

## Original Article

# Radiological Dependence in Diagnosis of Pulmonary Tuberculosis

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### Abstract

**Introduction:** Diagnosis of tuberculosis under the National Tuberculosis Control Program (NTCP) is based on microscopic examination of sputum. The main objective of this study was to assess the perception of physicians and patients regarding the importance of chest X-ray in diagnosing pulmonary tuberculosis with a view to suggest corrective measures.

**Materials & Methods:** One hundred and eighty three consecutive patients reporting at the Nikopoor Tuberculosis Center under the National Tuberculosis Control Program were questioned in detail through a specially designed semi-structured questionnaire.

**Results:** Of all patients, 145 (79.23%) had already taken a chest X-ray before attending the Center, either for medical advice or on own initiative, but only 37 (19.66%) had been sputum examined. Apart from these 145 patients, another 38 (15.63%) had to have their chest X-ray taken at the Center according to NTCP. Thus, 100%, in all, had to be examined radiologically.

**Conclusion:** Physician's belief that chest X-ray is the most important initial investigation of pulmonary tuberculosis needs a change or else the NTCP's curtailing of radiological examination will become meaningless.

**Keywords:** Radiology; Mass Chest X-Ray; Tuberculosis, Pulmonary; Diagnosis; Diagnosis/radiography

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## Introduction

Tuberculosis (TB), one of the oldest diseases known to affect humans and likely to have existed in pre-hominids, is a major cause of death worldwide <sup>[1]</sup>. The incidence and prevalence of TB are very different in various parts of Iran and also throughout the world <sup>[2]</sup>. This disease is caused by bacteria of the *Mycobacterium tuberculosis* complex and usually affects the lungs, although other organs are involved in up to one-third of cases. If properly treated, TB caused by drug-susceptible strains is curable in virtually all cases. If untreated, the disease may be fatal within 5 years in 50–65% of cases. Transmission usually takes place through the airborne spread of droplet nuclei produced by patients with infectious pulmonary TB. The key to the diagnosis of TB is a high index of suspicion.

The National Tuberculosis Control Program (NTCP) was launched in Iran to overcome some of the adverse factors considered responsible for the failure of the earlier National Tuberculosis Program to make an epidemiological impact. For example, there was over-dependence on radiology and under-use of sputum smear for the diagnosis of pulmonary tuberculosis <sup>[1]</sup>.

Diagnosis of pulmonary tuberculosis under NTCP is based on sputum examination by microscopy. However, the perception among physicians and general public persists that chest radiography is the most important tool for diagnosis of pulmonary tuberculosis <sup>[3]</sup>. Often, it is observed that patients referring to the Center, since they did not get relief from cough and expectoration for a

considerable period, bring along X-ray of the chest taken outside, either on the advice of a physician or on their own initiative.

The purpose of this investigation was to assay the perception of physicians and patients regarding the importance of radiological survey in diagnosing pulmonary tuberculosis with a view to suggest corrective measures.

## Materials & Methods

Nikopoor Tuberculosis Center is an urban tuberculosis centre giving service to a population of approximately 0.7 million in central Iran. In the domiciliary area of the Center, NTCP is being implemented since 1997, and is fully operational, with 7 sub-centers established to provide DOTS (Directly Observed Treatment Short course) treatment facilities under NTCP.

Patients diagnosed and registered under NTCP for DOTS treatment formed the study group. Diagnosis was based on history and sputum microscopy and they were placed in one of the following three treatment categories before the start of the survey <sup>[3]</sup>.

Category I- Newly diagnosed, sputum smear positive cases, seriously ill sputum smear negative or extra-pulmonary cases

Category II- Sputum smear positive cases, failure, relapse or “re-treatment after default” cases

Category III- Sputum smear negative, pulmonary and extra-pulmonary cases (not seriously ill)

One hundred and eighty three consecutive pulmonary tuberculosis patients were registered, under NTCP, during the period between 2008 and

2012. The patients were subjected to a personal interview and were interrogated in detail. This study conducted a cross-sectional research design. A specially designed structured questionnaire was filled up for each patient. The patients, who had brought with them chest X-rays taken before referring to the Center, were interrogated regarding the investigations carried out on the advice of general practitioners, specialists or on their own initiative.

## Results

Out of the 183 patients studied, 89 (48.63%) were males and 94 (51.36%) were females. Mean age of the patients studied was 50 years in males

and 46 years in females. A total of 30.60% was referred voluntarily, 39.89% were referred by general physicians while those referred by specialists comprised another 29.50%.

A survey done before referring to the Nikopoor Tuberculosis Center is shown in Table 1. A total of 79.23% patients had a radiological examination of chest prior to reporting at the Center. Out of these, only 18.03% had sputum examination in addition to the radiological examination.

Of the 145 patients who were referred with chest X-ray, 53.79% were advised to get X-ray done by general practitioners and 46.89% of specialists. Only 4.13% of the patients got themselves X-rayed on their own (Table2).

**Table 1.** A survey done before referring to the Nikopoor Tuberculosis Center according to NTCP categories

Investigation	Category 1	Category 2	Category 3	Total (n=161)
X-ray chest alone	89	2	21	112(61.20%)
X-ray chest + sputum examination	27	1	5	33(18.03%)
Sputum examination alone	4	0	0	4(1.63%)
None	14	3	17	34(14.20%)

**Table 2.** Sources of advice to get chest X-ray before referring to Nikopoor

Advised by	Category 1(N=116)	Category 2(n=2)	Category 3(n=26)	All (n=145)
Self	4	1	1	6(4.13%)
General practitioners	61	1	16	78(53.79%)
specialists	52	0	9	68(46.89%)

In addition to 79.23% patients who came with radiological examination from outside, another 20.77% required chest X-ray at Nikopoor Tuberculosis Center as a complementary examination, in addition to sputum examination, to arrive at a diagnosis according to the guidelines of the National TB Control Program.

## Discussion

“The Tuberculosis and Leprosy Control” of the Ministry of Health and Medical Education in Iran together with WHO reviewed National Tuberculosis Control Program in 1992 and concluded that it had various failures. One of these was over-reliance on chest X-ray [2]. The National Tuberculosis Control Program depends on a smear of sputum examination for diagnosis of pulmonary tuberculosis, which is more practicable, inexpensive, quick, simple, and an effective case-finding method for developing countries. The success of the sputum microscopy depends on three important factors i.e. proper smearing, proper staining and proper scanning [4, 5]. Under the National Tuberculosis Control program, all symptomatic cases are required to get three sputum specimens examined by high-quality microscopy for diagnosis.

However, scanty positive cases can not be all detected by microscopy, as the number of bacilli required for microscopy to be positive is enormous. Zeihl-Nelson staining is unlikely to give a positive result if the number of the acid fast bacilli is less than 5000 per ml [6, 7]. There must be 105 bacilli per ml of sputum to get a consistent

positive result in the direct smear examination. A sputum specimen with a concentration of  $10^4$  colony forming units (CFU) is more likely to result in a positive smear while a negative smear result is likely if the count is lower [8, 9]. Examination of three sputum specimens, no doubt, increases the diagnostic yield but there is always a possibility of missing the cases if the number of bacilli is scanty, which is the main reason for dependence on radiology among physicians including general physicians and specialists.

In spite of evidence of tuberculosis lack in more than half of smear negative cases under treatment, radiology is a primary way of diagnosis among physicians [2]. In one study in India most of a group of 143 private physicians, who dealt regularly with tuberculosis cases in their private practice, heavily depended on chest X-ray [10].

Radiology is still a beneficial method for identification of tuberculosis types. It is used in children tuberculosis where sputum is often negative. It is also used in the diagnosis of miliary tuberculosis, smear negative pulmonary tuberculosis and extra-pulmonary tuberculosis [11-13].

There is a rule about radiological investigation in the National Tuberculosis Control protocol that is used when the sputum samples are negative and the patients have not any sign from a good status after treatment by antibiotics for two weeks. However, radiology is a secondary complementary way to consequential smear microscopy.

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