

Prolonged stay predictors in patients admitted with chronic obstructive pulmonary disease acute exacerbation

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ABSTRACT

Objectives: The study aimed to identify the factors related to prolonged stay in those patients admitted with acute exacerbations of chronic obstructive pulmonary disease (AECOPD) to our hospital. **Methods:** We conducted a retrospective study by reviewing the medical records of all patients admitted with AECOPD to the University Hospital Complex of Santiago de Compostela in 2007 and 2008. To identify variables independently associated with length of stay, we conducted a logistic regression including those variables which proved to be significant in the univariate analysis. **Results:** Six hundred and sixty-one patients were assessed; 76.6% were male and the mean age was 74.5 years (standard deviation [SD]: 11.48). The mean stay was 11.9 days (SD: 8) and 24% of all patients required prolonged stay. Factors associated with prolonged mean stay in multivariate analysis were admission to the Intensive Care Unit (odds ratio [OR], 14.7), hospitalization by internal medicine (OR, 2.1), and use of noninvasive mechanical ventilation (OR, 1.75). **Conclusions:** Prolonged stay in AECOPD is primarily related to the unit patients are admitted to, and to the need for more intensive care.

KEY WORDS: Chronic obstructive pulmonary disease exacerbation, hospital admission, predictors, prolonged stay

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INTRODUCTION

With high prevalence, chronic obstructive pulmonary disease (COPD) is a major health care issue globally.^[1] Acute exacerbations of COPD (AECOPD) are frequent in the course of the disease, they are associated with high morbidity and mortality,^[1,2] and they account – especially those acute exacerbation episodes requiring hospitalization – for a large share of treatment costs.^[1] Admission costs partly depend on the length of stay.^[3] Previous studies have shown great variability in

COPD management across hospitals^[4] and countries.^[5] Such variability partly depends on the characteristics of both patients and admitting hospitals. Identifying the factors influencing mean stay could improve resource use and efficiency.

The aim of this study is to identify the factors related to prolonged stay in those patients admitted with AECOPD to our hospital.

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METHODS

Ethical approval

All procedures performed in this study were in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. As it is a retrospective study, formal consent is not required.

We conducted a retrospective study by reviewing the medical records of all patients admitted with AECOPD to the University Hospital Complex of Santiago de Compostela in 2007 and 2008. Data were retrieved from the hospital database and included all patients admitted to the internal medicine unit (IMU) and pneumology unit. For each patient, we reviewed the first admission with AECOPD in the study period, and we excluded all those patients with different reasons for admission, such as pneumonia or acute pulmonary edema, as well as those deceased during admission. The study sample includes 661 patients, whose baseline characteristics, comorbidities, AECOPD characteristics, and analyses conducted both at the emergency department (ED) and during the stay were recorded.

COPD diagnosis and baseline severity were defined following GOLD criteria.^[6] In those cases with no spirometry available, COPD diagnosis was accepted by consensus of the research team for patients with a smoking history and clinical and radiological characteristics consistent with such diagnostic hypothesis.^[1,7] Patients who had quit smoking at least a year before the moment of admission were considered former smokers.^[8] Alcohol users were sorted into four different categories: those consuming over 1 g alcohol/day (regular drinkers),^[9] those consuming <1 g alcohol/day (occasional drinkers), those who quit at least a year before (former drinkers),^[10] and never drinkers. Comorbidity was assessed with the Charlson index^[11] and categorized into three groups: patients scoring “0,” “1 or 2,” and “over 2” points, respectively. COPD baseline therapy was noted: short-acting and long-acting beta2-agonist inhalers, oral or inhaled corticosteroids, anticholinergics, theophylline, oxygen therapy, and noninvasive mechanical ventilation (NIV) at home. The use of at least 5 mg prednisone/day for at least 3 months in a row was considered chronic steroid therapy.^[12]

Weekends were defined as the period between Friday midnight and Sunday midnight.^[13]

Patients with prolonged stay were identified as those staying over the 75th percentile of length of stay in our sample, in our case 14 days.^[14]

Vital signs and arterial blood gas values were obtained upon patient arrival to the ED. In those cases where no blood gas was determined, a record of O₂ saturation by

pulse oximetry was obtained. Data from the CBC and serum biochemistry tests conducted on the first sample obtained upon arrival to the hospital were recorded.

Statistical analysis

Data obtained were expressed as mean values \pm standard deviation (SD) for continuous variables and as frequencies and percentages for categorical variables. Continuous variables were compared with either Student's *t*-test or with Wilcoxon's test; as for categorical variables, they were compared with the Chi-squared and Fisher's exact tests. To identify variables independently associated with length of stay, we conducted a logistic regression including those variables with $P \leq 0.05$ in the univariate analysis. We considered statistically significant those variables associated with $P < 0.05$. Data were analyzed with SPSS 15.

RESULTS

A number of 661 patients were assessed; 76.6% were male and the mean age was 74.5 years (SD: 11.48). The mean stay was 11.9 days (SD: 8), and 24% of all patients required prolonged stay (14 days). Patients' baseline characteristics are shown in Table 1. Acute exacerbation characteristics and complementary test results are shown in Table 2. The following factors were significantly associated with prolonged stay: older age ($P = 0.02$), chronic kidney disease ($P = 0.008$), hospitalization by the IMU ($P < 0.0001$), lower hemoglobin count ($P = 0.001$), need for admission to the Intensive Care Unit (ICU) ($P < 0.0001$), and the need for NIV ($P = 0.04$).

Factors associated with prolonged mean stay in multivariate analysis were admission to the ICU, hospitalization by the IMU, and the need for NIV [Table 3].

DISCUSSION

Prolonged stay may identify more fragile patients who may need more careful attention.^[15] The parameters better identifying prolonged stay in our study are primarily related to the unit patients are admitted to, and to the need for more intensive care.

By patients with AECOPD, severe dyspnea unresponsive to treatment, altered state of consciousness, PO₂ worsening, acidosis, the need for mechanical ventilation, and hemodynamic instability are considered indicators of admission to the ICU.^[1] This is, admission to the ICU seems related to AECOPD severity, to the occurrence of AECOPD-related complications, or to the decompensation of preexisting comorbidities.^[16,17] 2.6% of all our patients required admission to the ICU. As baseline characteristics in these patients did not differ from those admitted to the conventional hospitalization ward, it seems reasonable to attribute ICU admission to AECOPD severity or to the

Table 1: Patient baseline characteristics

	Hospital stay		P
	≤14 days (n=502), n (%)	>14 days (n=159), n (%)	
Age (mean±SD)	73.9 (11.7)	76.3 (10.4)	0.02
Gender (males)	384 (76.5)	122 (76.7)	0.9
Tobacco use			
Never smokers	119 (74.8)	40 (25.2)	0.3
Active smokers	94 (76.4)	29 (23.6)	
Former smokers	162 (72.6)	61 (27.4)	
OH use			
Regular drinkers	142 (76.8)	37 (23.2)	0.1
Occasional drinkers	16 (76.2)	5 (23.8)	
Never drinkers	40 (66.7)	20 (33.3)	
Former drinkers	151 (80.7)	36 (19.3)	
GOLD			
I	59 (17.7)	12 (11.5)	0.1
II	137 (41.1)	42 (40.4)	
III	7 (2.1)	2 (1.9)	
IV	130 (39)	48 (46.2)	
Comorbidities			
AF/atrial flutter	125 (25.1)	41 (25.9)	0.8
Hypertension	249 (49.6)	79 (49.7)	0.9
Diabetes	122 (24.4)	37 (23.4)	0.8
Ischemic heart disease	100 (20)	28 (17.6)	0.5
Cancer	62 (12.4)	23 (14.5)	0.4
Cerebrovascular accident	48 (9.6)	22 (13.8)	0.1
Dementia	23 (4.6)	5 (3.1)	0.4
Chronic kidney disease	35 (7)	22 (13.8)	0.008
Liver disease	35 (7)	8 (5)	0.3
Charlson			
0	3 (100)	0 (0)	0.2
1	188 (78.7)	51 (21.3)	
>2	308 (74.2)	107 (25.8)	
Baseline therapy			
Inhaled anticholinergics	274 (60)	93 (66.4)	0.1
SABA	165 (36.1)	48 (34.5)	0.7
LABA	269 (58.9)	73 (52.5)	0.1
Inhaled corticosteroids	274 (60)	81 (58.3)	0.7
Theophylline	22 (4.8)	7 (5)	0.9
Oral corticosteroids	23 (5)	10 (7.2)	0.3
Oxygen therapy at home	126 (25.1)	47 (29.6)	0.2
NIV at home	34 (6.8)	15 (10.1)	0.1
Admissions due to			
AECOPD-previous year	137 (27.6)	47 (29.9)	0.5
Emergency due to AECOPD-previous year	199 (40.2)	55 (35.3)	0.2

AF: Atrial fibrillation, SABA: Short-acting beta2 agonists, LABA: Long-acting beta2 agonists, NIV: Noninvasive ventilation, AECOPD: Acute exacerbation of chronic obstructive pulmonary disease, SD: Standard deviation, GOLD: Global initiative for chronic obstructive lung disease

occurrence of complications. Previous studies related prolonged stay to mechanical ventilation and to the occurrence of complications during stay.^[18,19] With ICU admission figures similar to ours, Quintana *et al.* found an association between length of stay due to AECOPD and the stay in the ICU in their study.^[14] This is, AECOPD severity – and not COPD baseline severity – seems to affect the mean length of stay.

In our study, patients with AECOPD admitted to the IMU stayed longer compared to those admitted to the pneumology unit. Several factors could at least partially

Table 2: Characteristics of acute exacerbation (univariate analysis)

	Hospital stay		P
	≤14 days (n=502), n (%)	>14 days (n=159), n (%)	
HR	89.9 (19.4)	89.6 (19.3)	0.8
SBP	131 (23.2)	131 (27.2)	0.8
DBP	74 (13.6)	73 (13.2)	0.3
BT ≥38°C	152 (30.3)	48 (30.2)	0.9
Tachypnea	190 (55.4)	61 (63.5)	0.1
Weekend admission	110 (21.9)	32 (20.1)	0.6
Admission unit			
Pneumology	379 (80.8)	90 (19.2)	<0.0001
IMU	123 (64.1)	69 (35.9)	
Laboratory data, n (SD)			
Hemoglobin	13.7 (2.05)	13 (2.4)	0.001
Platelets	247,321 (99193)	255,589 (112,969)	0.3
Leukocytes	11,600 (5640)	11,500 (4665)	0.8
Glucose admission	144 (70)	142 (59)	0.7
Urea admission	66 (35)	67 (40)	0.8
Creatinine admission	1.1 (0.6)	1.1 (0.5)	0.7
Total protein count	6.3 (0.6)	6.4 (0.7)	0.6
Albumin	3.9 (3.6)	3.6 (0.4)	0.3
Fibrinogen	456 (150)	427 (143)	0.1
Initial blood gas, n (SD)			
pH	7.4 (0.08)	7.4 (0.07)	0.4
PCO ₂	47.4 (15.5)	47.4 (17.5)	0.9
PO ₂	58.4 (20.4)	57.5 (16.6)	0.5
Bicarbonate	28.4 (5.3)	29 (6.6)	0.2
SatO ₂	89 (43)	87 (0.6)	0.6
O ₂ /FiO ₂	241 (64)	242 (55)	0.8
Chest radiograph			
Pleural effusion	71 (14.2)	17 (10.7)	0.2
Cardiomegaly	150 (29.9)	38 (23.9)	0.1
Atelectasis	25 (5)	8 (5)	0.9
Bronchiectasis	20 (4)	8 (5)	0.5
ICU	3 (0.6)	14 (8.8)	<0.0001
NIV	66 (13.1)	31 (19.5)	0.04
Antibiotic therapy	435 (86.7)	143 (89.9)	0.2

HR: Heart ratio, SBP: Systolic blood pressure, DBP: Diastolic blood pressure, BT: Body temperature, IMU: INTERNAL Medicine Unit, ICU: Intensive Care Unit, NIV: Noninvasive ventilation, SD: Standard deviation

explain these differences: on the one hand, patients admitted to the ICU were older and scored more frequently higher in the Charlson Index, and older age and number of comorbidities had both been associated with longer stays in previous studies.^[20] The percentage of patients with atrial fibrillation and ischemic heart disease was higher among those admitted to the IMU; both conditions are subject to decompensation with beta2-agonist and anticholinergics used to treat AECOPD, and subsequent complications could affect the length of stay.^[21-23] However, the contribution by these factors does not seem relevant in our patients, since none of them was independently related to longer stays, as shown in the multivariate analysis. On the other hand, AECOPD management by pneumologists follows guidelines closer than that by internists, and this may lead to better management of hospitalized patients and to shorter mean stays.^[24,25]

Indications for NIV include respiratory acidosis and severe dyspnea with clinical signs of muscle fatigue or increased

Table 3: Prolonged stay predictors

Factors	OR	CI 95%
Age	1.01	0.99-1.03
ICU	14.7	4.02-53.7
Admission to the IMU	2.1	1.3-3.4
Chronic kidney disease	1.7	0.97-3.25
Hemoglobin	0.9	0.8-1.0
NIV	1.75	1.03-2.9

Multivariate analysis. Adjusted by: Age, chronic kidney disease, admission unit, hemoglobin, ICU, NIV. ICU: Intensive Care Unit, IMU: Internal Medicine Unit, NIV: Noninvasive ventilation, OR: Odds ratio, CI: Confidence interval

respiratory effort. Early NIV use is recommended in patients admitted with moderate and severe AECOPD.^[1] In our sample, 14.7% of all patients were treated with NIV, and this was associated with longer stays, as in the study by Zacho Priess Leere and Møller Weinreich.^[26] According to other authors, patients treated with NIV stay shorter than those treated with mechanical ventilation; however, patients treated with NIV stay longer and with worse outcomes in the event of NIV failure.^[27]

Our results should be interpreted with caution due to the limitations inherent to retrospective studies, including selection bias and the assumption that the information in the files reflects clinical practice. Furthermore, as our data come from a single hospital, they might not be generalized to other populations.

CONCLUSIONS

Prolonged stay likelihood by AECOPD hospitalizations is higher in those patients assisted by the IMU, in those admitted to the ICU, and in those requiring NIV.

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Conflicts of interest

There are no conflicts of interest.

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