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Original Article

COPD Exacerbation: Mortality Prognosis Factors in a Respiratory Care Unit

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ABSTRACT

Objective: The aim of our study was to determine the predictive factors for mortality during hospitalization for chronic obstructive pulmonary disease (COPD) exacerbation in a Spanish intermediate respiratory care unit (IRCU).
Patients and methods: Ours is a 2-year prospective observational study including all patients with acute COPD exacerbation and hypercapnic respiratory failure admitted to an IRCU. We analyzed different sociodemographic, functional and clinical variables as well as physical activity.
Results: We collected data from 102 consecutive cases admitted to IRCU (90.1% men). Mean age was 69.4 ± 10.6. Mean APACHE II was 19.6 ± 5.0 and 9.5% presented failure of another non-respiratory organ. Non-invasive mechanical ventilation was applied in 75.3% of the episodes, and this treatment failed in 11.6%. Mean IRCU stay was 3.5 ± 2.1 days, and mean hospitalization was 8.0 ± 5.3 days. Mortality rate during hospitalization was 6.9%, and 12.7% 90 days after discharge. In order to predict hospital mortality, multivariate statistics identified a predictive model with an AUC of 0.867, based on 3 variables: the number of hospitalizations for COPD exacerbation in the previous year (p = 0.048), the respiratory rate (RR) 2 hours after admittance to the IRCU (p = 0.0484) and the severity of the disease established with ADO score (p = 0.0241).
Conclusions: The number of hospitalizations for COPD exacerbation in the previous year, the respiratory rate two hours after being admitted to the IRCU and the severity of the disease established with the multidimensional ADO score allowed us to identify which patients were susceptible to death during hospitalization in IRCU for decompensated COPD.

Exacerbación de EPOC: factores predictores de mortalidad en una unidad de cuidados respiratorios intermedios

Palabras clave:
EPOC
Factores predictores
Exacerbación
Unidad de cuidados respiratorios intermedios (UCRI)
Ventilación mecánica no invasiva

RESUMEN

Objetivo: Determinar los factores predictores de mortalidad hospitalaria durante un ingreso por exacerbación de la enfermedad pulmonar obstructiva crónica (EPOC) en una unidad de cuidados respiratorios intermedios (UCRI).
Metodología: Estudio prospectivo observacional de 2 años de duración en el que se incluyeron todos los ingresos en una UCRI por exacerbación de la EPOC. Se analizaron diferentes variables sociodemográficas, funcionales, clínicas y la actividad física.
Resultados: Durante este periodo evaluamos 102 episodios (90,1% varones), con una edad media de 69,4 ± 10,6. El APACHE II (Acute Physiology and Chronic Health Evaluation Score) fue de 19,6 ± 5,0 y el 9,5% presentaban fallo de otro órgano no respiratorio. El 75,3% recibieron ventilación mecánica no invasiva y esta

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fracasó en el 11,6% de ellos. La duración de la estancia en la UCRI y en el hospital fue de 3,5 ± 2,1 y 8,0 ± 5,3 días, respectivamente. La mortalidad durante el episodio de hospitalización fue de 6,9% y un 12,7% a los 90 días del alta hospitalaria. El análisis multivariante identificó un modelo predictivo con un estadístico C de 0,867, basado en el número de ingresos por exacerbación durante el año previo (p = 0,048), la frecuencia respiratoria (FR) a las 2 horas del ingreso en la UCRI (p = 0,048) y la puntuación obtenida en la escala multidimensional ADO (p = 0,024).

Conclusiones: El número de ingresos por exacerbación de la EPOC durante el año previo, la FR a las 2 horas del ingreso en la UCRI y la escala multidimensional ADO nos permitirían identificar los pacientes susceptibles de fallecer durante un ingreso por descompensación de la EPOC en la UCRI.

Introduction

Severe exacerbation of chronic obstructive pulmonary disease (COPD) has been associated with increased mortality[1] in these patients. Initially, this increase in mortality was attributed to the baseline seriousness of the disease. Various recent studies, however, have observed an independent relationship between the number of previous exacerbations[2,3] and mortality. In addition, the degree of severity of the exacerbation itself is related to different survival rates during the hospitalization process. Thus, patients admitted with hypercapnic respiratory insufficiency,[1] respiratory acidosis or requiring intubation and admittance to intensive care units (ICU) present higher mortality rates: 21-50%.[4-9] During the last decade, we have been witness to a greater and greater use of non-invasive mechanical ventilation (NIMV)[10] and its use has been associated with a reduction in mortality[11,12] with fewer orotracheal intubations (OTI).

There is very limited information available about patients with COPD hospitalized in intermediate respiratory care units (IRCU) or monitoring areas. In general, subjects are admitted to these units due to hypercapnic respiratory insufficiency requiring ventilatory support. Currently, we lack the specific tools that would allow us to easily classify and establish the individual prognosis for each patient during their hospitalization. More complicated prognostic scales, such as the Acute Physiology and Chronic Health Evaluation (APACHE II) and SAPS (Simplified Acute Physiology Score), that evaluate patient severity upon admittance and which are widely used in ICUs, do not seem to correlate well with the mortality of COPD patients hospitalized in pulmonology ICUs.[13,14]

The objective of our study is to identify the predictive factors for hospital mortality in patients admitted to IRCU due to an episode of COPD exacerbation.

Patients and Methods

Study Setting and Design

Ours is a 2-year prospective, observational study (15 February 2007-14 February 2009). It was completed at the Galdakao-Usansolo Hospital, a 400-bed general teaching hospital that serves an area of 300,000 inhabitants. Our IRCU is under the direction of the Pulmonology Department. It is located in a separate structure adjacent to the conventional hospitalization room and has six beds equipped with multiple monitoring (continuous electrocardiogram, cardiac rate, blood pressure, oxygen saturation and respiratory rate). It is overseen by a pulmonologist who is physically present during the morning and afternoon shifts (8:00 a.m.-9:00 p.m.) and is on call 50% of the night duty, the other half being covered by cardiologists. The nursing staff is qualified and follows an established protocol of action.

Study Population

We included for study all those patients consecutively admitted to the IRCU for COPD exacerbation during the study period who fulfilled the previously-established inclusion criteria.[15] In brief, these criteria are*:* 1) acute or chronic intensified respiratory insufficiency requiring NIMV; 2) patients with potentially serious respiratory processes requiring non-invasive monitoring. Exclusion criteria were: 1) very serious patients who do not respond to the treatment administered and whose death is imminent or quite probable; 2) patients who refuse to be treated with NIMV or who refuse to be admitted to the IRCU after having been properly informed, and their families as well, of the possible risks that they are assuming. COPD and exacerbation were defined in accordance with the ATS (American Thoracic Society) and GOLD (Global Initiative for Chronic Obstructive Lung Disease) criteria.[16]

Variables Collected

Upon admittance in the IRCU, the following information was recorded: 1) sociodemographic variables; 2) clinical variables, including dyspnea measured by the Medical Research Council (MRC) scale[17] while stable, previous to admittance. This scale stratifies breathlessness into 5 groups: GRADE I: absence of dyspnea except with strenuous exercise; GRADE II: difficulty to breath walking quickly on the level or up a slight incline; GRADE III: unable to keep in step with other persons of the same age, or has to stop to breathe when walking on the level; GRADE IV: has to stop to catch his/her breath after walking 100 m or after a few minutes walking on the level; GRADE V: dyspnea impedes the subject from leaving the house or appears with activities such as getting dressed/undressed; 3) chronic co-existing diseases, using the Charlson comorbidity index.[18] This index ponders 22 comorbidities according to a pre-established score, and the sum of all these is correlated with the risk for death within the year; 4) the severity of the episode upon admittance, calculated using the APACHE II scale,[19] using the worst value obtained in the first 24h after being admitted to the IRCU. This scale is based on 2 components (the first compiles 12 physiological variables, the second compiles age, the patient's previous state of health and the type of admittance) and predicts hospital mortality by means of a logistic regression formula; 5) the Sequential Organ Failure Assessment (SOFA) scale,[20] which qualifies multi-organ failure based on the parameters of 6 major organs/systems (renal, neurological, hepatic, cardiovascular, pulmonary and hematologic), which is then related to ICU mortality. The SOFA score was obtained upon admittance in the IRCU; in addition, in order to evaluate the degree of non-respiratory organ dysfunction, we eliminated the impact of the lung dysfunction in the final SOFA score; 6) we analyzed other analytical parameters, such as glucose, albumin and hematocrit upon admittance (considering normal levels of hematocrit to be between 39 and 49% for men and between 36 and 48% for women; lower levels were considered anemia and higher levels, polyglobulia); 7) COPD severity by means of spirometry in a stable situation, carried out in the year previous to hospitalization or in a period of three months after hospital discharge in a situation of clinical stability.

In completing the final analysis of the data, the severity of the COPD patient was also calculated using the ADO (age, dyspnea,

obstruction) multidimensional index.[21] This scale, published in 2009, evaluates the severity of COPD depending on 3 parameters: age, level of obstruction analyzed with the percentage of FEV_1 and patient dyspnea measured by the MRC scale, assigning a total score of 0-10 to each patient, and predicts risk of death by the disease in the following three years. NIMV failure was defined by the death of the patient or the need for OTI. Criteria for OTI were the following: cardio-respiratory failure, presence of panting, hemodynamic instability, severe psychomotor agitation or aspiration. Even with the presentation of clinical criteria for OTI, the specialist made the final decision of whether to intubate the patient. In order to evaluate the results, we registered the percentage of patients that received invasive mechanical ventilation (IMV) and OTI due to failure of NIMV, and the hospital mortality rate.

Statistical Analysis

In the descriptive analysis, we used the means and standard deviations for the quantitative variables (for example: age, APACHE II) as well as frequencies and percentages for the qualitative variables (for example, number of previous hospitalizations). In order to measure the association between the categorical variables and the percentage of patient deaths, we used the Chi-squared or Fisher's exact test. This was only used if both variables were dichotomic and the expected frequencies were less than 5. In the rest of the situations, the Chi-squared test was applied. In contrast, for the comparison of the means of the variables upon admittance, the Student's t test was used (or the Mann-Whitney U in the event normality could not be assumed). In the multivariate analysis, logistic regression models were developed for predicting hospital mortality. Lastly, we evaluated the area under the curve (AUC) together with its 95% confidence interval. All statistical calculations we performed using the SAS System v. 9.1 program. A p level < 0.05 was considered statistically significant.

Results

During the study period, 102 consecutive cases were included with the diagnosis of COPD exacerbation (91% males) with a mean age of 69.4 ± 10.6 (table 1). Of these, 56.6% had a Charlson index higher than 2, without including COPD. The most frequently-associated pathologies were cardiac insufficiency (CI) (48.5%) and systemic arterial hypertension (50.5%).

A baseline dyspnea of III/V or higher was present in 87.0% of the subjects, as measured following the MRC scale, and 29.4% had presented two or more hospitalizations for exacerbation over the course of the previous year. Mean body mass index (BMI) was 30.1 ± 6.8 and mean FEV_1 was 1,460.2 ± 554.5 ml (45.0 ± 16.3% predicted). Long-term home oxygen therapy was used by 49% of the cases. Severe sleep apnea-hypopnea syndrome (SAHS) had been diagnosed in 31.4% cases prior to admittance or afterwards due to our suspicion in the three months following discharge (out of these patients, 15 were receiving NIMV with bi-level pressure system, 2 used CPAP and 4 home oxygen before hospitalization). In addition to the SAHS patients, another 18 patients (17.6%) were being treated with home NIMV. According to the ADO index, the mean patient score was 5.2 ± 1.6.

Regarding the severity of the exacerbation, APACHE II in the first 24h after being admitted to the IRCU was 19.6 ± 5.0. According to the SOFA scale, 50% of the patients suffered dysfunction of another non-respiratory organ and 9.5% failure of another non-respiratory organ. 75.3% of our patients received NIMV. We observed ventilation failure in 9 patients (11.6% of those treated with ventilation), 5 of whom (45.5%) were transferred to the ICU, where they received OTI and IMV. None of the patients died during their hospitalization.

In our group of patients, 23.5% presented with some type of complication upon admittance, the most frequent of these being: diabetic decompensation (6.9%), arrhythmia (3.9%) and ischemic cardiopathy in the form of angina or acute myocardial infarction (2.9%). Mean IRCU stay was 3.5 ± 2.1 days and mean total hospital

Table 1
Characteristics of the hospitalized COPD patients

Variables	Lost values	Total
N (%)		102 (100)
Mean age (SD)	0	69.4 (10.6)
Sex: males	0	92 (90.1)
Active smoker	0	37 (36.3)
Packs/year (SD)	0	54.1 (27.1)
Baseline dyspnea (MRC)		
I	1	4 (4.0)
II		8 (7.9)
III		40 (39.6)
IV/V		44 (43.5)
Mean BMI		
> 20	7	8 (8.5)
20-24		13 (13.8)
25-29		27 (28.7)
30-34		22 (23.4)
≥ 35		25 (26.6)
Charlson index[a]		
0	0	18 (17.7)
1		26 (25.6)
2		29 (28.4)
≥ 3		29 (28.4)
N hospitalizations previous year		
0	0	48 (47.1)
1		24 (23.5)
≥ 2		30 (29.4)
% predicted FEV_1 (SD)	5	42.4 (13.5)
Multidimensional ADO scale score (DS)	5	5.2 (1.6)
Variables upon admittance in IRCU		
FR (SD)	2	28.7 (7.1)
pH (SD)	0	7.28 (0.09)
pCO_2 (SD)	0	72.0 (20.7)
pO_2 (SD)	0	53.3 (16.6)
Glasgow (SD)	2	14.5 (1.5)
Glycemia		
< 110	0	19 (18.6)
110-200		62 (60.8)
200-250		14 (13.7)
> 250		7 (6.9)
Albumin (SD)	17	4.0 (0.5)
Hematocrit	0	16 (15.8)
< 39 (< 36 in women)		
39-49 (36-48 in women)		52 (51.5)
49 (> 48 in women)		33 (32.7)
APACHE II (SD)	1	19.0 (5.2)
SOFA (SD)	2	6.6 (1.5)
SOFA (SD)[b]	2	3.5 (1.6)
0		37 (50.0)
1		20 (27.0)
2		10 (13.5)
≥ 3		7 (9.5)

The numerical variables express the number (N) and the percentage (%) calculated with the total number of study patients (n = 102 patients). Age, packs/year, forced expiratory volume in one second (FEV_1), respiratory rate (RR), pH, pCO_2, pO_2, Glasgow scale, albumin, APACHE II score, SOFA and the multidimensional scale for the evaluation of COPD (ADO) are reported as means and standard deviation. The body mass index (BMI) is given as mean and SD, and also categorized.
MRC: Medical Research Council.
[a]The Charlson index has been calculated without including chronic obstructive pulmonary disease (COPD) as a chronic disease.
[b]In order to calculate the presence of non-respiratory failure according to the SOFA scale, we excluded the score that would have been obtained for the respiratory parameter.

Table 2
Variables associated with hospital mortality: univariate analysis

Variables	Lost values	Patient deaths	Remaining patients	Total	p
N (%)		7 (6.9)	95 (93.1)	102 (100)	
N hospitalizations in the previous year	0				
0-1		2 (28.7)	70 (73.7)	94 (93.1)	0.0005
≥ 2		5 (71.4)	25 (26.6)	30 (29.49	
SAHS	0	0 (0)	32 (34.4)	32 (31.4)	0.007
ADO (SD)	5	6.7 (1.5)	5.1 (1.6)	5.2 (1.6)	0.01
Baseline dyspnea (MRC scale)	1				0.01
I		1 (14.3)	3 (3.2)	4 (4.0)	
II		0 (0)	8 (8.5)	8 (7.9)	
III		1 (14.3)	39 (41.5)	40 (39.6)	
IV-V		5 (71.4)	44 (46.8)	44 (43.5)	
RR 2 h after admittance (SD)	7	28.5 (10.4)	24.4 (5.7)	24.7 (6.2)	0.41
RR 4-6 h after admittance (SD)	11	28.1 (8.9)	22.4 (5.1)	24 (6.1)	0.04
Glasgow 4-6 h after admittance (SD)	16	10.8 (4.8)	14.7 (1.1)	14.5 (1.8)	< 0.001

The numeric variables express the number (N) and the percentage (%) that they represent of the total number of patients hospitalized (n = 102 patients). Respiratory rate (RR) and the Glasgow score are reported as mean and standard deviation (SD). The relationship with mortality of the following variables was not statistically significant: age, sex, active smoker, number of packs/year, body mass index, Charlson index, FEV_1, RR, pH, PCO_2, pO_2 and Glasgow upon admittance to the intermediate respiratory care unit (IRCU), albumin, hematocrit, APACHE II and SOFA scores.
ADO: multidimensional scales for the evaluation of COPD[18]; MRC: Medical Research Council; SAHS: sleep apnea-hypopnea syndrome.

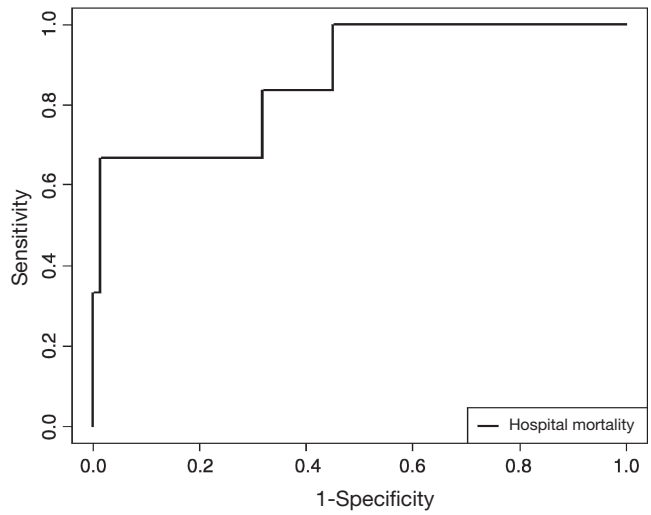

Figure 1. ROC curve of the predictive model for calculating hospital mortality, based on the number of hospitalizations due to exacerbation during the previous year, the ADO multidimensional scale score and respiratory frequency 2 h after being admitted to the intermediate respiratory care unit (AUC: 0.867).

stay was 8.0 ± 5.3 days, with a median of 6 days. Mortality during hospitalization was 6.9%, and 12.7% within 90 days of hospital discharge. NIMV after discharge was prescribed in 8 new patients (7.9%). There were no statistically significant differences between the patients that presented SAHS and those who did not.

Table 2 lists the variables that in the univariate analysis presented a statistically significant association with hospital mortality: baseline dyspnea, the number of hospitalizations for COPD exacerbation during the previous year, the COPD classification using the ADO multidimensional scale, the evolution of the RR and the Glasgow scale score. We found no relationship between the Charlson index and hospital mortality, not even by analyzing the patients separately for cardiovascular, diabetes mellitus or ischemic cardiopathy comorbidities.

The multivariate analysis (table 3) identified 3 variables related with hospital mortality: the number of hospitalizations for exacerbation during the previous year (p = 0.048), respiratory rate 2 hours after admittance to IRCU (p = 0.024) the score obtained on the ADO multidimensional scale (p = 0.048). The predictive model reached an AUC of 0.867 (fig. 1).

Discussion

This is the first study done in a Spanish IRCU that jointly analyzes clinical-physiological variables measured during a hospital stay for COPD exacerbation and parameters related with multisystem affectation and the severity of the disease itself. The results of this study point out the need for a simple multidimensional evaluation, even in the specific subgroup of patients with decompensated COPD that are admitted to the IRCU. The main strength of the paper is that it identifies 3 simple variables that provide us with an overview of the baseline situation of the patient and of the severity of the current episode that together achieve a very high predictive capacity for hospital mortality (C statistic: 0.867). Another of the advantages that this model offers, when compared with other prognostic scales,[1,4] is that it is based on simple, easily-available data, meaning that a prediction of the course of the disease could be made in the first few hours of admittance. Unlike other IRCU studies,[22-26] we did not include patients with pneumonia, IC or pulmonary thromboembolism (PT) as a cause for hospitalization of the COPD patients because the response to treatment and the prognosis of these diseases is different from COPD exacerbation.

Each of the variables of the model has been previously studied in patients with COPD and has been related to the prognosis of said disease. The number of previous hospitalizations for acute exacerbation of the disease has been shown as an independent variable for mortality in stable COPD patinets[5] as well as those admitted due to another exacerbación.[3] Moreover, a linear relationship is observed, meaning the greater the number of hospitalizations for exacerbation, the greater the risk for death.[3,5] In our study, the presence of 2 or more hospitalizations during the previous year multiplied by nine the possibility of death during the episode analyzed (OR = 9.1, 95% CI: 1.02-81.12). Furthermore, 80% of the COPD patients who died had been hospitalized over the course of their last year of life.[27] What is not clear is by which mechanism the exacerbation would impact the general course of the disease. It does seem, however, that it would increase local and systemic

Table 3
Variables related with hospital mortality and mortality within 90 days after admittance to the intermediate respiratory care unit for exacerbation of chronic obstructive pulmonary disease. A multivariate logistic regression analysis

Variables	Hospital mortality		
COPD patients admitted to IRCU	OR	95% CI	p
Number of hospitalizations during the previous year			
0-1	1		
≥ 2	9.10	(1.02-81.12)	0.048
ADO index[a]	2.84	(1.15-7.05)	0.0241
Respiratory rate 2 hours after admittance to IRCU[b]	2.25	(1.01-5.05)	0.0484
Area under the curve	0.867	(0.703-1)	< 0.0001

To calculate the multivariate analysis, we used all the variables that were statistically significant or with a ≤ 0.50 in the univariate analysis, detailed in table 2.
[a]For every point that ADO increases.
[b]For every 5 units of increase in respiratory rate.

inflammatory response and that the degree of this inflammation would be related to the presence of pathogenic germs,[28] although how long this effect persists has yet to be defined.

Mean RR after 2 h is another of the variables that has been previously related with mortality in ventilated patients in the pulmonary ward[11] as well as in the ICU.[29] This variable could be indicating a response to the treatment administered (pharmacological or ventilatory support) and therefore it would be the response to treatment and not only the initial severity which would allow us to establish a prognosis in these patients. This would explain why gasometric or physiological variables (RR, cardiac frequency, arterial hypertension) were not associated with mortality in our study or in others with similar patients.[6,11,30] The subpopulation of COPD patients that were admitted to IRCU was very advanced, meaning that most presented high PCO_2 and altered Ph, and the values of these variables moved in such a low range that it was not possible to discriminate what patients were at risk of death during hospitalization. The studies that confirmed the relationship between Ph,[31] pO_2/FiO_2[1,5] and PCO_2[32,33] and mortality were studies done in COPD patients hospitalized due to exacerbation, but not in such an advanced-disease subpopulation like ours. They instead included patients from the pulmonology ward (with and without respiratory insufficiency) as well as patients admitted to the ICU and intubated patients, therefore the range of values for Ph, PCO_2 and pO_2/FiO_2 was wider.

Since 2005, various multidimensional models have been published for evaluating the prognosis of COPD.[21,34-36] All these scales were derived from stable patients and, although there is an admitted variation in their scores during exacerbation,[37,38] they have not been used to evaluate prognosis during an these episodes. In 1996, Connors et al.[1] published the most numerous multicenter study in patients hospitalized for COPD exacerbation and hypercapnic respiratory insufficiency, with a hospital mortality of 11%. They created a mathematic model in order to calculate the mortality of exacerbated patients based on albumin upon admittance, BMI, age, Acute Physiology Score (APS) III, pO_2/ FiO_2, IC as the cause of the decompensation and the functional state of the patient, reaching an AUC of 0.75. Their model, however, is complex and has not reached compliance in everyday clinical practice. The ADO index,[21] recently published and based on the age, dyspnea and obstruction of the patient, had not been used previously to evaluate patients during exacerbation. The prognostic scales of severity used in ICUs and IRCUs (APACHE II, SAPS) have presented divergent results when used to study COPD patients.[4,29,30,39,40] According to Agarwal et al.,[14] COPD patients would have a higher score in the APACHE II scale due to their age compared to other patients with respiratory insufficiency, which would not correspond with the observed mortality. In our study, we found no statistically significant relationship between APACHE II and hospital mortality,[13] nor with the analytical variables studied: glucose, hematocrit, albumin. Glycemia has been previously related with NIMV failure,[41] a finding confirmed by Chakrabarti et al.[24] in their article. Nevertheless, in their sample of 88 patients, 11 presented pneumonia, and in this pathology glycemia values have been related with mortality,[42] which could be conditioning their results and explain the differences with our findings. In another instance, Baker et al.[43] carried out a retrospective study of all the COPD patients hospitalized over the period of one year. They took the highest glucose level during hospitalization, not the initial value upon admittance; therefore these differences in the methodologies used could explain the differences in the results. Albumin[44] and hematocrit[45] have been related with survival in stable patients. On the other hand, in COPD patients treated with invasive ventilation while hospitalized in the ICU, albumin has been related with hospital[6] and mid-term[33] mortality, but in our patient cohort we have not been able to confirm this finding.

The main limitations of our study are: 1) the total number of patient deaths in the study cohort is small, but the high C statistic reached by our model using so few cases gives consistency to the 3 predictive variables included; 2) the data only correspond to one hospital, thus the results might not be generalizable; 3) in addition, this sample could be considered heterogeneous because we have included monitored and mechanically-ventilated patients, but this circumstance is also found in other articles about COPD patients admitted to the IRCU.[23,24-27] Unlike them, and in reducing this heterogeneity, we have excluded COPD patients hospitalized for other causes: pneumonia, sepsis, TEP, IC; 4) the BMI of our patients is high, but this is a growing tendency among COPD patients in European countries, especially in the Mediterranean, and in North America.[46,47] Directly linked with this BMI, the percentage of patients in our sample that have been diagnosed with SAHS is high. In a prevalence study from our region published in 2001,[42] 32.2% of men between the ages of 60 and 70 presented an AHI higher than 10, and this percentage increased as did BMI and age. Our patients presented mean BMI and age higher than the Durán et al. sample,[48] therefore we consider that this prevalence would be similar to the population of our setting with similar age and BMI.

In conclusion, in evaluating patients hospitalized in IRCU due to hypercapnic COPD exacerbation, the presence of 2 or more previous hospitalizations for COPD episodes, the multidimensional ADO scale score and the response to treatment administered in the first few hours, as evaluated by RR 2h after being admitted to the IRCU, allow us to be able to identify those patients with greater risk for dying from said exacerbation in a simple, quick way with an approximate probability of 90%. However, due to the limitations of our paper, done in one center with a relatively small sample and little observed mortality, this model should be validated by later studies.

Conflict of Interest

The authors declare having no conflict of interest.

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