

Analysis on influencing factors for the cure of pulmonary tuberculosis patients in adolescents

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Abstract: To explore the influencing factors of adolescent tuberculosis patients, and to provide a basis for improving the cure rate of adolescent tuberculosis patients. The clinical data of adolescent tuberculosis patients aged 14-35 in the tuberculosis control centers of 7 counties in Linyi area of Shandong Province from 2009 to 2013 were collected. Logistic regression model was used to analyze the influencing factors of adolescent tuberculosis patients. A total of 706 adolescent pulmonary tuberculosis patients were included in this study, of whom 669 were cured and 37 were not cured. Multiple Logistic regression analysis showed that pulmonary cavity (OR=3.190, 95%CI=1.433-7.054), complications (OR=8.826, 95%CI=3.327-23.414), sputum test results at the end of second month (OR=0.112, 95%CI=0.033-0.386) and treatment classification (OR=13.737, 95%CI=4.682-40.304) could affect the cure of pulmonary tuberculosis in adolescents. We should raise attention for adolescent tuberculosis patients. During the treatment of tuberculosis, evaluate and actively intervene in adolescent tuberculosis patients with pulmonary cavity, comorbidities, positive sputum test at the end of second month and retreatment, so as to effectively improve the cure rate of adolescent tuberculosis patients and prevent the spread and prevalence of tuberculosis.

Keywords: Pulmonary tuberculosis; adolescents; influencing factors; logistic regression

Received 16 May 2019, Revised 16 July 2019, Accepted 18 July 2019

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1. Introduction

Tuberculosis is a chronic infectious disease caused by *Mycobacterium tuberculosis*, which seriously endangers human health. The World Health Organization (WHO) reported that the global latent infection rate of tuberculosis was 23% in 2017, the incidence was 133/100000, and the mortality rate was 17/100000. It is still a major health problem in the world [1]. The tuberculosis epidemic in China is also extremely serious, according to WHO estimates that 889000 people in China are newly infected with tuberculosis. In recent years, the incidence of tuberculosis in adolescents is on the rise year by year. The study found that the prevalence of tuberculosis among adolescents in South Africa was 14.0%[2], and the proportion of latent tuberculosis infections increased from 26% at the age of 58 to 53% at 14-17 years old, and reached 75% at the age of 25[3-5]. There are a large number of adolescents in China. Statistics show that the population of young people aged 14 to 35 in China is about 449.4 million, accounting for 33.03% of the total population of the country. In recent years, with the implementation of Directly Observed Treatment Short-course (DOTS) strategy, the epidemic situation of tuberculosis in China has been controlled to a great extent, and the cure rate of pulmonary tuberculosis has also been significantly improved. However, due to the vast territory and large population of our country, the coverage of DOTS strategy is relatively limited. These uncured teenagers with pulmonary

tuberculosis are often active in schools, Internet cafes and other gathering places, which are highly contagious to the surrounding population, but have not received enough attention at present. In this study, 706 cases of 14-35 years old adolescent pulmonary tuberculosis patients in Linyi area were taken as the research object to explore the influencing factors of cure, which is of great significance to effectively improve the cure rate of adolescent patients with pulmonary tuberculosis and improve the prevention and control strategy of tuberculosis.

2. Objects and methods

2.1. Research objects

The study population was from the tuberculosis control centers of 7 counties and districts in the Linyi area of Shandong Province from 2009 to 2013. The number of patients diagnosed with tuberculosis between the ages of 14 and 35 was 706.

Inclusion criteria: (1) The diagnosis of tuberculosis complies with the diagnostic criteria of the "Guidelines for the Implementing the national tuberculosis control program in China(2008)"[6]. According to the results of sputum smear examination and X-ray examination, combined with clinical signs for tuberculosis diagnosis.(2) The age of the study subjects is ≥ 18 years old; (3) The patient is prescribed medication; (4) the subjects had no mental illness and signed informed consent.

Exclusion criteria: (1) Patients with other heart or lung dysfunction or major diseases; (2) Patients with

diseases such as cancer or AIDS (HIV); (3) Patients with cognitive dysfunction; (4) Alcoholics.

reproductive tuberculosis, bone and joint tuberculosis and so on.

2.2. Research methods

From the tuberculosis prevention and control institutes of 7 counties and districts in Linyi area of Shandong Province, the sex, age, educational level, sputum culture results, complications, extrapulmonary tuberculosis and treatment classification were collected, and the influencing factors of cure of juvenile pulmonary tuberculosis patients were analyzed.

2.3. Definition of relevant indicators

Cure: Including cure and completion of treatment; Not cure: Including tuberculosis death, non-tuberculosis death, failure, loss, adverse reactions, rejection and transfer to multidrug-resistant treatment. The criteria for its judgment are referred to the "Guidelines for the Implementing the national tuberculosis control program in China (2008)"[6].

Classification of treatment: It can be divided into two categories: initial treatment and retreatment. Initial treatment: Any new case in which antituberculosis drugs have not been used in the past or have been used for less than a month. Retreatment: Including new cases, recurrent cases, failed cases of initial treatment, etc., where antituberculosis drugs have been used for more than one month.

Extrapulmonary tuberculosis: Tuberculosis is caused by respiratory infection and can also be disseminated by pulmonary lesions to various organs of the human body through the blood or lymphoid system. Tuberculosis occurs outside the lungs and is called extrapulmonary tuberculosis. There are the following common extrapulmonary tuberculosis: lymphoid tuberculosis, tuberculosis meningitis, tuberculosis peritonitis, intestinal tuberculosis, renal tuberculosis, epididymal tuberculosis, female

2.4. Statistical method

The professionals who have undergone unified training in medical record information are input into SPSS23.0 database, and the final data of this study are checked as the final data, and then the data are statistically analyzed through the software. The regression analysis of single factor and multiple factors was carried out by Logistic regression. The corresponding ratio (OR) and 95% confidence interval (CI). The assignment of related indexes is detailed in Table 1, and $P < 0.05$ as the difference was statistically significant.

3. Results

3.1. General demographic characteristics

A total of 706 adolescents with pulmonary tuberculosis among 14-35 years old were enrolled in the study, including 438 males (62.0%) and 268 females (38.0%). The ratio of male to female was 1.63 :1 and the average age was 24.98 years. There were 84 primary and secondary school graduates with adolescent tuberculosis, accounting for 11.9%; 409 junior high school students, accounting for 57.9%; 213 with high school and above, accounting for 30.2%. After treatment, 669 people were cured, 37 were not cured, and the cure rate was 94.8%.

3.2. The influencing factors for the cure of pulmonary tuberculosis patients in adolescents

The variables in Table 1 were analyzed by univariate Logistic regression analysis, and the statistically significant indexes were selected for multivariate Logistic regression analysis, and the related influencing factors for cure of pulmonary tuberculosis in adolescents were finally determined.

Table 1. The explanation of the assignment of influencing factors in logistic regression analysis

Variables	Assignment
Gender	Male=1; Female=0
Degree of education	Primary school and below = 1; Junior high school and above = 0
Pulmonary cavity	Yes=1; No=0
Complications	Yes=1; No=0
Extrapulmonary tuberculosis	Yes=1; No=0
Sputum testing results	Positive = 1; Negative = 0
Treatment classification	Primary treatment = 1; Retreatment = 0

3.2.1. Univariate Logistic analysis of cure in adolescent pulmonary tuberculosis

Taking whether tuberculosis is cured as dependent variable (1=cure, 0=not cured), and gender, degree of education, cavitation, comorbidities, sputum

testing results at the end of second month, treatment classification as independent variables, univariate logistic regression was carried out. The results showed that under the standard of test level $\alpha=0.05$, there were significant statistical differences in

cavities, comorbidities, sputum testing results at the end of second month, and treatment classification, which can be entered into the regression equation. See Table 2 for details.

Table 2 Univariate Logistic analysis of cure in adolescent pulmonary tuberculosis

	β	SE	OR	95%CI	P
Gender	0.232	0.341	1.261	0.646-2.461	0.497
Degree of education	-0.154	0.496	0.857	0.324-2.264	0.755
Pulmonary cavity	1.167	0.370	3.211	1.556-6.625	0.002
Complications	2.047	0.452	7.748	3.193-18.799	<0.001
Extrapulmonary tuberculosis	1.141	0.783	3.129	0.674-14.522	0.145
Sputum testing results	-1.811	0.599	0.163	0.051-0.529	0.002
Treatment classification	2.390	0.499	10.917	4.104-29.038	<0.001

OR: odds ratio; CI: confidence interval.

3.2.2. Multivariate Logistic analysis of cure in adolescent pulmonary tuberculosis

On the basis of univariate analysis, whether tuberculosis was cured as a dependent variable. Multiple Logistic regression analysis was carried out for independent variables based on cavity, complications, sputum test results at the end of second month, and treatment classification. The

results showed that the factors affecting the cure of pulmonary tuberculosis patients in adolescents were pulmonary cavity (OR=3.190,95%CI=1.433-7.054), complications (OR=8.826,95%CI=3.327-23.414), sputum test results at the end of second month (OR=0.112,95%CI=0.033-0.386) and treatment results (OR=13.737,95%CI=4.682-40.304). See Table 3 for details.

Table 3. Multivariate Logistic analysis of cure in adolescent pulmonary tuberculosis

	β	SE	OR	95%CI	P
Pulmonary cavity	1.160	0.405	3.190	1.433-7.054	0.004
Complications	2.178	0.498	8.826	3.327-23.414	<0.001
Sputum testing result	-2.189	0.631	0.112	0.033-0.386	0.001
Treatment classification	2.620	0.549	13.737	4.682-40.304	<0.001

OR: odds ratio; CI: confidence interval.

4. Discussion

In recent decades, our country has taken a number of effective measures to strengthen the control of tuberculosis, and has achieved some results, but at present, the burden of tuberculosis in our country is still the second in the world, and the number of patients with the disease is second only to India, and the tuberculosis epidemic is still serious. Surveys of tuberculosis in China have shown that adolescents have a higher proportion of tuberculosis patients. The uncured adolescents are more contagious to the surrounding population, but there are still few studies on the influencing factors of cure in young patients with pulmonary tuberculosis. In this study, the data of pulmonary tuberculosis patients in 6 counties and

districts of Linyi , Shandong Province were selected as the research objects. Logistic regression model was used to analyze the suspicious factors affecting the cure of pulmonary tuberculosis. The results showed that cavity, complications, sputum testing results at the second month, and treatment classification were the factors affecting the cure in adolescent pulmonary tuberculosis.

The study found that pulmonary cavity and comorbidities can affect the cure rate of adolescent tuberculosis patients. This is consistent with the results of Van et al., Bernard et al[7,8]. Pulmonary tuberculosis patients with cavity are highly contagious, the course of disease is long, the condition is unstable, and the tuberculosis bacteria in the cavity are often resistant to drugs, which can

seriously affect the therapeutic effect of anti-tuberculosis drugs. Some studies have shown that the tiny droplets in the air can produce infection as long as they contain 1~3 Mycobacteria, and the amount of Mycobacteria in the cavity can reach $1 \times 10^7 \sim 1 \times 10^9$. Therefore, patients with cavity formation take the high risk of repeated self-infection, and Mycobacterium tuberculosis in the cavity is more likely to develop into drug resistance. After the cavity formation, it can also break through the wall of the cave to cause hemoptysis, pneumothorax or empyema, which can aggravate the condition of the patients and affect the cure of adolescent pulmonary tuberculosis patients.

This study found that sputum testing results at the second month could have an effect on the cure of pulmonary tuberculosis in adolescents, which was consistent with the recent results[9-11]. The result of sputum testing results at the second month is an important index to evaluate the effectiveness of the treatment of pulmonary tuberculosis[12]. Recent studies[13-15] reported that non-conversion of sputum bacteria test results predicted treatment failure and relapse. If the smear is turned negative after 2 months of treatment, it indicates that the patient is more likely to be treated after completing the treatment. If the treatment is negative after 2 months of treatment, we can take targeted interventions during the treatment process, adjust the treatment plan in time, and improve the treatment effect.

This study found that retreatment could have an effect on the cure of pulmonary tuberculosis in adolescents. Retreatment significantly affects the treatment outcome, and need for pulmonary tuberculosis has been related to not using standard regimens for initial treatment[16,17], resulting in increased incidence of drug-resistance[18]. However, there is still promising to cure pulmonary tuberculosis by standardized treatment using first-line drugs. At the same time, the disease status of retreated patients is more complex, and the therapeutic effect on them is often not so satisfactory. Poor treatment of retreated patients is easy to develop drug resistance, which brings harm to patients and society[19,20]. Therefore, the successful improvement of initial treatment is very important, and the choice of standard first-line drugs or second-line drugs for retreatment of patients can be individualized[21].

We should pay attention to adolescent pulmonary tuberculosis patients with pulmonary cavity, complications, sputum testing results at the second month, and retreatment. In the process of treatment, doctors should pay attention to the health education of patients, urge patients to check sputum on time, take medicine on time and so on. In addition, individualized treatment can be carried out according

to the specific situation of patients in order to improve the cure rate and reduce the failure rate.

5. Conclusion

The lung cavities, comorbidities, sputum testing results at the second month, and treatment classification have an impact on the cure rate of adolescent pulmonary tuberculosis. It is of great significance to understand the influencing factors of cure in adolescent patients, and to effectively improve the cure rate of adolescent patients through active intervention and monitoring of influencing factors.

Acknowledgements

This study was supported by the National Natural Science Foundation of China (NSFC, No. 81673160).

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