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Evaluation of Tuberculin Skin Test (TST) in Medical Students in Mazandaran University of Medical Sciences, Sari, Iran

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Abstract

Background: Working in health care units has been known as occupational risk factor in mycobacterium tuberculosis (TB) infection. The TB exposure rate in medical students is more than other people. In several studies significant correlation has been reported between hospital presence hours and positive PPD test prevalence. With regard to morbidity of several medical students and nursing staff due to primary tuberculosis in recent years, we decided to investigate positive tuberculin skin test (TST) prevalence in medical students and examine correlation between positive cases prevalence with presence hours in hospitals.

Methods: This was a cross sectional study and 297 medical students of Mazandaran University of medical sciences were investigated. TST was done with Mantoux method. After 48 hours, injection site induration was measured. Subjects that had induration <10 millimeters were injected again (1-3 weeks later) with same method. (As a booster dose)

Results: 32 cases (10.7%) had positive test at the first phase. Second phase was done on rest 265 persons and 20 cases had positive test. In summation 52 positive cases (17.5%) were observed. 21 cases of 151 persons (13.9%) in group with <100 hours/annual hospital presence, had positive tests. 21 cases of 71 persons (16.9%) in group with 100-1000 h/a hospital presence (Extern) and 19 cases of 75 people (25.3%) those who had >1000 h/a hospital presence(Intern), had positive tests. There was a meaningful statically difference in positive tests, between groups < 1000 hours exposure and the other who had > 1000 hours contact (p=0.032).

Conclusions: Because of, Interns' high responsibilities and their more involvement in patient's diagnostic and therapeutic process, they have high chance to contact with undiagnosed and diagnosed tuberculosis patients. Due to these reasons, TB infection rate is increasing among Interns. As a result of these findings, performing PPD test should be considered at the beginning of entrance to hospital departments and then annually. Necessary tasks and following up are needed to new positive cases.

Keywords: tuberculin skin test (TST), PPD, medical students, hospital presence hours

1. Introduction

TB, one of the known oldest infectious diseases that affect humans, which is caused by bacteria, belongs to Mycobacteria family (Bennett, Dolin, & Blaser, 2014). TB still remains a major global health problem. In 2012, an estimated 8.6 million people developed TB with 1.3 million mortalities. The majority of reported TB cases to WHO are from Southeast Asia (29%), Africa (27%), western pacific (19%), India (26%), and China (12%).Latent infection usually occurs after contamination with TB. After several years, 2-23% of cases may be converted to active tuberculosis disease. Early tuberculosis disease following infection is called as primary tuberculosis and is common among children that may be converted to milliary tuberculosis but it's not generally associated with

high-level transmissibility(Casper, Braunwald, Fauci, Hauser, & Longo, 2006). TB reactivation can create secondary TB. When people suffering from active pulmonary TB coughs, sneeze, speak, or spit, they eject infectious aerosol droplets. Each one of these droplets may transmit the disease to other patients (Bennett et al., 2014; Jahromi & Pourahmad; WHO). Therefore, people with prolonged and frequent close contact are at high risk of becoming infected particularly. A person with active, untreated tuberculosis can infect 10–15 other people per year (Babamahmoodi et al., 2015). Working in medical-health care unites has been known as one of the occupational risk factors for tuberculosis infection(Casper et al., 2006) .Based on previous studies, there wasn't seen difference about Mycobacterium tuberculosis infection prevalence among medical-health care unites' personnel and common population in Iran and especially Mazandaran province (Babamahmoodi et al., 2015) . It may be due to high possibility of contamination with Mycobacterium tuberculosis among most of people in childhood(Lamabadusuriya & SOYSA, 1972) Recent years, by health level elevation and no contamination with TB in childhood ages, primary TB infection probability rose in adolescences and adults(Golchin & Rostami, 2005) . It seems that health care workers including medical students (who have higher health level rather than general population) can be affected easier than the others because of probable high risk contacts with tuberculosis in different clinical departments such as: internal medicine, pediatric, infectious and urgency unites(Golchin & Rostami, 2005).In some studies have been suggested that Contact hours of medical-health care personnel and medical students with hospitalized patients in different hospital parts, might be increased TB contamination chance(Nader & Rakei, 2001; Silva, Cunha, & Kritski, 2002) . Studies showed a meaningful correlation between hospital education hours during the period of clinical training in hospitals with positive prevalence of TST (Soares, Mello, & Kritski, 2004).Performance of screen test has been offered to medical students and nursing staffs routinely (Silva et al., 2002). Even in advanced and industrial countries, to prevent from spread of TB, screen test with PPD and rapid identification of patients with infectious TB and their following up with prophylaxis and treatment tasks is one of the Medical Sciences Universities' routine objects .But unfortunately, in Iran Universities this matter isn't as a routine project and we have not a protocol for it, so we don't recognize patients with recently infection during training period in hospitals and we can't prevent from primary activated TB occurrence in them (Golchin & Rostami, 2005).With regard to, some medical students and nursing staff morbidity due to primary tuberculosis during recent years in Sari and Ghaemshahr educational hospitals, we decided to investigate positive PPD test prevalence among medical students of Mazandaran University of medical sciences in Sari in 2015 and examine correlation of positive tests prevalence and presence hours in hospitals. If meaningful link was seen, screening tests and prophylaxis should be considered for medical students.

2. Materials and Methods

This is a cross-sectional study and its object was determination of positive TST prevalence among medical students in 3 groups (based on presence hours in hospital sections) such as:

Group 1: no presence in hospital or lesser than 100 hours presence in hospital annually (students in basic medicine and physiopathology periods)

Group 2: between 100 to 1000 hours presence in hospital sections annually (Extern)

Group 3: more than 1000 hours presence in hospital sections annually (Intern)

In this study, medical students of Mazandaran University of medical sciences who were educating in different degrees in 2015 were evaluated. Method sampling was census. After receiving their written consent and describing ethical principles of study about keeping patient's information secretly, they were entered to our study. At the beginning, they filled an information form, which included age, sex, birth place, Residential area at the end of high school and before entrance to college, past history of BCG vaccine injection, previous history of contact with TB patient in family or out of home, education level in medical school and presence hours in hospital departments. Also, to be or not to be of BCG injection scar site was recorded in information form by examination of study designers. The exclusion criteria were past history of tuberculosis, active tuberculosis, is under treatment, immunocompromised condition, high dose corticosteroid and immunosuppressive drugs consumption.

Then TST with Mantoux method was done on students. 0.1cc of tuberculin (5 units), PPD solution (span diagnostic ltd, India, kept in refrigerator and out of light) was injected intra-dermal with 1cc insulin syringe on the anterior aspect of left forearm by expert Intern. Skin reaction was read after 48 and 72 hours. The largest transverse diameter of indurations was measured by study's designer touching and utilizing transparent ruler (within neonatal blood exchange set) and determined its borders and interpreted as negative (less than 5mm), suspected (5-9 mm), positive (10-14 mm) and significant (15mm and more). Patients with indurations < 10 millimeters were studied

again 1-3 weeks after beginning test with TST using Mantoux method. ≥ 10 mm after first or second test was considered positive. Also, ≥ 6 mm increase in size was considered positive. Data entry was carried out in SPSS software version 16. Data were analyzed with using descriptive biostatistics e.g. frequency and analytic biostatistics e.g. Chi-square (X_2) test.

3. Results

315 cases(77%) of all 416 medical students of mazandaran university of medical sciences filled the first information form but 297 student accepted to be injected by TST. Of 297 sample, 223 persons (75.1%) were women and 74 subjects (24.9%) were men.32 sample of them (10.7%) had positive test at the first step (in 48 hours after injection, induration site diameter was 10 millimeters and more). After 1 week, second test was done on 265 persons and 20 persons were found positive newly. in summation, 52 positive cases (17.5%) in evaluated population were observed.

13 persons (25%) of positive PPD were men and 39 persons (75%) were women. There was no meaningful difference between two gender groups about number of positive Persons statistically (p=0.55). Regarding birth place, 9 persons(3%) were rural and 288 persons(97%) were urban. 2 samples of 52 subjects that had positive test were rural and 50 subjects were urban but there was no meaningful difference between these groups statistically (p=0.48).

Regarding Residential area at the end of high school and before entrance to college, 295 Persons were urban and 2 persons were rural. There was no meaningful difference between these groups about positive skin test statistically (p>0.05).All of 297 samples in our study, had past history of BCG vaccine injection and vaccine scars were obvious on their forearm. 182 cases (61.3%) had no previous history of contact with TB patient in family or out of home. 25 subjects that had positive test were in this group. 115 persons (61.3%) had positive past history of contact with TB patient in family or out of house and 27 subjects of positive persons (51.9%) were in this group. There was a meaningful difference between these groups about positive skin test (p=0.024) (table.1).151 cases of 297 subjects (50.8%) were in basic medicine and physiopathology periods (<100 hours hospital exposure annually), 71 samples (23.8%) were Externs with 100 to 1000 hours presence in hospital sections annually and 75 subjects (25.3%) were Interns with > 1000 hours presence in hospital sections annually. 21 subjects (13.9%) that had positive tests were in basic medicine and physiopathology periods, 12 cases (16.9%) were externs and 19 subjects (25.3%) were interns. There was a meaningful difference about positive test examples between groups with <1000 hours exposure and >1000 hours exposure to hospital environment (p=0.032) (table.2).The mean of students' age was 22.4 years old with maximum 29 yr and minimum 18 yr. The mean of students' age in group with < 1000 hours exposure was 21.05±1.76 yr and in group with > 1000 hours was 26.41±1.01 yr. There was meaningful difference about age between these groups (p<0.001). The average PPD test measurement among groups with <1000 hours was 2.55±5.17 millimeters and in > 1000 hours was 4.65±5.78 millimeters and there was meaningful difference (p=0.003).

Table 1. Frequency distribution of positive and negative PPD test results in 2 groups of patients with and without tuberculosis exposure

Exposure with tuberculosis patients	**PPD test result**		**Total**
	positive	negative	
negative	25 (13.7%)	157 (86.3%)	**182 (100%)**
positive	27 (23.5%)	88 (76.5%)	**115 (100%)**
Total	52 (17.5%)	245 (82.5%)	**297 (100%)**

$X^2 = 4.63$; p=0.024.

Table 2. Frequency distribution of PPD test results in education groups with lesser than 1000 hours exposure to hospital environments and more than 1000 hours hospital contact

Education level	**PPD test result**		**Total**
	positive	negative	
Lesser than 1000 hours presence in hospital departments	33 (14.9%)	189 (58.1%)	**222 (100%)**
More than 1000 hours presence in hospital departments	19 (25.3%)	56 (74.7%)	**75) 100(%**
Total	52 (17.5%)	245 (82.5%)	**297 (100%)**

$X^2 = 4.25$; p =0.032.

Table 3. Frequency distribution of PPD test outcomes of medical students of mazandaran university of medical sciences

Frequency (%)	**Size of induration in PPD test**
221 (74.41%)	<5 millimeter
24 (8.09%)	5-9 millimeter
39 (13.13%)	10-14 millimeter
13 (4.37%)	>14 millimeter
297 (100%)	Total

4. Discussions

During this study, positive TST among Sari medical school students was reported 17.5%. (52 positive cases of 297 subjects), but there was no meaningful differences between 2 groups men and women and also birth place and Residential area has been no affected on test consequence. Exposure with TB patient in family or out of home was exposure most common at hospital environment departments, had meaningful effect on test result among evaluated students. As age, there was a meaningful difference in positive and negative test groups. The mean of age in negative tests was 22.16 yr and in positive tests was 23.54 yr. this matter may be due to correlation between education level and presence hours in hospital sections. All of students had past history of BCG vaccination that can't prevent of infection can prevent of infection progress to clinical disease (Villarino, Huebner, Lanner, & Geiter, 1996). BCG vaccine can induce positive PPD test, but if people didn't involve with active TB disease, then positive PPD test second to vaccination may be convert to negative during several years. Also, in Iran because of giving BCG vaccine at birth time, it only in primary years of life can induce positive PPD test (Bloch, 1995; El-Kassimi et al., 1991; Rezai, Khotaei, Mamishi, Kheirkhah, & Parvaneh, 2008). Positive tests among students in basic medicine and physiopathology periods with lesser than 100 hours hospital exposure was 21 (13.9%) yearly. Positive test among externs (between 100 to 1000 hours presence in hospital sections annual) was 16.9% (12 cases) and among interns with more than 1000 hours presence in hospital sections annual was 25.3 % (19 cases). Elevated positive test prevalence in 3 groups due to increase contacts to hospital departments was clinically seen. But there was no statistically meaningful difference between these groups in basic medicine and externs but this difference among these 2 groups and Interns' group was statistically meaningful. Second to no direct involving to hospital responsibilities and hospitalized patients and no hospital presence in the afternoon and night, Externs may be at lower risk. Because of Interns more involvement in patients' diagnostic and therapeutic process, they have high contact chance and longer exposure duration with undiagnosed tuberculosis patients. Proper isolation for TB patients must be considered in some hospital sections, because if does not, then increasing in TB transmissibility will be occurred. Meaningful difference was seen in positive test results between 2 groups with < 1000 hours hospital contact and > 1000 hours hospital contact and it was demonstrated that some students during work in hospital sections and contact with TB patients in distinct departments were infected to TB. These findings is shown the importance of yearly evaluation students about TB infection with PPD test for those students that present in hospital departments. Fernanda CL and et al investigated 316 students registered in distinct education degrees with cross-sectional method in 2002. Their analysis showed increasing TST positivity rate corresponding to extent of clinical experience and an appetence to correlation with high education level. The highest prevalence of positive test was found during the period of clinical training, which was corresponded to more than 1000 hours hospital

sections exposure similar to our study (Soares et al., 2004).Also, Silva VM and et al perform a cohort study in medical students and Of 414 participants, 16 cases had converted to a positive reaction after 1 year and higher level of clinical training with greater hours contact was confirmed to be an independent factor associated with TST conversion. Finally, they concluded that medical students are at increased risk of TB infection (Silva et al., 2002).Golchin M and et al in another Cohort study, studied 320 students (160 nursing and 160 human-sciences). PPD test was done at the beginning and end of education course. Difference in that proportion of frequency distribution of positive TST in nursing students and human-sciences group with positive PPD test at the end of study was statistically significant. It means new TB infection during hospital education course occurred among nursing students. They confirmed that hospital presence and contact with TB patients is an independent factor associated with recent infection. Finally, they concluded that medical students are at increased risk of TB infection (Golchin & Rostami, 2005). As a result of previous studies findings and our results, hospital presence and contact with TB patients (>1000 hours) is associated with new PPD test positivity and new TB infection. Because of it, increasing primary TB may occur among these students. Performing PPD test should be considered at the beginning of entrance to hospital departments and then annually for students with primary negative test. Necessary tasks and following up need to recent positive cases and we can administer prophylactic drugs to prevent from active TB infection appearance.

At the end, based on this study we suggest PPD test should be done in all of medical students at the beginning of entrance to hospital, and cases with positive test should be evaluated about active TB. Cases with negative test should be reexamined annually and if their tests convert to positive they should be referred to specialist for prophylaxis and following up. Necessary facilities should be prepared in medical-educational departments for isolation patients with recognized or suspicious TB infection, and declining disease transference to minimum degree should be considered.

Competing Interests Statement

The authors declare that there is no conflict of interests regarding the publication of this paper.

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