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Prevalence and Determinant of Tuberculin Skin Test among Health Care Workers of Imam Khomeini Hospital of Uremia, Iran.

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Abstract:

Background and Aim: Health care workers (HCWs) in developing countries are at risk for nosocomial tuberculosis (TB). In this study, we are going to determine the prevalence of TB infection among HCWs in Imam Khomeini hospital of Uremia, northwestern Iran.

Materials and Methods: It is a cross sectional study, conducted between April and June 2004. Tuberculin skin test (TST) survey was conducted among 350 HCW, and measured the indurations size.

Results: From 350 participants, 71 (20.28%) had indurations between 10-15mm and 96 (27.42%) had indurations more than 15mm. Most of HCWs with indurations more than 15mm were in age of 20-30 years. From 75 HCWs with employment duration of more than 10 years, 45(47%) had indurations of more than 15mm.

Conclusion: PPD reaction in HCWs was higher comparison with control group, meaning this group are at high risk for Acquired TB.

Key Words: TB, Tuberculin Test, Health Workers.

Introduction:

It has been well documented that the nosocomial spread of tuberculosis (TB) poses a risk to health care workers (HCWs) as well as to susceptible patients ^(1,2). However the occupational hazard has been received little attention until numerous outbreaks of both drug susceptible tuberculosis and multidrug-resistant TB to be occurred in hospitals in the United States and Europe in the 1980s and 1990s ⁽³⁾.

Health Care Workers in developing countries are not spared from the risk of nosocomial transmission of *M. tuberculosis*. However, risk assessment data regarding this occupational hazard in developing countries have remained insufficient. Limited resources, difficulty in collecting TB incidences data among HCWs, lack of awareness that TB is an occupational hazard, a high prevalence of *M. tuberculosis* infection and disease in general population, and the widespread use of Bacilli Calmete-Guerin (BCG) vaccination complicating the interpretation of tuberculin skin testing may have deterred the initiation of such assessment ⁽³⁾.

The tuberculin skin test (TST) has been a traditional method of demonstrating infection with *M. tuberculosis*. Although currently available tuberculin skin test is substantially less than 100% sensitive and specific for detection of infection with *M. tuberculosis*, no better diagnostic methods have been yet advised ⁽³⁾. The TST has been integrated into TB infection control programs in many developed countries with a low prevalence of BCG vaccination for the purpose of monitoring and preventing nosocomial transmission of TB. However, the feasibility of use of

TST to monitor nosocomial transmission or infection has not been examined fully in setting with high prevalence of BCG vaccination. The incidence of TB highly has been decreased recently in Iran. According to the report of center of control disease in Iran the incidence of TB was 14 per 100,000 in our country in 2004. The aim of this study was to determine risks of *Mycobacterium* infection among HCWs of Imam Khomeini hospital of Urmia, Iran.

Materials and Methods:

Study groups: A cross-sectional survey of tuberculin skin testing was considered for all 450 HCWs of Imam Khomeini Hospital of Urmia from April to June 2004. However, three hundred and fifty out of all 450 HCWs employed were participated in this study. This hospital is 300-bed university affiliated teaching hospital. A questionnaire and a consent form were distributed to each participating to read, fill out and sign. For completion of survey the questionnaires data on demographic variable, history of BCG vaccination were collected.

350 HCWs of our hospital were nurses, assistant nurses, ward sisters, physicians, paramedical staffs and personals not involved patients care.

Control group: Ninety people selected as a control group. These people were selected randomly from out-patient admitted to hospital. This group had not any history of working in any hospital.

TST procedure: The TST was performed by trained and experienced personnel. The TST was done by using Mantoux method. The Mantoux test is given in the

volar surface of the forearm using 0.1 ml of 5 unit tuberculin units (TU) of Purified Protein Derivative (obtained from Iran Pasteur Institute). All of participants were advised to return 72 hours after the injection for measurement of skin reaction to tuberculin. The widest transverse diameter of skin induration was measured by standardized palpolar method^(4,5,6). For the purpose of our analysis the size of induration was scored as 0-4mm, 5-10mm, 10-15mm and greater than 15mm. Those with a highly positive tuberculin reaction (i.e., a skin induration of 15 mm or greater) were advised to undergo future evaluation of TB activity. This involved a brief clinical assessment followed by chest x-ray and other diagnostic examination (e.g., sputum examination for acid fast bacillus or mycobacteria culture and sensitivity) as necessary by the same investigator.

Data analyzed procedure: Data were analyzed by SPSS software (Version 13.0, SPSS Inc, Cary NC). To examine the effect of different factors on TST reaction, indurations of 15 mm or greater was considered as cut off point for positive reaction. Cross-tabulation of nominal variables were compared using the chi-squared test and continuous variables by t-test. A P value of less than 0.5 was considered statistically significant.

Results:

Ninety one of the HCWs reported having a BCG vaccination twice (e.g., the first BCG vaccination at the birth and the second BCG vaccination at age of 7 years) and nine percent did not report any history of vaccination.

Assistant nurses with 34% had the highest frequency of PPD indurations of more than 15mm followed by physician (33.3%). The lowest frequency of indurations of more than 15mm was observed among service workers. In this group, only 22.22% had indurations of more than 15mm.

Comparison of indurations rate of participants with control group: 71 out of 350 participants (20.28%) had indurations of 10-15mm and 96 (27.42%) had indurations greater than 15mm, while in control population, only 16 out of 90 people (17.77%) had 10-15mm and 9 (10%) had indurations greater than 15mm. Most of participants with indurations greater than 15mm were in age of ranged 20-30 years old.

Among 350 HCWs, 240 (69%) had employment duration of 2-5 years, 35 (10%) had 6-10 years and 75 (21%) had more than 10 years of employment duration.

129 (89%) HCWs with employment duration of 2-5 years had indurations of 0-4mm. Indurations more than 15mm were observed in HCWs which their duration of employment was more than 10 years. From 75 HCWs with employment duration of more than 10 years 45 (47%) had indurations of more than 15mm.

The chi-square test was performed for comparison of HCWs and control population who had induration more than 15mm. There was a significant difference between these groups (p -value = 0.0005) and there was also a significant difference in mean indurations more than 15mm in HCWs and control population (t -test P value = 0.0005)

Table 1, Characteristic of tuberculin skin test survey participants baseline characteristics

Baseline characteristic		No	(%)
Gender	Female	220	62.8
	Male	130	31.7
Occupation	Nurse	150	42.8
	Assistant Nurse	50	14.28
	Ward Sister	45	12.85
	Physician	15	4.28
	Paramedical Staff	45	12.85
	Service Workers	45	12.8
BCG vaccination	Yes	320	91.4
	No	30	8.57

Table 2, Comparison of PPD reaction among HCWs and control population.

PPD indurations	Health care workers: N (%)	Control population: N (%)
0-4mm	145 (41.42)	42(46.66%)
5-9mm	38 (10.86)	23(25.55%)
10-15mm	71(20..28)	16(17.77%)
>15mm	96(27.42)	9(10%)
Total	350(100)	90(100)

Table 3, Results of tuberculin skin test regarding the occupation among health care workers.

Occupation	Number of tested	Reactions> 15-mm (Number)	%
Nurses	150	41	27.33
Assistance Nurse	50	17	34
Ward Sister	45	12	26.66
Paramedical Staff	45	11	24.44
Service Workers	45	10	22.22
Physician	15	5	33.33

Discussion:

This study reveals that in our hospital despite having a high BCG vaccination rate in HCWs, there is a high risk for infection for *M. tuberculosis*, because HCWs regarded as having a higher level of exposure to the bacteria. In our study 96 (27.42) of HCWs had indurations

more than 15mm. Regarding to occupation, assistant nurses and physicians had 34% and 33.33% of indurations more than 15mm respectively. One reason for high frequency of PPD-positive in these groups included that physicians and assistant nurses are at high risk of exposure to patients with active TB because

of delayed diagnosis and appreciate isolation of infectious patients, and aerosol generation procedures.

Although there have been many studies of TB infections in HCWs, as measured by the prevalence of tuberculin reactivity and active disease, physicians are often either not included, or they comprise only a small percentage of total population examined. Plitt SS (et al) studied prevalence and risk factors for tuberculin reactivity among physicians in Edmonton, Canada. In their study, the overall tuberculin reactivity for this population was 45.9%, the risk factors for reactivity were aged over 45 years, of foreign-birth, previous BCG vaccination, foreign practice experience, and being respiratory medicine specialist ⁽⁷⁾. Molna-Gamboa J (et al) has reported prevalence of reactivated PPD in 123 out of 175 HCWs in Mexico. In their study, the rate of reactivity was higher among persons with a history of BCG vaccination than those without such history ⁽⁸⁾.

PPD skin test may have different interpretations. One reason may be due to the results of cross reaction between tuberculosis and non-tuberculosis mycobacteria, booster effect anergy, tuberculin quality and BCG vaccination ^(9,10,11) However Menzies and Vissandjee, reported that after an interval of 10 to 25 years, the most important determinant of the effect of BCG vaccination in infancy and pre-school ages did not affect of TST positive ⁽¹²⁾.

In meta-analysis performed by Wang L (et al) for detection effect of BCG vaccination on tuberculin skin test reactivity, they concluded that, the effect of vaccination on PPD skin test results was less

than 15 years. Positive skin tests with indurations of 15mm are more likely to be the result of tuberculosis infection than BCG vaccination ⁽¹³⁾. Age is another factor that affects PPD reaction. The elderly have had decreased sensitivity to the PPD, however age was not found to be a factor associated with positive PPD reactions in our study, as it has been reported in other studies. The participants in our study were generally young and healthy.

In general the probability of positive reaction due to the *M. tuberculosis* infection has been greater than the size of the TST reaction, especially when individual is in contact with an active TB patient or there is a family history of TB. The effects of these potential factors on false positive TST reaction can be minimized by a high cut-off point (i.e., an indurations of 15mm or greater for positive PPD test).

Exposure to tuberculosis is an occupational risk for health care workers, especially those employees in hospitals, and therefore screening should be done by annual tuberculin skin tests, especially for those workers living in communities with a high prevalence of tuberculosis.

This study has established the baseline prevalence of TST positivity for HCWs in our hospital. These findings indicate for HCWs to have increased awareness of the transmission of *M. tuberculosis* has been increased in HCWs in the workplace especially in area with a high frequency of direct contact with active TB patients. We need for study tuberculin test conversion rate among our HCWs in future.

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