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A Study of Chronic Obstructive Pulmonary Diseases in Post Tuberculosis Patients Reporting in a Tertiary Care Hospital in Eastern India

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Abstract
Background: *Chronic Obstructive Pulmonary Diseases (COPD) is a common preventable and treatable disease characterized by persistent airflow limitation. TB is a serious public health problem causing immense morbidity, mortality and distress to individuals, families and communities.*
Methodology: *In this study 100 consecutive subjects who had pulmonary TB in the past and had taken full course of anti-tubercular treatment and now coming with the complaint of one or more of cough, shortness of breath and expectoration were selected.*
Results: *100 % of the patients presented with shortness of breath. About 78 % of the patients presented with cough and 56 % of the patients presented with expectoration. Near about 58 % of the patients presented with wheeze. Hemoptysis was present in 16 % of the patients and 31% of the patients presented with chest pain. Most of the 81 % of the patients had the duration of the symptoms less than 5 years.*
Conclusion: *There is a significant association between the severity of dyspnea and the COPD in post TB patients. There is a statistically proven association between the number of years before the pulmonary TB disease and the development of COPD. There is a statistically proven association between the duration of symptoms and the development of COPD.*
Keywords: *Chronic obstructive pulmonary disease, Tuberculosis, mMRC scale, spirometry.*

Introduction

Chronic Obstructive Pulmonary Diseases (COPD), a common preventable and treatable disease, is characterized by persistent airflow limitation that is usually progressive and associated with an enhanced chronic inflammatory

response in the airway and in the lungs to noxious particles or gases. The chronic airflow limitations characteristic of COPD are mixtures of small airway diseases and parenchymal destruction, the relative contribution of which varies from person to person. Chronic inflammation causes structural changes and airway narrowing, destruction of the lung parenchyma, also by inflammatory processes, leads to the alveolar loss of attachment to the small airways and decreased lung elastic recoiling.[1]

COPD is a leading cause of morbidity and mortality worldwide and results in an economic and social burden that is substantial and increasing.[2,3]

The prevalence of COPD in India according to studies was 3.67% (4.46 and 2.86% among males and females, respectively). The estimated burden of COPD in India is about 15 million cases (males and females contributing to 9.02 and 5.75 million, respectively).[4,5] Outdoor air pollution and infections are important factors. A history of recurrent childhood respiratory infection has been associated with a reduced lung function and more respiratory symptoms in adults.[6, 7]

Respiratory tract infection even causes exacerbation in COPD patients. History of pulmonary tuberculosis is also a risk factor for the development of COPD. However, the impact of pulmonary tuberculosis on the prevalence of COPD has often remained neglected. Pulmonary functional impairment as a sequel of pulmonary tuberculosis manifests in various patterns but mainly as airflow limitation.[8]

TB is a serious public health problem causing immense morbidity, mortality and distress to individuals, families and communities. The local complications of pulmonary TB are hemoptysis, post tubercular bronchiectasis, fungal ball or aspergilloma, spontaneous pneumothorax, disseminated calcification of the lungs, secondary pyogenic infection, scar carcinoma, tuberculous endobronchitis and tracheitis and pulmonary function changes mainly as obstructive airway diseases.[9-11]

There has been a limited study in India about the impact of pulmonary TB on the development of COPD. The prevalence of both TB and COPD is high in India. As a matter of interest it has been studied whether TB as such can cause COPD. TB can cause pulmonary architectural distortion by the form of parenchymal fibrosis or chronic bronchitis or bronchiectasis. The incidence and the prevalence of post-TB fibrosis patients are not known.

Aims & Objectives

1. To find out the incidence of COPD in post TB patients.
2. To assess the demographic profile of post Tuberculosis COPD patients.

Materials and Methods

In this study 100 consecutive subjects who had pulmonary TB in the past and had taken full course of anti-tubercular treatment and now coming with the complaint of one or more of cough, shortness of breath and expectoration were selected. The patients fulfilling the inclusion criteria were included in the study. An informed consent was obtained from each such subject.

The subjects were taken from among the patients attending outdoor as well as indoor of the Department of Pulmonary Medicine, Medical College, Kolkata between February 2013 to January 2014.

Inclusion Criteria

1. Age: 18-70 years
2. A patient who had past history of pulmonary TB and treated under DOTS program and declared cured or treatment completed.
3. Presence of chronic exertional dyspnea or cough.

Exclusion Criteria

1. Active pulmonary TB
2. Active hemoptysis
3. Pre-existing asthma, COPD, bronchiectasis, bronchogenic carcinoma, interstitial lung disease

4. Current or previous smoking
5. Past history of lung resection surgery
6. History of bio-mass fuel exposure
7. Abdominal surgery within last one month
8. Acute myocardial infarction in last one month
9. Congestive heart failure
10. Human immunodeficiency virus (HIV) infection

Symptoms especially shortness of breath, cough, expectoration, wheeze etc. was noted along with the duration, progression, aggravating and relieving factors. For the breathlessness evaluation, mMRC dyspnoea scale was used. A detailed history of pulmonary tuberculosis has been taken. The mode of diagnosis and history of contact with TB patients is also noted. Treatment taken by the patient and its duration is meticulously checked. Previous documents were checked thoroughly for the documented evidence of pulmonary tuberculosis. The treatment received by the patient is also noted. The number of times a patient suffered from pulmonary tuberculosis is also documented. Any patient, who showed suspicion of active pulmonary tuberculosis, underwent sputum examination for TB bacilli from RNTCP laboratory. Sputum positive patients were excluded from the study and advised anti tuberculosis therapy from the DOTS clinic.

Diagnosis of COPD:

Modified Medical Research Council (mMRC) dyspnoea scale[12]:

mMRC Grade 0	Breathless with strenuous exercise
mMRC Grade 1	Short of breath when hurrying on the level or walking up a slight hill
mMRC Grade 2	Walks slower than people of the same age on the level or has to stop for breath while walking at own pace on the level
mMRC Grade 3	Stops for breath after walking about 100 meters or after a few minutes on the level
mMRC Grade 4	Too breathless to leave the house or breathless when dressing or undressing

Chest x-ray PA view was taken for every patient to assess the radiological evidence of COPD. The number of zones affected by post tuberculosis fibrosis was noted. Spirometry including reversibility test was done in the chest department by maintaining ATS recommendation using Recorders and Medicare System (RMS Medspiror, Platform win XP. Version 1, Interpretation set-Recorders, Transducer- Bi-direction, Eth error100) Machine.

For Reversibility testing, short acting beta-2 agonist (total dose 400 µg of Salbutamol or 200 µg of Levo-salbutamol) was delivered at 30 s intervals via a spacer after the initial test and spirometry was repeated 15 to 20 minutes later.

A test is called reversible if there is post bronchodilator FEV1 improvement of 12% and 200 ml from the baseline. Absence of improvement of 15% and 200ml or more in Post Bronchodilator FEV1 was taken as absence of reversibility. Post Bronchodilator FEV1 was recorded in all cases to assess severity of air way obstruction.

All the post Tuberculosis fibrosis patients underwent spirometry examination. The diagnosis of COPD was confirmed by spirometry according to GOLD 2014 guideline, that is, presence of a post-bronchodilator (FEV1/FVC < 0.70).

The severity of COPD was classified according to GOLD 2014 guidelines[1]:

- GOLD 1 (Mild): Post-bronchodilator FEV1/FVC < 0.70 and Post-bronchodilator FEV1 ≥ 80% predicted
- GOLD 2 (Moderate): Post-bronchodilator FEV1/FVC < 0.70 and Post-bronchodilator FEV1 < 80% predicted and ≥ 50% predicted
- GOLD 3 (Severe): Post-bronchodilator FEV1/FVC < 0.70 and Post-bronchodilator FEV1 < 50% predicted and ≥ 30% predicted
- GOLD 4 (Very severe): Post-bronchodilator FEV1/FVC < 0.70 and Post-bronchodilator FEV1 < 30% predicted or FEV1 < 50% Predicted plus chronic respiratory failure.

Results

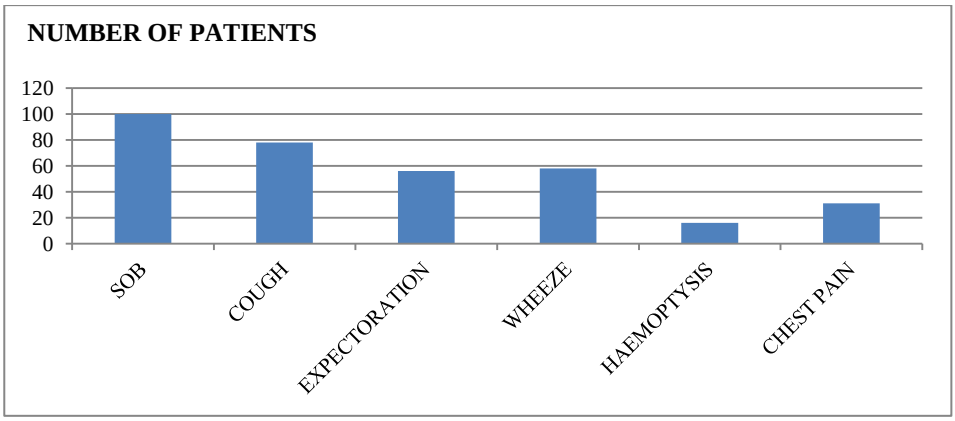
Table 1: Distribution of study population according to age group

Age group in years		Count	percentage
age	less than 30	2	2%
	31-45	25	25%
	46-60	46	46%
	more than 60	27	27%

(n=100)

Most of the study population belonged to 46-60 year age group (46 %). Mean age of the study population is 53.27 years. Majority of the study population were male (54 %). Male: female ratio was 1.5:1. Majority of the study population were from rural area (56%). Majority of the study population were Hindu (68%).

Figure 1: Distribution of study population according to symptoms (n=100)



100 % of the patients presented with shortness of breath. About 78 % of the patients presented with cough and 56 % of the patients presented with expectoration. Near about 58 % of the patients presented with wheeze. Hemoptysis was present in 16 % of the patients and 31% of the patients presented with chest pain.

Table 2: Distribution of study population according to level of education (n=100)

Level of Education		Count (%)
	Illiterate	21
	Primary School	56
	Middle	12
	High School	9
	Post High School Diploma	2
	Graduate	0

Majority of the study population studied up to primary school (56%) [Table 2]. Most of the study population belongs to the group with income rupees 1601-4809 (43%). Majority of the study population were unskilled (48%). Majority of the study population 64 (64%) belongs to upper lower class.

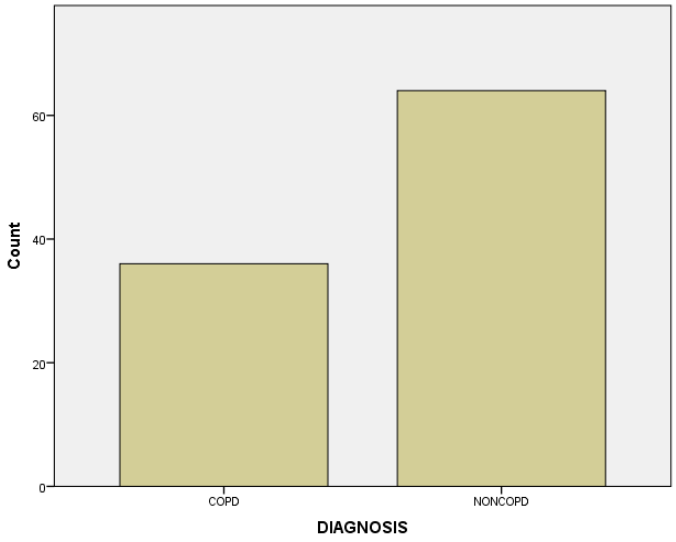


Figure 2: Distribution of study population according to development of COPD (n=100)

About 36 (36%) of the study population are diagnosed with COPD [figure 2].

Table 3: Distribution of study population according to severity of shortness of breath by MMRC scale (n=100)

	Grading of dyspnea according to MMRC scale		Count
MMRC dyspnoea scale	Grade 0	breathlessness with strenuous exercise	0
	Grade 1	breathlessness hurrying in level	51
	Grade 2	stop for breath walking at own pace	18
	Grade 3	SOB after 100 yards	28
	Grade 4	too breathless to leave the house	3

Most of the 51% of the study population presented with grade 1 shortness of breath according to MMRC scale [Table 3].

Table 4: Distribution of study population according to duration of symptoms (n=100)

		Count (%)
DURATION	less than 5	81
	6-10	18
	more than 11	1

Most of the 81 % of the patients had the duration of the symptoms less than 5 years [Table 4].

Table 5: Distribution of study population according to duration since TB diseases (n=100)

		Count (%)
TB Cases	Less than 5	30
	6-10	30
	11-15	34
	more than 16	6

Approximately 94% 0f the patients developed COPD within 15 yrs after being treated for pulmonary TB [Table 5].

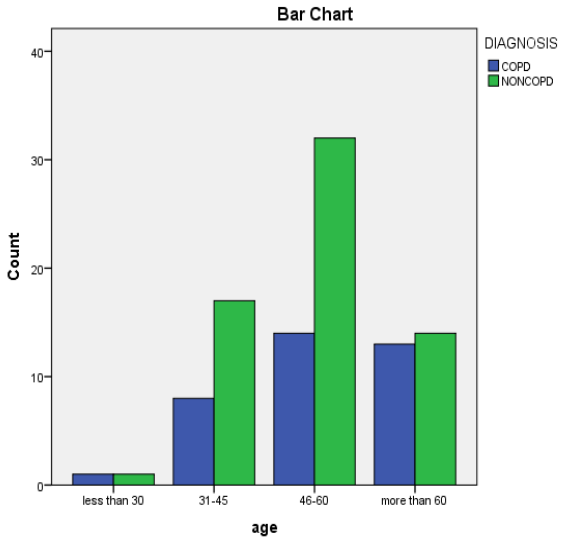


Figure 3: Distribution of study population according to the age and development of COPD (n=100)

No significant association between the age of the patient and the development of COPD.

Table 6: Distribution of study population according to sex and COPD (n=100)

Count				
Gender		DIAGNOSIS		Total (%)
		COPD	NON-COPD	
	Male	21	33	54
	Female	15	31	46
Total		36	64	100

No significant association between sex and COPD.

Table 7: Distribution of study population according to the Socio Economic Status (SES) and Presence of COPD (n=100)

Cross tab between COPD vs SES

			COPD		Chi square	P value	Odds Ratio (95% CI)
			COPD	NOCOPD			
SES	low SES	Count	23	32	1.796	0.18	1.77 (.765-4.091)
		percentage	(41.8%)	(58.2%)			
	high SES	Count	13	32			
		percentage	(28.9%)	(71.1%)			
Total		Total count	36	64			
		Total percentage	(36.0%)	(64.0%)			

SES was calculated according to modified Kuppuswamy scale. Majority of the subjects are from upper lower SES, followed by lower and few are from lower middle SES. No subject is from upper middle or upper category. The mean SES score is 6.5. The subjects are divided into two categories after taking the mean SES value as cut off and keeping the mean value i.e. 6.5 in the upper category. So here low SES means score 6.4 and below and high SES means 6.5 and above.

Chi square test has been done and odd's ratio is calculated to show the statistical association. Here the odd's ratio is 1.77 (95% Confidence Interval .765-4.091) which means subjects in the low socio economic condition are 1.77 times more prone to develop COPD in comparison to high SES. But this association is not statistically significant as value of 95% Confidence Interval includes 1.

The association also can be explained by Chi square test. Here the chi square value is 1.796 at degree of freedom 1, which is not statistically significant as p value is 0.18.

Table 8: Distribution of study population according to the radiological involvement in X-ray and development of COPD (n=100)

Number of zone effected					
One zone	Two zone	Three zone	Four zone	Five zone	Six zone
Count	Count	Count	Count	Count	Count
38	21	10	17	9	5

Number of zone effected * DIAGNOSIS Cross tabulation				
Count				
		DIAGNOSIS		Total
		COPD	NONCOPD	
Number of zone effected	one zone	0	38	38
	Two zone	2	19	21
	Three zone	7	3	10
	Four zone	15	2	17
	Five zone	8	1	9
	Six zone	4	1	5
Total		36	64	100

Chi-Square Tests				
	Value	df	Asymp. Sig. (2-sided)	Chi-square= 68.042 df=5 p value <0.0001
Pearson Chi-Square	68.042[a]	5	.000	
Likelihood Ratio	81.660	5	.000	
Linear-by-Linear Association	57.912	1	.000	
No. of Valid Cases	100			

There is a statistically proven association between the number of zone affected in x-ray and the development of COPD in post-TB patients.

Table 9: Distribution of study population according to the severity of SOB and development of COPD (n=100)

		DIAGNOSIS		Total [%]
		COPD	NON-COPD	
MMRC dyspnoea scale	breathlessness hurrying in level	0	51	51
	stop for breath walking at own pace	5	13	18
	SOB after 100 yards	28	0	28
	too breathless to leave the house	3	0	3
Total		36	64	100

Chi-Square Tests				
	Value	df	Asymp. Sig. (2-sided)	Chi-square=84.327 df=3 P value < 0.001
Pearson Chi-Square	84.327[a]	3	.000	
Likelihood Ratio	109.413	3	.000	
Linear-by-Linear Association	78.496	1	.000	
N of Valid Cases	100			

There is a significant association between the severity of dyspnea and the COPD in post-TB patients**.**

Table 10: Distribution of study population according to the years after the TB disease and development of COPD (n=100)

		DIAGNOSIS		Total [%]
		COPD	NON-COPD	
History of TB	Less than 5	1	29	30
	6-10	6	24	30
	11-15	23	11	34
	more than 16	6	0	6
Total		36	64	100

Chi-Square Tests				
	Value	df	Asymp. Sig. (2-sided)	Chi-Square= 42.67 df=3 P value< 0.001
Pearson Chi-Square	42.674[a]	3	0.000	
Likelihood Ratio	49.085	3	.000	
N of Valid Cases	100			

Discussion

The present observational, descriptive, cross sectional, hospital based study was conducted in the Department of Pulmonary Medicine, Medical College, Kolkata in the period of February 2013 to January 2014. During the study period a total of 100 individuals having a past history of treatment for pulmonary tuberculosis and presenting with dyspnea who fulfilled all the inclusion/exclusion criteria were included in the study. All of them were subjected to spirometry.

A study conducted by Baig et al[13] in post -TB patients found that 76.5% (n=36) were males. The age in ranged between 24 and 65 years with a mean of 56.4 years. Another study done by Menez et al[14] found that male female ratio was 0.65. Mean age was 56.6 ± 11.9 years. Another study done by Lee et al. found that 57% of the study populations were male. In this study, it is observed that, male is 54(54%), female 46 (46%). Male female ratio is 1.2. Maximum age is 87 years, minimum age is 18 years. Average age is 53.27 years. So the result of the age and sex in this study is corroborating with the other studies. The present study demonstrates a male predominance and older age group. In the current study it is observed that, 56 (56%) of the post-TB patients live in rural area. 44% of the study populations live in the urban area.

In the current study it is observed that, 68(68%) of the post-TB patients are Hindu. 32% of the study population are Muslim. This study is corroborating with the study done by Jethani et al[15] in which 74% of the study population were Hindu. The analysis of the occupational status revealed that majority (48%) of the study population were unskilled workers. 26 % of the people were unemployed. About 18 % were semiskilled. 2% were skilled and 6% of them were farmer.

The socioeconomic status of the study population revealed that, 64% of them belonged to upper lower class according to the scale of Kuppuswamy.[16] About 30% of the population is in the lower class, 6% in the middle class. This result also corroborates with the RNTCP report.[17]

A study conducted by Lee et al.[18] in South Korea found that, 86% of the post-TB patients presented with shortness of breath. 24% of the patients presented with cough. 24 % of the patients had expectorations and 19 % of them had hemoptysis. A study conducted by Hassan et al.[19] in Saudi Arabia found that Cough was present in 100%, production of sputum in 92.6%, shortness of breath in 83.3%, and wheeze in 72.2%. In the current study it is observed that, 100 % of the study population presented with the complaint of shortness of breath whereas 78 % had cough as their chief complaint. 56 % had expectoration,

58% had wheeze, 16% had hemoptysis and 31 % had chest pain at presentation. The occurrence of shortness of breath and hemoptysis in post-TB patients are well corroborated with the earlier findings. There is a difference in the presentation of other symptoms. This difference may be due to the fact that, the current study is a tertiary hospital based study. The difference may be due to the smaller sample size.

One of the main objectives of the current study is to find out the proportion of COPD in post-TB patients. All the 100 patients selected for the study underwent spirometry. The patients were diagnosed as a case of COPD according to the GOLD guideline 2014.[1] The criteria was post bronchodilator FEV1/FVC <0.70. Baig et al[13] found in his study in Rawalpindi, Pakistan that 55.3 % of the post-TB patients had COPD. In PLATINO[14] study conducted in five Latin American countries, Menez et al[14] found that, the prevalence of COPD in post-TB patients was 30.7%. Study conducted in Saudi Arabia by Hassan et al.[18] concluded that COPD was present in 40.7% of the post-TB patients. In another study by Aktogu et al[20] in Turkey documented that 6% of the post-TB patients suffer from COPD in later life. In a study conducted by Verma et al[21] in India, which was aimed at study of prevalence of airway obstruction in post TB patients. Of the 92 post TB patients selected for the study, 36 (39.12%) patients had obstructive airway defect diagnosed by spirometry. In the current study it is observed that the prevalence of COPD in post-TB patient is 36%. This result is well corroborating with the previous studies.

The study conducted by Baig et al.[13] in Rawalpindi found that, the post-TB patients presented with different degrees of obstructive impairment. He graded the airflow limitation in those patients as mild, moderate and severe obstruction. In his study 5.9% presented with mild degree of impairment, 23.0% had moderate airflow obstruction, 69.2% had severe degree of airway obstruction. In the current study it is found that 51% of the post-TB patients presented with grade 1 shortness of breath, 18% presented with grade 2 , 28% grade with grade 3 and 3% had grade 4 shortness of breath. So the current findings are corroborating with the result of the previous study. Vast majority of the patients are having grade-1 and grade-2 dyspnea.

The study population presented with variable duration of symptoms of COPD. So the duration was divided in categories. About 81% of patients were having chest symptoms of less than 5 years duration.18% of the study population were having symptoms for last 6 to 10 years and 1% of the population had symptoms for more than 11 years.

The study population presented with variable duration of history of pulmonary TB. The duration was divided in categories. About 30% of patients had pulmonary TB less than 5 years back. Another 30% had pulmonary TB 6 to 10 years back. 34% of the study population had pulmonary TB 11to 15 years back and 6% had more than 15 years back. In the study conducted by Baig et al.[13] It was found that 30.7% (n=8) were treated in less than 10 years back,57.6%(n=15) were treated between 10 and 15 years back, and 11.3% (n=3) had a history of receiving treatment more than 15 years back. The result of the current study is corroborating with the earlier study as, in both the cases majority of the post TB patients were treated for pulmonary TB between 10 and 15 years back. Another study done by Hnizdo et al[22] in USA found that, majority of the patients developed airflow obstruction 5.6 years after receiving treatment for pulmonary TB.

In the current study, it is found that the majority of the post-TB COPD patients were in the age group between 46 to 60 years. 38% of the post-TB COPD patients belong to the age group 46 to 60 years. 36% of the COPD patients belonged to age group more than 60 years. According to the PLATINO[14] study the majority of the COPD cases are aged more than 60 years. COPD is a disease of the older age group but in the current study a definite statistical evidence of association between age and the presence of post-TB COPD could not be found (Chi-square=2.6, df=3, p value= 0.442).

This may be attributed to the hospital based study and the small sample size. Other factor which interferes with the result is that, older people accept minor chest complaints as a complication of TB and do not seek medical attention.

The current study revealed that post-TB COPD is more common among males (58.34%) than females. Female patients contributed to 41.66% of the post-TB COPD cases. In the study conducted by Lee et al.[18], the percentage of male patients contributing to post-TB COPD was 57%. So the result of this study corroborates well with the earlier result. Another study done by Menezes et al[14] could not find a definite relationship between male sex and development of COPD (p= 0.11).

In this study it is observed that, there is a statistically proven association between the number of zones affected in chest x-ray and the development of COPD in post-TB patients (Chi-square=68.042, df=5, p value <0.001). In another study done by Hassan et al.[19] it was found that 13 patients (48.1%) had bilateral radiological changes. 20 patients (74.0%) had a right upper lobe change and 12 (44.4%) a left upper lobe involvement. 9 (33.3%) had both upper lobar changes. Pleural thickening was evident in 21 patients (77.7%), cavitation, and bronchiectasis changes were present in 22 patients (81.5%) and fibrotic scarring in all (100%). Another study done by Ahmed et al evaluated chest-x-ray abnormalities. The study revealed fibro-cavitary disease in 7 (50%) patients, fibrosis in 5 (36%), bullae and fibrosis in 1 (7%) and fibrothorax in 1 (7%). In the current study it is observed that, among the patients who developed COPD, 41.67% have radiological changes in four zones and 22.22% of the patients have fibrosis in five zones. So it can be concluded that the extent of lung fibrosis is associated with severity of COPD.

In this study it is observed that, there is a significant association between the severity of dyspnea and COPD in post TB patients (Chi-square=84.327, df=3, p value < 0.001). Most of the patients (77.78%) diagnosed with COPD presented with grade 3 dyspnea as per the MMRC scale.

In this study it is found that, there is no statistically proven association between BMI and development of COPD in post TB patients (Chi-square= 3.05, df=5, p value= 0.692). The majority of the study population is having normal BMI.

There is statistically proven association between pulmonary tuberculosis and the number of years before the development of COPD. In the study by Baig et al.[13] it was found that 15(57.6%) had been treated between 10 and 15 years ago, 30.7% (n=8) had been treated in less than 10 years and 11.3% (n=3) had a history of receiving treatment more than 15 years before. The result of the current study is corroborating with the earlier study as in both the cases, majority of the post TB patients were treated for pulmonary TB between 10 and 15 years ago. Another study done by Hnizdo et al.[22] in USA found that majority of the patients developed airflow obstruction 5.6 years after being treated for pulmonary TB.

Conclusion

Majority of the study population belonged to 46-60 year age group (46 %). Mean age of the study population was 53.27 years. Majority of the study population were male (54 %). Majority of the study population were from rural area (56%). Majority of the study population studied up to primary school (56%). Most of the study population belonged to monthly income score 2 with monthly income rupees 1601-4809 (43%). Majority of the study population were unskilled worker (48%). Majority of the study population belonged to upper lower class (64%). About 36 patients out of 100 were diagnosed to have COPD (36%).

Most of the study population presented with grade-I shortness of breath according to mMRC scale (51%). Most of the patients had symptoms of duration less than 5 years (81 %). No significant association between gender and COPD was found. There was a statistical evidence of association between Hindu religion and COPD.

There was no association between residence and development of COPD in post TB patients. There was no statistical evidence of association between literacy and development of COPD in post-TB patients. There was no statistically significant association between occupation and development of COPD in post TB patients. There is no association between the monthly income and the development of COPD. There is a statistically proven association between the number of zone affected in x-ray and the development of COPD in post-TB patients. There was no association between the age of the patient and the development of COPD. There is a significant association between the severity of dyspnea and the COPD in post TB patients. There is a statistically proven association between the number of years before the pulmonary TB disease and the development of COPD. There is a statistically proven association between the duration of symptoms and the development of COPD.

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