Is there a correlation between co-morbidities and initial severity score of pneumonia in patients admitted with community acquired pneumonia? – a retrospective study

Vaani Valerie Visuvanathan[1], Hui Min Chong[2], Shien Yee Ng[3], Chen Nee Ch'ng[3], Juliana Shook Shin Tan[3], Sree Viknaraja Arun Kumar[3], Ming Wai Wan[3]

Background: Community-acquired pneumonia (CAP) is the most important cause of hospitalisation in Malaysia and the 6th most important cause of mortality in patients aged 65 years and above. CAP is a lower respiratory tract infection that includes signs and symptoms like cough, fever, dyspnoea, the presence of new focal chest signs and new radiographic shadowing with no prior cause. To assist clinical judgement in deciding whether to admit the patient for in-ward treatment or otherwise, the severity of CAP is most commonly graded using the CURB-65 score as the components are more readily accessible in the Accidents and Emergency Department. We believe that cardiopulmonary diseases, immunosuppressive diseases like HIV infection or diabetes mellitus and other co-morbidities may affect the severity of CAP and are thus aspects of a patients' history that should play a more significant role in influencing a clinician's judgement of CAP severity. The general objective of the study is therefore to identify the relationship between co-morbidities and initial severity assessment of a patient admitted for community acquired pneumonia. The 3 specific objectives are i) to determine if presence of co-morbidities affects initial severity assessment in a patient admitted with CAP ii) To identify which co-morbidities affects initial severity assessment and iii) to determine whether having multiple co-morbidities increases initial severity assessment.

Methodology: A retrospective study was carried out from the month of February 2013 to July 2013 at Hospital Tuanku Ja'afar, Seremban (HTJS). Patients admitted to the four Medical wards – 6A, 6B, 7A, and 7B – from July 2012 to December 2012 and have been diagnosed with CAP were chosen. A checklist was used as a survey instrument. Using statistical analysis, the severity of CAP in patients was compared in patients with different factors like gender, different co-morbidities and the number of co-morbidities.

Results: A total of 63 patients in the control group had no co-morbidities and 54 patients were of low risk, 7 patients had moderate risk, and 2 patients had high risk CAP. Of the remaining 337 patients in the sample population, 124 patients had one co-morbidity, while 213 patients had multiple co-morbidities. Among those with a single co-morbidity, 100 patients had low risk, 19 patients had moderate risk, and 5 patients had high risk CAP. For the group with multiple co-morbidities, 135 patients had low risk, 58 patients had moderate risk, and 20 patients had high risk CAP. This study found that the presence and number of co-morbidities present in a patient affected the severity of CAP. Co-morbidities like diabetes mellitus, hypertension and asthma had significant correlation to the severity of CAP in patients. The gender of the patient had no significant correlation to the severity of CAP.

Conclusion: The presence and number of co-morbidities present in a patient increases the severity of CAP. Hypertension, diabetes mellitus, and asthma are co-morbidities that are prerequisites for increased caution and alert when judging the severity of CAP in patients. Comparison of patients with single and multiple co-morbidities showed that patients in the latter group present with higher severity scores (p-value = 0.004).

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Introduction

Community-acquired pneumonia (CAP) is one of the most common infectious diseases and the world's leading cause of mortality and morbidity, especially in patients aged 65 years and above.[1,2] It is the 6th cause of mortality and the most important cause of hospitalisation in Malaysia. According to the British Thoracic Society, the gold standard in diagnosing CAP is based on radiological findings and it is defined into 2 different settings – community and hospital.[3]

In a community setting where a radiological diagnosis is unavailable and physical examination is more useful,

[1]Department of Internal Medicine, Clinical School, IMU, Jalan Rasah, 70300 Seremban, Negeri Sembilan, MALAYSIA
[2]Department of Internal Medicine, Hospital Tuanku Jaafar, Seremban, Negeri Sembilan, MALAYSIA
[3]Medical students, IMU Clinical School, Seremban, Negeri Sembilan, MALAYSIA

Address for Correspondence :

Dr Vaani Valerie Visuvanathan, Department of Internal Medicine, Clinical School, IMU, Jalan Rasah, 70300 Seremban, Negeri Sembilan, MALAYSIA
Email: vaani_valerie@imu.edu.my

CAP is defined by the presence of cough and one or more symptoms of an acute lower respiratory tract infection, new focal chest signs on physical examination and at least one systemic feature like fever or when there is no other explanation for the present illness and the patient is treated as CAP with antibiotics. In a hospital setting, patients with CAP may be admitted and radiological investigations can support the diagnosis.[4] Patients may have signs and symptoms consistent with an acute lower respiratory infection, new radiographic shadowing in one segment or more than one lobe that cannot be attributed to any prior cause and that the illness is the main reason for admission and is managed as pneumonia.[4]

Symptoms of CAP are productive or non-productive cough, pleuritic chest pain, tachypnoea, dyspnoea with systemic symptoms like fever, chills and rigors, tachycardia and dehydration. Signs of CAP include body temperature of 37.8°C and above, heart rate of more than 100 beats per minute, respiratory rate of 25 breaths per minute and above, oxygen saturation of less than 90%, rhonchi and decreased breath sounds.[3,5,6]

Factors which increase the risk of developing CAP include extremes of age, immunosuppressive diseases (e.g. diabetes mellitus, neoplasms and HIV infection) respiratory disorders (e.g. bronchial asthma), use of drugs (e.g. oral steroids) and alcohol abusers.[3,4,5,7,8,9] Common organisms known to cause CAP in adults are *Streptococcus pneumonia*, *Mycobacterium tuberculosis*, *Klebsiella pneumonia*, *Pseudomonas aeruginosa* and commensals.[1,5,9,10,11] Common investigations performed in the management of CAP are blood oxygen saturation levels, chest radiographs, serum urea and electrolyte levels, full blood count, liver function tests and blood culture or sputum culture.[4]

CAP is a very common disease and presents as a wide spectrum from mild and self-limiting to life-threatening. Hence, the decision to hospitalise a patient with CAP is very important to prevent unfortunate outcomes. There are several methods to assess the severity of CAP complementary to clinical judgment – Pneumonia Severity Index (PSI) which is used to identify low risk patients suitable for ambulatory outpatient care, CURB-65 when blood urea is unavailable.[4]

CURB-65 is used to aid clinical judgment regarding the necessity of in-patient management. It is one of the commonest severity assessment scoring system used by clinicians.[3] The clinical parameters included in CURB-65 score are confusion, which is defined as the score of 8 or less on the Mini Mental State Examination (MMSE); blood urea concentration of more than 7mmol/L; a respiratory rate of 30 breaths per minute and above; systolic blood pressure of 90mmHg and below and/or diastolic blood pressure of 60mmHg and below; and age of 65 years and above. A score of 1 will be given to each of the clinical parameters that are present in the patient and totalled. Based on their scores, patients are then separated into different risk groups. Patients with a CURB-65 score of 0 and 1 are at low risk of mortality, therefore, they can be treated at home. Those with a CURB-65 score of 2 are at moderate risk of mortality and may be managed for a short duration in the hospital or at home with close supervision. Those with a CURB-65 score of 3 and above are at high risk of mortality and should be admitted.

Methodology

A retrospective study was carried out from February 2013 to July 2013 in Hospital Tuanku Jaafar Seremban (HTJS). A two stage cluster sampling method was used. Patients admitted from July 2012 to December 2012 with a diagnosis of community acquired pneumonia were identified. Patients' files were chosen by simple random sampling method. The medical records of 400 patients were evaluated for data analysis. A structured checklist was used as a research instrument. Each file obtained from the Records Office was evaluated based on their Accident and Emergency records by 4 sections in the checklist.

The first section, Section A, was used to record the personal details which included their initials, age, hospital registration number, date of birth and gender.

Section B was used to assess the details of the community acquired pneumonia of the patient starting with status of confusion – defined as a score of 8 or less on the MMSE and assessed based on orientation of the patient to time, place and person; vital signs which include blood pressure, pulse rate, respiratory rate, temperature, random blood glucose and oxygen saturations; systemic and acute lower respiratory tract infection symptoms like fever, cough, pleuritic chest pain, fatigue, chills and rigors, sputum, dyspnoea/ tachypnoea and wheezing; and signs of CAP including bronchial breath sounds, dullness on percussion, rhonchi and crackles; and blood investigations which includes blood urea levels and arterial blood gases (ABG) values – arterial pH, PaO2, and PaCO2. These details were used to assess the diagnosis and presence of CAP in these patients.

The third section was used to assess co-morbidities present in the patients at that time. All co-morbidities were included. This section of the checklist included diseases such as hypertension, diabetes mellitus, dyslipidaemia, bronchial asthma, chronic obstructive pulmonary diseases (COPD), infectious diseases (Human Immunodeficiency Virus & viral hepatitis), autoimmune diseases, obesity and cancer as well as any other additional co-morbidities such as pregnancy and end-stage renal failure under a separate column labelled "Others". Compliance of the patient to medication was also recorded based on an assumption that a more severe CAP could have been the result of a non-compliant patient and vice versa. Presence of past or current pulmonary tuberculosis (PTB) infection was assessed as part of the checklist as PTB patients were included in our research. We also assessed the compliance of the patient to his PTB management regimen.

The final section, Section D, enabled us to group our samples into control and sample groups based on presence and number of co-morbidities, and to assess the severity of their CAP by retrospectively scoring them using the CURB-65. Patients with no co-morbidities were grouped in the NONE category and were placed in the control group. Those with a single co-morbidity were place in the SINGLE category and those with 2 or more co-morbidities were placed in the MULTIPLE category. Patients in the latter 2 categories were placed in the sample group.

Statistical analysis

Once data was collected, the checklist was coded into the Statistical Package for Social Science (SPSS) version 17.0 for statistical analysis. Data entry and interpretation was done once the sample size of 400 was reached.

Descriptive statistics were utilised for analysing categorical variables which includes group, age, gender, signs and symptoms, individual co-morbidities and collective number of co-morbidities, individual CURB-65 criteria as well as overall CURB-65 score and risk stratification based on CURB-65 score. These data were expressed in frequencies and percentages.

Statistical analysis was done by using Pearson's Chi-square test. For this research, we decided on a margin of error of 5%, a confidence level of 95% and a confidence interval of 0.05. The statistical significance value is set as $p < 0.05$.

Results

Of the 400 patients whose medical records were looked into, 58% were aged 64 years and below, while 42% were aged 65 years and above. The most common symptoms recorded was cough (84.5%), followed by fever (67.3%), sputum production (62.3%), and dyspnoea (50.5%).

The patients were divided into two groups based on presence or absence of co-morbidities: 63 patients or 15.8% (45 males, 18 females) had no co-morbidity and were labelled the control group, whereas 337 patients or 84.3% (187 males, 150 females) who had at least one co-morbidity were labelled the sample group. In the sample group, 124 patients had a single co-morbidity and 213 patients had multiple co-morbidities.

The most common co-morbidity recorded was hypertension (179 patients, 53.1%). It was closely followed by diabetes mellitus (135 patients, 40.1%). Chronic Obstructive Pulmonary Disease (COPD), bronchial asthma, and dyslipidaemia were recorded in 20.8%, 15.4%, and 12.8% of sample group patients respectively. Current or past PTB infections were reported in 20 patients (5.9%). Besides cancer (3.9%), infectious diseases such as HIV and hepatitis (3.9%), and autoimmune diseases (2.4%), other conditions including pregnancy, ischaemic heart disease (IHD), and end stage renal failure (ESRF) were present in 165 patients (49%).

In the control group, 54 patients (85.7%) had low risk (CURB-65 core 0 and 1), 7 patients (11.1%) had moderate risk (CURB-65 score 2), and 2 patients (3.2%) had high risk (CURB-65 score 3, 4 and 5). In the sample population of 337 patients, 235 patients (69.7%) had low risk, 77 patients (22.8%) had moderate risk, and 25 patients (7.4%) had high risk CAP. The cross tabulation between risk scoring and co-morbidities among the sample and control groups is illustrated in Table 1. On comparing patients with single and multiple co-morbidities, patients in the latter group present with higher severity scores (p-value = 0.004).

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Table 1: Cross tabulations between Risk and Other Factors

Variables	Prevalence (n, %)	CURB-65 Risk			P-value
		Low Risk N = 289	Moderate Risk N = 84	High Risk N = 27	
Group	63, 15.8 (C), 337, 84.3 (S)	54 C, 235 S	7 C, 77 S	2 C, 25 S	0.034
Gender	232, 58.0 (M), 168, 42.0 (F)	169 M, 120 F	49 M, 35F	14 M, 13 F	0.799
Diabetes Mellitus	135, 33.8	85	37	13	0.012
Hypertension	179, 44.8	106	55	18	0.000
Dyslipidaemia	43, 10.8	33	8	2	0.748
Asthma	52, 13.0	45	5	2	0.047
COPD	70, 17.5	50	15	5	0.983
Cancer	13, 3.3	9	3	1	0.969
Infectious Disease	13, 3.3	13	0	0	0.076
Autoimmune Disease	8, 2.0	7	0	1	0.305
Others	165, 41.3	109	39	17	0.022
No Co-morbidities	63, 15.8	54	7	2	
Single Co-morbidities	124, 31.0	100	19	5	
Multiple Co-morbidities	213, 53.3	135	58	27	

C – Control Group; S – Sample Group; M – male; F – female

Discussion

The CURB-65 score is used in clinical practice as an adjunct to clinical judgement on the necessity of in-patient treatment. This is based on the score being validated as a reliable indicator of mortality rates, assuming standard treatment procedures are followed. Hence, patients with higher CURB-65 score have a higher mortality rate, and would require more intensive management which is available for warded patients in hospitals. However, one study suggested that clinical judgement is much more sensitive for assessing severity at admission; indeed the introduction and recommendation for the use of CURB-65 along with other objective scoring systems also warn that such tools are not meant to supersede nor replace clinical judgement of severity.

What then influences clinical judgement? Among many other factors, presence of co-morbidities, number of co-morbidities and the specific co-morbidities may be taken into account when clinically judging the severity of CAP. Our study aimed to further confirm these links, and to identify which co-morbidities should the most attention be given to when clinically assessing CAP patients on arrival to the hospital.

The presence of co-morbidities has previously been identified as a predisposing factor to contracting CAP.[5,9] In addition, the results of this study showed that specific co-morbidities influence severity of CAP at first presentation. This follows general medical knowledge, published guidelines and studies that presence of co-morbidities in a patient is an important feature of patients' history.

The results of this study support the fact that co-morbidities influence the severity of CAP at first presentation. A correlation between the number of co-morbidities and severity of CAP on presentation is also suggested. A history of multiple co-morbidities in patients is common in the hospital setting (more than half of the patients we surveyed had multiple co-morbidities). This not only complicates management of such patients, but our results imply that it may increase the severity of CAP at presentation as well.

In particular, we have identified hypertension and diabetes as having a significant relation with the initial severity of CAP. The expectation that established pulmonary diseases would be more likely to increase severity is not completely corroborated by the results of this study, as only bronchial asthma is identified as a possible factor and not COPD or cancer. One possible explanation is that the demographics of sufferers of hypertension, diabetes mellitus, and asthma are different from that of COPD and cancer. Also, we were unable to obtain more details regarding the authenticity of the diagnosis, severity and control of bronchial asthma. Furthermore, in our local setting, there is tendency for patients to self-diagnose bronchial asthma in the presence of post-viral cough, cardiac asthma and even COPD.

Based on the results of this study, we would like to suggest that the presence of co-morbidities, especially if multiple, should alert the attending doctor to the possibility of the patient having a poor outcome due to CAP, and hence warrant in-patient treatment.

However, we would like to highlight some of the limitations of the study as follows:

Being a retrospective study, we relied heavily on record keeping of other doctors. Unfortunately, some crucial details were not recorded in the patients' notes. In particular, the respiratory rates and MMSE scores which are components of the CURB-65 score are frequently not recorded. The validity of respiratory rates recorded later in observation charts is doubtful. ABG analysis was not performed in all patients. Frequently, the ABG result slips were faded beyond comprehension. In a majority of patients, a Venous Blood Gas (VBG) analysis was done instead. Other features which were not sufficiently documented were compliance to medications and follow-up treatments, and a positive or negative history of PTB. Illegible documentation is another factor that may affect accuracy of our research results as misinterpretation is possible.

With regards to sampling, of the 400 patients surveyed, the control group only had 63 patients, while the sample group had 337 patients. Among those in the sample group, very few patients had co-morbidities such as cancer, infectious diseases and autoimmune diseases. This resulted in imbalanced comparisons being made while cross-tabulating co-morbidities and risk. Not all relevant patients from July 2012 to December 2012 could be used in our research, because data collection was halted upon achieving the target sample size. Some records were also not accessible, including all the patients from the ICU, CCU, and HDW wards.

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