

Adherence to guidelines and its impact on outcomes in patients hospitalized with community-acquired pneumonia at a university hospital*

Adesão a diretrizes e impacto nos desfechos em pacientes hospitalizados por pneumonia adquirida na comunidade em um hospital universitário

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Abstract

Objective: To evaluate the agreement between the criteria used for hospitalization of patients with community-acquired pneumonia (CAP) and those of the Brazilian Thoracic Association guidelines, and to evaluate the association of that agreement with 30-day mortality. Secondly, to evaluate the agreement between the treatment given and that recommended in the guidelines with length of hospital stay, microbiological profile, 12-month mortality, complications, ICU admission, mechanical ventilation, and 30-day mortality. **Methods:** This was a retrospective study involving adult patients hospitalized between 2005 and 2007 at the Federal University of Minas Gerais *Hospital das Clínicas*, located in Belo Horizonte, Brazil. Medical charts and chest X-rays were reviewed. **Results:** Among the 112 patients included in the study, admission and treatment criteria were in accordance with the guidelines in 82 (73.2%) and 66 (58.9%), respectively. The 30-day and 12-month mortality rates were 12.3% and 19.4%, respectively. The 30-day mortality rate was lower for patients in whom the CRB-65 (mental Confusion, Respiratory rate, Blood pressure, and age ≥ 65 years) score was 1-2 and the antibiotic therapy was in accordance with the guidelines ($p = 0.01$). Cerebrovascular disease and appropriate antibiotic therapy showed independent associations with 30-day mortality. There was a trend toward an association between guideline-concordant antibiotic therapy and shorter hospital stay. **Conclusions:** In the population studied, admission and treatment criteria that were in accordance with the guidelines were associated with favorable outcomes in hospitalized patients with CAP. Cerebrovascular disease, as a risk factor, and guideline-concordant antibiotic therapy, as a protective factor, were associated with 30-day mortality.

Keywords: Pneumonia/therapy; Pneumonia/mortality; Hospitalization; Guideline adherence.

Resumo

Objetivo: Avaliar a concordância entre os critérios de hospitalização utilizados para a admissão de pacientes com pneumonia adquirida na comunidade (PAC) e aqueles da Sociedade Brasileira de Pneumologia e Tisiologia e avaliar a associação dessa concordância com a taxa de mortalidade em 30 dias. Secundariamente, avaliar a associação da concordância entre o tratamento instituído e as recomendações dessas diretrizes com duração da internação hospitalar, investigação microbiológica, mortalidade em 12 meses, complicações, internação em UTI, ventilação mecânica e mortalidade em 30 dias. **Métodos:** Estudo retrospectivo que incluiu pacientes adultos internados entre 2005 e 2007 no Hospital das Clínicas da Universidade Federal de Minas Gerais, na cidade de Belo Horizonte (MG). Foram revisados prontuários e radiografias de tórax. **Resultados:** Dentre os 112 pacientes incluídos, os critérios de internação e de tratamento foram concordantes com as diretrizes em 82 (73,2%) e 66 (58,9%), respectivamente. A taxa de mortalidade em 30 dias e em 12 meses foi de 12,3% e 19,4%, respectivamente. Pacientes com escore de CRP-65 (Confusão mental, frequência Respiratória, Pressão arterial e idade ≥ 65 anos) de 1-2 e com antibioticoterapia concordante com as diretrizes foram associados a menor mortalidade em 30 dias ($p = 0,01$). Doença cerebrovascular e tratamento antibiótico adequado apresentaram associações independentes com mortalidade em 30 dias. Houve uma tendência de associação entre antibioticoterapia concordante e menor duração da internação hospitalar. **Conclusões:** Na população estudada, os critérios de hospitalização e de antibioticoterapia concordantes com as diretrizes associaram-se a desfechos favoráveis do tratamento de pacientes hospitalizados com PAC. Doença cerebrovascular, como fator de risco, e antibioticoterapia concordante, como fator protetor, associaram-se à mortalidade em 30 dias.

Descritores: Pneumonia/terapia; Pneumonia/mortalidade; Hospitalização; Fidelidade a diretrizes.

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Introduction

Community-acquired pneumonia (CAP) is the leading cause of death from infectious disease in various parts of the world, as well as consuming a large part of health resources.^(1,2) The rates of hospitalization for CAP are high in Brazil, and it is speculated that noncompliance with national and international guidelines for CAP management constitutes one of the factors explaining such high rates.⁽³⁾

In most cases, initial treatment is empirical, which is due to the fact that the etiological evaluation has little impact on outcomes in CAP patients.⁽⁴⁾ Although there is no consensus in the literature, various studies have shown that the systematic use of CAP guidelines results in an increase in the proportion of patients treated as outpatients (with no worsening of outcomes), as well as in a reduction in 30-day mortality, in-hospital mortality, length of hospital stay, time to clinical stability, and complications in those treated as inpatients.⁽⁵⁻⁹⁾

The primary objective of the present study was to evaluate the agreement between the criteria used for hospitalization of CAP patients in the *Hospital das Clínicas da Universidade Federal de Minas Gerais* (HC/UFMG, Federal University of Minas Gerais *Hospital das Clínicas*), located in the city of Belo Horizonte, Brazil, in the 2005-2007 period and those of the Brazilian Thoracic Association guidelines, as well as to evaluate the association of that agreement with 30-day mortality. The secondary objective of the study was to evaluate the association between the agreement of the treatment given with that recommended in the Brazilian guidelines for CAP and length of hospital stay, microbiological profile, 12-month mortality, incidence of complications, need for ICU admission, need for mechanical ventilation, and variables associated with 30-day mortality.

Methods

This was a retrospective observational study carried out at the HC/UFMG, a 501-bed university hospital located in the city of Belo Horizonte, Brazil. The study involved adult patients who were diagnosed with CAP in accordance with the tenth revision of the International Classification of Diseases, used in the hospital admission form (J-12 to J-18 and their subdivisions), and who were hospitalized between 2005 and 2007 in

the clinical medicine ward of the HC/UFMG. The inclusion criteria were as follows: being ≥ 18 years of age; the onset of symptoms having occurred outside the hospital environment or within up to 48 h after admission; presenting with radiological infiltrate consistent with the diagnosis of pneumonia; and presenting with at least two specific signs and symptoms (cough, expectoration, dyspnea, chest pain, focal findings on physical examination of the chest, confusion, headache, sweating, chills, myalgia, and temperature $\geq 37.8^\circ\text{C}$). The radiological evaluation was performed by a HC/UFMG radiologist who was blinded to the clinical data.^(6,10) The exclusion criteria were as follows: presenting with immunosuppression due to AIDS; having a history of neoplasia in the last 6 months or a history of immunosuppressive diseases, immunosuppressive therapy (prednisone or equivalent ≥ 10 mg/day or other immunosuppressants for ≥ 3 months), or cystic fibrosis; data being missing or inconsistent with the diagnosis of CAP; chest X-rays being unavailable; and meeting criteria for hospital-acquired pneumonia or healthcare-associated pneumonia.⁽¹⁰⁾

The 30-day and 12-month mortality rates were determined by examining data from the medical charts or by contacting patients by telephone.

The patients were classified according to the severity scores that are recommended by the Brazilian guidelines, namely CURB-65—an acronym based on the key terms of each risk factor evaluated (i.e., mental **C**onfusion, **U**rea, **R**espiratory rate, **B**lood pressure, and age ≥ 65 years)—and its simplified form, CRB-65 (without urea levels).^(10,11) A CURB-65 score of 2 and a CRB-65 score of 1 were considered indications for hospitalization. In the presence of CURB-65 and CRB-65 scores lower than 2 and 1, respectively, we determined whether there were concomitant decompensated diseases, multilobar involvement on chest X-rays, impossibility of oral drug use, and hypoxemia.

We determined whether the antibiotic therapy prescribed initially was in accordance with the recommendations of the current (2004) Brazilian guidelines for the treatment of CAP in immunocompetent patients.⁽¹¹⁾ The use of beta-lactam antibiotics (ceftriaxone, cefotaxime, amoxicillin, amoxicillin/clavulanate, and ampicillin/sulbactam) in combination with a macrolide (azithromycin or clarithromycin) and the use

of a respiratory fluoroquinolone (moxifloxacin or levofloxacin) in isolation were considered to constitute treatments that were in accordance with the guidelines. The use of gatifloxacin was considered to constitute appropriate antibiotic therapy because the drug is currently available, having been approved for use during the study period. In the case of antibiotic use in the 3 months preceding hospital admission, the same regimens were considered to be in accordance with the guidelines, provided that the therapeutic class was changed. The use of amoxicillin/clavulanate was considered appropriate in cases of suspected aspiration pneumonia (as recorded in the medical charts).

For ICU patients in whom we found no risk factors for infection with *Pseudomonas* sp., the use of the treatment regimen that is given to ward patients was considered to be in accordance with the guidelines. In the presence of risk factors for *Pseudomonas* sp., the use of an antipseudomonal antibiotic (piperacillin/tazobactam, ceftazidime, cefepime, imipenem, or meropenem) in combination with ciprofloxacin and the use of an antipseudomonal antibiotic agent in combination with an aminoglycoside were considered to be in accordance with the guidelines.

The associations among categorical variables were determined by the chi-square test with continuity correction, when necessary. For continuous variables, the Kruskal-Wallis test was used, given that the data had non-normal distribution. The association between clinical variables and 30-day mortality was established by Poisson regression with robust variance, which was due to the high prevalence of the outcome analyzed (> 10%). Initially, we performed bivariate analyses, variables with a value of $p < 0.20$ being included in the multivariate analysis. The final model included the variables with a level of statistical significance of less than 5% ($p < 0.05$). The mortality rates obtained were compared with those predicted by the CURB-65 and CRB-65 scores by the test of equivalence of two proportions with normal approximation or by Fisher's exact test when the expected frequency was less than 5. The analyses were performed with the Statistical Package for the Social Sciences, version 13.0 (SPSS Inc., Chicago, IL, USA), with $\alpha = 0.05$.

The study project was approved by the Research Ethics Committee of the Federal University of Minas Gerais.

Results

During the study period, 709 patients were admitted to the HC/UFMG with a diagnosis of pneumonia. Of those, 357 were immediately excluded, 133 had no chest X-rays available, 31 had no chest X-ray findings consistent with the diagnosis of pneumonia, and 76 were not evaluated, given that their medical charts were inactive. Therefore, the final study sample comprised 112 patients (Figure 1), the mean age being 57.34 years (median, 56 years); of the 112 patients, 42 (37.5%) were aged ≥ 65 years (Table 1).

Regarding the primary objectives, we found that the admission criteria were in accordance with those recommended in the guidelines in 82 (73.2%) of the cases; in 18 (16.1%), we were unable to identify the admission criteria employed. For the sample as a whole, the 30-day mortality rate was 12.3% (13 patients). Of those 13 patients, 10 (76.9%) were aged ≥ 65 years. The 12-month mortality rate was 19.4% ($n = 20$). There were no significant differences between the mortality rates predicted by the CURB-65 or CRB-65 scores and those found in the present study ($p > 0.05$ for both scores).⁽¹²⁾

Of the 112 patients under study, 66 (58.9%) received treatments that were in accordance with the Brazilian guidelines for CAP. Of the 16 ICU patients evaluated, 7 (43.8%) received treatments that were in accordance with the Brazilian guidelines for CAP. As can be seen in Table 2, the medication that was most commonly prescribed was gatifloxacin (28.6%), followed by the amoxicillin-clavulanate combination (19.6%); however, in the latter case, the medication was appropriately prescribed in only 15 patients (13.4%), who were suspected of having aspiration pneumonia (as recorded in the medical charts). Excluding the cases of aspiration pneumonia, we found that a beta-lactam antibiotic was used in isolation for the initial treatment of 24 patients (21.4%).

In order to evaluate the association between the 30-day mortality rate and guideline-concordant antibiotic therapy, we used the CRB-65 score, given that serum urea was not determined in 27 patients and that the CRB-65 and CURB-65

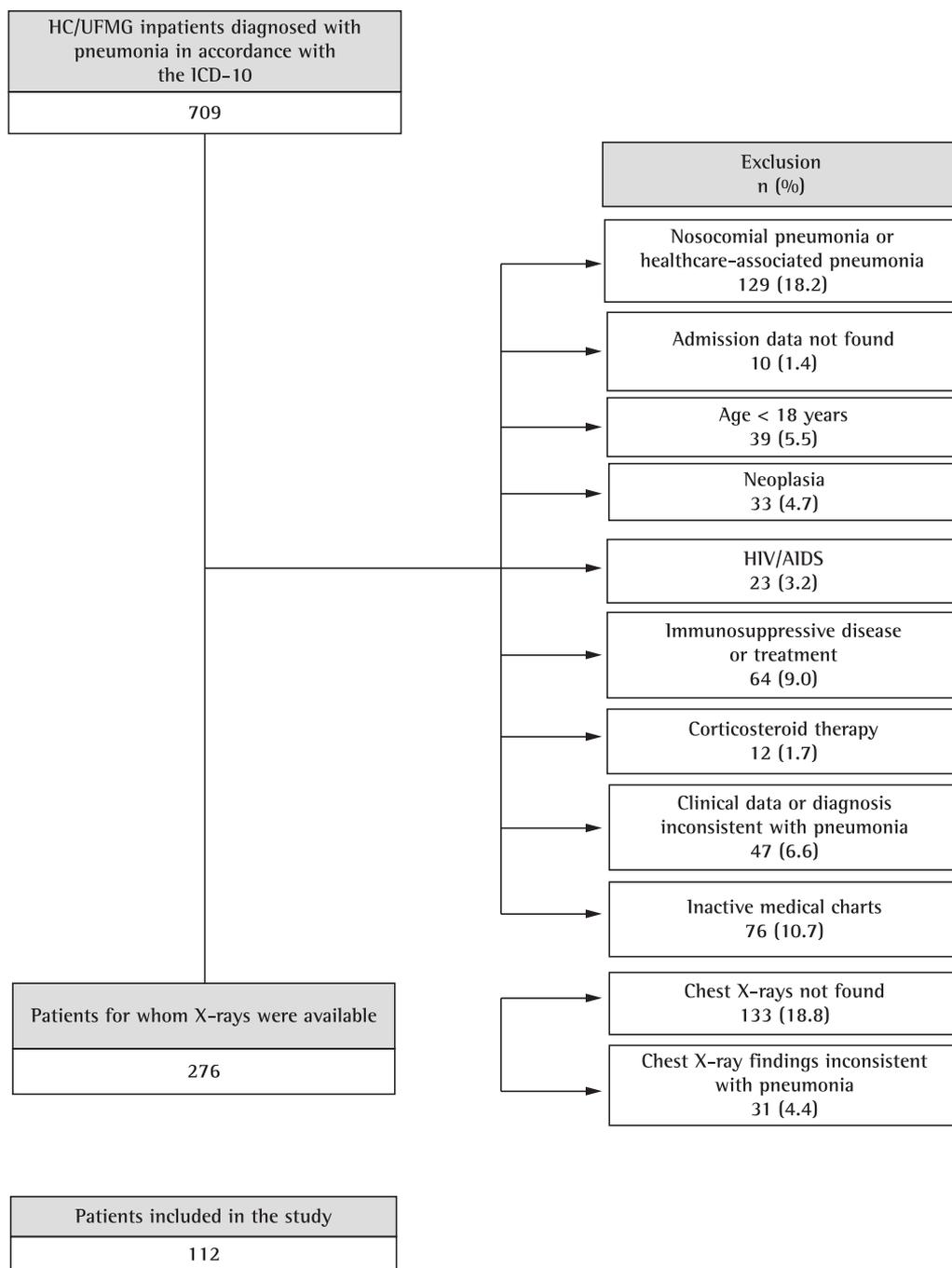


Figure 1 - Flowchart of patient inclusion and exclusion. HC/UFGM: *Hospital das Clínicas da Universidade Federal de Minas Gerais* (Federal University of Minas Gerais *Hospital das Clínicas*); and ICD-10: International Classification of Diseases, tenth revision.

scores are similar in terms of their ability to predict mortality in CAP patients. A significant inverse association was found only for those patients with a CRB-65 score of 1-2 ($p = 0.01$). Among those patients, 7 died, having received

antibiotic therapy that was not in accordance with the guidelines (Figure 2).

The patients who received treatment that was not in accordance with the Brazilian guidelines were, in general, older and had more often received

Table 1 – Demographic characteristics of and risk conditions in patients with community-acquired pneumonia, according to antibiotic therapy compliance or noncompliance with the 2004 Brazilian Thoracic Association guidelines.^a

Variables	Guideline-concordant antibiotic regimen		p
	Yes	No	
	(n = 66)	(n = 46)	
Male gender	43 (65.1)	23 (50.0)	0.159
Age, years ^b	53.89 ± 18.22 (21-89)	62.28 ± 22.64 (20-105)	0.036
Length of hospital stay, days ^b	12.17 ± 10.28 (3-61)	15.87 ± 15.86 (2-105)	0.066
Associated conditions			
Smoking	12 (18.1)	7 (15.2)	0.877
Chronic renal failure	7 (10.6)	6 (13)	0.923
Heart failure	8 (12.1)	13 (28.2)	0.057
COPD	9 (13.6)	2 (4.3)	0.193
Diabetes mellitus	12 (18.1)	5 (10.8)	0.428
Chronic liver disease	3 (4.5)	1 (2.1)	0.882
Alcoholism	13 (19.6)	8 (17.3)	0.951
Cerebrovascular disease	14 (21.2)	16 (34.7)	0.168
Asthma	2 (3.0)	2 (4.3)	1.000
Antibiotic use in the last 3 months	3 (4.5)	12 (26.0)	0.003
Risk factors for <i>Pseudomonas</i> sp.			
Structural lung disease	4 (6.0)	7 (15.2)	0.201
Antibiotic use in the last month	3 (4.5)	8 (17.3)	0.054
CRB-65 score of 3-4	5 (7.5)	8 (17.3)	0.076

CRB-65: mental **C**onfusion, **R**espiratory rate, **B**lood pressure, and age ≥ **65** years. ^aValues expressed as n (%), except where otherwise indicated. ^bValues expressed as mean ± SD (range).

antibiotics in the 3 months preceding admission (Table 1). We found that hospital stays tended to be longer among the patients who received treatment that was not in accordance with the guidelines than among those who received treatment that was (16 days vs. 12 days; $p = 0.066$).

Etiological investigation was performed in 32 patients (28.6%), blood cultures having predominated (in 25 patients). Blood culture was performed in 10 (55.5%) of the 18 patients who met criteria for severe CAP. The etiologic agent was confirmed by blood culture alone in only 4 patients (3.6%), who received a definitive diagnosis of CAP. *Streptococcus pneumoniae* was the only etiologic agent isolated. All of the remaining patients were classified as probable cases ($n = 108$; 96.4%).

There were complications in 5 patients (4.46%), all of whom had received treatment that was in accordance with the guidelines; of those 5 patients, 2 presented with empyema, 1 presented with endocarditis, 1 presented with abscess, and 1 presented with arthritis. We found no association between guideline-

concordant antimicrobial treatment and incidence of complications ($p = 0.148$).

Of the 16 ICU patients, 8 (50%) required mechanical ventilation, and 4 (25%) died within 30 days, no new deaths having occurred among those patients in 12 months.

In order to evaluate independent associations with 30-day mortality, the variables age, CRB-65 score, appropriate antibiotic therapy, antibiotic use in the last 3 months, presence of cerebrovascular disease, presence of arterial hypotension, ICU admission, and presence of complications were selected for inclusion in the multivariate analysis model on the basis of the results of the bivariate analyses. The multivariate analysis revealed that the variables inappropriate antibiotic therapy and presence of cerebrovascular disease were independently associated with 30-day mortality (Table 3).

Discussion

The primary objective of the present study was to evaluate the admission criteria for CAP patients hospitalized in the HC/UFGM in the

Table 2 - Initial antibiotic therapy used in community-acquired pneumonia patients admitted to the Federal University of Minas Gerais *Hospital das Clínicas* during the study period (n = 112).

Antibiotics	Patients n (%)
Amoxicillin	2 (1.8)
Amoxicillin/clavulanate	22 (19.6)
Second-generation cephalosporin	1 (0.9)
Third-generation cephalosporin	14 (12.5)
Clarithromycin	1 (0.9)
Levofloxacin	1 (0.9)
Moxifloxacin	8 (7.1)
Gatifloxacin	32 (28.6)
Beta-lactam antibiotic + macrolide	15 (13.4)
Antipseudomonal beta-lactam antibiotic + aminoglycoside	3 (2.7)
Third-generation cephalosporin + clindamycin	9 (8.0)
Levofloxacin + clarithromycin	1 (0.9)
Imipenem	1 (0.9)
Ciprofloxacin + clindamycin	2 (1.8)

2005-2007 period, as well as to evaluate the association of those criteria with 30-day mortality.

For most (73.2%) of the patients, the HC/UFMG admission criteria were in accordance with those recommended in the Brazilian guidelines for CAP. That proportion is similar to those found in two studies evaluating the implementation of CAP guidelines in emergency rooms. In a study including more than 3,200 patients, Yealy et al. found that 71.9% of hospitalizations were in

accordance with the guidelines that had been implemented.⁽¹³⁾ In a study that constituted an arm of the abovementioned study, Aujesky et al. found that 78.7% of the hospitalizations among the 1,306 patients under study were in accordance with the pneumonia severity index after a high intensity of implementing guidelines.^(14,15) Our finding might be due to the fact that the HC/UFMG is a university hospital, reflecting greater knowledge of the guidelines for CAP. However, the low proportion of appropriate antibiotic therapy (58.9%) does not support that hypothesis.

The 30-day mortality rate in our study sample was 12.3% (n = 13). Of those 13 patients, 4 were admitted to the ICU. Other authors^(7,16) have reported 30-day mortality rates of 11.7% and 13.4%, which are similar to those found in the present study. There were no differences between the 30-day mortality rates predicted by the CURB-65 and CRB-65 scores (0-1, 2, and 3-5; and 0, 1-2, and 3-4, respectively) in the present study and those found by Lim et al. in the study validating those scores.⁽¹²⁾ This finding suggests that, albeit small, our study sample was representative.

Most (58.9%) of the patients investigated in the present study received antimicrobial treatment that was in accordance with that recommended in the 2004 Brazilian guidelines for CAP. However, that proportion was lower than were those reported in other studies involving ward and ICU patients (79.6%-84.0%).^(6,17) Previous studies have reported that guideline-concordant antibiotic therapy is associated with lower short-term mortality rates.^(7,16,17) A study conducted in Brazil showed a trend toward a reduction in the overall mortality rate after the implementation of CAP guidelines.⁽¹⁸⁾ In the present study, that was true only for the patients with a CRB-65 score of 1-2. It is possible that the same was not true for the remaining CRB-65 classes because we were unable to control factors that are known to be associated with increased mortality, such as comorbidities, time to initiation of antibiotic therapy, duration of treatment, and treatment adherence after discharge, as well as local resistance patterns.

Although we analyzed compliance with the 2004 Brazilian guidelines for CAP, it is possible to establish comparisons with guidelines published by other medical societies, as well as with the latest Brazilian national guidelines (published in 2009), because they are all similar in terms of

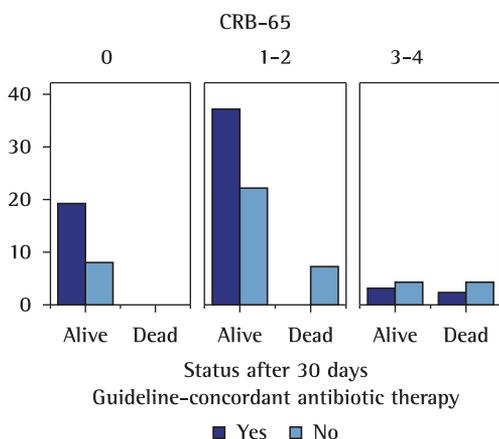


Figure 2 - Distribution of patients by antibiotic therapy (compliance or noncompliance with the guidelines) and 30-day mortality. CRB-65: mental Confusion, Respiratory rate, Blood pressure, and age ≥ 65 years.

Table 3 – Factors associated with 30-day mortality, according to Poisson regression.^a

Factors	β	SE	p	RR (95% CI)
Appropriate antibiotic regimen	-0.16	0.06	< 0.01	0.85 (0.76-0.96)
Cerebrovascular disease	0.26	0.08	< 0.01	1.30 (1.11-1.53)
Constant	1.15	0.05	< 0.01	-

RR: relative risk. ^aThe reference category is “death”.

the therapeutic regimens recommended for ward patients.^(19,20) When ward patients were evaluated separately, compliance with the guidelines was found to be slightly higher (i.e., 61.5%). Two studies evaluating ward patients exclusively found guideline-concordant antibiotic therapy in 57% and 65% of the cases.^(21,22) In those studies, guideline-concordant antibiotic therapy was found to be associated with shorter hospital stays and reduced complications. Likewise, we found a four-day reduction in the length of hospital stay among the patients who received treatment that was in accordance with the recommendations, a trend toward significance having been observed ($p = 0.066$). It is possible that the small number of patients included in our study contributed to that result. In addition, a delay in initiating antibiotic therapy might have influenced, at least in part, that result.

Among the ICU patients investigated in the present study, the rate for guideline-concordant antibiotic therapy (43.8%) was quite similar to that reported in a study evaluating ICU patients (i.e., 41%).⁽⁹⁾ However, it is of note that, in that study, the treatment regimens recommended for ICU patients were different from those recommended in the Brazilian guidelines.

Although therapeutic alternatives were available, 24 (21.4%) of the patients investigated in the present study were treated with a beta-lactam antibiotic in isolation, a regimen that is not in accordance with the guidelines. However, certain aspects should be taken into consideration. Antibiotic therapy with coverage of atypical pathogens, which consists of beta-lactam antibiotics used in combination with macrolides or a fluoroquinolone used in isolation, is not universally used in hospitalized patients with CAP. Although there is evidence that antibiotic therapy with coverage of atypical pathogens reduces length of hospital stay, time to clinical stability, and mortality, further studies have yet to confirm that. In addition, the question remains whether those outcomes are more closely related to the

immunomodulatory effect of macrolides than to the antimicrobial effect of those antibiotics.⁽²³⁾

Broad-spectrum antibiotic therapy, including the combined use of beta-lactam antibiotics and macrolides, aims at broadening the coverage of gram-negative bacteria, as well as of atypical or resistant pathogens. However, the incidence of such agents is higher in cases that are more severe, *S. pneumoniae* remaining the principal etiologic agent in CAP that is less severe (CURB-65 score, 0-1).⁽²⁴⁾ Therefore, the use of a beta-lactam antibiotic in isolation (when recommended) is reserved for low-risk patients without comorbidities or aggravating factors.^(20,25)

Although we found a significant proportion of patients receiving a beta-lactam antibiotic in isolation (i.e., 21.4%, excluding those treated for aspiration pneumonia), 66.7% of those had a CURB-65 score of 0-1 or a CRB-65 score of 0. However, we did not compare that specific group of patients with low-risk patients receiving treatment in accordance with the Brazilian guidelines in terms of outcomes. In addition, we did not analyze other aggravating factors, such as multilobar involvement on chest X-rays and the presence of hypoxemia or comorbidities, which might indicate a broad coverage in that group of patients.

Etiological investigation was performed in 32 patients (28.6%), a definitive diagnosis of CAP having been established in only 4 (3.6% of the study population). The Brazilian Thoracic Association guidelines recommend that etiological investigation be performed in patients with severe disease.⁽¹⁰⁾ However, only 10 (55.5%) of the patients with severe disease underwent microbiological investigation, bacteria having been isolated in only 1 case. The absence of a systematic protocol at the hospital under study, including all stages of care to patients with CAP, partially explains this finding.^(10,24,26) However, Ewig et al. evaluated patients with severe CAP and found that only 11 (61%) of the 18 patients considered to have severe disease were admitted to the ICU.⁽²⁷⁾ Nevertheless, patients requiring noninvasive ventilatory support

were not included. It is possible that patients were not transferred to the ICU because there were no beds available.

In the present study, the variables guideline-concordant antibiotic therapy (relative risk = 0.85; 95% CI: 0.76-0.96; $p < 0.01$) and presence of cerebrovascular disease (relative risk = 1.3; 95% CI: 1.11-1.53; $p < 0.01$) were found to be independently associated with 30-day mortality. Other authors have reported the association of comorbidities and guideline-discordant antibiotic therapy with mortality.^(7,28)

The present study has limitations, which should be pointed out. It is possible that the retrospective design contributed to the significant loss of information that might have changed the results obtained. It is possible that some cases of nosocomial pneumonia or healthcare-associated pneumonia were inadvertently included because the related characteristics were not described in the medical charts. It is possible that the study sample, which was small and consisted predominantly of patients younger than 65 years of age, was not representative of the hospital population. In addition, we did not evaluate the time to initiation of antibiotic therapy, the total treatment duration, or treatment adherence after discharge, all of which could have affected the mortality rate. The single-center nature of the present study precludes the generalization of the results obtained. Although new scores for the management of patients with CAP—such as the severe community-acquired pneumonia score, known as SCAP, and the score known as SMART-COP, created in Australia—are currently available, they had not been validated at the time of the study.^(29,30)

In conclusion, in the study population, guideline-concordant admission and treatment criteria were associated with favorable outcomes in hospitalized patients with CAP. Cerebrovascular disease, as a risk factor, and guideline-concordant antibiotic therapy, as a protective factor, were associated with 30-day mortality. Although the rate of guideline-concordant admission criteria in the present study was comparable to that reported in implementation studies, the data obtained in the present study indicate the need for implementing systematic protocols, including criteria for hospital admission, clinical assessment, antibiotic prescription, and discharge, in order

to improve the quality of care to CAP patients in Brazil.

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