

WEIGHT GAIN IN PATIENTS WITH TUBERCULOSIS TREATED UNDER DIRECTLY OBSERVED TREATMENT SHORT-COURSE (DOTS)

M. Vasantha, P.G. Gopi and R. Subramani

(Received on 3.1.2008; Accepted after revision on 14.8.2008)

Summary

Set up: One Tuberculosis Unit (TU) in Tiruvallur district, Tamil Nadu, India where Tuberculosis (TB) patients treated under Directly Observed Treatment Short Course (DOTS) programme.

Objective: To identify the effects of weight gain among TB patients at the end of treatment on different factors such as socio-economic and demographic characteristics, smoking and drinking habits, treatment under supervision, the type of DOTS centres and problems in taking drugs.

Methods: TB patients registered between May 1999 and December 2004 formed the study population. Multiple regression method was used for the analysis.

Results: Among 1557 smear-positive TB patients registered under DOTS programme, the changes in weight ranged from a loss of 4 kgs to a gain of 20 kgs at the end of TB treatment; the average change in weight was 3.22 kgs. The gain in weight at the end of treatment was associated with age (<45 years), DOT at government centres, no problems in taking drugs as reported by patients and cure rate.

Conclusion: The findings showed that there is an association between gain in weight with DOT at government centres and cure of patients. [Indian J Tubrc 2009; 56: 5-9]

Key words: Tuberculosis, Weight gain after treatment, Multiple regression.

INTRODUCTION

Patients with Tuberculosis (TB) often suffer from severe weight loss, a symptom that is considered immuno-suppressive and a major determinant of severity and disease outcome¹. Malnutrition is an important risk factor for TB, because cell-mediated immunity (CMI) is the key host defense against TB. The association between body weight, TB mortality and morbidity has been studied extensively since 1986²⁻⁴. Directly Observed Treatment Short-course (DOTS) is the internationally recommended strategy for TB control, adopted as the Revised National TB Control Programme (RNTCP) in India since 1997. The country was covered under the programme by March 2006 and has almost achieved the global target of 85% cure and 70% case detection. There are about 8.9 million patients with TB in India, of whom half are infectious (sputum smear-positive pulmonary TB)⁵. Currently, nation wide coverage

results in a success rate of 86% and a death rate of 4%⁶.

The weight of the patient taken at different time points during treatment is an important component to assess the progress of patients. The relationship between change in weight among patients during anti-TB treatment and other factors such as socio-economic demographic characteristics, smoking and drinking habits, whether the patient took treatment under supervision, the type of DOT centres and problems in taking drugs has not been well documented. The objective of the study was to identify the association of weight gain during treatment to these factors and relative importance of these in RNTCP.

METHODS

The study was conducted at a rural TB unit (TU) in Tiruvallur district, South India. The study

Tuberculosis Research Centre, Chennai.

Correspondence: The Director, Tuberculosis Research Centre (ICMR), Mayor V.R. Ramanathan Road, Chetput, Chennai-600 031. Ph: 91 044 28369600, 28369671; Fax: 91 044 28362528; E-mail: icmrtrc@vsnl.com

area included 209 villages and nine urban clusters consisting of a population of 5,80,000 scattered across approximately 200 km². The DOTS strategy has been implemented in this area since May 1999⁷. Seventeen governmental health facilities (HFs) participate in the programme and, of these, seven offer diagnostic facilities for sputum examination. All the patients diagnosed with TB at one of these HFs are given DOT in accordance with RNTCP policies⁷. This study was approved by the Scientific Advisory Committee and the Institutional Ethics Committee as per the Indian Council of Medical Research (ICMR) guidelines.

Between May 1999 and December 2004, 5366 TB patients were registered for treatment under DOTS in this area. Data on socio-economic and demographic characteristics was collected within a week of starting the treatment. Trained field staff interviewed the patients at their residence and collected information on smoking and drinking habits (only from men), whether the patient took treatment under supervision, the type of DOTS centres and any problems in taking drugs using a pre-tested semi-structured questionnaire. Data regarding treatment outcome was collected at the end of the treatment from the TB register maintained at the TU. Standard international definitions were followed to classify TB patients according to outcome⁸. Weight recorded at the initial stage of treatment and at the end of anti-TB treatment was collected from the treatment cards of the patients.

Data were scrutinized and entered twice in order to ensure accuracy, corrected for discrepancy and missing information. The analysis was confined to smear-positive cases and hence extra-pulmonary cases and Category III patients were removed from final analysis. Multiple regression (SPSS version 13.0) was performed to identify the association of weight gain on different factors. The adjusted hazard ratio and 95% confidence intervals (CI) were estimated for the factors. The level of statistical significance was defined as $p < 0.05$.

RESULTS

Among the 5366 TB patients, 1557 smear-positive patients whose weight was available at the initiation of treatment, and at the end of treatment were considered for the analysis. Of the 1557 TB patients registered under DOTS programme, 1175 (75%) were males, 690 (44%) were aged 45 years or more, 623 (40%) were illiterate and 478 (31%) were unemployed. Major life style indicators for the patients included the following: 638 (41%) smokers and 474 (30%) alcoholics. Of the 1557 patients, 1285 (83%) were treated under Category I, and 272 (17%) were treated under Category II (Table 1). For these patients, the treatment outcomes were as follows: 1394 (89.5%) were cured, four (0.3%) completed treatment, 52 (3.3%) defaulted, nine (0.6%) expired, 97 (6.2%) failed treatment and one (0.1%) was transferred out.

The mean weight of patients at the initial stage of treatment was 42 kgs. At the end of treatment, the change in weight for 1557 patients by category-wise is set out in Table 2. Overall, the change in weight ranged from a loss of 4 kgs to a gain of 20 kgs with an average change in weight of 3.22 kgs. Weight remained constant from initial stage to the end of treatment for 98 (6.3%) patients. Sixty-eight (4.4%) patients lost weight (mean = -1.79, Standard Deviation (SD) = 1.43, range (-9,-1) where as 1391(89.3%) attained weight (mean = 3.67, SD = 2.45, range (1, 20). Among the 1391 patients, 228 (16.4%) patients gained weight less than 2 kgs, 762 (54.8%) gained 2-4 kgs, 401 (28.8%) gained more than 4 kgs.

Among the Category I patients, the change in weight ranged from -4 to 20 kgs with an average of 3.34 kgs whereas among Category II, it ranged from -3 to 13 kgs with an average of 2.56 kgs. Weight remained constant from initial stage to end of treatment for 72 (5.6%) Category I patients compared to 26 (9.6%) Category II patients. The corresponding figures for patients who lost weight were 42 (3.3%) and 26 (9.6%); and for those gained weight were 1171(91.1%) and 220 (80.8%) respectively. The difference in weight gain between

Table 1: Characteristics of TB patients registered under DOTS in a rural district, south India

Factors	n = 1557 Total (%)
Sex	
Female	382 (25)
Male	1175 (75)
Age (Years)	
<45	867 (56)
≥45	690 (44)
Education	
Illiterate	623 (40)
Literate	828 (53)
Non-availability	106 (7)
Occupation	
Unemployed	478 (31)
Employed	974 (62)
Non-availability	105 (7)
Smoking	
No	813 (52)
Yes	638 (41)
Non-availability	106 (7)
Alcoholism	
No	978 (63)
Yes	474 (30)
Non-availability	105 (7)
DOT centre	
Government	931 (60)
Non-Government	529 (34)
Non-availability	97 (6)
Supervision under IP	
No	319 (20)
Yes	1130 (73)
Non-availability	108 (7)
Problem in taking drugs	
No	476 (30)
Yes	588 (38)
Non-availability	493 (32)
Category	
I	1285 (83)
II	272 (17)

Category I and Category II patients was statistically significant ($p < 0.001$).

The gain in weight at the end of treatment was associated with age (< 45 years) ($p < 0.05$), Government DOTS centres ($p < 0.05$), no problems in taking drugs ($p < 0.01$) and cure rate ($p < 0.05$). (Table 3).

DISCUSSION

This study showed that weight gain during the treatment was associated with age (< 45 years), DOT at government centres, no problems in taking drug as reported by patients and cure of patients. TB control programme prevents infection and stops progression from infection to active disease, treats all active cases and completely cures all of them. The DOTS strategy has been found to be very effective all over the world and our country has almost achieved the global target. In the study area, the success rate of patients treated under DOTS during the study period was about 80%. Patients put on treatment gaining body weight show improvement towards the end of treatment. Our study has supported that the cure is significantly associated with patient's gain in body weight. Another factor associated with gain in weight was age of the patients; younger patients are more likely to gain body weight during treatment compared to older patients. Patients who took treatment at Government centres and those who reported that they had no problems in taking drugs were more likely to have gained body weight.

There are many studies that have shown the effect of body weight on the treatment outcome. An earlier report from our centre⁷ showed that 39 (6%) of 676 TB patients died during the treatment period, and that higher death rates were independently associated with base line body weight < 35 kgs and a history of previous treatment for TB. The study recommended that nutritional interventions should be considered among underweight patients to reduce mortality. Another study from our centre found that the higher death rates were independently associated with patient's age (≥ 45 years), previous history of treatment, alcoholism and initial body

Table 2: Category-wise distribution of change in weight at end of treatment period

Category	No. of patients	Difference in weight (kgs)			Average (Range) (kgs)
		No change No. (%)	Loss No. (%)	Gain No. (%)	
I	1285	72 (5.6)	42 (3.3)	1171 (91.1)	3.34 (-4, 20)
II	272	26 (9.6)	26 (9.6)	220 (80.8)	2.56 (-3, 13)
Total	1557	98 (6.3)	68 (4.4)	1391 (89.3)	3.22 (-4, 20)

Table 3: Results of the multiple regression analysis of factors for gain in weight among 904 TB patients at the end of treatment

Factors	Non-standardised Co-efficient		Standardized Regression Co-efficient	95% C.I.for B	P
	B	S.E			
Male	-0.035	0.232	-0.006	(-0.490, 0.420)	0.879
Age (<45 years)	0.349	0.173	0.071	(0.010, 0.689)	<0.05
Cure of the patient	0.350	0.135	0.086	(0.084, 0.615)	<0.05
Employed	0.059	0.181	0.012	(-0.296, 0.413)	0.745
Non-smokers	-0.075	0.219	-0.015	(-0.505,0.355)	0.731
Non-alcoholics	-0.134	0.210	-0.026	(-0.547,0.279)	0.525
DOT at Government. Centres	0.346	0.164	0.071	(0.025, 0.668)	<0.05
Treatment under supervision	0.294	0.214	0.046	(-0.125,0.714)	0.169
No problems in taking drugs	0.434	0.163	0.089	(0.115, 0.753)	<0.01

B – Regression co-efficient, S.E- Standard error, C.I – Confidence Interval

The number of patients is less than 1557 due to non-availability of patients at the time of interview, within a week after treatment started.

weight (<35 kgs)⁹. In another study, the treatment success rate was increased as the body weight increased, and the increase in trend was statistically significant (Trend Chi square 22.0; p<0.001) (unpublished). All these findings showed that patient's body weight is associated with treatment

outcome. Our study has substantiated this finding of the association between weight gains of patients with cure of the patients. The proportion of Category I patients who gained weight was significantly higher compared to Category II patients. This finding emphasizes that patients under treatment have to

complete the full course of DOT without interruption. Khan et al reported that among persons who were underweight at diagnosis, weight gain of 5% or less among underweight tuberculosis patients after two months of treatment was associated with an increased risk of relapse¹⁰.

A study from Japan reported that the ageing of the Japanese population partially accounts for the increase in the number of patients with TB. The disease is often transmitted from these aged patients to those who were uninfected. After admission, in patients showing negative conversion of bacilli, there was a positive correlation between the increase in PNI (Prognostic Nutritional Index) and the gain of body weight ($p < 0.01$, $r = 0.30$)¹¹. Weight loss is associated with impaired physical function as well as increased mortality in patients with TB. Our study highlights the need to improve the body weight during treatment for a successful treatment outcome. A higher likelihood of weight gain was associated with patients taking treatment in DOT at government centres. Another important finding of this study was the need to have DOTS patient friendly.

In conclusion, weight gain at the end of treatment was associated with age (<45 years), DOT at government centres, no problems in taking drug as reported by patients and cure of patients. TB patients should be educated on optimizing nutritional intake as part of the routine management of TB control programme.

ACKNOWLEDGEMENTS

The authors thank the staff of Electronic Data Processing Department of Epidemiology Unit for computerization of data pertaining to this study. The authors appreciate the field staff and social workers for meticulous data collection under the guidance of Dr. C. Kolappan and Dr. K. Sadacharam. The authors are grateful to Mr. S. Radhakrishnan for maintaining the TB register and other documents. The study was supported in part by the World Health Organization (WHO) with financial assistance provided by United States Agency for International

Development (USAID) under the Model DOTS project.

REFERENCES

1. Van Crevel R, Karyadi E, Netea M G, Verhoef H, Nelwan RH, West CE, Va der Meer J W. Decreased plasma leptin concentrations in Tuberculosis patients are associated with wasting and inflammation. *J Clin Endocrinol Metab* 2002; **87(2)**:758-63.
2. A Tverdal. Body mass index and incidence of Tuberculosis. *Eur J respire Dis* 1986; **69**: 355-62.
3. England A, Bjorge T, Sogaard AJ, Tverdal A. Body mass index in adolescence in relation to total mortality: 32-year follow-up of 227,000 Norwegian boys and girls. *Am J Epidemiol* 2003; **157(6)**: 517-23.
4. Sacks LV, S Pendle. Factors related to in-hospital deaths in patients with Tuberculosis. *Arch Intern Med* 1998; **158(17)**: 1916-22.
5. TB India 2005. RNTCP status report. New Delhi: Central TB Division, Directorate General of Health Services, Ministry of Health and Family Welfare, Government of India; 2005.
6. Central TB Division. Directorate of General Health Services Ministry of Health and Family Welfare, Nirman Bhavan, New Delhi 110 011. <http://www.tbcindia.org> (Accessed on May April 2006).
7. Santha T, Garg R, Frieden T.R, Chandrasekaran V, Subramani R, Gopi P.G, Selvakumar N, Ganapathy S, Charles N, Rajamma J, Narayanan PR. Risk factors associated with default, failure and death among tuberculosis patients treated in a DOTS programme in Tiruvallur District, South India, 2000. *Int J Tuberc Lung Dis* 2002; **6(9)**: 780-88.
8. Khatri G.R, Frieden T.R. The status and prospectus of Tuberculosis control in India, *Int J Tuberc Lung Dis* 2000; **4**: 193-200.
9. Vasantha M, Gopi P G, Subramani R. Survival of Tuberculosis patients treated under DOTS in a rural TU, South India. *Indian J Tuberc* 2008; **55**: 64-69.
10. Awal khan, Timothy R. Sterling, Randall Reves, Andrew vernon, Robert Horsburgh C, and the Tuberculosis Trails Consortium. Lack of weight gain and relapse risk in a large Tuberculosis treatment trial. *Am J Respir Crit Care Med* 2006; **174**: 344-48.
11. Handa M. A nutritional and immunological investigation of patients with Tuberculosis. *Kekkaku* 1994; **69(7)**: 463-9.