Hospital acquired pneumonia in an Internal Medicine Department

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Abstract

In the last few years, hospital-acquired infections have been reported by health care workers and the general population, through the media. Pneumonia is the second most frequent nosocomial infection associated with prolonged hospitalization, an increase in human resources and financial needs, and higher intra-hospital morbidity and mortality.

Aware of such aspects, the authors carried out a retrospective review of all cases of nosocomial pneumonia that were admitted or evolved during an admission for any other cause, to an Internal Medicine Department between 1st January 2008 and 30th June 2009. In this review they point out the demographic patterns of the population, the pre-existence of co-morbidities, the previous use of antibiotics, the pneumonia clinical presentation, the cultures collected, which microbiological agents most frequently found, the therapeutic approach, hospitalization times, and finally, the outcome.

The authors carry out a descriptive critical and retrospective analyses of these cases, in order to find out the bacterial flora profile in the hospital, and determine which aspects may be improved in delivering daily clinical care.

Key words: Hospital-acquired pneumonia, health-care associated pneumonia, guidelines.

INTRODUCTION

Portuguese hospitals, like those in the rest of the world, have been the target of growing interest among the general population, due to cases of nosocomial infection reported in the media. We know that in the hospital environment, it is common to find multiresistant microorganisms, due to the selective pressure exerted by the inadequate and/or excessive use of antibiotics. The elderly, who constitute the majority of patients admitted in the Internal medicine wards, are one of the groups at highest risk. The responsibility, and indeed the duty to help actively reduce this type of situation rests largely with the health professionals, through education and hygiene measures, and through a policy for appropriate prescription of antibiotics.

Nosocomial pneumonia (NC) is a relatively frequent diagnosis in the hospital environment, and is the second most common nosocomial infection in the United States. Its incidence is estimated at between five and fifteen cases per thousand hospital admissions, and this incidence is six times higher among intubated patients. In our hospital, according to the internal Report of the Committee for Control of Infection/Epidemiological Surveillance of Nosocomial Infections (CCI/VEIN) for 2009, an increase of around 27.5% in nosocomial bacteria was registered, compared with 2008. In addition, respiratory infection was the most frequent cause of secondary bacteremia in 2009, and was reported the most times in Internal Medicine.[1]

Nosocomial pneumonia is associated, on one hand, with an increase in days of hospitalization and the associated costs, and on the other, with a considerable increase in intra-hospital morbidity and mortality.[1] The updating of the American Thoracic Society (ATS) recommendations, in partnership with the Infectious Diseases Society of America (IDSA), published in 2005, subdivides nosocomial pneumonias according to the day on which they begin. Thus, if the infection occurs within four days of admission, it is classified as early-onset nosocomial pneumonia; this type is associated with a more favorable prognosis, as it involves agents that are closer to those found in the community (Streptococcus pneumoniae, for example).[2]

If it occurs after the 5th day, it is termed late-onset pneumonia, a situation that is associated with increased prevalence of multiresistant microorganisms,

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with a significantly higher risk of mortality. Although the overall mortality rate can reach 70%, the mortality rate attributed to hospital-acquired pneumonia is between 33% and 50%.[2,3]

In view of the above, and bearing in mind the growing incidence of this diagnosis, the authors propose to carry out a retrospective study of cases admitted to the Internal Medicine Service of the Hospital Central do Funchal (HCF) due to NP, or cases that developed during hospitalization for some other reason, in a one and a half year period. The variables described below were analyzed, with the primary objective of evaluating the impact of this pathology on their local reality, which are the most frequent microorganisms isolated, and which aspects need to be improved in the daily clinical practice.

MATERIALS AND METHODS

The authors carried out a retrospective analysis of the clinical processes of patients admitted to the Internal Medicine Service of the HCF for NP, or who developed this pathology during hospitalization for some other reason, during the year 2008 and first half of 2009. The study included all patients with acute infection of the pulmonary parenchyma with onset after 48h of hospitalization, or those readmitted for this reason up to 14 days after previous discharge from hospital, based on the last criteria defined by the ATS and adopted by the National Consensus on nosocomial pneumonia (elaborated by the Portuguese Pneumology and Intensive Care Societies), published in 2007. Patients with healthcare-associated pneumonia (HCAP), i.e. individuals who developed pneumonia in their own homes or in continuing health care institutions, were accounted for but not included in the study. The authors sought to determine the frequency of this entity in comparison with nosocomial pneumonia itself, but did not include it in the study because it is a separate entity, and the bacterial flora found in these patients is not part of the hospital flora. Patients with ventilator-associated pneumonia (VAP) were also excluded, as this is an entity of the Intensive Care Units (ICU), and therefore goes beyond the scope of Internal Medicine, in the context of the ward.

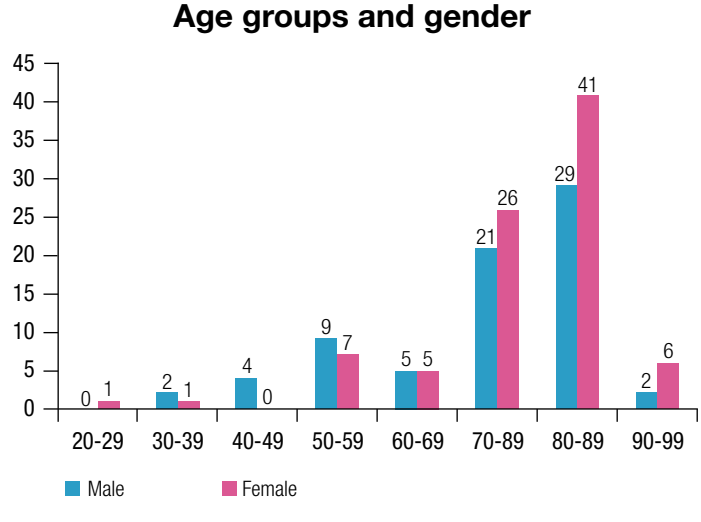
Of the 6975 patients admitted to Internal Medicine during the study period, the authors consulted 2184 clinical processes, consisting of admissions codified according to ICD-9, as follows: 481 (pneumococcic pneumonia), 482 (bacterial pneumonias NEC – not elsewhere classified), 483 (pneumonia due to specified microorganisms NEC), 485 (bronchopneumonia due to non-specified microorganism) and 486 (pneumonia due to non-specified microorganism). Of the total processes consulted, 211 were initially selected. Bearing in mind that 52 of these were healthcare-associated pneumonias, the sample selected consisted of 159 cases of acquired nosocomial pneumonias in the context of a hospitalization.

Excel was used to analyze the demographic characteristics of the sample, the existence of comorbidities, prior exposure to antibiotics, clinical presentation, the culture exams selected, whether or not a causal agent was identified and the most frequently isolated microorganisms, the therapy administered, the hospitalization time, and the outcome. The results are presented and discussed below.

RESULTS

Of the 211 cases initially selected by the authors, in 92 (43.6%) the diagnosis of nosocomial pneumonia was made during a hospitalization, and of these, 22 cases (24%) were early-onset NP (type: 4th day) and 70 (76%) as late-onset NP (type: 9th day). They had a history of recent hospitalization, with discharge in the 14 previous days (type: 7th day), 67 patients (31.75%). The remaining 52 cases (24.64%) were HCAP; of these, 37 were resident in nursing homes for the elderly (71.2%) and 15 had been left at the HCF (28.8%), in a situation of clinical discharge. Thus, considering only the 159 cases of nosocomial pneumonia acquired in a hospital context, whether in the current hospitalization or following a recent previous hospitalization, we obtained an incidence of NP of 22.8 cases per 1000 hospital admissions.

The population studied had a slight prevalence of females (55% of cases), with ages between 21 and 98 years, the majority between 80 and 89 years (*Fig. 1*). Only 8 patients did not present any comorbidity at all (3.79%). The most frequent pathologies found were arterial hypertension (AHT) and type 2 Diabetes mellitus (DM2), cerebrovascular disease (CVD) and chronic obstructive pulmonary disease (COPD), as shown in *Fig. 2*. Around half of the cases had a history of previous exposure to antibiotics (51%), which constitutes a factor of added risk for the existence of multiresistant microorganisms. The reasons for hospitalization (previous or current) are shown in *Fig.*

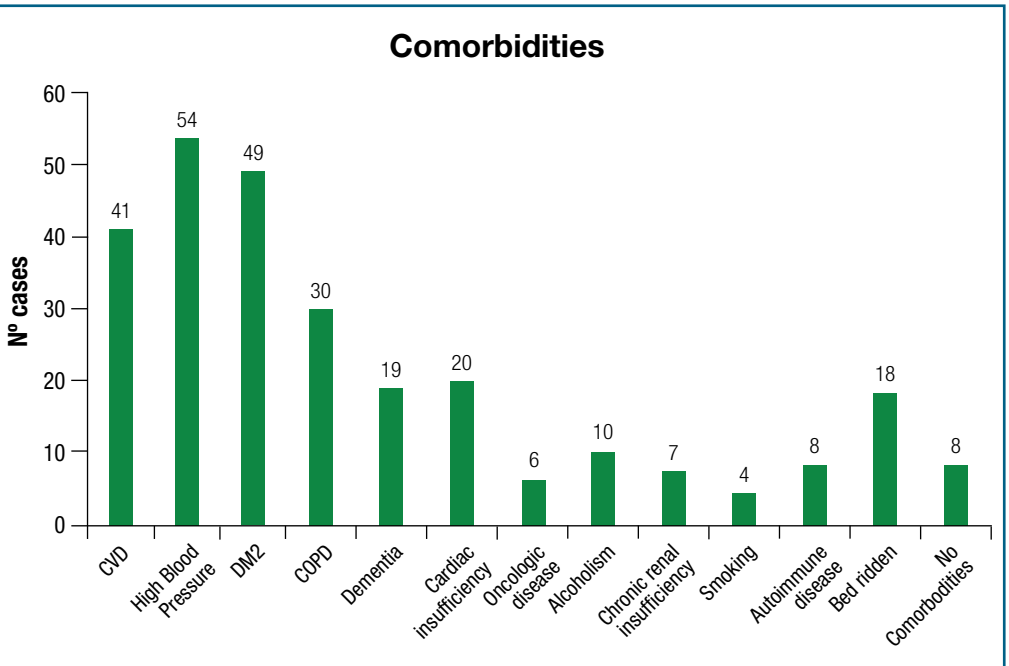


Distribution by age group and gender.

FIG. 1

3; the most frequent is bronchopulmonary infection (62.26%), followed by ischemic CVA (16.35%).

NP forms of presentation are variable. In our case series, 58.9% of patients presented productive cough. Around 56.39% presented dyspnea and 33.17% had fever (tympanic temperature >38ºC) (*Fig. 4*). Analytically, we observed that 85.78% of the cases had high CRP, 69.19% manifested leukocytosis, 1.42% presented leukopenia and 2.37% did not show any alteration in these acute phase markers. Blood cultures were taken for 49.29% of the patients, and sputum samples for 37.91%, for microbiological examination. In around 12.79% of the patients, no collection was carried out. Of the studies carried out, Pseudomonas aeruginosa was the microorganism most frequently isolated (43.48%), followed by Acinetobacter baumannii (17.39%) and methicillin-resistant Staphylococcus aureus (MRSA) (17.39%) (*Fig. 5*). It is noted that 84.78% of the microorganisms were isolated in the sputum, and only 15.21% were isolated in the blood cultures. It was possible to identify the causal agent in 35.2% of the cases. The most frequently used antibiotic was amoxycillin + clavulanic acid (48.8%), followed by piperacillin + tazobactam (30.3%) (*Fig. 6*).



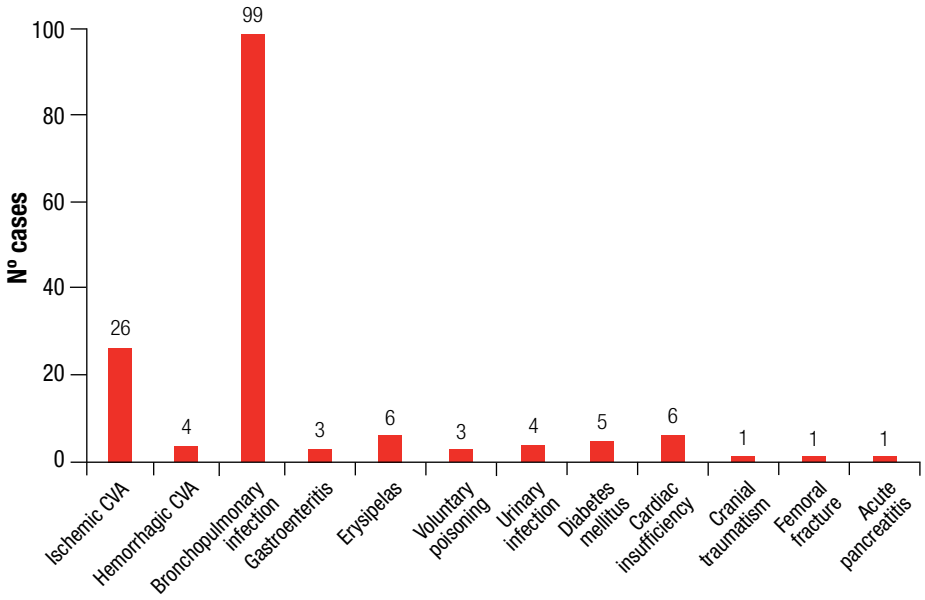
Comorbidities of patients of the sample.

FIG. 2

DISCUSSION

The diagnosis of NP is essentially clinical and by presumption, corroborated by chest x-ray and by the results of cultural exams of the bronchial secretions and blood cultures, which should be obtained in the initial evaluation, although we know that only around 20% of NPs include bacteriemia.[2,3] The most common symptoms are dyspnea, productive cough and fever. The Clinical Pulmonary Infection Score (CPIS) elaborated by Pugin and collaborators, and subsequently modified by Singh et al and Luna et al, may be useful in the initial evaluation of these patients, and in monitoring the clinical response to therapy.[3]

The vast majority



Reason for previous or current hospitalization.

FIG. 3

of data available in the international literature relates to ICU, and is extrapolated for the other hospital services. The most commonly involved etiological agents in NP are: Pseudomonas aeruginosa, Klebsiella spp, Escherichia coli and Acinetobacter spp.

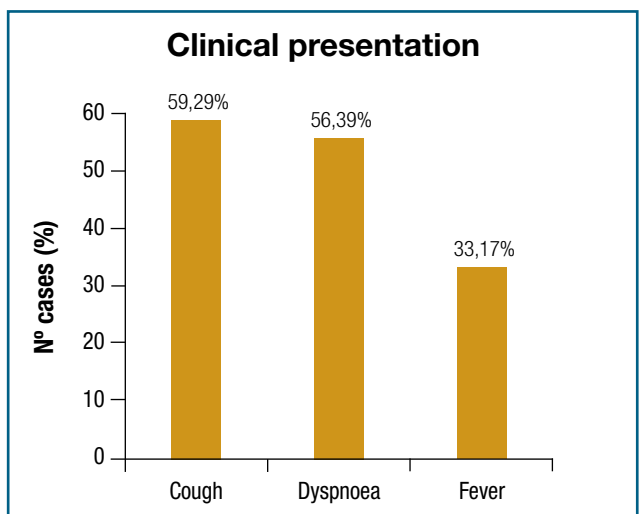
According to the 2009 CCI/VEIN report, the most frequently found microorganisms in blood cultures of patients with secondary bacteraemias, at our hospital in general and in the Internal Medicine Service in particular, by decreasing order of frequency, are: Escherichia coli, MRSA, Methicillin-sensitive Staphylococcus aureus (MSSA), Klebsiella pneumoniae and Pseudomonas aeruginosa. An increase was also registered in cases of isolation in the blood of Acinetobacter baumannii (4 in the ICU and 1 in Oncology). The most frequent cause of nosocomial bacteremia was respiratory infection (24.4%), followed by urinary tract infection (21,1%), unlike the year 2008, when urinary infection was the leading cause (with 29.3%).

In our case series, Pseudomonas aeruginosa was the most frequently isolated microorganism, followed by Acinetobacter baumannii and MRSA (Fig. 5), which may be related to the fact that around 33% of cases are of delayed-onset NP, with a high rate of exposure to antibiotics and/or recent hospitalization.

We cannot help but question this increase in identification of Acinetobacter in the sputum. Colonization? Poor asepsis procedures, or the inadequate use of antibiotics?

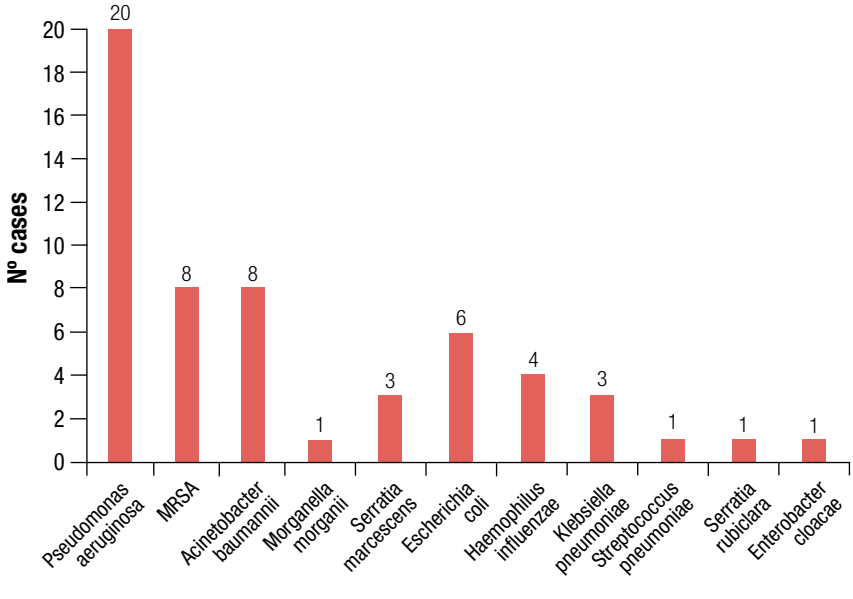
Some discrepancy observed between the data of our case series and those of the CCI/VEIN report may be due to the fact that only nosocomial pneumonias are included in this term. Furthermore, our microbiological results relate to the blood and sputum, also including infections in which there was no bacteremia and others in which no blood cultures were collected, more than 80% of the agents being identified in the sputum. On the other hand, in the CCI report, only the results of blood cultures are recorded, relating to all the nosocomial infections for the hospital as a whole.

Bearing in mind the increase in the number of nosocomial infections, their prevention is essential. For this, we must not neglect education of health



Clinical presentation.

FIG. 4



Etiological agents identified in the blood or sputum.

FIG. 5

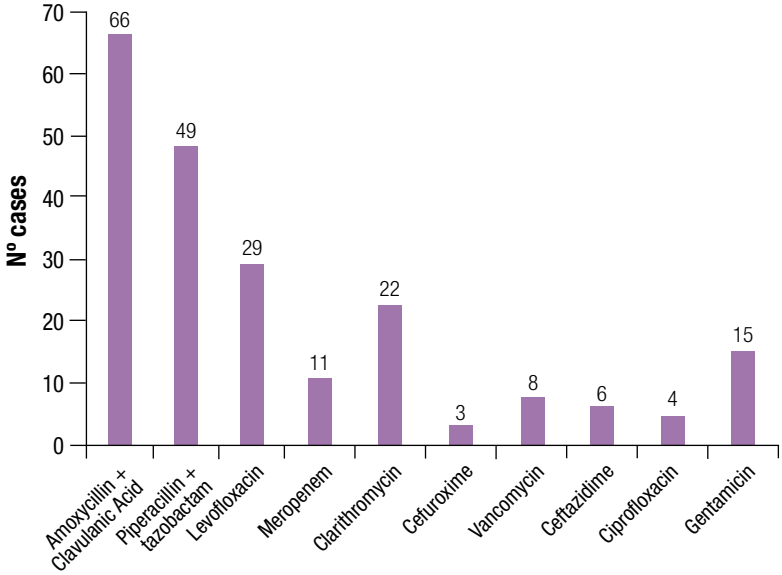
professionals and isolation of infected patients. Other measures include favoring orogastric intubation, providing oral hygiene care, keeping the head raised 30-45º, and the use of H_2 antagonists or sucralfate to prevent stress ulcer, since there are controversial data that suggest that the use of proton-pump inhibitors during hospitalization increases the risk of NP (5% vs 2%).[2,5] Enteral administration of food, where possible, to reduce bacterial translocation, and maintaining glycaemic levels between 80 and 110 mg/dL, are prophylactic measures to bear in mind.

In situations that we are unable to prevent, all that remains is treatment, which includes support measures, like the use of supplementary oxygen, which should be based on gasometrical criteria, and etiological treatment.[3] The vast majority of patients (59.29%) presented hypoxemia. In 46.44% of the clinical processes consulted, there were no records of arterial gasometry.[2]

Antibiotic treatment should be initiated empirically, as early as possible, ideally in the 1st hour after diagnostic presumption, in appropriate form, and in the correct dose, decreasing at 48-72h after clinical reevaluation and after obtaining the microbiological results, in order to reduce the induction of resistances. The samples should therefore be collected before the start of antibiotherapy, but without delaying it.[2,3] In our sample, the collection of products for bacteriological exams enabled the causal agent to be identified in 35.2% of cases. It is recommended that antibiotherapy be maintained for ten to fourteen days for pneumonias caused by gram-negative non-fermenting bacilli, or by Legionella, but in all other cases with good evolution, we should suspend them at seven days. Aminoglycoside, if used, should be suspended on the fifth day.[3]

The recommended regimens vary, depending on whether it is a case of early or late-onset NP. In the case of the former, monotherapy with amoxycillin + clavulanic acid may be acceptable. Viable alternatives to this antibiotic are: ceftriaxone, meropenem/imipenem, levofloxacin or moxifloxacin. In the case of late-onset NP or where there is another risk factor for multiresistant microorganisms, such as hospitalization in the past three months, recent antibiotherapy, severe COPD, structural pulmonary disease, or immunosuppression, a combination of antibiotics is indicated, seeking to empirically cover the Pseudomonas aeruginosa with active beta-lactam and aminoglycoside or fluoroquinolone (e.g. Piperacillin + tazobactam + gentamicin or levofloxacin) or carbapenem.[2,6] If two or more of these risk factors coexist, it is necessary to also cover the MRSA, for which an association of vancomycin or linezolid is indicated.[7,8] Cover for Acinetobacter (carbapenem + aminoglycoside and/or colistin) should be decided on according to its local prevalence.[3,4]

The most frequently used antibiotics were amoxycillin + clavulanic acid (41.5%), followed by piperacillin + tazobactam (30.8%) (Fig. The high use of amoxycillin + clavulanic acid may be associated with the fact that it is indicated in cases of early-onset NP, and because the antibiotherapy was initiated empirically in all the cases. An etiological agent was identified in only about 1/3 of the patients. The fact



Antibiotherapy administered.

FIG. 6

that some patients developed the infection while hospitalized for another reason (e.g. ischemic CVA) may also justify the choice of this antibiotic in patients not previously medicated with antibiotics. Piperacillin + tazobactam were the option most frequently taken in late-onset NP, seeking to cover anti-Pseudomonas. In 71.74% of cases, monotherapy was used, in 26.45% double therapy, and in just 1.79% a triple association was necessary. It is highlighted that in 12.79% of cases, the initial antibiotherapy was altered, due to a lack of favorable clinical response.

The average hospitalization time was 12.1 days, whereas the hospitalization time in Internal Medicine in general was 8.26 days in 2008 and 7.7 days in 2009. Here it is clear that nosocomial pneumonias cause the average hospitalization time to be extended.

With adequate and timely treatment, NPs may have a favorable prognosis. In cases of respiratory failure and/or failure of some other organ or system, it is essential to refer the patient to an ICU.[4] In our case series, we had a mortality rate of 19%, which is lower than that described in the literature. Even so, this value represents a growth in intra-hospital mortality, as the mortality for all causes was 12.01% in 2008 and 10.91% in 2009, in our Service. However, the prognosis depends more on previous cardiopulmonary function, and the immune system of the host (aspects translated by the presence of multiple organ dysfunction) than on the virulence of the etiological agent alone. The CPIS appears to be the available scale with the greatest prognostic value that can be used in these patients.

The authors recognize that this work has some limitations: the codification system used in our hospital, which prevents us from having direct access to nosocomial pneumonias, was a difficulty imposed when carrying out the work. A retrospective analysis, depending on the records made during the clinical processes, can lead to biases. The fact that we included situations of worsening of an initial pneumonia, as well as cases of readmission for "nosocomial pneumonia", may have led to the real data being over-estimated, since these could be cases of worsening of a previous infection, i.e. a complicated pneumonia, rather than new infections that can be characterized as nosocomial. Therefore, this distinction was not always easy to make, given that it was a retrospective analysis.

CONCLUSION

Nosocomial infections, and pneumonias in particular, given their high incidence and the fact that they are increasing in our hospital, are a theme of great importance. They lead to a significant increase in the need for human and financial resources, as they cause hospitalization times to be prolonged. Thus, it should be the primordial objective of the Health Services to actively reduce the incidence of these situations, not only to decrease overall costs, but also to provide a quality service. It is only by analyzing our local realities that we can find out what aspects are lacking, and plan the necessary changes. It was with this objective that this work was carried out.

We conclude that there are still some steps to be taken in this regard. We call the attention to the need to do the respective record of arterial gasometry, for better evaluation of the septic condition, and guidance on oxygen supplementation. Another aspect to be emphasized is the systematic collection of blood

cultures, in the initial evaluation of the patient, and microbiological examination of the sputum, in order to isolate the etiological agents more often, and guide the antibiotherapy more appropriately.

Bearing in mind that we obtained an incidence of 22.8 cases per 1000 admissions, clearly higher than that described in this international literature, it is, without doubt, a pathology that deserves special attention, despite the fact that we registered a mortality rate of 19%, lower than that reported by the majority of authors. Measures to bear in mind, which are effective in combating NPs, consist mainly of the correct and appropriate use of antibiotics and the use of hygiene measures, like frequent washing of the hands. It is also essential to reinforce the means of barrier and protection for health professionals, seeking to minimize cross-transmission of infections within the institution. The authors call attention to the need to implement a policy of use of antibiotics, in order to reduce some prescription errors (i.e. correct doses, duration of antibiotherapy). Thus, with the efforts of all the health professionals, in a collective attitude with a common goal, we can make progress to provide a healthcare that is continually improving. ■

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