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Retrospective analysis of nursing and healthcare-associated pneumonia: Analysis of adverse prognostic factors and validity of the selection criteria

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ABSTRACT

Background: Nursing and healthcare-associated pneumonia (NHCAP) is a relatively new condition that was recently defined by the Japanese Respiratory Society. Previous reports and guidelines have not thoroughly investigated the adverse prognostic factors and validity of the selection criteria for NHCAP. The purpose of this research was to clarify the adverse prognostic factors of NHCAP and investigate the validity of the selection criteria with respect to patient deaths.

Methods: We retrospectively analyzed 418 patients with pneumonia who were admitted to our hospital between January 2009 and December 2011.

Results: We analyzed 215 (51.4%) cases of community-acquired pneumonia (CAP) and 203 (48.6%) cases of NHCAP. NHCAP patients were generally older and had poorer performance status (PS), more complications, and higher levels of mortality than CAP patients. In both groups, the most common causative pathogen was *Streptococcus pneumoniae*. A multivariate analysis of NHCAP revealed that age ≥ 80 years, oxygen saturation (SpO_2) $\leq 90\%$, and methicillin-resistant *Staphylococcus aureus* (MRSA) infection to be independent factors associated with mortality. Of the NHCAP selection criteria, a PS ≥ 3 and a hospitalization history within the past 90 days were adverse prognostic factors in the broad community-acquired pneumonia

Abbreviations: CAP, community-acquired pneumonia; ATS, American Thoracic Society; IDSA, Infectious Diseases Society of America; HCAP, healthcare-associated pneumonia; NHCAP, nursing and healthcare-associated pneumonia; PS, performance status; CT, computed tomography; CRP, C-reactive protein; A-DROP, age, dehydration, respiratory failure, orientation disturbance, low blood pressure; CFU, colony-forming units; MRSA, methicillin-resistant *Staphylococcus aureus*; SpO_2, oxygen saturation

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category (CAP+NHCAP), according to a multivariate analysis. Univariate analysis revealed that admission to an extended care facility or nursing home was associated with death.

Conclusions: Our results demonstrated that age ≥ 80 years, $SpO_2 \leq 90\%$, and MRSA infection were adverse prognostic factors for NHCAP patients. Furthermore, we confirmed the validity of the NHCAP selection criteria.

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1. Introduction

Pneumonia is an extremely important disease and is ranked as the third most common cause of death both in Japan [1] and worldwide [2]. The importance of pneumonia will likely increase in developed countries with aging populations, as morbidity and mortality rates tend to increase drastically with age.

Previously, pneumonia cases outside hospital settings were generally considered community-acquired pneumonia (CAP). However, pneumonia in populations that require nursing care due to the effects of aging and underlying disease has different characteristics than CAP [3,4]. In 2005, the American Thoracic Society (ATS) and Infectious Diseases Society of America (IDSA) announced joint guidelines for hospital-acquired pneumonia [5] and proposed the new concept of healthcare-associated pneumonia (HCAP). HCAP is included within the broad category of CAP, but is often perceived as having high mortality due to the influence of potentially drug-resistant gram-negative bacteria [4].

Due to differences in healthcare environments between Japan and the United States, it was initially difficult to apply the HCAP guidelines to Japanese situations. In August 2011, practice guidelines for nursing and healthcare-associated pneumonia (NHCAP) were announced by the Japanese Respiratory Society. NHCAP is a new concept that considers the Japanese healthcare environment and insurance system.

NHCAP is described as a mixture of pneumonia cases with poor outcomes in elderly patients and drug-resistant pneumonia [6]. Adverse prognostic factors in NHCAP cases have been largely unexamined in past studies, and thus, they are not well understood. NHCAP selection criteria include residence in a nursing home, hospitalization within 90 days, a performance status (PS) ≥ 3, and intravenous therapy. Previous reports and guidelines have not addressed whether these selection criteria are adverse prognostic factors of the broad community-acquired pneumonia (CAP+NHCAP) category.

The purpose of this research was to clarify the adverse prognostic factors of NHCAP and investigate the validity of the selection criteria with respect to patient deaths.

2. Material and methods

2.1. Study design and patient population

Pneumonia patients (CAP or NHCAP) who were hospitalized at the National Hospital Organization Omuta Hospital from January 2009 to December 2011 were included. Pneumonia was diagnosed after pneumonia-indicative shadows were confirmed by thoracic imaging (routine chest radiographs or chest computed tomography [CT]) and corresponding inflammatory findings (at least 1 of the following: fever ≥ 37 °C, elevated white blood cell counts [our hospital criteria: men, >9400/μL; women, >8800/μL], or elevated C-reactive protein levels [CRP; >0.3 mg/dL]). Cases of interstitial pneumonia, pulmonary tuberculosis, or non-tuberculous mycobacterial infection (pneumonias other than acute pneumonia) that led to hospitalization were excluded from the analysis. Multiple hospitalizations of the same patient during the study period were considered different episodes.

2.2. Definition of terms

CAP and NHCAP were classified according to definitions of the Japanese Respiratory Society guidelines [6,7]. Patient self-reliance was evaluated according to the European Cooperative Oncology Group PS [8]. Pneumonia severity was based on the A-DROP (age, dehydration, respiratory failure, orientation disturbance, and low blood pressure) system [7], which was proposed by CAP guidelines from the Japanese Respiratory Society. Patient deaths were defined as deaths that occurred during hospitalization (patients who survived >6 months were excluded, as were deaths that were obviously due to other diseases), and deaths within 30 days after hospitalization were defined as early deaths.

2.3. Data collection

Patient data were retrospectively collected from medical records. Data on age, gender, PS (prior to pneumonia onset), primary disease, medical history, steroid use, and location at the time of pneumonia onset were collected. We also obtained hematological data, including white blood cell counts, blood urea nitrogen and CRP levels, and bacteriological assays (Gram-stain and bacterial cultures for sputum, pleural fluid, and blood, as well as tests for urinary pneumococcal antigen, Legionella urinary antigen, and mycoplasma antibody). We used data that were collected upon admission to the hospital as the test data. Information related to the clinical course of pneumonia was also collected.

2.4. Microbiological evaluation

Causative pathogens of pneumonia met the following criteria: (1) sputum Gram stain showing phagocytic bacteria and 1+ (equivalent to 10^3–10^5 colony-forming units [CFU]/mL) or more bacteria in the sputum culture; (2) 2+ (equivalent to 10^6 CFU/mL) or more bacteria in the sputum culture; (3) blood

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