

Screening tuberculosis in the Sistan region of Iran: A Population-Based Study

Mosayeb Shahryar¹, Abbasali Niazi² and Behzad Narouie^{3*}

- 1: Department of Internal Medicine, Infectious Diseases & Tropical Medicine Research Center, Zahedan University of Medical Sciences, Zahedan, Iran
2: Department of Pathology, Infectious Diseases & Tropical Medicine Research Center, Zahedan University of Medical Sciences, Zahedan, Iran.
3: Researcher of Clinical Research Development Center, Ali-Ebne-Abitaleb Hospital, Zahedan University of Medical Science, Zahedan, Iran.

*Corresponding Author:

Behzad Narouie (MD); General Practitioner, Researcher of Clinical Research Development Center, Ali-Ebne-Abitaleb Hospital, Zahedan University of Medical Sciences, Zahedan, Iran
Email: b_narouie@yahoo.com Telefax: +985413414103

Abstract: Estimation of the prevalence of tuberculosis is one of the most important needs for the provision of health services in Iran. In this study, we investigate the prevalence of pulmonary tuberculosis in the Sistan region of Iran. A cross-sectional study was carried out during 2010 in the Sistan region of Iran. Sistan has a total population of 410,713, including 50,322 families. 21,645 of these individuals (or 5.27%) have a history of chronic cough (a cough lasting more than 2 weeks) based on our survey. Individuals who were suspected of having tuberculosis were referred to the district health center. For each case, diagnostic procedures including physical examination of the chest for evaluation of Bacillus Calmette-Guérin status, obtaining of 3 sputum smear samples, and radiography of the chest. Of 410,713 individuals, 6250 (or 1.52%) demonstrated scarring typical of BCG, and chronic cough was confirmed via clinical workup in 8140 participants. Among these participants, 4034 (0.98% of the Sistan population) presented with productive cough; sputum specimens were taken from this group. Chest radiographs showed characteristic pulmonary tuberculosis lesions in 27 (6.58%) of 410 patients in whom radiography was performed on the basis of clinical findings. Seven patients were identified as having tuberculosis through sputum smears; five other patients were found to not have tuberculosis via this method. With respect to the different types of diagnostic methods used, the differences among them for positive predictive value, specificity and sensitivity were significant ($p < 0.05$). The likelihood ratio for chest radiography was also significantly greater than that for the sputum smear method (33.31 versus 19.1; $p < 0.05$). Only 276 of the patients with pulmonary Tuberculosis were identified via Health Service System (HSS) screening method in Sistan, and the rest were diagnosed through recent study. Our findings suggest that the diagnostic power of chest radiograph is more than sputum smear; however, we think the HSS method for taking sputum was not a controlled one.

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Introduction:

Tuberculosis continues to be a major clinical problem in specific populations world-wide. During the last two decades, a troubling, marked increase in drug-resistant strains of *Mycobacterium tuberculosis* (MTB) has been seen, further complicating the course and treatment of this disease.

Tuberculosis is of particular concern in low and intermediate income countries such as Iran (1). In Sistan, the annual incidence rate of TB was 96 cases per 100,000 population in 2005, 7 times higher than in the general population in Iran (2). The World Health Organization (WHO) recommends the DOTS strategy (for “directly observed treatment, short course”) to

combat TB in most high-income countries (3). For case finding, integration of active and passive discovery of cases is recommended, with a priority placed on detection of infectious cases (4, 5).

Chronic cough (>2 weeks duration) is an important symptom in the diagnosis of pulmonary tuberculosis. This symptom could be used as a screening index in the evaluation of TB prevalence in specific communities. In Zabol, however, even though the incidence rate of smear-positive pulmonary TB, miliary TB, and TB meningitis had apparently decreased the real incidence and prevalence of tuberculosis in this area is still unknown (3).

Before 1990, vaccination with BCG was not mandatorily given in Iran, and the annual risk of tuberculosis infection was estimated at 0.5-1%. These days, vaccination of ARTI is almost impossible (5, 6). Sistan is a region in the Sistan and Baluchistan province in eastern Iran (population, 410,713). The aim of this cross-sectional study was to compare the diagnostic value of chest radiograph with sputum smear as screening methods for TB in patients with chronic (>2 weeks duration) cough(7, 8).

Materials and methods:

A total of 50,322 families were interviewed (410,713 individuals) for this study. Individuals experiencing cough of >2 weeks duration were eligible for this study during 2010. Those with suspected tuberculosis were referred to the District Health Center. For each individual enrolled in the study who was suspected of having tuberculosis, the following diagnostic procedures were performed: physical examination of the chest, determination of BCG status through inspection for typical scars, and obtaining of three sputum specimens for laboratory submission; in the lab, these samples underwent microscopy examination and Ziehl Nielsen staining. The quality of the laboratory examinations was controlled by the central laboratory in Zabol, in the center of Sistan. Whether chest radiographs were obtained was left to the discretion of the physician. For cases in which radiographs were obtained, the films were read independently by two radiologists who were aware of the subject's signs or symptoms. Disagreements on interpretation of the radiographs were settled by consensus between the two specialists who read them at first primary care physician and then radiologists read the CXR.

After performing the aforementioned steps, all diagnosed pulmonary TB cases were registered in the study and referred to public health services for standard treatment. The diagnosis of tuberculosis was based on a combination of clinical findings, laboratory reports and response to treatment. Data analyses were performed using SPSS z-tests (SPSS/IBM, Armonk, NY, United States) to compare the sputum smear tests with radiography with respect to positive predictive value, negative predictive value, specificity, and sensitivity.

Results:

Of the 410,713 individuals initially included, 21,645 (8213 female and 13,432 male) had a history of more than 2 weeks' cough. Of these 21,645 individuals, 6250 had scarring that was typical of BCG. Chronic cough was confirmed in 8140 participants through clinical workup. Additionally, seven new pulmonary TB cases

were diagnoses through direct microscopy examination of sputum smear samples. (Table and Figure 1) Chest radiography suggested the presence of pulmonary TB in 27 cases; seven of these had positive sputum smears, 10 had negative sputum smears, and 10 had old TB lesions. Five of these 27 patients had no history of pulmonary TB. (Table 2) Sensitivity, specificity, PPV, NPV, and the likelihood ratio for sputum smear samples and chest radiography are shown in. (Table 3)

Discussion:

The reported incidence of pulmonary TB is lower in comparison with the actual incidence of disease in Sistan shown during this the study. 5270 individuals presented with chronic cough; 4034 of these presented with positive cough, and 0.173% of these were smear positive (7 of 4034). A similar study in Iran indicated that 1.5% of these types of cases had sputum smear samples that were positive for TB. Another study showed that 20% of cases with chronic cough had smear samples that showed the presence of TB (10). In Sistan in 2010, the prevalence of pulmonary TB and smear-positive pulmonary TB was 96 and 67 per 100,000 population, respectively.

During the present study, all of those with positive sputum smear samples presented clinically with anorexia and weight loss. Fever, cough, and weight loss have been reported as the most common symptoms of pulmonary TB in different studies (9, 11, 12). However, fever and chronic cough were not sensitive enough for adequate TB diagnosis in some studies (13). Overall, chest radiography has greater diagnostic ability than does sputum smear samples (9, 14); this was confirmed again in the present study, which found that chest radiography is significantly better than sputum testing for the diagnosis of TB.

The use of radiography for diagnosis of pulmonary TB has some limitations. Considering active pulmonary TB, 46.4 of suspected patients had positive results on chest radiography (active disease or old TB lesions). Of total tuberculosis cases and suspected cases, active disease was identified in 44.4% of them by means of chest radiography; 25.9% had positive results via sputum microscopy/laboratory examination. Annual incidence of pulmonary TB and the incidence of TB as shown on smear samples were 100 and 19.3 per 100,000 populations, respectively. The Iranian Health Service System identified 67 smear-positive cases of TB in 2006, while the recent study identified 12 additional cases with pulmonary tuberculosis at the same time. Therefore, the Health Service System only identified 90.54% of patients with tuberculosis. In our opinion, the only key for diminishing this difference is revising the application of diagnostic tools.

Conclusion Our findings suggest that the diagnostic power of chest radiograph is more than sputum smear; however, we think the HSS method for taking sputum was not a controlled one.

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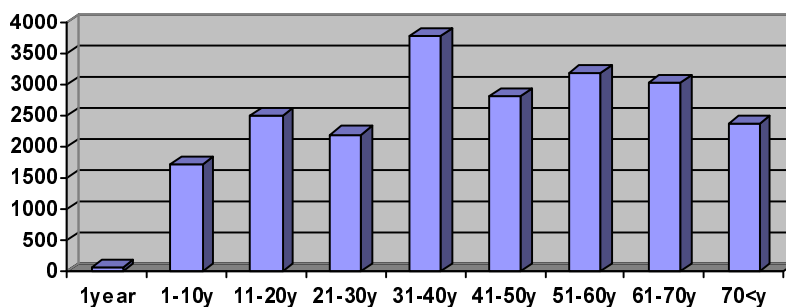


Figure 1. Frequency distribution of chronic cough in different age groups, Zabol, in 2010.

Table1. Results of sputum – smear direct microscopy

Productive cough	Sputum- smear		
	Total	positive	negative
4034	3670 (90.9%)	7(0.19%)	3663(99.81%)

Table2. Radiologic finding of patients with chronic cough

Lesion	Number of patients
Compatible with pulmonary TB	27(6.6%)
Non-Tuberculosis	190(46.4%)
Heart and alveolar lesion	14 (3.4%)
Non specific	20(4.9%)
Normal graph	159 (38.7%)
Total	410(100%)

Table3. Statistical comparison between sputum smear and chest X-ray

	Sputum smear	Chest X-ray	P value
sensitivity	57.7	96	0.00
specificity	100	85	0.023
PPV	100	54	0.00
NPV	9.1	100	0.11
Likelihood ratio	19.1	33.31	0.00