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ORIGINAL RESEARCH ARTICLE

"A STUDY ON PULMONARY FUNCTION PROFILE IN PATIENTS WITH POST TUBERCULOSIS LUNG DISEASE AND/OR PLEURAL DISEASE"

Dr. M. RAVINDRANATH[1], *Dr. RAJU CH[2], Dr. ANIL KUMAR KODAVALA[3]

1. **Associate Professor,Dept. of. Respiratory Medicine, Kamineni Academy of Medical Sciences and Research Center, L B Nagar, Hyderabad.**
2. **Associate Professor,Dept. of. Respiratory Medicine, Maheshwara Medical College, Hyderabad.**
3. **Associate Professor,Dept. of. Respiratory Medicine, Narayana Medical College and Hospital, Nellore, Andhra Pradesh.**

***Corresponding Author: Dr. RAJU CH, Associate Professor,Dept. of. Respiratory Medicine, Maheshwara Medical College, Hyderabad.**

ABSTRACT:

Background: Pulmonary tuberculosis affects the lung parenchyma commonly and thereby causes many structural and functional changes in the lungs [(8,9)]. These changes lead to functional disability of the patients leading to significant morbidity. The functional changes may lead to severe disability in the patients even after successful anti tubercular treatment.

OBJECTIVES: To correlate the derangement of lung functions with respect to the destruction in the lung parenchyma as a consequence of pulmonary tuberculosis and pleural tuberculosis.

Material & Methods: Study Design: Prospective cross-sectional study.**Study population:** established cases of pulmonary & pleural tuberculosis, that were completed antitubercular treatment under dots or privately and attended op/admitted in ward were taken up along with 30 healthy individuals with informed consent were grouped as controls.**Sample size**: study consisted of 130 cases and 30 controls. **Sampling method:** Simple Random sampling method.**Ethical consideration:** Institutional Ethical committee permission was taken prior to the commencement of the study. **Study tools and Data collection procedure:**A detailed case history was taken with consent from all.A thorough clinical examination was done to assess the underlying pathology and on its basis a clinical diagnosis was made. Chest X-Ray was done in all cases, the readings were independently made by two umpire readers for having correct assessment of underlying lesion. The extent of lesion was graded as minimal, moderately advanced or far advanced on the basis of guidelines given by National

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Tuberculosis Association. Presence of cavities if any and their number were also noted in each case.

Results: Chest x rays of the study group (pulmonary tuberculosis) was observed properly. It was found that 46.6 % had cavity lesions. Of them, 42 individuals had multiple cavities, 19 single cavities, had the lesions were also graded minimal, moderate, far advanced. 39% of study group had minimal lesions, 23% had moderate lesions & remaining38% had far advanced.

CONCLUSION: This study revealed that more advanced lesions of tuberculosis will lead to long term morbidity of the patients because of pulmonary derangements.

Key words: Pulmonary tuberculosis, lung parenchyma, pulmonary derangements

INTRODUCTION:

Tuberculosis is a disease of concern for the mankind since the time immemorial. Despite many significant developments in science the disease remained to be a challenge for the medical fraternity. It is one of the major causes of mortality and morbidity worldwide. The world health Organization declared Tuberculosis as a global epidemic in the year 1993[(1)].There are significant socio-economic impacts of the disease globally, due to its rising burden, particularly in most of the Asian countries, Eastern Europe and Africa where the disease is still endemic [(2, 3)]. In many regions of the world where tuberculosis is common, tubercular pleural effusion maintains its position as leading inflammatory pleural disease.[(4)]

Even after more than a century of discovery of the causative organism of the disease, we are still not in a position to completely control the epidemic.In 2015, an estimated 10.4 million people developed Tuberculosis of these 580,000 drug resistant and 1.8 million died from the disease.[(5)]

It is now ranked as the second human killer amongst all infectious diseases globally. It was estimated that out of 2.2 million annual incidence of tuberculosis cases in India 0.87 million were infective cases.India shoulders the 1/5th of the globally TB burden, about 40% of Indian population is infected with TB bacillus. Prevalence is 2.5 million.[(6,7)]

Pulmonary tuberculosis affects the lung parenchyma and thereby causes many structural and functional changes in the lungs [(8,9)]. These changes lead to severe functional disability and significant morbidity even after completing anti tubercular treatment.Pulmonary tuberculosis involves lung parenchyma,pleura and at times bronchi.The pathological features consist of exudation,caseation,cavitation & fibrosis in variable degrees;which are described as pleomorphic. These lesions impair lung function depending on the extent of involvement of lung parenchyma.[(10, 11)]

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The functional abnormalities comprise reduction of lung volumes, decrease in lung compliance & impaired gas transfer. It may also lead to generalized airflow obstruction when there is extensiveinvolvement of airways.Involvement of pleura along with adhesion to the diaphragm may lead to restrictive lung disease and hypoxemia. (12)

Peak expiratory flow meter is a very simple test used at the bedside which works as a wonderful tool in determining the underlying obstructive elements (13). Extensive damage to the lungs in pulmonary tuberculosis also leads to functional disturbances in the heart and cardio vascular system. (14)

In country like India, still tuberculosis is the most prevalent chronic respiratory disease. Patients with low socioeconomic status due to inadequate literacy, insufficient awareness about government programmes take incomplete anti tubercular treatment and ultimately suffer from severely deranged pulmonary function. The present study was under taken to correlate the derangement of lung functions with respect to the destruction in the lung parenchyma as a consequence of pulmonary tuberculosis and pleural tuberculosis.

OBJECTIVES: To correlate the derangement of lung functions with respect to the destruction in the lung parenchyma as a consequence of pulmonary tuberculosis and pleural tuberculosis.

Material & Methods:

Study Design: Prospective cross-sectional study.

Study area: Dept. of. Respiratory Medicine, Kamineni Academy of Medical Sciences and Research Center, L B Nagar, Hyderabad.

Study Period: July 2019 to June 2020.

Study population: established cases of pulmonary & pleural tuberculosis, that were completed antitubercular treatment under dots or privately and attended op/admitted in ward were taken up along with 30 healthy individuals with informed consent were grouped as controls.

Sample size: The study consisted of 130 cases and 30 controls.

Sampling method: Simple Random sampling method.

Inclusion criteria: All cases of treated pulmonary tuberculosis, and \ or pleural tuberculosis,

Exclusion criteria:

1) Patients treated for Extra pulmonary tuberculosis (except pleural effusion)

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2) Patients with other respiratory disorders likehistory of Asthma, COPD, Collagen diseases, Silicosis, Thoracic surgery ,.etc.,

Ethical consideration: Institutional Ethical committee permission was taken prior to the commencement of the study.

Study tools and Data collection procedure:

A detailed case history was taken with consent from all.A thorough clinical examination was done and a clinical diagnosis was made. Chest X-Ray was done in all cases, the readings were independently made by two umpire readers for having correct assessment of underlying lesion. The extent of lesion was graded as minimal, moderately advanced or far advanced on the basis of guidelines given by National Tuberculosis Association. Presence of cavities if any and their number were also noted in each case.Sputum examination for Acid fast bacilli by direct microscopy was done in all cases by the AuramineRhodaminestaining technique as per the RNTCP Guidelines. Two sputum samples were examined and reported as positive or negative.HIV by ELISA was done in all the patients.

All routine investigations like Haemogram, stool and urine examination (routine and microscopic), fasting blood sugar, culture studies of sputum for bacteria (other than M.Tuberculosis) were undertaken in each case. For assessment of the pulmonary function, each patient was subjected to various tests in the pulmonary function test laboratory of the department. The parameters calculated were forced expiratory volume in first second (FEV1), forced vital capacity (FVC), FEV1/FVC and peak expiratory flow rate (PEFR). All the tests were done with the patient in sitting position, FEV1 and FVC were calculated with the help of SUPER SPIRO spirometer a Computer based spirometer. PEFR was estimated by using Wright's peak flow meter. Before undertaking all the above tests, great care was taken so that the patient did not become apprehensive and cooperated fully.

Statistical Analysis:

The data was collected, compiled and compared statistically by frequency distribution and percentage proportion. Quantitative data variables were expressed by using Descriptive statistics (Mean ± SD). Qualitative data variables were expressed by using frequency and Percentage (%). P values of <0.05 were considered statistically significant. Data analysis was performed by using SPSS Version 20.

Observations & Results:

In the present study 130 treated cases of Pulmonary tuberculosis, pleural tuberculosis or both were subjected to different investigations like chest X-ray, sputum for AFB, Spirometry, ECG etc,to study the underlying pulmonary derangements.Thirty Healthy volunteers were selected amongst students & faculty and other employees of the hospital for this study as control. They also underwent the investigations like chest X-ray, Spirometry, ECG.

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Table 1: Age distribution

AGE	STUDYn=130	%	CONTROL n=30	%
<15	2	1.53	0	0
16-25	24	18.46	5	16.6
26-35	28	21.5	6	20
36-45	23	17.69	10	33.33
46-55	19	14.61	3	10
56-65	28	21.5	6	20
66-75	6	4.61	0	0

The mean age of the study group was 41.44+/-16.889. The mean age of control was 41.80+/-15.07.

Table 2:Gender Distribution

Gender	**Studyn=130**	**%**	**Controln=30**	**%**
Males	89	69	18	60
Females	41	31	12	40

Table 3:Symptoms duration

Symptomduration	n=130	%
<1month	14	10
1-2months	22	17.5
2-4months	58	48
4-6months	18	9
>6months	12	10

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Observed in the study that about 44.2% cases presented to the hospital after 2-4 months after initiation of symptoms.

Table 4:Sputum status

Sputumstatus	N=130	%
Sputumpositive	94	72.31
Sputumnegative	36	27.69

In the study group 73% were found to be sputum smear positive for acid fast bacillus.

31 patients were started with re-treatment regimen i.e Category 2 under RNTCP remaining were kept under category 1.

Among the study group,40 (30.53%) patients stopped treatment in less than 2 months, 35(26.7%) stopped treatment in less than 4months. And 56(42.7%) have completed 6months or 8months regimen.

In about 35% of patients sputum grading was 3+.

In this study, 46.92% hadCavitary lesions and of them 32% had multiple cavities.

Table 5: OBST / REST / MIXED

TYPE	Number	%
OBSTRUCTIVE	39	38.6
RESTRICTIVE	24	23.7
MIXED	18	17.8
NORMAL	20	19.8

Table 6: Radiology Vs spirometry

RADVSairway	Mild	Moderate	Far advanced
Mildrestriction	11	1	0
Moderaterestriction	4	5	2

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Severerestriction	0	2	5
MIXED	6	3	2
Normal	13	7	0
Mildobstruction	4	4	3
Moderateobstruction	2	3	15
Severeobstruction	0	4	9
Verysevere obst	0	2	2

FEV1 & FVC values of the study group were compared with same of the control & significant changes were noticed.

Table 7:AGE VS FVC in study group

AGE GROUP	NO	MALE	FEMALE	Fvc>60%	FVC 40-60	FVC <40
<15	2	1	1	1	1	0
16-25	24	14	10	15	6	3
26-35	28	18	10	24	2	2
36-45	23	16	7	16	5	2
46-55	19	15	4	12	4	3
56-65	28	20	8	20	5	3
66-75	6	3	2	3	2	1
				91	25	14

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CONTROL GROUP:

controls age	**Total**	**male**	**Female**	**fvc>60%**	**fvc40-60**	**fvc<40%**
16-25	5	3	2	3	1	1
26-35	6	4	2	3	2	1
36-45	3	2	1	1	1	1
46-55	10	6	4	3	3	4
56-65	6	4	2	1	2	3
				10	9	10
				33.4%	30%	33.4%

TABLE 8:AGE VS FEV1 in the study group

AGE GROUP	TOTAL	MALE	FEMALE	FEV1>70	60-69	50-59	35-49	<35
<15	2	1	1	1	0	1	0	0
16-25	24	14	10	7	8	4	1	4
26-35	28	18	10	4	8	6	2	8
36-45	23	16	7	6	2	8	4	3
46-55	19	17	2	3	2	6	4	4
56-65	28	20	8	10	4	5	4	7
66-75	6	5	2	3	2	1	2	0
TOTAL	131	91	40	34	26	31	17	26

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In control group:

AGE GROUP	TOTAL	MALE	FEMALE	FEV1>70	60-69	50-59	35-49	<35
16-25	5	3	2	3	1	1	0	0
26-35	6	4	2	3	2	0	1	0
36-45	3	2	1	2	0	1	0	0
46-55	10	6	4	4	1	2	2	1
56-65	6	4	2	0	1	2	2	1
TOTAL	30	19	9	12	5	6	5	2

DISCUSSION:

A Total of one hundred and thirty cases have been evaluated in the present study. Thirty healthy controls were also examined to compare the lung function. The male: female ratio of study group was 2.3:1.In the earlier study by S Akkara et al[15] in India 2011-12 (26) ratio was 4:1,In a similar type of study Rajesh et al[16] the ratio was 1.5:1.

The lower rates of pulmonary tuberculosis in females might be due to under reporting because of social and cultural factors which lead to lack of access to health care. This discrepancy may also be due to sedentary habits of females in comparison to males who have higher exposure by virtue of occupational habits.

The mean age of the study group 41.44+/-16.89. Most of the patients (57.3%)belong to age group 16-45 years. This age group constitutes the active working period of men and pulmonary tuberculosis affects commonly this age group. Previous studies also showed similar prevalence of thediseasein this age group.

About 44% of patients presented to the hospital after 2-4 months of symptoms. This is due to lack of health consciousness & proper education. Majority of the patients do not turn up to the hospital till the disease sufficiently advances and compelthem to seek medical advice. 72% of the study group were sputum smear for acid fast bacilli Positive and the rest were sputum smear for acid fast bacilli negative. 92 Patients were new cases and received Cat-1 regimen, remaining 39 were retreated with cat-2. 40 (30.53%) patients stopped treatment in less than 2 months, 35(26.7%) stopped treatment in less than 4months. And 56(42.7%) have completed ≥6months regimen.

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Chest x rays of the study group revealed lesions in 46.6 %. Of them, 42 had multiple cavities , 19 had single cavity, the lesions were also graded minimal, moderate, far advanced. 39 % of The study group had minimal lesions, 23% had moderate lesions & remaining38% had far advanced.

All the patients underwent pulmonary function tests. The dynamic lung volumes like FEV1,FVC,FEV1/FVC and PEFR were recorded. The association between values and patient'sdemographic characteristic sputum smear grading, and radiological grading of the lesions were analysed.We observed that the FEV1 values were significantly low in the study group compare to control group (P-0000). The mean FEV1 % was 53.9+/-17.1 in the study group while it was 88 +/- 3.3 in the control group.Only 25 (19.08 %) had normal spirometry, 40.2 % had obstruction. Mild obstruction was found in 7.4%, moderate obstruction in 12.8 % of cases, 14.6% had severe obstruction and 2.1 % had very severe obstruction.

In a study by Akkara et al[15], they found obstruction in 86.8% of cases and the majority of cases having severe obstruction. Similar our group also had majority in severe obstruction pattern.As it can be seen severity of obstruction increased with degree of radiological lesions, which were similar to findings of Akkara et al[15].

In a study by Mac Guiereet al[1] similar observations were found with moderate to severe impairment of lung functions in38.9 % of cases. Our study was also as per the PLATINO Study, in which low FEV1 value was found in patients with tuberculosis when compared with non-tuberculosis group.The mean FVC in the study group was 66.73+/_ 9.3 while in the control group it was 90.23+/-2.3. p-0.000 that is significantly low when compared to healthy contacts.

All treated pleural tuberculosis patients with restrictive pattern and with FEV1% less affected.This is similar to the study of Altschule et al found restrictive lung functions in pleural effusions.And Rupak et al[17] showed similar findings that all pleural effusion cases after treatment had insignificant changes in FEV1% and most of them had moderate restriction.

CONCLUSION:

FEV1 was found to be grossly reduced in the study group especially pulmonary tuberculosis.Forced vital capacity was also significantly reduced in the study group particularly in pleural tuberculosis cases. But FEV1 was not significantly reduced.The disease was associated with significant derangement of lung functions. The more the severity of the disease, the more was the functionalderangement. Hence early detection and treatment of tuberculosis are important to reduce the chronic airflow limitations.This study revealed that more advanced lesions of tuberculosis lead to long term morbidity of the patients.

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