

Study to find out about various risk factors responsible for repeat acute exacerbation of COPD, which cause readmission within 90 days after admission in hospital due to acute exacerbation of COPD



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ABSTRACT

Background: Approximately 3.2 million global deaths occur each year due to chronic obstructive pulmonary disease (COPD), in which exacerbations of COPD remain a prevailing cause. Exacerbations requiring hospitalization are associated with high mortality, and mortality risk is increased with higher exacerbation frequencies. **Aims and Objectives:** This study aimed to prospectively identify the risk factors of COPD that cause readmission within 90 days after admission to the hospital due to acute exacerbations of COPD. **Materials and Methods:** An observational study conducted at the School of Pulmonary Excellence, NSCB Medical College, Jabalpur, from the duration of March 2021 to August 2022 with a sample size of 140 estimated through 56% prevalence of readmission rate in available literature. Study participants, including all patients, were readmitted within 90 days after admission due to acute exacerbation of COPD (post-bronchodilator FEV1/FVC < 0.70). Data analysis was performed using IBM software SPSS 22.0 and statistical association with the confidence interval of 95% and P < 0.05. **Results:** The majority of COPD cases were male (84%) and belonged to the 50–60 years of age group. There was a statistically significant (P = 0.001) association between grades of dyspnea and readmission cases. Dyspnea among readmission patients was found to be 100%. The prevalence of CAT score > 10 was 64% and < 10 is 36% among readmission patients the association was highly significant and more exacerbation leads to more readmission. **Conclusion:** In the study, various clinical parameters were found statistically significant between the admission and readmission groups. These parameters were CAT score, previous hospitalization history, previous exacerbation history, SpO₂, dyspnea grading, and co-morbidities. The lung function test was difficult to do due to many of readmitted patients were not in a condition to do spirometry.

Key words: Acute exacerbation of chronic obstructive pulmonary disease; Readmission; CAT score; Comorbidities

INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is a common, preventable, and treatable disease that is

characterized by persistent respiratory symptoms and airflow limitation and that is due to airway or alveolar abnormalities usually caused by significant exposure to noxious particles or gases or influenced by host factors

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including abnormal lung development. An exacerbation of COPD is defined as an acute worsening of respiratory symptoms that results in additional therapy.¹ Approximately 3.2 million global deaths occur each year due to COPD, in which exacerbations of COPD remain a prevailing cause. Exacerbations requiring hospitalization are associated with high mortality and mortality risk is increased with higher exacerbation frequencies.²⁻⁴

COPD hospital readmissions contribute to a clinical and economic burden on patients and society. Identifying and mitigating risk factors for readmission is, therefore, essential. A recent systematic review and meta-analysis of nearly four million COPD patients found that the all-cause readmission rate at 30 days ranged from 9% to 26%, and from 18% to 39% at 90 days.⁵⁻⁸ The most common risk factors for all-cause readmissions within 30 and 90 days were comorbidities, previous exacerbations and hospitalizations, and increased length of stay during the initial admission. The European COPD Audit reported higher in-hospital mortality in those readmitted within 90 days compared to those who do not get readmitted (13.4% vs. 2.3%). Few prospective studies have been conducted in this important area, which limits the assessment of markers that might be used to predict early readmissions. Hence, there is an increasing need for extensive research to identify novel biomarkers or phenotypes of patients at greater risk of readmission, ideally identifying variables that can be modified timely through intervention.⁸⁻¹⁰

Aims and objectives

The study aimed to prospectively identify the risk factors of COPD that cause readmission within 90 days after admission to the hospital due to acute exacerbation of COPD.

MATERIALS AND METHODS

The present study is to be carried out in the Department of respiratory medicine at the School of Excellence in pulmonary medicine at Netaji Subhash Chandra Bose Medical College and Hospital Jabalpur (M.P). This was an observational study conducted from March 2021 to August 2022.

Sample size

The optimum sample size was calculated by 56% prevalence of readmission rate in the available literature.¹¹ The confidence interval was assumed to be 95% and the permissible error was 10% with 10% absolute precision. Under these assumptions, the optimum sample size came out to be 95. However, in the present study, total enrolled cases were 140.

Data collection and analysis method

The study group is selected from the patients who were readmitted to the respiratory medicine department at the School of Excellence in pulmonary medicine in NSCB Jabalpur for deteriorating symptoms within 90 days after admission in hospital due to acute exacerbation of COPD. All the records were recorded by using a structured schedule (as per the enclosed case report form) tabulated in Microsoft Excel sheet.

Ethical permission

The study was conducted after getting ethical permission was taken from the IEC committee of the medical college with IEC/2020/127. Furthermore, written informed consent from the patients was taken before enrolling them in the study.

Sampling method

The study group was selected from all the patients of COPD who were admitted to the Department of respiratory medicine from March 2021 to September 2022, and out of these cases, those were readmitted within 90 days after the date of discharge. Information from both admitted and readmitted groups was collected in the form of patient clinical history (previous exacerbation, comorbidities, smoking index, current smoking status, previous hospitalization, biomass fuel exposure, CAT score), examination findings (respiratory rate, mMRC grade, SpO₂, pulse rate, blood pressure, blood sugar, BMI) investigation findings (ABG, 2D echo, TLC, Hb, chest X-ray findings sputum gram staining) analyzed in detail.

Inclusion criteria

All patients readmitted to the respiratory medicine department at the school of Excellence in pulmonary medicine at NSCB medical college Jabalpur within 90 days after admission in the hospital due to acute exacerbation of COPD (post-bronchodilator FEV₁/FVC <0.70). Patients who are willing to give consent for the study.

Exclusion criteria

Follow-up cases of COPD without exacerbation. Patients are readmitted after 90 days of acute exacerbation of COPD. Respiratory disease cases other than COPD (post tubercular sequelae OAD). Patients who are not willing to give consent for my study.

RESULTS

From Table 1, it is observed that the majority of cases were between 50 and 60 years of age constituting 50%, while none of the cases belonged to the age group below 40 years.

From the Table 2, it has been concluded that the majority of the patients were male (84%), while few were only female (16%). The majority of patients are reformed smokers (74%) followed by 20% of non-smoker and 6% were current smokers. However, the statistical association between smoking and repetitive admission of COPD patients was non-significant.

Table 3 suggests that the majority of patients are grade 4 who are readmitted (56%), and in the admission group, 42% belong to Grade 1. Nevertheless, we found a statistically significant (P=0.001) association between dyspnea grading and readmission. It is also suggestive that

Table 1: Patient distribution according to age-group

Variables	Admission group		Readmission group	
	n	%	n	%
Age-group				
>80 years	3	2.1	1	2
71–80 years	25	17.8	9	18
61–70 years	33	23	7	14
51–60 years	49	35	25	50
41–50 years	29	20	8	16
<40 years	1	0.7	0	0
Total	140	100	50	100

Table 2: Patient distribution according to sex and their smoking status

Variables	Admission group		Readmission group	
	n	%	n	%
Sex				
Male	111	79.2	42	84
Female	29	29.7	8	16
Total	140	100	50	100
Smoking status*				
Current smoker	9	6.4	3	6
Reformed	103	73.5	37	74
Non-smoker	28	20	10	20
Total	140	100	50	100

*P=0.977

Table 3: Patient distribution as per dyspnea grading and oxygen saturation levels (%)

Dyspnea grading	Admission group		Readmission group	
	n	%	n	%
0	10	7.1	0	0
1	59	42.1	0	0
2	31	22.1	3	6
3	34	24.2	19	38
4	6	4.2	28	56
Total	140	100	50	100
SpO ₂ (%)				
<88	56	40	50	100
>88	84	60	0	0
Total	140	100	50	100

the prevalence of dyspnea among readmission patients is 100% and the association is highly statistical (P=0.0001) as well.

Among the study population, the prevalence of comorbidities in readmission is not very high (18%); however, the association is statistically significant (P=0.006). In Table 4, findings suggestive of previous hospitalization history prevalence 100% in the readmission group, and the association is highly significant (P=0.001). Table 4 also suggests that more exacerbation leads to more readmission.

Table 5 suggests that the prevalence of CAT score >10 is 64% and <10 is 36% among readmission patients; however, this distribution is almost equal, i.e., 50% among the admission group and the association is highly significant (P=0.001).

DISCUSSION

In the present study, a total of 140 cases of COPD were enrolled from March 2021 to September 2022, in which a total of 50 cases were readmitted within 90 days after discharge from the hospital, the prevalence of readmission was 35%. These readmitted cases are evaluated by detailed

Table 4: Patient distribution as per comorbidities, history of previous hospitalization, and as per the history of previous exacerbation

Comorbidities	Admission group		Readmission group	
	n	%	n	%
Yes	7	5	9	18
No	133	95	41	82
Total	140	100	50	100
Previous hospitalization				
0	55	39.2	0	0
1	3	2.1	0	0
2	79	56.4	24	48
3	3	2.1	25	50
4	0	0	1	2
Total	140	100	50	100
Previous exacerbation				
0	15	10.7	0	0
1	41	29.2	0	0
2	8	5.7	2	4
3	39	27.8	8	16
4 or >4	37	26.4	40	80
Total	140	100	50	100

Table 5: Patient distribution as per CAT scoring

Cat scoring	Admission group		Readmission group	
	n	%	n	%
0–10	71	50.7	18	36
>10	69	49.2	32	64
Total	140	100	50	100

history, examination findings, and investigation findings to identify risk factors that lead to frequent exacerbation and readmission. All the information was written in a proforma, and the results were analyzed.

Both admission and readmission group clinical variables were analyzed. Statistically significant difference ($P < 0.05$) was found in dyspnea grading, SpO₂ and comorbidities. In the present study, the admission group patients' mean age was 60.5 and the readmission group patients was 60.3. No statistically significant difference was found ($P = 0.905$). In the study, the maximum number of cases was in the age group of 50–60 years. This finding was similar to the study which was done by Sadigov et al.,¹² in Canada in 2017, they showed that the age of patients with early rehospitalization was different compared with patients who did not hospitalize within 30 days of discharge after admission for AECOPD (67.4511.25 vs. 61.8110.67; $P < 0.01$). In a study in the UK, in which a total number of patients were enrolled 129, of which 82 patients were readmitted, where patient age was in the range of 61.4–81.4 and there was no statistical difference between these two-age groups ($P = 0.85$); meanwhile, Bernabeu et al.,¹³ carried studied in Spain in which they found mean age in admission patients was 69.3 (8.6) and readmission patients was 75.0 (9.1), and found a statistically significant difference ($P < 0.05$).

In the present study, the prevalence of male patients was more than 77.8% for the admission group and 84% for the readmission group. There was no statistically significant difference found ($P = 0.111$). However, this finding was similar to a study which was done by Bernabeu et al.,¹³ in Spain, where a total of 103 COPD patients were enrolled, and out of this, 32 were readmitted within 90 days. In this study, 96% of patients were male in the admission group and 100% in the readmission group and there was no statistical significance was present ($P = 0.152$).

In the present study prevalence of smokers in admission and readmission were the same (80%) and there was no statistically significant difference found ($P = 0.977$). This finding was similar to a study which was done by Alqahtani et al.,¹¹ in UK. in which a total number of patients enrolled 129, out of which 82 patients readmitted. They found 100% prevalence of smokers in both groups and there was no statistically significant difference ($P = -0.30$).

In the current study, the prevalence of comorbidities was 5% in the admission group and 18% in the readmission group; however, there was a statistically significant difference was found ($P = -0.006$); this finding was similar to a study that was carried out by Bernabeu et al.,¹³ in Spain, in this study total 103 COPD patients were enrolled and out of 32 were readmitted within 90 days. They

found a statistically significant difference in both groups' comorbidities ($P = 0.024$). A meta-analysis reported that comorbidities were significantly higher in patients with COPD compared to non-COPD controls, and the number of comorbidities increased with age.¹⁴ The prevalence of comorbid conditions was shown to predict both symptom severity and the number of COPD exacerbations.¹⁵ In the study, another clinical parameter was also found significant, which were not studied in previous studies. This parameter was SpO₂ ($P = 0.000$), which may be due to the majority of patients admitted in exacerbation and chest X-ray findings ($P = 0.001$) because most of the patients were readmitted with new opacities and some patients due to secondary pneumothorax and pyogenic sputum gram staining ($P = 0.023$) most common organism found in staining was klebsiella followed by pseudomonas and respiratory rate ($P = 0.044$), because of the majority of patient admitted in respiratory distress.

In the study, mean of the CAT score in the admission group was 14.3 and 19.3 in the readmission group, a statistically significant difference was found ($P = 0.001$). This finding was similar with this finding was similar to a study which was carried by Alqahtani et al.,¹¹ in which 129 patients were enrolled, and 82 were readmitted within 90 days; they found a statistically significant difference between these two groups ($P = 0.01$).

Based on the study findings, various clinical parameters were responsible for the worsening of respiratory symptoms, which leads to frequent exacerbation and readmission. By controlling these various factors, it could be possible to prevent disease progression and frequent exacerbation and readmission. The most important factors which lead to frequent exacerbation were CAT score, previous hospitalization history, previous exacerbation history, dyspnea grading, SpO₂, and comorbidities.

Limitations of the study

Our study also has some limitations. First, we conducted single center study. Second, sample size of study was small. Third, some confounding factors of frequent exacerbations were not included in this study such as type, duration of antibiotic management during exacerbation and previous vaccination history. Fourth, we did not perform subgroup analysis such GOLD classification of COPD and Pulmonary function test grouping. Therefore we need large multi-center study and analysis of heterogeneity in COPD.

CONCLUSION

In the study, a total of 140 cases of COPD were enrolled from March 2021 to August 2022. Out of 140 total,

50 cases were readmitted within 90 days. Readmission rate was 35%. In the study, various clinical parameters found statistically significant differences between the admission and readmission groups. These parameters were CAT score, previous hospitalization history, previous exacerbation history, SpO₂, dyspnea grading, and comorbidities. Lung function test was difficult to do due to many of readmitted patients were not in a condition to do spirometry.

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SKP- Definition of intellectual content, literature survey, prepared first draft of manuscript, implementation of study protocol, data collection, data analysis, manuscript preparation and submission of article; **AJ**- Concept, design, clinical protocol, manuscript preparation, editing, and manuscript revision; **SKB**- Design of study, statistical analysis and interpretation; **BBP**- Review manuscript; **VP**- Literature survey and review manuscript; **BP**- Coordination and manuscript revision.

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