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Effect of Neutrophil CD64 Index in Elderly Patient with Community-acquired Pneumonia

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Abstract

Background: Elderly patient with community-acquired pneumonia is the leading infectious cause of death. During the clinical diagnosis and treatment, some elderly patients do not have typical clinical symptoms. Therefore establishment of safe and effective diagnosis, prognostic assessment systems is important for clinicians.

Objective: To evaluate the diagnostic and prognostic value of the neutrophil CD64 (nCD64) index in elderly patients with community-acquired pneumonia.

Methods: One hundred and twenty-eight elderly patients (≥ 65year) diagnosed with community-acquired pneumonia from December 2018 to December 2020. All patients were further subdivided into two groups: Non severe community-acquired pneumonia (N-SCAP) group and severe community-acquired pneumonia (SCAP) group. nCD64 index, procalcitonin (PCT) level, C-reactive protein (CRP) level, White blood cell (WBC) counts and Neutrophil (NEUT) absolute counts were obtained and CURB-65 scores were calculated for each patient.

Results: The nCD64 index, CRP, PCT, WBC, NEUT levels, CURB-65 score were higher in severe community-acquired pneumonia group patients. The nCD64 index, CRP, PCT levels, CURB-65 score was higher in non-survivors. The receiver operating characteristic (ROC) curve of nCD64 index was higher than those of CRP, PCT, WBC, NEUT levels for diagnosing infection. The AUC of nCD64 index for predicting 28-day mortality in community-acquired pneumonia was significantly higher than those of CRP, PCT, WBC and NEUT levels. The AUC of nCD64 index combined with CURB-65 score was significantly higher than that of CRP, PCT, WBC and NEUT parameter combined with CURB-65 score for predicting 28-day mortality.

Conclusion: The neutrophil CD64 index is a valuable biomarker for diagnosis of infection and prognostic evaluation in elderly patients (≥ 65 year) with community-acquired pneumonia.

Keywords: Community-acquired pneumonia • Neutrophil CD64 index • C-reactive protein • Procalcitonin

Introduction

Community-acquired pneumonia (CAP) is an infectious inflammation of the lung parenchyma that occurs outside the hospital, including pathogen infection with a specific incubation period and onset within the average incubation period after admission. It is defined as the presence of a lung infiltration shadow on chest radiography and any symptoms such as cough, sputum, fever, dyspnea, and chest pain [1]. Severe pneumonia can occur in both community-acquired pneumonia (CAP) and hospital-acquired pneumonia (HAP). Severe pneumonia is identified in pneumonia patients with continuous hypoxemia or acute respiratory failure requiring ventilation support, circulatory failure such as hypotensive shock, or other organ dysfunction. In this study, severe community-acquired pneumonia (SCAP) was studied. CAP is a major public health problem with high morbidity, mortality and short and long-term sequelae. In adults, the incidence of CAP and related hospitalization and mortality increase steadily with age, with a dramatic rise after the age of 65. In developed countries, almost one half of the total hospitalizations for CAP occur in patients over 65 years old [2]. The severity of CAP also increases with age, primarily due to age-related immune dysfunction, and greater likelihood of underlying comorbid factors in elderly patients [3]. In recent years, there has been a steady increase in the hospitalization rates including intensive care units (ICU) due to SCAP, especially in the elder population [4]. The immuneosenescence comorbidities and frailty of these patients increases their susceptibility to infectious diseases. It is the leading infectious cause of death and the fourth overall cause of mortality in the elderly [5]. During the clinical diagnosis and treatment, some CAP patients, especially elderly patients, do not have cough, sputum, fever. Therefore, we usually perform blood tests for biomarkers to differentiate CAP from other non-infectious respiratory diseases. The blood culture remains the gold standard for infection diagnosis, even though its result is usually delayed for more than 48 hours. Additionally, there are false-positive results due to the impossibility of excluding contamination, besides its false-negative results which are frequently encountered in the elder population due to small unsatisfactory blood sample volume encountered in many circumstances. Despite the routine use of infection markers such as white blood count (WBC), C-reactive protein (CRP), and procalcitonin (PCT), there are many confounding factors, false positives, and false negatives which make them less ideal. As a result, in the past few years, attention has been directed to other sepsis biomarkers including leukocyte cell surface antigens [6].

Neutrophil CD64 (nCD64) index is leukocyte cell surface antigens. Neutrophil CD64 known as Fc receptor 1 (FcR1), is a high-affinity receptor present on neutrophils for Fc part of immunoglobulin-G (IgG) heavy chain [7,8]. Its expression gets strongly up-regulated in response to pro-inflammatory cytokines of infection within 4–6 hours. Several studies have indicated that neutrophil CD64 (nCD64) index is a highly sensitive and specific marker for the diagnosis of sepsis of bacterial origin and differentiating sepsis from non-septic conditions. Neutrophil CD64 index is an emerging novel biomarker with

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prognostic implications in critically ill patients. Extensive literature search has revealed that nCD64 index is a valuable marker for the early diagnosis of patients with sepsis both in emergency department and ICU. Some prospective studies and meta-analysis have documented that nCD64 index has a very good sensitivity and specificity for the diagnosis of sepsis (80–90%) [9]. Its diagnostic accuracy is definitely better than conventional biomarkers for sepsis including the most widely used biomarker PCT and CRP, with better AUROC in most of the studies. Apart from a useful established diagnostic marker, it has its own prognostic implications. Neutrophil CD64 index has been found to be a predictor of outcome during ICU stay in the form of survival or mortality and an early predictor of impending clinical deterioration. However, only a few studies have evaluated the diagnostic and prognostic utility of nCD64 in elderly patients with community-acquired pneumonia.

In this study, we used a single-center, retrospective clinical study design to explore the diagnostic and prognostic significance of nCD64 in elderly patients with community-acquired pneumonia. The aim is to assess the effect of the nCD64 in elderly patients with community-acquired pneumonia.

Methodology

Subject data collection

A single-center retrospective study was conducted on 128 elderly patients with community-acquired pneumonia in Tianjin Hospital of Integrated Chinese and Western Medicine from December 2018 to December 2020. All selected patients were diagnosed with community-acquired pneumonia according to the diagnostic criteria in "Diagnosis and Treatment of Community-Acquired Pneumonia in China" [10]:1. The onset of the community; 2. Pneumonia-related clinical manifestations: (1) new cough or sputum symptoms, or exacerbation of symptoms or purulent sputum on the basis of existing cough or sputum; (2) fever; (3) pulmonary consolidation signs and/or wet rales;(4) Peripheral white blood cells ≥ 10×10^9/L or ≤ 4×10^9/L, with or without nucleus left shift; 3. Chest imaging examination revealed new patchy infiltrating shadows, leaf/segment consolidation shadows, ground glass shadows, or interstitial changes with or without pleural effusion. Have 1+3 and any item of 2.

Diagnostic criteria for severe pneumonia are met: Main diagnoses:

- Mechanical ventilation for endotracheal intubation
- Septic shock still requires vasoactive drug therapy after active fluid resuscitation

Secondary criteria:

- Respiratory rate ≥ 30 times/min
- Oxygenation index ≤ 250 mmHg
- Multiple lobar infiltrates
- Disturbance of consciousness
- Blood urea nitrogen ≥7.14 mmol/L
- Systolic blood pressure ≤ 90 mmHg requires after aggressive fluid resuscitation. Severe pneumonia can be diagnosed if one of the following primary diagnoses is met or ≥ 3 secondary criteria are met.

The following patients were excluded:

- Patients <65 years old
- Pulmonary tuberculosis
- Pulmonary tumor
- Atelectasis
- Pulmonary embolism
- Pulmonary eosinophilic infiltration
- Pulmonary vasculitis
- Patients with infection of other parts, trauma, surgery, long-term dialysis and serious diseases of other organs.

On admission to the hospital the following items were recorded for each selected patient: age, sex, medical history, comorbidities, All patients were followed up for up to 28 days, with the primary endpoint being 28-day mortality.

Analysis of laboratory biomarkers

The blood samples were collected within 24 hours of hospitalization. The WBC counts, NEUT counts, PCT level and CRP level information from enrolled patients were recorded on admission. WBC、NEUT absolute were measured via an automated hematology analyzer (Sysmex XS-500i, Sysmex Corporation Kobe, Japan). The concentrations of serum procalcitonin (PCT) were measured using a BioMerieux Mini VIDAS immunoassay analyzer (Block Scientific, Bohemia, NY, USA), and the limit of detection (LOD) was 0.05ng/ml Serum C-reactive protein (CRP) concentrations were analyzed utilizing turbidimetric immunoassay (BNII, Siemens Healthcare Diagnostic, Germany). Neutrophil CD64 (nCD64) was measured using flow cytometry using a commercial kit (Quanti BRITE PE, Becton Dickinson). Briefly, phosphate-buffered saline-diluted whole blood (100 μL) was incubated for 20 minutes at room temperature with a combination of anti-CD14-FITC and anti-CD64-PE. After lysis, blood samples were washed and fixed with BD Lyse/Wash Assistant. Neutrophils were identified by electronic gating based forward and side scatter. Interassay standardization and CD64 index quantization were performed using Quanti BRITEPE calibration beads with known numbers of PE molecules. Data analysis was performed by using light scatter gating to define the neutrophil population, and the nCD64 index was quantified as mean equivalent soluble fluorescence units using BD Diva software.

The study protocol was approved by the hospital's ethics committee. Written informed consent was obtained from either the patients or their legal surrogates.

Statistical analysis

Statistical analyses were performed with SPSS version 24.0 (IBM Corp, Armonk, NY, USA). Descriptive results of continuous variables were expressed as mean and standard deviation or median and interquartile range depending of the normality of their distribution. Variables were tested for their association with the diagnosis using Pearson's $\chi 2$ test for categorical data. Receiver operating characteristic (ROC) curves were used to compare the predictive prognostic efficacy of the nCD64 index, CRP, PCT, WBC, NEUT, CURB-65 score and to calculate their area under the curves (AUC) was calculated using MedCalc 15.0 Software (Acacialaan, Ostend, Belgium) for diagnostic power. A z-test was used to compare AUCs between different curves. Binary logistic regression was performed to analyze the risk factors of 28-day mortality. Statistical significance was set at P <0.05 (two-sided).

Results

Clinical characteristics of patients

From December 2018 to December 2020, 128 community-acquired pneumonia patients were further subdivided into two groups: Non severe community-acquired pneumonia (N-SCAP) group (n=96) and severe community-acquired pneumonia (SCAP) group (n=32). N-SCAP group: The mean age of patients was 74.78 (± 9.49) years, 55% were males, 45% were Females, 59.4% smoked, 12.5% Heavly alcohol consumption. Comorbidities: Coronary heart disease (66.7%), Hypertension (58.3%), Diabetes mellius (62.5%), Hyperlipemia (63.5%). SCAP group: The mean age of patients was 75.69 (± 9.73) years, 59.4% were males, 40.6% were Females, 50% smoked, 3.1% heavy alcohol consumption. Comorbidities: Coronary heart disease (68.8%), Hypertension (65.5%), Diabetes mellius (68.8%), Hyperlipemia (71.9%). The characteristics of patients in N-SCAP group and SCAP group had no significant difference (P >0.05).

Comparison of nCD64 index, CRP, PCT, WBC, NEUT, CURB-65 score in SCAP and N-SCAP groups

nCD64index, CRP, PCT, WBC, NEUT level as well as CURB-65 score were higher in SCAP patients compared with N-SCAP patients (Figure 1). Significant differences between the SCAP and N-SCAP groups (Table 1).

Evaluation of nCD64, CRP, PCT, WBC, NEUT levels and in diagnosing bacterial infection

The statistical values of ROC curves for nCD64, CRP, PCT, WBC, NEUT in differentiating a positive microbial culture from CAP are shown in Table 2. nCD64 produced the highest AUC (0.787), followed by CRP (0.681), PCT (0.629). There were significant differences between nCD64 and CRP or PCT (P <0.05), but there were no significant differences between WBC (*P* =0.325) and NEUT (*P* =0.077).

Comparison between patient survivors and non-survivors at the 28-day follow-up

Baseline characteristics are shown in Table 3. Among the patients enrolled, 109 survived and 19 died at the 28-day follow-up. The mortality rate was 14.8% (19/128). The nCD64, CRP, PCT levels, CURB-65 score were higher in non-survivors. There were significant differences in nCD64, but no significant difference in WBC, NEUT count between survivors and non-survivors.

Prognostic value of nCD64 index, CRP, PCT, WBC, NEUT levels and CURB-65 score

The ROC curves of nCD64, PCT, CRP, WBC, NEUT, CURB-65 score for predicting death are shown in Figure 2. nCD64 had the highest AUC (0.907), followed by CRP (0.710), PCT (0.678), WBC (0.592) and NEUT (0.573) (Table 4) (Figure 2). There were significant differences between nCD64 and CRP or PCT (*P*<0.001), but there were no significant differences between WBC (*P*=0.276) and NEUT (*P*=0.412). The combination of nCD64 +CURB-65 score achieved an AUC of (0.905), followed by the combination of CRP+ CURB-65 score achieved an AUC of (0.712), PCT +CURB-65 score achieved an AUC of (0.704), WBC +CURB-65 score achieved an AUC of (0.632), NEUT +CURB-65 score achieved an AUC of (0.636). There were significant differences between nCD64+CURB-65score, CRP+CURB-65score, PCT+CURB-65score (*P*<0.001), CURB-65score (*P*=0.005). There was no significant difference between WBC+CURB-65 score (P=0.101), NEUT+CURB-65 score (*P*=0.636) (Table 5) (Figure 3). Binary logistic regression analysis revealed that nCD64 were independent risk factors of 28-day mortality in patients with sepsis (Table 6).

Discussion

Community-acquired Pneumonia (CAP) is the most prevalent infectious disease in the elderly patient and is associated with high rates of mortality, morbidity and high costs worldwide [11,12]. Therefore, establishment of safe and effective diagnosis prognostic assessment systems of CAP is important for clinicians. Commonly used biomarkers for early diagnosis of bacterial infection include the CRP level, PCT level, White cell count, absolute neutrophil counts.

CRP is an acute-phase protein that increases within 4 to 6 hours upon

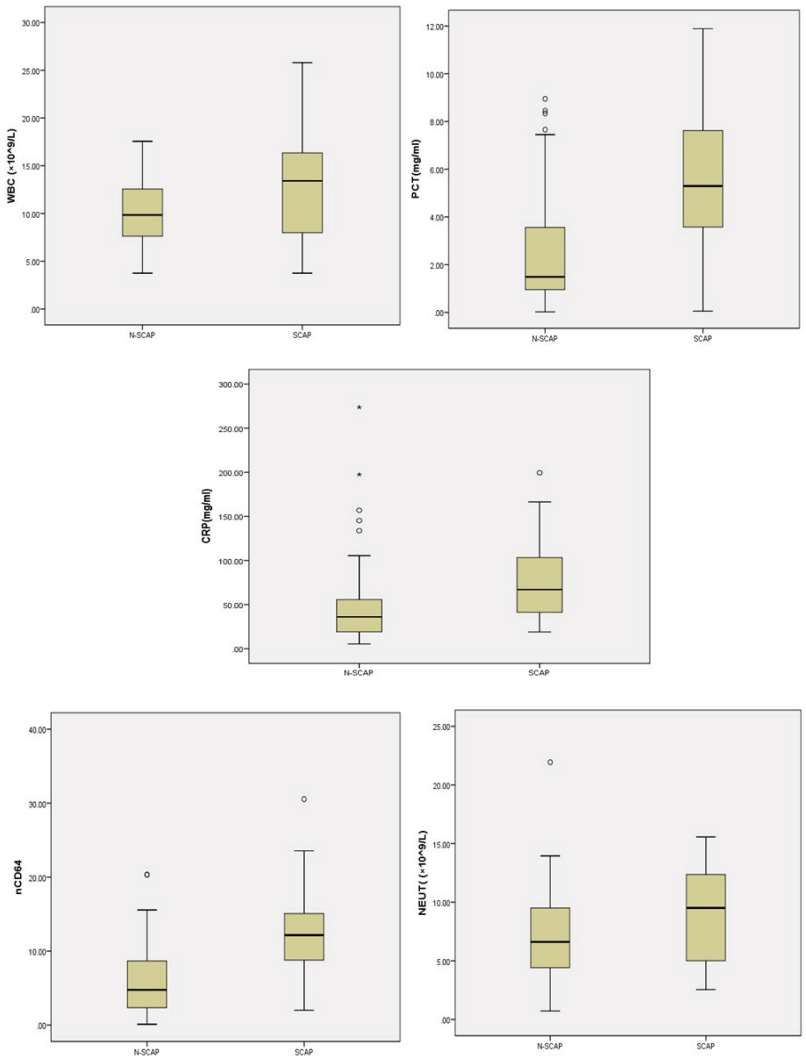

Figure 1. The nCD64, CRP, PCT, WBC,NEUT levels in two group. The nCD64, CRP, PCT, WBC, NEUT of the patient groups were significantly higher compared with the N-SCAP (P<0.05). The SCAP group had the highest level of these parameters.

Table 1. nCD64, CRP, PCT, WBC, NEUT levels and bacterial infection in N-SCAP and SCAP.

Characteristics	N-SCAP (n=96)	SCAP (n=32)	P value N-SCAP *vs.* SCAP
CURB-65	2.22 ± 1.32	4.06 ± 1.13	0.000
nCD64%	6.14 ± 4.46	11.91 ± 6.85	0.000
PCT (ng/ml)	2.27 ± 2.25	5.62 ± 3.37	0.000
CRP (mg/ml)	45.47 ± 41.36	76.86 ± 43.09	0.000
WBC (× 109/L)	9.95 ± 3.31	12.62 ± 5.39	0.012
NEUT (× 109/L)	7.12 ± 3.55	9.17 ± 4.06	0.007
Microbiological etiology			
Streptococcus pneumoniae	8	7	-
Haemophilus influenzae	4	0	-
Pseudomonas aeruginosa	3	6	-
Klebsiella pneumoniae	2	5	-
Other microorganism	1	2	-

Table 2. Baseline characteristics of patients based on N-SCAP and SCAP.

Characteristics	N-SCAP (N=96)	SCAP (N=32)	P value N-SCAP *vs.* SCAP
Age (Years)	74.78 ± 9.49	75.69 ± 9.73	0.605
Male (%)	55 (57.3%)	19 (59.4%)	0.836
Smoking (%)	57 (59.4%)	16 (50%)	0.354
Heavy alcohol consumption (%)	12 (12.5%)	1 (3.1%)	0.128
Comorbidities (%)			
Coronary heart disease	64 (66.7%)	22 (68.8%)	0.828
Hypertension	56 (58.3%)	21 (65.5%)	0.466
Diabetes mellius	60 (62.5%)	22 (68.8%)	0.523
Hyperlipemia	61 (63.5%)	23 (71.9%)	0.390

Table 3. Baseline characteristics of patients based on outcome.

Variables	Survival (n=109)	Death (n=19)	P value
Age (Years)	75.08 ± 9.85	74.58 ± 7.52	0.800
Sex (%)			
Male	63 (49.2%)	11 (8.6%)	
Female	46 (35.9%)	8 (6.3%)	0.994
Smoking	58 (45.3%)	15 (11.7%)	0.037
Heavy alcohol consumption	12 (9.4%)	1 (0.8%)	0.444
Comorbidities (%)			
Coronary heart disease	73 (57%)	13 (10.2%)	0.901
Hypertension	65 (50.8%)	12 (9.4%)	0.772
Diabetes mellius	69 (53.9%)	13 (10.2%)	0.668
Hyperlipemia	71 (55.5%)	13 (10.2%)	0.781
CURB-65	2.53 ± 1.48	3.53 ± 1.43	0.007
CD64 (MFI)	6.23 ± 4.78	14.89 ± 4.91	0.000
PCT (ng/mL)	2.82 ± 2.73	4.80 ± 3.59	0.006
CRP (mg/L)	50.04 ± 44.25	72.14 ± 36.78	0.042
WBC (× 10^9/L)	10.43 ± 3.91	11.68 ± 4.91	0.218
NENT (× 10^9/L)	7.43 ± 3.56	8.77 ± 4.81	0.260

stimulation by pro-inflammatory cytokines and peaks at 36 to 50 hours [13]. CRP is often used for early diagnosis of infection and as a bacterial biomarker for sepsis [14], but it has relatively low specificity [13].

PCT is a glycoprotein that consists of 116 amino acids and has a half-life of 20 to 24 hours. Studies using animal models have shown that PCT becomes elevated at 3 to 6 hours and peaks at 6 to 8 hours after bacterial infection [15]. A meta-analysis suggested that PCT cannot be used to distinguish between infectious and non-infectious diseases [16].

CURB-65 (confusion, uremia, elevated respiratory rate, hypotension, and age ≥ 65) score is a clinical prediction rule intended to stratify patients with pneumonia by expected mortality [17,18]. But this is a comprehensive measure that does not assess the extent of infection.

CD64 is a receptor for the Fc fragment of immunoglobulin G and serves as a link between humoral and cellular immunity [19,20]. CD64 is mainly distributed on the surface of monocytes, macrophages, and dendritic cells. In neutrophils, CD64 expression is low in the resting state but sharply increases upon activation by a variety of stimuli, including lipopolysaccharide, tumor necrosis factor-α, interferon-γ, and G-CSF [19]. When these stimulation factors are absent, it will substantially decrease within 48 hours and will be back to normal baseline values after 7 days [21].

This large retrospective analysis clarifies test characteristics of nCD64, CRP, PCT, WBC, NEUT in diagnosis and prognostic of community-acquired pneumonia. In the retrospective analysis, all community-acquired pneumonia patients were further subdivided into two groups: non severe community-acquired pneumonia (N-SCAP) group and severe community-acquired pneumonia (SCAP) group. The study reports on the evaluation of the usefulness of neutrophil CD64 in elderly patient with community-acquired pneumonia. In

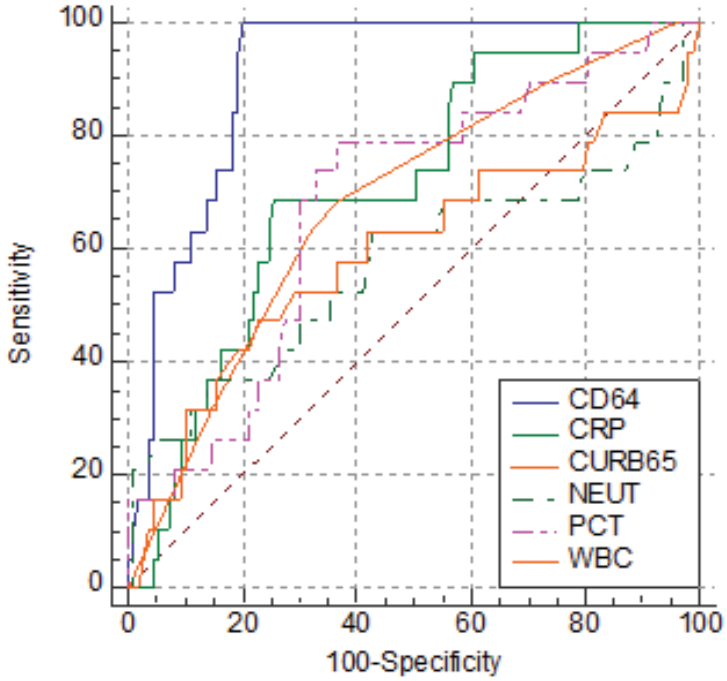

Figure 2. The ROC curves of nCD64, PCT, CRP, WBC and NEUT for prognosis. The AUC of nCD64 was the highest (0.907), followed by CRP (0.710) PCT (0.678), WBC (0.592) and NEUT (0.573). There were significant differences between nCD64 and CRP or PCT (P <0.001).

Table 4. Analysis of ROC curves in predicting 28-day mortality in patients with CAP.

Variables	AUC (95% CI)	*P* value	Cut-off value	Sensitivity	Specificity	PPV	NPV
CD64	0.907 (0.843-0.951)	<0.0001	>10.43	0.100	0.798	0.463	0.100
CRP	0.710 (0.623-0.758)	0.0004	>56.77	0.684	0.743	0.316	0.931
PCT	0.678 (0.590-0.758)	0.0070	>2.65	0.790	0.633	0.272	0.945
WBC	0.592 (0.501-0.678)	0.276	>12.87	0.474	0.771	0.264	0.894

Table 5. Analysis of ROC curves in diagnosing positive infection culture in patients with CAP.

Variables	AUC (95%CI)	P value	Cut-off value	Sensitivity	Specificity	PPV	NPV
CD64	0.787 (0.381-0.703)	<0.001	>8.95	0.743	0.820	0.645	0.879
CRP	0.681 (0.108-0.408)	<0.001	>28.67	0.871	0.438	0.405	0.886
PCT	0.629 (0.149-0.477)	0.020	>3.34	0.615	0.708	0.480	0.807
WBC	0.557 (0.089-0.280)	0.325	>10.33	0.590	0.584	0.384	0.764
NEUT	0.605 (0.515-0.691)	0.077	>9.34	0.513	0.753	0.477	0.779
CD64+CURB-65	0.905 (0.840-0.949)	<0.0001	>12.23	0.1	0.762	0.421	0.100
CRP+CURB-65	0.712 (0.840-0.949)	0.0004	>61.33	0.684	0.752	0.324	0.932
PCT+CURB-65	0.704 (0.173-0.582)	0.0012	>6.36	0.737	0.679	0.341	0.943
WBC+CURB-65	0.632 (0.164-0.517)	0.1011	>15.26	0.579	0.762	0.297	0.912
NEUT+CURB-65	0.636 (0.174-0.526)	0.088	>12.34	0.579	0.762	0.297	0.912
CURB-65	0.680 (0.591-0.759)	0.005	>2	0.684	0.633	0.225	0.920

our study nCD64, CRP, PCT, WBC, NEUT level as well as CURB-65 score were higher in severe community-acquired pneumonia patients than in non-severe community-acquired pneumonia. The nCD64 in severe community-acquired pneumonia was significantly upregulated compared with non-severe community-acquired pneumonia (*P* <0.001). Evaluation of nCD64 in diagnosing bacterial, AUC 0.787(0.381-0.703), cut-off value>8.95, Sensitivity 0.743, Specificity 0.820 PPV 0.645, NPV 0.879. The AUC of nCD64 was higher than that of any other parameter in combination. Similar to previous studies, nCD64 is rapidly upregulated in the early stages of pathogen invasion, it may be particularly valuable in narrowing down the differential diagnosis in emergent situations [22]. Increased nCD64 expression initiates and amplifies the immune response to bacterial infection. Therefore plays a vital role in host defense against bacterial infection. Analysis of ROC curves in predicting 28-day mortality in patients, The CURB-65score, nCD64, PCT, CRP levels were higher in non-survivors. nCD64 AUC 0.907(0.843-0.951), cut-off value >10.43, Sensitivity 0.1, Specificity 0.798 PPV 0.463, NPV 0.100. There were significant differences in nCD64. From the data, we found that nCD64 has been shown to be a better predictor of death, in contrast to CRP, PCT, WBC and NEUT. A recent study demonstrated that nCD64 has high diagnostic accuracy in recognizing ventilator-associated pneumonia (VAP) [23]. Consistent with previous studies, our research demonstrated that nCD64 has a higher AUC compared with PCT, CRP, WBC, NEUT levels. The nCD64 was more sensitive and specific than the CRP, PCT,WBC,NEUT levels. But there were no significant differences between WBC and NEUT. A recent study demonstrated that the White cell count, absolute neutrophil count can be influenced by many other factors, including trauma, stress, and tumor invasion; therefore, it may not be a suitable biomarker for infection [24,25]. We conducted a logistic regression analysis to explore the value of nCD64 expression. Consequence, nCD64 entered the logistic model as independent risk factors of 28-day mortality. The combination of nCD64+ CURB-65 showed the highest AUC (0.905) compared with the

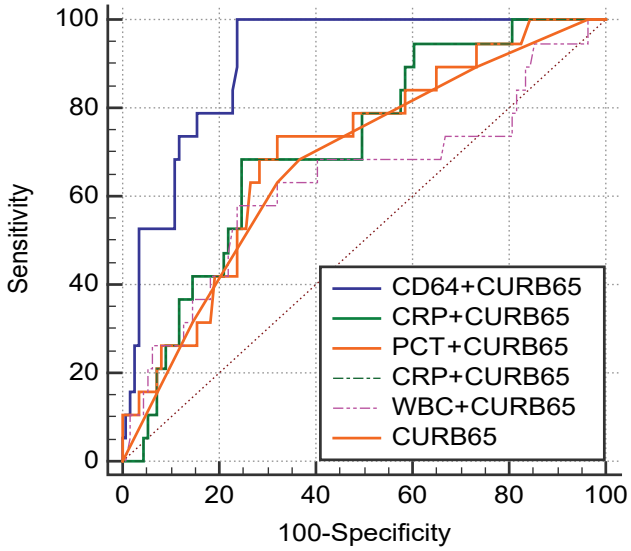

Figure 3. The ROC curves of nCD64+CURB-65 score, PCT+CURB-65 score, CRP+CURB-65 score, WBC+CURB-65 score, NEUT+CURB-65 score and CURB-65 score for prognosis. The AUC of nCD64+CURB-65 score was the highest (0.905), followed by CRP +CURB-65 score (0.712), PCT +CURB-65 score (0.704), WBC+CURB-65 score (0.632), NEUT+CURB-65 score (0.636). CURB-65 score (0.680). There were significant differences between nCD64+CURB-65 score, CRP +CURB-65 score, PCT+CURB-65 score and CURB-65 score (P<0.001).

Table 6. Independent predictive variables analysis by multivariate logistic regression.

Variables	Coefficient	Wald	*P* value	Adjusted OR	95%CI
nCD64	0.309	19.90	<0.0001	1.362	1.1891-1.560
Constant	-4.883	31.45	<0.0001	-	-

combination of other biomarkers (CRP、PCT、WBC、NEUT) + CURB-65 score. Because CURB-65 scor does not assess the extent of infection, So nCD64+ CURB-65 score may be a more promising biomarker for identifying infectious etiologies and for predicting mortality.

Limitations

Our study has several limitations. First, the relatively small sample size and the non-randomized single-center design with a short observational period may have resulted in selection bias for clinical data analysis. Second, it is retrospective in nature, so all patients did not have all laboratory values drawn, and this could have introduced bias. Third, further randomized, multicenter studies with larger sample size and long-term follow-up are needed to validate our results.

Conclusion

nCD64 expression is a valuable marker for early diagnosis of infection in community-acquired pneumonia, risk stratification and evaluation of prognosis elderly patients with community-acquired pneumonia.

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