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Role of serum albumin in monitoring nutritional status in patients with pulmonary tuberculosis

Sandeep Krishna Nalabothu[1*], Surendra Menon K[2]

[1]Senior resident, Department of Pulmonary Medicine, Siddartha Medical College, Vijayawada, India
[2]Professor & Head of Department, Department of Pulmonary Medicine, Mahatma Gandhi Medical College & Research Institute, Puducherry, India

ABSTRACT

Background: Pulmonary tuberculosis is a communicable disease caused by mycobacterium tuberculosis. Serum albumin is a more accurate indicator of crucial fat-free mass and survival in patients treated for tuberculosis.
Objective: To study the role of serum albumin as biochemical marker for monitoring the nutritional status in newly diagnosed tuberculosis patients during treatment.
Methodology: This was a longitudinal study carried out in Mahatma Gandhi Medical College and Research Institute, Puducherry. All the patients who satisfied inclusion criteria received tuberculosis chemotherapy. All the indices like Weight, Body Mass Index (BMI), Serum Albumin and sputum for Acid Fast Bacilli (AFB) were estimated before start of treatment and followed up once in two months until completion of treatment.
Results: Out of the 77 patients started the study, 50 patients completed the study. The pre-treatment mean weight, Body Mass Index and Serum albumin were 46.78kg, 17.22kg/m^2 and 25.68g/L respectively. The corresponding values at the end of six months of treatment were 52.86 kg, 19.09kg/m^2 and 40.14g/L. These three variables showed significant improvement with treatment. Serum albumin showed statistically significant improvement with treatment when compared to weight and Body Mass Index.
Conclusion: Both the Serum albumin and Body Mass Index pre-treatment values reveal that patients are malnourished at presentation. Serum albumin is more sensitive and reliable marker than weight and Body mass index for patients with tuberculosis that have an average of monthly visits to hospitals.

Keywords: Nutritional status; Body mass index; Body weight; Serum albumin; Pulmonary tuberculosis.

Introduction

Pulmonary tuberculosis is a communicable disease of global importance caused by mycobacterium tuberculosis. Tuberculosis (TB) is on the increase throughout the world and is one of the leading causes of death among adults in developing countries like India. In 1993, the World Health Organization declared tuberculosis to be a "global health emergency [1].

**Correspondence*
Dr. Sandeep Krishna Nalabothu
Senior resident, Department of Pulmonary Medicine, Siddartha Medical College, Vijayawada, India
Email: iam_sandeep_krishna@yahoo.com

Despite the availability of effective therapy for TB, it continues to infect an estimated one-third of the world's population, to cause disease in 8.8 million people per year, and to kill 1.6 million of those afflicted with disease [2]. India has the highest number of TB cases in the world and it is second leading cause of death among all diseases [3].
In most of the underdeveloped and developing countries of the world both tuberculosis and malnutrition are still problems of considerable magnitude [4]. Malnutrition may predispose people to development of disease and tuberculosis can contribute to malnutrition [5]. The risk of tuberculosis is higher among men who were at least 10% underweight at baseline by nearly four-fold than in men who were at least 10% overweight [6]. In tuberculosis, weight loss is one of the most obvious manifestations of nutritional wasting. The bulk of weight loss in patients with

tuberculosis is fat mass, though the fat free component, which is also lost in significant amounts, certainly has more of an effect on the physical functioning of patient. Protein deficiency has been described in the context of tuberculosis, Protein calorie malnutrition has been identified as an essential risk factor for the predisposition to intracellular infection and leading to death [7].Serum albumin has a half-life of 21days, it is a good index of body nutrition, more so for patients with pulmonary tuberculosis that have an average of monthly visits to the clinics.

Previous studies by Schwenk *et al* and Adebisi SA *et al* have shown that protein is one of the major components lost during an episode of tuberculosis; it is not significantly regained during the course of treatment, making overall weight gain an inadequate clinical marker for following the reversal of TB wasting.Serum albumin may be a more accurate indicator than weight of improving nutritional status [especially with regard to crucial fat-free mass] in patient treated for tuberculosis [8, 9].

This study was therefore carried out to determine the degree of malnutrition among patients with pulmonary tuberculosis using their Body Mass Index and serum albumin levels and to evaluate role of serum albumin as Biochemical marker for monitoring nutritional status of newly diagnosed smear positive pulmonary tuberculosis patients during treatment.

Methodology

The study was carried out in the department of Pulmonary Medicine, Mahatma Gandhi Medical College and Research Institute, pillayarkuppum, Puducherry, India after the clearance of the Institutional Human Ethical committee (IHEC). This is a prospective, longitudianl study that involves humans.

Inclusion Criteria

1. Newly diagnosed pulmonary tuberculosis who is atleast one sputum specimen positive for Acid-Fast bacilli (AFB) by microscopy.
2. Age above 18years.

Exclusion Criteria

1. Patients with Abnormal liver function as measured by increased serum levels of Aspartate amino transferase (AST), Alanine amino transferase (ALT) and Bilirubin levels.
2. Chronic renal failure as determined by elevated levels of serum urea and creatinine.
3. Patients with diabetes mellitus as measured by fasting blood glucose levels.
4. Patients on long term Acetaminophen and Statin therapy.
5. Patients with Hypoprotenaemia.

All the Patients who satisfied the inclusion criteria attending the Pulmonary Medicine Out Patient Department from December 2012 to January 2014 received Directly Observed Treatment Shortcourse (DOTS) chemotherapy for 6 months Category I under Revised National Tuberculosis Control Programme (RNTCP) This consists of Isoniazid, Rifampicin, Ethambutol and Pyrazinamide. Pyrazinamide and Ethambutol were used only for the first two months of the therapy.

In all the patients weight was measured using a weighing machine. Height was measured using a standard scale without wearing foot wear. Body Mass Index (BMI) was calculated using Quetelet's Index. Serum albumin levels were measured by Bromocresol green method [10].

Each patient was followed up for a period of six months. All the indices like Weight, BMI, Serum Albumin and sputum AFB were estimated on the first day of visit before start of treatment and followed up once in two months until completion of treatment.

SPSS version 19.0 (IBM SPSS, US) was used to analyze the data. The quantitative variables have been described as mean ± SD or Frequency analysis with numbers and percentage. Since data does not follow normal distribution non-parametric test Kruskal Wallis test and wilcoxon signed rank test are the statistical tests used for testing the hypothesis. Value of $p< 0.05$ was considered significant.

Results

Out of the 77 patients started the study, 27 of them were lost to follow up, while the remaining 50 patients followed up in department of pulmonary medicine, Mahatma Gandhi Medical College & Research Institute, Puducherry and completed the study. The 50 patients were made up of 32(64%) males and 18(36%) females. These patients by using pre-treatment data served as their own controls against which subsequent data were compared.

Table I shows frequency of gender among patients. It is shows that majority of the patients are males 32(64%) and only 18(36%) of the patients are females.

Table II shows the mean values of weight, Body Mass Index and serum albumin of the patients.Both the Body Mass Index (BMI) and Serum Albumin pre-treatment

values show clearly that the patients were malnourished at presentation.

Table III shows the results of analysis with wilcoxon signed rank test, using the pre-treatment values and the post treatment values of weight, Body Mass Index and serum albumin.The critical value ratio calculated (z-test) was -6.185, -6.161 and -6.179, while their corresponding p-values were 0.000, 0.000 and 0.000 respectively.This shows that with treatment there was significant improvement in all theoutcome variables.

Table IV shows further analysis of mean values of the patient's weight, Body Mass Index and serum albumin with Kruskal-wallis test gave a chi square value/kruskal-Wallis H of 10.074, 17.895 and 141.053, while their corresponding p-values were 0.018, 0.000 and 0.000 respectively.This that the weight, Body Mass Index and serum albumin had changed significantly; the serum albumin with chi square value of 141.053 is the most sensitive.

Table I: Frequency of Gender

Gender	Frequency	Percent (%)
Male	32	64.0
Female	18	36.0
Total	50	100.0

Table II: Mean and Standard deviation of Weight, Body Mass Index (BMI), and Serum Albumin before treatment, end of 2nd month, end of 4th month and at the end of treatment

Variable	Before Treatment		After 2 months of ATT		After 4 months of ATT		End of treatment	
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
Weight(kg)	46.7800	10.17	49.7400	9.83	51.3200	9.81	52.8600	9.92
BMI(kg/m^2)	17.2280	2.23	18.0860	2.14	18.6080	2.09	19.0980	2.09
Serum Albumin(g/L)	25.6800	3.72	33.2200	3.54	36.6400	3.13	40.1400	3.18

Table III: Wilcoxon-signed rank test analysis of pre-treatment and end of treatment values of weight, Body Mass Index (BMI) and Serum Albumin.

		N	Mean Rank	Sum of Ranks	z-test	P-value
Weight(kg) - Weight(kg)	Negative Ranks	0[a]	.00	.00	-6.185[b]	0.000
	Positive Ranks	50[b]	25.50	1275.00		
	Ties	0[c]				
	Total	50				
BMI(kg/m^2) - BMI(kg/m^2)	Negative	0	.00	.00	-	0.000

	Ranks	0[d]				
	Positive Ranks	50[e]	25.50	1275.00	6.161[b]	
	Ties	0[f]				
	Total	50				
Serum Albumin(g/L) – Serum Albumin(g/L)	Negative Ranks	0[g]	.00	.00	-6.179[b]	0.000
	Positive Ranks	50[h]	25.50	1275.00		
	Ties	0[i]				
	Total	50				

a. Weight(kg) <Weight(kg)
b. Weight(kg) >Weight(kg)
c. Weight(kg) = Weight(kg)
d. BMI(kg/m^2) <BMI(kg/m^2)
e. BMI(kg/m^2) >BMI(kg/m^2)
f. BMI(kg/m^2) = BMI(kg/m^2)
g. Serum Albumin(g/L) <Serum Albumin(g/L)
h. Serum Albumin(g/L) >Serum Albumin(g/L)
i. Serum Albumin(g/L) = Serum Albumin(g/L)

Table IV: Kruskal-Wallis test for analysis of weight (kg), Body Mass Index (BMI) and Serum Albumin (g/L)

	Group	N	Mean Rank	Chi-square value/Krushal-Wallis H	P-value
Weight (kg)	Pre Treatment BMI(kg/m2)	50	80.93	10.074	**0.018**
	After 2 months of ATT BMI(kg/m2)	50	97.89		
	After 4 months of ATT BMI(kg/m2)	50	107.21		
	End of treatment BMI(kg/m2)	50	115.97		
	Total	200			
BMI (kg/m^2)	Pre Treatment BMI(kg/m2)	50	74.93	17.895	**0.000**
	After 2 months of ATT BMI(kg/m2)	50	96.10		
	After 4 months of ATT BMI(kg/m2)	50	109.31		
	End of treatment BMI(kg/m2)	50	121.66		
	Total	200			
Serum Albumin(g/L)	Pre Treatment BMI(kg/m2)	50	29.36	141.053	**0.000**
	After 2 months of ATT BMI(kg/m2)	50	87.73		
	After 4 months of ATT BMI(kg/m2)	50	124.03		
	End of treatment BMI(kg/m2)	50	160.88		
	Total	200			

Discussion

The study was carried out in the department of Pulmonary Medicine, Mahatma Gandhi Medical College & Research Institute (MGMC&RI) pillayarkuppum, Puducherry after the clearance of the Institutional Human Ethical committee (IAEC).This study was carried out over a period of one and half year from December 2012 to July 2014.

Through this study, an attempt was made to study the role of serum albumin as biochemical marker for monitoring the nutritional status in newly diagnosed smear positive pulmonary tuberculosis patients during treatment and to find out association between sputum conversion and serum albumin levels at the end of intensive phase of treatment.

Out of the 77 patients started the study, 27 of them were lost to follow up, while the remaining 50 patients followed up in department of pulmonary medicine, Mahatma Gandhi Medical College & Research Institute (MGMC&RI) and completed the study. The 50 patients were made up of 32(64%) males and 18(36%) females. Out of 50 patients 33(66%) patients had low Body Mass Index (BMI) and 17(34%) patients had normal Body Mass Index (BMI) with a mean Body Mass Index (BMI) of 17.22kg/m2 at start of treatment. This shows a clear association between undernutrition and incidence of tuberculosis. Similar reports were given by Edwards LB *et al* and Tverdal A *et al* [6, 11]. In our present study, pre-treatment Serum albumin (25.68g/L) was significantly lower in patients with pulmonary tuberculosis. The lower levels of serum albumin in the present study might have been due to poor appetite, malnutrition and mal-absorption commonly observed in tuberculosis. Similar reports were given by Yamagishi *et al* and Cegielski JP *et al* [12, 13].

In our study, Weight, Body Mass Index (BMI), Serum albumin values of the patients showed a steady improvement as the treatment progressed. The pre-treatment mean weight, Body Mass Index (BMI) and Serum albumin were 46.78kg, 17.22kg/m2 and 25.68g/L respectively. The corresponding values at the end of six months of treatment were 52.86kg,19.09kg/m2 and 40.14g/L.The consistent upward trends of these parameters during treatment show that they may be reliable markers of nutritional status for monitoring tuberculosis.

Subjecting the patients pre-treatment value and the post treatment value of weight, Body Mass Index (BMI) and serum albumin using wilcoxon signed rank test, The critical value ratio calculated (z-test) was -6.185, -6.161 and -6.179,while their corresponding p-values were 0.000, 0.000 and 0.000 respectively.This shows that with treatment there was significant improvement in all the outcome variables.Similar observation was mentioned by Adebisi S.A *et al* [8].

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Conclusion

This study suggests that weight, Body Mass Index (BMI) and serum albumin are very reliable markers of nutritional status in patients with newly diagnosed smear positive pulmonary tuberculosis. Of these three parameters, serum albumin is the most sensitive. Since serum albumin is free from some of the short comings of weight and body Mass Index (BMI) like drug induced vomiting and diarrhoea. As serum albumin is a relatively easily available biochemical marker can be used in addition to weight and Body Mass Index (BMI) in monitoring the nutritional status of patients with pulmonary tuberculosis.

References

1. Reichmann LB. How to ensure the continued resurgence of tuberculosis. *Lancet*. 1996: 175–177.
2. World Health Organization. Tuberculosis Fact Sheet. Fact Sheet No. 104. 2007.
3. Dye C, Scheele S, Dolin P, Raviglione MC. Consensus Statement. Global burden of TB: estimated incidence, prevalence, and mortality by country. WHO Global surveillance and Monitoring Project. *JAMA*. 1999; 282:677-86.
4. Rubin S.A. Tuberculosis: Captain of all these men of death. *Radio ClinNoth Am*. 1995; 33:619-39.
5. Macallan DC. Malnutrition in tuberculosis. Diagn Microbial Infect Dis. 1999; 34:153-7.
6. Edwards LB, Livesay VT, Acquavivi FA, Palmer CE. Height, Weight, tuberculosis infection and tuberculous disease. *Arch Environ Health*. 1971; 22:106-12.

7. Tupasi TE, Velmonte MA, Sanvictores ME, Abraham L. Determinants of morbidity and mortality due to acute respiratory infections: Implications and intervention. *J Infect Dis*. 1988; 157:615-23.
8. Adebisi SA, Oluboyo PO, Oladipo OO. The usefulness of serum albumin and urinary creatinine as biochemical indices for monitoring the nutritional status of Nigerians with pulmonary tuberculosis. *Niger Post grad Med J.* 2003; 10: 247-250.
9. Achim schwenk *et al*. Nutrient partitioning during treatment of tuberculosis: gain in body fat mass but not in protein mass. Ajcn.nutrition.org August 5, 2013.
10. Dumas BT, Watson WA, Biggs HG. Albumin standards and the measurement of serum albumin with Bromocresol green. 1971. *ClinChimActa* 1997; 258:21–30.
11. Tverdal.A *et al*. Body mass index and incidence of tuberculosis. *Eur J Respiratory Diseases* 1986; 69:355-62.
12. Yamagishi F, Sasaki Y, Yasi T. Mizutani F. A case of pulmonary tuberculosis case with pancytopenia accompanied to bone marrow gelatinous transformation.1999; 74 (4):361-4.
13. Cegielski JP, Arab L, Cornoni-Huntle J. Nutritional risk factors for tuberculosis among adults in the United States 1971-1992.*Am J Epidemiology*. September 2012; 176(5):409-22.

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