Originales

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Management in the emergency room of patients requiring hospital treatment of community-acquired pneumonia

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Introduction. To identify factors influencing decisions in initial management of community-acquired pneumonia (CAP) admitted to hospital through Emergency departments.

Methods. Records of CAP adult patients admitted to 24 Spanish hospitals in January-Mars 2003 were reviewed. Patients sent for ambulatory treatment were excluded.

Results. 341 patients (67.0 ± 24.6 years; 65.3 % males) were included; 39 % were taking antibiotics at attendance. PSI was (% patients): I-II (19.7 %), III (14.7 %), and IV-V (65.6 %). Comorbidities were: COPD (37.2 %), heart disease (24.6 %), hypertension (17 %), diabetes mellitus (10.8 %), and malignancies (10 %). Pneumococcal/*Legionella* urinary antigens were performed in 34.0 %/42.2 % patients. Fewer (p ≤ 0.006) rapid tests were performed in class IV-V (p = 0.001), with higher (p ≤ 0.01) pneumococcal positive results in class V. Initial treatment was fluoroquinolone (37.5 %), beta-lactam + macrolide (26.4 %), beta-lactam (22.9 %), macrolide (4.7 %), and others (8.5 %). Patients referred to Internal Medicine had higher heart disease (p = 0.06) and hypertension (p = 0.001) as comorbidity than those at Short-Stay Units or Pneumology. COPD patients were equally distributed between Internal Medicine and Pneumology, with differences vs. Short-Stay Units.

Conclusions. Rapid diagnostic tests were underused, maybe due to broad empirical treatments covering drug-resistant pneumococci and *L. pneumophila* (regardless PSI and comorbidity). Presence of comorbidities or positive results in rapid diagnostic tests seems to influence the medical ward to which the patient is referred to, but not initial treatment.

Key Words:
Legionella urinary test. Pneumococcal urinary test. Community-acquired pneumonia. Empirical treatment. Emergency room.

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Manejo en la sala de urgencias de pacientes con neumonía adquirida en la comunidad que requieren tratamiento hospitalario

Introducción. Identificación de los factores que influyen en el manejo inicial de los pacientes con neumonía adquirida en la comunidad (NAC) ingresados en el hospital a través de los Servicios de Urgencias.

Material y métodos. Se revisaron los registros de pacientes adultos con NAC admitidos en 24 hospitales españoles en el período comprendido entre los meses de enero-marzo de 2003. Los pacientes remitidos para tratamiento ambulatorio fueron excluidos.

Resultados. Se incluyeron 341 pacientes (67,0 ± 24,6 años; 65,3 % varones). El 39 % estaba tomando antibióticos en el momento de atención en Urgencias. El grado de Fine de los pacientes fue (% pacientes): I-II (19,7 %), III (14,7 %), y IV-V (65,6 %). Las comorbilidades fueron: EPOC (37,2 %), enfermedad coronaria (24,6 %), hipertensión (17 %), diabetes mellitus (10,8 %) y neoplasia (10 %). Los tests de antígenos urinarios de neumococo y *Legionella* fueron realizados en 34,0 % y 42,2 % pacientes respectivamente. En las clases IV-V (p ≤ 0,006) se realizaron menos tests rápidos, con mayor número de resultados positivos para neumococos (p ≤ 0,01) en la clase V. El tratamiento inicial fue fluoroquinolonas (37,5 %), betalactámico + macrólido (26,4 %), betalactámico (22,9 %), macrólido (4,7 %), y otros (8,5 %). Los pacientes ingresados en Medicina Interna tenían una mayor incidencia de enfermedad cardiaca (p = 0,06) e hipertensión (p = 0,001) como comorbilidad que aquellos ingresados en Neumología o en Unidades de Corta Estancia. Los pacientes con EPOC fueron igualmente distribuidos entre Medicina Interna y Neumología, con diferencias respecto a las Unidades de Corta Estancia.

Conclusiones. Los tests diagnósticos rápidos fueron infrautilizados, debido posiblemente a la amplia cobertura de los tratamientos empíricos cubriendo neumococo resistente y *L. pneumophila* (independientemente del Fine y la comorbilidad). La presencia de comorbilidad o resultados positivos en los tests de diagnóstico rápido parecen influir en el servicio donde el paciente se ingresa, pero no en el tratamiento inicial.

Palabras clave:
Test urinario de *Legionella*. Test urinario de neumococo. Neumonía adquirida en la comunidad. Tratamiento empírico. Servicio de Urgencias.

INTRODUCTION

Community-acquired pneumonia (CAP) is a frequent cause of medical consultation both in primary health care and hospital's Emergency departments. The interest in its management is based on its high incidence, high morbidity and mortality, cost of care and empiric foundation of its aetiological treatment[1].

CAP is the sixth leading cause of death and the leading cause of death due to infection[2]. Attributable mortality to CAP is less than 1 % in outhospital treated patients and ranges from 2 % to 30 % in hospitalised patients[3-5]. Host-related factors as age, comorbidity of the patient, severity of the infection, bacteremia, and probability of development of septic shock greatly contribute to the risk of mortality[6]. In Spain CAP incidence is around 1.6/1,000 inhabitants/year[7], and incidence of CAP hospitalised patients is around 160 cases/100,000 inhabitants, a figure that increases to 523 cases/100,000 inhabitants in the elderly (> 65 years) population[7-8].

Pneumonia is one of the most common conditions for which patients seek emergency care, being nearly 75 % CAP patients initially evaluated and treated in hospital-based Emergency departments[1], and a high number of CAP patients require hospitalisation[2,9-11].

In the Emergency department, primary goals of management of CAP are to provide cost-effective care, to determine patients to be treated as outpatients[12], those that should remain in short-stay observation at the Emergency room, and patients candidates to hospital treatment selecting the adequate medical ward.

In this study we analyse factors influencing the physician's initial management and decisions (rapid diagnostic tests required, empirical treatment and selection of medical ward for admission) in the Emergency room of patients requiring hospital treatment for community-acquired pneumonia in 24 Spanish hospitals in a three-month winter period.

MATERIAL AND METHODS

Study setting and population

All clinical records of patients with ≥ 14 years of age and CAP diagnosis hospitalised through Emergency departments in a three-month period (January-Mars 2003) in 24 Spanish hospitals were retrospectively reviewed. Patients sent for treatment on an ambulatory basis were excluded from the study.

Hospitals were selected considering number of inhabitants in Spain (Instituto Nacional de Estadistica www.ine.es): Four centres in the north region (Galicia, Asturias, Cantabria, País Vasco, Navarra, and La Rioja autonomous communities) with approx. 7.4×10^6 inhabitants, 5 centres in the central region (Castilla-León, Aragón, Madrid, Castilla-La Mancha, and Extremadura autonomous communities) with approx. 10.5×10^6 inhabitants, 6 centres in the south region (Andalucía and Canarias autonomous communities) with approx. 9.7×10^6 inhabitants, and 9 centres in the Mediterranean area (Cataluña, Comunidad Valenciana, Baleares, and Murcia autonomous communities) with approx. 13.4×10^6 inhabitants.

Study design

Medical records were reviewed to obtain demographic, clinical and analytical data necessary to classify patients according to the Pneumonia Severity Index (PSI) category[4]. Data recorded consisted in: *a)* demographic data: age, gender, nursing home residence, previous antibiotic treatment and who take the decision (patient´s or primary care physician's decision) to refer the patient to the Emergency room; *b)* comorbidities: malignancies, liver, renal, heart or vascular disease, HIV, chronic obstructive pulmonary disease (COPD); *c)* clinical, radiological and analytical data for CAP diagnosis and calculation of PSI score[4]: fever, cough, sputum characteristics, pleuritic chest pain, auscultatory findings, dyspnoea or tachypnoea, total peripheral white blood cell count, PO_2 or oxygen saturation by pulse oximetry, chest radiograph; *d)* microbiological tests performed; *e)* initial antibiotic treatment, and *f)* outcome.

Statistical analysis

Comparisons of percentages were analysed by the Chi-square test. A $p < 0.05$ was considered significant.

RESULTS

Clinical records of 341 CAP patients attended at Emergency departments and requiring hospitalisation were reviewed. Mean age was 67.0 ± 24.6 years (range 15-94 years). Significantly ($p < 0.0001$) higher number of patients was male: 65.3 % vs. 34.7 % females. The proportion of patients that attended the Emergency room by their own decision (53.5 %) was not different ($p = 0.07$) to the proportion referred by a primary care physician (46.5 %). Twenty-nine percent of patients were taking antibiotic treatment at attendance, with similar percentages among those referred by physicians and those attending the Emergency room by their own (30.5 % vs. 27.6 %; $p = 0.57$).

According to the PSI score, patients were distributed as follows: 67 (19.7 %) in class I-II, 50 (14.7 %) in class III, 119 (34.9 %) in class IV, and 105 (30.8 %) in class V. COPD was the most frequent comorbidity (37.2 % patients), followed by heart disease (24.6 %), hypertension (17 %), diabetes mellitus (10.8 %), malignancies (10 %), cerebrovascular dis-

ease (7.6 %), renal disease (4.4 %), liver disease (4.1 %) and HIV (3.2 %).

Blood cultures were performed in 50.1 % patients. Significant higher number of blood cultures were taken in class IV (p = 0.04) or class V (p = 0.02) patients than in low-risk classes I-III patients (56.2 % or 53.8 % vs. 41 %, respectively). Sputum culture was performed in 35.8 % patients (without differences between PSI classes), urinary pneumococcal antigen in 34.0 %, and urinary *Legionella* antigen in 42.2 %. Table 1 shows rapid aetiological diagnostic tests (urinary antigens) and results according to PSI classes. Significant lower number of pneumococcal urinary antigen tests was performed in class V (p = 0.006) or class IV (p = 0.001) patients versus those in low-risk classes (I-III). This significant difference was also observed in relation to *Legionella* urinary antigen tests between class V (p = 0.002) or class IV (p = 0.003) and low-risk classes (I-III). Among rapid tests performed, 25 % showed positive result for pneumococcal antigen and 6.3 % for *Legionella* antigen. Of the pneumococcal urinary antigen tests performed, significant higher number of positive results corresponded to patients in class V (42.8 %) versus class IV (21.2 %) (p = 0.008) or classes I-II-III (20.9 %) (p = 0.007). Of the *Legionella* urinary antigen tests performed, higher number of positive results corresponded to patients in class IV and V, although differences between risk classes did not reach statistical significance (p = 0.2).

Treatment consisted in fluoroquinolone monotherapy in 37.5 % patients, 3rd generation cephalosporin plus macrolide in 19.4 % patients, beta-lactam/beta-lactamase inhibitor in 17.9 % patients, beta-lactam/beta-lactamase inhibitor plus macrolide in 7 % patients, 3rd generation cephalosporin monotherapy in 5 % patients, macrolide monotherapy in 4.7 % patients, fluoroquinolone plus beta-lactam in 4.1 % patients, and other antibiotic combinations in 4.4 %. No differences were found in antibiotic treatments between risk classes.

With respect to the medical ward of hospitalisation, 36.4 % patients were referred to Internal Medicine, 30.2 % to Pneumology, 24.1 % remained in Short-Stay Units at Emergency departments, 5.6 % were derived to a different hospital, 2.1 % were referred to Infectious Diseases, and 1.7 % to the Intensive Care Unit (ICU). Table 2 shows severity and comorbidity, together with percentage of patients with positive antigen results (among the subpopulation where the tests were performed), in relation to the medical wards where the patients were hospitalised. Comparing with patients remaining for observation at Short-Stay Units, patients hospitalised in Internal Medicine exhibited higher COPD (p = 0.04), heart disease (p = 0.006) and hypertension (p = 0.001) as comorbidity, and patients hospitalised at Pneumology departments higher COPD (p = 0.06). Heart disease (p = 0.03) and hypertension (p = 0.01) were higher in patients that were hospitalised in Internal Medicine than in those in Pneumology. Among those patients with urinary antigen tests performed, significant (p = 0.003) higher number of patients with positive pneumococcal antigen was hospitalised in Pneumology (17 out of 29, 58.6 %) versus those in Internal Medicine (6 out of 29, 20.7 %). Four out of 6 patients hospitalised in the ICU had positive result in the urinary *Legionella* antigen test (that was performed in 5 patients). Eleven patients died (mortality rate 3.2 %), all of them, were class IV or V.

DISCUSSION

Patients with CAP are usually in the mid-fifties to late sixties[13], as in the present series, with peak incidences of the disease in mid winter and early spring[14]. A high number of CAP patients require hospitalisation in our environment[10,11], although the number of patients admitted with CAP varies greatly between hospitals[11,15]. PSI score has been used to classify patients as outpatients (classes I and II), patients that may benefit from brief inpatient treatment (class III),

Table 1	Urinary pneumococcal antigen and urinary Legionella antigen (Ag) performed and positive results distributed by PSI classes				
PSI	No. patients	No. patients with test performed (%)		No. (%) positive results among tests performed	
		Pneumococcal Ag	*Legionella* Ag	Pneumococcal Ag	*Legionella* Ag
I - II - III	117	43 (36.7)	57 (48.7)	9 (20.9)	1 (1.8)
IV	119	52 (43.7)	57 (47.9)	11 (21.2)	5 (8.8)
V	105	21* (20)	30* (28.6)	9* (42.8)	3 (10)
TOTAL	341	116 (34)	144 (42.2)	29 (25)	9 (6.3)

* p < 0.01 versus class IV or class I-II-III

and patients who require hospital treatment (classes IV and V)[4,10-12,16]. But the PSI score has limitations since it was identified as predictor of mortality, and not set to determine the setting of care[12]: it does not contain the ability to integrate clinical judgement, remaining doubts on which is the optimal management of patients included in class III[10]. In this sense, the IDSA guidelines[17] establish the safety of home treatment based in a three step process: *a)* assessment of pre-existing conditions that compromise the home treatment safety, *b)* class I, II and III of the PSI score and *c)* clinical judgement.

In this series, we describe characteristics of decisions taken in the Emergency room in the management of CAP patients requiring hospital treatment in winter and early spring (January-March) in 24 hospitals distributed all over the Spanish geography.

The number of patients belonging to class I and II (19.7 %) and those belonging to class III (14.7 %) that were admitted to hospital in our series was comparable to previous series in our country (16.6 % and 17.4 %[10], respectively). Percentage of high-risk patients (classes IV and V) was similar among patients that remained in Short-Stay Units (64.6 %) than among those hospitalised in Pneumology (65 %) or Internal Medicine (68.5 %).

Surprisingly, and in relation to PSI score, rapid tests as urinary antigen detection for *S. pneumoniae* or *L. pneumophila* were required in a lower number in patients classified as class V in comparison with low-risk patients. On the contrary, not surprisingly, higher rate of positive results (among the patient population where rapid tests were performed) was found in class V versus the other PSI classes.

With respect to antibiotic treatment, it should be highlighted that around 30 % patients arrived to the Emergency room with previous antibiotic intake for the present condition, half of these treatments were prescribed by primary care physicians but the other half was due to self-medication, a common fact in our country[18,19]. At Emergency rooms, it seems that the request of rapid tests, as well as the PSI score did not influence initial hospital antibiotic treatment. Around 75 % patients included in this series were empirically treated with antimicrobial regimens or combinations covering *L. pneumophila* (regimens that included fluoroquinolones, macrolides or azalides), and >90 % patients received regimens covering penicillin/macrolide- resistant pneumococci. This empirical coverage is related to the fact that in our country 1 % to 5 % CAP (in a non epidemic environment) is caused by *L. pneumophila*[20], with higher percentages in some series[21]. *L. pneumophila* epidemics are frequent, and one-third of *Legionella* cases are seen in patients that do not present classical risk factors (smoking, COPD, and >65 years), thus stressing the need of *Legionella* coverage regardless the presence or not of risk factors[22]. From the perspective of rapid diagnosis, not all CAP patients infected by *Legionella* can be diagnosed by the rapid test because its sensitivity is 70 %[23] and the antigen is generally detectable 3 days after the onset of symptoms[24,25]. Risk factors for drug-resistant *S. pneumoniae* are similar to those for *Legionella* (> 65 years, previous antibiotic use due to COPD exacerbations, multiple medical comorbidities...)[26], but although Spain is a country with high prevalence of *S. pneumoniae* penicillin/macrolide resistance[27], pneumococci exhibits high susceptibility rates to parenteral third generation cephalosporins, amoxicillin or fluoroquinolones[27,28].

The difficulty in differentiating typical and atypical infection, and the possibility of co-infection[29,30], drives to the recommendation in all guidelines to typical and atypical coverage in empirical treatment[2,17,29,31]. This is more important in severe patients requiring hospital management where early (avoiding delays due to diagnostic testing)[29] empirical treatment providing broad coverage is essential to

Table 2	Severity, comorbidity and rapid diagnosis distributed by the medical ward where the patients were hospitalised							
Medical wards		PSI	% Patients showing the following comorbidities					% Patients with positive antigen test referred to the different medical wards	
	No. patients	% Classes IV-V	COPD	Heart disease	Hypertension	Diabetes	Malignancies	Pneumococcal n=29	Legionella n=9
Internal Med	124	68.6	43.5	33.1	27.4	14.5	10.5	20.7	44.4
Pneumo.	103	65.0	42.7	20.4	13.6	8.7	8.7	58.6	0
Short-stay	82	64.6	29.3	15.8	8.5	7.3	10.9	6.9	11.1
Other hospital	19	63.2	15.8	26.3	10.5	10.5	10.5	0	0
Infect Dis	7	28.6	0	0	0	14.3	0	10.3	0
ICU	6	83.3	33.3	66.6	16.6	16.6	16.6	3.4	44.4
Total	341	65.7	37.2	24.6	17.0	10.8	10.0	100	100

ensure good outcome since delay is associated with increased mortality[32,33]. In this sense, this broad coverage was preferably obtained in this series with fluoroquinolones than with 3rd generation cephalosporin plus macrolide or the combination of beta-lactam/beta-lactamase inhibitor plus macrolide (approx. 38 % vs. 19 % vs. 7 %, respectively).

While PSI score seems not to influence the medical ward of inhospital CAP treatment (except for patients admitted in the ICU), the result of the rapid test among patients in which it was performed, seems to influence it together with the comorbidity present in the patient. Significantly higher number of patients with positive pneumococcal antigen test (among those where the test was performed) was treated in Pneumology departments, and four out of the 6 patients admitted in the ICU (the test was performed in 5 of them) presented positive result of the urinary *Legionella* antigen. From the clinical point of view patients referred to Internal Medicine had significantly higher heart disease and hypertension as comorbidity than those that remained in Short-Stay Units or those referred to Pneumology. Patients with COPD (the most frequent comorbidity in this series) were equally distributed between Internal Medicine and Pneumology, with differences vs. those remaining in Short-Stay Units. The role of Infectious Diseases departments cannot be evaluated in this study since most participating hospitals do not have this medical ward for hospitalisation but only for consultancy.

This study explores the decisions taken in the Emergency room in a retrospective way by reviewing clinical records from CAP patients treated in the hospital. However we consider that is the only way to know the actual situation since a prospective study would influence the decisions taken by physicians. It is only a descriptive study and not an interventional study. On the other side it has been studied only the relationship between the patient's factors (PSI, comorbidity) and physician's decisions (aetiological diagnostic tests, treatment chosen and medical ward for hospitalisation). Other factors not related with those considered may have influence at single hospital level (bed disposition at the different wards, attendance pressure in Emergency rooms...).

The results of this study examining management in daily practice of CAP patients requiring hospital treatment show that rapid diagnostic tests are underused, maybe related to the high use of broad empirical treatments covering both penicillin/macrolide resistant pneumococci and *L. pneumophila* regardless PSI score or comorbidity. Presence of comorbidities or positive results in the rapid diagnostic tests seems to influence the medical ward to which the patient is referred to.

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