Usefulness of Plasma Procalcitonin to Predict Severity in Elderly Patients with Community-Acquired Pneumonia

Ji Hye Kim, M.D. 1, Joo Wan Seo, M.D. 1, Jeong Ha Mok, M.D. 1, Mi Hyun Kim, M.D. 1, Woo Hyun Cho, M.D. 1, Kwangha Lee, M.D., Ph.D. 1, Ki Uk Kim, M.D., Ph.D. 1, Doosoo Jeon, M.D., Ph.D. 1, Hye-Kyung Park, M.D., Ph.D. 1, Yun Seong Kim, M.D., Ph.D. 1, Hyung Hoi Kim, M.D., Ph.D. 2, Min Ki Lee, M.D., Ph.D. 1

Departments of 1Internal Medicine and 2Laboratory Medicine, Pusan National University School of Medicine, Busan, Korea

Background: Community-acquired pneumonia (CAP) is one of the leading causes of death among the elderly. Several studies have reported the clinical usefulness of serum procalcitonin, a biomarker of bacterial infection. However, the association between the levels of procalcitonin and the severity in the elderly with CAP has not yet been reported. The aim of this study was to evaluate usefulness of procalcitonin as a predictor of severity and mortality in the elderly with CAP.

Methods: This study covers 155 CAP cases admitted to Pusan National University Hospital between January 2010 and December 2010. Patients were divided into two groups (≥65 years, n=99; <65 years, n=56) and were measured for procalcitonin, C-reactive protein (CRP), white blood cell, confusion, uremia, respiratory rate, blood pressure, 65 years or older (CURB-65) and pneumonia severity of index (PSI).

Results: The levels of procalcitonin were significantly correlated with the CURB-65, PSI in totals. Especially stronger correlation was observed between the levels of procalcitonin and CURB-65 in the elderly (procalcitonin and CURB-65, ρ=0.408 with p<0.001; procalcitonin and PSI, ρ=0.293 with p=0.003; procalcitonin and mortality, ρ=0.229 with p=0.023). The correlation between the levels of CRP or WBC and CAP severity was low. The existing cut-off value of procalcitonin was correlated with mortality rate, however, it was not correlated with mortality within the elderly.

Conclusion: The levels of procalcitonin are more useful than the levels of CRP or WBC to predict the severity of CAP. However, there was no association between the levels of procalcitonin and mortality in the elderly.

Key Words: Community-Acquired Infections; Aged; Pneumonia; Procalcitonin

Introduction

Pneumonia is the sixth leading cause of overall mortality in Republic of Korea in 2011, which represents a 15.3% increase from 2010 and a 186.2% from 2001.1 Pneumonia in older people refers to pneumonia in people aged 65 or older. Pneumonia is one of the most common diseases, leading to death among the elderly. Older people tend to develop different symptoms of pneumonia, when compared with young people, making it difficult for doctors to treat and predict the prognosis. Instead of typical respiratory symptoms such as fever, cough and sputum, older people may have more vague signs such as subtle changes in mental status.2 Older adults have the risk for delayed diagnosis for pneumonia. Older patients are at the high risk of developing concurrent illness, which affect clinical outcome even after treatment.3

Generally, a severity-based approach is recommended for the diagnosis and treatment of community-acquired pneumonia. Pneumonia severity index (PSI) and
CURB-65 are widely used as severity scoring systems. And severity scores serve as useful indicators in clinical decision making. PSI, developed by Fine et al., is measured with 20 items, and each item is scored. In PSI, patients are classified into five severity classes where the higher class means poor prognosis and high mortality. The CURB-65 is based on the CURB parameters: confusion, urea, respiration rate, and blood pressure. A score of 1 is given to each parameter for patients aged 65 or over. Thus both scoring systems use patient's age as an important parameter. However, these systems are not effective to assess patients with a high mortality risk as much as it is for measuring patients with a low mortality risk.

In addition to PSI and CURB-65, biological markers have been developed to predict the severity of pneumonia in patients during the early infection. Among them, procalcitonin, a calcitonin precursor, has been reported as an useful indicator in assessment of severity of pneumonia. The use of procalcitonin was more evident for bacterial infections, including sepsis than local and viral infection as it facilitates not only assessment of severity but also identification of associated bacteria. Procalcitonin can also help reduce unwanted antibiotic treatment when its change is closely monitored. Study results on the association between PSI and procalcitonin have been divided. But Masia et al. claimed high levels of procalcitonin and subsequent increase in incidence of complications and mortality in the group with high PSI scores. Given a rapid increase in serum density during the early infection, procalcitonin tests allow easy specimen sampling, simple testing and prompt results. It is therefore very useful for older people as their symptoms may not be prominent and an invasive testing is not appropriate for them.

This study was aimed to evaluate the effectiveness of procalcitonin as a screening tool in assessing the severity and mortality risk in community-acquired pneumonia in elderly people.

Materials and Methods

1. Study subjects

A total of 250 patients admitted to Busan University Hospital due to community-acquired pneumonia and underwent the procalcitonin test during the period from January through December 2009. Their medical records were retrospectively analyzed. A total of 95 patients who developed pneumonia in 48 hours after initial hospital admission or received the procalcitonin test after taking antibiotics were excluded. The remaining 155 subjects were grouped into two groups using age 65 as a cutoff. And the differences in CURB-65, PSI, white blood cell, C-reactive protein (CRP), and procalcitonin test results were compared.

2. Study methods

Age, gender, comorbidities, white blood cell at admission, CRP, procalcitonin, length of hospital stay, and mortality. Charlson's comorbidity index (CCI) were calculated based on comorbidities. PSI levels and CURB-65 were calculated to estimate the severity of pneumonia. PSI class ≥ IV and CURB-65 score ≥ 2 are defined as severe pneumonia. Sputum samples were incubated and evaluated to detect pathogenic bacteria of pneumonia. Serum samples were tested to evaluate the role of Mycoplasma pneumonia and Chlamydia pneumonia. Also, urinary antigen test was performed and nasopharyngeal smear examined to detect Streptococcus pneumonia and influenza virus.

Community-acquired pneumonia is defined as the presence of respiratory symptoms including a fever of 38°C, purulent sputum, cough, shortness of breath, backed by signs of new pulmonary infiltration on the radiograph. CURB-65 was measured on a six point scale (range, 0–5) by adding a score of 1 for each of the following conditions: decreased consciousness, blood urea nitrogen > 20 mg/dl, respiration rate of more than 30 times, systolic blood pressure of less than 90 mm Hg, diastolic blood pressure 60 mm Hg or less, PSI score was calculated, and each score places a patient into one of four risk classes (range, I–IV). Procalcitonin level was