Original Research Article

Correlation of Radiological Changes, BMI and Weight Variation With Anti-Tubercular Treatment in Pulmonary Tuberculosis Patients

Ratan Kumar[1*], Anoop Kumar Singh[2], Animesh Kumar Dubey[3], Pushpak Goyal[4], Rahul Soni[5]

[1]Professor & HOD, Department of Pulmonary Medicine, LN Medical College & Research Centre, Kolar Road, Bhopal, Madhya Pradesh, India

[2]PG Student, Department of Pulmonary Medicine, LN Medical College & RC, Kolar Road, Bhopal , Madhya Pradesh, India

[3]Assistant Professor, Department of Pulmonary Medicine, LN Medical College & RC , Kolar Road, Bhopal , Madhya Pradesh, India

[4]PG Student, Department of Pulmonary Medicine, LN Medical College & RC, Kolar Road, Bhopal , Madhya Pradesh, India

[5]PG Student, Department of Pulmonary Medicine, LN Medical College & RC, Kolar Road, Bhopal , Madhya Pradesh, India

Received: 29-07-2021 / Revised: 30-09-2021 / Accepted: 26-10-2021

Abstract

Introduction: Despite of a relatively low transmission rate in TB as compared with other contagious diseases and the existence of effective chemotherapy for the past five decades, still tuberculosis remains a major global public health problem. Approximately one-third of the world's population is infected with tuberculosis.The radiological findings and Clinical parameters related to pulmonary Tuberculosis can be used for estimation of severity, deterioration and level of response to treatment, predicting to develop drug-resistant organisms in view of treatment failure, so it can be used as an important index for evaluating the efficacy of ATT. **Aims and objectives :**1.To determine the pattern of weight variation and BMI during treatment of pulmonary tuberculosis. 2. To assess the pattern of chest x-ray changes during the treatment of pulmonary tuberculosis. 3. To determine relationship between weight variation and chest x-ray changes during treatment of pulmonary tuberculosis **Materials and Methods :** This Cross Sectional observational study was done on 107 PTB patients whose **a**t least one initial sputum sample should be positive for Acid-Fast Bacillus (AFB) in , L.N. Medical College and Research Centre and J. K. Hospital, Bhopal , MP- India , Between December 2019 & July 2021. Apart from demographic data , Body weight, Height, BMI, Sputum AFB smear examination, Chest X-Ray etc. was done in all Patients at Initiation of ATT, at 2 months & at 6 months of ATT. After Data collection, Data analysis were performed using IBM SPSS (SPSS Inc., Chicago, Illinois-USA) ver. 20 software. Microsoft office and PRISM software was used to prepare the graphs. **Results :**In comparison from initiation of ATT, gain in mean wt , parenchymal clearance in CXR were observed 5.89%, 23.36% at 2 months while 7.66%, 69.16% at 6 months respectively. In comparison from initiation of ATT, gain in mean wt , subside in lymphadenopathy were observed 7.33%, 19.62% at 2 months while 11.80%, 29.91% at 6 months respectively. In comparison from initiation of ATT, gain in mean wt , cavitation clearance in CXR were observed 5.38%, 8.41% at 2 months while 10.38%, 22.43% at 6 months respectively. In comparison from initiation of ATT, gain in mean wt , subside in pleural effusion were observed 11.54%, 4.67% at 2 months while 20.76%, 7.47% at 6 months respectively. **Conclusions :**A significant increase in mean weight, BMI were observed along with improvement in chest x ray findings including Parenchymal Involvement, cavitation, pleural effusion and lymphadenopathy. This denotes that monitoring in baseline weight, height, Sputum smear and CXR during the first 6 months of treatment can help to identify persons who are more likely to have good or poor outcomes and require some other interventions or require greater medical attention. These inexpensive tools can help to improve outcome and reduce medical expenditure, which ultimately affect national economy.

Keywords: Pulmonary Tuberculosis , Weight variation , Radiological Changes, BMI, Anti Tuberculosis treatment.

Introduction

Tuberculosis is an infectious disease that can progress from focal infection to systemic infection caused by mycobacterium tuberculosis, spread from person to person most commonly by airborne transmission of droplet nuclei. Despite of a relatively low transmission rate compared with other contagious diseases and the existence of effective chemotherapy for the past five decades, still tuberculosis remains a major global public health problem. Approximately one-third of the world's population is infected with tuberculosis.The radiological findings and Clinical parameters related to pulmonary Tuberculosis can be used for estimation of severity, deterioration and level of response to treatment, predicting to develop drug-resistant organisms in view of treatment failure, so it can be used as an important index for evaluating the efficacy of ATT.

**Correspondence*

Dr. Ratan Kumar

Professor & HOD, Department of Pulmonary Medicine, LN Medical College & Research Centre, Kolar Road, Bhopal, Madhya Pradesh, India.

E-mail: ratan_vaish@yahoo.co.in

Radiology has been used as an important adjuvant to the diagnosis of tuberculosis due to its less expensive, easily availability and non-invasiveness. Chest radiography is a useful tools for achieving early diagnosis and reduction in morbidity.[1] Radiography presents high sensitivity for diagnosis, despite its low specificity.[2,3] Some CXR abnormalities are rather more specific for pulmonary TB (for example, cavities).

In drug sensitive TB, extent of lung disease and cavities on radiography at diagnosis are known to be associated with an increased sputum bacterial load, delayed smear and culture conversion, and an increased risk of treatment failure. There is scanty data about chest radiographic findings in MDR-TB/HIV co-infected patients. Chest computed tomography (CT) plays a significant role in the diagnosis of pulmonary tuberculosis (PTB) .[4] Chest CT can detect PTB in early stage and can be helpful to distinguish PTB from other etiologies.[5,6] Moreover, it can also provide additional information on the mycobacterial activity of TB lesions.[7]

Therefore this study was planned to conduct to study about radiological presentation and clinical changes in pulmonary tuberculosis on ATT in the young adults and elderly age group.

Aims and objectives

1. To determine the pattern of weight variation and BMI during treatment of pulmonary tuberculosis.
2. To assess the pattern of chest x-ray changes during the treatment of pulmonary tuberculosis.
3. To determine relationship between weight variation and chest x-ray changes during treatment of pulmonary tuberculosis

Materials and Methods

Study type: Cross Sectional observational study

Study Place: L.N. Medical College and Research Centre and J. K. Hospital, Bhopal

Duration of study: Between December 2019 & July 2021

Inclusion Criteria

1. Patients at the age of 18 years and above
2. Patients giving consent for the study
3. Patients with pulmonary tuberculosis

Exclusion criteria

1. Patients with history of Uncontrolled Diabetes and HIV.
2. Pregnant females diagnosed with tuberculosis.
3. Patients with extrapulmonary tuberculosis.

Sample Size: 107 patients with PTB.

Diagnostic criteria for PTB

At least one initial sputum sample should be positive for Acid-Fast Bacillus (AFB), in accordance with the NTEP and Indian technical and operational guidelines for TB control. (Ministry of Health India 2005)

Anti-tuberculosis treatment (ATT) for pulmonary tuberculosis is given in two phases as per NETP guidelines:

Fixed Dose Combinations (FDCs) refer to products containing two or more active ingredients in fixed doses, used for a particular indication(s). IN NTEP, for adults - 4-FDC (56 daily doses given in IP) consists of HRZE and 3-FDC (112 daily doses given in CP) consists of HRE.

Methodology

Approval from Institutional Ethics Committee was obtained before starting the study. A written informed consent was also obtained from all the patients enrolled after explaining them a risk and benefits of the study in their own language. Demographic data, including gender, age, weight, height and BMI was recorded.

Data collection and follow up data

Required data including Weight, height, BMI, Sputum smears examination and CXR PA view etc. were collected at the time of initiation of ATT, at 2 months and 6 Months

Statistical analysis

All the data analysis were performed using IBM SPSS (SPSS Inc., Chicago, Illinois-USA) ver. 20 software. Microsoft office and PRISM software was used to prepare the graphs. P value of <0.05 is considered significant.

Clinical Features

Respiratory symptoms such as cough, malaise, weight loss, fever and night sweats, pleuritic chest pain, and breathlessness etc. [NICE 2011, Barker RD 2012]

Results

Table 1: Distribution of patients and mean weight according to age groups

Age groups (years)	**No. of Pt. (%)**	**Mean Wt. At Initiation of ATT (Kg)**	**Mean Wt. at 2 Months in Kg (↑ in % from Initial Wt)**	**Mean Wt. at 6 months in Kg (↑ in % from Initial Wt)**
21-30	16 (14.95%)	43.43	45.48 (4.72 %)	47.88 (10.25 %)
31-40	28 (26.17 %)	42.25	44.36 (4.99 %)	46.96 (11.15%)
41-50	40 (37.38 %)	43.47	45.61 (4.92 %)	47.83 (10.03%)
51-60	11 (10.28 %)	42.72	44.77 (4.80 %)	47.27 (10.65 %)
61-70	9 (8.41 %)	42.75	45.03 (5.33%)	47.38 (10.83 %)
>70	3 (2.80 %)	45.33	47.1 (3.90 %)	48.93 (8.01%)
Total	107(100.00%)	P value (0.564)	P value (0.882)	P value (0.668)

Mean age of study population was 43.12±12.25 years which ranged from 21 to 78 years. Distribution of patients according to sex were male 60 (56.07 %) and female 47 (43.93 %).

Maximum cases of Pulmonary tuberculosis were found in the age group of 41-50 years (37.38%), while maximum cases were from most effective working age group 21-50 years (78.50%). Minimum mean wt 42.25 was found at initiation of ATT in age group of 31-40 yrs, but they gain maximum mean wt 11.15%(46.96 Kg) at 6 months of ATT, while maximum mean wt 45.33 was found at initiation of ATT in age group of >70 yrs, but they gain minimum mean wt 8.01%(48.93 Kg) at 6 months of ATT

Table 2: **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)**	Mean Wt. of all **Male** Pts. (Kg)	Mean Wt. of all **Female Pts.** (Kg)
At Initiation of ATT	15.91	43.18	43.93	42.23
At 2 months (↑ in % from Initial Wt)	16.71 (5.03 %)	45.31 (4.93%)	46.03 (4.78%)	44.39 (5.11%)
At 6 months (↑ in % from Initial Wt)	17.59 (10.56%)	47.70 (10.47%)	48.35 (10.06%)	46.88 (11.01%)

ATT resulted in significant increase in weight and BMI of patients at the end of 2 month and 6 months as compared to at the time of initiation of ATT. However, no significant change was observed in mean weight and BMI was observed among genders and different age groups. Mean weight was increased by 4.93% at the end of 2 months which and 10.46% at the end of 6 months follow up in majority of the patients on ATT.

Table 3: Comparing weight variation at 2 months and 6 months of ATT

	Wt. Loss No. of patients (%)	Wt. Constant No. of patients (%)	Wt. Gain No. of patients (%)	In all Wt. gain cases total % increase from initial wt.
Follow up at 2 months	4/107 (3.7 %)	3/107 (2.8 %)	100/107 (93.5 %)	4.93 % (<0.001)
Follow up at 6 months	1/107 (0.93 %)	2/107 (1.87 %)	104/107 (97.20 %)	10.47 % (<0.001)

Table 4: Comparison of % of patients with mean weight in different involved radiological sites at different stage of ATT

Site of Involvement	At Initiation of ATT		At 2 Months of ATT		At 6 months of ATT	
	No. 0f Pt. (%)	Mean Wt (Kg)	No. 0f Pt. (%)	Mean Wt (Kg)	No. 0f Pt. (%)	Mean Wt (Kg)
No Parenchymal finding	8 (7.48 %)	44.0	33 (30.84%)	46.59 (5.89%)	82 (76.64 %)	47.37 (7.66%)
Single Quadrant	26 (24.30 %)	43.08	41 (38.32%)	44.15	20 (18.69 %)	47.57
Two Quadrant	52 (48.60 %)	42.98	26 (24.30 %)	44.93	4 (3.74 %)	52.54
Three Quadrant	12 (11.21 %)	43.08	5 (4.67 %)	45.38	1 (0.93 %)	31.00
All 4 Quadrant	9 (8.41%)	44.11	2 (1.87 %)	46.1	NO Pt.	47.37
PTB with Lymph adenopathy	44/107 (41.12 %)	42.02	23/107 (21.50 %)	45.10 (7.33%)	12/107 (11.21 %)	46.98 (11.80%)
PTB with NO cavity	81 (75.70 %)	42.97	90 (84.11%)	45.28 (5.38%)	105 (98.13 %)	47.43 (10.38%)
PTB with One cavity	24 (22.42 %)	43.67	17 (15.89 %)	45.06	2 (1.87 %)	51.4
PTB & >One cavity	2 (1.87 %)	46.00	NO Pt.	NO Pt.	NO Pt.	NO Pt.
PTB & Pleural effusion	10/107 (9.34 %)	39.5	5/107 (4.67%)	44.06 (11.54%)	2/107 (1.87%)	47.70 (20.76%)

In comparison from initiation of ATT, gain in mean wt , parenchymal clearance in CXR were observed 5.89%, 23.36% at 2 months while 7.66%, 69.16% at 6 months respectively. In comparison from initiation of ATT, gain in mean wt , subside in lymphadenopathy were observed 7.33%, 19.62% at 2 months while 11.80%, 29.91% at 6 months respectively. In comparison from initiation of ATT, gain in mean wt , cavitation clearance in CXR were observed 5.38%, 8.41% at 2 months while 10.38%, 22.43% at 6 months respectively. In comparison from initiation of ATT, gain in mean wt , subside in pleural effusion were observed 11.54%, 4.67% at 2 months while 20.76%, 7.47% at 6 months respectively.

Discussion

We tried to find out any study about weight variation, BMI along with the X ray changes in patients treated with ATT for intergroups comparison. Most probably this study may be the first of its kind which have studied the relation of weight variation , BMI and CXR changes with the outcome of patients treated with ATT.

In resource-constrained settings, weight assessment may be a simple and low-cost method for predicting prognosis among patients undergoing ATT.[8] In this study we tried to evaluate at different stage about the effect of ATT on weight variation, BMI and chest x-ray changes in patients with Pulmonary TB. This study observed a significant association between weight variation, BMI and chest x-ray changes not only during treatment but also at time of treatment outcome. As per World Health Organization patient weight should be monitored each month, and dosages should be adjusted if weight changes.[9] In this study, it was found that pulmonary tuberculosis was more prevalent in the age group of 41-50 years (37.38%) followed by 31-40 years (26.17%) and 21-30 years (14.95%). Mean age of study population was 43.12±12.25 years which ranged from 21 to 78 years. In an another study by Barnwal et al observed that maximum (28.3%) study subjects belonged to age group of 41 to 50 years followed by (20.75%) in age group 21 to 30 years, where mean age was 39.15±13.29 years which ranged from 18 to 76 years.[10]

In this study it was found that prevalence of pulmonary tuberculosis was more in male population (56.07%) as compared to females (43.93%). In another retrospective study of diagnosed 375 TB patients from all age groups which also reported about male preponderance (53.87%) compared to female (46.13%).[11] While in another study by Barnwal et al also reported male's dominance in their study (79%).[10] In this study a significant increase in mean BMI with the highly significant p values was observed after initiation of ATT to till end of course. Mean BMI at Initiation of ATT was 15.91±1.62 kg/m^2 which increased to 5.03% (16.71±1.34 kg/m^2) at 2 month and 10.56% (17.59±1.28 kg/m^2) at 6 month. This shows that ATT treatment leads to increase in BMI of patients with pulmonary tuberculosis. A study among 2 cohorts in Taiwan reported 2-fold increase in TB risk among underweight subjects .[12] Similarly, a meta-analysis of 6 studies found a log-linear dose-response relationship between BMI and TB incidence and a 13.8% decrease in TB incidence per unit increase in BMI.[13]

Body Weight monitoring is simple, inexpensive and easily accessible. Nearly all TB clinics have a weighing scale machine and measure weight of their patients monthly during the course of treatment. In this study a significant increase($p<0.001$) in mean weight was observed from 43.18±5.75 kg which increased to 4.93% (45.31±4.81 kg) at the end of 2 months and 10.47% (47.70±3.84 kg) at the end of 6 months. This shows that ATT treatment leads to increase in weight of patients with pulmonary tuberculosis. In a study from Nagpur, Maharashtra by Barnwal et al found the impact of anti-tubercular treatment on weight in 58 TB patients reported that at baseline mean weight of all study subjects was 41.17±7.91 which improved to 3.03%(42.42±7.58) at two months and 5.90%(43.60 ±8.78) at six months.[10] In study by Bernabe Ortiz et al mean weight at baseline was 54.7±8.3 which improved to 3.84% (56.8± 8.5Kg) at 2 months and 7.31%(58.7±8.7Kg) at the end of 5th months in those with good outcome.[14] Phan et al reported that at baseline the mean weight was 63.9±1.4 which improved to 1.88%(65.1±1.7 Kg) at 2 months and 6.57%(68.1±1.4Kg) at 6 months.[15]In this study found weight gain, weight loss, weight constant in 93.5%, 3.7%, 2.8% at 2 months and 97.2%, 0.93%, 1.87% respectively at the end of 6 months.

In another study found 91.46% gained weight, 4.27% weight constant and 4.27% patients lost weight at end of ATT therapy.[11] In a similar study from Nagpur, Maharashtra concluded that mean weight improved in six months of ATT treatment in this study, however the improvement found non-significant.[10] Similarly, in study by Hoa et al most of the weight gain occurred in first two months.[16] A study from Netherlands reported that in most patients (85·4 %) in their study body weight stabilized or increased during treatment, whereas a small proportion (14·6 %) demonstrated weight loss.[17] Phan et al observed a significant change in weight over the course of treatment ($p < 0.0001$), 31.9% of patients had gained at least 5% of initial body weight after 2 months of treatment and 62.4% of patients had gained at least 5% of initial weight at end of treatment.[15] In this study when compared to mean weight at Initiation of ATT, an increase of 4.93% was observed at the end of 2 months ($p<0.001$) and10.46% at the end of 6 months($p<0.001$). This shows a significant increase in the weight of patients with pulmonary tuberculosis on ATT. Average weight gain at the end of therapy in different studies were found 3.2 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 treatment had

a higher chance of relapse. They studied among 857 United States and Canadian patients with drug-susceptible TB, patients who had a weight deficit of 10% or more of their ideal body weight at diagnosis and who gained at least 5% of their baseline weight during the first 2 months of treatment had a lower risk for later relapse.[19] A recent study in Vietnam with 2,609 patients treated in DOTS clinics showed that those patients who had a baseline weight of < 40 kg and had a weight gain of more than 5% after 2 months of treatment had a lower risk of poor outcome.[16] CXR potentially provides useful information for grading the extent of pulmonary involvement and disease severity at diagnosis, as well as for assessing treatment outcome.[20] Grozdanovic et al aimed to grade disease severity in PTB patients at diagnosis and after completion of DOTS treatment by developing a reading scheme based on five different radiographic manifestations and analyze their association with the clinical parameters of systemic involvement and infectivity.[21].IIn this study with PTB involvement of lymphadenopathy, parenchymal , cavitation and pleural effusion were 41.12%, 92.52%, 24.29% and 9.34% respectively on CXR.

In other`s study the CXR revealed that 94.3% of patients had alveolar infiltrates, with different levels ranging from the one to the all four lung quadrant; in addition, 41.8% of patients had lymphadenopathy. Cavitation was present in 29.1% of patients.[21] A significant increase in mean weight was observed with improvement in parenchymal Involvement at the end of 2 and 6 months(p value of <0.001).

In this study it was found that a significant improvement was noted in lymphadenopathy(p=0.001). Out of 41.12%(44/107) PTB patients with lymphadenopathy at Initiation of ATT, subsided in 19.62% (21/107) patients at 2 months and 29.91%(32/107) patients at the end of 6 months (Only 11.21%(12/107) patients had persisted with lymphadenopathy at the end of 6 months). In a similar study by Grozdanovic et al reported that lymphadenopathy decreased from 46.8% to 16.1%.[21]) It was also revealed that a significant increase in mean weight was noted with improvement in lymphadenopathy. In this study mean weight among the patients with lymphadenopathy at the initiation of ATT was 42.02Kg, which had increased to 7.33%(45.10Kg) at 2 months (p=0.001) and to 11.80%(46.98Kg) at 6 months (p<0.001).

Presence of cavitation can affect treatment decisions, such as the duration of therapy.[22] Cavitation occurs in a minority of patients with primary tuberculosis.[23] and when cavitation occurs, it is known as progressive primary disease. In this study PTB patients diagnosed with cavitation were 24.29%(26/107), which subsided in 8.41%(9/107) patients at 2months of ATT and further subsided in 22.43%(24/107) patients(or persisted in 1.87%(2/107) patients at 6months of ATT), which was observed as significant difference(p=0.024) in intergroup comparison at 2 months and 6 months as compared to Initiation of ATT. In a similar study reported that, the presence of cavities decreased substantially from 34.8% to 1.6% after 6 months of treatment, which was an excellent cure rate.[21] In Another study 53.1% of the PTB patients were found who presented cavities in CXR at diagnosis, 16.9% of subjects still had persistent cavities at the end of 6 months of treatment, that was associated with an increased risk of TB relapse.[24] In this study an increase in mean weight was observed with significant improvement in cavitation (p=0.001). Mean weight at Initiation of ATT was significantly increased to 45.06 kgs in those with 1cavity at 2 months (p=0.002) and 51.4 kgs at the end of 6 months (p<0.001) after ATT treatment. In a study done on 120 patients with pulmonary TB, 49.2% had cavitary disease and 30.8% had extensive disease found in plain chest radiograph at the time of diagnosis and reported a significant weight gain with improving the cavitary disease (determined by the presence of cavities on plain chest radiograph) .[15] Pleural effusion is seen in approximately 25% of primary tuberculosis cases in adults, with the vast majority of such effusions being unilateral.[22] Pleural effusion is less common in children and may only appear in 6%–11% of pediatric cases, with increasing prevalence with age.[22] In this study 9.34%(10/107) patients were also diagnosed with pleural effusion, which persisted in 4.67%(5/107) patients at 2 months and 1.87%(2/107) at 6 months of ATT, which showed no significant difference(p=0.782). Insignificant result in this study may be due to small sample size of the study population. A similar study from Germany involving 141 newly diagnosed PTB patients reported a significant improvement in pleural effusion from 19.4% to 6.5% after 6 months of treatment.[21]Mean weight (39.50Kg) at Initiation of ATT was significantly increased by 11.54%(44.06 Kgs) in those with pleural effusion at 2 months (p=0.001) and by 20.76%(47.70 Kgs) at the end of 6 months (p<0.001) after ATT treatment. In this study we observed that a significant weight gain and improvement occurred as in lymphadenopathy and also in various chest X rays findings i.e. Parenchymal Involvement, cavitation and pleural effusion.

Conclusion

In this study we observed that maximum cases of Pulmonary tuberculosis were found in male population and in the age group of 41-50 years (37.38%), while maximum cases affected most effective working age group 21-50 years (78.50%). Minimum mean wt 42.25 Kg was found at initiation of ATT in age group of 31-40 yrs, but they gain maximum mean wt 11.15%(46.96 Kg) at 6 months of ATT, while maximum mean wt 45.33Kg was found at initiation of ATT in age group of >70 yrs, but they gain minimum mean wt 8.01%(48.93 Kg) at 6 months of ATT.

Along with gain in mean wt and mean BMI from initiation of ATT , it was observed that parenchymal clearance in CXR, cavity clearance, subside in pleural effusion and subside in lymphadenopathy were 23.36%, 8.41%, 4.67% &19.62% respectively at 2 months of ATT and 69.16% , 22.43%, 7.47% & 29.91%, respectively at 6 months of ATT.

A significant increase in mean weight, BMI were observed along with improvement in chest x ray findings including Parenchymal Involvement, cavitation, pleural effusion and lymphadenopathy. This denotes that monitoring in baseline weight, height, Sputum smear and CXR during the first 6 months of treatment can help to identify persons who are more likely to have good or poor outcomes and require some other interventions or require greater medical attention. These inexpensive tools can help to improve outcome and reduce medical expenditure, which ultimately affect national economy.

Limitations

This study has few limitations due to small sample size and cross-sectional study done in small area so there is a need of a large randomized study in future. Another limitation of this study was the absence of other clinical parameters correlated with disease severity, such as underlying lung disease, as well as FEV1, which would have allowed the assessment of its association with individual CXR manifestations and their confounding effect on the association between the extent of CXR features with weight variation.

Acknowledgement

Authors are grateful to all enrolled patients, concern faculties, concern PGs, Dean and concern staffs for their best efforts and dedication.

Institutional Ethics committee approval: Received.

Abbreviations

PTB- **Pulmonary Tuberculosis , Wt.-** Weight **, CXR-** Chest X-Ray**, BMI-** Basic Metabolic Index, **ATT-** Anti Tuberculosis treatment, **NTEP-** National Tuberculosis Elimination programme, **Kg-** Kilogram.

References

1. Harisinghani MG, McLoud TC, Shepard JA. Tuberculosis from head to toe. Radiographics. 2000; 20:449-470.
2. Hlawtsch A, Kauczor HU, Thelen M. Pulmonary tuberculosis - the current radiological diagnosis of an old disease. Radiologe. 2000; 40:507-517.
3. Kwong JS, Carignan S, Kang EY, Muller NL, Fitzgerald JM. Miliary tuberculosis. Diagnostic accuracy of chest radiography. Chest. 1996; 110:339-342.
4. Ryu YJ. Diagnosis of pulmonary tuberculosis: recent advances and diagnostic algorithms. Tuberculosis and respiratory diseases. 2015; 78(2):64–71.
5. Skoura E, Zumla A, Bomanji J. Imaging in tuberculosis. International journal of infectious diseases: IJID: official publication of the International Society for Infectious Diseases. 2015; 32:87–93.
6. Lee KS, Im JG. CT in adults with tuberculosis of the chest: characteristic findings and role in management. AJR American journal of roentgenology. 1995; 164(6):1361–7.
7. Jeong YJ, Lee KS. Pulmonary Tuberculosis: Up-to-Date Imaging and Management. American Journal of Roentgenology. 2008; 191(3):834-844.
8. Sarin R, Dey LBS. Indian national tuberculosis programme: revised strategy. Ind J Tub. 1995; 42:95-100.
9. World health Organization. Treatment of tuberculosis Guidelines. Fourth Edition. https://apps.who.int/iris/bitstream/handle/10665/44165/9789241547833_eng.pdf. Accessed on 2 June 2021.
10. Barnwal RK, Gawande AV, Narlawar UW, Zurmure SA. Impact of anti-tubercular treatment on weight and symptoms of category I tuberculosis patients in an urban city of central India. Int J Community Med Public Health. 2020; 7(2):1-4.
11. Kumar R, Ahirwar RK, Dave L et al. Study of weight variation during anti-tuberculosis treatment in tuberculosis patients put on dots in RNTCP in Central India. J. Evolution Med. Dent. Sci. 2017; 6(6):478-481.
12. Lin HH, Wu CY, Wang CH, Fu H, Lönnroth K, Chang YC et al. Association of Obesity, Diabetes, and Risk of Tuberculosis: Two Population-Based Cohorts. Clin Infect Dis. 2018; 66(5):699–705.
13. Lonnroth K, Williams BG, Cegielski P, Dye C. A consistent log-linear relationship between tuberculosis incidence and body mass index. Int J Epidemiol. 2010; 39(1):149–55.
14. Bernabe-Ortiz A, Carcamo CP, Sanchez JF, Rios J. Weight variation over time and its association with tuberculosis treatment outcome: A longitudinal analysis. PLoS One. 2011; 6(4):2-6.
15. Phan MN, Elizabeth S. Guy, Ruby N. Nickson, Christina C. Kao. Predictors and patterns of weight gain during treatment for tuberculosis in the United States of America, International Journal of Infectious Diseases. 2016; 53:1-5.
16. Hoa NB, Lauritsen JM, Rieder HL. Changes in body weight and tuberculosis treatment outcome in Viet Nam. Int J Tuberc Lung Dis. 2012; 17(1):61-5.
17. Warmelink I, Ten Hacken N, Van der Werf T, Van Altena R. Weight loss during tuberculosis treatment is an important risk factor for drug-induced hepatotoxicity. British Journal of Nutrition. 2011; 105(3):400-408.
18. Vasantha M, Gopi PG, Subramani R. Weight gain in patients with tuberculosis treated under directly observed treatment short-course (DOTS). Indian J Tuberc. 2009; 56(1):5-9.
19. Khan A, Sterling TR, Reves R et al. Lack of weight gain and relapse risk in a large tuberculosis treatment trail. Am J Respir Crit Care Med. 2006; 174(3):344-8.
20. Hunter RL, Actor JK, Hwang SA, Karev V, Jagannath C. Pathogenesis of post primary tuberculosis: immunity and hypersensitivity in the development of cavities. Annals of clinical and laboratory science. 2014; 44(4):365–87.
21. Grozdanovic Z, Berrocal Almanza LC, Goyal S, Hussain A, Klassert TE, Driesch D et al. A Novel Reading Scheme for Assessing the Extent of Radiographic Abnormalities and Its Association with Disease Severity in Sputum SmearPositive Tuberculosis: An Observational Study in Hyderabad/India. PLoS One 2015;10(9):e0138070.
22. Nachiappan AC, Kasra Rahbar MD, Xiao Shi MD, Elizabeth S MD. Guy, Eduardo J MD, Mortani Barbosa, Jr, Girish S MD, Shroff M et al. Pulmonary Tuberculosis: Role of Radiology in Diagnosis and Management. Radio Graphics. 2017; 37:52–72
23. Woodring JH, Vandiviere HM, Fried AM, Dillon ML, Williams TD, Melvin IG. Update: the radiographic features of pulmonary tuberculosis. AJR Am J Roentgenol. 1986; 146(3):497–506.
24. Hamilton CD, Stout JE, Goodman PC, Mosher A, Menzies R, Schluger NW et al. The value of end-of treatment chest radiograph in predicting pulmonary tuberculosis relapse. The international journal of tuberculosis and lung disease: the official journal of the International Union against Tuberculosis and Lung Disease. 2008; 12(9):1059.
25. Phan MN, Guy ES, Nickson RN, Kao CC. Predictors and patterns of weight gain during treatment for tuberculosis in the United States of America. Int J Infect Dis. 2016; 53:1-5.
26. Khan A, Sterling TR, Reves R, Vernon A, Horsburgh CR. Lack of weight gain and relapse risk in a large tuberculosis treatment trial. Am J Respir Crit Care Med. 2006; 174:344–348.
27. Training Modules (1-4) for Programme Managers and Medical Officers; New Delhi, India: Central TB Division, MoHFW, Government of India, 2020. Available from:www.tbcindia.gov.in
28. Ministry of Health India. Revised National Tuberculosis Control Programme (RNTCP)-Training module for general practitioners 2010. Available:http://tbcindia.nic.in/pdfs/TrainingModuleforMedicalPractitioners.pdf. Accessed on 2 Aug 2021.
29. Treatment of tuberculosis: guidelines 4th ed. 2010. Available: http://apps.who.int/iris/bitstream/10665/44165/1/9789241547833_eng.pdf?ua=1&ua=1. Accessed on 2 Aug 2021.

Conflict of Interest: Nil
Source of support:Nil