Severe community-acquired pneumonia requiring intensive care: a study of 80 cases from Singapore

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ABSTRACT

Introduction: Severe community-acquired pneumonia is a major cause of mortality and morbidity worldwide. This study looked at the clinical characteristics of these patients admitted to a Singaporean community hospital and the prognostic impact of age, bacteraemia and logistic organ dysfunction score (LODS) on intensive care unit mortality.

Methods: Retrospective analysis of 80 severe community-acquired pneumonia patients admitted to the intensive care unit over a 20-month period was conducted. The Mann-Whitney U and chi-square tests were used for statistical analysis and a p-value of less than 0.5 was considered as significant.

Results: There were 55 male and 25 female patients, with a median age of 62 years. The median LODS was 5. The intensive care unit mortality was 30 percent. The median LODS of intensive care unit survivors was 5 and of non-survivors, 8. The overall hospital mortality was 37.5 percent. A microbiological aetiology was identified in 38 percent of patients. Three of four patients with melioidosis died. Between intensive care unit survivors and non-survivors, there was a significant difference in the LODS, but no significant difference in the age and incidence of bacteraemia.

Conclusion: Severe community-acquired pneumonia is a highly fatal disease which requires early initiation of appropriate empirical antibiotic therapy, which should include coverage for melioidosis in the local context. The microbiological workup should include testing for tuberculosis. The LODS system may be an appropriate tool in estimating the severity of illness.

Keywords: intensive care unit, logistic organ dysfunction score, melioidosis, severe community-acquired pneumonia

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INTRODUCTION

Severe community-acquired pneumonia (SCAP) is a major cause of mortality and morbidity worldwide, with estimated mortality rates ranging from 30% to 50%. Early initiation of appropriate antibiotic therapy is of paramount importance due to the fatality of this illness. However, there is no uniform consensus as to what defines a SCAP. Several clinical criteria have been identified in the literature as being poor prognostic factors in CAP; viz, the need for mechanical ventilation, shock, confusion, multilobar involvement, age > 65 years, respiratory rate > 30/min, acute renal failure, bacteraemia, and comorbidities. The Pneumonia Severity Index (PSI) and the CURB-65 indices use a point system to grade the severity of CAP.[1,2] The recently-published Infectious Diseases Society of America (IDSA)/American Thoracic Society (ATS) consensus guideline has attempted to incorporate criteria from several systems and defines SCAP as the presence of either one of two major criteria, or the presence of three of nine minor criteria.[3] The major criteria include the need for mechanical ventilation and septic shock; the minor criteria include respiratory rate > 30/min, multilobar infiltrates, $PaO_2/FiO_2 < 250$, confusion, uraemia, thrombocytopenia, leucopenia, hypothermia and hypotension.

Empirical antibiotic regimens for SCAP in the IDSA/ATS guidelines are based on the clinical setting (outpatient, inpatient or intensive care unit [ICU]) and the presence or absence of patient comorbidities. However, caution must be employed while using these guidelines in the local context in view of the microbiological differences. I conducted this retrospective analysis to look at the clinical characteristics of our SCAP patients with a focus of the prognostic impact of factors such as advanced

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Table I. Baseline demographics of the study population.

Demographics	No. of patients (n = 80)
Gender	
Male	55
Female	25
Race	
Chinese	49
Malay	22
Indian	7
Others	2
Age (years)	
Range	21–96
Median	62
Mean	60

Table II. Clinical characteristics of the study population (n = 80).

Clinical characteristics	Median value
ICU mortality* (%)	30
LODS score	5
Length of ICU stay (days)	5
No. (%) of intubated patients	58 (72.5)
No. of days intubated	3

*The overall hospital mortality was 37.5%.

age and bacteraemia on mortality. We also wanted to test the validity of the logistic organ dysfunction score (LODS) for scoring severity in SCAP.

METHODS

The data was prospectively collected over a 20-month period from July 2003 to March 2005 from patients who were admitted to the medical ICU (MICU) with a diagnosis of CAP. The presence of at least one clinical criterion (fever, dyspnoea, cough, leucocytosis), in addition to the finding of a suggestive infiltrate on the chest radiograph, was needed to make a diagnosis of CAP. Patients were diagnosed to have SCAP if they met one of two major criteria, or two of three minor criteria. The major criteria were septic shock and the need for mechanical ventilation. The minor criteria were the presence of multilobar involvement, respiratory rate > 30/min and PO_2/FiO_2 ratio < 250. Exclusion criteria were patients with decompensated left ventricular dysfunction, patients who were admitted to the MICU after a 48-hour stay in the general ward, or where a decision for conservative management during the course of the MICU stay was made.

All patients had blood and respiratory specimens sent for culture and staining within 12 hours of ICU admission. Sputum or endotracheal tube (ETT) specimens (Gram stain and cultures) were considered valid only if microscopy showed > 25 neutrophils and < 10 epithelial cells per low-power field. The choice of antibiotic regimen and further microbiological testing was left to the discretion of the MICU team concerned. We used the LODS system for scoring severity of illness within the first 24 hours of ICU admission (Appendix I).[4] We obtained a waiver of consent from the hospital's Institutional Review Board. For statistical analysis between the ICU survivors and non-survivors, we used the Mann-Whitney U and chi-square tests, and a p-value < 0.05 was considered as significant.

RESULTS

80 patients met the study criteria. The baseline demographics are given in Table I. The median age was 62 years and there was a strong male predominance. Clinical characteristics are shown in Table II. There were 56 ICU survivors, with an ICU mortality rate of 30%. The hospital mortality (all causes) was 37.5%. The median LODS score was five (which predicted a mortality of 21%). A microbiological aetiology was identified in 38% of patients (Table III). None of the patients had a history of antibiotic use prior to hospital admission. All patients had blood cultures done and a positive blood culture was obtained in 18 (22.5%) patients. In addition, there were seven cases that were considered as contaminants. The ICU mortality rate in the bacteraemic patients was 38%. The results of microbiological testing were beneficial in ten cases with regard to change in antibiotic regime. In two cases, the results of the Gram staining were potentially harmful, since it led to an unnecessary change in the regime (cultures grew coagulase negative staphylococci which were considered contaminants).

A valid respiratory specimen was obtained in 65 patients. The three patients with acid-fast positive smears subsequently grew *Mycobacterium tuberculosis* on culture. All three were already on empirical antituberculosis therapy when the smears were reported as positive.

Three of the four patients with pulmonary melioidosis died. Only half of the cases had a history of diabetes mellitus. The sole melioidosis survivor was 41 years of age, had a history of diabetes mellitus and a LODS score of six, and was not on a melioidosis regime at the time of microbiological diagnosis. Among the non-survivors, the mean age was 47 years, the mean LODS score was seven, and there was a history of diabetes mellitus and a, in one patient. Only one patient had been empirically started on a melioidosis regime. We compared some characteristics between ICU survivors and non-survivors (Table IV). There was no significant difference in the age or incidence of bacteraemia between the two groups, but there was a difference in the LODS score.

Table III. Results of microbiological testing.

Microbiological test results	No. (%)
Positive tests for bacteria in:	
Blood culture	7
Respiratory culture	8
Blood & respiratory culture	11
Acid-fast bacilli stain	3
Urine legionella antigen	1
Leptospira serology	1
Total	31(38)
Organisms identified:	
S. pneumoniae	10
B. pseudomallei	4
Klebsiella spp.	4
M. tuberculosis	3
Group B *Streptococcus*	2
H. influenza	1
E. coli	1
A. baummani	1
MRSA	1
P. aeruginosa	1
Legionella spp.	1
Leptospira spp.	1
Mixed flora *(E. coli & Acinetobacter)*	1

Table IV. Comparison between ICU survivors and non-survivors.

	ICU survivors (n = 56)	Non-survivors (n = 24)	p-value
Age* (years)	60.5	66.5	0.58
LODs score*	5	8	<0.001
Bacteraemia (%)	20	29	0.57
Intubation* (days)	3.5	3	0.91
ICU stay* (days)	5	3	0.001

* Median values.

DISCUSSION

The racial distribution of study patients reflected the ethnicity of Singapore's population. The mortality rates and other clinical characteristics were similar to what has been previously described in literature. The microbiological yield was relatively low (38%) when compared to other studies on SCAP.[5,6] Aside from the microbiological tests mentioned in the methods section, any further investigations were left to the discretion of the physician concerned. The usefulness of microbiological studies in hospitalised patients with CAP has been a subject of controversy with several studies failing to show an impact on the outcomes.[7-9] However, in the case of SCAP patients, microbiological testing has been found to be useful.[5] The recent ATS/IDSA guidelines on CAP recommend detailed testing in all SCAP patients including cultures of sputum, ETT and blood specimens and urinary antigen testing for *Legionella* and pneumococcus.[3]

The LODS scoring system was put forward by Le Gall et al in 1996 as a new method to assess organ dysfunction in the ICU.[4] It scores the severity of six organ systems and the total score gives us the estimate of the probability of death. The scoring chart is freely available online and is very user-friendly. A template of the chart is shown in Appendix I. The LODS score had been compared to the other organ dysfunction scoring systems and shown to be a reliable outcome predictor.[10,11] A score of 8 predicts a mortality of around 50%. Advanced age and bacteraemia have been identified as poor prognostic factors in CAP. Being an observational study with a relatively small sample size, I did not want to draw inferences as there was no significant difference in these factors between survivors and non-survivors in this study. It is quite clear from this study and a previous study that tuberculosis and melioidosis need to be considered in the aetiology in SCAP cases seen in Singapore.[6]

The high mortality rate in melioidosis patients (75%) has been shown in two other studies from Singapore.[6,12] As a result, we routinely send respiratory specimens for acid-fast bacillus stains and have modified our antibiotic regimen to cover *Burkholderia pseudomallei,* even in nondiabetic patients (half of our melioidosis cases were nondiabetics). In conclusion, SCAP is a highly fatal disease which requires early initiation of appropriate antibiotic therapy, which in the local context should cover melioidosis. The microbiological workup should include testing for tuberculosis. The LODS system may be an appropriate tool in estimating the severity of illness.

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Appendix I

Logistic organ dysfunction scoring system to assess the severity of illness.[4]