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Tuberculin Skin Test Conversion among Students during their Educational Course in Medical and Pharmacy Schools: A Multiple Cohort Study

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ABSTRACT

Background: *Mycobacterium tuberculosis* can be transmitted via aerosols in hospital wards and affect medical students as well as other hospital personnel. This study aimed to assess the changes of tuberculin skin test in medical students compared to pharmacy students during their education.

Materials and Methods: This was a natural multiple cohort study performed in the medical education system to assess the rates of TST conversion among students. Tuberculin skin tests were performed on 212 students, including 100 pharmacy students and 112 medical students before the initiation of their clinical rotations and repeated 36 months later after their exposure to hospital wards. Participants completed self-administered questionnaires.

Results: Tuberculin skin test (TST) conversion in medical and pharmacy students was 18.1% and 4.3%, respectively during the years 2003 and 2006. Although there was no significant difference between positive TST of the two groups at baseline, a significant difference ($P=0.005$) was observed after their exposure to hospital wards. There were no significant correlations between TST conversion and age or gender of students.

Conclusion: Exposure of medical students to tuberculosis during their education is substantial in Iran and more attention should be paid to prevention strategies in medical students prior to and during their clinical training. (*Tanaffos* 2009; 8(4): 33-36)

Key words: Tuberculosis, Medical students, Tuberculin skin test conversion

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INTRODUCTION

Tuberculosis (TB) is a major cause of morbidity and mortality in the world. It is also a frequent occupational infection in health care workers (HCWs). Increased rate of tuberculin test conversion among HCWs may be explained by poor compliance to standard infection control measures and delay in diagnosis (1, 2). Risk of transmission to health care workers depends on the hospital ward, type of patients being treated and the enforcement and effectiveness of infection control policies. The risk is the highest among personnel who are in contact with smear positive patients (3-5).

Occupational transmission of TB imposes enormous economic burden on the society and significant stress on health care personnel in developing countries with high prevalence of TB. The health care system requires the public health practitioners to advise periodic screening of HCWs. One of the most common and least invasive screening methods is the tuberculin skin test (TST). Although not a perfect test for TB, TST test uses Mycobacterial purified protein derivative (PPD) and is widely used for detection of latent TB infection (6).

Public health policies require on-going examination of data to justify or validate their continued use. In this study, we calculated the risk of occupational transmission of TB among medical students with potential exposure to patients using TST conversion rates and compared it to pharmacy students with presumed minimal exposure to patients.

MATERIALS AND METHODS

This was a natural multiple cohort study performed in the medical education system to assess the rates of TST conversion among students. Two groups of medical (n=134) and pharmacy students (n=122) were tested by TST at the beginning of their

clinical training in 2003 at Tehran University of Medical Sciences (TUMS). The TST was repeated 3 years later in 2006 when medical students had potential contacts with TB patients in their clinical rotations. Pharmacy students do not have direct patient care responsibilities and are presumed to have less exposure to TB in a medical center. Rates of TST conversion are compared between medical and pharmacy students during a 3-year period. Participants were those who were in good standing in their education curriculum, did not have immunodeficiencies of any kind, and provided an informed consent to be in the study.

Tuberculin skin test was performed using the Mantoux method with the injection of 5 International Unit (IU) of P(PPD) in 1 microliter of solution on the volar aspect of the forearm, using a 26 or 27 gauge needle to produce a raised blanched wheal as a sign of precise placement of the injection. A positive test was defined by the diameter of indurations (not the erythema) induced by PPD 48 to 72 hours after the injection. The reaction was measured tangentially against a light background or by drawing a line 1 to 2 centimeters away from the skin reaction moving toward its center by using a medium size ballpoint pen. TST conversion was defined as an increase in diameter of ≥ 10 mm at any point during the 3-year study period. All individuals with a positive skin test were evaluated for active TB, including an assessment for TB symptoms and a chest x-ray.

Data analysis was performed by using SPSS software (version 13). The chi-squared test and the paired t-test were used. Logistic regression was used for comparing TST conversion between the two student groups while controlling other factors. P values less than 0.05 were considered as significant.

RESULTS

Initially, 256 students were included in the first TST done in 2003. By the second TST, 17% of the

cases were lost for the follow-up. The remaining students who were retested in 2006 included 212 individuals, of whom 100 were pharmacy and 112 were medical students. Table 1 shows the gender and age of the students by their faculty.

Table 1. Demographic data of medical and pharmacy students.

	Gender (male) (%)	Age (mean±SD) at beginning of study
Medical students	51 (45.5)	21.49±1.61
Pharmacy students	49 (49)	19.81±1.45

At baseline, 6% of medical students and 7% of pharmacy students had positive TST results. In 2006, 23% of medical students and 11% of pharmacy students had positive TST. The difference in TST conversion rate was statistically significant (18% versus 4%, respectively) between medical and pharmacy students ($P=0.019$; $OR=0.32$, $CI: 0.10-1.03$) (Figure 1). There were no significant differences in the distribution of age and gender of cases between groups and controlling of these factors did not affect the results.

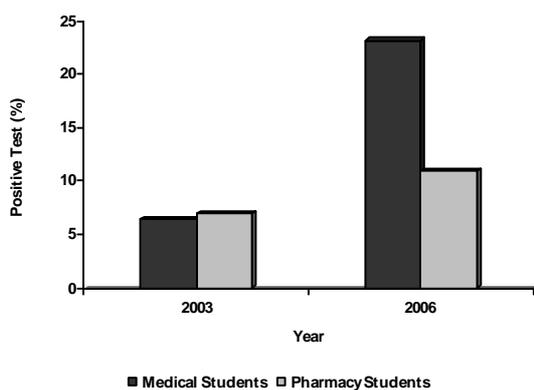


Figure 1. Conversion of tuberculin skin test among medical and pharmacy students between 2003 and 2006

DISCUSSION

TB is an important occupational disease among HCWs, and reduction of its risk should be a priority.

Prevalence of TB is low among freshman medical students entering the health-care profession, but increases with each year of training. HCWs whose occupation involves close patient contact also have higher TB prevalence (7). According to different studies, more years of clinical training and greater exposure to TB patients are risk factors for a new infection, and this provides additional support for nosocomial transmission. Also, many studies reported higher prevalence of TB among HCWs than in the general population, which is suggestive of nosocomial transmission. The high incidence of TB among young HCWs is particularly alarming (7).

Our findings verify that a substantial number of medical students are exposed to TB during their first years of clinical training. Our study results along with those of other studies imply that even limited contacts with patients infected with mycobacterium tuberculosis may pose serious health risks to HCWs and onward to their patients (8-12). A prospective study was conducted in Iran (2002) on 147 people who were in close contact with 34 smear positive TB patients. The diameter of indurations induced by PPD was <14mm in 61.8% of people and >15mm in 38.2%. Overall, 4.8% had respiratory tuberculosis (13).

Although students in our study supposedly had a positive history of BCG vaccination considering the standard vaccination protocol in Iran, it had been 20 years since their vaccination (14). Moreover, the cohort design of the study evaluated the individual reactivity from baseline to follow-up. The TST detects lifetime cumulative occupational plus nonoccupational exposure to *Mycobacterium tuberculosis* (7).

The prevalence of occupational TB could be overestimated in this study because it was based on TST. These results suggest that nosocomial TB contributes to the burden of TB among HCWs. Despite the above-mentioned limitations, the results suggest that

medical students had a higher risk of TB infection compared to the estimates of risk in the pharmacy students. Considering the obtained results and the potentially high transmission risk of TB from the patient population, we recommend strengthening medical students' immune system before and during their hospital ward training. Implementation of infection control measures and TB prevention strategies should improve. Low-cost measures can include engineering controls such as exhaust ventilation, improved natural ventilation, or sunlight (7). Annual tuberculin screening is also recommended for medical students.

REFERENCES

- Centers for Disease Control and Prevention (CDC). Expanded tuberculosis surveillance and tuberculosis morbidity--United States, 1993. *MMWR Morb Mortal Wkly Rep* 1994; 43 (20): 361- 6.
- Broekmans JF, Migliori GB, Rieder HL, Lees J, Ruutu P, Loddenkemper R, Raviglione MC; World Health Organization, International Union Against Tuberculosis and Lung Disease, and Royal Netherlands Tuberculosis Association Working Group. European framework for tuberculosis control and elimination in countries with a low incidence. Recommendations of the World Health Organization (WHO), International Union Against Tuberculosis and Lung Disease (IUATLD) and Royal Netherlands Tuberculosis Association (KNCV) Working Group. *Eur Respir J* 2002; 19 (4): 765- 75.
- Blumberg HM, Watkins DL, Berschling JD, Antle A, Moore P, White N, et al. Preventing the nosocomial transmission of tuberculosis. *Ann Intern Med* 1995; 122 (9): 658- 63.
- Blumberg HM. Tuberculosis infection control in healthcare settings. In: Lautenbach E, Woeltje K, editors. Practical handbook for healthcare epidemiologists. New Jersey: Slack Incorporated; 2004. p. 259–73.
- Menzies D, Fanning A, Yuan L, Fitzgerald M. Tuberculosis among health care workers. *N Engl J Med* 1995; 332 (2): 92- 8.
- Jensen PA, Lambert LA, Iademarco MF, Ridzon R; CDC. Guidelines for preventing the transmission of Mycobacterium tuberculosis in health-care settings, 2005. *MMWR Recomm Rep* 2005; 54 (RR-17): 1- 141.
- Joshi R, Reingold AL, Menzies D, Pai M. Tuberculosis among health-care workers in low- and middle-income countries: a systematic review. *PLoS Med* 2006; 3 (12): e494.
- Shigetoh E, Maeda A, Oiwa H, Yokosaki Y, Murakami I. Repeated tuberculin skin tests in nurse students--observation for 3 years. *Kekkaku* 2002; 77 (10): 659- 64.
- Bozkanat E, Ciftçi F, Apaydin M, Kartaloğlu Z, Tozkoparan E, Deniz O, et al. Tuberculin skin test screening in a military school in Istanbul city center. *Tuberk Toraks* 2005; 53 (1): 40- 50.
- Hohmuth BA, Yamanija JC, Dayal AS, Nardell E, Salazar JJ, Smith Fawzi MC. Latent tuberculosis infection: risks to health care students at a hospital in Lima, Peru. *Int J Tuberc Lung Dis* 2006; 10 (10): 1146- 51.
- Ball R, Van Wey M. Tuberculosis skin test conversion among health care workers at a military medical center. *Mil Med* 1997; 162 (5): 338- 43.
- Porteous NB, Brown JP. Tuberculin skin test conversion rate in dental health care workers--results of a prospective study. *Am J Infect Control* 1999; 27 (5): 385- 7.
- Khalilzadeh S, Masjedi H, Zahirifard S, Bolorsaz MR, Velayati AA. Prevalence tuberculosis in people who were in close contact with smear positive patients. *Infectious Disease Journal* 2004; 9 (24): 50-5.
- Wang L, Turner MO, Elwood RK, Schulzer M, FitzGerald JM. A meta-analysis of the effect of Bacille Calmette Guérin vaccination on tuberculin skin test measurements. *Thorax* 2002; 57 (9): 804- 9.