



Original Research Article

Study of incidence of heart failure in COPD exacerbation- A study in north India

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ARTICLE INFO

Article history:

Received 15-05-2021

Accepted 24-05-2021

Available online 27-07-2021

Keywords:

Chronic obstructive pulmonary disease (COPD)

Heart failure (HF)

Respiratory failure (RF)

Nonrespiratory failure (NRF)

ABSTRACT

Rationale: Progression of chronic obstructive pulmonary disease has a considerable effect on heart function including pulmonary hypertension, cor-pulmonale, Right and Left sided heart dysfunction. As COPD and heart failure (HF) share a common clinical feature, delay in diagnosis is associated with increased mortality. We aimed to study the incidence of heart failure in patients with COPD exacerbation.

Materials and Methods: 142 patients were enrolled for study. It is a cross-sectional comparative study. We categorized exacerbation into two groups: respiratory failure and non-failure group. Patients were staged by spirometry after stabilization. Echocardiographic evaluation and BNP levels were measured along with routine investigations.

Result: The mean age of the study group was 63.53±9.021. The overall incidence of heart failure in exacerbation of COPD patients in our study group was 33.09%(n=47). Incidence of HF was 50.6%(n=41) patients in the respiratory failure group and 9.8%(n=6) in non-respiratory failure group respectively. Right sided heart failure was recorded in 82.92% of case in group one whereas in group two 66.66% had left ventricular dysfunction.

Conclusion: Our study concludes that overall incidence of heart failure in COPD exacerbation is 33.09%. Respiratory failure complicates heart failure and hence the incidence increases. Severe stages of disease are associated with Right sided heart failure more frequently.

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1. Introduction

Chronic obstructive pulmonary disease is a major public health problem that has high prevalence and chronicity which affects around 329 million people worldwide and is the third leading cause of death.¹ In India it is estimated that 30 million people are suffering from COPD and has the highest mortality in the world, data suggests that about 556,000, i.e. (>20%) of total 2,748,000 die in India annually.^{2,3} The major risk factor for COPD is smoking. It is responsible for 40% to 70% of COPD cases. Globally, 84% of smokers live in developing and transitional economy countries.⁴ COPD along with accompanying cardiac disease are common due to shared risk factors like aging, cigarette smoke, inactivity, low-grade pulmonary and

systemic inflammation.

HF is a clinical syndrome with typical symptoms caused by a structural and/or functional cardiac abnormality and resulting in reduced cardiac output and/or elevated intracardiac pressures.⁵ HF is defined according to left ventricular ejection fraction (EF): HF with preserved EF (HFpEF) (i.e., EF ≥ 50%) or HF with reduced EF (HFrEF) (i.e., EF < 40%).

COPD is frequently accountable for delayed diagnosis of HF and vice versa because they both have similar clinical feature such as dyspnea and poor exercise tolerance.

2. Aim of Study

To study the incidence of heart failure in patients with COPD exacerbation.

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3. Materials and Methods

Our study is a cross-sectional comparative study. In the group 1 patient with exacerbation of COPD with respiratory failure as per Gold Initiative for Obstructive Lung Disease guidelines.¹ The study was conducted in Sir Sundarlal hospital, Banaras Hindu University (BHU), Varanasi from August 2018 to July 2020. Approval of the ethical committee was obtained in July 2018.

3.1. Inclusion criteria

Adult aged >40 years with diagnosis of COPD as per GOLD guidelines,

1. COPD patient on Indian population
2. Respiratory rate (RR) > 30 breaths per min or <12/min
3. Signs of increased work of breathing or paradoxical respiration
4. Partial pressure of (PCO₂) >45 mmHg
5. Arterial pH <7.35.

3.2. Exclusion criteria

1. Patient not giving consent.
2. Unconscious patient.
3. Need for endotracheal intubation on admission to protect the airways or to manage respiratory secretions.
4. Inability to properly fit the facemask due to skeletal deformity.

In total 142 patients were enrolled for this study. 81 patients in respiratory failure group and 61 patients in non-respiratory failure group. The study was planned to include 100 patients in each group however due to pandemic and time limit we had to conclude our study. During hospital admission all patients were treated with standard protocol including oxygen support, oral or intravenous antibiotics and oral or intravenous steroids as recommended by treating physician. Non-invasive ventilation and Invasive ventilation were done whenever mandated and possible. Patients with NIV were shifted to High dependency Unit (HDU). Patients with heart failure were treated as per standard guidelines. Patients were ventilated with Phillips Respironics using oro-nasal mask. The ventilator settings that were used are: BiPAP, S/T, AVAPS mode with an IPAP min/max 16/30 cm H₂O, EPAP 6-8 cm H₂O, respiratory backup rate was 16/min, target volume of 5-7 ml/kg. Adjustment of these parameters were done on the basis of ABG analysis, oximetry, patients tolerance, patient ventilator synchrony as per our protocol.

NIV was initially administered as long as necessary to maintain pH \geq 7.35, followed by gradual decrease over time. Initial ABG was done immediately after admission in Chest Ward following standard guidelines. Repeat ABG was done and clinical parameters were re-assessed as per our hospital protocol. BNP levels were measured at the time

of admission. A complete workup including 2D-Echo was done.

2D-echocardiography was done by a multi-frequency probe with a range of 2-4.3 MHz both 2D and M-mode studies were done. Echo was done to review the pericardium, valvular anatomy and function, both sided chamber size and cardiac function.

3.3. Measures of right ventricular functions

Right ventricle dimension was measured by M-mode echocardiography, and right ventricular dilation (Cor-pulmonale) was present when it exceeded the normal range of 0.9-2.6 cm. Right ventricle contractility was also noted, and right ventricular systolic dysfunction was said to be present when it was hypokinetic.

3.4. Measures of left ventricular functions:

E/A = diastolic filling of left ventricles usually classified initially on the basis of the peak mitral flow velocity of the early rapid filling wave (E), peak velocity of the late filling wave caused by atrial contraction (A). In normal subjects, LV elastic recoil is vigorous because of normal myocardial relaxation, therefore, more filling is completed during early diastolic, so LVDD is said to be present when E/A is <1.3 (age group 45-49 years), <1.2 (age group 50-59 years), <1.0 (age group 60-69 years), and <0.8 (age group \geq 70 years).⁶

Data analysis was done using version of SPSS software. Patient characteristics were described using means and SD for continuous variables and frequency with percentages for categorical variables.

4. Results

Our study involved 142 clinically and spirometrically proven COPD patients. 81 Patients were in respiratory failure group. 61 patients were in the non-respiratory failure group.

In our study the mean age of the study group was 64.02 \pm 9.97 in the respiratory failure group and 62.87 \pm 7.60 in the non-failure group. There was almost equal distribution based on gender.

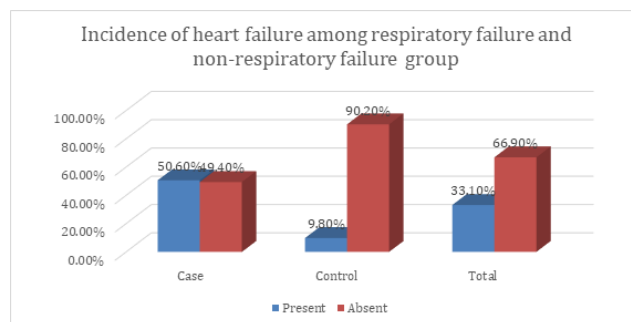


Fig. 1: Incidence of heart failure among the study groups

Table 1: Patient characteristics among respiratory failure and non-respiratory failure group

Variables	Respiratory failure group(n=81) (Group-1)	Non-respiratory failure group (n=61) (Group 2)	p-value	t-value
Age	64.02±9.97	62.87±7.60	0.45	0.75
Gender				
Males	39(48.1%)	35(57.4%)	0.28	1.19
Females	42(51.9%)	26(42.6%)		
Heart failure				
Present	41(50.6%)	6(9.8%)		
Absent	40(49.4%)	55(90.2%)		
BNP	656.32±623.16	159.91±303.04	<0.001	-5.72

Table 2: Percentage distribution of heart failure

Heart failure	Respiratory failure	Non-respiratory failure
Rt sided heart failure	82.92%(n=34)	33.33%(n=2)
Lt sided heart failure	17.07%(n=7)	66.66%(n=4)

Table 3: Incidence of shared risk factor for both COPD and heart failure

Risk Factor	Respiratory failure group(n=81) (Group-1)		Non-respiratory failure group (n=61) (Group-2)	
	Number (n)	Percentage (%)	Number(n)	Percentage
Smoker				
Current	12	14.81%	10	16.39%
Former	64	79.01%	30	49.18%
Never smoked	5	6.17%	21	34.42%
Biomass exposure	5	6.17%	21	34.42%
H/O exacerbation/admission within 1 year	81	100%	20	32.78%
Hypertension	10	12.34%	12	19.67%
Diabetes Mellitus	22	27.16%	16	26.22%
Coronary artery Disease	8	9.87%	6	9.83%
Racial origin		Indian population		

The incidence of heart failure was present 50.6%(n=41) and 9.8%(n=6) respectively in the respiratory failure group and non-respiratory failure group. In group 1 the incidence of Cor-pulmonale was present is 82.92%(n=34) whereas in the non-failure group the incidence of Left ventricular dysfunction 66.66%(n=4) was more common.

Our study shows that overall incidence of heart failure was more common in COPD exacerbation with respiratory failure compared to non-failure group.

5. Discussion

COPD is a multifactorial disease. COPD affects pulmonary blood vessels, right ventricle, as well as left ventricle leading to the development of pulmonary hypertension (PH), cor-pulmonale (COR-P), right ventricular dysfunction, and left ventricular dysfunction. Ischemic heart disease is one of the main causes of mortality in COPD.⁷

In our study the overall incidence of heart failure in COPD exacerbation was 33.09%(n=47). However

individually in between groups respiratory failure group and non-failure group was 50.6%(n=41), 9.8%(n=6) respectively.

In our study in RF group cor-pulmonale was present is 82.92%(n=34) whereas in the NRF group the incidence of Left ventricular dysfunction was more common. Hence our study shows that with increased severity of disease the right sided heart failure was more prevalent. Our findings are consistent with the findings by Vizza CD et al.⁸ in which they concluded that prevalence of right ventricular dysfunction is high in patients with end-stage pulmonary disease, but the prevalence of left ventricular dysfunction is relatively low. Left ventricular dysfunction appears to be related to right ventricular dysfunction, perhaps through ventricular interdependence.

Another study by Kawut SM et al.⁹ in hospitalized patients with moderate/severe COPD, 48% demonstrated abnormality of RV structure/function, with RV enlargement being the most common (29.9%). Our findings are consistent with increased right heart failure in severe

exacerbation with RF. RV failure confers a poor prognosis in COPD.^{10,11}

In our study the incidence of HTN, DM and CAD was 12.34%, 27.16%, 9.87% respectively in the respiratory failure group whereas in the non respiratory failure group the incidence was 19.67%, 26.22% and 9.83% respectively. In a study conducted in Spain by Almagro et al.¹² (2010) they found that 55% of the patients had hypertension, 26% diabetes mellitus, 27% chronic heart failure, and 17% ischemic heart disease. Female COPD patients had a lower prevalence of ischemic heart disease. However in our study there was no gender disparity. Another study done by Baty et al.,¹³ (2013) they found that prevalence of HF, IHD, Arrhythmias was 11%, 25% and 13% respectively they also concluded that co-morbidities were associated with worst outcome.

In our study in the respiratory failure group there was h/o previous hospitalization for exacerbation within past year in almost all patients whereas in the non-respiratory failure group only 32.78% patients had history of hospitalization. According to Garcia-Gutierrez et al.,¹⁴ predictors of previous hospitalization were severity of current COPD exacerbation, response to previous treatment, and expected adherence to treatment.

6. Limitations of Study

The limitations of our study was a small sample size and also we were not able to perform right heart catheterization or Transesophageal echocardiography. However the results are encouraging.

7. Source of Funding

None.

8. Conflict of Interest

None.

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Cite this article: Oli R, Mishra JK, Srivastava GN, Mishra S, Brighten M. Study of incidence of heart failure in COPD exacerbation- A study in north India. *J Community Health Manag* 2021;8(2):83–86.