infections: antimicrobial susceptibility patterns from the SENTRY antimicrobial surveillance program (United States and Canada, 1997). *Antimicrob Agent Chemother* 1999; **43**: 385–389.

RESEARCH NOTE

Patterns of delays in diagnosis amongst patients with smear-positive pulmonary tuberculosis at a teaching hospital in Turkey

E. Okur[1], A. Yilmaz[2], A. Saygi[1], A. Selvi[2], F. Süngün[1], E. Öztürk[1] and G. Dabak[1]

[1]Heybeliada Center for Chest Diseases and Thoracic Surgery and [2]SSK Süreyyapasa Center for Chest Diseases and Thoracic Surgery, Pulmonology, Istanbul, Turkey

ABSTRACT

In total, 151 newly diagnosed patients with smear-positive pulmonary tuberculosis were studied. The mean time from the onset of symptoms to the first visit to a physician was 46.4 days; the mean referral delay was 28.9 days; the mean delay in diagnosis was 2.4 days; and the mean delay in treatment initiation was 0.8 days. There was a delay in consulting a physician by 49% of patients. A low index of suspicion for tuberculosis on the part of the physician and healthcare system and laboratory delays were the most common reasons for delays in diagnosis.

Keywords Delays in diagnosis, *Mycobacterium tuberculosis*, pulmonary disease, tuberculosis

Original Submission: 18 March 2005; **Revised Submission:** 12 June 2005; **Accepted:** 16 July 2005

Clin Microbiol Infect 2006; 12: 90–92
10.1111/j.1469-0691.2005.01302.x

Despite efforts to control tuberculosis, the disease remains a major health problem worldwide. It is estimated that the annual number of newly diagnosed cases increased from 7.5 million in 1990 to 11.9 million in 2005; i.e., a 58.6% increase during a 15-year period [1]. Among communicable diseases, tuberculosis is the second most common cause of death worldwide [2], with an estimated 19–43% of the world's population infected with *Mycobacterium tuberculosis* [3]. Spread of *M. tuberculosis* is predominantly by patients with pulmonary tuberculosis, and it is believed that smear-positive cases are more infectious than smear-negative cases [4].

The key components of any tuberculosis control programme are early diagnosis and prompt institution of effective therapy. This is especially important for cases of smear-positive pulmonary tuberculosis because they are the most important reservoir for the transmission of infection in a community [5]. It is estimated that an untreated patient with smear-positive disease may infect 10–14 individuals annually [6]. Delays in diagnosis and treatment result in a prolonged period of infectivity in the community [5,7], and are a common problem in both developed and developing countries [5,7–11]. The present study investigated patterns and reasons for delays among patients with smear-positive pulmonary tuberculosis in Turkey.

The study was conducted at the Heybeliada Center for Chest Disease and Thoracic Surgery (Istanbul, Turkey) between January and May 2004. In total, 151 newly diagnosed patients with smear-positive pulmonary tuberculosis were studied. The clinical files of the patients were analysed and a questionnaire was completed to obtain data concerning age, gender, educational level, economic status, presence of index case for tuberculosis, presence of co-morbidity, and appearance of first symptoms. The various intervals and delays in diagnosis (Fig. 1) were determined for each patient. Patient application intervals that exceeded 30 days were considered to be a *patient delay*. Referral intervals that exceeded 2 days were regarded as an *institutional delay*. Diagnosis intervals that exceeded 1 day were considered to be a *delayed diagnosis*. Treatment intervals that exceeded 1 day were recorded as a *delayed treatment* [9,10,12]. The chi-square test, ANOVA test or Student's *t*-test were used to assess differences between groups.

The study population comprised 84 (55.6%) males and 67 (44.4%) females; the mean age was 30.4 years (range 14–70 years). The delays associated with the various stages in diagnosis

Corresponding author and reprint requests: A. Yilmaz, SSK Süreyyapasa Center for Chest Diseases and Thoracic Surgery, Pulmonology, Istanbul, Turkey
E-mail: elifim@rt.net.tr

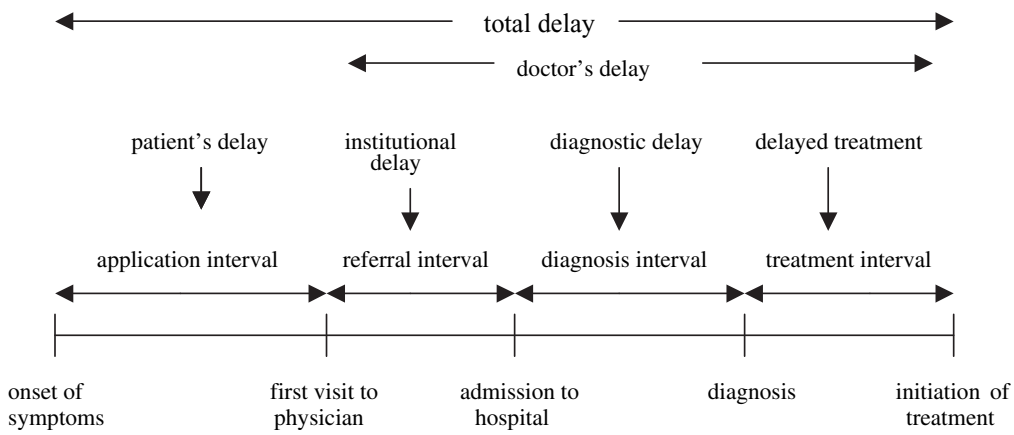

Fig. 1. Components of the delay in diagnosis and treatment for patients with pulmonary tuberculosis

Table 1. Values (days) associated with delays in treatment and diagnosis for patients with pulmonary tuberculosis

Intervals	Mean	SD	Median	95% CI
Application	46.4	54.6	30	37.6–55.1
Referral	28.9	35.1	17	22.5–33.7
Diagnosis	2.4	2.1	1	2.1–2.7
Treatment	0.8	1.3	1	0.6–1

and treatment are summarised in Table 1. The application interval was <30 days for 77 (51%) patients, and >30 days for 74 (49%) patients (a patient delay). Age, gender, educational level, economic status, marital status, presence or absence of index case and co-morbidity, and appearance of first symptom had no effect on the application interval and the patient delay ($p > 0.05$). The referral interval was <3 days for 15 (10%) patients, 3–5 days for 44 (29.1%) patients, and >10 days for 92 (60.9%) patients. In total, 136 (90%) patients experienced an institutional delay. The diagnosis interval was <2 days for 77 (51%) patients, 2–3 days for 47 (31.1%) patients, 3–10 days for 25 (16.6%) patients, and >10 days for two (1.3%) patients; thus, 49% of patients experienced delays in diagnosis. The initiation of treatment interval was <2 days for 139 (92.1%) patients, 2–10 days for 11 (7.2%) patients, and >10 days for one (0.7%) patient; thus, 7.9% of patients experienced delays in treatment.

The mean (median) time from the first visit to a physician to initiation of treatment was 31 (19) days. This interval was <5 days for 12 (7.9%) patients. In total, 150 (76.1%) patients experienced a doctor's delay. The mean (95% CI) interval from onset of symptoms to initiation of treatment was 77.3 (67.8–86.8) days. Reasons for delays are summarised in Table 2. The most common reason for a patient's delay was neglect of symptoms by the patient. A low index of suspicion for tuberculosis on the part of the physician was the most common reason for a doctor's delay.

Table 2. Possible reasons for patients' and doctors' delays in the diagnosis and treatment of patients with pulmonary tuberculosis

Reason	*n*	%
Patient's delays		
Neglect of symptoms	32	43.2
Sociocultural factors	15	20.3
Distance to hospital or lack of transport	15	20.3
Economic status	10	14.9
Other	2	1.3
Total	74	100
Doctor's delays		
A low index of suspicion for tuberculosis	77	54.2
Healthcare system	23	16.3
Laboratory system	12	8.5
Distance to hospital	11	7.7
Under-utilised sputum examinations	7	4.9
Economic status	7	4.9
Sociocultural reasons	5	3.5
Total	142	100

The median application interval in this study of 30 days compares favourably with reported median application intervals of 1.8 months in Korea [13], 120 days in Tanzania [11] and 8 weeks in Nigeria [8], but less favourably with median application intervals of 17.5 days in Turkey [12] and 3 weeks in Botswana [14]. The importance of a patient's delay was higher in the present study than in previous reports [9,12]. The median doctor's delay of 19 days was short compared with a median doctor's delay of 7 weeks in

Malaysia [15], 8 weeks in Ghana [5] and 5 weeks in Botswana [14], but longer than that in other studies [8,16]. As reported elsewhere [9,12], the results indicated that the institutional delay was more significant than delays in diagnosis and treatment. The most common reasons for a doctor's delay were a low index of suspicion for tuberculosis on the part of physicians and healthcare system, as well as laboratory delays and the distance to a hospital. Previous studies have reported similar findings, and have also identified under-utilised chest X-ray examination facilities and a failure to perform sputum smear examinations as important reasons for a doctor's delay [11,12,14,16,17].

In conclusion, delays in diagnosis and treatment of pulmonary tuberculosis were a common problem at the Heybeliada Center for Chest Disease and Thoracic Surgery. Delayed diagnosis results in a more advanced disease state, the likelihood of complications, increased mortality, and enhanced transmission of infection among healthcare workers and in the community. Delays should be reduced for good control of tuberculosis. Education of physicians and the public about tuberculosis, reductions in healthcare system and laboratory delays, together with improvements in economic status and sociocultural factors, are the most important factors likely to reduce delays in diagnosis and treatment among tuberculosis patients.

REFERENCES

1. Dolin PJ, Raviglione MC, Kochi A. *A review of current epidemiological data and estimation of future tuberculosis incidence and mortality.* WHO/TB/93.173. Geneva: World Health Organization 1993.
2. Frieden TR, Sterling TR, Munsiff SS, Watt CJ, Dye C. Tuberculosis. *Lancet* 2003; **362**: 887–899.
3. Sudre P, Dam GT, Kochi A. Tuberculosis: a global overview of the situation today. *Bull WHO* 1992; **70**: 149–159.
4. Hernandez-Garduno E, Cook V, Kunimoto D, Elwood RK, Black WA, FitzGerald JM. Transmission of tuberculosis from smear negative patients: a molecular epidemiology study. *Thorax* 2004; **59**: 286–290.
5. Lawn SD, Afful B, Acheampong JW. Pulmonary tuberculosis: diagnostic delay in Ghanaian adults. *Intl J Tuberc Lung Dis* 1998; **2**: 635–640.
6. Murray JC, Styblo K, Rouillon AT. Tuberculosis in developing countries. Burden, intervention, cost. *Bull Intl Union Tuberc Lung Dis* 1990; **65**: 6–24.
7. Mathur P, Sacks L, Auten G, Sall R, Levy C, Gordin F. Delayed diagnosis of pulmonary tuberculosis in city hospitals. *Arch Intern Med* 1994; **154**: 306–310.
8. Odusanya OO, Babafemi JO. Patterns of delays amongst pulmonary tuberculosis patients in Lagos, Nigeria. *BMC Public Health* 2004; **4**: 18–22.
9. Yilmaz A, Boða S, Sulu E *et al.* Delays in diagnosis and treatment of hospitalized patients with smear-positive pulmonary tuberculosis. *Respir Med* 2001; **95**: 802–805.
10. Pirkis JE, Speed BR, Yung AP, Dunt DR, Maclntryre CR, Plant AJ. Time to initiation of anti-tuberculosis treatment. *Tuberc Lung Dis* 1996; **77**: 401–406.
11. Wandwalo ER, Morkve O. Delay in tuberculosis case-finding and treatment in Mwanza, Tanzania. *Intl J Tuberc Lung Dis* 2000; **4**: 133–138.
12. Güneylioðlu D, Yilmaz A, Bilgin S, Bayram Ü, Akkaya E. Factors affecting delays in diagnosis and treatment of pulmonary tuberculosis in a tertiary care hospital in Istanbul, Turkey. *Med Sci Monit* 2004, **10**: CR62-67.
13. Mori T, Shimao T, Jin BW, Kim SJ. Analysis of case-finding process of tuberculosis in Korea. *Tuberc Lung Dis* 1992; **73**: 225–231.
14. Steen TW, Mazonde GN. Pulmonary tuberculosis in Kweneng District, Botswana: delays in diagnosis in 212 smear-positive patients. *Intl J Tuberc Lung Dis* 1998; **2**: 627–634.
15. Liam CK, Tang BG. Delay in the diagnosis and treatment of pulmonary tuberculosis in patients attending a university teaching hospital. *Intl J Tuberc Lung Dis* 1997; **1**: 326–332.
16. Sherman LF, Fujiwara PI, Cook SV, Bazerman LB, Frieden TR. Patient and health care system delays in the diagnosis and treatment of tuberculosis. *Intl J Tuberc Lung Dis* 1999; **3**: 1088–1095.
17. Rao VK, Iademarco EP, Fraser VJ, Kollef MH. Delays in the suspicion and treatment of tuberculosis among hospitalized patients. *Ann Intern Med* 1999; **130**: 404–411.

RESEARCH NOTE

Monitoring of vancomycin serum levels for the treatment of staphylococcal infections

M. D. Kitzis and F. W. Goldstein

Hospital Saint Joseph, Clinical Microbiology Laboratory, Paris, France

ABSTRACT

Vancomycin serum concentrations were determined for 1737 patients treated with either 2×1 g of vancomycin or 4×500 mg daily (780 patients), according to current nomograms, or by

Corresponding author and reprint requests: F. W. Goldstein, Clinical Microbiology Laboratory, Fondation Hospital Saint Joseph, 185 rue Raymond Losserand, 75014 Paris, France
E-mail: fgoldstein@hopital-saint-joseph.org