

Original Article

Clinical Profile and Echocardiographic Evaluation of COPD Patients Admitted in a Tertiary Care Hospital

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Abstract:

Introduction: Chronic obstructive pulmonary disease (COPD) ranks as the fourth leading cause of global mortality, with anticipated increases in prevalence and mortality in the future. The Global Initiative for Chronic Obstructive Lung Disease (GOLD) highlights the importance of considering COPD diagnosis in patients with relevant symptoms or risk factors, confirmed through spirometry. While COPD is preventable and treatable, it often presents with significant extra-pulmonary effects, particularly cardiac manifestations. Echocardiography offers a rapid, noninvasive method to assess these cardiac complications.

Objective: This study aimed to investigate the clinical profiles and echocardiographic changes in COPD patients and their correlation with disease severity.

Method: Conducted as an observational cross-sectional study, the research took place in the indoor departments of Medicine and Respiratory Medicine at Sir Salimullah Medical College & Mitford Hospital, Dhaka, between May 25th, 2017, and November 24th, 2017; enrolling 105 diagnosed COPD patients aged e"18 years. Data collection involved a structured questionnaire covering socio-demographic details, risk behavior, and respiratory complaints. Physical examinations, spirometry, and echocardiography were conducted for diagnosis, severity grading, and cardiac evaluation, respectively. Statistical analysis employed SPSS software (version-22), presenting results through frequency, percentage, tables, graphs, and figures.

Result: The study population was predominantly male (88.6%) with a mean age of 64.1 years. Most patients (94.2%) were smokers with a mean pack-year history of 22.03. All patients presented with cough and shortness of breath, and 88.5% had wheezing. Spirometry revealed moderate COPD in 40% of patients, with a distribution across all severity grades. Echocardiography showed abnormalities in 52.4% of patients, with tricuspid regurgitation, pulmonary hypertension, and right ventricular dilatation being the most frequent findings. A significant correlation was observed between C OPD severity and the presence of these echocardiographic abnormalities.

Conclusion: Clinical examination unveiled common respiratory findings, while echocardiography demonstrated diverse cardiac manifestations in COPD patients. A significant proportion of patients exhibited normal findings on X-ray and echocardiography. The study highlights the prevalence of moderate COPD severity and the association between very severe COPD and specific cardiac complications, emphasizing the importance of comprehensive assessment and management strategies for COPD patients.

Key words: COPD, Echo, Pulmonary Hypertension

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Introduction:

COPD is one of the major causes of chronic morbidity and mortality worldwide and is considered the fourth leading cause of death¹. The global initiative for chronic obstructive lung disease defines COPD as a disease state characterized by airflow limitation that is not fully reversible. The airflow limitation is usually both progressive and associated with an abnormal inflammatory response of the lungs to noxious particles or gases².

Consistent history & physical examination, investigation findings including radiological features, spirometric readings, and blood gas analysis help diagnose COPD. FEV1 < 80% of predicted and FEV1/FVC < 0.7 that remains unchanged after bronchodilator administration is considered diagnostic findings of COPD. GOLD severity classification criteria take FEV1 and FEV1/FVC to categorize COPD in four stages (I – IV). FEV1/FVC < 0.7 is the mandatory requirement in all four stages whereas post-bronchodilator FEV1 ≥ 80% predicted consists stage I, ≥ 50% but < 80% predicted consists stage II, ≥ 30% but < 50% predicted makes stage III and < 30% predicted makes stage IV².

While COPD primarily affects the lungs, it also has significant extra-pulmonary (systemic) effects³. Among these, cardiac complications are the most common⁴. Research suggests that COPD patients are more susceptible to cardiovascular diseases, including coronary artery disease, heart failure, and arrhythmias^{5,6}. In fact, cardiovascular disease is now recognized as the most significant non-respiratory contributor to both morbidity and mortality in COPD patients⁴.

The burden of cardiovascular complications in COPD is further highlighted by the finding that it accounts for nearly half of all hospitalizations and a significant portion of deaths. Pulmonary hypertension is a major cardiovascular complication associated with advanced COPD. This complication often leads to right ventricular dysfunction and cor pulmonale, a condition where the right ventricle of the heart weakens due to increased workload, further worsening the prognosis^{1,7}.

Early diagnosis and management of COPD are crucial to prevent such complications. However, data on the clinical profiles and cardiac changes associated with COPD in our specific population is limited. This study aims to address this gap by investigating the clinical profiles and echocardiographic findings of COPD patients, and assessing their correlation with disease severity.

Material and Methods

The study was a cross-sectional investigation conducted at Sir Salimullah Medical College & Mitford Hospital (SSMCH) in Dhaka, Bangladesh, from November 2017 to April 2018. A purposive sampling technique was employed to select 105 adult patients (>18 years) admitted to the Department of Medicine and Respiratory Medicine at SSMCH, diagnosed with Chronic Obstructive Pulmonary Disease (COPD).

Inclusion criteria comprised patients over 18 years of age, irrespective of sex, and those clinically diagnosed with COPD. Exclusion criteria included patients with tuberculosis, thromboembolism, ischemic heart disease, hypertension, rheumatic heart disease, and thyrotoxicosis.

Data collection involved obtaining written informed consent from participants and administering a pretested semi-structured questionnaire to gather socio-demographic data, risk behavior, and respiratory complaints. Physical examinations and spirometry were conducted for diagnosis and grading COPD severity. Echocardiography was performed on all patients using 2-Dimensional and M-mode recording techniques.

The collected data were analyzed using SPSS software (version 22). Descriptive statistics such as frequency, percentage, tables, graphs, and figures were utilized for result presentation. Ethical approval was obtained from the Institutional Review Board.

Result:

Table 1. Distribution of patients according to age

Age (years)	No. of Patients	Percentage
40-49	2	1.9
50-59	30	28.5
60-69	23	21.9
70-79	50	47.61
Total	105	100

The majority (47.6%) were aged 70-79 years, with a mean age of 64.1 ± 11.1 years (Table 1). This study, 88.6% of patients (n=93) were male and 11.4% of patients were female (n=12). Here, most (94.2%) of the patients were smoker. Out of 99 smokers, 59 (59.5%) were cigarette smokers and 40 (40.5%) were bidi smokers and 35.3% had a smoking history of 22-27 pack years (Table 2).

Table 2. Smoking history in pack year among smokers

Smoking (pack year)	Frequency	Percentage
10-15	6	6.2
16-21	24	24.2
22-27	35	35.3
28-33	31	31.3
>33	3	3.0

Among the study population, 44.7% of the patients were laborers, 33.3% of patients were farmer. Only 3.8% of patients were in service. And 65 (61.9%) patients were from rural area and 40 (38.1%) patients were from urban area.

Table 3. Clinical features of study population

Clinical Presentations		
Clinical Presentations	No. of Patients	Percentage
Cough	105	100
Shortness of breath	105	100
Wheeze	93	88.5
Chest pain	12	11.4
Ankle swelling	10	9.5
Increased respiratory rate	105	100
Cyanosis	20	19.0
Pedal edema	10	9.5
Raised jugular venous pressure	3	2.8
Barrel-shaped chest	70	66.6
Use of accessory muscles	77	73.3
Rhonchi	105	100
Crepitations	67	63.8
Systolic murmur in tricuspid area	10	9.5
Loud P2	9	8.5
Hepatomegaly	8	7.6

Among the symptoms analysis, we have seen that all of the patients had the presentations of cough and shortness of breath. About 88.5% of patients had the symptoms of wheeze. Only 11.4% and 9.5% of patients had chest pain and ankle swelling respectively. General physical examination revealed that all the patients had increased respiratory rate. Cyanosis, pedal edema and raised jugular venous pressure were present in 20 (19.0%), 10 (9.5%) and 3 (2.8%) patients respectively. On systemic examination, the table shows that all the patients had rhonchi. Of the patients, 70 (66.6%) and 77(73.3%) patients had the findings of barrel shaped chest and usage of accessory muscles (Table 3).

In this study, 23.8% of patients had normal x-ray findings. Of the patients, 61.9% had increased broncho-vascular markings, 52.3% patients had changes of emphysema.

Table 4. Interpretation of spirometry results and grading of severity of COPD.

Stages	No. of Patients	Percentage
Mild	15	14.3
Moderate	42	40
Severe	28	26.7
Very severe	20	19.0

We found 14.3% of patients had mild and 40% of patients had moderate COPD About 26.7% of patients had severe and only 19.0% of patients had very severe (Table 4).

Table 5. ECG and Echo-cardiographic findings of the study population

ECG Findings		
ECG Findings	No. of Patients	Percentage
P Pulmonale	40	38.9
Right axis deviation	19	18.1
Right ventricular hypertrophy	30	28.5
Right bundle branch block	7	6.67
Normal	50	47.7
Tricuspid regurgitation (TR)	40	38.1
Pulmonary hypertension	40	38.1
Right atrial dilatation (RAD)	4	3.8
Right ventricular dilatation (RVD)	40	38.1
Right ventricular hypertrophy (RVH)	8	7.6
Left ventricular hypertrophy (LVH)	12	11.4
Left ventricular systolic dysfunction	5	4.7
Left ventricular diastolic dysfunction	37	35.2
Normal	50	47.6

Among the study population 47.7% of patients had normal ECG findings. P pulmonale, right ventricular hypertrophy and right bundle branch block were present in 38.9%, 28.5% and 6.67% of patients respectively. 47.6% of patients had normal echo-graphic findings. About 38.1% patients had tricuspid regurgitation, pulmonary hypertension and right ventricular dilatation. Of the patients 37(35.2%) had left ventricular diastolic dysfunction. Only 11.4%, 7.6% and 4.7% of patients had left ventricular hypertrophy, right ventricular hypertrophy and left ventricular systolic dysfunction (Table 5).

Table 6. Echocardiographic findings according to severity of COPD

Findings	Total (n=105)	Mild (15) n%	Moderate (42) n%	Severe(28) n%	Very severe(20) n%	p value
Tricuspid regurgitation (TR)	40	0	2(4.7)	18(64.2)	20(100)	.07
Pulmonary hypertension	40	0	2(4.7)	18(64.2)	20(100)	.0001
Right atrial dilatation (RAD)	04	0	1(2.4)	2(7.1)	1(5)	.2
Right ventricular dilatation (RVD)	40	0	2(4.7)	18(64.2))	20(100)	.07
Right ventricular hypertrophy (RVH)						
(RV ant. Wall >6mm)	08	0	0	3(10.7)	5(25)	.0001
Left ventricular hypertrophy (LVH)	12	0	2(4.7)	5(17.9)	5(25)	.1
Left ventricular systolic dysfunction (LVSD)	5	0	0	2(7.1)	3(15)	.3
Left ventricular diastolic dysfunction (LVDD)	37	0	4(9.5)	16(57.1)	17(85)	.001

All the patients with very severe COPD and 64.2% of patients with severe COPD had tricuspid regurgitation, pulmonary hypertension and right ventricular dilatation respectively. About 85% of very severe patients and 57.1% of severe patients had left ventricular diastolic (Table 6).

Discussion:

This single centre cross sectional observational study over a one year period illustrated the clinical profile and echocardiographic evaluation of COPD patients. A total of 105 admitted patients with COPD aged more than 18 years were enrolled for this study. In this study, most (47.6%) of the patients were in the age group of 70-79 years and 28.5% of patients were in the age group of 50-59 years. Mean age of the patients was 64.1 ± 11.1 years and minimum and maximum age were 40 years and 79 years respectively which were almost similar in previous studies. Similar results were found by Asif *et al* (2014) where most of the patients were in the group between 60-70 years⁸. Among the study population, most of the patients (88.6%) were male and only 11.4% were female. Males also had been dominating among study group in different studies⁸.

Most of the patients were smoker (94.2%). Out of 99 smokers, 59 (59.5%) were cigarette smokers and 40 (40.5%) were bidi smokers. A study by Vijiand his co-workers in 2008 documented that 80% of the patients were smokers in their study⁹. In 2009, William Macnee showed that cigarette smoking was clearly the single most important etiological factor in COPD¹⁰. Thus present study correlates with above mentioned studies.

As smoking is the main cause of COPD, the smoking habit and number of pack years correlates with the disease severity in COPD patients. The likelihood of developing COPD increases with the total smoke exposure.¹¹³ In this study, the

mean value of pack years was 22.03 ± 12.9 in the smoker group. This study matched with a study by Pirrozi *et al* in 2012 who reported mean value of pack year in the smoker group was 25.0 ± 13 ¹¹. The higher prevalence in males can be attributed to smoking, in the present study none of the female were smoker but it was noticed that most of them had history of cooking with dried cow dung or dried wood fuel in a poorly ventilated kitchen that may be the reason for their sufferings¹².

In present study, the common symptoms were cough (100%). Respiratory rate were increased in all of the patients. According to John *et al* (2011) the three most common symptoms in COPD are cough, sputum production, and exertional dyspnea¹³. On general examination signs of cyanosis, pedal edema and increased respiratory rate were present in 19.0%, 9.5% and 100% of total patients. On respiratory system examination, the study showed out of 105 patients, 70 patients (66.6%) had barrel shaped chest, 77 (73.3%) patients had usage of accessory muscles, 105 patients (100%) had rhonchi and 67 (63.8%) patients had crepitations, 9.5% of patients had systolic murmur in tricuspid area and 8.5% of patients had loud P₂. About 7.6% of patients had hepatomegaly. William Macnee (2009) found wheeze, barrel shaped chest, cyanosis, crepitations in COPD patients¹⁴.

In present study, x- ray chest findings in patients of COPD were prominent broncho-vascular markings, changes of emphysema and cardiomegaly. Out of 105 patients, 25 (23.8%) patients had normal chest x- ray. These findings were similar to William Macnee¹⁴ and Textbook of Radiology and Imaging by David Sutton¹⁵.

In present study, ECG changes were present in 47.7% of the COPD patients. Out of 105 patients, P pulmonale was present

in 40 (38.9%) patients, right ventricular hypertrophy was present in 30 (28.5%) patients, right axis deviation was present in 19 (18.1%) patients and right bundle branch block was present in 7 (6.7%) patients. In a study done by Agarwal *et al* in 2008 showed that ECG changes were present in 35.7% and P pulmonale was present in 35.7% patients of COPD¹⁶. Another study by Chappell showed that, P pulmonale was found in 10% of COPD patients and right ventricular hypertrophy in 10%¹⁷. Ursa Bones *et al* (2011) found right ventricular hypertrophy in 17% patients, right axis deviation in 11%, right bundle branch block in 8% patients¹⁸.

In present study, out of 105 patients, 42 patients (40%) had FEV₁ between 50 %-< 80% predicted, 28 patients (26.7%) had FEV₁ between 30 %-< 50% predicted, 20 (19.3%) patients had FEV₁<30 % predicted, 15 patients had FEV₁ e” 80 % predicted. Grading of severity of COPD was done according to GOLD criteria for COPD². Out of total patients, 15 patients (14.3 %) had mild COPD, 42 patients had moderate COPD, 28 patients had severe COPD, and 20 patients had very severe COPD. In present study, out of 105 patients of COPD, 40 patients (38.1%) had Cor Pulmonale including pulmonary hypertension, tricuspid regurgitation and right ventricular dilatation. The presence of pulmonary hypertension, tricuspid regurgitation and right ventricular dilatation in mild, moderate, severe, and very severe COPD was 0%, 5.4%, 64.28%, 100% respectively. Chi-square test was applied and the p value was 0.0001 indicating statistically significant association between severity of COPD and presence of pulmonary hypertension and right ventricular hypertrophy on 2D Echocardiography and color Doppler study. According to Gupta *et al*. pulmonary hypertension (PH) was observed in 42.5% of COPD patients in their study¹⁹. PH in mild, moderate, severe, and very severe COPD was present in 16.67%, 54.55%, 60%, 83.33%, respectively thus indicating good correlation between the frequency of PH and severity of COPD. In a study by Higham *et al* (2001) pulmonary hypertension was present in 55% of COPD patients and pulmonary hypertension correlated with FEV₁²⁰. According to Adil Shujaat *et al* (2007) the reported prevalence of pulmonary hypertension and cor pulmonale varies considerably from 20%–91%²¹. Viji *et al* (2008) found that the incidence of pulmonary hypertension, tricuspid regurgitation and RV enlargement increases with the severity of the disease with COPD patients. Thus, present study correlates with above mentioned studies²².

In present study, out of 105 patients, LV systolic dysfunction was present in 5 patients (4.7%). In a study by Gupta *et al* (2011) LV systolic dysfunction was present in 7.5% of COPD patients¹⁹. Jorgenson Houltz *et al* (2007) found that LV

systolic function is not significantly impaired in patients of COPD indicated by p value 0.95 due to low preload²³. In this study, LV diastolic dysfunction was present in 37 patients (35.2%). Left ventricular diastolic dysfunction in mild, moderate, severe, and very severe COPD group was present in 0%, 10.81%, 57.14% and 85% respectively. Chi-square test was applied and the p value was 0.001 indicating statistically significant association between severity of COPD and LV diastolic dysfunction. In a study by Shrestha *et al* (2009), LV diastolic dysfunction was present in 38.7 % of COPD patients²⁴. In a study by Gupta *et al* (2011), LV diastolic dysfunction was present in 47.5% of COPD patients¹⁹. LV diastolic dysfunction in mild, moderate, severe, and very severe COPD was present in 33.33%, 36.36%, 60%, and 100% respectively.

Conclusions:

The study concludes that COPD predominantly affects elderly males, presenting with cough, dyspnea, and typical clinical signs. Abnormalities on chest X-ray and echocardiography, alongside spirometry findings, highlight the significant association between COPD severity and cardiac involvement.

Limitations:

The study's limitations include a small sample size, restricted to one center, potentially limiting generalizability. Additionally, purposive sampling rather than random sampling was employed.

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