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CORRELATION OF CHEST COMPUTED TOMOGRAPHY FINDINGS WITH SIX MINUTE WALK DISTANCE IN PEOPLE WITH POST TUBERCULAR SEQUELAE

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ABSTRACT

Background:- Tuberculosis is an infectious disease that affects the lungs and results in poor lung compliance secondary to diffuse fibrotic changes to lung tissue. Consequently, people with pulmonary tuberculosis experience impaired gas exchange resulting in a decline in functional capacity.

Methodology:-A hospital based cross sectional study was conducted on 70 patients to study the correlation radiological findings with 6MWD in patients with sequelae of pulmonary tuberculosis. CT scans were analyzed for fibrosis, cavitation, bronchiectasis, consolidation, nodules,and aspergilloma. Scores were added to obtain a total morphological score (TMS) and the total lung score (TLS). 6MWT was done as per ATS guideline.

Results:- There was a significant difference in the median scores for fibrosis (P<0.007), TMS (P<0.037) and TLS (P<0.037) between 6MWD<300m and 6MWD>300m groups.

Conclusion:-There was a significant difference in physical functional capacity those with TB sequelae.

KEYWORDS : six minute walk test, tuberculosis, functional capacity

INTRODUCTION

Tuberculosis (TB) is a global public health problem,[1] Despite adequate pharmacologic treatment, the disease while healing produces fibrosis, cavitation and calcification leaving permanent sequelae in the lungs.[2]Consequently, the functional status of persons following tuberculosis is diminished secondary to poor ventilation and gas exchange leading to progressive dyspnea, deconditioning, and an overall decline in functional status.

Functional walk tests are typically administered as a means of evaluating functional status, monitoring effectiveness of treatment, and establishing prognosis. The ability to ambulate for a distance is a quick and inexpensive measure of physical function and an important component of quality of life since it reflects the capacity for undertaking everyday activities.[3]

The six minute walk test (6MWT) is an example of a functional walk test that is practical and simple and only requires the ability to walk. The distance that a patient can walk on a flat surface in 6 minutes may be used as a measure of functional status or as an outcome measure from a rehabilitation program. Currently, there is little research describing the differences in the functional limitation in patients with pulmonary sequelae as a result of tuberculosis. An understanding of the functional limitations in these patients may be useful in developing appropriate rehabilitation programs in these patients as well as quantifying the level of disability.

To correctly interpret the results of the 6MWT, the result from a given patient must be compared to the appropriate reference values for that specific population. Since there are many predictors for 6MWT distance (6MWD), it is also necessary to develop reference equations to better interpret the results in tuberculosis sequelae populations. Therefore, the purpose of this study was evaluated the functional capacity of lung people with tuberculosis sequelae specially resource poor country.

MATERIAL & METHODS

Aim: To correlate functional capacity with chest computed tomography.

Study protocol: - This cross sectional hospital based study was carried out on clinically stable Post-TB patients during their outpatient and inpatient department visit at Department of Respiratory medicine, Institute of Respiratory Disease, SMS Medical College, Jaipur, Rajasthan, between 1 June 2017 to 31, may 2018.Study was approved by the Institutional Review Board, SMS Medical College, Jaipur with a sample size of 70 Cases. After giving full explanation regarding the study, written informed consent was obtained from patients. Consent form included details of the study plan. Seventy patients with tuberculosis sequelae >18 years of age and cured pulmonary tuberculosis were selected from the inpatient as well as outpatient department of the institute of respiratory Diseases. Patient with unstable cardiovascular status,active hemoptysis, severe respiratory distress, physical limitations, cognitive impairment and dementia were excluded from study.

Multidetector computer tomography (CT) evaluation

Computed tomography scans of the thorax were obtained in supine position from apices to lung bases in full inspiration after intravenous injection of 50–60 ml nonionic iodinated contrast on 128-slice CT scanners (Philips ingenuity core 128). Images were acquired at collimation of and 64×0.625mm. Image reconstruction was carried out on ZFS standard resolution acquisitions. Axial images were reconstructed using a slice thickness of 5 mm and 5 mm reconstruction increment and viewed at standard mediastinal window and lung window settings. Computed tomography (CT) images were also reconstructed at 1 mm slice thickness and 10 mm increment using a sharp (bone) kernel (B80).

All CT scans were analyzed by one radiologist with 15 years' experience in chest imaging to avoid inter-reader variation and evaluated the CT scans for the presence of morphological abnormalities such as (a) fibrosis, (b) cavitation, (c) bronchiectasis, (d) consolidation, (e) nodules and (f) aspergilloma. Semi-quantitative analysis was done for each of these abnormalities using a visual estimation of the extent of abnormality present expressed regarding percentage of each lung involvement as shown in Table 1. The lungs were divided into three zones Upper zone defined as the area above the carina, middle zone: Between the carina and inferior pulmonary veins, and lower zone: Below the level of the inferior pulmonary veins(Figure 1).[4] Radiological involvement of zones by disease was also scored as shown in Table 1,2. Thus, for each of these morphological findings, the score was 0 if findings were absent, and the maximum score was 8 for both lungs. The sum of these scores for

six abnormalities was added to obtain a total morphological score (TMS) with 0 being minimum and 48 being maximum possible obtainable score(Table 1,2) . The scores of the six lung zones were added to obtain a single score named total lung score (TLS). Normal lungs had a TLS of 0 while the maximum possible TLS was 24 (Table 2).[4]

Table:1

Scoring system for morphological Abnormality	
Percentage of lung Parenchyma Involved	Score
<25	1
25-50	2
50-75	3
>75	4

Table :2

Zone wise scoring system for radiological extent of disease	
Percentage of lung Zone Involved	Score
<25	1
25-50	2
50-75	3
>75	4

Computed tomography scoring system according to percentage of lung involvement [4]

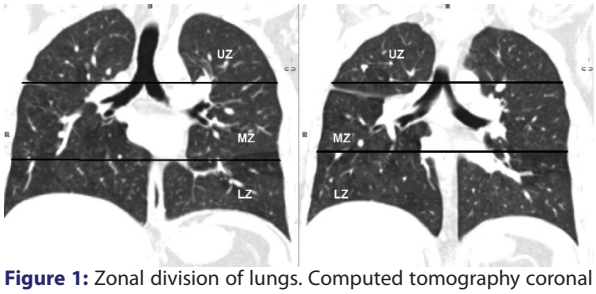


Figure 1: Zonal division of lungs. Computed tomography coronal reformatted images show the division of lungs into upper, middle and lower zones. Upper zone was defined as area above the carina, middle zone as area between carina and junction of inferior pulmonary veins with left atrium and lower zone as the area below the second line.(92) UZ: Upper zone, LN: Lower zone, MZ: Middle zone

6MWT

A 42 m hospital corridor marked by colored tape at each end was used. Subjects were instructed to walk from end to end at their self-selected pace, while attempting to cover as much distance as possible in the 6 minutes.The materials used to administer the 6MWT and the preparation of subjects was done using American Thoracic Society (ATS) guidelines.[5]

Statistical analyses : Quantitative / continuous variables were summarized as mean and standard deviation and were analyzed using ANOVA test for more than 3 group comparison while Ordinal variables were expressed as medina and range and were analyzed using Mann Whitney test for 2 group comparison and Kruskal wallis test for 3 group comparison. Qualitative variables were expressed as number and percentage.

A P value <0.05 was taken as statistically significant. All statistical analyses were done using Epi info version 7.2.1.0 statistical software.

RESULTS

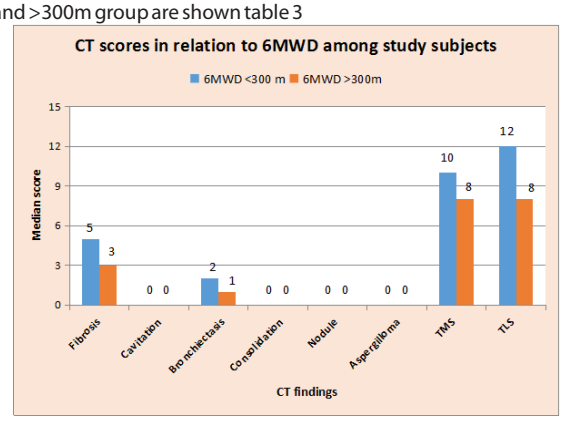
A total of 70 patients with previous history of TB and respiratory symptoms were initially recruited. Patients were excluded, if CT scan showed severe emphysematous changes secondary to COPD rather than Post-TB sequelae . Thus, the CT findings with 6WD were analyzed. There were 41 males and 29 females with a median age of 25 years (range 21–80 years). A total of 18/70 (25.7%) patients were nonsmokers while 52/70 (74.3%) patients were either smokers or ex-smokers. Of 70 patients, dyspnea was present in 48/70 (68.6%) while 66/70 (94.3%) patients had cough, and 28/70 (40%) patients had hemoptysis. Average 6MWD was 375.6 ±122.39m.The most prevalent imaging findings in our study were fibrosis.

Table 3: CT scores in relation to 6MWD among study subjects

CT scores	6MWD <300 m (N=17)	6MWD >300m (N=53)	P value
Fibrosis	5 (2 – 8)	3 (0 – 8)	0.007 (S)
Cavitation	0 (0 – 8)	0 (0 – 4)	0.352
Bronchiectasis	2 (0 – 6)	1 (0 – 8)	0.745
Consolidation	0 (0 – 6)	0 (0 – 6)	0.234
Nodule	0 (0 – 6)	0 (0 – 6)	0.944
Aspergilloma	0 (0 – 4)	0 (0 – 4)	0.200
TMS	10 (4 – 23)	8 (0 – 16)	0.037 (S)
TLS	12 (8 – 20)	8 (0 – 20)	0.037 (S)

Computed tomography analysis and 6MWD and computed tomography correlation

CT scores were compared between the patients with 6MWD <300m or those without. The median scores for individual morphological abnormalities, TMS, and TLS for overall population, 6MWD<300m and >300m group are shown table 3



DISCUSSION

The most prevalent imaging findings in our study were fibrosis which was common sequelae of pulmonary TB.Moreover, these radiological findings also had clinical significance as the fibrosis scores was significantly different in patients <300m or those without. Thus, the morphologic lung damage contributed to the clinical symptoms.

There was a significant difference in the median scores for fibrosis (P<0.007) between 6MWD<300m and 6MWD>300m groups. The difference in TMS (P<0.037) and TLS (P<0.037) between two groups was also highly significant. However, the maximum TMS even in patients with 6MWD<300m was only 23, against a maximum obtainable score of 48. This is because of the absent nodule, cavitation, consolidation and aspergilloma scores in overall population. The maximum TLS score in both the 6MWD<300m and>300m groups were 20 against a maximum obtainable score of 24. Both TMS (sum of all morphological findings) and TLS (sum of the radiological extent of disease) were significantly higher in patients with 6MWD <300m which was suggestive of radiological and functional correlation.

The average 6MWD was 613 ± 93 m in a healthy, older population [6] and was 659 ± 62 m in healthy Caucasian subjects.[7] In contrast, the results of another study[8] indicate that in the older, normal Indian population, the average 6MWD was 445 ±56.64m. In comparison, the TB sequelae group had an average 6MWD that was 265.06 ±78.13m. In our study the TB sequelae group had an average 6MWD 375.6 ±122.39m.

CONCLUSION

There was a significant difference in physical functional capacity with 6MWD <300m or those without in PostTB sequelae. There were considerable impact of TB sequelae on respiratory endurance. The reference equations for 6MWD derived in this study computes the predicted 6MWD in an Indian population with TB. Future studies are recommended to examine other factors that may be included in the equation to predict Vo2max.

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