Original article

Initial empiric antibiotic therapy for community-acquired pneumonia in Chinese hospitals

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ABSTRACT

Objectives: Studies on treatment of community-acquired pneumonia (CAP) in China are scarce. We performed a study to investigate empiric antibiotic practices for patients hospitalized with CAP in China and the risk factors for treatment failure.
Methods: Data were collected from a national Chinese hospitalization database. Adult patients who were diagnosed with CAP between 1 October 2014 and 30 September 2015 were identified. We studied initial empiric antibiotic regimens, microbiologic sampling, treatment failure, in-hospital mortality and length of hospital stay.
Results: We included 18 043 adult patients from 185 hospitals who met all the study inclusion criteria. The most common initial antibiotic regimen for CAP was monotherapy with a fluoroquinolone (14.8%, 2671/18 043). The most common initial antibiotic (used alone or in combination with other antibiotics) was levofloxacin (15.7%, 4597/29 278 (this denominator represents the total number of initial antibiotics)). The microbiologic sampling rate was 26.9% (4851/18 043). A total of 4050 (22.4%) of 18 043 patients experienced treatment failure. Multivariate logistic regression demonstrated that older age, male sex, coexisting lung cancer and use of regimens not covering atypical pathogens were risk factors for treatment failure. In-hospital mortality was 2.1% (380/18 043). The median hospital length of stay was 11 days (interquartile range, 8–15 days).
Conclusions: Patients receiving Chinese guideline-adherent regimens had better outcomes, and atypical pathogen active regimens were associated with a lower treatment failure rate and shorter length of hospital stay. **X.M. Nie, Clin Microbiol Infect 2017;■:1**

Introduction

Community-acquired pneumonia (CAP) is a common infectious disease worldwide. Many countries have devoted efforts to improve the care of CAP patients, and some organizations and countries have developed CAP guidelines for adults [1,2]. China developed its adult CAP guidelines in 2006 [3] and updated it in 2016 [4]. However, studies on treatment of CAP in China are scarce.

Although most CAP patients are treated successfully in outpatient settings, about 25% require hospitalization in North America [5]. Even in hospitalized patients, initial antibiotics are almost always chosen empirically, as the causative pathogen is not known. The 2016 Chinese CAP guidelines [4] recommend several regimens as initial empiric antibiotics, depending on patient characteristics. To our knowledge, there have been no studies on initial empiric antibiotics for hospitalized CAP patients in China.

The objective of our study was to examine antibiotic treatment and microbiologic testing practices for hospitalized CAP patients in China and identify areas which require greater

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attention. We focused on several processes and outcomes of care, including the most common initial empiric antibiotic regimens and drugs, rate of microbiologic sampling, risk factors, frequency of treatment failure, in-hospital mortality and length of hospital stay (LOS).

Methods

Data for this study were obtained retrospectively from a national Chinese hospitalization database. This database includes all the hospitals belonging to the Chinese People's Liberation Army, and all of these hospitals are open to the public. A detailed description of this database is available online in Supplementary Appendix 1. The database contains deidentified comprehensive clinical records from hospitalized patients. Information available for each patient includes hospital characteristics, patient demographics, admission and discharge diagnoses (in International Classification of Diseases, Tenth Revision (ICD-10), format), all parenteral antibiotics administered, microbiologic testing and LOS.

We included patients ≥18 years old who were both admitted and discharged with a principal diagnosis of pneumonia (ICD-10 diagnosis codes J13—J16, J18) between 1 October 2014 and 30 September 2015. The inclusion criteria were receipt of parenteral antibiotics within 24 hours after admission; and receipt of parenteral antibiotics for at least 72 hours. We excluded patients with probable fungal pneumonia, based on usage of only antifungal agents; and patients who were diagnosed as having lung inflammatory pseudotumor (ICD-10 diagnosis code J18.802) and post-obstructive pneumonia (ICD-10 diagnosis code J18.805).

We captured patient characteristics, including age, gender and presence of selected comorbidities (as secondary discharge diagnoses); we also listed the teaching status and geographic region of the hospitals. We defined initial empiric antibiotic therapy as all parenteral antibiotics received within 24 hours after admission. We defined intensive care unit (ICU) patients as all patients admitted to the ICU within 24 hours of admission.

On the basis of previous literature [6] and the Chinese guidelines [4], we defined treatment failure as any of the following occurring more than 72 hours after the first antibiotic dose: change of initial empiric antibiotic therapy, transfer of patient to the ICU or death. We defined time until first antibiotic dose (TFAD) as the time from admission to the time of the first dose of antibiotics. The chi-square and Wilcoxon rank sum tests were used to analyse categorical and continuous data, respectively. Logistic regression was used to analyse factors associated with failure of the initial antibiotic regimen. The multivariable logistic regression model contained several variables, including age, gender, hospital type, ICU admission within 24 hours, comorbidities, TFAD, regimen covering atypical pathogen and adherence to Chinese guidelines. All variables were included in the logistic regression analysis without selection. In addition, we also considered the interaction of ICU admission within 24 hours and adherence to Chinese guidelines in the logistic regression model. Differences were considered statistically significant at a value of $p < 0.05$. All analyses were conducted by PC-SAS 9.3 software (SAS Institute, Cary, NC, USA). The Shanghai Changhai Hospital ethics committee waived approval for this study.

Results

Adult patients who were admitted and discharged with a principal diagnosis of pneumonia from 192 hospitals between 1 October 2014 and 30 September 2015 were identified. Of these patients, 18 043 from 185 hospitals met all the study inclusion criteria (Fig. 1). There were 177 nonteaching hospitals and eight teaching hospitals. Demographic and clinical characteristics of the
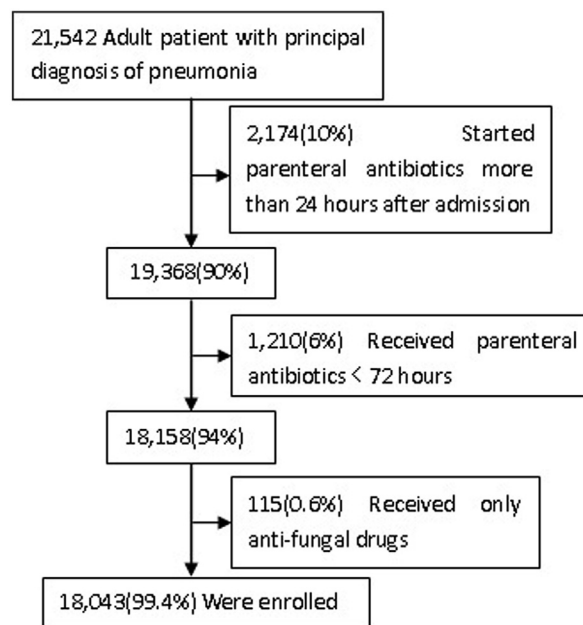

Fig. 1. Enrollment of community-acquired pneumonia patients.

patients are listed in Table 1. Geographic regions of China are shown in Fig. 2. Among the study patients, approximately two thirds were men. The mean (±SD) age was 59 ± 23 (range, 18—106) years. Most of the patients were non-ICU patients.

Among initial empiric antibiotic regimens, monotherapy was used more often (50.5%, 9117/18 043) than combination therapy (49.5%, 8926/18 043). The three most common initial antibiotic regimens and drugs are shown in Tables 2 and 3, respectively. Geographic region—specific antibiotic usage patterns are shown in Supplementary Appendix 2. Non-ICU patients received more guideline-adherent regimens (53.3%, 8414/15 795) than ICU

Table 1
Demographic and clinical characteristics of patients

Characteristic	n (%)
Gender	
Male	11 124 (61.7)
Female	6919 (38.3)
Age group	
18—44 years	5110 (28.3)
45—64 years	4336 (24.0)
65—79 years	4186 (23.2)
≥80 years	4411 (24.4)
Geographic region of hospital	
Northeast	3329 (18.5)
North China region	4627 (25.6)
East China region	4425 (24.5)
Central and South China region	2385 (13.2)
Northwest region	2131 (11.8)
Southwest region	1146 (6.4)
ICU or non-ICU	
ICU	2248 (12.5)
Non-ICU	15 795 (87.5)
Teaching or nonteaching	
Teaching	1157 (6.4%)
Nonteaching	16 886 (93.6%)
Comorbidity	
Chronic obstructive pulmonary disease	1833 (10.2%)
Diabetes mellitus	2406 (13.3%)
Heart failure	1871 (10.4%)
Lung cancer	358 (2.0%)