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Original Study

A New Prognosis Score to Predict Mortality After Acute Pneumonia in Very Elderly Patients

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A B S T R A C T

Objectives: Acute pneumonia (AP) induces an excess of mortality among the elderly. We evaluated the value of a new predictive biomarker index compared to usual prognosis scores for predicting in-hospital and 1-year mortalities in elderly inpatients with AP.
Design: Retrospective study in 6 clinical departments of a university hospital.
Setting: Burgundy university hospital (France).
Participants: All patients aged 75 and over with AP and hospitalized between January 1 and June 30, 2013, in the departments of medicine (5) and intensive care (1) of our university hospital.
Measurements: A new index, which we named UBMo, was created by multiplying the uremia (U in the formula) by the N-terminal–pro-brain natriuretic peptide (NT-proBNP) plasmatic rate (B), divided by the monocyte count (Mo).
Results: Among the 217 patients included, there were 138 community-acquired pneumonia, 56 nursing home–acquired pneumonia, and 23 hospital-acquired pneumonia. In-hospital and 1-year mortality rates were respectively 19.8% and 43.8%. In multivariate analysis, Pneumonia Severity Index (PSI), unlike CURB-65 (confusion, urea >7 mmol/L, respiratory rate ≥30 breaths/min, blood pressure <90 mmHg systolic or ≤60 mmHg diastolic, age ≥65) score, was associated with in-hospital and 1-year mortalities. UBMo index performed better than PSI and CURB-65 scores in predicting both in-hospital and 1-year mortalities. For in-hospital mortality, the areas under the receiver operating characteristic curves (AUCs) were 0.89 (95% CI = 0.84–0.94), 0.72 (95% CI = 0.65–0.80), and 0.63 (95% CI = 0.54–0.72), respectively, for the 3 scores. For 1-year mortality, the AUCs were 0.93 (95% CI = 0.89–0.98), 0.66 (95% CI = 0.59–0.74), and 0.58 (95% CI = 0.50–0.66), respectively, for the 3 scores. The cut point for the UBMo index of 20,000 × 10^{-9} ng·mmol/L had a sensitivity of 93.1% and 80.9% and a specificity of 76.3% and 95.8%, respectively, for in-hospital and 1-year mortalities.
Conclusion: If confirmed by prospective studies, the UBMo index appears very efficient in identifying patients at high risk of in-hospital and 1-year mortalities after an AP.

Acute pneumonia (AP) is a major medical concern in the older population. Mortality rates are reported to be as high as 30% among older individuals, and even higher in institutionalized elderly subjects.[1]

The authors declare no conflict of interest.

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Several prognosis scores for community-acquired pneumonia (CAP) have been proposed in the last 20 years. To our knowledge, their use has not been clearly validated in nursing home–acquired pneumonia (NHAP)[2] and hospital-acquired pneumonia (HAP).[3] The most widely used indices for predicting 30-day mortality are the CURB-65[4] (confusion, urea >7 mmol/L, respiratory rate ≥30 breaths/min, blood pressure <90 mmHg systolic or ≤60 mmHg diastolic, age ≥65) and the Pneumonia Severity Index (PSI).[5] They were both designed to predict 30-day mortality from CAP. However, these scores have limitations: the CURB-65 does not take into account comorbidities—responsible for a large part of mortality after AP in the elderly population[6,7]—and the PSI is difficult to calculate in routine clinical practice.

The PSI and CURB-65 score have validated performances to assess patients suffering from less severe CAP[8] or NHAP,[2] but not to predict death in frail inpatients. Thus, there is a need to develop adequate easy-to-use prediction tools, adapted to the geriatric population, to identify patients with a high risk of dying after AP.

Recent studies have reported the prognostic value of biomarkers, such as markers of inflammation,[9,10] cardiac dysfunction,[10,11] renal failure,[4,12] and hypoalbuminemia.[4] A new simple index, we named UBMo, was created after an analysis of the literature on the most relevant prognostic biomarkers (ie, those most strongly associated with mortality), among biological data used in everyday practice. We thus chose a widely used marker of heart dysfunction, N-terminal–pro brain natriuretic peptide (NT-proBNP), associated with a marker of sepsis severity (monocyte count) and a marker of renal failure (uremia). In this retrospective study, we investigated the prognostic value of the UBMo score to predict death after AP in elderly subjects.

Methods

Study Design

This was a retrospective study conducted in 6 clinical departments of our university hospital.

Participants

The clinical records of all patients aged 75 and older hospitalized for AP in all departments of our university hospital involved in the medical management of these patients, that is, 5 medical departments: geriatrics, pneumology, infectious diseases, and 2 internal medicine departments, as well as 1 intensive care unit, between January 1 and June 30, 2013, were retrospectively reviewed. Potentially eligible participants were identified through the diagnostic coding system in the French medical information database "Programme de Médicalisation des Systèmes d'Information."

The following criteria of pneumonia, defined by the American guidelines,[13] were required: (1) 2 or more of the following signs: new cough, sputum production, dyspnea, pleuritic pain, abnormal temperature (<35.6°C or >37.8°C), altered breathing sounds on auscultation; and (2) a new infiltrate on chest imaging. Ventilator-associated pneumonia was not included. Pneumonia was considered CAP or NHAP if the first clinical signs appeared at home or at a nursing home. Pneumonia was considered late-onset HAP if the first clinical signs appeared at least 5 days after the admission.[14]

The study was conducted in accordance with the Declaration of Helsinki and National standards. Because this was an observational study, no written consent or approval of the Ethics Committee was necessary.

Recorded Data

For each subject, we recorded demographic, clinical, and laboratory data including age, gender, residential status, World Health Organization (WHO) performance status score,[15] underlying diseases, Charlson comorbidity index (CCI),[16] history of hospitalization in the past 3 months, Pneumonia Severity Index (PSI),[5] CURB-65 score,[4] in-hospital death and death at 1 year, uremia, creatininemia, albuminemia, C-reactive protein (CRP), procalcitonin (PCT), plasma N-terminal–pro brain natriuretic peptide (NT-proBNP) levels, and leucocyte counts, including monocytes, lymphocytes, polynuclear neutrophils taken at admission or, failing that, within 72 hours.

The UBMo Index was created by multiplying uremia by the plasma NT-proBNP level, divided by the monocyte count.

Data Analysis

We compared on the one hand patients who had been discharged with those who had died in hospital and on the other hand patients who were alive 1 year later with those who had died at 1 year.

Continuous variables were expressed as means and interquartile ranges, and categorical variables as numbers and percentages. Continuous variables were compared using the Mann-Whitney *U* test, and categorical variables were compared using the chi-square test and Fisher test when appropriate. Variables that showed a significant association with death ($P < .2$) in the bivariate analysis and factors we considered relevant were included in a multivariate binary logistic regression model. To compare the accuracy of markers to predict death, we constructed receiver operating characteristic (ROC) and determined the area under the curve (AUC). Patients with missing data were excluded from the analyses. Statistical analyses were performed using SPSS 21.0 software (IBM Corp, Armonk, NY). All statistical tests were 2-tailed. Statistical significance was defined for $P < .05$.

Results

Patients' Characteristics

A total of 217 patients with confirmed AP were hospitalized during the selected period in the 6 departments that participated in the study. These patients were responsible for 218 admissions to medical departments (89 to the 2 internal medicine departments, 80 to geriatrics, 32 to the pneumology department, 17 to the infectious diseases department) and 39 admissions to the ICU.

Among these 217 patients, 174 were discharged from hospital and 43 (19.8%) died in hospital. As shown in Table 1, there was no significant difference between the 2 groups for age (respective mean ages: 85.5 ± 6.4 vs 85.6 ± 5.8, $P = .9$), gender (men: 42% vs 58.1%, $P = .06$), CCI, hospitalization in the previous 3 months, and WHO performance status. HAP was significantly less frequent (7.5% vs 23.3%) and NHAP more frequent (28.7% vs 14%) among patients who were discharged than among patients who died in hospital ($P = .004$). The mean CURB-65 (2.73 ± 1.05 vs 3.20 ± 0.94, respectively, $P = .01$) and PSI scores (128 ± 34 vs 156 ± 34, $P < .001$) were significantly lower among discharged patients. There was no significant association between any underlying disease and in-hospital death, except for progressive neoplasia. Except for temperature, which was higher in the group of patients who were discharged, the clinical presentation was not statistically associated with in-hospital death.

As shown in Table 1, at 1 year, 118 patients were alive, 92 (43.8%) patients had died, and 7 were lost to follow-up. There were significant differences between patients who were alive and those who had died at 1 year for age (respective mean age: 84.6 ± 6.1 vs 86.9 ± 6.2, $P = .009$) and WHO performance status but not for gender. HAP was significantly less frequent (5.1% vs 18.5%) and CAP more frequent (67.8% vs 55.4%) among patients who were still alive than in those who had died at 1 year ($P = .008$). The mean CURB-65 (2.71 ± 1.02 vs 3.04 ± 1.05, respectively, $P = .03$) and PSI scores (126 ± 32 vs 146 ± 37,