原　著

TUBERCULIN SURVEY IN ETHIOPIA

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For planning and implementation of effective national tuberculosis control programme (NTP) in Ethiopia, it is essential to know the real magnitude of tuberculosis problem. Previous tuberculin survey carried out during the period from 1953 to 1955 revealed the annual risk of infection 3.0%, and since then, there has been no survey. A new tuberculin survey was thus conducted during the period from December 1987 to April 1990.

In order to get a sample of 47 previously BCG unvaccinated children, aged 6 to 10 years, selected from each 480 representative clusters of randomly selected 16 Woredas (districts), a total of 26,529 children, approximately 55 in each cluster, were given tuberculin intradermal injection, and the reaction was read in 26,269 children (99.0%). A scar survey was done, and 23,695 had no BCG scar, while 2,574 (10.1%) had BCG scar. Out of the former, 2,503 children (10.6%) were positive, and the annual risk of infection thus calculated was 1.4%. Out of the latter, 591 (23.0%) were positive.

The results of these two surveys indicate that tuberculosis showed decline in the past 37 years with the annual reduction rate of 2.2%, however, the trend might change in the future due to present pandemic of HIV infection.

Key words : Tuberculin survey, TB in Ethiopia

INTRODUCTION

Though the magnitude and trend tuberculosis might better be assessed at least every ten years in developing countries, the only survey so far available for Ethiopia is the one carried out from 1953 to 1955[1].

Tremendous efforts were made in many developing countries in the past several years to reduce the incidence of tuberculosis, however, the disease still remains one of the most prevalent health problems. Numerous reasons could be considered why national tuberculosis control programme (NTP) failed in most developing countries, and among them, socioeconomic factors and various short-comings in NTP might be the major ones.

In order to obtain basic informations for planning and implementation of rational NTP in Ethiopia, a national tuberculin survey was thus conducted.

MATERIALS AND METHODS

The survey was conducted in Ethiopia during

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the period from December 1987 to April 1990. In order to get a sample of 47 previously BCG unvaccinated children, aged 6 to 10 years, chosen from each 480 representative clusters of 16 randomly selected Woredas (Districts), a total of 26, 529 children, approximately 55 in each cluster, were subjected to the survey. A tuberculin used in the survey was RT 23 of 2 tuberculin units with Tween 80 produced by the State Seruminstitute, Copenhagen, Denmark. The test was done by injecting 0.1m*l* of tuberculin intradermally into the middle of back side of left forearm with disposable syringes and needles. The diameter of the induation was measured 72 hours after the injection by the same nurse who were well trained and experienced in the administration and reading of tuberculin test. The reaction with induration size 10 mm or more was regarded as positive.

Out of total sample of 26,529 children of both sexes, 260 (1.0%) did not show up for tuberculin test reading. Of the remaining 26,269 children, a scar survey for previous BCG vaccination was done, and 2,574 (9.8%) had scar, while 23,695 (90.2%) had no scar.

The annual risk of infection (ARI) and the annual rate of reduction of ARI (ARR) were calculated by the following formulae [2)~4)] :

$$r = 1 - (1-p_t)^{1/t}$$

where r is an annual risk of infection, p is a tuberculin positivity at t years of age and t is an age of children, and in this survey, t = 8 as the average age of children under the survey is 8, and

$$R = 1 - (r_n/r_o)^{1/n}$$

where R is an annual reduction rate of annual risk of infection, r_o is an initial annual risk of infection, r_n is an annual risk of infection after n years.

RESULTS

Frequency distribution of size of induration of tuberculin reaction among children with and without previous BCG vaccination scar is shown in Figure 1. Out of 23, 695 children who had no scar, 2,503 or 10.6% were positive, and by the above formula, the annual risk of infection was calculated as 1.4%. In the previous survey carried out in 1953 to 1955, tuberculin positivity was 30.0%, and the annual risk of infection was 3.0%. As shown in Figure 2, tuberculin positivity as well as annual risk of infection dropped down during these 35 years, and annual reduction rate of annual risk of infection during this period was 2.2%.

Out of 2,574 children with BCG scar, 591 (23.0%) were positive, and the tuberculin positivity was slightly higher than that of children without BCG scar, and this could be explained by post-vaccination tuberculin allergy.

The tuberculin positivity among children without previous BCG scar and ARI thus calculated in each locality are given in Table 1. The tuberculin positivity was highest (27.9%) in Deder Woreda of Harrarghe Region and lowest (2.0%) in Wuchale Woreda of Shoa Region. The results of the survey in urban area of each locality compared with those in whole area are given in Table 2. Generally speaking, the tuberculin positivity was higher in urban area than in whole area with a few exception.

An attempt was made to study the prevalence of atypical mycobacterial infection in 20% of children who had no previous BCG vaccination.

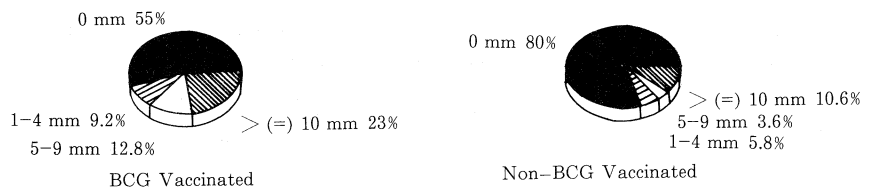

Fig. 1. Nation–wide Tuberculin Survey. Frequency Distribution of Induration Size in mm in both Non–BCG and BCG vaccinated Children aged 6–10 Years in 1988–1990, Ethiopia.

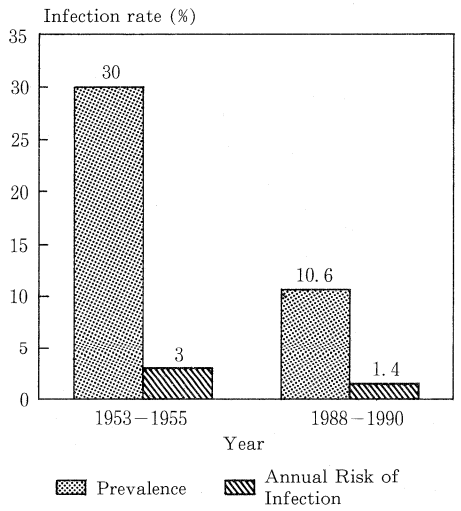

Fig. 2. Prevalence and Annual Risk of Tuberculosis Infection in the Years 1953–1955 and 1988–1990, Ethiopia

However, due to limited supply of PPD produced from atypical mycobacteria (sensitin), it was possible to cover only 1,240 or 5% of target children. The results in this small sample revealed that 79% showed no reaction, 11% showed reaction of 1–9 mm and 10% showed reaction of 10 mm and above ; this finding was similar to the results of the test with RT 23.

DISCUSSION

From the results of BCG scar survey, only 9.8% of children in this survey showed scar, and the coverage of BCG vaccination in EPI seems to be insufficient in the early 1980s.

Comparing the results of the surveys in 1953–1955 and in 1987–1990, the prevalence of tuberculosis infection and the annual risk of infection thus calculated has reduced during the past 37 years as shown in Figure 2. The reason of this reduction is not convincingly clear although better health service coverage and living conditions might be considered in spite of several hard events which took place during this period.

The trend of annual risk of tuberculosis infection (ARI) and its annual reduction rate (ARR)

Table 1. Prevalence and annual tuberculosis risk of infection by district in Ethiopia, for children aged 6–10 years, 1988–90.

Serial No.	Region	Woreda (district)	BCG un vaccinated			
			No. Tested	No. Positive	Prevalence rate (%)	Risk of Infection (%)
1	Addis Ababa	Addis Ababa	1947	313	16.1	2.2
2	Gonder	Dembia	1380	92	6.7	0.9
3	Harrarghe	Deder	1430	399	27.9	4.0
4	Shoa	Wuchale	1465	30	2.0	0.3
5	Wollo	North Kalu	1275	122	9.6	1.3
6	Gojam	G / Wonberema	1456	130	8.9	1.2
7	Gojam	Senane	1490	148	9.9	1.3
8	Arssi	Sude	1492	178	11.9	1.6
9	Shoa	Ambo	1480	100	6.8	0.9
10	Shoa	Cheha	1502	130	8.7	1.1
11	Keffa	Limu Kossa	1435	160	11.1	1.5
12	Wellega	Lalo Asabe	1430	137	9.6	1.3
13	Sidamo	Hagere–Selam	1404	85	6.1	0.8
14	Shoa	Siltee	1545	155	10.0	1.3
15	Shoa	Angacha	1408	146	10.4	1.4
16	Sidamo	Sodo–Zuria	1556	178	11.4	1.5
		TOTAL	23,695	2,503	10.6	1.4

Table 2. Urban and urban plus rural prevalence and risk of infection rates of tuberculosis in Ethiopia, 1988–90.

Serial No.	Woreda (district)	Urban		Urban and Rural	
		Prevalence rate (%)	ARI* (%)	Prevalence rate (%)	ARI* (%)
1	Addis Ababa	14.9	2.0	16.1	2.2
2	Dembia	19.0	2.6	6.7	0.9
3	G / Wonberema	13.7	1.8	8.9	1.2
4	Senane	—	—	9.9	1.3
5	North Kalu	17.5	2.4	9.6	1.3
6	Deder	34.0	5.0	27.9	4.0
7	Sude	11.9	1.6	8.9	1.2
8	Wuchale	—	—	2.0	0.3
9	Hagere–Selam	10.4	1.4	6.1	0.8
10	Limu Kossa	15.7	2.0	11.1	1.5
11	Lalo Asabe	5.3	0.7	9.6	1.3
12	Siltee	8.3	1.0	10.0	1.3
13	Sodo Zuria	12.3	1.6	11.4	1.5
14	Ambo	7.5	1.0	6.8	0.9
15	Angacha	17.0	1.3	10.4	1.4
16	Cheha	—	—	8.7	1.1
	TOTAL	14.6	2.0	10.6	1.4

* Annual risk of infection

Table 3. Estimated risks of tuberculosis infection and their trends in developing countries, 1985–90[6].

Serial No.	Area	Estimated risk of tuberculous infection (ARI) (%)	Estimated annual decrease in risk of infection (ARR) (%)
1	Sub–Saharan Africa	1.50–2.50	1 – 2
2	North Africa and Western Asia	0.50–1.50	5 – 6
3	Asia	1.00–2.00	1 – 3
4	South America	0.50–1.50	2 – 5
5	Central America and the Caribbean	0.50–1.50	1 – 3
6	Present study (Ethiopia ; 1988–90)	1.4	2

in developing countries reported by K. Styblo[4] is summarized in Table 3. ARI in Ethiopia revealed from this survey was 1.4%, and ARR in the past 35 years was estimated at 2.2%. These figures were quite similar to those in Sub–Saharan Africa[6].

The tuberculin positivity as well as ARI thus calculated were slightly higher in urban area as shown in Table 2, and this could be explained by relatively overcrowded environment in urban

areas. A certain difference seems to exist in the results of the survey in different localities, however, its cause is unclear.

In the past experiences, ARI was found to be a useful index to estimate the incidence of smear positive pulmonary tuberculosis[4]. By multiplying ARI expressed in % with 50 to 60, the incidence of smear positive pulmonary tuberculosis per 100,000 population could be estimated. Based on the official report of 48,500,000 population in Ethiopia in 1987, and assuming 2.9% annual increae, the estiamted population of Ethiopia at present is about 50,000,000[5]. As present ARI calculated from the results of the present survey is 1.4%, the incidence of smear positive pulmonary tuberculosis is estimated at 77 per 100,000 using 55, a middle figure of 50 to 60, and the number of new cases in a year in the whole country is estimated at 38,500.

Assuming that the point prevalence of tuberculosis at a particular date per 100,000 is double of the incidence, it is estimated that there are about 77,000 smear positive cases. The annual report of the Ministry of Health shows that a total of 555,000 tuberculosis patients were treated over a 10 year period from 1978 to 1987. This would give an annual case load of 55,000. However, the number of cases has increased from 26,000 in 1978 to 86,000 in 1987, and these figures include tuberculosis of all types. Out of 86,000 patients in 1987, 51,000 (59.3%) were pulmonary tuberculosis including smear negative patients. Comparing these figures with estimated prevalence of 77,000 cases, there are still many cases who are not yet covered by health services.

According to Tuberculosis Training and Demonstration Center (TTDC), the estimated prevalence of pulmonary tuberculosis in Ethiopia ranged 1 to 2%, which is mugh higher than the estimate from the present survey. However, this estimate is based mainly on statistics from clinics where recording system is still improper, and the estimates derived from the present survey would be a base for planning improvement of NTP in Ethiopia.

It is well-known that the situation of tuberculosis has been deteriorating in many African countries due to pandemic of HIV infection, and Ethiopia is not an exception. HIV infection has been spreading rapidly in this country, and it is urgently needed to improve and intensify NTP.

One of most important problems we are facing is a cost of drugs needed for proper treatment of tuberculosis cases. The cost of treatment depends on the regimens of chemotherapy applied. The cost of current standard regimen consisting of isonaiazid and thiacetazone with initial streptomycin is Birr 37 per patients (1 US$ = 2.05 Birr), which gives 80 to 90% cure rate, and the cost of short-course chemotherapy (SCC), which gives 100% cure rate in shorter period with the provision of appropriate bacteriological diagnosis and best compliance of patients is Birr 166. The provision of adequate dose of drugs and of laboratory facilities are of paramount importance to be considered urgently together with other essentials for effective tuberculosis control programme, and this may require exploration of assistance from international organizations and friendly countries.

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