Risk Factors Associated with Ninety Day Readmission in Chronic Obstructive Pulmonary Disease Exacerbation at a Tertiary Care Hospital: A retrospective cohort study

Pant P,[1] Joshi A[2]

[1]Department of Pulmonology and Critical Care

[2]Department of General Practice and Emergency Medicine,

Tribhuvan University Teaching Hospital,

Institute of Medicine, Kathmandu, Nepal.

Corresponding Author

Pankaj Pant

Department of Pulmonology and Critical Care

Tribhuvan University Teaching Hospital,

Institute of Medicine, Kathmandu, Nepal.

E-mail: drpant2015@gmail.com

ABSTRACT

Background

Chronic obstructive pulmonary disease (COPD) exacerbation is a leading cause of frequent hospital admission. Globally, several studies have reported potential risk factors associated with COPD exacerbations which are largely unknown in Nepalese health care setting.

Objective

To identify the risk factors associated with hospital readmission within ninety days of discharge in acute COPD exacerbation.

Method

This is a hospital based retrospective cohort study conducted at Tribhuvan University Teaching Hospital. COPD patients admitted in respiratory ward from August 2019 to November 2019 were followed up till 90 days after discharge. Logistic regression analysis was performed at 95% Confidence Interval (CI) to identify risk factors for readmission in COPD exacerbation. Statistical analysis was performed using SPSS version 20.0.

Result

Of total 86 patients hospitalized for COPD, 42 (48.8%) had at least one subsequent readmission during post-discharge follow-up period of 90 days. Mean age of patients was 70.55±10.98 years. There were 45 (52.3%) males. Logistic regression analysis revealed preadmission domiciliary oxygen use (Odds Ratio (OR) 2.93; 95% CI 1.195-7.202; p=0.019), admission in intensive care unit (ICU) (OR 3.060; 95% CI 1.145-8.179; p=0.026), previous hospital admission for COPD exacerbation (OR 3.230; 95% CI 1.219-8.556; p=0.018), age (OR 0.946; 95% CI 0.905-0.988; p=0.012) and duration of hospital stay (OR 0.901; 95% CI 0.819-0.992; p=0.034) were independently associated with ninety day readmission in COPD patients.

Conclusion

Five clinical factors were found to be independently associated with COPD readmission in this study. Large multi-centre study at various health care levels is recommended to validate the potential risk factors in different populations and health care settings in Nepal.

KEY WORDS

COPD, Readmission, Risk factors

INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is one of the leading causes of chronic morbidity and mortality worldwide resulting in substantial socioeconomic burden in global health care costs.[1,2] Patients with COPD suffer frequent episodes of exacerbations, with worsening of symptoms and reduction in lung function requiring subsequent admission to hospital.[3]

The ninety days post discharge period covers a high risk period for COPD patients as compared to risk over subsequent months and years.[4] The national COPD audit programme, United Kingdom (UK) found that 8% of patients discharged following an acute exacerbation of COPD died while 43% got readmitted within 90 days.[5] A wide range of potential modifiable and non- modifiable risk factors have been associated with COPD exacerbation requiring hospital admission.[6-9] However, these factors are largely unknown in Nepalese health care setting.

The aim of this study was to identify the risk factors associated with ninety day post discharge hospital readmission in acute COPD exacerbation.

METHODS

This is a hospital based retrospective observational cohort study conducted at Tribhuvan University Teaching Hospital, Kathmandu Nepal to identify the risk factors associated with ninety day readmission in acute COPD exacerbation. Ethical approval was obtained from Institutional Review Committee (IRC), Institute of Medicine (IOM). COPD patients admitted in respiratory ward from August 2019 to November 2019 were included and followed up till 90 days after discharge from hospital. The primary end point was readmission due to COPD exacerbation. Those who had in-hospital mortality and those who died during the post discharge ninety day follow-up period were excluded. Information at admission was obtained from medical records as well as semi-structured questionnaire. The cohort of patients who survived till discharge was further followed up for 90 days during post-discharge period and information on readmission for COPD exacerbation was obtained via telephonic interviews.

Variables for analysis were selected based on previous studies pertaining to readmission for an acute COPD exacerbation. Categorical variables selected for logistic regression analysis were male sex, evidence of chronic cor pulmonale, previous hospital admission, vaccination (pneumococcal and influenza), domiciliary oxygen use, evidence of pneumonia, and need for non invasive ventilation and intensive care unit (ICU) admission. Continuous variables selected were age, body mass index (BMI), duration of hospital stay and duration of COPD. The association of these variables with ninety day hospital readmission was analyzed with odds ratio (OR) using a logistic regression model.

Statistical analysis was performed using SPSS version 20.0. Binary logistic regression analysis was performed at 95% Confidence Interval (CI) and p-value < 0.05 was considered statistically significant. Dummy variables were created during logistic regression analysis for dichotomous and polychotomous categorical variables before considering for regression equation. Univariate analysis was performed; with baseline characteristics as independent variables and hospital readmission as dependent variable. Values for categorical variables were reported in percentage (%) while those for continuous variables were reported as mean ± standard deviation (SD).

RESULTS

A total of 86 patients who met the inclusion criteria during the study period were included for final analysis. Mean age of patients was 70.55 ± 10.98 years. There were 45 (52.3%) males and 41 (47.7%) females. Baseline characteristics like age, sex, literacy, body mass index (BMI), COPD duration, pneumococcal and influenza vaccination, smoking status, medication compliance, domiciliary oxygen use and features of chronic cor pulmonale were obtained (Table 1).

Table 1. Baseline characteristics of the patients (n=86)

Characteristics	Mean±SD
Age (years)	70.55±10.98
Duration of COPD (years)	7.55±5.0
BMI (kg/m²)	21.20±3.80
	n (%)
Sex (male)	45 (52.3)
Literacy	37 (43)
Vaccination	12 (14)
Cigarette smoking	
Current smoker	17 (19.8)
Past smoker	59 (68.6)
Never smoked	10 (11.6)
COPD medication compliance	
Regular	49 (57)
Irregular	22 (25.6)
Not under medication	15 (17.4)
Domiciliary oxygen use	33 (38.4)
Chronic cor pulmonale	65 (75.6)
Previous hospital admission	26 (30.2)

Infective cause for COPD exacerbation was seen in nearly 70% of patients. More than one fourth of admitted patients required further admission in ICU (Table 2).

The mean duration of hospital stay among the patients was 10.73 ± 5.08 days. Of the total 86 patients hospitalized for acute COPD exacerbation, 42 (48.8%) had at least one subsequent readmission during the post-discharge ninety day period.

Table 1. Baseline characteristics of the patients (n=86)

Clinical course	n (%)
Evidence of pneumonia	60 (69.8)
Need for non invasive ventilation	20 (23.3)
ICU admission	24 (27.9)

Table 3. Logistic regression analysis of risk factors (categorical variables) for ninety day readmission in acute COPD exacerbation

Risk factors (categorical variables)	n (%)	Odds ratio (OR)	95% Confidence interval (CI)	p-value
Male	45 (52.3)	0.691	0.295-1.617	0.394
Chronic cor pulmonale	65 (75.6)	0.643	0.238-1.734	0.383
Previous hospital admission	26 (30.2)	3.230	1.219-8.556	0.018
Vaccination	12 (14)	0.477	0.169-1.347	0.162
Domiciliary oxygen	33 (38.4)	2.933	1.195-7.202	0.019
Evidence of pneumonia	60 (69.8)	1.167	0.464-2.934	0.743
Non invasive ventilation	20 (23.3)	2.369	0.838-6.700	0.104
ICU admission	24 (27.9)	3.060	1.145-8.179	0.026

Among the various categorical and continuous variables selected for logistic regression analysis, five clinical factors were independently associated with readmission after acute COPD exacerbation which were statistically significant (p-value < 0.05) (Table 3 and 4). Logistic regression analysis revealed that preadmission domiciliary oxygen use (OR 2.93; 95% CI 1.195-7.202; p=0.019), ICU admission (OR 3.060; 95% CI 1.145-8.179; p=0.026), previous hospital admission for COPD exacerbation (OR 3.230; 95% CI 1.219-8.556; p=0.018), age (OR 0.946; 95% CI 0.905-0.988; p=0.012) and duration of hospital stay (OR 0.901; 95% CI 0.819-0.992; p=0.034) were independently associated with ninety day readmission for an acute exacerbation of COPD.

Table 4. Logistic regression analysis of risk factors (continuous variables) for ninety day readmission in acute COPD exacerbation

Risk factors (continuous variables)	Mean ± SD	Odds ratio (OR)	95% Confidence interval (CI)	p-value
Age (years)	70.55±10.98	0.946	0.905-0.988	0.012
BMI (kg/m²)	21.20±3.80	1.041	0.930-1.165	0.484
Duration of COPD (years)	7.55±5.08	1.053	0.965-1.149	0.245
Duration of hospital stay (days)	10.73±5.08	0.901	0.819-0.992	0.034

DISCUSSION

We found that out of total 86 patients hospitalized for acute COPD exacerbation, 42 (48.8%) had at least one subsequent readmission during the post-discharge ninety day period. This finding is consistent with a report from the national COPD audit programme from the Royal College of Physicians in 2014 which reported that 43% of patients in England hospitalized for COPD exacerbation were readmitted at least once during ninety days post discharge period.[5] Hartl et al. reported 35.1% (5,337/15, 191) of readmission within 90 days following COPD exacerbation with a higher proportion of readmitted patients in COPD global initiative for chronic obstructive lung (GOLD) stage IV compared with non-readmitted patients (29.5%, versus 22.5%).[10] Bahadori et al. in a study done in Vancouver, British Columbia among a cohort of 310 patients followed up for over one year reported a lower proportion (38%) of at least one subsequent readmission as compared to our study.[11] The study also reported the mean duration from index admission to first readmission as 5 ± 4.08 months. A higher proportion (63%) of readmission rate than observed in our study was reported by Garcia-Aymerich et al. in Barcelona, Spain among 340 patients followed up for a mean period of 1.1 years.[6] The same study reported a median time to first readmission of 186 days. The differences in readmission rates as observed in these studies could be due to differences in duration of post discharge follow-up period among these studies. The time to readmission after discharge from hospital and the number of readmissions during the ninety days follow-up period was not taken into consideration in our study.

We evaluated twelve potential modifiable and non-modifiable risk factors for logistic regression analysis among which five clinical factors were found to be independently associated with readmission for acute COPD exacerbation. Logistic regression analysis revealed that preadmission domiciliary oxygen use (OR 2.93; 95% CI 1.195-7.202; p=0.019), ICU admission (OR 3.060; 95% CI 1.145-8.179; p=0.026), previous hospital admission for COPD exacerbation (OR 3.230; 95% CI 1.219-8.556; p=0.018), age (OR 0.946; 95% CI 0.905-0.988; p=0.012) and duration of hospital stay (OR 0.901; 95% CI 0.819- 0.992; p=0.034) were independently associated with ninety day readmission for an acute COPD exacerbation. Bahadori et al. observed four clinical factors independently associated with frequent readmission for acute COPD exacerbation among which preadmission home oxygen use (OR 2.55; 95% CI 1.45 to 4.42; p=0.001) and shorter length of hospital stay (OR 0.97; 95% CI 0.945 to 0.995; p=0.021) were two factors found consistent with our study.[11] The EFRAM study reported previous hospital admission for COPD exacerbation (OR 6.21, p= 0.008), lower forced expiratory volume in one second (FEV1) (OR 0.96 per percentual unit, p < 0.0005), and under prescription of long term oxygen therapy (LTOT) (OR 22.64, p= 0.007) as risk factors for hospitalization in COPD exacerbation.[12] Mohapatra et al. in India observed

number of hospitalizations during previous year for COPD exacerbation, reduced FEV1 and peak expiratory flow rates were significantly associated with hospitalization in acute COPD exacerbation.[13] However, we did not consider spirometric values and GOLD COPD grading for analysis in this study.

The clinical factors associated with post discharge ninety day readmission as seen in our and several other studies like previous hospital admissions for COPD exacerbation, ICU admission and domiciliary oxygen use are indicators of baseline severity of disease in COPD patients. Domiciliary oxygen use is frequent requirement in patients with advanced disease indicating a potential marker of disease severity who are at higher risk for readmission.[12,14] These results suggest that the principal determinant

of readmission following hospitalization for COPD exacerbation depend upon the disease severity; greater the severity of COPD, greater the risk for recurrent COPD exacerbations requiring frequent hospital readmissions.[15]

CONCLUSION

Five clinical factors remained important cause of post discharge ninety day readmission in COPD exacerbation in this study. Understanding potential modifiable and non-modifiable risk factors associated with frequent hospital admission could have implication in planning therapeutic strategy and pulmonary rehabilitation in COPD patients. Further large multi-centre studies at various health care levels are needed to validate these risk factors in Nepalese health care setting.

REFERENCES

1. Soriano JB, Kendrick PJ, Paulson KR, Gupta V, Abrams EM, Adedoyin RA, et al. Prevalence and attributable health burden of chronic respiratory diseases, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017. *The Lancet Respiratory Medicine.* 2020 Jun 1;8(6):585-96.

2. Vos T, Flaxman AD, Naghavi M, Lozano R, Michaud C, Ezzati M, et al. Years lived with disability (YLDs) for 1160 sequelae of 289 diseases and injuries 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010. *The lancet.* 2012;380(9859):2163-96.

3. Halpin DM, Decramer M, Celli BR, Mueller A, Metzdorf N, Tashkin DP. Effect of a single exacerbation on decline in lung function in COPD. *Respiratory medicine.* 2017 Jul 1;128:85-91.

4. Tsai CL, Clark S, Cydulka RK, Rowe BH, Camargo Jr CA. Factors associated with hospital admission among emergency department patients with chronic obstructive pulmonary disease exacerbation. *Academic Emergency Medicine*. 2007 Jan;14(1):6-14.

5. Royal College of Physicians. National COPD Audit Programme. COPD: Who care when it matters most? 2017. [cited: 7 November 2020]; Available from: https://www.rcplondon.ac.uk/projects/outputs/copd-who-cares-when-it-mattersmost-outcomes-report-2014

6. Garcia-Aymerich J, Farrero E, Felez MA, Izquierdo J, Marrades RM, Anto JM. Risk factors of readmission to hospital for a COPD exacerbation: a prospective study. *Thorax.* 2003 Feb 1;58(2):100-5.

7. Müllerova H, Maselli DJ, Locantore N, Vestbo J, Hurst JR, Wedzicha JA, et al. Hospitalized exacerbations of COPD: risk factors and outcomes in the ECLIPSE cohort. *Chest.* 2015 Apr 1;147(4):999-1007.

8. Chan FW, Wong FY, Yam CH, Cheung WL, Wong EL, Leung MC, et al. Risk factors of hospitalization and readmission of patients with COPD in Hong Kong population: analysis of hospital admission records. *BMC health services research*. 2011 Dec 1;11(1):186.

9. Müllerová H, Shukla A, Hawkins A, Quint J. Risk factors for acute exacerbations of COPD in a primary care population: a retrospective observational cohort study. *BMJ open*. 2014 Dec 1;4(12).

10. Hartl S, Lopez-Campos JL, Pozo-Rodriguez F, Castro-Acosta A, Studnicka M, Kaiser B, et al. Risk of death and readmission of hospital-admitted COPD exacerbations: European COPD Audit. *European Respiratory Journal.* 2016;47(1):113-21.

11. Bahadori K, FitzGerald JM, Levy RD, Fera T, Swiston J. Risk factors and outcomes associated with chronic obstructive pulmonary disease exacerbations requiring hospitalization. *Canadian respiratory journal.* 2009 Oct;16.

12. Garcia-Aymerich J, Monso E, Marrades RM, et al. Risk factors for hospitalization for a chronic obstructive pulmonary disease exacerbation. EFRAM study. *Am J Respir Crit Care Med.* 2001;164:1002-7.

13. Mohapatra PR, Janmeja AK. Factors Associated with Hospital Admission in Patients with Acute Exacerbation of Chronic Obstructive Pulmonary. *Indian J Chest Dis Allied Sci*. 2010 Oct;52:203-6.

14. Kessler R, Faller M, Fourgaut G, Mennecier B, Weitzenblum E. Predictive factors of hospitalization for acute exacerbation in a series of 64 patients with chronic obstructive pulmonary disease. *Am J Respir Crit Care Med.* 1999;159:158-64.

15. Harries TH, Thornton H, Crichton S, Schofield P, Gilkes A, White PT. Hospital readmissions for COPD: a retrospective longitudinal study. *NPJ primary care respiratory medicine.* 2017 Apr 27;27(1):1-6.