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Community-acquired pneumonia – which patients are hospitalised?

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Summary

Background and objective: Patients with community-acquired pneumonia can be allocated into low and high-risk mortality groups by simple clinical criteria.

We studied the value of the stratification for outcome as proposed by Fine, et al. to guide the decision for in-hospital versus outpatient treatment in the emergency department.

Patients and methods: We studied demographic data, risk group stratification and decision-making for in-hospital versus outpatient treatment in 101 consecutive medical emergency department patients with community-acquired pneumonia. We also analysed predictive factors for hospitalisation of low-risk patients. We obtained complete 30 day follow-up information.

Results: Forty-three of 44 high-risk patients were hospitalised after medical emergency department triage. Twenty-seven (47%) of 57 low-risk patients were hospitalised as well. Based on routine clinical assessment, hospitalisation of low-risk patients was required for poor medical condition or severe pneumonia (67%), for lack of social support (15%) and for relevant comorbidity (18%). In an univariate analysis, age (p = 0.003), C-reactive protein (p = 0.0006), presence of comorbidity (p = 0.0001), Charlson index (p = 0.0001) and active oral steroid treatment (p = 0.028) were significantly correlated with hospitalisation of low-risk patients.

The 30-day mortality rate was 32% in patients allocated to the high-risk group at the time of diagnosis in the emergency department, compared to 0% in low-risk patients.

Conclusion: Simple clinical criteria distinguish well between low and high 30-day-mortality risk in patients diagnosed with community-acquired pneumonia. Nevertheless, 47% of low-risk patients require in-hospital treatment. Age, C-reactive protein, presence of comorbidity and steroid treatment are significantly correlated with hospitalisation of low-risk patients with community-acquired pneumonia.

Keywords: community-acquired pneumonia; hospitalisation; outcome

Introduction

Community acquired-pneumonia (CAP) is a common problem in emergency medicine. The annual incidence is 10 to 15 cases per 1000 patients in the United States and Western Europe [1, 2]. The rate of hospitalisation of CAP patients varies considerably from one geographic region to another [3], suggesting variations in the criteria determining the admission decision. The cost of care directly depends on the decision to hospitalise since the extent of the diagnostic work up, the mode of the antibiotic treatment and the intensity of the clinical monitoring differs between outpatient and in-hospital treatment [4–6]. Physicians primarily rely on their clinical judgement when considering inpatient or outpatient treatment. The decision is based on the general, the respiratory and the mental condition of the patient, on presumed sufficient compliance with treatment, and the possibility of oral treatment [5, 7]. Physicians may overestimate the mortality of patients with pneumonia [7]. The overestimation is associated with an increased hospitalisation rate of patients with low mortality risk [5]. Fine, et al. have developed and validated an index for patients with CAP (fig. 1 and table 1). Fine's criteria can identify CAP patients with low risk for mortality and severe complications [8]. Fine's index yields a prognostic information [8] and correlates significantly with the hospitalisation rate of patients who initially were treated as outpatients, and furthermore

it correlates with intensive care unit treatment and with the length of stay of inpatients [8].

Strategies based on Fine's criteria can decrease the hospitalisation rate of patients with CAP [8, 9]. Marrie, et al. [9] have tested an algorithm based on Fine's criteria and on other clinical findings. Patients in the high mortality-risk group are almost always hospitalised. However, 31% of the low mortality-risk patients were hospitalised as well [8]. Recently, Marras, et al. [10] reported on 245 patients with CAP admitted for in-hospital treatment. Seventy-one patients were in low-risk classes I-III, and 67 of them had additional reasons for admission, i.e. other medical problems (n = 35), psychosocial issues (n = 18), failed outpatient therapy for CAP (n = 16), or hypoxemia (n = 13). There are no published data on predictors of hospitalisation of patients with low mortality risk with CAP.

Therefore, we aimed in our study with 101 consecutive emergency department patients with CAP (1) to compare Fine's index with the 30-day outcome, and (2) to analyse the reasons for hospitalisation in low mortality-risk patients.

Patients and methods

Setting

The study was conducted in the Medical Emergency Department of the University Hospital of Basel. Our institution has the only emergency department in town with a 24-hour open access for emergency care for a population of 300'000. It counts 12'000 admissions of adult medical patients per year. Thirty six per cent of the patients are referred by their treating physicians, and 64% present directly to our Medical Emergency Department.

Fine's index

The criteria developed and validated by Fine and co-workers can identify patients with low risk for mortality and other severe complications in CAP [8]. Data on age, sex, comorbidity, clinical examinations and laboratory investigations are collected for stratification into 5 risk groups (fig. 1 and table 1). The mortality is 0.1–0.4% in Fine's risk group I, 0.6–0.7% in group II, 0.9–2.8% in group III, 8–13% in group IV, and 27–31% in group V [8].

Study design

One hundred and one consecutive patients with CAP from our Medical Emergency Department were enrolled in a prospective cohort study from January to April 1998. Inclusion criteria were age = 18 years, a minimum of one symptom suggesting pneumonia (cough, expectoration, fever), and infiltrates in the chest X-ray, confirmed by a radiologist. All patients had signed an informed consent form. Exclusion criteria were hospitalisation in the preceding 10 days before presentation to the emergency department, and known HIV disease. An independent study physician collected data required for the calculation of Fine's index for every patient (fig. 1 and table 1), and reasons for hospitalisation were noted. With complete data, Fine's index can be calculated quickly, in about a minute.

Figure 1
Fine's Index I

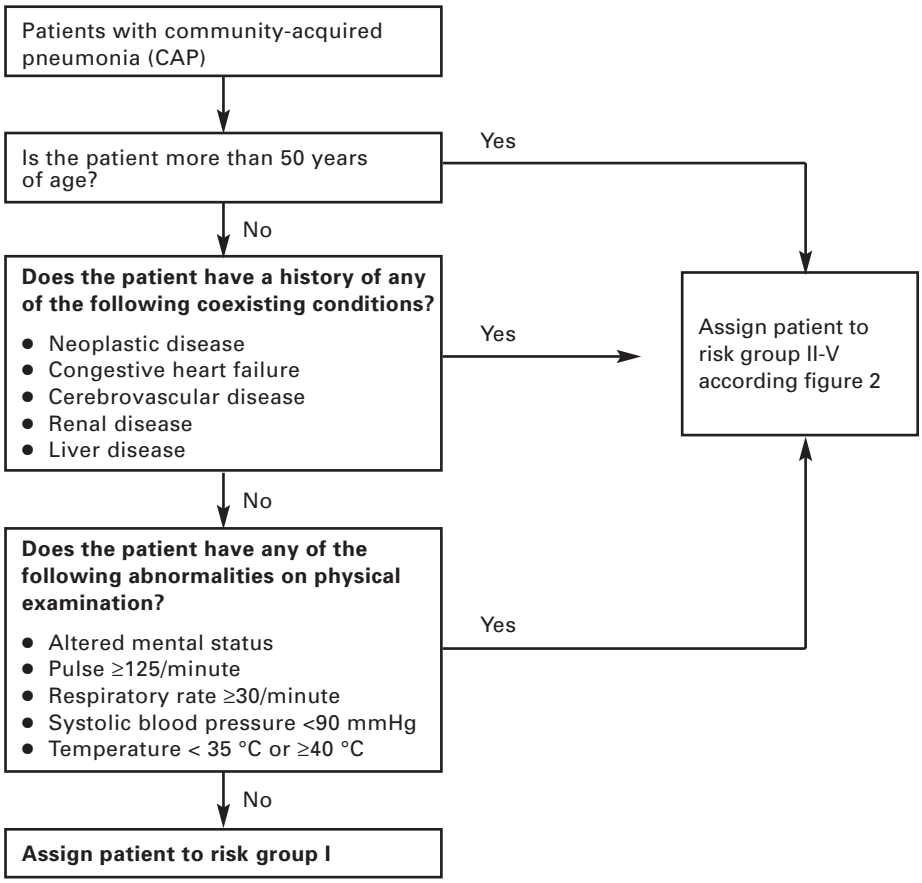

Table 1

Characteristic	Points
Demographic factor	
Age	
Men	Age (years)
Women	Age (years) –10
Nursing home resident	+10
Coexisting illness	
Neoplastic disease	+30
Liver disease	+20
Congestive heart failure	+10
Cerebrovascular disease	+10
Renal disease	+10
Physical examination findings	
Altered mental status	+20
Pulse ≥125/min	+20
Respiratory rate ≥30/min	+20
Systolic blood pressure <90 mm Hg	+15
Temperature <35 °C or ≥40 °C	+10
Laboratory and radiographic findings	
Arterial pH <7.35	+30
Creatinine ≥145 mmol/l	+20
Natrium <130 mmol/l	+20
Glucose ≥ 14 mmol/l	+10
Hematocrit <30%	+10
PaO_2 <60 mm Hg or SaO_2 <90%	+10
Pleural effusion	+10

Fine risk group	(Total number of points)
Fine II	(≤70)
Fine III	(71–90)
Fine IV	(91–130)
Fine V	(>130)

The patients received routine diagnostic work up and treatment for CAP without calculation of Fine's index by the treating physicians.

The 30-day follow-up information was obtained from the patients' chart of patients that were still hospitalised on day 30 (n = 18), by a questionnaire sent to the general practitioner (n = 71), or by a telephone interview of the patients (n = 12).

The study physician assessed 30 day-mortality and the number of additional investigations. In outpatients, the rate of hospitalisation within 30 days, and in case of hospitalisation, total and intensive care unit length of stay, and the reason for the hospitalisation were protocolled. The routine triage decision was compared with Fine's index [8] obtained by the study physician. We defined Fine's index I-III as low-risk and Fine's index IV and V as high-risk. In all patients the Charlson comorbidity index was calculated as a validated measure of the comorbidity [11]. Two independent experienced attending physicians in internal medicine assessed the indications of hospitalisation and of further diagnostic interventions.

To identify factors correlated with hospitalisation of low-risk patients, we tested the following variables in an univariate analysis: age, sex, comorbidity present or not, Charlson comorbidity index, C-reactive protein, body temperature, oxygen saturation or partial pressure, and steroid treatment. We compared these variables in hospitalised patients of low-risk groups with those of patients treated as outpatients in low-risk groups.

Student's *t*-test was used for continuous variables and Chi^2 test was used for categorical variables. A p value of <0.05 was considered significant. Statistical calculations were done with GB-Stat 7.0.

Results

One hundred and one patients, 34 females and 67 males, were included in the study. Mean age was 62.5 years (range 19–95 years, 55 patients ≥65 years). Fifty-seven patients were categorised into groups I-III, and 44 patients were categorised into groups IV-V according to Fine's index (figure 1, tables 1 and 2). The mean Charlson comorbidity index was 2.4 (range 0–10). The thirty-day mortality data of the patients are given in table 3. The total 30-day mortality rate was 14%. After 30 days 9 patients were still hospitalised.

A majority of patients (82%) was treated on an outpatient basis in risk group I. In groups II to V the patients were treated predominantly as inpatients. One patient of group I and the patient with initial outpatient treatment of group IV (patient wish) were rehospitalised within 3 days after the decision to treat them on an outpatient basis.

The reasons given by the treating physicians to hospitalise the 27 patients of the low-risk group were: serious medical condition and severe pneumonia (67%) based on clinical assessment, lack of social support (15%) or comorbidity (18%).

Ten patients required intensive care treatment for an average of 7.9 days (range 1–22 days). Nine of these 10 patients had mechanical ventilation in the intensive care unit for an average of 7.3 days (range 1–20 days) (table 1). Six of these patients were alive on day 30. Two patients of the low-risk groups required intubation and mechanical ventilation.

In an univariate analysis, age, comorbidity, Charlson comorbidity index, C-reactive protein and oral steroid treatment were statistically significant and correlated with hospitalisation.

To analyse whether the hospitalisation and the

Table 2

Patient treatment and outcome according to Fine risk group.

Fine	n	out-/inpatient treatment	30 day mortality	Patient in hospital on day 30	intensive care/ mechanical ventilation	length of total hospital stay (days; mean, range)
I	21	18 / 3	0	1 (4.5%)	0 / 0	11.3 (3–30)
II	21	10 / 11	0	0	2 / 2	12.5 (5–28)
III	15	2 / 13	0	2 (13%)	0 / 0	13.6 (5–30)
IV	28	1 / 27	8 (29%)	3 (11%)	5 / 4	14.8 (1–30)
V	16	0 / 16	6 (38%)	3 (19%)	3 / 3	11.4 (1–30)
Total	101	31 / 70	14 (14%)	9 (9%)	10 / 9	13.7 (1–30)

Table 3
Univariate characteristics of low-risk patients with CAP

Characteristics	Outpatient treatment (n = 30)	Inpatient treatment (n = 27)	p (Chi^2/*t*-test)
Age	45.2 ± 16	62.7 ± 16	0.0003
Gender (m/f)	22/8	14/13	ns
Comorbidity (yes/no)	5/25	22/5	0.0001
Charlson Index	0.23	1.7	0.0001
C-reactive protein (mg/dl)	98 ± 84	180 ± 124	0.0006
Fever (yes/no)	20/10	13/14	ns
SaO_2 <90% or pO_2 <60 mm Hg (yes/no/missing)	11/10/9	17/7/3	ns
Steroid treatment (yes/no)	0/30	4/23	0.028

additional investigations were indicated, the charts were assessed by two independent experienced attending physicians in internal medicine that were not involved in the management of these patients. They fully agreed that all hospitalisations of the low-risk group patients were indicated. Reasons to hospitalise low-risk patients were severe pneumonia or serious medical conditions with relevant comorbidity (n = 23) (based on clinical assessment), and psychosocial reasons (n = 12). Four patients had been hospitalised exclusively for lack of social support. Patients with relevant comorbidity had chronic obstructive lung disease (n = 4), were on a systemic steroid treatment (n = 4), suffered from drug abuse (n = 3), heart failure (n = 2), diabetes mellitus (n = 1), or lung fibrosis (n = 1). Some patients had more than one of these conditions.

Fifteen of the 27 hospitalised patients of the low-risk groups received a total of 19 additional investigations or interventions: computer tomograms of the thorax (10), bronchoscopies / bronchoalveolar lavages (4), video-assisted thoracoscopy (1), chest drains (2) and lung scintigraphies (2). According to the independent physicians these investigations were all indicated with the exception of one lung scintigraphy.

Discussion

The prognostic value of the risk stratification according to Fine, et al. [8] is confirmed by the outcome observed in our study in patients with CAP. In group I-III 30-day mortality was 0%, whereas in group IV and V mortality was 29% and 28%, respectively.

However, the triage decision for inpatient versus outpatient treatment is not sufficiently predicted by Fine's criteria [8]. All but one patient of the high mortality-risk groups IV and V were initially hospitalised. However, many patients of the low-risk groups I-III (27 of 57 patients, 47%) were hospitalised as well. Similarly, in the study performed by Marrie, et al. [9] almost all high-risk patients and 31% of the low-risk patients were hospitalised. In the control group without explicit use of Fine's criteria, 48% of the low-risk patients were hospitalised.

Reasons for hospitalisation of low-risk patients may be relevant comorbidity, drug abuse, immunosuppressive medication, patient wish, wish of relatives or referring physicians, or lack of social support [10]. These reasons are not, or not sufficiently covered by Fine's criteria.

At initial triage decision, Fine's criteria do not identify all patients with CAP requiring hospitalisation. Exclusive use of Fine's criteria to determine hospital admission would have sent home every second patient in low-risk classes, despite legitimate reasons for hospitalisation. The careful clinical assessment is an additional important contributor for the decision-making process for inpatient versus outpatient treatment. In addition, physicians assess the clinical course in the first hours and they consider the possibilities of support and the reliability of drug administration at home [5, 9].

In a univariate analysis, age, C-reactive protein, presence of relevant comorbidity, Charlson comorbidity index and active steroid treatment were significantly correlated with hospitalisation of low-risk patients.

All but one additional investigation performed in hospitalised low-risk patients were indicated according to independent evaluation by two experienced attending physicians. No patient hospitalised for nonmedical reasons had additional investigations.

The 30-day mortality rate in our patients with CAP is 14%. Other studies have reported total mortality rates to be 9–15% in hospitalised patients with CAP [8, 9, 12, 13].

For the interpretation of our results the following strengths and limitations have to be considered. All studied patients were prospectively included and had complete follow-up. HIV-positive patients were excluded from our study as well as that performed by Fine, et al. [8]. The admitting emergency department physicians knew that the prospective study was taking place; therefore, their behaviour may have been influenced, although to a limited extent since they were not explicitly informed about the study aims, nor were they aware of the calculated Fine's index when making the

decision for inpatient versus outpatient treatment. The total number of study patients was not large enough for reliable detection of differences between the five risk groups. Therefore, we compared only low and high-risk groups. Logistic regression did not reveal significant and clinically meaningful and valid predictors for hospitalisation, because the number of low-risk patients with CAP was too small. We used overall-hospitalisation including medical and social reasons as dependent variable to analyse variables correlated with hospitalisation. Therefore, valid CAP triage predictors for "life saving" hospitalisation have to be evaluated in another study.

In CAP patients allocated to a low-risk group at initial diagnosis, hospitalisation or even admission to an intensive care unit and mechanical ventilation may be required to ensure a favourable outcome. These patients should be differentiated from CAP patients that are hospitalised for psychosocial reasons or from CAP patients with concomitant exacerbation of extrapulmonary diseases and consideration of outpatient treatment, such as heart failure or diabetes mellitus. Safe strategies to decrease hospitalisations of low-risk patients are required to reduce costs.

In conclusion, Fine's index [8] can be reliably used for our medical emergency department patients with CAP to distinguish high and low 30-day mortality risk. However, Fine's criteria do not sufficiently predict the need to hospitalise low-risk patients. Forty-seven per cent of all low-risk patients required hospitalisation.

Significant variables correlated with hospitalisation of CAP patients with low mortality risk are age, C-reactive protein, presence of comorbidity and oral steroid treatment.

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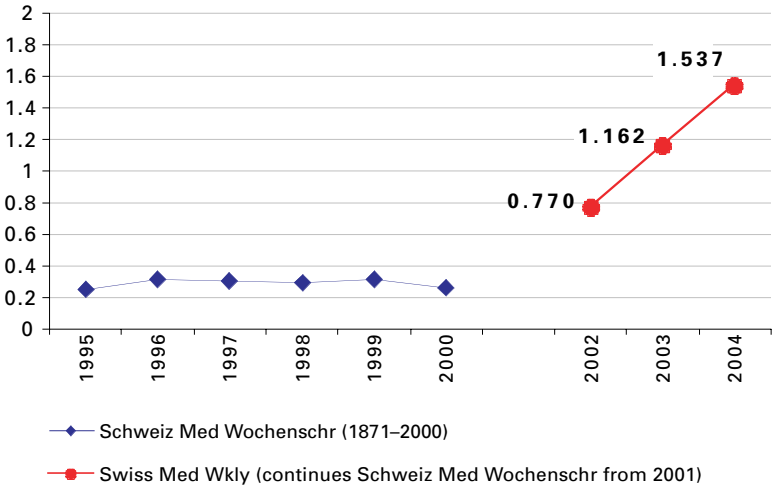

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