

# Community-acquired pneumonia in adult patients admitted to Horta Hospital

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### Abstract

This study aim was to acquire clinical and analytical data in adult patients with community acquired pneumonia requiring hospitalization, and to evaluate the prognostic influence on mortality end-points available in an emergency unit of a small regional hospital.

A four year study (1990 – 93), including all patients consecutively admitted with a diagnosis of community acquired pneumonia selected by retrospective review of the Horta Hospital records, was carried out. Clinical, analytical and demographic data, available on admission and recorded in the medical records was analyzed. Using logistic regressions, the prognostic factors from medical data, recorded on admission showing univariate associations with mortality were analyzed.

88 patients were included in the study, representing 4 percent

of all admissions in the Department of Internal Medicine. Three cases per 1000 inhabitants were admitted in 1990, and this ratio decreased to 1.5 per 1000 inhabitants in 1993. The mean age was 64+17 (range: 20 – 92); 41% were male and 59% female. Seven patients (8%) died because of respiratory failure or sepsis. The prognostic factors associated with mortality were: chronic ethanol intake, leukocytes > 15 x 10<sup>9</sup>/L, glucose > 6.8 mmol/L, urea nitrogen > 7.2 mmol/L, creatinine > 110 mmol/L, LDH >, LDH >50 U/L, AST > 40 U/L, pH < 7.30, PaO<sub>2</sub> < 7.33 kPa and PaCO<sub>2</sub> > 6 kPa. In the multivariate analysis elevation in PaCO<sub>2</sub> and LDH, remained significant.

Keywords pneumonia, prognostic factors, mortality.

### Introduction

Community-acquired pneumonia (CAP) is a common entity. It represents between 1% and 16% of all reasons for visits to General Practitioners, and can account for around 2.8% of total admissions in some hospitals.<sup>1-3</sup>

Despite the advances in diagnostic techniques and the introduction of wide-spectrum antibiotics, this disease is still a major cause of mortality in developed countries, accounting for around 4% to 24% of fatal cases among the patients requiring hospital admission, according to various review series.<sup>4-9</sup> It is logical to assume that this variation in mortality directly attributable to CAP may be related to the degree of differentiation between hospitals, the severity criteria used for admission, and the type of population referred to them.

Its annual incidence is not clearly known, since carrying out large population studies is difficult, and also, there are clear variations depending on the patient's social and geographical environment. Furthermore, the numerous studies describing case series at each hospital, which are far from being a complete reflection of the existing cases in the areas they serve, are not entirely reliable since the criteria for admission are not universally defined.

The initial therapy for this type of pneumonia is almost always empirical. This is because, on one hand, not all medical institutes are equipped with specific diagnostic tools, and on the other, the chance of detecting the causal agent is low. In fact, blood cultures are positive in only 25% of cases; serology methods are not always available and the results are slow to obtain, the isolation of a certain microorganism in the bronchial secretions, even after completion of a fibroscope technique, does not ensure that this microorganism is the actual agent responsible for the pathology in question.<sup>10</sup> Thus, antibiotics are selected based on a general opinion expressed in the literature, which targets the most probable microorganisms, after taking into consideration the social environment, geography, clinical-radiological characteristics of the case, the patient's age, and the existence of other underlying diseases.<sup>11</sup>

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Received for publication on 12<sup>th</sup> July 1996

In a time when the theme of rationalization in Medicine has resulted in so much effort on the part of the bodies responsible, the main challenge facing doctors is to determine, with as little error as possible, which patients with underlying diseases require inpatient treatment in hospitals, including in more intensive form, from those who can benefit from outpatient treatment. This new approach of Hospital Medicine has been an object of research and protocols, in which attempts have been made to include patients with CAP who, based on their socio-cultural characteristics and the characteristics inherent to the primary pulmonary pathology itself and the associated diseases, can be treated in an outpatient setting, even with parenteral therapy.

Horta Hospital has 120 beds serving directly a population of approximately 15,000 people living on the island of Faial. Its catchment area also includes 36,000 people from the islands of Pico, Flores and Corvo. Even though the hospital has a Clinical Pathology laboratory, it has insufficient human and technical resources in the field of Microbiology. Despite these limitations, we conducted a retrospective study to investigate the clinical and laboratory characteristics of the patients who were hospitalized after being diagnosed with CAP, and fundamentally, the prognostic factors related to their mortality. Our aim, therefore, is to create a protocol for future validation that will allow us to classify our risk population based on clinical and laboratory data that would be easy workable at the time of admission.

### Population and methods

The population sample was obtained retrospectively between 1990 and 1993 from the records on file at Horta Hospital, in which pneumonia was reported as the main diagnosis. This was the diagnosis when the patient had a chest X-ray with a “new” pulmonary infiltrate and at least one of the following major symptoms was detected: fever, cough or expectoration, or two of the following minor symptoms: dyspnea, chest pain, mental alterations, pulmonary consolidation auscultation or leucocytosis.<sup>12</sup> A priori, all cases of hospital-acquired pneumonia were excluded, that is, the onset of clinical-radiological conditions 48 hours after admission, in patients who were 18 years old or under, cases of proven tuberculosis, pulmonary abscess, patients with human immunodeficiency virus and those with underlying neoplasm.

The demographic data reported were gender and age; the clinical data collected were the existence of a previously known pathology, for example, chronic obstructive pulmonary disease, congestive heart failure, diabetes or regular drinking habits (qualified based on regular consumption of alcohol) and during the observation in hospital, alterations in consciousness (confusion, agitation or stupor), breathing difficulty (based on complaints of dyspnea and/or the presence of tachypnoea), chest pain, purulent expectoration, hemoptyses, axillary temperature, and systolic and diastolic blood pressure. The laboratory data considered on admission were hemoglobin levels (Hb), leukocyte count, serum glucose levels, urea, creatinine, sodium, total bilirubin, lactate dehydrogenase (LDH), aspartate transaminase (AST), pH, and arterial PaCO<sub>2</sub> and PaO<sub>2</sub>. The population demographics were based on the 1991 Azorean census.<sup>13</sup>

The recorded variables were studied based on cure or demise of the patients. The software SPSS/PC+14 was used for statistical purposes. The average results are given with their standard deviations and limit values (lim). The confidence intervals (CI) presented are 95%.

For the analysis of discontinuous variables, the chi-squared test was used, with Fisher's test for the small samples. For the continuous variables, the Student t test was used in case of normal distribution, otherwise the Mann-Whitney Test was applied. A significance of  $p < 0.05$  was considered.

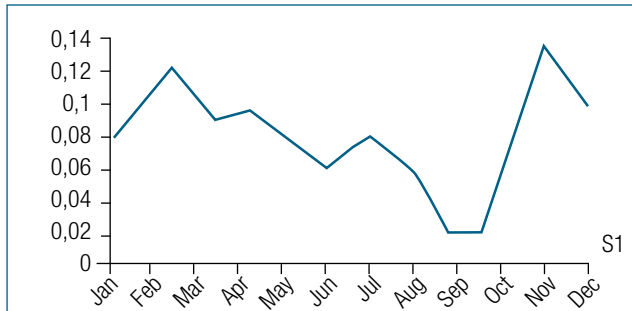
The statistically significant variables in the univariate analysis were subjected to multivariate analysis, following the model of logistic regression.

The prognostic utility of the significant variables in the logistic regression analysis was estimated by calculation of sensitivity, specificity, predictive positive and negative values, and global precision index.<sup>15</sup>

### Results

Between 1990 and 1993, eighty-eight patients with CAP were admitted to Horta Hospital. All of these patients had been attended by the Internal Medicine Service and were all residents of the island of Faial.

The population of this island aged 17 years or over was 10,723 inhabitants. Thus, approximately three cases per 1,000 inhabitants were admitted to hospital in 1990, and this figure dropped to half in 1993. Respectively, from 1990 to 1993, a total of 30, 24, 18 and 16 patients were successively hospitalized;



Percentage distribution over the months of the cases of community-acquired pneumonia admitted to Horta Hospital.

FIG. 1

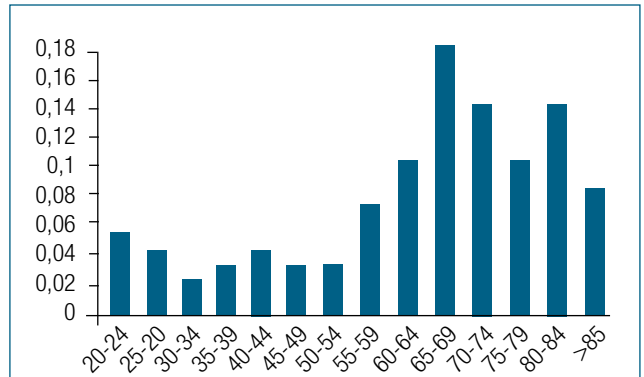
a decrease in the number of admissions was observed over the course of this study.

Considering that during that time 2,259 patients were hospitalized in the same department, 1,350 of whom were referred by the Emergency Department, the cases of CAP accounted for around 4% (CI: 3-5) of all the admissions to the ward and 6.5% (CI: 4.5-8) of the cases referred from the emergency unit. In regards to the total number of emergencies dealt with at this hospital, the cases of CAP that needed hospitalization accounted for less than 0.2%. It should be noted that at the Emergency Unit of the hospital there is also a Permanent Support Service managed by family doctors.

The percentage distribution of these cases over the months of the year is shown in *Fig. 1*. As it can be observed, a greater number of admissions (44% of the cases) are seen between November and February.

Of the total patients, 41% (CI: 30-51) were male and 59% (CI:48-69), female. The average age of the patients was 64 + 17 (lim: 20-92; CI: 62-66) years. The average age for males was 63 + 16 (lim: 21-92), and for females, 66 + 20 (lim: 20-87) years. The comparison of mean ages between both groups was not significant. *Fig. 2* shows the patient's age distribution by class intervals. It can be observed that around three quarters of the cases were aged over 59 years and the peak age was between 65 and 74 years.

Approximately 6% of the patients had a family history of hospitalization due to pneumonia and around two thirds had one or more known underlying chronic pathologies: 41% (CI: 30-52) had chronic obstructive pulmonary disease, 25% (CI:16-35) had congestive



Distribution by age ranges of the cases of community-acquired pneumonia admitted to Horta Hospital.

FIG. 2

heart failure, 13% (CI: 6-21) had diabetes and 38% (CI:26-50) had regular drinking habits. In relation to the latter, the exact daily intake of alcoholic drinks was not quantified.

The symptoms identified on admission were changes in consciousness in 27% of the patients (CI: 18-37%) – though in this case, it was not possible to determine the patient's mental state prior to the onset of infection –, breathing difficulties in 73% of cases (CI: 62-82), chest pain in 23% (14-33), purulent expectoration in 35% (CI: 24-45) and hemoptysis in 7% (CI: 2-14).

In terms of clinical indications recorded, 48% of the patients had an axillary temperature below 37.5°C, around 9% had systolic blood pressure below 100 mm Hg and 19% had diastolic blood pressure below 70 mm Hg. The clinical data are shown in *Table 1*.

The analytical Hb and leukocyte count, as well as glucose, creatinine, urea, sodium, total bilirubin, serum LDH and AST and pH, arterial PaO<sub>2</sub> and PaCO<sub>2</sub>, are shown in *Table 2*.

The parenteral antibiotic most frequently administered was penicillin G as monotherapy in 69% of cases, or penicillin G in combination with aminoglycoside in 30% of the patients. This was followed by cephalosporin as monotherapy in 23% of the cases and macrolide in 4%. The duration of antibiotic treatment was between 7 and 15 days.

The average hospitalization time of these patients was 13 + 8 (lim: 1-43) days, with an average time at the service of 11.5 days, in this same period.

TABLE I

Clinical data for patients hospitalized due to community-acquired pneumonia

Clinical data	Total group	Survivors	Deceased	P
Age	64 ± 18	64 ± 18	70 ± 10	NS
Male	41%	59%	57%	NS
Heart disease	25%	23%	57%	NS
Pulmonary disease	41%	40%	57%	NS
Diabetes	13%	13%	16%	NS
Alcohol consumption	38%	33%	85%	0,01
Change in consciousness	27%	23%	71%	NS
Respiratory changes	73%	70%	87%	NS
Chest pain	23%	25%	14%	NS
Expectoration	35%	34%	42%	NS
Hemoptysis	7%	7%	00%	NS
Axillary temperature	37.9 ± 1.1	37.9 ± 1.1	37.9 ± 1.3	NS
Systolic BP	140 ± 30	140 ± 30	130 ± 20	NS
Diastolic BP	77 ± 15	75 ± 15	80 ± 15	NS

The above average values are followed by their respective standard deviations.  
Axillary temperature (°C); BP: blood pressure (mmHg); NS: not significant

Of the 88 patients, 7 died, the mortality rate attributable to pneumonia being approximately 8% (CI: 3-15). Of these, 43% died within the first 72 hours of hospitalization. The overall mortality rate for the service, in the same period, was 10%. The deceased patients had an average hospitalization time of 6 + 5 (lim 1-16) days, compared to 14 + 8 (lim: 12-43) days for the surviving group. Based merely on clinical and analytical data, the causes of death were acute respiratory failure and/or septic shock.

In the univariate analysis, the clinical and laboratory factors related to mortality were regular consumption of alcohol, leukocyte count, serum glucose levels, urea, LDH, AST, pH and arterial PaO<sub>2</sub> and PaCO<sub>2</sub>, as shown in *Tables 1 and 2*. It can be observed that changes in consciousness (p=0.058), previous existence of congestive heart failure (p=0.052) and serum creatinine level (p=0.054) were not statistically significant, perhaps due to the small sample size.

Taking the analytical parameters with statistical significance as discontinuous variables, significant differences can be observed between the group of

surviving and deceased patients for the following discriminative values: leukocytes > 15,000/mm<sup>3</sup> (p < 0.01); glucose > 125 mg/dL (p < 0.05); urea > 40 mg/dL (p < 0.05); LDH > 350 U/L (p < 0.001); AST > 40 U/L (p < 0.001); pH < 7.30 (p < 0.05); PaO<sub>2</sub> < 55 mm Hg (p = 0.05) and PaCO<sub>2</sub> > 45 mm Hg (p < 0.05).

In the multivariate analysis, the LDH and PaO<sub>2</sub> values remained as independent prognostic factors, as shown in *Table 3*. With this model, a good overall classification of the cases can be observed, mainly at the cost of the accurate percentage of surviving patients.

Considering the latter two factors, their predictive values on mortality are presented in *Table 4*.

## Discussion

Despite the diagnostic and therapeutic advances in recent years, CAP is still one of the primary causes of death, and the primary one cause of infectious diseases in western countries.<sup>16</sup> Its actual incidence, even based on hospital statistics, is difficult to determine, since it

is a condition that can disappear without treatment; it is sometimes reported as a non-specific respiratory infection, and it can also be treated in an outpatient setting by the family doctor or hospital emergency service. In fact, only 10% to 60% of the patients that seek an Emergency service are admitted to hospital.<sup>17-20</sup>

However, some authors estimate that this figure can range from 0.4 to 4 new cases for every 1,000 inhabitants/year.<sup>2,8,21</sup> More precisely, in Spain, the data published in a multicentre trial indicate a figure of 3 cases a year to every 1,000 inhabitants.<sup>22</sup> On other hand, trials carried out in the United Kingdom indicate that 1 in every 1,000 inhabitants would be hospitalized due to CAP.

Our results do not allow us to draw conclusions on the incidence of the disease. However, we can affirm that around 3 cases to every 1,000 inhabitants with CAP were admitted to Horta Hospital in 1990, and that this incidence decreased by approximately half from 1990 to 1993. We do not know whether this decrease is due to a smaller number of new cases, with fewer patients being admitted to hospital, or to

TABLE II

Laboratory data	Total group	Survivors	Deceased	P
ESR (mm/1st hour)	68 ± 38	69 ± 37	54 ± 40	NS
Hemoglobin (g/dL)	12.9 ± 2.5	12.8 ± 2.5	13.6 ± 1.6	NS
Leukocytes (x10 <sup>3</sup> /mm <sup>3</sup> )	13.7 ± 2.5	12.2 ± 6.7	19.1 ± 1.4	0.03
Prothrombin time (sec)	14 ± 1.5	14 ± 1.5	15 ± 1.4	NS
Glucose (mg/dL)	137 ± 58	122 ± 55	180 ± 72	0.04
Urea (mg/dL)	45 ± 29	40 ± 21	88 ± 46	0.01
Creatinine (mg/dL)	0.9 ± 0.3	0.9 ± 0.2	1.2 ± 0.6	NS
Sodium (mEq/L)	136 ± 5.6	136 ± 5.5	136 ± 1.3	NS
Bilirubin (mg/dL)	1.0 ± 0.7	1.1 ± 0.7	0.8 ± 2.1	NS
AST (U/L)	32 ± 49	23 ± 18	116 ± 100	0.01
LDH (U/L)	292 ± 169	263 ± 112	549 ± 211	0.001
pH	7.36 ± 0.07	7.37 ± 0.07	7.29 ± 0.09	0.02
PaO <sub>2</sub> (mm Hg)	65.1 ± 20	67.5 ± 19	47 ± 15	0.01
PaCO <sub>2</sub> (mm Hg)	48 ± 17	45 ± 15	65 ± 20	0.007

The above average values are followed by their respective standard deviations. ESR: Erythrocyte sedimentation rate; AST: aspartate transaminase; LDH: lactate dehydrogenase; NS: not significant

stricter selection criteria for hospitalization. It can be observed that the mortality rate remained virtually consistent, with 2 fatal cases a year, except in 1991 when only one patient died, which can be interpreted as an increase in mortality relative to the number patients hospitalized. This fact suggests the existence of stricter selection criteria for hospitalization, i.e. more severe cases, but the data we have available to us are not conclusive.

It is important to highlight that on average, over the four-year period, patients hospitalized with CAP accounted for 4% of all hospitalizations in the Internal Medicine Service, which is similar to the figures

TABLE III

### Statistically significant variables in the logistic regression analysis

Parameters	Coefficient b +SD	Odds Ratio	P
LDH	0.0431 +0.022	1.044	<0.001
PaCO <sub>2</sub>	0.1173 +0.069	1.124	<0.05

SD: standard deviation. b0: 21.371 +11. Cases of survivors accurately classified: 95%; cases of deceased accurately classified: 67%; total cases accurately classified: 93%

reported by other authors - approximately 5%.<sup>23</sup>

The identical distribution between genders, and the constant higher prevalence in the first months of the year, which we observed in our cases, are also reported in similar articles.<sup>23-25</sup>

In this investigation of prognostic factors, we considered only some of the clinical and laboratory parameters that are usually recorded at the time of admission and that have been object of study in other studies.<sup>6,9,26-28</sup> This is a retrospective analysis, and as such, is clearly not designed specifically for that purpose. As a result, the non-inclusion of some of the clinical and laboratory parameters that are considered important by other authors, and the possible inaccuracy in the evaluation of the patient's subjective symptoms and family history, obliges a careful interpretation of the definitive results. We are aware that these factors limit our conclusions, since

we do not know whether, had we had included all the major parameters, especially in the multivariate analysis, they could have been related to the final prognosis of these patients.

Due to technical difficulties, and also because they were not part of the scope of this study, culture tests and isolated germs were not analyzed. Nevertheless, bearing in mind that in general, all the techniques used have little sensitivity, in most of the studies it is difficult to conceive that the classification of the germ is a constant datum for all patients, despite the relevance of this fact for the prognosis of pneumonia.

There are certain severity criteria that are usually associated with CAP, reported in the classic literature.<sup>6,10,17,21,24,26,28-31</sup> We address these below, comparing with our results.

These studies suggest as risk factors: old age, obnubilation, tachypnoea, hypotension, leukocytosis or leukopenia, high urea levels and hypoxemia, and more inconsistently: fever, absence of chest pain, low hematocrit, elevated liver enzymes, hypoalbuminaemia, acidosis, immunosuppression, underlying disabling diseases or the type of the etiological agent. However, the conclusions are not unanimous, as can be observed in *Table 5*. The disparity in the deter-

TABLE IV

Discriminative values related to mortality for the independent parameters obtained by multivariate analysis

Parameters	S	E	PPV	NPV	OP	OR
LDH>350 U/L	0.71	0.93	0.56	0.97	0.91	35
PaCO <sub>2</sub> >45 mm Hg	0.86	0.65	0.29	0.97	0.68	11

S: sensitivity; E: specificity; PPV: positive predictive value; NPV: negative predictive value; OP: overall precision; OR: Odds Ratio

mination of the most important prognostic factors, especially in the multivariate analysis, is undoubtedly associated with the type population studies, and the parameters included in the statistical studies. On the other hand, the patient's social class, the evolution time of the disease, the possibility and type of previous therapy with antibiotics, the possibility of polymicrobial infection and its onset, the complications and interurrences, the type of hospital and the technical tools it possesses, or even the admission criteria have not always been considered. As for us, these factors deserve special attention as they cannot be dissociated of the infection evolution and outcome of the infectious disease.

The criteria that lead to admission of patients with

TABLE V

Results of some studies on the prognostic factors of community-acquired pneumonia published in the literature

Prognostic factors	UA/MA10	UA/MA24	UA/MA26	UA/MA28
Age	Yes/Yes	Yes/No	Yes/No	Yes/Yes
Absence of chest pain	Yes/Yes	Yes/No	Yes/No	Yes/No
Obnubilation	Yes/Yes	NR	No/No	Yes/Yes
RR >30/min	Yes/Yes	NR	Yes/Yes	NR Yes/
Diastolic BP	Yes/Yes	NR	Yes/Yes	No
Urea	Yes/Yes	NR	Yes/Yes	Yes/Yes
Albumin	Yes/No	Yes/Yes	Yes/No	Yes/No
PaO <sub>2</sub>	Yes/No	NR	Yes/No	Yes/No
PaCO <sub>2</sub>	NR	Yes/No	NR	Yes/No
pH	Yes/No	NR	NR	Yes/Yes
LFT alterations	Yes/No	NR	No/No	Yes/Yes

UA: univariate analysis; MA: multivariate analysis; RR: respiratory rate; BP: blood pressure; LFT: liver function tests; NR: not reported

CAP have a major affect on mortality rate, since more rigorous selection of patients will, logically, correspond to higher mortality. Although there are no universal criteria, many hospitals follow the severity parameters suggested by the quality control commissions of the United States,<sup>33</sup> as described in *Table 6*. However, also these criteria are insufficient, as 37% of the patients in outpatient treatment had a complicated evolution.<sup>17</sup> *Table 7* shows some indications relating to admission of patients with CAP that have been proposed by other authors.<sup>17,18</sup>

Chronic alcoholism is one of the disabling diseases pointed out in the literature as possibly having an influence on the mortality of these patients. In our analysis, regular drinking habits was a prognostic parameter in the univariate analysis. However, subjectivity in the collection of this data, whether due to omission patient, or to the non-quantification of the amount of alcohol consumed, partly limits our conclusions. It is worth noting that in some of the abovementioned studies, in which this parameter was not taken into consideration, altered liver enzymes, such as AST, were independent factors in their analysis. However, altered liver function can also be a consequence of sepsis.

Leukocytosis was also closely linked to higher mortality. In the literature, the proposed discriminative value is often 15,000/mm<sup>3</sup>, as observed in our patients. It should be pointed out that in our case series, one patient had leukopenia, therefore this could not be tested.

Unlike a history of diabetes, glycaemia level above 125 mg/dL was also correlated with a poorer prognosis. On the other hand, the existence of diabetes was not correlated with the final prognosis. This may suggest that perhaps a diabetic condition, with no complication caused by the primary infection, is not, in itself, an unfavorable factor. In the literature, the discriminative value for hyperglycemia also lacks consensus.

Although it can be related to previous kidney disease, urea can be a result of renal hypoperfusion secondary to hypotension, either due to a decrease in the peripheral vascular resistance during

TABLE VI

**Admission criteria for community-acquired pneumonia of the American Quality Control Commissions (Adapted from 33)**

Clinical and analytical parameters
Vital signs indicating severity: HR>140/min; systolic BP<90 mmHg; RR>30/min
Recent changes in consciousness: disorientation; stupor or coma
Concomitant disease requiring hospitalization, independent of the pneumonia
PaO <sub>2</sub> <60 mmHg (FIO <sub>2</sub> : 21%)
Pneumonia with purulent infection: empyema, meningitis, endocarditis, arthritis, etc.
Recent and serious analytical changes: Sodium <130 mEq/L; Hb <10 g/dL; WBC <1000/mm <sup>3</sup> ; urea >50 mg/dL; creatinine >2.5 mg/dL.
HR: Heart rate; BP: Blood pressure; RR: Respiratory rate; Hb: Hemoglobin; WBC: White blood cells

sepsis or to dehydration. Also, a level above 40 mg/dl was related to a more ominous prognosis in the multivariate analysis. The discriminative values most frequently reported were between 36 and 50 mg/dL.

Although AST was significant in the univariate analysis, it had no final statistic association in the multivariate analysis. The conclusions drawn from its values in the different studies are, likewise, not unanimous.

High LDH was another statistically significant factor in the univariate analysis, being an independent factor in the multivariate analysis. In spite of its non-specificity, this enzyme can indicate a certain degree of tissue destruction, in this case, of the lung and/or liver tissue.

Lastly, other authors report that acidosis, hypercapnia and hypoxemia, can also have an influence

on mortality. PaO<sub>2</sub> and pH had only significant values in the univariate analysis, while PaCO<sub>2</sub> remained as an independent prognostic factor. It is important to observe that the mean PaO<sub>2</sub> value was previously low in all the groups, and it is possible that the high average age of the sample, and the high percentage of smokers in this population, play an important role. On the other hand, hypercapnia can be a reflection of muscle fatigue and a prelude to imminent respiratory failure, although chronic alterations in ventilation/perfusion can also cause this parameter to be higher. The direct non-correlation between PaCO<sub>2</sub> and pH could be explained by

previous compensatory mechanisms, which would cause this parameter to remain the same over some time, in patients with chronic pulmonary pathology. A more detailed study of gasometry, for example, bicarbonate ion concentration, would be valuable.

Other commonly accepted prognostic factors that were not considered in the present study are age above 60 years, changes in upper functions, congestive heart failure and diastolic blood pressure below 60 mmHg.

As for age, its relation to mortality is questionable.<sup>10</sup> Moreover, no unanimity is seen for the discriminative values, which range from 40 to 75 years. In our case, age was not a relevant factor either, but it should be noted that in the majority of studies, the patients were elderly and were grouped in the same age range. In terms of alterations in upper functions, this parameter was slightly significant, like heart failure. Nevertheless we must not neglect to mention that due to the retrospective nature of this study, its accurate definition is difficult. It is known that cognitive impairment often contributes to a delay in the diagnosis of pneumonia, and that particularly among the elderly, it can represent its form of presentation. However, it is difficult to determine in previously uncollaborative patients, or in those whose previous mental condition cannot be determined, as we believe this data is highly subjective, except in cases where it can be clearly observed. As for the diastolic blood pressure value, it is possible that its statistical power was also minimized by the small size sample. However, in the case of diastolic blood pressure, we believe that it can be difficult to establish discriminative values in populations with poorly-controlled hypertension, in

TABLE VII

**Admission criteria for community-acquired pneumonia (Adapted from 17,18)**

Clinical, radiological and bacteriological parameters
Pneumonia progressing for <1 week or >4 weeks
Age > 65 years
Condition of immunosuppression
Underlying disabling diseases, including chronic pulmonary pathology
Chest x-ray showing multilobular infiltrates
High risk etiology: gram-negative, S. aureus, aspiration, bronchial obstruction

whom apparently normal values can correspond to marked decreases from the baseline, with the same functional repercussions.

As we stressed earlier, this study did not include some other parameters that are thought to be relevant, as this was not a prospective study and, because many of the determinations, not being in the protocols, were not analyzed, at least at the time of admission. One of these parameters was respiratory rate, as a rate of above 30 cycles per minute may be associated with higher mortality. Chronic renal failure was another parameter, but we did not have conclusive data and, as is known, changes in creatinine and urea do not, per se, allow us to reach a definitive diagnosis. Lastly, although the etiology of the infection is also a very important prognostic factor,<sup>34</sup> its inclusion in this study was not possible, and was not the object of this study, though its inclusion would have been interesting in epidemiological terms.

## Conclusions

We know that in the vast majority of cases, pneumonia has a benign course, responds favorably to treatment, and can be treated in an outpatient setting. On the other hand, inpatient treatment of patients with community-acquired pneumonia is fifteen to twenty times more expensive than outpatient treatment,<sup>35,36</sup> moreover, the inconvenience for some patients of being removed from their family environment is incomparable. Nevertheless, the inexistence of conclusive studies, designed for the classification of high risk cases, the socio-cultural factors inherent to individuals and their family environment, and the inexistence of a coherent legal support, sometimes make it difficult to make a decision on whether to include a certain patient in the group of patients with CAP referred for outpatient treatment, even under close medical monitoring. It is clear that patients with pathologies subject to decompensation during the course of pneumonia should be considered individually, such as diabetics or those with chronic airway obstruction, among others, as in these cases, ineffective control could indirectly alter the outcome of the infectious process.

At the Hospital da Horta, in 1990, 3 cases to every 1000 inhabitants were hospitalized due to CAP, an incidence that had decreased by approximately half by 1993. These patients comprised 4% of the total cases treated at the Internal Medicine Service during

the 4 years of the study. The mortality rate directly attributable to CAP in this period was 8%.

Although the results of this study indicate that patients with CAP without increased LDH or hypercapnia may be considered as having low risk, prospective studies are necessary to evaluate this conclusion. Such additional studies would allow the early determination of the patients who would inevitably require immediate hospitalization and special attention from that moment on. ■

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