

Prevalence of Tuberculosis Infection Among Health-Care Workers in Hamadan, West of Iran

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Background: The risk of occupationally acquired tuberculosis (TB) remains a concern, even now that the infection has been under control to a great extent.

Objectives: The aim of this study was to ascertain the prevalence of latent TB infection and pulmonary TB, and to assess the risk factors for TB, among health care workers in Hamadan.

Patients and Methods: Tuberculin skin test was performed on 245 health care workers, in two educational hospitals. The reaction was considered as "positive" if the induration diameter was ≥ 10 mm. Individuals with a positive test $>$ than 15 mm were encouraged to seek further medical evaluation, including a chest-x-ray and a smear and sputum culture of the sputum for acid-fast bacilli, in those with radiographic changes indicating TB.

Results: Out of 245 health-care workers included in this study, 92 (38%) had positive tuberculin test. There was a significant association between aging and tuberculin positivity. There was also a significant association between the length of employment and tuberculin positivity. Ward attendants had higher rates of positive test results, compared with other occupational groups.

Conclusions: It was concluded that latent TB infection is common among health-care workers in the studied region. Age, occupational group and employment length were found to be strongly associated with tuberculin positivity.

Keywords: Health; Risk Factors; Tuberculosis; Tuberculin Test

1. Background

Tuberculosis (TB) has long been recognized as a risk for health-care workers (HCWs). The rate of infection in HCWs, is 2-10 times higher than the general population. In most studies, nurses have had the highest risk; 2-3 times more than that of the physicians (1). Nurses of the HIV unit may show a higher prevalence of tuberculin positivity, compared to the other wards' HCWs. Tuberculin conversion rates, as high as 50%, were reported among HCWs of the HIV wards, early in the AIDS epidemic (2). On the other hand, since the early 90s, several hospital outbreaks of multidrug-resistant (MDR) TB were reported. At least, 20 HCWs developed MDR-TB during these outbreaks (3-5). Moreover, several cases of extended drug-resistant TB have been reported in HCWs, in the recent years (6, 7). According to the World Health Organization records, the reported number of TB cases in Iran is 17 per 100,000 people, 5% of which are MDR-TB (8). The high prevalence of MDR-TB reported in Iran highlights the concerns for TB infection in HCWs. However, little infor-

mation is available about the situation of TB infection in Iranian HCWs. In a study on 160 nursing students in Iran, the prevalence of latent TB infection (LTBI) was 2% at entry and 15% on graduation (9). Similarly, other HCWs can also be at a high risk of TB infection. At present, there are no routine screening measures for TB infection in health care facilities in Iran.

2. Objectives

The aim of this study was to determine the prevalence of TB infection among HCWs in Hamadan, an endemic area in Iran and also to assess the risk factors for TB infection among HCWs in a hospital setting.

3. Patients and Methods

Two hundred forty-five HCWs of Sina and Beheshti Hospitals were selected for this cross-sectional study. The study protocol was approved by the ethical committee

Implication for health policy/practice/research/medical education:

Due to the high potential risk of acquiring TB for HCWs in the region under study, additional infection-control measures are necessary to reduce the possibility of transmission in hospitals.

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of Hamadan University of Medical Sciences. Sina and Beheshti Hospitals are two 250-bed major referral centers in Hamadan, Iran, each having approximately 250 full-time employees. Hamadan city is the capital of Hamadan province, with a population about 600000, located in the western part of Iran. These two hospitals have many wards and specialty and subspecialty centers, including referral wards for patients with TB, where every year 35-40 patients are admitted to, for 1-3 weeks. Patients with TB are admitted to any ward in these hospitals. There are no fixed personnel in any ward and the HCWs rotate in all wards on regular intervals, therefore they have equal risks for TB exposure.

All HCWs in frequent contact with patients were included in the study. Employees who had no direct contact

with patients, including accountants, administrators, cashiers, medical records personnel, custodians, laboratory personnel, laundry workers and pharmacists were excluded. Tuberculin skin test (TST) was performed using 5 IU of PPD solution provided by Pasteur Institute, Tehran. The results were checked 48 to 72 hours following tuberculin administration. The reaction was reported as "positive" if the diameter of resulting induration was ≥ 10 mm. Individuals with a positive test were encouraged to seek further medical evaluation, including chest-x-ray and direct smear examination of the sputum for acid-fast bacilli in those with radiographic changes indicating TB, followed by a culture of sputum in smear-negative cases. In addition, a clinical chart was prepared for recording the HCWs' demographic information, medical histories,

Table 1. Characteristics of 245 Health-Care Workers With Positive and Negative Tuberculin Skin Test ^{a, b}

Variable	Positive TST (n = 93)	Negative TST (n = 152)	P Value
Gender, No.			0.001
Female	36	93	-
Male	57	59	-
Age, y	41.3 \pm 7.1	35.7 \pm 8.9	< 0.001
Duration of employment, y	15.4 \pm .1	9.9 \pm 7.3	< 0.001
Hospital			NS
Sina	52 (40)	78 (60)	-
Ekbatan	41 (35.7)	74 (64.3)	-

^a Abbreviations: NS, not significant; TST, tuberculin skin test.

^b Data are presented in No. (%) or Mean \pm SD.

Table 2. Multivariate Analysis of Factors Associated With Positive Tuberculin Skin Test ^a

Variable	Patients, No.	Positive TST (n = 93)	Odds Ratio (95% CI)	P Value
Age, y				
< 26	22	-	reference	-
26-35	77	20 (26)	0	0.998
36-45	98	46 (46.9)	0.27 (0.12-0.58)	0.001
> 45	48	27 (56.3)	0.68 (0.34-1.32)	0.291
Duration of employment, y				
< 3	30	1 (33)	reference	-
3-10	88	25 (28.4)	0.02 (0.00-0.17)	< 0.0001
11-20	88	43 (48.9)	0.24 (0.11-0.54)	0.001
> 20	39	24 (61.5)	0.59 (0.27-1.28)	0.189
Occupation				
Clerical staff	10	3 (30)	reference	-
Nurse	112	30 (26.8)	3.09 (1.53-6.22)	0.002
Nurse aid	74	34 (45.9)	1.17 (0.28-4.82)	0.827
Ward attendant	49	26 (53.1)	2.32 (1.25-4.31)	0.008

^a Data are presented in NO. (%).

infection related symptoms and requested laboratory or radiologic investigations. Data were analyzed using SPSS statistical package, version 13. Student's t-test was used to compare the mean values of quantitative variables. Comparison of values of categorical variables was performed by chi-square test. The association between TST positivity and each factor was estimated through odds ratio (OR) and confidence intervals (CIs), using multivariate logistic regression analysis. A P value of less than 0.05 was considered statistically significant.

4. Results

Out of the 245 people included in this study, 93 (38%) had positive tuberculin test and among the test-positive group, 57 (61.3%) were male and 36 (38.7%) were female. The number of personnel with positive tuberculin-test, in different hospitals of Hamadan was as follows: 52/130 (40%) in Sina Hospital and 41/115 (35.7%) in Ekbatan Hospital, with no significant difference between the frequency of positive tuberculin skin tests between the staff of the two hospitals, while the mean age and length of employment was significantly higher in the positive-test group, compared to the negative-test group (Table 1). As shown in Table 2, the relative frequency of positive TST was directly related to older ages and to be more precise, the highest frequency was observed in the age group above 45 years. The same was noticed in those with more than a 20 year history of employment. TST positivity was observed with a higher rate in the ward attendants compared to the other HCWs. Among the positive TST cases, 56 people had an induration of more than 15 millimeters, while 4 individuals (7.1%) had relevant calcifications and fibrosis in chest X-ray. None of the mentioned cases had positive sputum for acid-fast bacilli and therefore, no patient with active pulmonary TB was found among HCWs.

5. Discussion

For several years TB has been identified as an occupational risk in HCWs. This risk may vary in different hospital staff, according to the frequency and severity of the contact with TB patients and mode of preventive measures (10). Nevertheless, there are no routine screening measures available for TB infection in HCWs in our country. In the present study, a relatively high prevalence (38%) of LTBI was observed in HCWs of two educational centers in Hamadan. Age, years of employment and job categories were found to be associated with LTBI. In these hospitals, patients with TB are admitted in all wards and healthcare personnel work in different wards and not fixedly in a specific ward, therefore it was not possible to assess the ward-specific risk of exposure to *Mycobacterium tuberculosis*. According to the studies in various regions of Iran, the prevalence of LTBI in HCWs, varies from 27% to 54%, depending on the number of workers and the rate of yearly admission of TB patients (11-13). The prevalence rate, found in our study,

was an average rate compared to the above mentioned literature.

According to a systemic review of 51 studies conducted by Joshi et al. (14), the prevalence of LTBI among HCWs in low- and middle- income countries (LMICs) was 54% (range: 33-79%), on average. Similarly, Menzies et al. (15) have reviewed the published literature regarding prevalence of TB among HCWs in countries, categorized by mean income. The median prevalence of LTBI in HCWs was 63% (range: 33-79%) in LMICs and 24% (range: 4-46%) in high-income countries. Accordingly, the prevalence of LTBI in HCWs of the studied hospitals is within the range of LMICs. Lack of concurrent data on LTBI prevalence in the population was one limitation to our study. However, according to the recent studies in general population, the average prevalence of LTBI in Iran has been estimated to be 8% (range: 1.5-16.5%) for adults (16, 17). Therefore, working in the studied hospitals appears to be associated with more than 4-fold risk of LTBI. In the present study, age and years of employment were associated with the risk of TB infection. These associations have been shown in other studies, as well (14, 18, 19). Several studies have reported a high prevalence of LTBI in nurses, a subgroup with a high level of patient contact and therefore a high potential of exposure to TB (14). Our study, however, showed the highest prevalence in the ward attendants compared to other HCWs. This difference may be due to the close contact of ward attendants with patients, without observing respiratory precautions and their lower level of education. Most studies have reported higher estimates of TB disease among HCWs, compared to the general population (15, 19, 20). However, no active cases of TB were observed in the studied population. Indeed, due to the poor preventive measures, the potential risk of acquiring TB, remains high for HCWs in the region under study. Based on the results of this study, it was concluded that TB is an occupational hazard among HCWs in Hamadan, Iran. Additional infection-control measures are necessary to reduce the possibility of transmission in hospitals.

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Authors' Contribution

Seyyed Hamid Hashemi and Nargess Alizadeh developed the original idea and the protocol, abstracted and wrote the manuscript; Mansour Nazari participated in study design and analyzed the data; Mojgan Mamani and Iraj Sedighi contributed to the development of the protocol, abstracted data and prepared the manuscript.

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No conflict of interest to declare.

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