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Pulmonary tuberculosis and diabetes mellitus: Co-existence of both diseases in patients admitted in a teaching hospital in the southwest of Iran

Abstract

Background: A number of former studies have shown that tuberculosis (TB) is higher in diabetes mellitus (DM) patients than non-diabetics. Both DM and TB are major public health problems in Iran, and because of the lack of investigation in this field in the region, we conducted this study to evaluate the prevalence of DM in admitted pulmonary tuberculosis patients.

Methods: The medical files of documented tuberculosis cases and DM patients hospitalized in Infectious Diseases Ward in Razi Hospital in Ahvaz, southwest Iran from 2008 to 2010 were reviewed. The study population was divided into 2 groups as DM-TB and non-DM-TB. The data in the two groups were compared.

Results: One hundred and forty eight TB cases [36 (24.3%) DM cases with the mean age of 56.6±12.7 years, and 112 (75.7%) non-DM with mean age of 44.8±18.3 years] were studied. The estimated odds ratio (OR) of the association between DM and tuberculosis was 2.65 [95% confidence interval (CI), 1.77 to 3.95], p<0.001]. There was significant difference in HIV infection, illicit drug use and imprisonment between the two groups (p<0.05).

Conclusion: We found that the frequency of DM in TB patients in the region is more prevalent than it was expected. Tuberculosis had positive association to DM. DM might be an important risk factor for developing tuberculosis.

Keywords: Co-morbidity, Diabetes mellitus, Tuberculosis.

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The World Health Organization (WHO) in 1998 estimated that the prevalence of diabetes mellitus (DM) among the adults worldwide will increase more than double from 135 million to 300 million by the year 2025. Majority of this population will be in the developing countries (1). The burden of diabetes in Iran, as illustrated by Iranian Center for Diseases was found as an important health problem with a high prevalence of diabetes (8%) and a large proportion (50%) of undiagnosed diabetes (2). WHO has declared tuberculosis (TB) a global emergency, with an estimated one third of the world's population infected with mycobacterium tuberculosis (3).

It is well known that there is an immune-suppression in DM due to impaired phagocytosis and cellular immunity. Previous studies have explained a positive association between DM and tuberculosis, especially in populations living in TB endemic area with a high incidence rates for DM (1, 3, 4).

In a study done in 2004, pulmonary TB was observed among 50% of the autopsied DM subjects (5). In another study, it was reported that 2.8% of the hospitalized diabetics had pulmonary TB. It was also said that tuberculosis was diagnosed in 1.6% diabetic children as compared to 0.12% among school children (6).

It was supposed that in countries with high prevalence of DM, the influence of this disease on tuberculosis could be equal to HIV (7, 8). A number of former studies have shown that developing TB is higher in DM patients than non-diabetics (9). However, due to controversial results in different countries, the positive association in most parts of the world and no association in some industrialized countries, the important role of DM as a main risk factor for TB is still unclear, although a recent report in Mexico concluded that 25% of pulmonary TB was attributable to DM (5, 10).

Both DM and TB are major public health problems in Iran (2, 11). So we conducted this study to evaluate the prevalence of DM in admitted pulmonary tuberculosis patients in Ahvaz, a city southwest of Iran.

Methods

This case-control study was carried out on 2124 admitted patients in a teaching hospital in Ahvaz city, southwest of Iran. The study population investigated included 250 DM and 1874 non-DM hospitalized in Infectious Diseases Ward from 2008 to 2010. The study was approved by the Research Council of Infectious Diseases Department in Razi Hospital affiliated to Ahvaz Joundishapour University of Medical Sciences.

In this study, there was no need for ethical approval. Demographic characteristics, medical history, imprisonment, HIV serology status, drug addiction, DM, and other study related data were gathered through medical charts. One hundred and forty eight TB patients including 36 DM –TB as cases and 112 non-DM-TB as controls were enrolled into the study. From the total TB-DM cases, two patients were type I and 34 were type II. The inclusion criteria for cases were documented as TB diagnosed based on the National Tuberculosis Program (NTP) (12).

The cases with at least two sputum smear positive for acid fast bacillus (SSP-AFB) or, a chest radiography suggestive of tuberculosis plus one SSP-AFB or, sputum culture positive for *M. tuberculosis* and one SSP-AFB were defined as pulmonary tuberculosis (PTB). The history of DM in the family and patient himself, anti diabetic drug user, amount of fasting blood sugar (FBS) were considered in DM case definition.

Patients were considered as diabetic if they had baseline diagnosis of DM, self reporting who were taking oral anti-

DM drugs (hypoglycemic), or FBS \geq 126 mg/dl or 200 mg/dl or more for random samples. The exclusion criteria were: age less than 15 years and incomplete data. To rule out the association between DM and related variables and the confounding factors such as age and sex, we statistically compared DM and non-DM individuals regardless of TB infection.

Statistical analysis: The data in the two groups (cases and controls) were statistically compared with SPSS version 16 using chi square test to compare the frequency of DM and t-test to compare the mean values in two groups. Odds Ratio for TB and DM patients was estimated with 95% confidence interval and a totally p values of <0.05 were considered significant.

Results

One hundred and forty eight of TB cases with the mean age of 49.3 ± 15.1 years including 36 (24.3%) DM cases with the mean age of 56.6 ± 12.7 years, and 112 (75.7%) non-DM with mean age of 44.8 ± 18.3 years were studied. From the total 1976 admitted non-TB patients, 214 (10.8%) were DM. The estimated odds ratio (OR) of the association between DM and tuberculosis was 2.95 (95% CI, 1.77 to 3.95, $p < 0.001$). TB related variables in DM and non-DM individuals are shown in table 1.

Demographic status, HIV and HCV co-infection and other data among DM-TB and non DM-TB patients are shown in table 2. There were significant differences in HIV infection, illicit drug use and imprisonment between the two groups ($p < 0.05$).

Table 1. Comparison of risk factors between diabetics and non-diabetics individuals admitted in hospital during the study

Variables	Diabetics N=250	Non Diabetics N=1874	pvalue
Age (mean \pm SD)	52.4 \pm 14.1	41.3 \pm 19.6	$p < 0.001$
Sex:			
male N(%)	130 (52%)	1032(55.1%)	0.360
Female N(%)	120 (48%)	842 (44.9%)	
Smoking	75 (30%)	643 (34.3%)	0.172
Illicit drug usage	12 (4.8%)	73 (3.9%)	0.493
Imprisonment	14 (5.6%)	81 (4.3%)	0.359
HIV/AIDS	8 (3.2%)	62 (3.3%)	0.928

Table 2. comparison of risk factors between diabetics and non-diabetics pulmonary tuberculosis admitted in hospital during the study

Variables	Diabetics N=36	Non Diabetics N=112	pvalue
Age (mean±SD)	56.6±12.7	44.8±18.3	0.001
Sex :			
Male N(%)	25 (69.4%)	55 (49.1%)	0.033
Female N(%)	11 (30.6%)	57 (50.9%)	
Smoking	15 (41.7%)	41 (36.6%)	0.586
Illicit drug usage	10 (27.8%)	14 (12.5%)	0.031
Imprisonment	14 (38.9%)	21 (18.8%)	0.013
HIV/AIDS	9 (25%)	11 (9.8%)	0.020

Discussion

To the best of our knowledge, the present study is virtually the first study of its kind in Ahvaz and probably in Iran. In this study as well as previous reports, DM is associated with pulmonary TB (10, 13). We showed that DM might be a more important risk factor for pulmonary TB than it was expected. We found that more than 24% of our tuberculosis patients were diabetic. Stevenson et al. in their study determined that DM accounted for 14.8% of incident TB in India (14).

A review of recent published reports showed that DM as a risk factor for TB indicated a variation of odds ratio in different areas, ranging from 1.23 to 6 (10). There is a potential explanation of the strong association between DM and TB in our study. Although, DM and non-DM individuals were similar in studied risk factors (except age), the existence of the risk factors such as smoking, HIV infection, imprisonment and illicit drug use in our patients might be responsible for the development of TB. A previous study in Ahvaz suggested that TB prevalence and its mortality were caused by imprisonment, IDU and HIV infection (11). Other studies have reported that TB is associated with illicit drug use and HIV infection (15, 16). Thus, the higher prevalence of DM in TB patients is likely to be higher among the patients due to their lifestyle such as nutrition condition related to addiction or imprisonment. Significantly, a higher prevalence of DM found in our study is therefore not surprising.

We found that TB was more prevalent in diabetic males than females. This is in agreement with previous studies

(17). Occupational status and habits such as smoking and illicit drug use which is prevalent in males in this area put them at a higher risk of infection and developing TB.

Iran is a developing country with young population. DM is projected to rise to 366 million globally by 2030 mostly in the developing countries (18). Thus, DM as comorbidity with pulmonary TB cannot be ignored. The finding that DM is an important risk factor for TB in our region has obvious TB control implication. A high prevalence of DM in TB patients requires high attention focused on DM control program in the population especially young people as well as TB patients.

This result, therefore, suggests that it is important for Iranian health policy makers to further develop strategies for controlling DM in order to reduce the impact of TB in Iran. Since our study is a hospital based study, it may be biased. This bias may result as an underestimation of the effect of DM on TB. Another source of bias included diagnosis of DM when we restricted our analysis to DM status in their medical files, however people with undiagnosed diabetes might be mistaken in our analysis. A further prospective study including large population of diabetics and non-diabetics is needed for determining DM as a risk factor for TB.

In conclusion we found that the frequency of DM in TB patients in the region is more prevalent than it was expected. Tuberculosis had positive association to DM and might be an important risk factor for developing tuberculosis.

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