Original Article

Factors Associated with Hospital Admission in Patients with Acute Exacerbation of Chronic Obstructive Pulmonary Disease

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ABSTRACT

Background. Acute exacerbations of chronic obstructive pulmonary disease (AE-COPD) impair quality of life (QOL), accelerate the decline in lung function and often require hospitalisation, and thus, leading to increased healthcare burden. By identifying factors that may be associated with AE-COPD and managing them rationally, not only the hospital admissions could be avoided but progression of the disease may also be slowed.

Objective. The aim of the present study was to determine the factors associated with hospital admissions among adults with AE-COPD.

Methods. Seventy-three patients admitted with AE-COPD were administered a structured questionnaire during their hospital stay. Data on body mass index (BMI), smoking, symptoms, co-morbidities course of the disease, spirometry management and outcomes during the hospitalisation were obtained. Factors associated with hospital admissions were analysed.

Results. The hospitalisation due to AE-COPD was significantly associated with the reduced forced expiratory volume in one second (FEV_1), and peak expiratory flow rates, increasing sputum purulence, number of hospitalisations during previous year for COPD and presence of co-morbidities.

Conclusions. The study shows that both disease and healthcare-related factors are predictors for hospitalisation. Identification of risk factors and appropriate management may reduce hospitalisation due to AE-COPD.

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Key words: COPD, Acute exacerbation, Admission, Risk factors.

INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is a major cause of morbidity and mortality worldwide. Exacerbations of COPD are detrimental in progression of the disease and lung function. Exacerbations impair the quality of life (QOL), require frequent hospitalisations and also accelerate the decline of lung function.[1] Hospitalisations due to exacerbations of COPD account for major economic costs in addition to causing disease progression. The available studies[2,3] have mostly focused on risk factors for admission of stable COPD patients, external factors (*e.g.*, air pollution) and admission,[4] or prognostic factors for hospital mortality.[5-7]

The prevention of COPD exacerbations is recognised as an important management goal.[8] By identifying patients who are more likely to have acute exacerbations and treating them in a rational and cost-effective manner, not only the hospital admission could be avoided but also the progression of the disease can be slowed.

Observational studies with various designs have evaluated risk factors for hospitalisation due to COPD. Independent risk factors reported in these studies include low levels of lung function,[1,2,9-11] the number of respiratory medications,[11] advancing age,[12] abnormal blood gas levels,[3,9] pulmonary hypertension,[3] low BMI,[3] low levels of physical activity,[9] prior hospital admissions,[2,9,11,12] impaired QOL,[12] current smoking status,[2,13] lack of influenza vaccination,[14] and air pollution.[4] However, no study on risk factors for exacerbations of COPD from India is available.

PATIENTS AND METHODS

The present study was performed in accordance with the Helsinki 1975[15] declaration and the project was undertaken after due clearance separately from the

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Ethics and Research Committees of Government Medical College and Hospital, Chandigarh.

We studied patients admitted with AE-COPD. Over a period of one year. Patients with COPD were diagnosed as per the criteria of World Health Organization-Government of India (WHO-GOI) guidelines-2003 for the management COPD.[16] According to the guidelines, the AE-COPD is defined as "a sustained worsening of the patient's condition, from the stable state and beyond normal day-to-day variations, that is acute in onset and necessitates a change in regular medication".[16] All the patients in this study were managed as per the hospital protocol of the treating unit.

All the patients were administered a structured questionnaire during their hospital stay after they had improved and became stable clinically. The questionnaires were completed by the doctors of the Department of Pulmonary Medicine. Baseline data relating to demographics, respiratory disease history, frequency of admissions to hospital for COPD in the past one year, current respiratory medications and co-morbidities was collected. Data on BMI, smoking, symptoms, disease course, other investigations, management and outcome during the hospitalisation were obtained from the patient and in-patient records. Records of previous hospitalisations were also obtained. If a patient was admitted number of times during the study period, the parameters recorded during most recent admission were considered for analysis.

Sputum culture for pyogenic organisms and sensitivity were obtained in patients where infective aetiology was suspected. Patients with overlapping features of COPD and asthma were classified as having mixed disease. To address possible diagnostic misclassification, we also performed spirometry in the patients during their hospital stay.

Smoking status was recorded as never-smoker, former smoker (left smoking >10 years and left smoking within 10 years), or current smoker. Pack-years of smoking were calculated. Symptom frequency between COPD exacerbations was classified into four levels: no symptoms, some symptoms on some days, some symptoms on most days, and symptoms most of the time.

All questionnaires and spirometric data submitted were reviewed and rated for quality by two of the authors who filtered inconsistencies. Questionnaires that did not have precise information or which had missing values were excluded from the analysis. Only clearly definable and reliably obtained terms were included.

Statistical Analysis

Candidate variables analysis were: age, sex, BMI calculated as kg/m^2, FEV_1 as percent predicted, peak expiratory flow rate (PEFR), smoking habits and sputum purulence. The co-morbidities were also assessed as per records. The associations between the variables and the possible risk factors were initially assessed with univariate logistic regression analysis. The variables found significant were put into a step-wise multivariate regression analysis to determine the final results. All statistical analyses were carried out using SPSS (Statistical Package for the Social Sciences Inc., USA) software with the help of the statisticians. Data is shown as mean ± standard deviation (SD).

RESULTS

We collected data of 96 admitted patients over one year duration since April 2008. Seventy-three patients met the inclusion criteria for the study. Our sample comprised of 96% males. The demographic baseline characteristics of the patients are shown in table 1. Eighty-eight percent of the admitted patients had current or past smoking habit of '*Bidi*' and 9% were cigarette smokers. Of admitted patients, 46% had at least one co-morbid condition. Mean FEV_1 was 42.5% of the predicted. The medication history during previous month was also obtained and shown in table 1. In our study, 41 (56%) and 14 (19%) patients were using inhaled and oral corticosteroids, respectively before admission. There were 52 (71%) patients on inhaled β_2-agonists, out of which 18 (25%) were on short-acting and 34 (47%) were on long-acting β_2-agonist, respectively. No association was found between corticosteroid use and the risk of hospitalisation due to AE-COPD.

Table 1. Characteristics of the patients with AE-COPD

Male:Female	70:03
Age (years) (mean±SD)	60±9
BMI (kg/m^2) (mean±SD)	23.0±5.6
FEV_1 (L) (mean±SD)	0.96±0.8
FEV_1% predicted (mean±SD)	42.5±14.0
Smokers (n=73)	71 (97%)
Smoking history in pack years (mean±SD)	35±19
Co-morbidity (n=73)	35 (46%)
History of previous hospitalisation (n=73)	43 (59%)
Medication history (previous one month)	
Inhaled short acting β_2-agonists	18 (25%)
Inhaled anticholinergics	43 (59%)
Inhaled corticosteroids	41 (56%)
Methyl xanthenes	17 (23%)
Inhaled long acting inhaled β_2-agonists	34 (47%)
Systemic corticosteroids	14 (19%)

AE-COPD=Acute exacerbations of chronic obstructive pulmonary disease; BMI=Body mass index; FEV_1=Forced expiratory volume in one second

Out of 73 patients, 43 (59%) patients were hospitalised some time earlier for similar illness. The mean time interval between two successive

admissions was 5.0±4.1 months. Fifty-nine percent patients had at least one admission and 37% patients had at least two admissions due to AE-COPD during the last one year.

Different types of co-morbidities with which the patients were admitted are shown in table 2. Diabetes and cardiovascular morbidities were more common and were often co-existing with other diseases.

Table 2. Types of co-morbidies and frequency

Co-morbidities	Frequency (%)
Without co-morbidity	38(52.1)
Tuberculosis	10(13.7)
Diabetes and history of tuberculosis	4(5.5)
Hypertension	4(5.5)
Diabetes and hypertension	2(2.7
Depression	4(5.5)
Severe pulmonary artery hypertension	1(1.4)
Diabetes, hypertension and coronary artery diseases	2(2.7)
Coronary artery diseases	2(2.7)
HIV positive	1(1.4)
Diabetes	4(5.5)
Liver failure	1(1.4)
Total	**73(100)**

HIV=Human immunodeficiency virus

Univariate analysis was performed with initial parameters, the co-morbidities as independent variables and the hospital admissions as dependent variables. Significant variables were then considered for multivariate regression analysis. The variables found as significant factors for hospital admission are shown in table 3.

Table 3. Multivariate analysis of risk factors for AE-COPD

Variables/Parameters	*P value	*OR	95% *CI
PEFR	0.046	1.835	1.117-3.012
FEV_1	0.037	1.365	1.067-3.768
Sputum purulence	0.039	1.731	0.914-3.132
Previous (one year) hospitalisation history	0.048	1.963	1.037-3.814
Co-morbidities	0.041	2.373	1.231-3.127

*=P is significant if $\leq$ 0.05, OR=Odds ratio, CI=Confidence interval; PEFR=Peak expiratory flow rate; FEV_1=Forced expiratory volume in one second

The hospitalisation of patients with AE-COPD was significantly associated with the duration of COPD and pre-exacerbation morbidity. The spirometric values (expiratory flow) provide an estimate of the increased risk of exacerbation. A lower FEV_1 (percent predicted) was associated with increasing risk of exacerbations.

In the present study, 49% had sputum purulence before admission. Patient with persistent purulence in sputum were more likely to have exacerbations than those not having this symptom. However, no significant association could be drawn between age, sex and frequency of exacerbations. In addition to the variables, we observed pedal oedema as another possible predictor for hospital admissions.

DISCUSSION

This study was carried out to determine the factors associated with hospital admission among adults who were admitted with exacerbations of COPD. Our findings revealed that hospitalisations due to AE-COPD were associated with impairment of PEFR and FEV_1. The consistent and important association of decreased FEV_1 during frequent exacerbations is well known. A low FEV_1 is also a pre-eminent risk factor for mortality from COPD in most epidemiological studies.[3, 17, 18] From the results of the present study, it can be speculated that persistent respiratory infections as reflected in sputum purulence may be facilitating factors for exacerbations. Previous hospitalisation within a year possibly is an important factor that suggests that these patients lack access to routine preventive care required for averting hospitalisations.

Ball *et al*[19] found that co-existent cardiopulmonary disease was a risk factor for hospitalisation. Nearly half of the patients in our study had one or more co-morbidities. Fifteen percent patients had cardiovascular related problems and 11% of patients had at least two co-morbidities. Our results also suggest that co-morbidity is a risk factor for frequent exacerbations. Among these, diabetes may be an important risk factor for exacerbations requiring longer periods of hospitalisation associated with aggressive bacterial infection.[20]

History of pulmonary tuberculosis (PTB) in the past is an important cause of progression of COPD.[21] In India where PTB is endemic and smoking habit is high, the prevalence of COPD with concomitant old tuberculosis (TB) is expected to be more. Further, relapse of TB may mimic AE-COPD clinically. Such observations have also been documented in intensive care settings from south India by Mohan *et al*.[22] However, we had excluded patients with active PTB from our study.

We believe this is the first study from northern India to gather information about predictors of hospitalisation due to AE-COPD. In addition, this study was done in reference to recommendation of current WHO-GOI guidelines.[16] Among other factors, we found sputum purulence as a predictor for exacerbations which may be useful clinically and may be considered in formulating further guidelines. With the growing prevalence of COPD and exacerbations, there is a need for closer follow-up and precise therapeutic and preventive measures to avoid

hospital admissions. The risks factors observed in the present study might find a role in decision making in the clinical management of AE-COPD and may reduce frequency of hospitalisations.

Our study has some limitations. This is a small observational study. The spirometric data collected during hospital stay may not correlate the pre-hospital phase of AE-COPD. The assessment of risk factors were based on patient's previous record and clinical history obtained from the patients. The possible observers' bias and the inaccuracy of the clinical history cannot be ruled out completely. These outcomes, therefore, need to be confirmed by multi-centric studies with large sample size.

CONCLUSION

Retrospective information collected from hospitalised patients with AE-COPD suggests spirometric impairments, frequency of hospitalisation during the previous year, sputum purulence and co-morbidities are important risk factors for exacerbations necessitating hospitalisation.

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