

Clinical Characteristics Differentiating Bacteriologically Positive Pulmonary Tuberculosis Patients from Negative Ones in Mongolia

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The objective of this study is to clarify clinical characteristics which differentiate bacteriologically positive pulmonary tuberculosis patients from negative ones in Mongolia. The subjects include 338 patients aged 16 years and older who had undergone bacteriological examinations. Of them, 107 patients (31.7%) were confirmed bacteriologically. The proportion of bacteriological positive results increased significantly among patients who had cavities in the roentgenographic examination, cough at diagnosis and the family history of tuberculosis. Addressing these clinical characteristics will contribute to raising not only the sensitivity of the sputum examination, but also the specificity of the roentgenographic examination in the diagnostic process of tuberculosis. *J Epidemiol*, 1998 ; 8 : 90-93.

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Mongolian tuberculosis control program, which was influenced by that of the former USSR, laid weight on findings of roentgenographic examinations in diagnosing pulmonary tuberculosis. The proportion of bacteriologically positive cases among newly registered pulmonary tuberculosis patients was less than 10 %. The WHO anti-tuberculosis strategy which weighs heavily in performing sputum examinations (85 % cure rate of all sputum positive patients under treatment and 70% case detection)¹, was introduced into Mongolia in 1994. Since then, the proportion of bacteriologically positive cases is increasing. However, physicians still rely on the roentgenographic examination in the diagnostic process of tuberculosis. Therefore, for factors influencing the low rate of confirmation of bacteriologically positive cases, we have to address not only the presence of patients with active tuberculosis who show the false-negative results in the bacteriological examination, but also the presence of patients with inactive tuberculosis whose disease was diagnosed based on the radiographic findings². The former issue is accounted for by the low sensitivity of the sputum smear examination. The latter issue has to do with the specificity of the roentgenographic examination. Since the

common roentgenographic examination used in Mongolia is a 60-mm-square film with a limited quality, the low specificity of the radiography is a unique issue which has to be addressed in the tuberculosis control program of Mongolia. Measures should be taken to make both the sputum examination and the roentgenographic examination more accurate. If physicians address characteristics of patients who are likely to have active tuberculosis in the diagnostic process, not only the sensitivity of the sputum examination, but also the specificity of the roentgenographic examination increases. The objective of this study is to clarify clinical characteristics which differentiate bacteriologically positive pulmonary tuberculosis patients from negative ones.

MATERIALS AND METHODS

The eligible subjects of this study are pulmonary tuberculosis patients who were newly registered at the nine specialized tuberculosis facilities in Ulaanbaatar, Mongolia from May 1995 to March 1996. A total of 483 patients were registered during the study period. Of them, patients aged 15 years and

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younger (N =119) were excluded because most of them were diagnosed without undergoing a bacteriological examination. Of 364 pulmonary tuberculosis patients aged 16 years and older, those who had not undergone a bacteriological examination (N=20) and those with unknown dates of initial symptoms (N = 6) were excluded. Therefore, this study included 338 patients aged 16 years and older who had undergone a bacteriological examination.

A skilled medical staff of the Center for Tuberculosis of Mongolia visited facilities where eligible patients were registered and interviewed them within a few days after commencement of treatment. In the interview survey, each patient was asked demographic factors such as age and sex, family history of tuberculosis, past history of tuberculosis and symptoms when the diagnosis was confirmed. Each patient's medical record was reviewed to obtain the duration of total delay, i.e. the time interval from the onset of symptoms until the start of treatment under proper diagnosis, the result of the bacteriological examination and the findings of the roentgenographic examination.

RESULTS

The number of male subjects was almost equal to that of female subjects. The average age of the study subjects was 33.4 years old. For the bacteriological examination, 328 patients (97.0%) underwent only a direct smear examination, and 10 patients (3.0%) underwent both a smear examination and a culture examination. A total of 107 patients (31.7%) were confirmed bacteriologically. Of them, 106 patients were positive in the direct smear examination and one patient was demonstrated in the culture examination only. For the roentgenographic examination, 325 patients (96.2%) underwent chesty radiography, and 13 patients (3.8%) underwent only fluoroscopy.

Table 1 shows the association between the bacteriological positive result and study variables. The proportion of bacteriological positive cases increased significantly when patients had the past history of tuberculosis, the family history of tuberculosis, cough and sputum at diagnosis, a total delay of more than three months and cavities found in the roentgenographic examination.

Table 2 shows the results of multiple logistic regression analyses in relation to the bacteriologically positive finding.

Table 1. Proportions of bacteriological positive by study variables.

Variable	Category	Total	Bac pos † No. (%)
Sex	Male	175	58 (33.1)
	Female	163	49 (30.1)
Age (years)	≤29	177	54 (30.5)
	30-80	161	53 (32.9)
Past history of tuberculosis	Present	34	16 (47.1) *
	Absent	304	91 (29.9)
Family history of tuberculosis	Present	46	22 (47.8) *
	Absent	292	85 (29.1)
Cough at diagnosis	Present	249	92 (36.9) **
	Absent	89	15 (16.9)
Sputum at diagnosis	Present	118	47 (39.8) *
	Absent	220	60 (27.3)
Cavities in X-ray examination	Present	84	50 (59.5) **
	Absent	254	57 (22.4)
Total delay	≤3 months	191	51 (26.7) *
	>3 months	147	56 (38.1)

† Bac pos: bacteriological positive.

* $p < 0.05$ ** $p < 0.01$ (Chi-square test)

Table 2. Results of multiple logistic regression analyses in relation to bacteriologically positive findings.

Variable	Category	Model 1)		Model 2)	
		OR	95%CI	OR	95%CI
Sex	Male	1.08	0.83-1.40	1.09	0.85-1.39
	Female †	1.0		1.0	
Age (years)	≤ 29	0.97	0.75-1.26	0.95	0.75-1.22
	30-80 †	1.0		1.0	
Past history of tuberculosis	Present	1.36	0.91-2.03	1.38	0.94-2.03
	Absent †	1.0		1.0	
Family history of tuberculosis	Present	1.47*	1.03-2.11	1.45*	1.04-2.03
	Absent †	1.0		1.0	
Cough at diagnosis	Present	1.64**	1.16-2.33	1.62**	1.16-2.25
	Absent †	1.0		1.0	
Sputum at diagnosis	Present	1.07	0.81-1.41	1.16	0.90-1.50
	Absent †	1.0		1.0	
Cavities in X-ray examination	Present	2.27**	1.71-3.00		NA
	Absent †	1.0			
Total delay	≤ 3 months	1.25	0.96-1.62		NA
	> 3 months †	1.0			

Model 1): All variables in the tables are included.

Model 2): Cavity in X-ray examination and total delay are not included in this model.

OR: Odds ratio of bacteriologically positive finding.

CI : Confidence interval.

NA: Not applicable.

† : Reference category.

* p < 0.05 ** p < 0.01

Cavities in the roentgenographic examination, cough at diagnosis and the family history of tuberculosis were significantly associated with the bacteriologically positive finding; the adjusted odds ratios of bacteriological positive result for patients with abnormal findings in individual characteristics were 2.3(95 % confidence interval, 1.7-3.0), 1.6(95 % confidence interval, 1.2-2.3) and 1.5(95 % confidence interval, 1.0-2.1), respectively, in the model which included all study variables (model 1). In the model which did not include cavities in the roentgenographic examination and the total delay (model 2), cough at diagnosis and the family history of tuberculosis remained to be significantly associated with the bacteriologically positive result.

DISCUSSION

Studies of reported cases of pulmonary tuberculosis from

various countries show a marked variation in the proportion of bacteriologically positive cases³. To evaluate the quality of diagnosing process of tuberculosis, the proportion of bacteriologically positive cases among newly registered ones is useful. In the present study, the proportion was as low as 31.7%. Such a low proportion can be accounted for by the low sensitivity of the sputum smear examination which leads to missing cases with active tuberculosis². The sensitivity of the sputum examination can be raised by obtaining adequate numbers of specimens (a minimum of three sputa) per case⁴. It is practical to target this measure of repeated collection of specimens on patients who are more likely to have active tuberculosis. The characteristics which are associated with the bacteriologically positive result in the present study; the family history of tuberculosis, cough at diagnosis and cavities in the roentgenographic examination, can be considered in defining the target group of patients. Furthermore, measures should also include

establishing a quality control program which makes the sputum smear examination more sensitive in individual laboratories⁵; for example, improving examiner's skills to prepare smears, and equipping the laboratories with binocular microscopes (Monocular microscopes are still common in the local facilities in Mongolia.)²

Because the roentgenographic examination is popularly performed in the diagnostic process, the low specificity of this test can also influence the low proportion of bacteriologically positive cases. Inactive tuberculosis or non-tuberculous diseases with bacteriologically negative results seem to be overdiagnosed as active tuberculosis solely based on the radiographic findings. The overdiagnosis could be avoided if physicians became cautious in differential diagnosis of bacteriologically negative patients who have neither respiratory symptoms nor cavities in the roentgenographic examination.

The health care reform in Mongolia, which began in 1993, is on its way to adequate performance. A new category of doctors called family physicians play an important role in detecting tuberculosis patients as initial consulting facilities⁶. Family physicians are expected to refer individual patients to proper specialists. It is useful for family physicians in Mongolia to know that the classic symptoms and family history of pulmonary tuberculosis are excellent indicators to choose patients who have to be transferred to tuberculosis specialists.

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