

## Patients admitted to the ICU for acute exacerbation of COPD: two-year mortality and functional status\*

Exacerbação aguda da DPOC: mortalidade e estado funcional dois anos após a alta da UTI

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### Abstract

**Objective:** To assess ICU patients with COPD, in terms of in-hospital characteristics, two-year mortality and two-year functional status of survivors. **Methods:** A prospective cohort study involving patients with acute exacerbation of COPD admitted to the ICUs of two hospitals in the city of Porto Alegre, Brazil, between July of 2005 and July of 2006. At two years after discharge, survivors were interviewed by telephone in order to determine Karnofsky scores and scores on a scale regarding activities of daily living (ADL). **Results:** The sample comprised 231 patients. In-hospital mortality was 37.7%, and two-year post-discharge mortality was 30.3%. Of the 74 survivors, 66 were interviewed (89%). The mean age at ICU admission was  $74 \pm 10$  years, and the mean Acute Physiology and Chronic Health Evaluation II score was  $18 \pm 7$ . Two or more comorbidities were present in 87.8% of the patients. Of the 66 interviewees, 57 (86.3%) lived at home, 58 (87.8%) were self-sufficient, 12 (18.1%) required oxygen therapy, and 4 (6.1%) still required ventilatory support. There was a significant reduction in the quality of life and autonomy of the survivors, as evidenced by the Karnofsky scores ( $85 \pm 9$  vs.  $79 \pm 11$ ,  $p = 0.03$ ) and ADL scale scores ( $29 \pm 5$  vs.  $25 \pm 7$ ;  $p = 0.01$ ), respectively. **Conclusions:** In this patient sample, two-year mortality was quite high. Although there was a noticeable reduction in the functional status of the survivors, they remained self-sufficient.

**Keywords:** Pulmonary disease, chronic obstructive/mortality; Quality of life; Intensive care units.

### Resumo

**Objetivo:** Determinar a taxa de mortalidade de pacientes com DPOC e avaliar o estado funcional dos sobreviventes dois anos após a alta da UTI. **Métodos:** Estudo de coorte prospectiva realizada nas UTIs de dois hospitais na cidade de Porto Alegre (RS) com pacientes com exacerbação aguda de DPOC e internados em UTI entre julho de 2005 e julho de 2006. Dois anos após a alta, os sobreviventes foram entrevistados via telefone. Os dados obtidos foram utilizados na determinação dos escores da escala de Karnofsky e de uma escala de atividades de vida diária (AVD). **Resultados:** Foram incluídos 231 pacientes. A mortalidade hospitalar foi de 37,7% e a mortalidade extra-hospitalar foi de 30,3%. Dos 74 sobreviventes, foram entrevistados 66 (89%). A média de idade dos pacientes no momento da internação na UTI era de  $74 \pm 10$  anos e a do escore *Acute Physiology and Chronic Health Evaluation II* era de  $18 \pm 7$ . Tinham duas ou mais comorbidades 87,8% dos pacientes. Dos 66 entrevistados, 57 (86,3%) viviam em suas casas, 58 (87,8%) eram capazes de realizar seu autocuidado, 12 (18,1%) utilizavam oxigenoterapia, e 4 (6,1%) necessitavam suporte ventilatório. Houve uma significativa redução na qualidade de vida e na autonomia, segundo os escores da escala de Karnofsky ( $85 \pm 9$  vs.  $79 \pm 11$ ;  $p = 0,03$ ) e de AVD ( $29 \pm 5$  vs.  $25 \pm 7$ ;  $p = 0,01$ ), respectivamente. **Conclusões:** A mortalidade desta amostra de pacientes foi muito elevada nos primeiros dois anos. Embora houvesse evidente redução do estado funcional dos sobreviventes, os mesmos preservaram a capacidade de realizar seu autocuidado.

**Descritores:** Doença pulmonar obstrutiva crônica/mortalidade; Qualidade de vida; Unidades de terapia intensiva.

\* Study carried out at the Moinhos de Vento Hospital and the Santa Casa Hospital Complex in Porto Alegre, Porto Alegre, Brazil.

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## Introduction

It has been estimated that COPD, currently the sixth leading cause of death worldwide, will have become the third leading cause of death by 2020.<sup>(1)</sup> The researchers who constitute the Global Initiative for Chronic Obstructive Lung Disease have been standardizing the preventive and treatment practices for COPD; this has greatly benefited patients because the natural history of COPD is chronic and is characterized by a progressive decline in pulmonary function, as well as by recurrent exacerbations and frequent hospitalizations.<sup>(2)</sup>

The development of acute respiratory failure, which often requires ventilatory support, worsens the prognosis of the disease,<sup>(2,3)</sup> as well as increasing health care costs.<sup>(4,5)</sup> In-hospital mortality among patients with acute exacerbation of COPD admitted to the ICU is 20–82%,<sup>(6,7)</sup> and the one-year mortality rate is 11–39%.<sup>(2,8,9)</sup> A retrospective study<sup>(10)</sup> evaluating 101 patients who required invasive ventilatory support because they were suspected of having COPD exacerbation demonstrated that the two-year survival rate among patients in follow-up treatment was 55.4%.

Although many instruments have been developed in order to evaluate mortality in patients with COPD, less attention has been given to the quality of life of survivors. The reintegration of COPD patients into society, their cognitive sequelae, their motor sequelae, their ability to maintain adequate social interaction, and their ability to resume their work activities, as well as the psychological changes that they experience, have yet to be properly studied.<sup>(11,12)</sup> The objective of the present study was to assess ICU patients with COPD, in terms of two-year mortality and the functional status of survivors two years out.

## Methods

The present study was a prospective cohort study involving all COPD patients admitted to two medical-surgical ICUs in the city of Porto Alegre, Brazil (the Central ICU of the Santa Casa Hospital Complex in Porto Alegre, a university hospital with 18 beds; and the Adult ICU of the Moinhos de Vento Hospital, a private hospital with 21 beds), between July of 2005 and July of 2006. During the study period, 1,219 patients

were admitted (566 and 653, respectively). Of those, 231 were admitted because of COPD exacerbation and were therefore included in the present study. The study was approved by the research ethics committees of the two institutions.

The diagnosis of COPD was based on data from hospital admission records and on the clinical history taken by the attending physician. The clinical history included the following: smoking history; previous hospitalizations for COPD exacerbation; current cough and chronic dyspnea; constant or continuous use of bronchodilators or corticosteroids; and pulmonary function data obtained by spirometry.

During the ICU stay of each patient, we collected data related to the following: age; gender; Acute Physiology and Chronic Health Evaluation II (APACHE II) score; accompanying diseases; length of ICU stay; length of hospital stay; need for mechanical ventilation; need for dialysis; respiratory infection; septic shock; and outcome.

Two years after the patients had been discharged from the ICU, the researchers contacted the patients or closest family members by telephone in order to explain the objective of the present study, request the address to which the written informed consent form was to be mailed, and schedule a telephone interview. Together with the consent form, we mailed a return postage-paid envelope in order to facilitate the return of the consent form. Patients who refused to sign the consent form were excluded from the present study.

After the interviews had been scheduled and the consent forms had been returned, we collected the data by administering the research instrument in the form of an interview. The interviewers had previously been trained in using the structured questionnaire and administering it by telephone. The data collected by filling out the questionnaires allowed us to calculate the scores on two numeric scales: the Karnofsky scale; and a scale to assess activities of daily living (ADLs).<sup>(13–15)</sup>

## Statistical analysis

The data are expressed as means  $\pm$  SD, as medians (interquartile range), or as proportions. Categorical variables were analyzed by the chi-square test and Fisher's exact test. Continuous

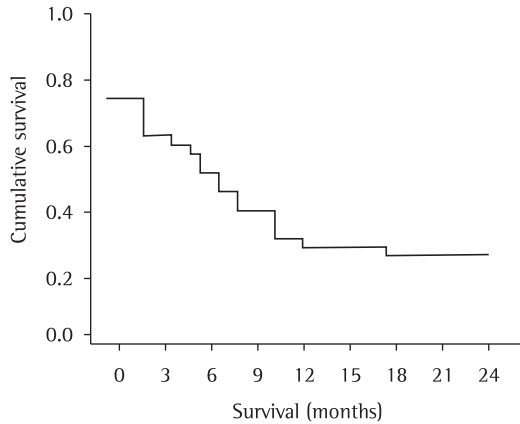
variables with normal distribution were analyzed by the Student's t-test for paired samples, whereas those with non-normal distribution were analyzed by the Mann-Whitney test. Values of  $p < 0.05$  were considered significant. Patient mortality throughout the months was demonstrated by the Kaplan-Meier curve. The data were analyzed with the Statistical Package for the Social Sciences, version 16.0 (SPSS Inc., Chicago, IL, USA).

**Results**

Of the 1,219 patients who were admitted to the ICUs during the 12-month study period, 231 were admitted for acute exacerbation of COPD. We interviewed 66 patients (28.6%). There were 165 patients who were not interviewed, because of the following (Figure 1): death in the ICU, in 63 patients (27.3%); in-hospital death after ICU discharge, in 24 (10.4%); death less than 6 months after ICU discharge, in 42 (18.2%); death within 6-12 months after ICU discharge, in 19 (8.2%); and death within 12-24 months after ICU discharge, in 9 (3.9%). In addition, 8 patients (3.4%) were excluded from the study: 5 because they declined to participate; and 3 because they were lost to follow-up.

Of the 66 patients who were interviewed (89% of the two-year survivors), 66.4% were male, the mean age being  $74 \pm 10$  years and the mean APACHE II score at ICU admission being  $18 \pm 7$ . Approximately 60% had presented with respiratory infection at ICU admission or developed respiratory infection during their stay in the ICU, and 31.8% had developed septic shock. Approximately 82% had required ventilatory support, and 19.6% had required dialysis (Table 1).

As can be seen in Table 2, 86.3% of the two-year survivors lived at home, 18.1% required home oxygen therapy; and 6% were dependent on ventilatory support. Figure 2 shows a reduction in the quality of life of survivors, as evidenced by the difference between the mean Karnofsky scale scores at ICU admission and those calculated at two years after ICU discharge ( $85 \pm 9$  vs.  $79 \pm 11$ ;  $p = 0.03$ ). Figure 3 shows a significant loss of autonomy among survivors, as evidenced by the difference between the mean ADL scale scores at ICU admission and those calculated at two years after ICU discharge ( $29 \pm 5$  vs.  $25 \pm 7$ ;  $p = 0.01$ ).



**Figure 1** – Survival of patients with COPD, from ICU admission to  $\leq$  two years after ICU discharge.

**Discussion**

In the present study, ICU mortality was high among patients with COPD, as was mortality within the first months after hospital discharge. Although there was a noticeable reduction in the functional status of the survivors, they remained self-sufficient.

Approximately one third of patients with acute exacerbation of COPD die during their stay in the ICU,<sup>(2,3,9)</sup> and mortality remains

**Table 1** – Characteristics of COPD patients who had been admitted to ICUs and who participated in the present study two years after ICU discharge (n = 66).<sup>a</sup>

Characteristics	Values
Male gender	42 (63.6)
Age, years <sup>b</sup>	$74 \pm 10$
APACHE II at admission <sup>b</sup>	$18 \pm 7$
Two or more comorbidities at admission	58 (87.8)
Smoking history, pack-years <sup>b</sup>	$20 \pm 12$
Smoker at admission	41 (62.1)
Oral corticosteroid use at admission	14 (21.2)
Confirmed respiratory infection	40 (60.3)
Development of septic shock	21 (31.8)
Need for ventilatory support	54 (81.8)
Noninvasive mechanical ventilation	22 (40.7)
Invasive mechanical ventilation	32 (59.3)
Need for dialysis	13 (19.6)
Duration of mechanical ventilation, days <sup>c</sup>	3 (2-11)
Length of ICU stay, days <sup>c</sup>	8 (5-18)
Length of hospital stay, days <sup>c</sup>	15 (8-34)

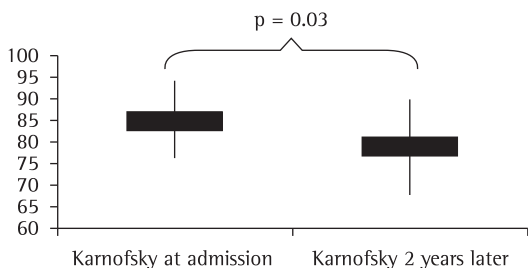
APACHE II: Acute Physiology and Chronic Health Evaluation II. <sup>a</sup>Values expressed as n (%), except where otherwise indicated. <sup>b</sup>Values expressed as mean  $\pm$  SD. <sup>c</sup>Values expressed as median (interquartile range).

**Table 2** – Characteristics of the patients with COPD two years after ICU discharge (n= 66).

Characteristics	n (%)
Lives at home	57 (86.3)
Lives in an ALF	9 (13.7)
Is self-sufficient	58 (87.8)
Uses home oxygen therapy	12 (18.1)
Depends on ventilatory support	4 (6.1)
Was tracheostomized	2 (3.0)

ALF: assisted living facility.

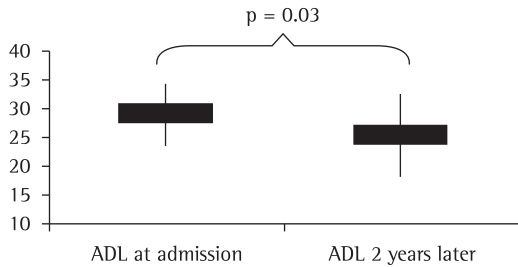
high in the first year after hospital discharge.<sup>(2,3,9,16,17)</sup> In our study sample, mortality in the ICU was 27.3%, and the mortality rate in the first year after hospital discharge was 64.6%. At the time of the interview, two years after ICU discharge, 32% of our patients were alive. In three other studies,<sup>(9,12,17)</sup> two-year survival was 51%, 44%, and 41.9%, respectively. The prognosis for such patients has been related to multiple factors, including pulmonary function test results, blood gas analysis results, degree of pulmonary hypertension, age, nutritional status, need for ventilatory support, and APACHE II score at ICU admission.<sup>(6,9,16-19)</sup> The reintegration of such patients into society, in terms of their ability to maintain adequate social interaction or perform their activities satisfactorily, has yet to be thoroughly investigated.<sup>(12-15)</sup> There are few data regarding the need for hospital readmissions, the degree of dependence, the ability to remain self-sufficient, and the ability to resume work activities. The principal sequelae in individuals who survive critical disease are cognitive impairment,<sup>(20,21)</sup> neuromuscular weakness, polyneuropathy,<sup>(22)</sup> end-stage renal failure,<sup>(23)</sup> and ventilatory support dependence.<sup>(3,24)</sup> Patients with COPD constitute a group of patients who are particularly likely to develop such problems.



**Figure 2** – Karnofsky scale scores of COPD patients at ICU admission and at two years after ICU discharge.

One group of authors<sup>(12)</sup> demonstrated that 75% of the patients with COPD who survived their ICU stay were self-sufficient six years after discharge. Our data show that 87.8% of the patients who survived remained self-sufficient two years after discharge. Most patients retain their ability to ambulate and perform tasks that require precise movements; in addition, they retain their cognitive abilities and are able to preserve intrafamily and interfamily relationships.<sup>(12)</sup> However, there is a reduction in exercise tolerance, as well as in the ability to perform work activities.<sup>(12,25)</sup> One study demonstrated, by means of the Glasgow Outcome Score, moderate worsening of the quality of life of survivors.<sup>(12)</sup> Our data are in agreement with those from that study because we found a significant reduction in Karnofsky scale and ADL scale scores at two years after ICU discharge. It is noteworthy that, after hospital discharge, 18% of the patients in the present study required home oxygen therapy and 6% required ventilatory support, via tracheostomy or noninvasive ventilation, after hospital discharge. One group of authors<sup>(26)</sup> reported that the quality of life of 73% of patients with COPD improved or remained the same 6 months after ICU discharge, without the need for additional drugs.

The terms “health status”, “social functioning”, and “quality of life” have been used interchangeably in clinical studies and defined as health-related quality of life.<sup>(27)</sup> In order to assess the clinical conditions, psychological conditions, and autonomy of patients who are critically ill and receive treatment in the ICU, patient status has been graded by health status scales, functional independence scales, and scales regarding the ability to perform simple ADLs.<sup>(27)</sup> Each scale has characteristics that allow a more appropriate evaluation of the different subgroups of patients, taking into consideration aspects such as pathology, age, and comorbidities. The scales that are most commonly used in order to evaluate functional capacity in the elderly are the Katz scale and the Lawton scale.<sup>(27)</sup> Neurological patients benefit from the use of the Glasgow Outcome Score, the Barthel index, and the Rankin scale.<sup>(27)</sup> In order to assess quality of life, the Medical Outcomes Study 36-item Short-form Survey and its shortened version, comprising 12 items, can be used, as can other instruments, such as the



**Figure 3** – Activities of daily living (ADL) scale scores of COPD patients at ICU admission and at two years after ICU.

EuroQol Group questionnaire.<sup>(14,15,27)</sup> The ADL scale<sup>(27)</sup> grades the ability of elderly individuals to perform ADLs such as taking their medication, using the telephone, and preparing food. The Karnofsky scale<sup>(15,27)</sup> assesses self-care, work capacity, the ability to ambulate, and the need for assistance in performing those tasks. In order to assess the functional capacity, autonomy, and quality of life of our patients, we chose to use the Karnofsky and ADL scales because they are easy to administer and to complete, as well as having been previously validated for use via telephone in similar studies involving critically ill patients.<sup>(28)</sup>

The objective of the present prospective cohort study was to evaluate the prognosis of patients admitted to ICUs and the quality of life of survivors at two years after ICU discharge. The strength of the present study lies in its design, which is appropriate for data collection in prognostic studies (cohort). In addition, the study was conducted at two different facilities, and there is a lack of similar data in Brazil. One of the limitations of the present study is the small sample size, which is due to the high mortality rate in the first year after ICU discharge, which in turn prevented us from furthering the analysis of aspects such as infectious exacerbations versus noninfectious exacerbations, invasive ventilatory support versus noninvasive ventilatory support, and presence of comorbidities versus absence of comorbidities. The small sample size is also attributable to difficulties related to the lack of diagnostic criteria, as well as to the diagnostic confusion with asthma, especially in the subgroup of elderly individuals; to the lack of information regarding the severity of COPD, including pulmonary function test results and the need for home oxygen therapy prior to ICU

admission; and to the fact that we did not use questionnaires specific to the evaluation of COPD patients.<sup>(29,30)</sup> Another limitation is the lack of specific assessment of exercise capacity, which has been reported to be greatly impaired in such patients.<sup>(12,25)</sup>

In conclusion, ICU mortality among the COPD patients evaluated in the present study was high, as was mortality in the first months after hospital discharge. In addition, the survivors remained self-sufficient two years after ICU discharge, although their functional capacity was significantly reduced, as demonstrated by the Karnofsky scale and ADL scale scores.

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