Original article   http://dx.doi.org/10.1016/j.joad.2016.03.008

Clinical epidemiology and treatment findings of acute tuberculosis patients in Babol City (2009–2013)

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ARTICLE INFO

ABSTRACT

Objective: To examine the clinical epidemiology and treatment findings of tuberculosis in Babol, Northern Iran.
Methods: This cross-sectional study was carried out on medical records of tuberculosis registry pertaining to health center of Babol City, Mazandaran, Iran. The investigated variables included demographic characteristics and some clinical patterns of patients. To present the findings, the descriptive statistics such as mean (and SD) and frequency (%) was used. Analytical statistics was applied by using *Chi*-square test and independent samples *t*-test.
Results: The average age of 200 patients infected with tuberculosis was 47.51 years (SD = 21.36), and 58.5% of the cases were male. In both genders, the highest number of tuberculosis patient was found in 18–38 age group. During the 5-year study period, 95% of the patients received treatment protocol 1 (including new cases with positive smear, negative smear, extra-pulmonary) and in the end of treatment given to patients, 90.5% were improved or treatment period completed. The most important clinical symptoms for referring the patients to the therapeutic centers were cough (75.1%) and fever (60.9%).
Conclusions: Education and giving information to general population about the most important clinical symptoms of tuberculosis such as fever and cough might be effective in early detection and prevention of *Mycobacterium tuberculosis*. Then treatment might be effective in decreasing the burden of the disease.

1. Introduction

Infection with *Mycobacterium tuberculosis* (*M. tuberculosis*) causes tuberculosis (TB) in mammals such as humans[1]. This infection leads to substantial economic losses[2]. It is one of the main public health problems[3,4] which afflicted about one third of the world population[3]. This pathogenic agent is usually transmitted from those infected in the pulmonary forms to the others[5] and it is diagnosed by sputum samples test[6]. Prevalence of TB is associated with some epidemiologic factors like HIV/AIDS epidemics, low social and economic level, over-population and malnutrition[7,8]. According to several studies, the main identified risk factors of TB are age, gender, having positive or negative smear, direct observed treatment of cases by healthcare workers, the co-morbidity with HIV infection and diabetes mellitus[3,9–11].

From the global burden perspective, TB is in the tenth place and it is anticipated that this disease will stay in that place or even come to the seventh place until 2020. The main priorities in TB control

are decreasing its global prevalence to 50% of that in 1990 and decreasing TB associated deaths to one person in a million by the year 2050[12]. Technology development in developed countries, population rise, increased medical costs and the critical role of education in treatment of patients together with a good relationship with patients will lead to better treatment results[13,14].

In 2013, the prevalence of TB has been 21 people per one hundred thousand people in Iran[15–23]. The prevalence of TB in marginal parts of Iran like provinces of Sistan-va-Baluchistan, Khorasan, Mazandaran, Guilan, Western Azerbaijan, Eastern Azerbaijan, Ardabil, Kurdistan, Khuzestan and south costal parts is high and on the contrary in the central parts of the country it is low[24]. Provinces of Golestan and Sistan-va-Baluchistan have the highest incidence and prevalence of TB in Iran. The age group of 60–80 years old has the highest percentage of TB patients with the rate of 90.1%[16].

In order to control every disease, other than its surveillance, doing some cross sectional studies is needed to find out its epidemiologic pattern. Therefore, this study aimed to describe the clinical epidemiology of TB in Babol City during a 5-year period so that we will have an overview of TB pattern and provide some effective recommendations to improve the situation.

2. Materials and methods

2.1. Study design and sampling

This was a cross sectional study which was performed in Babol Health Centre from April 2009 to March 2013 using census sampling method. The study site, Babol, is located in the northern part of Iran on the costal line of Caspian Sea with humid climate.

In this study, data were collected from TB registry and according to patients' profile in the health centre. Patients' information has been collected and documented by experienced personnel of Babol Health Centre and under supervision of a physician who was the coordinator of TB control program. The study populations were all TB patients who were identified according to the flowchart approved by the Ministry of Health during the study period. The inclusion criteria were being a registered TB patient, being either Iranian or non-Iranian and having a complete medical profile and exclusion criteria were wrong TB diagnosis, uncompleted information in medical profile or migration from the city. Totally, 201 patients were registered during the 5 years study period and one patient was excluded due to incomplete profile. For the remaining 200 patients, questionnaires were filed according to the recorded information.

2.2. Study variables

The investigated variables included age, gender, education level, job, marital status, the living place and some clinical characteristics of patients like successful treatment (cured and completed treatment course) and unsuccessful treatment (incomplete treatment, treatment failure, death and migration), history of contact with a TB patient, apparent clinical symptoms at the time of coming to the health centre, type of treatment regimen, history of having TB risk factors, history of hospitalization, and the name of TB diagnosing centre.

The collected data was analysed by SPSS statistical software version 19. Descriptive characteristics of patients were presented by mean (SD) for normal quantitative variables and median and interquartile range for non-normal ones. Qualitative variables were also presented by frequency (%). To investigate the significance of associations between qualitative variables, we used *Chi*-square test and in case of limitation in the frequency of observations, we used Fishers exact test. We also used independent samples *t*-test to compare the means of qualitative variables with the assumption of equal variances. *P* value of less than 0.05 was considered as the significance level.

2.3. Ethic statement

The study protocol was performed according to the Helsinki declaration and approved by the institutional review board which is the Ethics Committee of Babol University of Medical Sciences. The TB patient's information was kept confidentially and informed written consent was obtained from all patients.

3. Results

Totally 200 TB patients were recruited in this study from 2009 to 2013. The mean age of patients was 47.51 years old (SD = 21.36) with the age range of 1–91 years old. The mean age of male and female was 50.04 (SD = 20.42) and 43.93 (SD = 22.25) years, respectively. There was a statistically significant association between patients' mean age and sex ($P = 0.04$). A total of 103 patients (51.5%) were living in urban areas. The details of some demographic characteristics of TB patients referred to Babol Health Center are summarized in Table 1. The highest rate of TB patients in both sexes was in age group of 18–38 years, followed by age group of > 60 years in male and 38–60 years in female (Table 2).

Table 1

The details of demographic characteristics of TB patients referred to Babol Health Centre (2009–2013).

Variables	Groups	Frequency (%)
Gender	Male	117 (58.5)
	Female	83 (41.5)
Living place	Urban	103 (51.5)
	Rural	97 (48.5)
Marital status	Married	160 (80.0)
	Single	35 (17.5)
	Others	5 (2.5)
Education	Illiterate or primary school	105 (52.5)
	Under high school	50 (25.0)
	High school and academic	45 (22.5)
Job	Farmer	30 (15.0)
	Jobless	21 (10.5)
	House wife	58 (29.0)
	Others	91 (45.5)

Table 2

The age group and gender of TB patients referred to Babol Health Centre (2009–2013).

Age groups	Frequency (%)		P
	Male	Female	
< 7	1 (0.9)	4 (4.8)	0.005
7–18	1 (0.9)	6 (7.2)	
18–38	50 (42.7)	28 (33.7)	
38–60	22 (18.8)	25 (30.1)	
> 60	43 (36.8)	20 (24.1)	

During the 5 years of study, only 3 patients (1.5%) were diagnosed to have AIDS. From the perspective of risk factors of AIDS in TB patients, 37 patients were tested for HIV including 9 prisoners (23.7%), 1 prisoner's spouse (2.6%), 5 with the history of drug injection. In addition, 22 (57.9%) patients were tested in the national screening program. A statistically significant association was observed between job and having AIDS ($P = 0.001$). There was also a significant association between age and AIDS risk factors ($P = 0.001$). The places of diagnosing these patients were as follows: 140 (70%) in government hospitals, 23 (11.5%) clinics, 21 (10.5%) health centres, 12 (6%) self-reporting, 3 (1.5%) private hospitals and 1 person (0.5%) was diagnosed in prison. In addition, 46 patients (23.5%) reported the history of contact with a TB patient. The TB contact history of patients according to the time is presented in Table 3.

Table 3

History of contact with a TB patient.

Frequency of history of contact in years	Frequency (%)
< 2	15 (32.6)
2–5	11 (23.9)
> 5	20 (43.5)

In this study, according to the national guideline, only for 6 qualified patients the antibiogram test was done, and of them, 5 patients (2.5%) showed sensitivity to the drug and 1 patient (0.5%) showed no sensitivity. Table 4 shows the distribution of therapeutic services among TB patients according to the treatment protocol. Adverse effect of drugs was reported in 15 (7.5%) patients. According to the treatment results, the majority of patients who had died due to TB or other causes and also cases of treatment failure and treatment cut, were in treatment Group 2 (Figure 1).

Table 4

Distribution of treatment services among TB patients referred to Babol health centre (2009–2013).

Treatment groups	Patients under treatment	Intensive phase	Continuation phase	Frequency (%)
1	New patients with: positive smear test, negative smear test, extra pulmonary TB	HRZE 2 months or HRZS 2 months	HR 4 months	190 (95)
2	Relapse or treatment failure and others	HRZES 2 months and then HRZE 1 month	HRE 5 months	10 (5)

H: Isoniazid; R: Rifampin; Z: Pyrazinamide; E: Ethambutol; S: Streptomycin.

The early symptoms of TB in the studied population included cough [131 (66.2%)], fever [19 (9.6%)], asthma [7 (3.5%)] and neck oedema [6 (3%)]. In addition, cough and fever were the main causes of referring to the health centre. The frequency of other symptoms is shown in Figure 2. In the studied population, 103 patients (51.5%) had the history of hospitalization before their TB diagnosis. In patients with the history of TB related risk
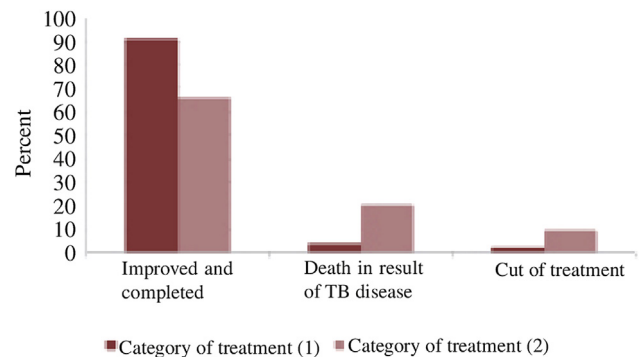
Figure 1. Comparison of treatment results among two groups of TB patients referred to Babol Health Centre (2009–2013).
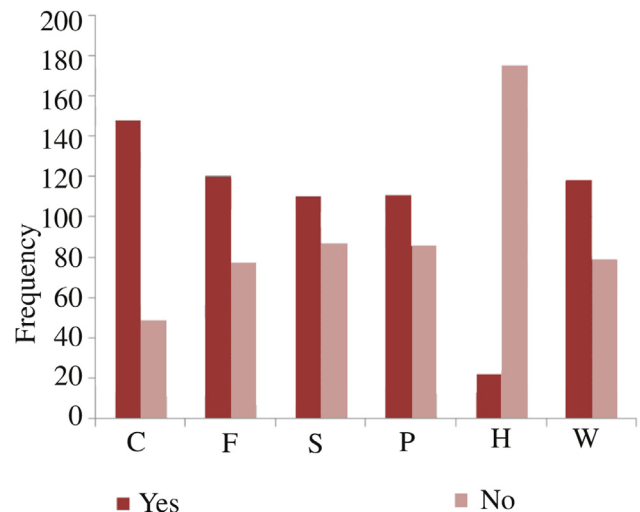
Figure 2. Frequency of apparent clinical symptoms leading to referral to Babol Health Centre (2009–2013).
C: Cough; F: Fever; S: Sputum; P: Perspiration; H: Haemoptysis; W: Weight loss.

factors, 29 (14.5%) had diabetes, 8 (4%) drug injection, 4 (2%) cancer and 10 (5%) had other diseases.

4. Discussion

According to the study findings, age group of 18–38 years old had the highest number of TB patients in both genders, followed by age group of > 60 years in male and 38–60 years age group in female. A statistically significant association was observed between variables of age and gender (Table 2). In a study of Khazaei *et al.* in Hamedan Province, Iran, age group of > 60 years old had the highest number of TB patients[17]. In a study conducted by Gholami *et al.* in Urmia City, Iran, most of TB patients were in age group of 31–40 years old[18]. In most of the studies conducted in Iran, the highest number of TB patients has been in > 60 years old age group[16,19]. It seems that the high number of TB patients in 18–40 years old age group is due to the higher population of this group in comparison with other age groups, or maybe it is due to some issues like high rate of addiction in the province and referring the patients from all existing camps in the province to the health centres. In age group of > 60 years old, weakness of immune system and having contact with children and other family members increase the risk of opportunistic infections

such as infection with *M. tuberculosis* and that's why TB is more prevalent among them.

In this study, men constituted a high proportion of TB patients. In a study by Babamahmoodi *et al.* conducted in Northern Iran, the TB incidence rate was higher in men as well[20]. Generally, according to the studies conducted in Iran, the number of TB patients in men is more than women[21,22]. It seems to be due to the genetic factors, nutrition, frequency of men out of home and job related factors.

Results of this study show that most of the TB patients have been diagnosed in governmental hospitals, clinics and health centres. In study by Hassanzadeh *et al.*, governmental hospitals, clinics and private hospital had the highest report of diagnosis[4]. In another study conducted by Masjedi *et al.* in Tehran, the percentage of TB diagnosis by private sector was 87.3%[23]. According to the findings of the mentioned study, there is a weak relationship and coordination between governmental systems and private sector[23]. Having the highest reports of TB diagnosis from governmental hospitals shows that TB patients have passed from the first level of health care services without being diagnosed and for diagnosis or hospitalization they have been referred to the hospitals and in this process, the time between onset of symptoms and diagnosis will be longer. Therefore it is recommended that health houses and health centres as the first levels of providing health services to people do require actions for early diagnosis of patients.

In this study, a statistically significant association was observed between job and having AIDS and also between age and AIDS risk factors ($P = 0.001$). In study of Khazaei *et al.*, the highest number of TB and HIV cases which were mostly found in male was observed in 31–60 years old age group (90.7%) with the mean age of 36.2 years old[17].

According to the treatment results, totally 90.5% of TB patients were in the cured and completed treatment course group (Category of treatment 1) (Figure 1). Another study in the Babol City reported that 90% of TB cases had completed the treatment course and improved[25]. In Golestan Province, Iran at the beginning of 5th month of treatment, the rate of treatment failure in direct observed treatment strategy (DOTS) group was 1.7% while the rate of treatment failure in control group was 7.3%. Therefore a significant correlation between treatment strategy and treatment failure rate was observed[26]. In a study conducted to compare the efficacy of family based DOTS with professional-family mix DOTS in Tabriz City, in 2 and 4 months periods, professional-family mix DOTS had better efficacy[27]. Studies conducted all around the world have shown that implementation of DOTS may promote treatment success up to 90%–95%[28,29]. In a study conducted in Iranian capital city (Tehran), it was estimated that the mean costs for a TB patient include 28 467 737 Rials (2 588 US Dollars) for direct medical costs, 1 011 360 Rials (92 US Dollars) for indirect medical costs and 5 533 020 Rials (503 US Dollars) for other indirect costs. Since high costs of TB treatment are usually imposed on families during the first 2–3 months, this may lead to the reduction in the quality of their lives[30]. There are many factors causing treatment delay and treatment failure including lack of compliance to the treatment protocol, improper nutrition during treatment, wrong treatment regimen, delayed treatment, problems in drug distribution, lack of timely supervision and correct advice on the way of taking drugs[27,31]. According to the mentioned points, the treatment status in cured and completed treatment group in Babol City is better than that has been reported in other studies.

The rate of adverse effects of medicines in this study was 7.5%. In study of Farazi *et al.*, acute side effects and mild side effects were observed in 17.6% and 82.4% of the patients, respectively[31]. A study of Ayatollahi and Khavandegaran in Shiraz City, Iran reported that 29.5% of TB patients had mild and 5.2% had acute drug adverse effects[32]. In a study conducted in Guilan Province, Iran, almost 27.3% of TB patients reported more than one drug side effect. Their side effects included liver failure (48.2%), ocular complications (1.7%), intestinal complications (82%) and dermal complications (5.3%)[33].

According to the results of this study, the most prevalent symptoms in TB patients were cough, fever, sputum and weight loss which are the most important signs for TB diagnosis. This result is consistent with those of other studies in Iran in which cough has been the most prevalent symptom in TB patients[34–36]. In study by Alavi *et al.* in Ahvaz City, Iran symptoms of cough, fever and sweating at night in diabetic patients with TB were the same as those in non-diabetic TB patients, but having sputum, haemoptysis and dyspnoea were more prevalent among diabetic TB patients in comparison with non-diabetic ones[37]. In a study the more the age, the less the body mass. Also the response to the tuberculin test was significantly correlated with tuberculosis clinical symptoms[38]. These symptoms may be emphasised in training for the society. Health care worker should consider TB as soon as they see these symptoms in a patient and do the needed actions. In addition, these patients should be screened in TB high risk group for early diagnosis.

About one fourth of patients in this study had reported the history of contact with a TB patient. In a study, more than 50% of patients had the history of contact with a TB patient in the past time[20].

In this study, 14.5% of TB patients had diabetes mellitus. In another study, 9.5% of TB patients were diabetic[20]. The probability of TB treatment failure in patients having TB and diabetes concurrently is higher[39]. The weakness of immune system in patients with TB and diabetes is associated with some factors such as reduction in the activity of alveolar macrophages and decreased ability in producing interleukin[40,41]. Therefore case finding among high risk groups like diabetic patients is recommended.

A limitation of this study was the access to the medical reports of patients only. In addition, due to the probability of under reporting, the incidence rate is not calculated.

Based on the results of this study, it is needed to inform people about main clinical symptoms of TB such as cough and fever to diagnose and treat it as soon as possible and prevent the spread of *M. tuberculosis* in the society. Of course having effective treatment is very important. Active screening by health care workers in TB high risk groups and symptomatic patients and evaluation of barriers of implementing the preventive and therapeutic programs in the society is emphasized.

Conflict of interest statement

The authors report no conflict of interest.

Acknowledgment

of a research project registered with the number of 9338811 in Babol University of Medical Sciences. This study was supported by the Health Research Centre, Babol University of Medical Sciences.

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