ORIGINAL ARTICLE

Community-acquired pneumonia in elderly patients: adherence to Brazilian guidelines for the treatment of pneumonia*

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Background: Pneumonia is a common disease with a high mortality rate, being the sixth leading cause of death among elderly people in the USA and the fifth among those in Brazil. Initial treatment of pneumonia is usually empirical since the etiological agent is identified in only approximately 50% of cases. Therefore, several scientific societies have defined some guidelines for initial antimicrobial therapies.

Objectives: This study evaluated adherence to the guidelines set forth by the *Consenso Brasileiro sobre Pneumonias* (Brazilian Consensus on Pneumonia) for treatment of community-acquired pneumonia in hospitalized elderly patients.

Method: Fifty-four patients, aged 60 or over, hospitalized at Londrina University Hospital with community-acquired pneumonia between 2 August 1999 and 2 August 2000 were evaluated. Whether their treatment adhered or did not adhere to guidelines, the patients were compared in terms of 30-day mortality, average time for clinical stabilization, average length of hospital stay, cost of treatment and severity score.

Results: The average age was 74.1, and 61.1% of the patients were treated in accordance with the Brazilian guidelines for treatment of community-acquired pneumonia. There were no differences in length of hospital stays, cost of treatment, time to clinical stability and severity score between the two groups (adherent and nonadherent). However, there was a difference in mortality. The rate of mortality was higher in patients with pneumonia severity index (PSI) scores of IV or V who were treated according to the guidelines than in those with the same score whose treatment was nonadherent ($p = 0.04$). In general, PSI score was related to mortality. The mortality rate among patients with scores of II and III was 9.5%, compared with 30.3% in patients with scores of IV and V.

Conclusion: Adherence to the Brazilian guidelines for treatment of community-acquired pneumonia in elderly patients was satisfactory, and there was no difference in results between both groups, except for the higher mortality rate found for patients with higher PSI scores who were treated according to the guidelines. A positive correlation was found between PSI score and mortality.

Key Words: Pneumonia. Health Planning Guidelines. Community-Acquired Infections. Health Services for the Aged.

INTRODUCTION

Pneumonia continues to be the leading cause of death from infectious disease worldwide, despite advances in the medical and social areas throughout the century, as well as the availability of new antibiotics. It is the sixth cause of death among elderly people in the USA[1] and the fifth among those in Brazil. This age group presents 70% of all cases of pneumonia reported in Brazil[2]. Several factors, including age and chronic diseases, such as chronic obstructive pulmonary disease, *diabetes mellitus* and cardiac insufficiency, have been associated with pneumonia severity and mortality[1,3].

Increased life expectancy resulting from improvement in health services and basic sanitation, as well as lower birth rates, are responsible for altering the age pyramid, significantly increasing the population of elderly individuals[4], who are at greater risk for developing pneumonia due to the changes caused by the aging process itself.

When, as health care providers, we are confronted with an infectious disease, it is essential, though not always possible, to identify the etiological agent. There are several methods available For identifying etiological agents in pneumonia, various methods, such as bacterioscopy with sputum culture, serology; bacterioscopy with culture of material obtained by bronchoalveolar lavage, bronchoscopy with protected specimen brush, tracheal aspiration and fine-needle aspiration lung biopsy. Nevertheless, the etiological agent is only identified in approximately 50% of the cases[5,6,7,8,9]. Therefore, the initial therapy for the treatment of pneumonia is empirical.

Based on studies focusing on the identification of etiological agents and clinical characteristics of patients, various scientific societies have developed guidelines for the empirical use of antimicrobial agents in the initial treatment of community-acquired pneumonia[1,10,11,12,13]. If there is adherence to the recommendations, some of these guidelines are quite valuable and provide verifiable improvements in median survival, cost efficiency, length of hospital stay and other relevant clinical parameters[15]. The American and the Canadian guidelines are the ones most often referred to when judging whether patients have or have not been treated according to the guidelines of scientific societies, as well as when determining any differences in the clinical results regarding length of hospital stay, mortality and cost. At the time of this study, these guidelines recommended the use of certain antibiotics for the treatment of community-acquired pneumonia in patients who require hospitalization. These included second and third-generation cephalosporins or beta-lactam plus beta-lactamase inhibitors, either alone or combined with an antimicrobial agent of the macrolide class.

In Brazil there is no data available regarding adherence to guidelines on the treatment of pneumonia in elderly patients proposed by the *Sociedade Brasileira de Pneumologia e Tisiologia* (SBPT, Brazilian Society of Pulmonology and Phthisiology). Neither is there any data regarding differences between results from hospitalized patients with pneumonia whose treatment adhered to the guidelines and those from those whose treatment did not.

The objective of this study was to analyze the percentage of patients aged 60 or over who were hospitalized at the *Hospital Universitário Regional do Norte do Paraná* (HURNP) and treated according to the guidelines set forth by the *Consenso Brasileiro sobre Pneumonias* (Brazilian Consensus on Pneumonia). We compared the evolution of those who were treated according to the Consensus guidelines to that of those whose treatment did not adhere. Parameters evaluated included 30-day mortality, average length of hospital stay, average time to clinical stability, cost of treatment and severity score.

METHOD

This study was conducted at the HURNP, a 298-bed hospital at Londrina State University. This is a prospective case-control study, carried out from August 2, 1999 to August 2, 2000. Patients aged 60 or over who required intrahospital treatment for community-acquired pneumonia were evaluated. This evaluation was initially made by a resident or by an attending physician. After being diagnosed with pneumonia and hospitalized, these patients were evaluated by a pulmonologist. The patients were included in the study only if the pulmonologist confirmed the diagnosis, through clinical history, laboratory and radiological exams. Patients were excluded if they had recently been hospitalized (discharge within ten days of new admission), had recently taken antibiotics, were HIV-positive, were being treated with immunosuppressants, or were under corticosteroid therapy (prednisone at a dosage greater than 10 mg/day for a period of more than one month).

Data were collected daily from patient records and written on a specific protocol, with data on identification, comorbidities, severity score, initial antibiotic therapy, evolution of the patient and mortality. The following data were compared: mortality rate, average time to symptom resolution, cost of treatment, average length of hospital stay and pneumonia severity index (PSI) as a predictor of mortality.

Prior to the time of this study, the Brazilian Consensus on Pneumonia recommended certain antibiotics for the treatment of community-acquired pneumonia in patients who require hospitalization. These included second and third-generation cephalosporins or beta-lactam plus beta-lactamase inhibitors, either alone or combined with an antimicrobial agent of the macrolide class. The treatment was considered to be adherent to the guidelines when one of these antimicrobial regimens was prescribed.

The time to clinical stability was considered the period from initiation of treatment to the first day on which vital signs and clinical abnormalities met the criteria for stability for a period of 24 hours. Cardiac frequency was considered stable when less than 100 beats per minute. Arterial pressure was considered stable when systolic arterial pressure was equal to or higher than 90 mmHg. Temperature was considered stable when equal to or lower than 37.2°C. Neither oxygen saturation in ambient air nor respiratory rate were taken into consideration when determining clinical stability since these are not routinely documented in patient records at HURNP[16].

The PSI score was calculated based on the attribution of scores to three demographic characteristics, five comorbidities, five changes in physical exam results and seven laboratory and radiological findings[17].

Mortality was evaluated within 30 days of patient admission. Patients discharged prior to 30 days were later contacted by telephone or letter in order to augment the data compiled from HURNP files.

The costs of the treatments were compared according to the price of the antimicrobial agents used during intervention, as listed in the *Índice Brasileiro de Medicamentos* (Brazilian Medication Index)[18], disregarding other costs related to the hospitalized patient, such as infirmary and medical fees, diets, medication, staff, etc.

Data were collected according to a standardized protocol and were entered into an Epi-Info database, version 6.04 (October, 1997) developed by the US Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention.

For data description we applied the descriptive statistics using averages and standard deviations. The chi-square test or Fisher's exact test was used for the comparison of mortality rates, cost and clinical evolution comparisons between the two groups Values of p = 0.05 were considered statistically significant.

This study was approved by the HURNP Bioethics committee.

RESULTS

A total of 91 patients over the age of 60 and hospitalized with a diagnosis of community-acquired pneumonia were evaluated. Of those 91, 30 were excluded because the diagnosis was contradicted by a pulmonologist, who diagnosed 16 with uncompensated congestive cardiac insufficiency, 4 with chronic obstructive pulmonary disease, 4 with pulmonary neoplasia, 1 with pulmonary thromboembolism and 5 with catarrhal tracheobronchitis. Two additional patients were excluded for having used antibiotics prior to admission, 3 for previous hospitalization within the last 10 days and 2 for not producing their blood gas test results at admission, which impeded calculation of the PSI score, as prescribed for use of the method devised by Fine et al.[17]. Therefore, 54 patients were included in the study.

Overall average age of the patients evaluated was 74.4 $\pm$ 8.3 years. The average age of the patients treated according to the guidelines was 76.4 $\pm$ 8.1 years, compared with 70.5 $\pm$ 7.3 years for those whose treatment was nonadherent, a statistically significant difference of p = 0.007. Slightly more than half of the patients (53.7%) were women. Most of the treatments (67%) adhered to the guidelines set forth by the *Consenso Brasileiro sobre Pneumonias.*

There were no differences found between the PSI scores of patients treated according to the guidelines and the PSI scores of those whose treatment was nonadherent (Table 1). However, among patients treated according to the guidelines and having higher PSI scores (IV and V), the mortality rate was higher. A positive correlation was found between PSI score and mortality (Table 2).

In relation to clinical stability, there were no differences between the two groups in any of the clinical parameters evaluated. Furthermore, there were no differences regarding average length of

hospital stay, which consisted of 11 $\pm$ 7 days for patients receiving adherent treatment and 11.5 $\pm$ 6.4 for those receiving nonadherent treatment (p = 0.793; Table 3).

The cost of treatment according to the antimicrobial agents used was equal for both groups (Table 4).

Table 5 shows that there were no differences in patient distribution based on the presence of comorbidities between the two groups.

Adherence to the guidelines set forth by the Brazilian Consensus on Pneumonia for elderly patients who require hospitalization for community-acquired pneumonia was 61.1%. Although most of the patients were treated according to the guidelines, we did not observe statistically significant differences for the parameters time to clinical stability, length of hospital stay, cost of treatment or PSI score. Regarding mortality, differences were found between adherence and nonadherence for patients with higher PSI scores (VI and V). A higher mortality rate was found for the group of patients treated according to the guidelines and presenting higher PSI scores than for the group with the same PSI scores and receiving nonadherent treatment.

The design of this study allowed observational evaluation of adherence to a given treatment. Other observational studies have found similar rates of adherence to pneumonia guidelines. Although these studies had evaluated adherence to guidelines established by other societies (American Thoracic Society, Canadian Thoracic Society, and Canadian Infectious Diseases Society), similarities among guidelines allow us to make comparisons. In a study evaluating 20 Canadian hospitals (eleven university hospitals and nine community hospitals), 79.8% of the patients were found to have been treated according to the American guidelines, with wide variation in their application (47.9% to 100%)[19]. Marras et al.[20] reported an 80% adherence to the guidelines set forth by the American Thoracic Society, the Canadian Infectious Diseases Society and the Canadian Thoracic Society. An evaluation of 2,963 patients in 72 non-teaching hospitals in the USA[21] demonstrated that 81% of the patients were treated in accordance with the American guidelines.

In other studies that included patients of all ages[19,21,22], average age was similar to that seen in the present study, which evaluated the geriatric population alone, implying that pneumonia prevails in the elderly population. In Brazil, 70% of all pneumonia occurs in individuals older than 60 years[2]. Jokinen et al.[23] found an incidence of 20 cases of pneumonia for every 1,000 inhabitants older than 60 and only 1 to 5 cases for those between 5 and 60. Cohort studies also allow the evaluation of prognosis and treatment. However, since this is an observational study, some biases may occur in the choice of treatment and consequently in the results. In this study, a potentially confusing variable, comorbidities and pneumonia severity, was controlled through the inclusion of PSI scoring, a proven instrument which is used worldwide. The PSI scores were similar in the two groups. However, a positive correlation between PSI score and mortality rate was found. The mortality rate was 30.3% for patients with higher scores (IV and V) and 9.5% for patients with lower scores (II and III). Other authors also found the same correlation. The mortality rate described by Fine et al. [17] was 0.1% to 2.8% for classes I to III and 8.3% to 29.6% for classes IV and V, respectively. In another study[22], with 244 patients, in agreement with Fine et al. criteria, the authors found a mortality rate of 9.9% and 25% for classes IV and V, respectively. This correlation was also reported by Feagan et al.[19], who found a mortality rate of 22.4% for patients with scores IV and V, 0% for those with scores I and II and 3.3% for those with score III. Gleason et al.[24] described a mortality rate of 47.7% for patients with scores IV and V, with a significant difference in mortality in comparison with patients presenting lower scores.

Although adherence to the guidelines for the treatment of pneumonia in this study was similar to that found in other studies, the results of other measured variables are conflicting. When the parameter evaluated was length of hospital stay, no difference was found in this or other studies between the group of patients whose treatment adhered to the guidelines and those whose treatment was nonadherent (there was no reduction in length of hospital stay with greater adherence to guidelines)[20,24]. However, other researchers[25] found a reduction of 2.5 days in length of hospital stay when patients used the antibiotics recommended by the American guidelines in combination with antibiotics of the macrolide class. Patients who used third-generation cephalosporins alone presented no reduction in length of hospital stay. A contrasting finding came from Burgess & Lewis[26], who found no difference in length of hospital stay between patients who used the combination above and those who used third-generation cephalosporins alone. A possible cause for our inability to find a difference in length of hospital stay between the two groups may be the fact that, since HURNP is a teaching hospital,

the patients studied were of low socioeconomic status. Due to the cost of the treatment, it is often impossible for a patient who is discharged early to continue treatment as an outpatient.

Higher 30-day mortality was found for patients with higher PSI scores (IV and V) treated in accordance with the guidelines than for patients whose treatments did not adhere to the guidelines and who presented the same scores. This difference may also be explained by the age difference between the two groups, rather than simply by adherence or nonadherence to the guidelines. Dudas et al.[21] observed an increase of 1.6 in relative mortality risk per decade of age. The size of the sample did not allow analysis of variance, which would have revealed whether age was a determinant of mortality in our study. Although a tendency, rather than a statistically significant difference, was found in relation to altered level of consciousness, this may represent another determinant of mortality. Lim et al.[27], based on the determinants of severity for community-acquired pneumonia according to the British Thoracic Society, found, in a multivariate analysis, that altered level of consciousness is indeed a determining factor for mortality. Houston et al.[28] also showed that a change in level of consciousness is correlated with higher mortality.

Apart from the age difference and the change in level of consciousness, other factors may be have influenced our results. In particular, the etiological agent and the period between the admission to the hospital and the introduction of antibiotics (parameters that were not evaluated in this study), may have also been partially responsible for the difference in mortality between the two groups. Another study[28] showed that the use of antibiotics within the first eight hours after hospital admission reduces mortality in 30 days (reducing relative risk by 15%). Other authors[21][20] have also concluded that a delay of eight hours or more in the administration of antibiotics after admission to the hospital increases relative mortality risk by a factor of 1.9. In the most recent guidelines published by the Infectious Diseases Society of America, the introduction of an antimicrobial agent within the first eight hours is recommended for patients who require hospitalization[29].

No difference was found between the two groups in the cost analysis of the antimicrobial agents used. However, Gleason et al.[26] suggested that use of the antimicrobial agents recommended by the American guidelines for treating patients older than 60, increased the cost of the treatment by ten times when compared with not using those agents. Since disease severity probably differs between the two populations (inpatients and outpatients), it is difficult to compare the cost of the treatment, although the authors did not evaluate PSI scores. In addition, the authors only evaluated the cost of the antimicrobial agent prescribed in their research. In the present study, the cost was calculated for all antimicrobial agents prescribed during hospitalization.

Until recently, guidelines were developed solely on the basis of the opinions of specialists and data in the literature, although not on data from randomized studies. Randomized studies comparing antimicrobial regimes recommended by the guidelines to the new quinolones, for both inpatients and outpatients, have now been published. These studies have shown similar results, sometimes favoring the quinolones, when length of hospital stay, mortality and cost savings were evaluated[30].

Based on the results of these studies, the Canadian Infectious Diseases and the Canadian Thoracic Society published new guidelines for the treatment of pneumonia that recommend use of the new quinolones[30]. The SBPT has also recently published new guidelines that sanction the use of quinolones[31].

One of the authors of the Canadian guidelines emphasized the need for randomized studies to constantly reevaluate the guidelines. The management of respiratory infections is a dynamic process, since new pathogens frequently emerge and known pathogens become resistant to antimicrobial agents[32]. In light of these factors, as well as the fact that there are great variations in etiological agents by location, there is also a need for reevaluations to be performed locally.

The treatment of pneumonia is complex. Future studies should evaluate the etiological agents most frequently encountered in the respective institutions. In addition, proven instruments, such as PSI scoring, should be used for comparison among groups of patients, and the recommended antibiotic therapy should be initiated as rapidly as possible.

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TABLE 1
**Distribution of patients according to pneumonia severity index score
and adherence to the Brazilian Consensus on Pneumonia**

PSI	ADHERENCE		NO ADHERENCE		p
	n	%	n	%	
II and III	12	36.4%	9	42.9%	0.741
IV and V	21	63.6%	12	57.1%	0.844
TOTAL	33	100%	21	100%	

PSI: pneumonia severity index

TABLE 2
**Thirty-day mortality according to adherence to the Brazilian Consensus on Pneumonia
and the pneumonia severity index**

PSI	ADHERENCE				NO ADHERENCE				TOTAL			
	DEATH		SURVIVAL		DEATH		SURVIVAL		DEATH		SURVIVAL	
	N	(%)	N	(%)	N	(%)	N	(%)	N	(%)	N	(%)
II and III*	1	(4.8)	11	(52.4)	1	(4.8)	8	(38)	2	(9.5)	19	(90.5)
IV and V**	9	(27.3)	12	(36.4)	1	(3)	11	(33.3)	10	(30.3)	23	(69.7)
TOTAL	10	(18.5)	23	(42.6)	2	(3.7)	19	(35.2)	12	(22.2)	42	(77.8)

*$p = 0.68$
**$p = 0.04$
PSI: pneumonia severity index

TABLE 3
**Distribution of patients according to average time to clinical stability
and adherence to the Brazilian Consensus on Pneumonia**

AVERAGE TIME FOR CLINICAL STABILIZATION (IN DAYS)			
CLINICAL PARAMETERS	ADHERENCE	NO ADHERENCE	p
CARDIAC FREQUENCY	1.6±1.3	1.3±1.0	0.374
SYSTOLIC ARTERIAL PRESSURE	1.7±1.9	1.0±0.7	0.412
TEMPERATURE	2.1±1.3	2.5±2.7	0.277

TABLE 4
Average cost of antibiotics used according to the adherence to the Brazilian Consensus on Pneumonia

	ADHERENCE	NO ADHERENCE	p
COST IN BRAZILIAN REALS	1241.35 ± 1069.60	1282.31 ± 1012.38	0.918

TABLE 5
Distribution of patients according to the presence of comorbidities and clinical alterations and adherence to the Brazilian Consensus on Pneumonia

	ADHERENCE		NO ADHERENCE		p
	n=33	(%)	n=21	(%)	
SEPSIS	20	(60.6)	14	(66.7)	0.652
COPD	9	(27.3)	9	(42.9)	0.249
CCI	12	(36.4)	5	(23.8)	0.331
CVA	8	(24.2)	6	(28.6)	0.724
NEOPLASIA	3	(9.1)	2	(9.5)	0.668
DIABETES MELLITUS	5	(15.2)	2	(9.5)	0.556
KIDNEY DISEASE	1	(3)	0	(0)	0.423
LIVER DISEASE	2	(6.1)	0	(0)	0.681
ALTERED CONSCIOUSNESS	8	(24.2)	1	(4.8)	0.065
RF > 30	9	(27.3)	9	(42.9)	0.248
SP < 90	3	(9.1)	0	(0)	0.152

COPD: chronic obstructive pulmonary disease; CCI: congestive cardiac insufficiency; CVA: cerebral vascular accident; RF: respiratory frequency; SP: systolic (arterial) pressure.