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ORIGINAL ARTICLE

Mortality predictors of *Pneumocystis jirovecii* pneumonia in human immunodeficiency virus-infected patients at presentation: Experience in a tertiary care hospital of northern Taiwan

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Background: Pneumocystis jirovecii pneumonia (PJP) remains the leading cause of opportunistic infections and deaths among human immunodeficiency virus (HIV)-infected patients. We would like to identify the predictors of mortality of these patients at initial presentation, and assist clinicians to aware the patients in risk of mortality earlier.
Methods: From 1997 to 2009, adults with HIV infection and a discharge diagnosis of PJP at Mackay Memorial Hospital were included in this retrospective study. Patients' demographic data and laboratory data were analyzed by reviewing the medical records.
Results: Eighty-five patients were included in this study. The overall mortality rate was 37.7%. Univariate analysis revealed several host factors significantly related to mortality, including age, systolic blood pressure, diastolic blood pressure, partial pressure of oxygen in arterial blood (PaO_2), percentage of lymphocyte, percentage of CD4 lymphocyte, CD4 counts, serum total protein, serum albumin, and blood urea nitrogen. Multivariate analysis identified three independent predictors associated with mortality, i.e. systolic blood pressure $\leq$110 mmHg [adjusted odds ratio (AOR) 3.88; 95% confidence interval (CI) 1.17–12.83; $p = 0.03$], PaO_2 at room air $\leq$60 mmHg (AOR 4.97; 95% CI 1.34–18.23; $p = 0.01$), and lymphocytes $\leq$10% (AOR 8.19; 95% CI 1.48–45.36; $p = 0.02$). With these predictors, we can stratify patients into three groups with increasing risks for mortality, $\leq$one predictor (mortality rate 14%), any two predictors (47%), and three predictors (75%).

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Conclusions: HIV-infected patients with PJP can be clinically stratified by three prognostic variables identified by multivariate analysis. Early recognition of patients in higher risk can assist clinicians to prevent rapid deterioration and seek for better outcomes.

Introduction

Pneumocystis jirovecii pneumonia (PJP) (previously known as *Pneumocystis carinii*), is a common opportunistic infection for hospitalization of patients with acquired immunodeficiency syndromes (AIDS), and is often life threatening.[1–4] The mortality rate for human immunodeficiency virus (HIV)-infected patient with PJP ranged from 11 to 53% in recent studies.[1,5–9] Because of high-mortality rate, experts take effort to determine events affecting mortality earlier for providing better care and outcomes in hospital.

Several factors associated with mortality from HIV-infected PJP patients have been identified previously, including age of the patient,[3,6,10] poor oxygenation at admission to hospital [based on partial pressure of oxygen in the arteries (PaO_2) at room air or alveolar-arterial O_2 (A-a O_2) gradient],[1,3,10] septic shock requiring vasopressor use,[11,12] low-hemoglobin level,[3] low-total leukocyte count,[12] low-serum albumin level,[1,9,10,13] higher total bilirubin level,[10] need for mechanical ventilation support,[6,9,11,13] development of pneumothorax,[6,9] wasting,[1] higher acute physiology and chronic health evaluation II score,[12] number of acute respiratory failure causes,[11] recent injection drug use,[10] pulmonary Kaposi sarcoma,[3] and acute kidney injury requiring renal replacement therapy.[12] Among these factors, some could not be quantitated precisely, such as wasting, vasopressor use, or severity of pneumothorax; some would be too complicated to be required, such as acute physiology and chronic health evaluation II score, renal replacement therapy, or pulmonary Kaposi sarcoma. Because of these limitations, clinicians need a simple tool for stratifying HIV-infected patients with PJP by risk for mortality at illness presentation.

Therefore, we performed a retrospective study of HIV-infected adult patients with diagnosis of PJP in a tertiary care center of northern Taiwan more than 13-year period. We collected clinical and laboratory data from these patients at or soon after their admission, and our goals were to measure the mortality rate in our study group; to compare differences between mortality and survival subgroups; to identify objectively independent predictors of mortality; and to develop a predicting rule that could stratify patients by the risk for mortality.

Methods

Patients who were discharged with diagnosis of HIV-related diseases between 1 January 1997 and 31 December 2009 at Mackey Memorial Hospital, a 2,100-bed tertiary care center in northern Taiwan, were reviewed in this study. We conducted a computerized search of hospital records by the International Classification of Diseases, 9th revision (ICD-9) codes, and 304 adult patients with 440 admissions were screened because of diagnosis of HIV infection. Their medical records were carefully reviewed. Readmission at more than 2 weeks after discharge was considered as another admission. A definitive PJP was diagnosed by identification of *Pneumocystis* cystic or trophic forms on microscopic examination of Giemsa-stained induced sputum or bronchoalveolar lavage (BAL) specimens. Presumptive diagnosis was dependent on a history of recent onset (within the past 3 months) of dyspnea on exertion or nonproductive cough, image studies [including high-resolution computed tomography (HRCT) scan] with typical findings such as diffuse pattern of ground-glass opacity, and no evidence of a bacterial pneumonia or concurrent opportunistic infections.

Data collection

The patients' medical records were retrospectively reviewed. Clinical data abstraction included: demographic characteristics; medical history; HIV and non—HIV-related comorbid conditions; cigarette, alcohol, and drug use history; preadmission use of antiretroviral and prophylactic medications; CD4 counts, CD8 counts, and plasma HIV viral load titer within 1 month of admission; and initial vital signs, arterial blood gas, and the initial laboratory data at presentation.

Highly active antiretroviral therapy (HAART) was defined as use of at least three antiretroviral agents from at least two classes among the following: protease inhibitors, nucleoside reverse transcriptase inhibitors, and nonnucleoside reverse transcriptase inhibitors. We defined patients as receiving HAART if the medication was prescribed for more than 30 days before admission. Mortality was defined as death in the hospital or discharged at critical condition. Prior pulmonary diseases were defined as a history of physician-diagnosed nonmalignant lung diseases, such as pulmonary tuberculosis, chronic bronchitis/emphysema, or asthma. Recent injection drug use was defined as injection during the 6 months before admission.

Statistical analysis

Statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS) for Windows (Version 12.0; SPSS Inc., Chicago, IL, USA). Results are reported as numbers and percentages. Continuous variables were analyzed by means, standard deviations (SDs), medians, and ranges. Independent sample *t* test was used to check the association between clinical characteristics and mortality. A p value of <0.05 was considered statistically significant, and two-tailed test was adopted for all probabilities. Univariate and multivariate analyses were performed using logistic regression with mortality as the dependent variable. Predictors with nonnormal distribution were dichotomized