ISSN: 234-5197
Impact Factor: 3.765

INTERNATIONAL JOURNAL OF RESEARCH SCIENCE & MANAGEMENT

CORRELATION OF RED-CELL DISTRIBUTION WIDTH (RDW) IN FIRST DAY AND FOURTH DAY BASED ON CURB-65 SCORES AND PSI SCORES IN PNEUMONIA COMMUNITY PATIENTS

Dedi Irwansyah[1], Alwinsyah Abidin[2] & Dairion Gatot[3]
[1]Department of Internal Medicine, Faculty of Medicine Universitas Sumatera Utara
[2]Division of Pulmonology, Department of Internal Medicine, Faculty of Medicine Universitas Sumatera Utara
[3]Division of Hemato-oncology Medic, Department of Internal Medicine, Faculty of Medicine Universitas Sumatera Utara

DOI: 10.5281/zenodo.3271757

Keywords: RDW, community pneumonia, CURB-65, PSI.

Abstract

Introduction: RDW (Red-cell Distribution Width) is a concept of variations in the size of red blood cells and reflects the heterogeneity of the volume of red blood cells. RDW is a component of the complete count (Complete Blood Count / CBC). Until now, the clinical significance of RDW has been limited to the differential diagnosis of anemia. However, recent reports linking increased of RDW can predict severe mortality and morbidity in cardiovascular disease, pneumonia, rheumatoid arthritis, colon cancer and metabolic syndrome. PSI and CURB-65 were used in assessing disease severity and predicting the prognosis of pneumonia patients using PSI and CURB-65

Aim: To investigate the RDW value as a prognostic marker for the death of community pneumonia patients through PSI and CURB-65 scores

Methods: Cohort study was conducted at the Haji Adam Malik General Hospital in Medan from June 2018 to March 2019 with total sample are 50 pneumonia patients. Patients performed RDW examinations on the first and fourth days, sputum cultures, and calculation of PSI and CURB-65 scores. Data analysis using SPSS 22nd.

Result: 50 pneumonia patients were tested for RDW on the first and fourth days with a median result are 13.65% and 14.70%. There is a positive correlation of the fourth day RDW to CURB 65 with moderate correlation ($p = 0.001$; $r = 0.441$), but no correlation of the fourth day RDW to PSI ($p=0,178$). This study assess the difference of RDW for life status patient. It was found that there were differences in the fourth day RDW which was statistically significant for the patient's life status ($p = 0.046$).

Conclusion: RDW on the fourth day is significantly corelated to CURB 65 scores.

Introduction

Pneumonia is one of the main causes of high morbidity and mortality in the world. Community Acquired Pneumonia (CAP) mortality ranges from less than 5% in outpatients and up to 12% in hospitalized patients.1Assessing of disease severity and predicting prognostic in CAP patients are important for adequate care and treatment in CAP management. There are various score systems to determine CAP severity that are developed and widely used, including PSI (Pneumonia Severity index), PORT (Patients Outcomes Research Team Score), and CURB-65 (Confusion, Urea, Respiratory rate, Blood pressure , Age > 65 years).2,3

In recent years, many studies found that biomarkers can provide additional information in determining the severity of CAP disease, differentiating the CAP etiology (bacterial or viral) and knowing the complications / prognostic of the disease early.3The biomarkers are C-Reactive Protein (CRP), procalcitonin, D-Dimer, Cortisol, total leukocytes, immunoglobulin, IL-6, tumor necrosis factor-a (TNF-α) and Triggering receptor

expressed on myeloid cell-1 (TREM- 1). Those biomarkers are expensive and generally not always available in the hospital.4

The British Thoracic Society (BTS) proposes the use of CURB-65 regulations with a five-point scoring system and three risk categories: 0-1 (low mortality risk; class 0 = 0.7%; class 1 = 3.2%), 2 (risk deaths between = 13%) and > 3 (high risk of death; class 3 = 17%; class 4 = 41.5%; class 5 = 57%). This severity score, introduced in 2003, is now widely validated in more than 12,000 patients from several different countries. Studies that assessed CURB-65 have shown to be a powerful tool with moderate to good discriminatory values (AUC values ranged from 0.73 to 0.83) for predictions of 30-day mortality.5

PSI (Pneumonia Severity Index) is a score to assess the severity of community pneumonia, which consists of several components, namely age, comorbid diseases, level of consciousness, blood urea value, respiratory frequency, blood pressure, pulse frequency, blood gas analysis, levels blood sugar, serum sodium, hematocrit and blood urea are obtained from blood tests that show whether or not there is a disorder in the kidneys.5

RDW (Red-cell Distribution Width) is a concept of variation in the size of red blood cells. It reflects the heterogeneity of the volume of red blood cells and is a component of the complete count (Complete Blood Count / CBC). Until now, the clinical significance of RDW has been limited to the differential diagnosis of anemia. Many study explain a correlation of increased RDW can predict severe mortality and morbidity in cardiovascular conditions, rheumatoid arthritis, colon cancer and metabolic syndrome. The mechanism of increasing RDW is assumed to be related to an inflammatory process that might interfere with the erythropoesis.6,7

Study by Braun et. al shows that CAP patients with an increasing RDW at the first start of hospitalization, either in combination with white blood cell levels, are associated with high mortality and high complications during hospital treatment. In this study, we compared red blood cell distribution width (RDW) in first day and the fourth day of hospital treatment with the severity of pneumonia (CURB-65 and PSI scores).8

Method

This research uses analytical research methods with prospective cohort study design. The research was conducted at the General Hospital Haji Adam Malik Medan. The data collection obtained from inpatients and outpatients with a diagnosis of CAP in Haji Adam Malik Hospital that existed from June 2018 until March 2019. For exclusion criteria are chronic kidney disease, cystic fibrosis, tuberculosis, anemia iron deficiency, malnutrition, HIV, nephrotic syndrome, liver cirrhosis and imunnosupression patient. The samples were taken with total sampling technique and processed using statistical software.

Result

This study was attended by 50 patients who met the inclusion criteria with the average age of respondents in this study was 59.70 years, of which 24 patients (48.0%) were male and 26 patients (52.0%) were woman. RDW mean value on the first day is 13.65% and RDW mean values on the fourth day is 14.70%. The results of leukocytes is 13221,60 mm3. The results of the CURB-65 scoring calculation in this study population showed a mean score of 3, with the majority of the study population classified as moderate group (CURB-65 score > 2) was 32 people (64.0%), and 18 people (36.0%) belonging to the mild group (CURB-65 ≤ 2 score). The median score of the PSI is 126.5 with the majority of the population classified as moderate severity (PSI score 91-130) was 23 people (46%) and high (PSI score> 130) was 23 people (46.0 %).

Based on the results of sputum culture examination, the majority of microbacteria found were Klebsiella pneumonia 12 people (24.0%), Staphylococcus hemolitycus 11 people (22.0%), Staphylococcus pneumonia 6 people (12.0%), Acinobacter sp 3 people (6.0%), Klebsiellaoxytoca 3 people (6.0%), Staphylococcus hominis 1 person (2.0%) and no bacterial growth 8 people (16.0%). The patient's life status showed that 12 people (24.0%) died, while the living patients were 38 people (76.0%). (Tabel 1)

Tabel 1. Basic and Clinical characteristics of subject

Characteristics	n (%)
Agea	59,70 + 17,37
Gender	
Men	24 (48,0)
Female	26 (52,0)
RDW 1stdayb	13,65 (10,2-29,0)
RDW 4thdayb	14,70 (10,5-23)
Leukocytesa	13221,60 + 3990,12
4-11 x103 mm3	14 (28,0)
> 11 x103 mm3	36 (72,0)
CURB-65b	3 (1-4)
Mild (≤ 2)	18 (36,0)
Moderate - Severe (> 2)	32 (64,0)
PSIb	126,5 (40-172)
Low (≤ 90)	4 (8,0)
Moderate (91-130)	23 (46,0)
High (> 130)	23 (46,0)
Cultures	
Klebsiella pneumonia	12 (24.0)
Staphylococcus hemolyticus	11 (22,0)
Staphylococcus pneumonia	6 (12,0)
Streptococcus pneumonia	6 (12,0)
Acinobacter sp	3 (6,0)
Klebsiella oxytoca	3 (6,0)
Staphylococcus hominis	1 (2,0)
No bacterial growth	8 (16,0)
Patient's life status	
Life	38 (76,0)
Dead	12 (24,0)

a: mean +standart deviation; b: median (minimum - maximum)

In this study, we examine a correlation of basic characteristics to CURB-65 score using Spearman correlation test. There was no correlation RDW on the first day and age to CURB-65 score (p = 0.657; p=0,307). There was a positive correlation of RDW the fourth day and leukocytes to the CURB-65 score with a moderate correlation strength (p = 0.001; r = 0.486; p=0,008; r= 0,371).(Table 2)

Tabel 2.Correlation of basic characteristics data to CURB-65 Score

Variabel	CURB-65	
	P	r
Age	0,307	-0,148
RDW 1st day	0,657	0,064
RDW 4th day	0,001	0,486
Leukocytes	0,008	0,371

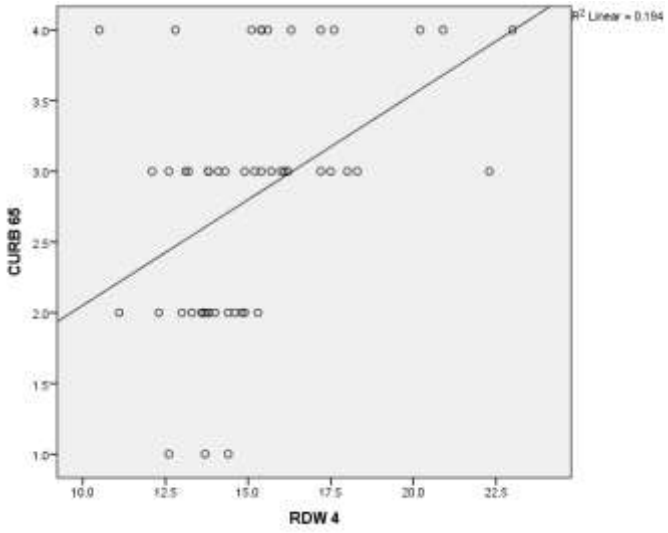

Figure 1. Scatter plots of fourth day RDW to CURB-65 score

In this study, we examined a correlation of basic characteristics to PSI score using Spearman correlation test. There was no correlation of the first day RDW, the fourth day RDW, age, and leukocytes to the PSI score (p = 0.483; p = 0.178; p=0,496; p=0,232 respectively). (Table 3).

Tabel 3. Correlation of basic characteristics data to PSI score

Variabel	PSI Score	
	P	R
Age	0,496	-0,099
RDW 1st day	0,483	-0,102
RDW 4th day	0,178	0,193
Leukocytes	0,232	0,172

In this study, we assess the difference of the first day RDW and the fourth day RDW to the patient's life status. By using the Mann Whitney test, the results showed that there was no difference in the RDW the first day to the patient's life status (p = 0.453), but there was a difference in the fourth day RDW to the patient status (p = 0.046).

Disscusion

This study assessed RDW on the first day and compared with RDW on the fourth day, indicating that there was an increase in RDW on the fourth day of treatment compared to the first treatment day which was in line with increasing in CURB-65 scores and PSI scores.

Spearman correlation test was conducted the correlation of RDW on the first day and RDW on the fourth day with the CURB-65 score and PSI score. There are significant correlation in fourth day RDW and the severity of pneumonia assessed by the CURB-65 score (p = 0.001) with r = 0.486. But there is no correlation between the fourth day RDW to the PSI score (p = 0.178).

The result of this study are in accordance with the study conducted by Bello et al. in Spain which through its univariate test stated that there was a significant relationship between RDW values and predictive mortality factors (p <0.001).9 As well as the research conducted by Braun, et al, where in their study it was found that there was a significant relationship between RDW values and 90 days mortality (p <0.001).8 The same results

were also supported by Lee et al. through his research in Korea, which through the regression correlation test stated that there was a relationship between the RDW value and the 30-day mortality rate ($p < 0.05$), with an average RDW value in the study sample of 14.8 ± 1.9.10

The study by Bello et al. also stated that RDW was also associated with a 30 day mortality rate ($p = 0.017$), 90 days ($p = 0.004$) 180 days ($p < 0.0001$), 1 year ($p < 0,0001$), 2 year ($p < 0,0001$) to 3 years ($p < 0,0001$).9 In accordance with research conducted by Perlstein et al., it can concluded that more higher the RDW value, more mortality rate increases with a hazard ratio 1.32-1.36 in chronic respiratorial disease mortality rates.11

Conclusion

RDW on the fourth day is significantly corelated to CURB 65 scores.

References

[1] Akpinar, E.E., Hosgun, D., Doganay, B. dan Gulhan, M. (2013) The role of albumin level and blood urea nitrogen / albumin ratio in prediction of prognosis of community acquired pneumonia. Pulmonary and Respiratory Medicine, 3(5), pp. 159.

[2] Lee, J.H., Kim, J., Kim, K., Jo, Y.H., Rhee, J. dan Kim, T.Y.(2011) Albumin and C-Reactive Protein have prognostic significance in patients with community-acquired pneumonia.Journal of critical care. 26,pp. 287-294.

[3] Viasus, D., Vidal, C.G., Simonetti, A., Manresa, F., Dorca, J. dan Gudiol, F. (2013) Prognostic value of serum albumin levels in hospitalized adults with community acquired pneumonia. Journal of infection. 66, pp. 415-23.

[4] Capelastegui, A., Espana, P.P., Quintana, J.M., Arcitio, I., Gorondo, I. danEgurolla, M.(2006) Validation of Predictive Rule for the management of Community Acquired Pneumonia. EurRespir J. 27,pp. 151-57.

[5] Singanayagam, A., Chalmers, J.D. dan Hill, A.T. (2009) Severity assessment in community-acquired pneumonia: a review. Q J Med. 102, pp. 379-88.

[6] Oleg, G., Shimon, I., Dana, B., Dorit,A.S., Tzur, I., Swarka, M.,Beberashvili, I., Feldman, L., Cohen, N. danShteinshnaider, M. (2016) Changes in Red Cell Distribution Width During Hospitalization for Community-Acquired Pneumonia: Clinical Characteristics and Prognostic Significance: Springer Science + Business Media New York.

[7] Sang-Min, L., Jae, H.L., Kyuseok, K., You, H.J., Jungyoup, L., Joonghee, K., Ji, E.H., Young, S.K., Chulmin, H., Sujin, J. danHyunmi, P. (2016) The clinical significance of changes in red blood cell distribution width in patients community-acquired pneumonia. ClinExpEmerg Med. 3(3),pp. 139-47

[8] Braun, E., Kheir, J., Mashiach, T., Naffaa, M. danAzzam, Z.S.(2014) Is elevated red cell distribution width a prognostic predictor in adult patients with community acquired pneumonia?. BMC Infect Dis. 14, pp. 129.

[9] Bello, S., Fandos, S., Lasierra, A.B., et al. (2015). Red blood cell distribution width (RDW) and long term mortality after community-acquired pneumonia. A comparison with proadrenomedulin. Respiratory Medicine.109: 1193-1206.

[10] Lee, J.H., Kim, J., Kim, K., Jo, Y.H., Rhee, J. dan Kim, T.Y.(2011) Albumin and C-Reactive Protein have prognostic significance in patients with community-acquired pneumonia. Journal of critical care. 26,pp. 287-294.

[11] Perlstein, T.S., Weuve, J., Pfefeer, M.A, et al. Red blood cell distribution width and mortality risk in a community based prospective cohort: NHANES III: RDW and mortality risk. Arch Intern Med; 169(6): 588-94.