Factors Associated with Treatment Success for Tuberculosis Patients: a Single Center’s Experience in Turkey

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SUMMARY: We aimed to evaluate the treatment outcome of pulmonary tuberculosis patients and factors affecting treatment outcomes. We analyzed the records of 586 pulmonary tuberculosis patients who were older than 15 years followed between January 1999 and December 2004. Of these patients, 76.1% were smear-positive for tuberculosis and 23.9% were smear-negative for tuberculosis. The treatment outcomes of all patients analyzed were as follows: treatment success 91.7%, defaulted treatment 5.1%, died 2.4%, failure 0.3%, and transferred out 0.5%. The treatment outcomes of smear-positive pulmonary tuberculosis patients were as follows: cured 77.1%, treatment completed 13.5%, defaulted treatment 5.4%, died 2.9%, failure 0.4%, and transferred out 0.7%. In multivariate regression analysis, risk factors for non-successful treatment outcome were determined to be re-treatment patients, patients older than 46 years of age, and the presence of rifampicin resistance. We conclude that application of Directly Observed Therapy may increase treatment success in all patients, especially patients who have risk factors for a low treatment success rate.

INTRODUCTION

The World Health Organization (WHO) proclaimed tuberculosis (TB) a worldwide public health emergency in 1993 (1). The WHO has targeted the detection of 70% of estimated smear-positive patients globally and a cure rate of 85% in newly detected smear-positive pulmonary TB cases (2). According to the 2006 report of the WHO, in Turkey, the number of TB patients diagnosed in 2004 was 19,944 and the incidence of TB was 28 per 100,000 (3). TB dispensaries, present in nearly all regions of the country, provide follow-up treatment for TB patients in Turkey. In these dispensaries chest X-rays are obtained for patients who have respiratory complaints, and sputum examinations and culturing are done in patients where TB is suspected due to clinical and radiological findings. The patients needing further evaluations are sent to hospitals dealing with chest diseases. The physical examinations, investigations, and follow-up of the TB contacts are also done in these dispensaries.

Eyup is a district of Istanbul with a population of approximately 300,000 people and a moderate socioeconomic level. In this study we aimed to evaluate the treatment outcomes and factors affecting treatment outcomes in pulmonary TB patients treated and followed in Istanbul’s Eyup Tuberculosis Dispensary between 1999 and 2004.

PATIENTS AND METHODS

Subjects: The study population consisted of adult pulmonary TB patients (older than 15 years) documented in the Istanbul Eyup Tuberculosis Dispensary between January 1999 and December 2004. The documents of the patients were evaluated retrospectively. The subjects were either sputum smear-positive or sputum smear-negative TB patients. This study was approved by the Ethical Committee of Yedikule Training and Research Hospital for Chest Disease and Thoracic Surgery, Istanbul, Turkey.

Diagnostic procedures: Diagnostic procedures were accomplished according to the WHO and the International Union Against Tuberculosis and Lung Disease (IUATLD) definitions (3). The diagnosis of the smear-positive pulmonary TB patients was performed in our dispensary or at a chest disease hospital by detecting acid-fast bacilli (AFB) in the sputum smear examination or sputum culture. The smear microscopic examination and TB cultures were done in the microbiology laboratories of the hospitals if the patients had been hospitalized or in the Central Microbiology Laboratory of the Istanbul Union Against Tuberculosis if the patients had been diagnosed in dispensaries or followed and treated in dispensaries after being discharged from hospitals. All the TB patients in Turkey are treated and followed up in TB dispensaries, except multidrug-resistant (MDR)-TB cases.

Follow-up: Directly Observed Therapy (DOT) was not applied in our dispensary between 1999 and 2004. Patients who were not hospitalized were diagnosed, treated, and followed up by our dispensary. Some of the pulmonary TB patients, especially some of the smear-positive patients and patients whose general conditions was not good or re-treatment patients were treated for chest diseases in hospitals during the initial phase of the disease. The mean hospitalization duration of these patients was 14.5 ± 20.0 days. These patients received the same treatment regimen as the other cases and were treated and followed by our dispensary after being discharged from the hospital. All patients were followed monthly, and sputum AFB examinations were performed in pulmonary TB patients during the continuation phase and at the end of the treatment. The patients were asked whether they had any complaints. When it was needed as well as at the end of treatment, chest X-rays were obtained. Patients who
had MDR-TB were followed by chest diseases hospitals.

**Radiological extent:** We divided the cases into two groups based on the extent of lesions in the chest radiographs. Non-extensive lesions were those in which the total diameter of the cavities was less than 4 cm or the sum of the opaque areas was less than 1/3 of the area of one lung or the sum of the dispersed infiltrations was less than the area of one lung. Extensive lesion were those in which the total diameter of the cavities was more than 4 cm or the sum of the homogeneous lesions was more than 1/3 of the area of one lung or the sum of the dispersed infiltrations was more than the area of one lung.

**Definitions:** The patients were subdivided into 'new cases', i.e., those who had never been treated for TB or who had taken anti-TB drugs for less than 4 weeks before the beginning of the study, and 're-treatment cases', i.e., those who had previously taken anti-TB drugs for 4 weeks.

Smear-positive and smear-negative cases were identified as follows (3). Smear-positive pulmonary cases were patients with at least two initial sputum smear investigations (direct smear microscopy) with an AFB+ result, or one sputum investigation with an AFB+ result and radiographic abnormalities consistent with active pulmonary TB as decided by a clinician. One sputum sample with an AFB+ result and culture positive for *Mycobacterium tuberculosis* is smear-negative pulmonary cases were patients with pulmonary TB not meeting the above criteria for smear-positive disease. Diagnostic criteria should contain at least 3 sputum smear examinations negative for AFB, radiographic abnormalities consistent with active pulmonary TB, no response to a course of broad-spectrum antibiotics, and assessment by a clinician to treat with a full course of anti-TB treatment, or positive culture with at least two initial sputum smear investigations.

The treatment outcome was divided into six categories according to the WHO/IUATLD guidelines (3), as follows:

- **Cured** (patients who finished treatment with negative bacteriology result at the end of treatment)
- **Completed treatment** (patients who finished treatment, but without bacteriology result at the end of treatment)
- **Failure** (patients remaining smear/culture positive at 5 months despite correct intake of medication)
- **Defaulted treatment** (patients who interrupted their treatment for 2 consecutive months or more after registration)
- **Death** (patients who died due to TB or other causes before or during treatment)
- **Transfer out** (patients whose treatment results are unknown due to emigration before or during treatment)

Treatment success was defined as the sum of the cases that were cured and who completed treatment. The proportion of patients with a potentially bacteriologically unsuccessful outcome (failure, default, died, transfer) was also computed.

The recommended regimen for TB treatment (in new cases) in the study period was isoniazid (INH), rifampicin, pyrazinamide, and ethambutol in the intensive phase (2 months). The continuation phase consisted of 4 months of administration of INH and rifampicin. Re-treatment patients (relapses, failures, and smear-positive patients who had previously defaulted) were treated with a 2HREZS/1HREZ/5HRE (Z, pyrazinamide; S, streptomycin) regimen. Treatment of MDR-TB patients was carried out for at least 18 months by including minor drugs. Treatment regimes and follow-ups of those patients were carried out in chest hospitals by an authorized committee assembled for these patients.

**Statistical analysis:** Statistical analysis was done using the SPSS statistical software program version 10.0. We used logistic regression analysis to estimate the odds ratio (OR) for treatment outcome (success versus non-success), and we determined the confidence interval (CI) for the OR. Independent variables such as sex, age group, patient's category, sputum smear status, radiologic extent, INH resistance, and rifampicin resistance were entered into both univariate and multivariate logistic regression models. Descriptive statistics was used to determine the mean age of all cases. A T test and an ANOVA test were used to compare quantitative variables. Pearson's chi-square was used to determine independence between paired variables, with significance set at $P < 0.05$.

**RESULTS**

**Demographic characteristics of patients:** The characteristics of 586 pulmonary TB patients with a mean age and standard deviation (SD) of $32.5 \pm 13.2$ years are given in Table 1. Of the TB patients, 446 (76.1%) were smear positive, and 140 (23.9%) were smear negative. The mean age and SD of the smear-positive and smear-negative patients were $33.0 \pm 13.3$ and $30.8 \pm 12.5$ years, respectively (Table 1). Of the smear-positive patients, 358 (80.3%) were male. **

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![Table 1. Characteristics of the patients](image-url)

<table>
<thead>
<tr>
<th>Sex</th>
<th>Male No. (%)</th>
<th>Female No. (%)</th>
<th>New No. (%)</th>
<th>Re-treatment No. (%)</th>
<th>Smear (+) No. (%)</th>
<th>Smear (-) No. (%)</th>
<th>Total (%)</th>
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<tbody>
<tr>
<td>Education</td>
<td></td>
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<tr>
<td>Illiterate</td>
<td>33.4 ± 12.9</td>
<td>28.7 ± 13.4</td>
<td>31.8 ± 12.9</td>
<td>35.8 ± 13.5</td>
<td>33.0 ± 13.3</td>
<td>30.8 ± 12.5</td>
<td>32.5 ± 13.2</td>
</tr>
<tr>
<td>Primary school</td>
<td>229 (63.1)</td>
<td>64 (52.0)</td>
<td>267 (58.8)</td>
<td>89 (67.4)</td>
<td>278 (62.3)</td>
<td>78 (55.7)</td>
<td>356 (60.8)</td>
</tr>
<tr>
<td>Secondary school</td>
<td>61 (13.2)</td>
<td>11 (8.9)</td>
<td>55 (12.1)</td>
<td>17 (12.9)</td>
<td>56 (12.6)</td>
<td>16 (11.4)</td>
<td>72 (12.3)</td>
</tr>
<tr>
<td>High school</td>
<td>64 (13.7)</td>
<td>27 (22.0)</td>
<td>80 (17.6)</td>
<td>11 (8.3)</td>
<td>67 (15.0)</td>
<td>24 (17.1)</td>
<td>91 (15.5)</td>
</tr>
<tr>
<td>University</td>
<td>24 (5.2)</td>
<td>7 (5.7)</td>
<td>28 (6.2)</td>
<td>3 (2.3)</td>
<td>16 (3.6)</td>
<td>15 (10.7)</td>
<td>31 (5.3)</td>
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<tr>
<td>Radiologic extent</td>
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<tr>
<td>Non-extensive</td>
<td>323 (77.1)</td>
<td>96 (22.9)</td>
<td>346 (82.6)</td>
<td>73 (17.4)</td>
<td>293 (69.9)</td>
<td>126 (30.1)</td>
<td>419 (71.5)</td>
</tr>
<tr>
<td>Extensive</td>
<td>140 (83.8)</td>
<td>27 (16.2)</td>
<td>108 (64.7)</td>
<td>59 (35.3)</td>
<td>153 (91.6)</td>
<td>14 (8.4)</td>
<td>167 (28.5)</td>
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<tr>
<td>Period of treatment</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>1999 - 2001</td>
<td>234 (80.4)</td>
<td>57 (19.6)</td>
<td>217 (74.6)</td>
<td>74 (25.4)</td>
<td>214 (73.5)</td>
<td>77 (26.5)</td>
<td>291 (49.7)</td>
</tr>
<tr>
<td>2002 - 2004</td>
<td>229 (77.6)</td>
<td>66 (22.4)</td>
<td>237 (80.3)</td>
<td>58 (19.7)</td>
<td>232 (78.6)</td>
<td>63 (21.4)</td>
<td>295 (50.3)</td>
</tr>
<tr>
<td>Total</td>
<td>463 (79.0)</td>
<td>123 (21.0)</td>
<td>454 (77.5)</td>
<td>132 (22.5)</td>
<td>446 (76.1)</td>
<td>140 (23.9)</td>
<td>586 (100)</td>
</tr>
</tbody>
</table>
2788 (19.7%) were female, 338 (75.8%) were new cases, and 108 (24.2%) were re-treatment cases. The distribution of smear-positive cases in terms of age was as follows: 221 (73.4%) people were between the ages of 15 and 29, 146 (79.8%) people were between the ages of 30 and 45, and 79 (77.5%) people were above 46 years old.

The treatment outcome and factors affecting this outcome:

The cure rate of smear-positive TB patients was 77.1%. The cure rate was higher in new smear-positive patients (81.7%) than in re-treatment smear-positive patients (63.0%), (P < 0.05) (Table 2). The default, death, and failure rates of re-treatment smear-positive patients were higher than those rates in new smear-positive patients (P < 0.05). The death rate of re-treatment smear-negative patients was higher than that in new smear-negative patients (P < 0.05) (Table 2). The treatment success rate in pulmonary TB patients was 91.7% (Table 3). The treatment success rate was higher in female patients, new patients, patients within the 15 - 29 age group, patients who had non-extensive lesions on chest X-ray, and in the absence of INH and rifampicin resistance (P < 0.05). There was no relationship between treatment success and marital status, education level, presence of pyrazinamide resistance, or presence of ethambutol resistance (P > 0.05).

In following years, although the treatment success increased, there was no statistically significant difference. The cure rate of smear-positive patients was higher between 2002 and 2004.

Table 2. Treatment outcome of all patients according to patient category and sputum investigations

<table>
<thead>
<tr>
<th></th>
<th>Cured No. (%)</th>
<th>Completed treatment No. (%)</th>
<th>Defaulted treatment No. (%)</th>
<th>Failure No. (%)</th>
<th>Death No. (%)</th>
<th>Transfer out No. (%)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Smear-positive patients</strong></td>
<td></td>
<td></td>
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</tbody>
</table>
| New                  | 276 (81.7)
(a) | 144 (13.0)    | 10 (3.0)                   | 0                           | 6 (1.8)        | 2 (0.6)             | 338    |
| Re-treatment         | 68 (63.0)     | 16 (14.8)                  | 14 (13.0)
(b) | 2 (1.9)
(c) | 7 (6.5)
(c) | 1 (0.9)             | 108    |
| Total                | 344 (77.1)    | 60 (13.5)                  | 24 (5.4)                   | 2 (0.4)        | 13 (2.9)       | 3 (0.7)             | 446    |
| **Smear-negative patients** |               |                            |                            |                |               |                     |       |
| New                  | 111 (95.7)    | 5 (4.3)                    | 0                           | 0              | 0             | 0                   | 116    |
| Re-treatment         | 22 (91.6)     | 1 (4.2)                    | 0                           | 1 (4.2)
(d) | 0              | 0                   | 24     |
| Total                | 133 (95.0)    | 6 (4.3)                    | 0                           | 1 (0.7)        | 0             | 0                   | 140    |
| **All patients**     | 344 (58.7)    | 193 (32.9)                 | 30 (5.1)                   | 2 (0.3)        | 14 (2.4)      | 3 (0.5)             | 586    |

(a) P < 0.05, compare to re-treatment smear-positive patients.
(b) P < 0.01, compare to new smear-positive patients.
(c) P < 0.05, compare to new smear-positive patients.
(d) P < 0.05, compare to new smear-negative patients.

Table 3. Treatment outcome of all patients

<table>
<thead>
<tr>
<th></th>
<th>Cured No. (%)</th>
<th>Completed treatment No. (%)</th>
<th>Defaulted treatment No. (%)</th>
<th>Failure No. (%)</th>
<th>Death No. (%)</th>
<th>Transfer out No. (%)</th>
<th>Treatment success No. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
| Male                 | 463           | 269 (58.1)                 | 145 (31.3)                 | 30 (6.5)
(b) | 2 (0.4)        | 14 (3.0)                   | 3 (0.6)             | 414 (90.3)    |
| Female               | 123           | 75 (61.0)                  | 48 (39.0)                  | 0              | 0             | 0                   | 123 (100)
(b) |
| **Age group**        |               |                            |                            |                |               |                     |                           |
| 15 - 29              | 301           | 172 (57.1)                 | 117 (38.9)
(b) | 7 (2.3)
(b) | 1 (0.3)        | 2 (0.7)                    | 2 (0.7)             | 289 (96.0)
(b) |
| 30 - 45              | 183           | 113 (61.7)                 | 50 (27.3)                  | 16 (8.7)       | 1 (0.5)        | 3 (1.6)             | 0             | 163 (89.0)    |
| 46+                  | 102           | 59 (57.8)                  | 26 (25.5)                  | 7 (6.9)        | 0              | 9 (8.8)
(b) | 1 (1.0)             | 85 (83.3)    |
| **Patient category** |               |                            |                            |                |               |                     |                           |
| New                  | 454           | 276 (60.8)                 | 155 (34.1)                 | 15 (3.3)       | 0              | 6 (1.3)             | 2 (0.4)             | 429 (94.9)    |
| Re-treatment         | 132           | 68 (51.5)                  | 38 (28.8)                  | 15 (11.4)
(b) | 2 (1.5)
(b) | 8 (6.1)
(b) | 1 (0.8)             | 94 (80.3)    |
| **Radiologic extent** |              |                            |                            |                |               |                     |                           |
| Non-extensive        | 419           | 231 (55.1)                 | 164 (39.1)
(b) | 19 (3.9)       | 1 (0.2)        | 1 (0.2)             | 3 (0.4)             | 388 (94.2)    |
| Extensive            | 167           | 113 (67.7)
(b) | 29 (17.4)                  | 11 (6.6)                   | 1 (0.6)        | 13 (7.8)
(b) | 0              | 142 (85.1)    |
| **Sputum smear**     |               |                            |                            |                |               |                     |                           |
| Smear-negative       | 140           | 66 (47.1)                  | 54 (38.6)                  | 10 (7.1)       | 0              | 1 (0.7)             | 0             | 133 (95.1)    |
| Smear-positive       | 446           | 344 (77.1)
(b) | 60 (13.5)                  | 24 (5.4)                   | 2 (0.4)        | 13 (2.9)       | 3 (0.7)             | 404 (90.6)    |
| **Isoniazid resistance** |           |                            |                            |                |               |                     |                           |
| Absent               | 293           | 212 (72.4)                 | 60 (20.5)                  | 15 (5.1)       | 0              | 6 (2.0)             | 0             | 272 (92.9)    |
| Present              | 46            | 28 (60.9)                  | 9 (19.6)                   | 4 (8.7)        | 2 (4.3)
(c) | 2 (4.3)             | 1 (2.2)             | 37 (80.5)    |
| **Rifampicin resistance** |         |                            |                            |                |               |                     |                           |
| Absent               | 317           | 234 (73.8)                 | 62 (19.6)                  | 14 (4.4)       | 0              | 7 (2.2)             | 0             | 296 (93.4)    |
| Present              | 22            | 6 (27.3)                   | 7 (1.7)                    | 32 (22.7)
(b) | 2 (9.1)
(b) | 1 (4.5)             | 1 (4.5)             | 13 (59.1)    |
| **Total**            | 586           | 344 (58.7)                 | 193 (33.0)                 | 30 (5.1)       | 2 (0.3)        | 14 (2.4)            | 3 (0.5)             | 537 (91.7)    |

(b) P < 0.05.
(b) P < 0.01.
(c) P < 0.001.
(d) Information for isoniazid and rifampicin resistance was available for 57.8% of the patients.
compared to between 1999 and 2001 (73.8% in 1999 - 2001, 83.6% in 2002 -2004; P < 0.05). The defaulted treatment rate was higher in males, re-treatment patients, patients older than 30 years, and in the presence of rifampicin resistance (P < 0.05). Death rates were higher in re-treatment patients, patients older than 46 years old, and patients who had extensive lesions on chest X-ray (P < 0.05). In multivariate regression analysis, risk factors for death were determined in patients older than 30 years and patients who had extensive lesions on chest X-ray. The failure rate was higher in re-treatment patients, in the presence of INH, and in the presence of rifampicin resistance (P < 0.05) (Table 3).

**Deceased patients and MDR-TB patients:** There were 20 MDR-TB patients in our study group. Among those patients 2 were new cases and 18 were re-treatment cases. The treatment outcome of these patients was as follows: 5 were cured, 7 completed treatment, 4 defaulted treatment, 2 experienced treatment failure, and 1 transferred out.

Fourteen male patients with a mean age of 48.2 ± 17.4 years died during the treatment. Of the patients who died, 6 were new patients and 8 were re-treatment patients. Radiologically severe disease was present in 13 of these patients. One case also had chronic renal failure and diabetes mellitus. One case had MDR-TB.

**DISCUSSION**

In our study, the treatment success and cure rates of new smear-positive patients were 94.7 and 81.7%, respectively. According to a WHO 2006 report, the treatment success and cure rates in new smear-positive patients subjected to DOT were 78 and 69% in Poland, 83 and 70% in Mexico, 84 and 79% in Iran, and 80 and 69% in Egypt, respectively (3). Our treatment success and cure rates of new smear-positive cases were slightly higher than those of countries with a TB incidence and socioeconomic level similar to those of our country. The rate of treatment success in new smear-positive TB patients was 82% and the cure rate was 46% in the study of Kilicaslan et al. (4), done between 1998 and 2000 in the Istanbul Tuberculosis Dispensary. In the study of Ozkara et al. (5), done in 1999 and including nearly 2/5 of Turkey, the treatment success and cure rates in TB dispensaries were 82 and 37% in new patients, respectively. When compared to these two studies the treatment success and cure rates were higher in new smear-positive patients in our dispensary. Because the physicians and other medical personnel in our TB dispensaries have been working in this field for a long
time and due to their sensitivity in treating patients, we believe our cure and treatment success rates for new smear-positive TB patients to be higher than the mean values of all TB dispensaries in Istanbul. Particularly in the study of Ozkara et al. (5), the cure rate was significantly low. In the study of Kilicaslan et al. (4), the cure rate in Istanbul was raised to 51.1% in 2000 from 41.8% in 1998. In our study, the cure rate was increased to 83.6% between 2002 and 2004 from 73.8% between 1999 and 2002. We attribute our successful cure rate and the observed increase in the more recent years to our awareness of the importance of aiming for the cure rate targeted by the WHO and our persistency in carrying out sputum analysis in our patients during and after the treatment. Moreover, the fact that all the sputum samples are analyzed in a single central laboratory without any payment contributes in a positive way to these results.

In our study, the cure and treatment success rates of re-treatment smear-positive patients were 63.0 and 77.8%, respectively. According to a WHO 2006 report, cure and treatment success rates in smear-positive re-treatment patients subjected to DOT were as follows: in Poland 61 and 70%, in Syrian Arab Republic 49 and 64%, in Iran 62 and 77%, in Egypt 53 and 65%, respectively (3). In Turkey, Ozkara et al. (5) reported the cure and treatment success rates in re-treatment patients as 31 and 66%, respectively. In their study, which covered a considerable part of Turkey, the cure rate in re-treatment cases was reported to be significantly low. We believe, within the framework of the National Tuberculosis Program in our country, that inclusion of the healthcare workers in TB dispensaries in regular TB training programs, establishment of a central TB laboratory for each region, and the application of DOT following the end of the infrastructure instrument will provide improvements in cure and success rates achieved in each region of Turkey.

In this study, the treatment success rate was higher in females, new patients, patients who had non-extensive lesions on chest X-ray, patients older than 46 years, patients with INH resistance, and patients with rifampicin resistance. Cure rates were higher in new smear-positive cases than in re-treatment smear-positive cases. Gninafon et al. (6) found a higher treatment success rate in females than in males. In studies done in Russia (7) and Indonesia (8), it was reported that treatment success was higher in new patients than in re-treatment patients. As in the other studies, the treatment success in our study was also higher in new cases than in re-treatment cases. Four of 20 MDR-TB patients defaulted treatment, two showed treatment failure, one died, and one transferred out of the program. Moreover, rifampicin resistance was present in one of the patients who defaulted. Approximately half of the MDR-TB patients had a non-successful outcome, underscoring the importance of evaluating MDR-TB patients more carefully. Following the results of the resistance tests of these patients, they should be immediately transferred to chest hospitals or university hospitals, which are superior health institutions, and their treatment should be decided by the authorized committees of these hospitals. In addition, we think that the low treatment success rate in patients older than 46 years was due to the fact that most of the death cases were within this group. In our study, most of the patients in whom treatment was not successful were those patients who died or defaulted treatment. Radioclogially extensive disease was present in 13 of the patients who died, and in most of the patients who defaulted treatment.

The default rate was 6.1% in our study. The default rate was higher in males, re-treatment patients, patients older than 30 years, and cases with rifampicin resistance. Farah et al. (9) found a higher default rate among male patients. Diel and Niemann (10) determined risk factors for defaulting in males, noting that females were more eager to come into the center and receive their treatment than were males, and they used their medicines regularly. As our study was retrospective, the patients’ smoking and alcohol habits were not regularly documented. In Turkey, the smoking and alcohol use rates are higher in males than females, and the high default rate in males may be due to these habits. In the present study, 4 (7.8%) of the cases who defaulted treatment were MDR-TB cases, and 1 of them had documented rifampicin resistance. Fifteen (50%) of the patients who defaulted were re-treatment cases. The risk of defaulted treatment was higher in re-treatment patients in multivariate regression analysis. Defaulted treatment is the most important problem in TB treatment. Primarily, DOT should be implemented in all the regions of Turkey.

In a multivariate regression model, risk factors for non-successful treatment were determined in re-treatment patients, patients older than 46 years of age, and patients with rifampicin resistance. Farah et al. (9) reported that high age and initial INH resistance remained as significant risk factors for non-successful treatment. Re-treatment patients were comprised of relapses, returns after default, and returns after failure. Follow-up of re-treatment patients, who manifest heterogeneous character, is commonly more difficult. Rifampicin is the most important drug of TB treatment. Thus, we followed patients with rifampicin resistance more carefully.

In the present study, in re-treatment patients, those patients older than 46 years of age and patients who have rifampicin resistance were determined to have a higher risk for non-successful outcome among patients with pulmonary TB. We think that in these patients and all patients the application of DOT would increase treatment success.

ACKNOWLEDGMENTS

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REFERENCES