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ORIGINAL RESEARCH

To determine the correlation of Radiological Changes, BMI, and Weight Variation with Anti-Tubercular Treatment in Patients With Pulmonary Tuberculosis

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Abstract

Aim: To determine the correlation of Radiological Changes, BMI, and Weight Variation with Anti-Tubercular Treatment in Patients With Pulmonary Tuberculosis.

Methods: After obtaining authorization from the institution, this cross-sectional observational research was conducted. This research comprised 100 patients aged 20 and above, as well as patients with pulmonary TB. Patients with uncontrolled diabetes and HIV, pregnant women with TB, and patients with extrapulmonary tuberculosis were all excluded from the trial. Demographic information such as gender, age, weight, height, and BMI were collected.

Results: The mean age of the study population was 44.22±10.20 years, ranging from 20 to 80 years. Males made up 56 percent of the patients and females made up 44 percent (44 percent). In the majority of patients on ATT, mean weight rose by 5.83 percent after three months and 11.56 percent after six months. In contrast to the start of ATT, the gains in mean weight and parenchymal clearance in CXR were 6.99 percent, 24.46 percent at 3 months, and 8.76 percent, 70.26 percent at 6 months, respectively. In compared to the start of ATT, there was an 8.43 percent increase in mean weight and a 20.72 percent decrease in lymphadenopathy at 3 months, and a 12.90 percent and 30.81 percent decrease at 6 months. In contrast to the start of ATT, gains in mean weight and cavitation clearance in CXR were 6.48 percent and 9.51 percent after 3 months, respectively, and 11.48 percent and 23.53 percent at 6 months. In contrast to the start of ATT, there was a 12.64 percent increase in mean weight and a 5.77 percent decrease in pleural effusion at 3 months, and a 21.86 percent and an 8.57 percent decrease at 6 months.

Conclusion: There was a substantial rise in mean weight and BMI, as well as improvement in chest x-ray abnormalities such as parenchymal involvement, cavitation, pleural effusion, and lymphadenopathy. This means that monitoring baseline weight, height, Sputum smear, and CXR over the first 6 months of therapy might assist identify people who are more likely to have excellent or bad results and need more treatments or more medical care.

Keywords: Radiological Changes, BMI, Weight, Anti-Tubercular Treatment

Introduction

Resistance to the two potent anti-TB medications isoniazid (INH) and rifampicin is described as multidrug-resistant tuberculosis (MDR-TB) (R). The World Health Organization (WHO)

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reported 600,000 new cases of MDR-TB worldwide in 2016, including 136 cases in Guinea (Conakry). [1,2] In a resource-constrained setting like Guinea, identifying a biomarker of MDR-TB treatment response that is readily assessed and accessible in clinical practise would be advantageous for patient care and tuberculosis control initiatives. Numerous studies have shown that malnutrition as assessed by body weight is related with a poor MDR-TB treatment result, most likely owing to a complicated interaction between lower energy needs and decreased nutritional intake, and that weight loss may be a biomarker of treatment response. [3-7] Furthermore, a longitudinal research found that weight variance during the first 6 months varied according to treatment result, with a bad outcome being related with weight loss over time. [7] The basic premise of the mixed linear model employed in this work to examine weight change is that each patient has a unique mean profile of weight trajectory over time. However, this assumption of homogeneous weight change appears to be untenable, because patients with MDR-TB frequently differed in the severity of the disease at baseline in terms of clinical presentation, number of episodes of TB, presence of HIV co-infection or co morbidity (diabetes), susceptibility to drug toxicity, and resistance. As a result, it is necessary to identify and define homogenous groups of patients with varied weight changes using an appropriate approach as latent class models, in order to identify at-risk patients and ensure more effective resource usage and optimum patient treatment. [7]

Materials and Procedures

After obtaining authorization from the institution, this cross-sectional observational research was conducted. This research comprised 100 patients aged 20 and above, as well as patients with pulmonary TB. Patients with uncontrolled diabetes and HIV, pregnant women with TB, and patients with extrapulmonary tuberculosis were all excluded from the trial. Demographic information such as gender, age, weight, height, and BMI were collected.

PTB diagnostic criteria

According to the NTEP and Indian technical and operational recommendations for tuberculosis control, at least one first sputum sample should be positive for Acid-Fast Bacillus (AFB). (Indian Ministry of Health, 2005)

According to NETP standards, anti-TB therapy (ATT) for pulmonary tuberculosis is administered in two stages: Set Dose Combinations (FDCs) are medications that comprise two or more active substances in fixed dosages and are used for a specific indication (s). In NTEP, 4-FDC (56 daily doses administered in IP) contains HRZE, whereas 3-FDC (112 daily doses given in CP) contains HRE.

Weight, height, BMI, sputum smears examination, and CXR PA view, among other things, were gathered at the start of ATT and after 6 months.

Statistical investigation

The IBM SPSS (SPSS Inc., Chicago, Illinois-USA) ver. 25 software was used for all data analysis. The graphs were created using Microsoft Office and PRISM software. A P value of 0.05 is regarded as significant.

Results

The mean age of the study population was 44.22±10.20 years, ranging from 20 to 80 years. Males made up 56 percent of the patients and females made up 44 percent (44 percent). The age range 35-45 years had the highest prevalence of pulmonary TB (37%), whereas the age group 25-45 years had the highest prevalence (78 percent). Minimum mean wt 43.35 was found at ATT initiation in the age group of 25-35 years, but they gained maximum mean wt 12.25 percent (47.86 Kg) at 6 months of ATT, whereas maximum mean wt 46.43 was found

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at ATT initiation in the age group above 65 years, but they gained minimum mean wt 9.11 percent (49.83 Kg) at 6 months of ATT.

ATT resulted in a substantial rise in weight and BMI of patients at the end of 3 and 6 months as compared to the start of ATT. However, no significant differences in mean weight or BMI were found across genders or age groups. In the majority of patients on ATT, mean weight rose by 5.83 percent after three months and 11.56 percent after six months.

In contrast to the start of ATT, the gains in mean weight and parenchymal clearance in CXR were 6.99 percent, 24.46 percent at 3 months, and 8.76 percent, 70.26 percent at 6 months, respectively. In compared to the start of ATT, there was an 8.43 percent increase in mean weight and a 20.72 percent decrease in lymphadenopathy at 3 months, and a 12.90 percent and 30.81 percent decrease at 6 months. In contrast to the start of ATT, gains in mean weight and cavitation clearance in CXR were 6.48 percent and 9.51 percent after 3 months, respectively, and 11.48 percent and 23.53 percent at 6 months. In contrast to the start of ATT, there was a 12.64 percent increase in mean weight and a 5.77 percent decrease in pleural effusion at 3 months, and a 21.86 percent and an 8.57 percent decrease at 6 months.

Table1 age and gender of the patients

Gender	Number	%
Male	56	56
Female	44	44
Age	44.22±10.20	

Table 2: Distribution of patients and mean weight according to age groups

Age groups (years)	No. (%)	Mean Wt. At Initiation of ATT (Kg)	Mean Wt. at 6 months in Kg (increase in % from Initial Wt)
Below 25	15	44.53	48.98 (11.35 %)
25-35	26	43.35	47.86 (12.25%)
35-45	37	44.57	48.93 (11.13%)
45-55	10	43.82	48.37 (11.75 %)
55-65	8	43.85	48.48 (11.93 %)
Above 65	4	46.43	49.83 (6.11%)
Total	100	P value (0.51)	P value (0.55)

Table 3: **Comparison of Mean BMI, Mean Wt., Gender wise mean weight at different stage of ATT**

	Mean BMI of all pts.	Mean Wt. of all pts. (Kg)
At Initiation of ATT	16.81	44.28
At 3 months (increase in % from Initial Wt)	17.81 (6.13 %)	46.41 (5.83%)
At 6 months (increase in % from Initial Wt)	18.69 (11.66%)	48.80 (11.57%)

Table 4: Comparing weight variation at 3 months and 6 months of ATT

	Wt. Loss	Wt. Constant	Wt. Gain	Increase from initial wt.
Follow up at 3 months	4	3	93	5.83 %
Follow up at 6 months	1	2	97	11.57 %

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Table 5: Comparison of % of patients with mean weight in differentinvolved radiological sites at different stage of ATT

Site of Involvement	At Initiation of ATT		At 6 months of ATT	
	No. 0f Pt. (%)	Mean Wt (Kg)	No. 0f Pt. (%)	Mean Wt (Kg)
No Parenchymal finding	7	45.0	77	48.47 (8.76%)
Single Quadrant	24	44.18	19	48.67
Two Quadrant	49	43.88	4	53.64
Three Quadrant	11	44.18	1	32.10
All 4 Quadrant	8	45.21	00	48.47
PTB with Lymph adenopathy	41	43.12	11	47.88 (12.90%)
PTB with NO cavity	76	43.87	98	48.53 (11.48%)
PTB with One cavity	22	44.77	2	52.5
PTB &>One cavity	2	47.10	00	00
PTB & Pleural effusion	9	40.6	2	48.80 (21.86%)

Discussion

Weight evaluation may be a straightforward and low-cost tool for predicting outcome among patients receiving ATT in resource-constrained settings. [8] In this research, we attempted to assess the impact of ATT on weight fluctuation, BMI, and chest x-ray alterations in patients with pulmonary tuberculosis at various stages. This research discovered a substantial relationship between weight fluctuation, BMI, and changes in chest x-rays not only during therapy but also at the time of treatment result. According to the World Health Organization, patient weight should be checked once a month and doses should be modified if weight varies. [9] In this research, it was shown that pulmonary TB was more frequent in the mean age of the study group, which spanned from 20 to 80 years. The age range 35-45 years had the highest prevalence of pulmonary TB (37%), whereas the age group 25-45 years had the highest prevalence (78 percent). In another research, Barnwal et al discovered that the majority of study participants (28.3 percent) belonged to the age group of 41 to 50 years, followed by (20.75 percent) in the age group 21 to 30 years, with a mean age of 39.15±13.29 years ranging from 18 to 76 years. [10] In this investigation, it was shown that men had a higher prevalence of pulmonary TB (56%) than females (44 percent). Another retrospective research of 375 diagnosed tuberculosis patients of all ages found a male predominance (53.87 percent) compared to females (46.13 percent). [11] Another research by Barnwal et al. found male dominance in their investigation (79 percent). [10] In this research, a substantial rise in mean BMI was seen with highly significant p values from the start of ATT through the completion of the course. The mean BMI at the start of ATT was 16.812.72 kg/m2, rising to 6.13 percent (17.81±2.44 kg/m2) at 3 months and 11.66 percent (18.69±2.38 kg/m2) at 6 months. This demonstrates that ATT therapy raises the BMI of individuals with pulmonary TB. A study of two Taiwanese cohorts found a 2-fold increase in TB risk in underweight patients. [12] Similarly, a meta-analysis of six studies discovered a log-linear dose-response connection between BMI and TB incidence, as well as a 13.8% reduction in TB incidence per unit rise in BMI. [13] Body weight monitoring is straightforward, affordable, and convenient. Almost all TB clinics have a weighing scale equipment and weigh their patients once a month throughout treatment. In this research, mean weight rose significantly ($p<0.001$) from 44.28±6.65 kg to 5.83 percent (46.41±5.91 kg) at the end of 3 months and 11.57 percent (48.80±4.94 kg) at the end of 6 months. This demonstrates that ATT therapy causes individuals with pulmonary TB to gain weight. Barnwal et al observed the influence of anti-tubercular medication on weight in 58 TB patients in a research from Nagpur, Maharashtra revealed that at baseline mean weight of all study participants was 41.17±7.91, which improved to 3.03 percent (42.42±7.58) at two months and 5.90 percent (43.60±8.78) at six months. [10] Among a research conducted by Bernabe Ortiz et al, the mean weight at baseline

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was 54.78.3, which improved to 3.84 percent (56.8±8.5Kg) at 2 months and 7.31 percent (58.7±8.7Kg) at the end of 5 months in those who had a satisfactory result. [14] According to Phan et al, the mean weight at baseline was 63.9±1.4, which improved to 1.88 percent (65.11.7 Kg) at 2 months and 6.57 percent (68.11.4 Kg) at 6 months. [15] Weight increase, weight loss, and weight constant were determined to be 93.5 percent, 3.7 percent, and 2.8 percent after 2 months, and 97.2 percent, 0.93 percent, and 1.87 percent at the end of 6 months, respectively.

Another research found that 91.46 percent of patients gained weight, 4.27 percent maintained their weight, and 4.27 percent lost weight after the conclusion of ATT treatment.

[11] In a comparable research from Nagpur, Maharashtra, mean weight improved after six months of ATT therapy, but the change was determined to be non-significant. Similarly, in the trial by Hoa et al, the majority of the weight increase happened in the first two months. [16] According to a Dutch research, the majority of patients (85.4 percent) in their study had their body weight stable or grown throughout therapy, while a tiny number (14.6 percent) lost weight. [17] Phan et al found a substantial change in weight throughout the duration of therapy ($p< 0.0001$), with 31.9 percent of patients gaining at least 5% of their starting body weight after 2 months of treatment and 62.4 percent gaining at least 5% of their beginning weight at the conclusion of treatment. [15] In this research, as compared to the mean weight at the start of ATT, there was a 5.83 percent rise at the end of 3 months ($p<0.001$) and an 11.56 percent increase at the end of 6 months ($p<0.001$). This demonstrates a considerable rise in the weight of individuals on ATT with pulmonary TB. In several investigations, the average weight increase at the conclusion of treatment was reported to be 4.3 kg[18] and 4.39 kg. [11] Patients who were underweight at the time of diagnosis or gained less than 5% of their body weight during the first two months of therapy were more likely to relapse. They found that individuals with drug-susceptible TB who had a weight deficit of 10% or more of their ideal body weight at diagnosis and gained at least 5% of their baseline weight during the first two months of therapy had a decreased probability of subsequent recurrence. [19] A recent research of 2,609 patients treated in DOTS clinics in Vietnam found that individuals with a baseline weight of 40 kg and a weight increase of more than 5% after 2 months of therapy had a decreased chance of poor outcome. [16] CXR may be helpful for grading the amount of lung involvement and disease severity at diagnosis, as well as evaluating therapy outcome. [20] Grozdanovic et al developed a reading scheme based on five distinct radiographic appearances and analysed their connection with the clinical parameters of systemic involvement and infectivity in PTB patients at diagnosis and after completion of DOTS therapy. [21] On CXR, the percentages of lymphadenopathy, parenchymal, cavitation, and pleural effusion in this research with PTB involvement were 42.22 percent, 93.62 percent, 25.39 percent, and 10.44 percent, respectively.

In another research, the CXR indicated that 94.3 percent of patients had alveolar infiltrates, ranging from one to all four lung quadrants; moreover, 41.8 percent of patients exhibited lymphadenopathy. Cavitation was found in 29.1% of the patients. 21 At the end of 3 and 6 months, there was a substantial rise in mean weight with improvement in parenchymal involvement (p value of 0.001).

In this trial, there was a substantial improvement in lymphadenopathy ($p=0.001$). Out of 41 percent of PTB patients with lymphadenopathy at the start of ATT, 20% improved after 3 months and 30% improved at the end of 6 months (Only 11 percent patients had persisted with lymphadenopathy at the end of 6 months). Grozdanovic et al observed that lymphadenopathy dropped from 46.8 percent to 16.1 percent in a comparable research. [21]

In this research, there was an increase in mean weight with a substantial improvement in cavitation ($p=0.001$). The mean weight at the start of ATT therapy rose considerably to 46.16 kgs at 3 months ($p=0.003$) and 52.5 kgs at the end of 6 months ($p<0.001$). A study of 120

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individuals with pulmonary tuberculosis revealed that 49.2 percent had cavitary disease and 30.8 percent had severe disease on plain chest radiographs at the time of diagnosis and reported a considerable weight gain with improvement of the cavitary illness. [15]

Conclusion

There was a substantial rise in mean weight and BMI, as well as improvement in chest x-ray abnormalities such as parenchymal involvement, cavitation, pleural effusion, and lymphadenopathy. This means that monitoring baseline weight, height, Sputum smear, and CXR over the first 6 months of therapy might assist identify people who are more likely to have excellent or bad results and need more treatments or more medical care. These low-cost solutions may assist to improve outcomes and save medical costs, which eventually influence the national economy.

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