

Process-of-Care Indicators and Results in Community Acquired Pneumonia after the Introduction of New Guidelines (SEPAR/IDSA)

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Abstract

Objective: Process-of-care and outcome indicators obtained with two guidelines for the management of community-acquired pneumonia (CAP) were compared: SEQ/ATS guidelines vs. SEPAR/IDSA guidelines.

Patients and methods: Observational prospective study including 457 patients diagnosed for CAP in a hospital general in 2006 (SEQ/ATS guidelines) and 2007 and 2008 (SEPAR/IDSA guidelines). Process-of-care and outcome indicators were compared between the two guidelines and also between the two years after the introduction of the SEPAR/IDSA guidelines. Moreover, the influence of the use of the Pneumonia Severity Index (PSI) was also studied.

Results: Global adherence to the guidelines was significantly higher with the SEPAR/IDSA guidelines. Length of hospital stay was not influenced by the adherence to either of the two guidelines. Both guidelines seem to be more useful in ruling serious illness out than in ruling in. The estimation of the severity as measured by the PSI significantly decreased the inappropriate hospitalization of the patients of risk class I-III. In patients of moderate-high risk classes, the adequateness of treatment was higher when the PSI had been estimated in the emergency unit. In the second year of the implementation of SEPAR/IDSA guidelines, mortality was lower and early treatment was higher in the patients of risk classes IV-V in which the PSI had been estimated in the emergency unit, in comparison to the patients in which the PSI had not been estimated.

Conclusion: The implementation of the SEPAR/IDSA guidelines improved the process-of-care and outcome indicators of patients diagnosed for CAP.

Keywords: Community-acquired pneumonia; Practice guidelines; Conventional admission criteria; Pneumonia severity index; Quality indicators; Inappropriate admission; Length of hospital stay; Intensive care unit admission; Hospital readmission; Mortality

Introduction

Community-acquired pneumonia (CAP) is a prevalent and potentially life-threatening infection and has poor prognosis in aged patients. Within Europe, CAP is the leading cause of death due to infection [1] with approximately 90% of deaths due to pneumonia occurring in people aged >65 years [2]. Several risk factors for CAP are recognized, including age >65 years [3-5] smoking [4], alcoholism [5], immunosuppressive conditions [5] and conditions such as COPD [6] cardiovascular disease, cerebrovascular disease, chronic liver or renal disease, diabetes mellitus and dementia [7].

Clinical guidelines that include assessment of the initial severity scales help the physicians in making decisions about the need for income and the most appropriate treatment. Different guides have been implemented for a better management of community acquired pneumonia (CAP) and for reducing the hospitalization of patients without risk factors. The guidelines include prognostic indices, being the Pneumonia Severity Index (PSI) proposed by Fine et al. [8,9] one of the most used.

Up to June 2006, the physicians of our hospital used the Chemotherapy Spanish Society (SEQ) guideline, a transposition of the 1993 American Thoracic Society (ATS) guidelines, (SEQ/ATS guidelines) [10,11] (Table 1). In 2006, new guidelines based in the Spanish Society of Pulmonology and Thoracic Surgery (SEPAR) and the Infectious Diseases Society of America (IDSA) consensus (SEPAR/IDSA guidelines) [12,13] which includes the PSI, were implanted (Table 2). While the SEQ/ATS guidelines classify patients according to immediate severity criteria, SEPAR/IDSA guidelines use the PSI and

ICU admission (Some of these criteria)	Conventional hospital admission* (Some of these criteria)
<ul style="list-style-type: none"> • Severe sepsis • Severe respiratory failure • Or Progression of the X-ray Image 	<ul style="list-style-type: none"> • >65 years old • Some of these parameter: <ul style="list-style-type: none"> ○ >30 breaths per minute ○ >38,3°C of temperature ○ <60 mmHg of Systolic pressure • Risk of complications as: <ul style="list-style-type: none"> ○ Immunosuppressed patient ○ Respiratory failure ○ Chronic disease risk of decompensation • Emergence of empyema or bad evolution • Suspicion of CAP by unusual organism

Table 1: Guide I: SEQ/ATS guideline.

other additional criteria to assess the need for empirical treatment and hospital admission. The simplicity of the SEQ/ATS guidelines and the consideration of social aspects for the management of the patients are some advantages of these guidelines. Therefore, SEQ/ATS may be more useful than other guidelines in a busy emergency department. However, its simplicity leads to application of very lax criteria; moreover, clinical

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Characteristics of the patient		Score
Age		Number of years (-10 in women)
Acquired in asylum or residence		+10
Previous illnesses:		
Neoplastic disease		+30
Hepatic disease		+20
Congestive heart failure		+10
Acute cerebral stroke		+10
Renal disease		+10
Physics exploration data:		
Altered mental status		+20
Respiratory rate >=30/minute		+20
Systolic blood pressure <90 mmHg		+20
Temperature <35°C or >=40°C		+15
Heart rate >=125/minute		+10
Radiological and laboratory data:		
pH <7.35		+30
BUN >30		+20
Sodium <130mEq/L		+20
Glucose >250		+10
Hematocrit <30%		+10
O ₂ blood pressure <60 mmHg or O ₂ saturation <90%		+10
Pleural effusion		+10
Type of risk	Score	Mortality
I	*	0.1%
II	<70	0.6%
III	71-90	2.8%
IV	91-130	8.2%
V	>130	29.2%
		Preferred place of care
		Outpatient
		Outpatient
		Outpatient or brief
		hospitalization
		Hospital admission
		Hospital or ICU admission

*Patients who do not meet any of the criteria

Table 2: Guide II: PSI (Pneumonia severity index).

judgment results more relevant, which could induce to classify the patients incorrectly. The PSI has demonstrated consistency and a clear improvement of the baseline estimation made by physicians. On the other hand, the PSI needs a computer support for the management of the data; moreover, it presents some limitations: it gives excessive weighting to the age, inadequate assessment of certain situations as chronic bronchitis, and functional dependence, and underestimation of the magnitude of the acute illness.

Even so, we hypothesized that guidelines implementation reduce the rate of admission, improves the management of patients with CAP, and therefore have an influence on the process-of-care and outcome indicators. For this reason, the objective of this study was to evaluate process-of-care indicators (inappropriate hospitalization, suitability and early antibiotic treatment) and outcome indicators (length of hospital stay, hospital readmission, ICU admission and mortality) in the management of CAP when the SEPAR/IDSA guidelines were applied and to compare with previous data.

Patients and Methods

In a period prior to the start of the study, emergency medical practitioners decided in clinical session to use the new guidelines (SEPAR/IDSA guidelines). The software to calculate the PSI was installed on the computers of the emergency service. There was a brief period of time prior to the beginning of the study in which both guidelines were used in parallel (during software training). The guidelines applied were recorded in the medical history of the patient. The study was authorized by the Ethics Committee of the hospital.

We reviewed the medical records of patients diagnosed with CAP at hospital discharge. Demographic and clinical data as well as the necessary indicators to calculate the severity of each patient included in the study were recorded. In addition, we determined the rate of patients in which the PSI was calculated, and the type of risk calculated.

	SEQ/ATS (2006) (n=110)	SEPAR/IDSA (2007) (n=186)	SEPAR/IDSA (2008) (n=161)	p value
Patients admitted	78 (71,0)	125 (67,2)	135 (83,9)	<0,001
Global adherence to the guidelines**	37/110 (33,6)	90/186 (48,4)	82/161 (51,0)	0,02
POT/PSI I-III	12/66 (18,2)	44/106 (41,5)	28/64 (43,8)	0,002
POT/PSI IV-V	25/44 (56,8)	46/80 (57,5)	54/97 (55,7)	NS
p	<0,001	0,03	NS	
Treatment appropriateness	81 (73,6)	178 (95,7)	149 (92,5)	<0,001
Low risk patients admitted				
POT/PSI I-III total	37/66 (56,1)	40/106 (37,7)	27/64 (42,2)	0,048
POT/PSI I-III admitted with some clinical or social justification	11/37 (29,7)	31/40 (77,5)	16/27 (59,2)	<0,001
POT/PSI I-III admitted without apparent reason	26/66 (39,4) [†]	9/106 (8,5)	11/64 (17,2)	<0,001
PSI I-II admitted without apparent reason		3/67 (4,5) ^{††}	5/36 (13,9) ^{††}	NS
PSI III admitted without apparent reason		6/39 (15,3)	6/28 (21,4)	NS
Moderate-high risk patients admitted				
PHT/PSI IV-V total	41/44 (93,2)	72/80 (90,0)	96/97 (99,0)	0,03
PHT/PSI IV-V not admitted	3/44 (6,8)	6/80 (7,5)	1/97 (1,0)	NS

Qualitative variables expressed in absolute numbers (%); Days of stay expressed in median and range; POT: Patient with pneumonia of outpatient treatment; PHT: Patient with pneumonia of hospital treatment

^{*} p value: χ^2 for categorical variables; Kruskal-Wallis for comparison of quantitative variables

^{**} Global adherence to guidelines: adequacy of the areas of treatment and prescribed antibiotic therapy

[†] Positive predictive value as indicator of inadequate hospitalization of the SEQ/ATS guidelines

^{††} Positive predictive values as indicators of inadequate hospitalization of the SEPAR/IDSA guidelines

Table 3: Process indicators (I). Global adherence of the guidelines, the appropriateness of the treatment, and the indication of hospital admission.

The study, observational and retrospective, was conducted on adults patients (>=18 years old) diagnosed with CAP in the emergency unit of a general hospital (University Hospital, Vitoria-Gasteiz, Spain). Consecutive patients having CAP as a primary or secondary diagnosis according to the ICD-9, 9^a edition, codes 480-486, 487.0 and 507.0 were included. As exclusion criteria, we considered obstructive pneumonitis, aspiration pneumonia, abscess, or pulmonary tuberculosis. One hundred and eighty six patients from the first semester of 2007, and 161 patients from 2008 were included. The process-of-care and outcome indicators in 2007 and 2008 (first and second year after the implantation of SEPAR/IDSA guidelines) were evaluated, including the differences depending on the use of the PSI. Additionally, both indicators were compared with those in 2006 (110 patients), when the current guidelines were those of SEQ/ATS. Process-of-care indicators included global adherence to the guidelines, the appropriateness of treatment, unjustified hospital readmission, and early treatment. Outcome indicators included length of hospital stay, hospital readmission, admission at the Intensive Care Unit (ICU), and mortality at 30 days. Treatment was considered adequate if it was the same than that proposed by the guidelines, and precocity in the establishment of initial antibiotic treatment when it was initiated not more than eight hours from the arrival to the Emergency Department. When discrepancies in the assessment of the parameters existed, they were resolved by consensus of three of the authors who did not participate in the initial evaluation of cases.

Results

(Table 3) shows the global adherence to the guidelines, the appropriateness of the treatment, and the indication of hospital admission. Global adherence to the guidelines was significantly higher with the SEPAR/IDSA guidelines, and the number of low risk patients that were hospitalized was lower. A significant increase in the percentage of the moderate-high risk patients who received the appropriate treatment in emergency unit was observed when PSI was used. In 2008, the second year after the implantation of the SEPAR/IDSA guidelines, the rate of patients belonging to IV-V PSI group who received an early treatment (Table 4) was significantly higher than the rate of patients with hospitalization criteria, according to the SEQ/ATS guidelines (2006).

Global mortality at 30 days was around 10%, and no significant difference depending on the guidelines or the year after implantation

of SEPAR/IDSA guidelines was detected. However, mortality was significantly lower ($p < 0.001$) in classes IV-V patients in which the PSI was calculated, in comparison with classes IV-V patients in which the PSI was not applied. Furthermore, global mortality at 30 days in 2008 was significantly lower ($p = 0.003$) in those patients than in patients with hospitalization criteria according to SEQ/ATS. There were no significant differences in the rest of parameters studied.

Discussion

This work shows that global adherence to the new guidelines (SEPAR/IDSA) increased with respect to the previous one (SEQ/ATS). The SEPAR/IDSA guidelines implantation contributed to significantly decrease the hospitalization of low risk CAP patients, reaching the same rate (around 40%) similar to that reported by other national [14,15] and international studies [16]. Although PSI may help physicians of the emergence unit to evaluate the need for hospitalization, 90% of the inadequate admission to hospital found in our study was justified by the associated co-morbidity, mainly asthma or acute exacerbation of chronic bronchitis, and due to the patient's social situation as well. However, all these criteria are not included to calculate the PSI. These results, similar to those found by other authors [16-18] confirm that the decision for hospitalization admission must be analysed case by case.

The appropriateness of antimicrobial treatment depended on whether the physicians applied or not the PSI; actually, when the PSI was calculated, the appropriateness of antimicrobial treatment was higher than 80%. The percentage of patients that received early treatment within 8 hours from their arrival to the Emergency Department increased significantly in 2008 compared to the previous years (Table 4). However, it is still lower than the values obtained in other studies, around 75% [14,18].

The decrease of the mortality in high risk patients (IV-V PSI group) in the second year of implementation of SEPAR/IDSA guidelines may be due, among other factors, to the increase of the appropriateness and early antimicrobial treatment. Recent studies have also shown that CAP patients treated in emergency units where the guidelines include the application of the PSI have lower mortality rates [17]. In the same way, the adherence to the guidelines with risk stratification has a protective effect against the therapeutic failure and the mortality. This largely affects patient at high risk [18-20].

		% of patients with inappropriate treatment				% of patients with early treatment			
		2006	2007	2008	p	2006	2007	2008	p
Global (%)		59/110 (53,6)	84/186 (45,1)	88/161 (54,6)	NS	48/110 (43,6)	80/186 (43,0)	98/161 (60,9)	0,028
SEQ/ATS	POT	29/66 (43,9)			NS	21/66 (31,8)			NS
	PHT	25/44 (56,9)				22/44 (50,0)			
SEPAR/IDSA	PSI I-III	PSI calculated in ED		12/34 (35,3)	18/30 (60,0)			16/34 (47,1)	18/30 (60,0)
		PSI not calculated in ED		24/72 (33,3)	16/34 (47,1)			26/72 (36,1)	14/34 (41,2)
	PSI IV-V	PSI calculated in ED		19/23 (82,6)*	36/44 (81,8)			12/23 (52,2)	34/44 (77,3)
		PSI not calculated in ED		29/57 (50,9)	18/53 (34,0)			26/57 (45,6)	32/53 (60,4)
		p calculated PSI IV-V vs not calculated in ED		<0,01	<0,01			NS	NS

Qualitative variables expressed in absolute numbers (%); POT: Patient with pneumonia of outpatient treatment; PHT Patient with pneumonia of hospital treatment; ED: Emergency Unit

p value: χ^2 for categorical variables

* $p < 0,05$ respect to PHT (SEQ/ATS)

Table 4: Process indicators (II). Adequacy and early antibiotic treatment in patients with CAP.

The present study has several limitations: a) the observational-retrospective design of the study favours the selection bias and the influence of confounding factors, b) the fact that PSI figure in history clinic does not guarantee its use for patient management, c) therapeutic changes after the initial antibiotic therapy have not been investigated, and d) the microbial aetiology of the CAP has not been studied.

In conclusion, SEPAR/IDSA guidelines decreased the unjustified hospitalization admission. In the second year of its application, an increase in the number of patients received early treatment, and a decrease of the mortality rate of the patients of risk classes IV-V in which the PSI had been estimated, where also observed.

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