *Mycobacterium tuberculosis*, 40 million are HIV-infected and over 10 million are dually infected with *M.tuberculosis* and HIV^{1,2}.

Infection with HIV is the most potent known risk factor for progression of active tuberculosis. HIV-seronegative individuals infected with *M.tuberculosis* have an approximately 10 per cent lifetime risk of developing active tuberculosis, compared with a 60 per cent or more risk in persons infected with both HIV and *M. tuberculosis*³.

The number of HIV-infected individuals in India is estimated to be 3.9 million⁴. Tuberculosis is the

commonest opportunistic infection occurring among HIV-positive individuals in India and it is estimated that 60-70 per cent of HIV-positive patients will develop tuberculosis in their lifetime^{5,6}. Studies from different parts of the country have reported both low (0.4-4.7%)^{7,8} and high HIV seroprevalence rates (10-24%)⁹⁻¹⁴ among tuberculosis patients.

Among the Indian states, Tamil Nadu and Maharashtra have the highest documented number of HIV and AIDS cases¹⁵. Sentinel surveillance has been carried out among the various high risk groups periodically. The Tuberculosis Research Centre (TRC), Chennai had undertaken a survey in 1992-1993 at two sites in North Arcot district of Tamil Nadu to study the seroprevalence of HIV among patients with newly diagnosed tuberculosis¹⁶. A repeat survey was undertaken in 1997-1998 in the four centres (including the two previous sites in North Arcot district) to study the change in HIV prevalence among tuberculosis patients.

Material & Methods

Four centres selected for the study were District Tuberculosis Centre (DTC), Vellore (Urban), Pennathur Sanatorium Vellore (Rural), District Tuberculosis Centre, Kancheepuram (semi-urban) and the Government Thiruvotteswarar Tuberculosis Hospital (GTTH), Chennai (Metropolitan). Consecutive patients attending these centres during the period from July 1997 to June 1998 with a diagnosis of tuberculosis were registered for the study. All patients were residents of the northern part of Tamil Nadu.

The patients were questioned regarding their symptoms and signs and given pre-test counseling. The medical officers of the TB clinics made the diagnosis of tuberculosis based on clinical, radiological and bacteriological findings. Blood sample for HIV serology (2 ml) and two sputum specimens were collected from each patient. Appropriate treatment was given for pulmonary and extrapulmonary tuberculosis. Post-test counseling was done and patients were referred to the nearest district headquarters hospital for special investigations and management as required. The study was approved by the Ethical Committee of the Tuberculosis Research Centre.

The blood and sputum specimens were transported to TRC, Chennai for further testing. The sputum smears were examined for acid-fast bacillus (AFB) by fluorescent microscopy. The sputum samples were processed by the Petroff's method¹⁷, cultured on the Lowenstein-Jensen medium (LJ, prepared at the bacteriology lab, TRC) and examined weekly up to 8 wk for growth. The positive cultures were subjected to identification tests, viz. niacin production, growth in LJ medium containing 500mg/l of para nitro benzoic acid and stability at 68°C in order to identify the organism as *M.tuberculosis* or non-tuberculous mycobacteria¹⁸. All the isolates of *M.tuberculosis* isolated from HIV positive patients were subjected to drug susceptibility testing using standard methods¹⁸. HIV infection was diagnosed by performing two ELISA tests with two different kits according to the WHO recommendation for developing countries¹⁹. The samples were tested using the TRIDOT rapid test (J Mitra, New Delhi, India) and those found positive were confirmed using routine ELISA (Lab Systems, India). The data were statistically analysed by the Chi-square test.

Results

A total of 2361 patients (1682 males, 679 females) with newly diagnosed tuberculosis were registered for the study. Of them, 111 were seropositive, giving an overall prevalence of HIV among newly diagnosed tuberculosis patients in these centres as 4.7 per cent. The seroprevalence rates at the four centres showed wide variation ranging from 0.6 per cent (4/613) in DTC Kancheepuram, 4.0 per cent (22/545) in GTTH, Chennai, 4.3 per cent (23/540) in DTC, Vellore and 9.4 per cent (62/663) in Pennathur Sanatorium, Vellore. The prevalence of HIV infection was 6 per cent in patients aged 20-29 yr, reached a peak of 10.6 per cent at 30-39 yr and thereafter decreased to 1.2 per cent in the ≥50 yr age group (Table). It was higher in males in most age groups, but the difference between the sexes was statistically significant only in the age group of 30-39 yr ($P<0.005$).

Of the total 2361 patients, 1048 (44%) were new smear positive TB patients, 905 (38%) were X-ray positive smear negative patients and 133 (5.6%) were extrapulmonary tuberculosis patients. Of the 1323 patients initially categorized as new smear positives 275

Table. HIV seroprevalence among tuberculosis patients in Tamil Nadu by age, sex & type of institution

	Males			Females			Both sexes		
	Total	HIV No.	Positives %	Total	HIV No.	Positives %	Total	HIV No.	Positives %
<i>Age (yr)</i>									
<20	89	0	0	101	1	0.9	190	1	0.5
20-29	264	17	6.4	210	11	6.0	474	28	6.0
30-39	360	45	12.5*	168	11	6.6	528	56	10.6
40-49	426	15	3.5	98	3	3.1	524	18	3.4
≥50	543	6	1.1	102	2	1.9	645	8	1.2
<i>Centres</i>									
GTTH, Chennai	445	19	4.2	100	3	3.0	545	22	4.0
DTC, Kancheepuram	404	2	0.5	209	2	0.9	613	4	0.6
DTC, Vellore	379	14	3.7	161	9	5.6	540	23	4.3
Pennathur Sanatorium, Vellore	454	48	10.6	209	14	6.7	663	62	9.4†
Total	1682	83	4.9	679	28	4.1	2361	111	4.7

* $P < 0.05$ compared to females; † $P < 0.001$ compared to DTC Kancheepuram; DTC, District Tuberculosis Centre; GTTH, Government Thiruvotteswarar Tuberculosis Hospital

were smear negative on subsequent examination at TRC, Chennai and were excluded from further analysis. Sixty eight (6.5%) of new smear positive patients, 39(4.3%) X-ray positive smear negative patients and 4(3.0%) extra-pulmonary TB patients were found to be HIV seropositive. Of the 1184 culture positive patients, 59 (5%) were HIV positive. There was no difference in the proportion of smear positivity between the culture confirmed HIV positive (83%) and HIV negative (88%) tuberculosis patients.

Anti tubercular drug susceptibility testing was done only on the 59 isolates obtained from the 111 HIV positive TB patients. Isoniazid (H) resistance was observed in 7 (12%), and rifampicin (R) was noted in 3 (5%) isolates which were also resistant to H.

Discussion

We found that HIV seroprevalence rates among tuberculosis patients were similar in males (4.9%) and females (4.1%) and were highest in the age-group 30-39 yr (10.6%). Our data suggest that it is better to target tuberculosis patients aged between 20-49 yr for

HIV screening, as 92 per cent of the cases were found in this age group.

The seroprevalence of HIV among TB patients showed wide variations between the different centres where the survey was undertaken. The prevalence in DTC, Vellore and GTT hospital, Chennai was 4.3 and 4.0 per cent respectively compared to 0.6 per cent in DTC, Kancheepuram; this could be due to the fact that most patients suspected to be HIV positive from Kancheepuram seek medical attention at Tambaram Sanatorium, Chennai, which is geographically close. In our previous survey¹⁶, 4 per cent of TB patients were HIV seropositive in DTC, Vellore and 2 per cent in Pennathur Sanatorium. In the present survey the highest rate was recorded in Pennathur Sanatorium, where it has increased from 2.0 per cent in 1992-1993 to 9.4 per cent in 1997-1998. This marked increase in HIV seroprevalence in this centre is statistically significant ($P < 0.001$) compared to DTC, Vellore where it has marginally increased to 4.3 per cent from 4 per cent in 1992-1993, and could be attributed to the fact that the government has identified TB sanatoria and STD clinics all over Tamil Nadu as centres for comprehensive HIV care (HIV/TB and other opportunistic infections).

The higher HIV seroprevalence rate in Pennathur Sanatorium is also reflected in other studies among STD clinic attendees in the same area²⁰ and in Pondicherry²¹. Rajasekaran *et al*²² reported an increase in HIV seroprevalence from 0.59 per cent in 1996 to 8.9 per cent in 1999 among TB patients in rural Tamil Nadu. These studies indicate that HIV seroprevalence among various high-risk groups is increasing in Tamil Nadu.

Another important finding of our study was that positive smears were obtained in similar proportions of HIV positive and negative, culture confirmed cases of tuberculosis. Our data confirm the findings of Smith *et al*²³ who observed no differences in the frequency of positive smears between HIV-infected and not-infected individuals. This suggests that sputum smear microscopy is a useful test for diagnosis of tuberculosis in the TB control program.

A limitation of this study was that information on the stage of HIV infection was not available; hence it was not possible to correlate the degree of immunosuppression with sputum smear positivity. However, as most of these patients were ambulatory and attending outpatient clinics (except for a small number among those attending the sanatorium), it is likely that they did not have advanced HIV infection or AIDS. It is well known that tuberculosis occurs in all stages of HIV disease and tuberculosis need not be considered an AIDS defining illness in disease endemic countries as it also has a better prognosis than other AIDS-defining illnesses²⁴.

Our study underlines the fact that *M.tuberculosis* is the predominant pathogen among the HIV positive TB patients as none of the culture isolates was identified as non-tuberculous mycobacteria (NTM). The pattern of drug resistance among the HIV positive patients in the present study was found to be similar to that found among the HIV-negative population in this part of Tamil Nadu²⁵. Hence, HIV positive patients with tuberculosis can be treated with standard antituberculosis regimens recommended and employed in the Revised National Tuberculosis Control Program (RNTCP)²⁶. Our findings show wide variations in the HIV seroprevalence among the TB patients from the three different districts of northern Tamil Nadu, as the percentage of HIV prevalence is likely to be higher in tertiary care centres and lower in peripheral and district hospitals.

Acknowledgment

The authors thank Dr S. Shanmugam, Deputy Director TB Vellore District, the Superintendents of Pennathur Sanatorium and Government Thiruvotteswarar TB hospital, Chennai and the District TB Officer of DTC Kancheepuram for their support and cooperation in the conduct of the study. The technical support received from the field staff of the Epidemiology Unit and the Immunology department of TRC, Chennai is acknowledged.

References

1. Global AIDS Surveillance Part I. *Wkly Epidemiol Rec* 2000; 40 : 379-83.
2. Dye C, Scheele S, Dolin P, Pathania V, Raviglione MC. Global burden of tuberculosis: estimated incidence, prevalence, and mortality by country. WHO Global Surveillance and Monitoring Project. *JAMA* 1999; 282 : 677-86.
3. Telzak EE. Tuberculosis and human immunodeficiency virus infection. *Med Clin North Am* 1997; 81 : 345-60.
4. Estimation of HIV infection among adult population -HIV estimates for year 2001. HIV/AIDS - Indian scenario. NACO website accessed on 21.11.2002. (www.naco.nic.in).
5. Swaminathan S, Ramachandran R, Baskaran G, Paramasivan CN, Ramanathan U, Venkatesan P, *et al*. Risk of development of tuberculosis in HIV -infected patients. *Int J Tuberc Lung Dis* 2000; 4 : 839-44.
6. Kaur A, Babu PG, Jacob M, Narasimhan C, Ganesh A, Saraswathi NK, *et al*. Clinical and laboratory profile of AIDS in India. *J Acquir Immune Defic Syndr* 1992; 5 : 883-9.
7. Sharma SK, Saha PK, Dixit Y, Siddarmaiah NH, Seth P, Pande JN. HIV seropositivity among adult tuberculosis patients in Delhi. *Indian J Chest Dis Allied Sci* 2000; 42 : 157-60.
8. Talib SH, Bansal MP, Kamble MM. HIV-1 seropositivity in pulmonary tuberculosis (study of 340 cases from Marathwada). *Indian J Pathol Microbiol* 1999; 36 : 383-8.
9. Paranjape RS, Tripathy SP, Menon PA, Mehendale SM, Khelavkar P, Joshi DR, *et al*. Increasing trend of HIV seroprevalence among pulmonary tuberculosis patients in Pune, India. *Indian J Med Res* 1997; 106 : 207-11.
10. Tripathy S, Joshi DR Mehendale SM, Menon P, Joshi AN, Ghorpade SV, *et al*. Sentinel surveillance for HIV infection in tuberculosis patients in India. *Indian J Tuberc* 2002; 49 : 17-20.
11. Jain NK, Aggarwal JK, Chopra KK, Khanna SP. Prevalence of HIV infection among tuberculosis patients. *Indian J Tuberc* 1996; 43 : 105.
12. Deo S. Prevalence of HIV infection in patients with tuberculosis. *Indian J Tuberc* 1995; 42 : 183.
13. Solomon S, Anuradha S, Rajasekaran S. Trend of HIV infection in patients with pulmonary tuberculosis in south India. *Tuberc Lung Dis* 1995; 76 : 17-9.

14. Vasadevaiah V. HIV infection among tuberculosis patients. *Indian J Tuberc* 1997; 44 : 97-8.
15. HIV seroprevalence in India-Indian scene 2001. NACO website. Accessed on 21.12.2002.(www.naco.nic.in).
16. Ramachandran R, Datta M, Shanmugam S, Bhaskar G, Subramanian R, Rawoof A, *et al*. The sero-prevalence of HIV infection among the tuberculosis patients. *Int J Tuberc Lung Dis* 1998; 2 : 438.
17. Petroff SA. A new and rapid method for the isolation and cultivation of tubercle bacilli directly from the sputum and feces. *J Exp Med* 1915; 21 : 38-42.
18. Kubica GP, Kent PT. *Public health mycobacteriology: a guide for the level III laboratory*. Atlanta : US Department of Health & Human Services CDC, 1985; p. 159-84.
19. Joint United Nations Programme on HIV/AIDS (UNAIDS-WHO). Recommendations for the selection and use of HIV antibody tests. *Wkly Epidemiol Rec* 1997; 72 : 81-7.
20. Jacob M, John TJ, George S, Rao PSS, Babu PG. Increasing prevalence of human immunodeficiency virus infection among patients attending a clinic for sexually transmitted diseases. *Indian J Med Res* 1995; 101 : 6-9.
21. Thappa DM, Singh S, Singh A. HIV infection and sexually transmitted diseases in a referral STD centre in south India. *Sex Transm Infect* 1999; 75 : 191-2.
22. Rajasekaran S, Uma A, Kamakshi S, Jeyaganesh D, Senthamizchelvan A, Savithri S, *et al*. Trend of HIV infection in patients with tuberculosis in rural south India. *Indian J Tuberc* 2000; 47 : 223-6.
23. Smith RL, Yew K, Berkowitz KA, Aranda CP. Factors affecting the yield of acid-fast sputum smears in patients with HIV and tuberculosis. *Chest* 1994; 106 : 684-6.
24. Badri M, Ehrlich R, Pulerwitz T, Wood R, Maartens G. Tuberculosis should not be considered an AIDS-defining illness in areas with a high tuberculosis prevalence. *Int J Tuberc Lung Dis* 2002; 6 : 231-7.
25. Paramasivan CN, Bhaskaran K, Venkataraman P, Chandrasekharan V, Narayanan PR. Surveillance of drug resistance in tuberculosis in Tamil Nadu, India. *Indian J Tuberc* 2000; 47 : 27-33.
26. Revised National Tuberculosis control Programme. *Technical guidelines for Tuberculosis Control*. New Delhi: Central Tuberculosis Division, Directorate General of Health Services, Ministry of Health and Family Welfare; July 1999.

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