

Original Article**Tuberculin test in nursing and human-sciences students***M. Golchin MS*, M. Rostami MD MPH*****ABSTRACT**

Introduction: Tuberculosis (TB) is a leading cause of death worldwide due to any single infectious agent. It seems that health care workers including nursing students can be affected easier than the other people, because of probable contacts in hospital. The risk of TB infection in nursing students has not estimated in Iran, so we conducted this study to compare the results of tuberculin test in the beginning and the end of educational course for nursing and human-sciences student.

Methods: In a Cohort study, 320 students (160 nursing and 160 human-sciences) underwent PPD skin test (5 units RT 23) at the beginning and the end of educational course by expert technician. The data of remaining students (123 nursing and 111 human-sciences) were analyzed by SPSS software using Wilcoxon and Mann-Whitney tests.

Results: The frequency distribution of skin reaction in nursing students was negative (0-4 mm: 93.7%), suspected (5-9 mm: 4.4%) and significant (≥ 15 mm: 1.9%) at the beginning of study, while it was negative (75.5%), suspected (9.8%), positive (10-14 mm 3.3%) and significant (11.4%) at the end of study. The frequency of skin reaction in human-sciences student was negative (93.7%), suspected (0.6%), positive (1.3%) and significant (4.4%) at the beginning of study, while it was negative (79.3%), significant (10.8%), suspected (8.1%) and positive (1.8%) at the end of study. The difference in that proportion of nursing students and control group with positive and significant PPD test at the end of study was statistically significant. The difference for the above proportions between two groups was not statistically significant.

Conclusion: All subjects had no significant difference regarding to age, indigenous area and PPD test. Both groups have the same chance for exposure to M. Tuberculosis. The rate of new TB infection in Iranian community has diminished in comparison with the last few decades. Although risk of new infection may be a little bit more after age of 18, but it is still much lower than countries of high burden. The epidemiologic pattern of TB transmission has changed and it is going to become similar to that of developed countries.

Key words: Tuberculosis, PPD skin test, nursing students

JRMS 2005; 10(3): 172-176

Tuberculosis (TB) is an important public health problem in the world and mostly Eastern Mediterranean Region and its incidence will be increased year by year, if TB control activities are not strengthened¹. The possible increasing factors are insufficient TB control programs, population growth, increasing HIV infection rate, incurable multi drug resistance TB and social upheavals from man-made or natural disasters². Annually, about 12338 cases of active tuberculosis and estimated 58079 cases of infection occur in Iran³. The tuberculin skin test (PPD test) is used to diagnosing tuberculous infection in asymptomatic persons especially infants and young children⁴.

In epidemiological setting, the prevalence, the incidence and the average annual infection rate of tuberculous infection can be measured by PPD test. The prevalence of tuberculous infection (positive PPD) may be used to quantify the extent to which sources of infection have transmitted *Mycobacterium tuberculosis* to community or a segment thereof. Skin test survey may provide prevalence estimation of infection at a given time and hence be used to derive the average annual risk of infection and to allow a comparison with subsequent and previous surveys in order to ascertain the trend in the risk of infection. Although, some tuberculin conversions could not be differentiated from possible boosted reactions^{4, 5}. The

Supported by: Research Department, Isfahan University of Medical Sciences, Grant No: 77048.

*Academic member, Faculty of Nursing and Midwifery, Isfahan University of Medical Sciences.

**Assistant professor, Research Center for Infectious Diseases, Isfahan University of Medical Sciences.

Correspondence to: Mehri Golchin E-mail: Golchin@nm.mui.ac.ir

information also can be used to assess the impact of tuberculous control activities. However, factors other than control activities such as HIV, immunosuppressive therapy, and promotion of health and so on can affect epidemiological situation in a country. In spite of many limitations such as low specificity, variation with age, genetic factors and certain medical conditions (e.g. HIV), PPD test is a valuable indicator of tuberculous infection. Advantage in using the prevalence and annual risk of infection, rather than the prevalence of disease conclude that the infection is more prevalent than the disease and it can be measured in a more accessible population such as students with lower cost.

M. tuberculosis spreads by cough through the air and may be transmitted to contacts easily ⁶. It seems that health care workers including nursing students can be affected easier than the others because of probable causal contacts in hospital ⁷. The risk of infection in them has not been estimated in Iran, so we conducted this study to assess results of tuberculin test in the beginning and the end of educational course on nursing and human-sciences students who are not subjects of hospital infection.

Materials and methods

In a Cohort study, 320 subjects underwent PPD skin test in the beginning and in the end of educational course from 1998 to 2003. They were selected from nursing (n=160) and human-sciences (n=160, at no risk of occupational exposure) students and matched for age and sex.

For several reasons, 86 students dropped out the study: omitted for positive PPD test in the first stage (n=6), transferred to other Universities (n=14), quitted education (n=52), didn't agree to be in the second stage, out of reach during the second stage (n=10) and one died.

The remaining subjects were 123 nursing and 111 human-sciences students without history of working in hospital, family contact or history of positive skin test during and before the study. Five tuberculin units RT23 (0.1ml), PPD solution (Institute Pasteur, Iran), kept in refrigerator and out of light was injected interdermally on the volar aspect of left forearm by expert technician ⁸. Skin reaction was read after 48 and 72 hours. The largest transverse diameter of indurations was measured by transparent ruler and interpreted as negative (less than 5mm), suspected (5-9mm), positive (10-14 mm) and significant (15mm and more) ⁹. The data was analyzed by SPSS software using Wilcoxon test for comparison of results in the beginning and the end of study in each groups and using Mann-Whitney test for comparison of results between two groups.

Results

When the study started, 63.7% of students were at age of 19 to 21 years (Mean=19.6, SD= 1.69) and 36.3% of them were in age of 23 to 25 years. (Mean =23.5, SD= 1.59). Details are seen in Table 1.

Table 1: Demographic characteristics of two groups

Demographic Characteristics		Case (Nursing students)		Control (Human sciences students)					
		Beginning of education course		Beginning of education course					
		N	%	N	%				
Sex	female	110	68.8	85	69.1	108	67.5	75	67.6
	male	50	31.2	38	30.9	52	33.5	36	32.4
BCG scar	Negative	31	19.4	24	19.5	38	23.8	28	25.2
	Positive	129	80.6	99	80.5	122	76.2	83	74.8
Residential area	Isfahan Province	131	81.9	101	82.1	119	74.4	85	76.6
	The others	29	18.1	22	17.9	41	25.6	26	23.4
Age average	Min		SD	Min	SD	Min	SD	Min	SD
		19.6	1.46	23.4	1.32	19.55	1.89	23.5	1.87

Chi-square test showed no statistically significant difference between two groups for sex, age, indigenous area and BCG scar ($P>0.05$). BCG scar was observed in 78.4% at the beginning and in 77.8% at the end of study. The results of PPD test in nursing group at the beginning and end of study is showed in Figure 1 and Table 2.

The difference in proportion of nursing students with positive and significant test at the end of study was statistically significant based on Wilcoxon test ($P<0.000$ and $Z= - 4.532$).

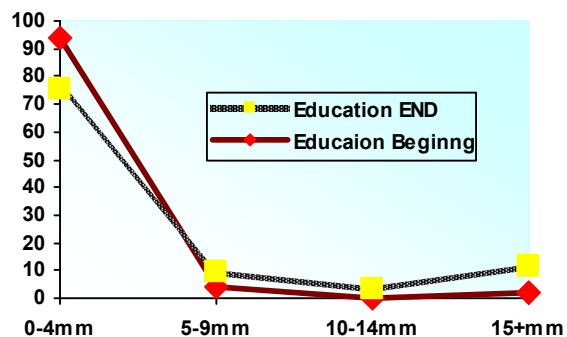


Figure 1. PPD test outcomes of nursing students in beginning and end of education course

Table 2: Frequency distribution of PPD test outcomes of human sciences and nursing students groups in the beginning and the end of education course

PPD test outcomes \ Group	Case (Nursing students)				Control (Human sciences students)				Mann-Whitney test	
	Beginning of Education Course		End of Education Course		Beginning of Education Course		End of Education Course		Beginning of Education Course	End of Education Course
	N	%	N	%	N	%	N	%		
Negative (0 - 4 mm)	150	93.7	93	75.5	150	93.7	88	79.3	Z = - 0.078 P = 0.938	Z = - 0.628 P = 0.530
Suspect (5 - 9 mm)	7	4.4	12	9.8	1	0.6	9	8.1		
Positive (10 - 14 mm)	0	0	4	3.3	2	1.3	2	1.8		
Significant (15 mm and more)	3	1.9	14	11.4	7	4.4	12	10.8		
Total	160	100	123	100	160	100	111	100		
Wilcoxon test	Z=-4.532 P<0.0001				Z=-4.283 P<0.0001					

The difference in proportion of nursing students with positive and significant test at the end of study was statistically significant based on Wilcoxon test ($P<0.000$ and $Z= - 4.532$).

The frequency distribution of reaction size in human-sciences group at the beginning and the end of study is showed in Table 2 and Figure 2.

The difference in this proportion was statistically significant ($P<0.000$ and $Z= - 4.283$). The difference for the above proportions between two groups was not statistically significant based on

Mann Whitney test (at the beginning $Z=0.078$, $P=0.938$ and at the end $Z=-0.628$, $P=0.530$).

Paired T test does not show significant difference for individual data in the beginning and the end of study (nursing group $P<0.0001$ and $t=5.41$, human-sciences $p<0.94$ and $t=0.08$).

PPD conversion in the beginning and the end of study was calculated for each group, and according to student T test, difference between two groups was not significant ($P=0.94$ and $T=0.08$).

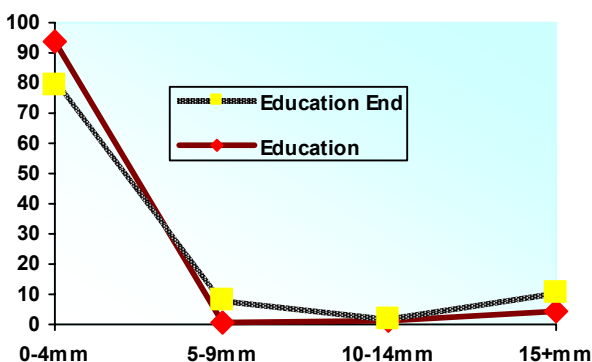


Figure 2. PPD test outcomes of human-sciences students in beginning and end of education course

Discussion

The results of study provide useful information on epidemiology of tuberculous infection in central part of Iran. Most of students had BCG scar without statistical difference between two groups ($P=0.4$). Vaccination with BCG does not prevent infection by *M. tuberculosis* but it does strengthen the immune system of first-time TB patients. As a result, serious complications are less likely to develop^{10, 11}.

Therefore, BCG doesn't prevent infection but prevents progression of infection to disease¹².

In Iran, BCG vaccination is done at birth and if infection will not come through, PPD test reverts to negative within several years after vaccination but in the majority of subjects, BCG-induced tuberculin sensitivity fades a few years after vaccination^{13, 14}. So that, BCG scars versus negative tuberculin test is not an unusual finding. Negative reaction in both groups at the beginning was 93.7% in spite of BCG scar. We can say that they

have not been exposed again after vaccination. At the end of study, result of tests changed to 75.5% negative and 11.4% significant (for nursing) and 79.3% negative and 10.8% significant for human-sciences group. It can be say that, in subjects who converted to positive with significant indurations during study, infection with mycobacterium tuberculosis has occurred¹⁵. Booster effect doesn't work here because of prolong period between two stages of test. It seems that epidemiological pattern of infection in Iran has changed and is going to become similar to developed countries. Latest declaration about annual risk of infection belonged to Salak who estimated it overall 0.5%¹⁶ and last time in 1990 reported 0.7%¹⁷. In the present study this risk before 18 years is about 0.25% and after then is about the same as Salak's study¹⁶.

Although majority of students were born and reside in Isfahan and districts, but many others were from the other parts of country formerly known as high burden areas such as Semi rom, Lordegan and Kohkiloieh. Chi-square test rulled out any statistical difference between indigenous area and positive test ($P=0.05$). One can say that distribution of infection is even and low all over the country.

Conclusion

After successful tuberculous control activity in Iran, the age of transmission for tuberculous infection has raised in most parts of our country including Isfahan. Nowadays, it seems that the overall infection rate among Iranian people is low for all ages, especially rare in children.

References

1. Floyd K, Blanc L, Raviglione M, Lee JW. Resources required for global tuberculosis control. *Science* 2002; 295(5562): 2040-1.
2. Wilkinson D, Floyd K, Gilks CF. Costs and cost-effectiveness of alternative tuberculosis management strategies in south Africa--implications for policy. *S Afr Med J* 1997; 87: 451-5.
3. WHO report on global tuberculosis epidemic 1998. www.who.int/tdr/diseases/tb/files/GTRI1.pdf
4. Chadah VK, Vaidanathan PS, Jagannatha, Unikirishana KP, Mini PA. Annual risk of tuberculosis infection in northern zone of India. *Bulletin of WHO Geneva* 2003;81(8): 573. [whqlibdoc.who.int/bulletin/2003/Vol81-No8/bulletin_2003_81\(8\)_573-580.pdf](http://whqlibdoc.who.int/bulletin/2003/Vol81-No8/bulletin_2003_81(8)_573-580.pdf)
5. Cook S, Lay Maw K, Fujiwara PI, Frieden TR. Prevalence of tuberculin skin test positivity and conversions among healthcare workers in New York City during 1994 to 2001. *Infection Control and Hospital Epidemiology* Nov 2003; 24 (11): 807.

6. Styblo K, Meijer J, Sutherland I. The transmission of tubercle bacilli. Its trend in a human population. *Bulletin of the International Union Against Tuberculosis* 1969; 42:1- 410.
7. Guidelines for the prevention of tuberculosis in health care facilities in resource-limited settings. www.who.int/gtb/publications/healthcare/PDF/WHO99-269.pdf WHOTB/99.269.
8. Mir Haghani L, Nasehi M. Iranian guide book of tuberculosis. Iranian Center for Disease Control. 2002;112-5.
9. Mandel GL, Bennett JE, Dolin R. Principles and practice of infectious diseases. Churchill Livingstone 2000:2576-604.
10. Colditz GA, Berkey CS, Mosteller F, et al. The efficacy of bacillus Calmette Guerin vaccination of newborns and infants in the prevention of tuberculosis: meta-analysis of the published literature. *Pediatrics*. 1995; 96:29-35.
11. Beers MH, MD, Berkow R. Infectious Diseases Caused by Mycobacteria in: *The Merck manual of diagnosis and therapy*. Merck Research Laboratories, 2001; Section 13, Chapter 157.
12. CDC. The Role of BCG Vaccine in the Prevention and Control of Tuberculosis in the United States, Joint Statement By the Advisory council for the Elimination of Tuberculosis, Recommendations and Reports U.S. CDC, 1996; 45 (Rr-4) 5.
13. El-Kassimi FA, Abdullah AK, Al-Orainey IO, Lambourne A, Bener AB, Al-Hajjaj MS. Tuberculin survey in the Eastern Province of Saudi Arabia. *Respir Med* 1991, 85:111- 6.
14. CDC. Screening for tuberculosis and tuberculosis infection in high-risk populations: recommendations of the advisory council for the elimination of Tuberculosis. *MMWR* 1995;44(RR-11):3-17.
15. Tuberculin skin test survey in a pediatric population with high BCG vaccination coverage-Botswana, 1996. *Morbidity and Mortality Weekly Report Atlanta*; 46(36): 846-52.
16. Salek S. Tuberculosis in Iran. *World health magazine (in Farsi)* 1995;1(27).
www.emro.who.int/RD/AnnualReports/2002/Index.htm
17. Annual Report of the Regional Director. The work of WHO in the Eastern Mediterranean Region. 2002; 1 January-31 December.www.emro.who.int/rd/AnnualReports/2002