ARTYKUŁ ORYGINALNY / *ORIGINAL ARTICLE*

Prognostic significance of red cell distribution width and other red cell parameters in patients with chronic heart failure during two years of follow-up

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Abstract

Background: Studies published during the last decade seem to indicate red blood cell parameters as inexpensive, rapidly available, and simple tools for the assessment of prognosis in patients with chronic heart failure (CHF).

Aim: To evaluate the prognostic value of red cell parameters determined in a routine blood count in patients with CHF.

Methods: The study group included 165 patients with the New York Heart Association (NYHA) class II–IV CHF hospitalised in the 2nd Department of Cardiology in Bydgoszcz. On the first day of hospitalisation, all patients in the study group underwent a complete blood count with an assessment of haemoglobin (Hb) level, mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH), mean corpuscular haemoglobin concentration (MCHC) and red blood cell distribution width (RDW). Follow-up was carried over 24 months by phone calls every 3 months.

Results: MCV, MCH and MCHC were not shown to be significant predictors of mortality in CHF patients at 1 and 2 years of follow-up. In univariate analysis at 1-year follow-up, the following variables were significantly associated with the occurrence of the study endpoint: Hb level ($p = 0.022$; HR = 0.80), RDW ($p = 0.004$; HR = 1.257), and N-terminal pro-B-type natriuretic peptide (NT-proBNP) level ($p = 0.0001$; HR = 1). At 2 years of follow-up, the following variables were significantly associated with the occurrence of the study endpoint: left ventricular ejection fraction ($p = 0.018$; HR = 0.956), NYHA class ($p = 0.007$; HR = 0.378), RDW ($p = 0.044$; HR = 1.175), and NT-proBNP level ($p < 0.001$; HR = 1). Multivariate analysis for 1-year follow-up showed that RDW and NT-proBNP level were independent significant predictors of mortality, while NT-proBNP level ($p = 0.006$; HR = 1) and NYHA class ($p = 0.024$; HR = 0.439) were significant predictors of mortality at 2 years of follow-up. Based on receiver operating characteristic curve analysis, the cut-off RDW was 15.00% (AUC = 0.63; 0.523–0.737), at 12 months of follow-up and 14.00% (AUC = 0.6; 0.504–0.697), at 24 months of follow-up. The cut-off for Hb level was 13.9 g/dL (AUC = 0.662; 0.553–0.77), at 12 months of follow-up and 12.2 g/dL (AUC = 0.581; 0.482–0.681), at 24 months of follow-up.

Conclusions: Baseline RDW and Hb level in patients hospitalised with the diagnosis of NYHA class II–IV CHF seem to be important predictors of mortality in this population. Among the red blood cell parameters, only RDW was shown to be an independent prognostic factor at 1 year of follow-up but it appeared to lose its significance during longer-term follow-up.

Key words: red blood cell distribution width, chronic heart failure, red blood cell parameters, haemoglobin

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INTRODUCTION

Based on the POLKARD HF registry data, the number of patients with chronic heart failure (CHF) in Poland has been estimated at 500,000 to 750,000 [1, 2]. Mortality among these patients is 30–40% during 1 year since the diagnosis of CHF, and up to 70% at 5 years [3]. The very term "epidemic of heart failure", as coined by Massie and Shah [4], suggests this condition is associated with a number of medical and economic problems, and if heart transplantation is needed, also religious and ethical issues. Thus, it is necessary to identify factors which have the greatest effect on the prognosis in this patient group. Studies published during the last decade seem to indicate red blood cell parameters as inexpensive, rapidly available, and simple prognostic tools, and determining their precise pathophysiological links to CHF may contribute to the development of new therapeutic options. The aim of the study was to evaluate the prognostic value of red cell parameters determined in a routine blood count in patients with systolic CHF who were followed for 24 months.

METHODS

The study group included 165 Caucasian patients with the New York Heart Association (NYHA) class II–IV systolic CHF who were hospitalised in the 2nd Department of Cardiology at the Nicolaus Copernicus University Collegium Medicum in Bydgoszcz, Poland. All patients included into the study were haemodynamically stable, did not require intravenous inotropic agents, and received optimal drug therapy. The patients were hospitalised on an elective basis to evaluate the severity of heart failure (HF) (cardiac catheterisation) or perform other diagnostic testing necessary before considering heart transplantation, cardioverter-defibrillator implantation, or cardiac resynchronisation therapy. The inclusion criteria were age above 18 years and systolic HF with left ventricular ejection fraction (LVEF) of < 45% documented during the index hospitalisation or within 6 months. The exclusion criteria included an acute coronary syndrome, acute HF, exacerbation of CHF, severe renal dysfunction (GFR < 30 mL/min), active malignancy, active infection, fever of unknown origin, autoimmune diseases, corticosteroid therapy, decompensated diabetes requiring intravenous insulin infusion, chronic obstructive pulmonary disease, iron therapy, and chronic inflammatory bowel disease. In all patients, complete blood count was performed on the first day of hospitalisation, including haemoglobin (Hb) level, mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH), mean corpuscular haemoglobin concentration (MCHC), and red cell distribution width (RDW). In addition, iron, ferritin, N-terminal pro-B-type natriuretic peptide (NT-proBNP), troponin T (TnT), and cholesterol fraction (LDL, HDL) levels were measured. Follow-up to evaluate endpoint occurrence was by phone every 3 months since patient inclusion into the study. Duration of follow-up was 24 months, and the study endpoint was all-cause mortality.

Statistical analysis

Results were analysed using the Statistica version 12 software. For all tests, $p < 0.05$ was considered significant. Normal distribution of the evaluated variables was verified using the Shapiro-Wilk test. Non-parametric tests were used for non-normally distributed variables. Haemoglobin level, MCV, MCH, MCHC, and RDW were compared overall and in relation to the occurrence of death at 12 and 24 months of follow-up, using the Mann-Whitney U test. Evaluation of the diagnostic power of RDW, NT-proBNP level, and Hb level for predicting mortality during 12 and 24 months of follow-up was performed using receiver operating characteristic (ROC) curves. ROC curves were also used to determine cut-off levels of RDW and Hb. Relations between Hb, MCV, MCH, MCHC, RDW, NT-proBNP level, TnT level, and LVEF were evaluated using the Spearman ran correlation coefficients. Hazard ratios (HR) were calculated based univariate analyses and Cox multivariate analysis. Survival was evaluated using the Kaplan-Meier curves.

RESULTS

We evaluated 165 patients (83% men) at the mean age of 60 ± 13 years. During 24 months of follow-up, 47 (28.5%) patients died. These cases were characterised by significantly lower LVEF, higher RDW, and higher TnT and NT-proBNP levels. Clinical and laboratory characteristics of the study group are shown in Table 1. Table 2 shows Spearman rank correlations in the study group.

In our study group, MCV, MCH and MCHC were not useful predictors of mortality at 12 and 24 months of follow-up. In univariate analysis at 12 months of follow-up, summarised in Table 3, the following variables were significantly associated with the occurrence of the study endpoint: Hb level ($p = 0.022$; HR = 0.80), RDW ($p = 0.004$; HR = 1.257), and NT-proBNP level ($p = 0.0001$; HR = 1). In multivariate analysis, RDW and NT-proBNP level were independent, significant predictors of mortality during 12 months of follow-up (Table 3).

Cox proportional hazard model univariate analysis for 24 months of follow-up, summarised in Table 4, showed that the following variables were significantly associated with the occurrence of the study endpoint: LVEF ($p = 0.018$; HR = 0.956), NYHA class ($p = 0.007$; HR = 0.378), RDW ($p = 0.044$; HR = 1.175), and NT-proBNP level ($p < 0.001$; HR = 1). In multivariate analysis, NT-proBNP level ($p = 0.006$; HR = 1) and worse NYHA class ($p = 0.024$; HR = 0.439) were independent, significant predictors of mortality during 24 months of follow-up (Table 4).

We analysed ROC curves for Hb level and RDW, comparing them the ROC curve for NT-proBNP level for 12 and 24 months of follow-up and providing AUC and cut-off values for each of these predictors of prognosis. The cut-off for RDW was 15.00% (AUC = 0.63; 0.523–0.737) for 12 months

Table 1. Baseline characteristics of the study groups

Parameter	Overall (n = 165)	Survivors (n = 118; 71.5%)	Died (n = 47; 28.5%)	P
Age [years]	60 ± 13	59 ± 13	61 ± 14	0.677
Men	83%	81%	89%	0.172
Ischaemic aetiology	53%	52%	57%	0.504
Body mass index [kg/m^2]	29 ± 6	28 ± 6	30.00 ± 6	0.125
NYHA class II/III/IV	39.4%/50.9%/9.7%	46.6%/44.9%/8.5%	21.27%/66%/12.73%	**0.011**
Diabetes mellitus	36%	36%	38%	0.744
Left ventricular ejection fraction [%]	27 ± 8	28 ± 8	24 ± 8	**0.007**
Haemoglobin [g/dL]	14 (13.2–15)	14.1 (13.3–15.1)	13.8 (12–14.9)	0.104
MCV [fL]	90.3 (87.5–93.5)	90.3 (87–93.5)	90.4 (87.9–96.4)	0.654
MCH [pg]	30.3 (28.8–31.3)	30.3 (28.8–31.2)	30.3 (28.7–31.7)	0.836
MCHC [g/dL]	33.1 (32.5–34)	33.2 (32.5–33.9)	33 (32.5–34.1)	0.671
RDW [%]	13.9 (13.2–15)	13.8 (13.1–14.7)	14.2 (13.5–15.9)	**0.044**
Troponin T [μg/L]	0.02 (0.013–0.034)	0.02 (0.011–0.030)	0.03 (0.018–0.043)	**0.001**
NT-proBNP [pg/mL]	1862 (730–4088)	1308 (569–3491)	3224 (1156–4971)	**0.001**
Fe [μg/dL]	74 (53–100)	77.5 (54–104)	65 (51–83)	0.139
Ferritin [μg/dL]	141 (85–247)	141.5 (88–250)	139 (55–241)	0.901
Low density lipoprotein [mg/dL]	104 (80–134)	104 (88–133)	96 (81–138)	0.968
High density lipoprotein [mg/dL]	38 (31–48)	38.5 (32–47)	36 (30–49)	0.694
ACE inhibitor	82%	84%	77%	0.382
Angiotensin receptor blocker	18%	16%	23%	0.669
Statin	81%	82%	79%	0.767
Beta-blocker	99%	100%	98%	0.633
Acetylsalicylic acid	48%	47%	49%	0.999
Digoxin	27%	26%	28%	0.99
Spironolactone	74%	76%	68%	0.376
Eplerenone	18%	16%	23%	0.395

Results expressed as: mean values ± standard deviation or median values (interquartile range); ACE — angiotensin converting enzyme; MCH — mean corpuscular haemoglobin; MCHC — mean corpuscular haemoglobin concentration; MCV — mean corpuscular volume; NT-proBNP — N-terminal pro-B-type natriuretic peptide; NYHA — New York Heart Association; RDW — red blood cell distribution width

Table 2. Spearman rank correlations in the study population (n = 165); bold indicates statistically significant values ($p < 0.05$)

	EF	Haemoglobin	RDW	NT-proBNP	Troponin T
EF	1	–0.115	**–0.042**	**–0.345**	–0.015
Haemoglobin	–0.115	1	**–0.218**	**–0.228**	–0.122
MCV	–0.037	0.135	**–0.156**	0.135	0.144
MCH	–0.017	0.07	**–0.351**	–0.112	**0.024**
MCHC	0.031	0.012	**–0.447**	**–0.421**	–0.193
RDW	–0.042	**–0.218**	1	**0.319**	0.097
Troponin T	–0.015	–0.122	0.097	**0.332**	1
NT–proBNP	**–0.345**	**–0.228**	**0.319**	1	**0.332**

EF — ejection fraction; rest abbreviation as in Table 1

Table 3. Univariate and multivariate analysis. Cox proportional hazard model at 1 year of follow-up; bold indicates statistically significant values ($p < 0.05$)

	P	HR	(–95%; 95% CI for HR)
Univariate analysis			
NYHA	0.053	0.498	(0.245; 1.01)
LVEF	0.15	0.973	(0.936; 1.01)
Haemoglobin	**0.022**	**0.793**	**(0.65; 0.967)**
MCV	0.394	1.025	(0.968; 1.085)
MCH	0.656	1.029	(0.907; 1.168)
MCHC	0.399	0.897	(0.698; 1.154)
RDW	**0.004**	1.257	**(1.077; 1.467)**
Troponin T	0.098	137.09	(0.403; 46618.1)
NT-proBNP	**< 0.001**	1	(1; 1)
Multivariate analysis			
RDW	**0.044**	**1.19**	**(1.004; 1.411)**
NT-proBNP	**0.008**	1	(1; 1)

CI — confidence interval; HR — hazard ratio; LVEF — left ventricular ejection fraction; rest abbreviations as in Table 1

Table 4. Univariate and multivariate analysis. Cox proportional hazard model at 2 years of follow-up; bold indicates statistically significant values ($p < 0.05$)

	P	HR	(–95%; 95% CI for HR)
Univariate analysis			
NYHA	**0.007**	**0.379**	**(0.188; 0.763)**
LVEF	**0.018**	**0.956**	**(0.922; 0.9924)**
Haemoglobin	0.066	0.835	(0.689; 1.012)
MCV	0.247	1.033	(0.978; 1.091)
MCH	0.452	1.047	(0.929; 1.181)
MCHC	0.568	0.931	(0.729; 1.189)
RDW	**0.044**	**1.176**	**(1.005; 1.375)**
Troponin T	0.086	145.094	(0.499; 42232.14)
NT-proBNP	**< 0.001**	1	(1; 1)
Multivariate analysis			
NT-proBNP	**0.006**	1	(1; 1)
NYHA	**0.024**	**0.439**	**(0.215; 0.897)**

CI — confidence interval; HR — hazard ratio; LVEF — left ventricular ejection fraction; rest abbreviations as in Table 1

Table 5. Comparison of area under the curve (AUC) for haemoglobin (Hb) level and red blood cell distribution width (RDW) versus N-terminal pro-B-type natriuretic peptide (NT-proBNP) level for 12 months and 24 months of follow-up

	AUC RDW/Hb	AUC NT-proBNP	Z	P	r
RDW vs. NT-proBNP — > 12 months	0.63	0.684	0.828	**0.408**	0.266
RDW vs. NT-proBNP — > 24 months	0.6	0.66	1.038	**0.299**	0.294
Hb vs. NT-proBNP — > 12 months	0.662	0.684	0.35	**0.727**	0.288
Hb vs. NT-proBNP — > 24 months	0.581	0.66	1.328	**0.184**	0.273

of follow-up and 14.00% (AUC = 0.6; 0.504–0.697) for 24 months of follow-up (Figs. 1, 2).

For Hb level, the cut-off was 13.9 g/dL (AUC = 0.662; 0.553–0.77) for 12 months of follow-up and 12.2 g/dL (AUC = 0.581; 0.482–0.681) (Figs. 3, 4).

For NT-proBNP level, the cut-off values for 12 and 24 months of follow-up were 2943 pg/mL (AUC = 0.684; 0.582–0.787) and 1615 pg/mL (AUC = 0.659; 0.569–0.75), respectively (Table 5).

These cut-off values were then applied to the Kaplan-Meier survival curves. We showed that the above cut-off values for both Hb level ($p = 0.005$) and RDW ($p = 0.007$) for 12 months of follow-up stratified our patients into two groups with significantly different survival (Figs. 5, 6).

For 24 months of follow-up, the above cut-off for RDW was not significant ($p = 0.24$) for a difference in patient survival but the cut-off for Hb level was significant ($p = 0.017$) (Figs. 7, 8).

DISCUSSION

Studies published in the recent years indicate that increased RDW is associated with worse outcomes, e.g. in stable angina, peripheral vascular disease, and acute myocardial infarction [5–7]. The pathogenesis of RDW changes, iron metabolism disturbances, and anaemia in patients with CHF is still debated [8–10]. It is currently believed that an increase in RDW and associated worse outcomes in patients with CHF are related to multiple interrelated pathomechanisms including oxidative stress, increased immune system activation, chronic inflammation, abnormal body iron distribution, malnutrition, and cachexia [11–15].

Felker et al. [16] were the first to indicate the potential of RDW as a simple parameter useful in these patients. This study evaluated two patient populations, 2679 participants of the CHARM study and 2140 patients from the Duke Databank study. In the CHARM study population, in which association of 36 parameters with the rate of the combined study endpoint

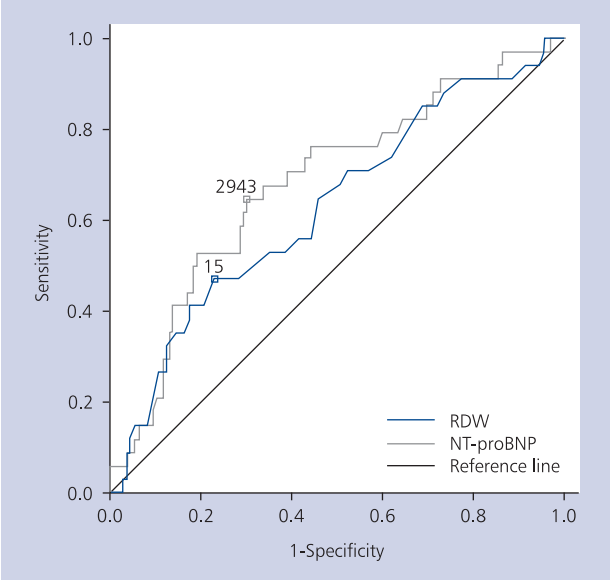

Figure 1. The receiver operating characteristic curve for red blood cell distribution width (RDW) at 12 months of follow-up; NT-proBNP — N-terminal pro-B-type natriuretic peptide

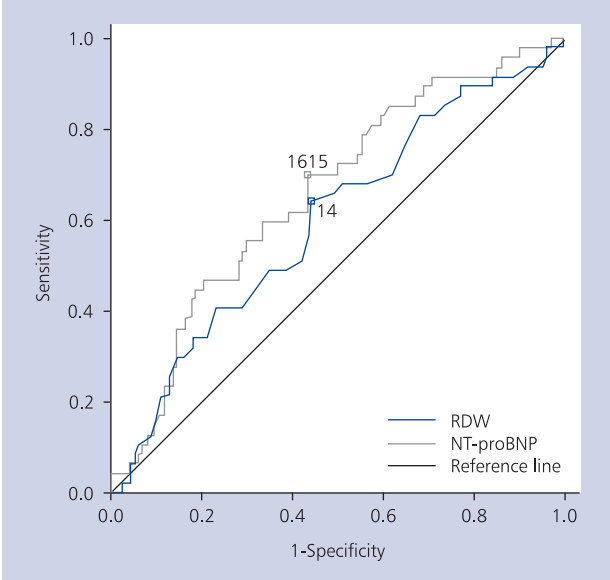

Figure 2. The receiver operating characteristic curve for red blood cell distribution width (RDW) at 24 months of follow-up; NT-proBNP — N-terminal pro-B-type natriuretic peptide

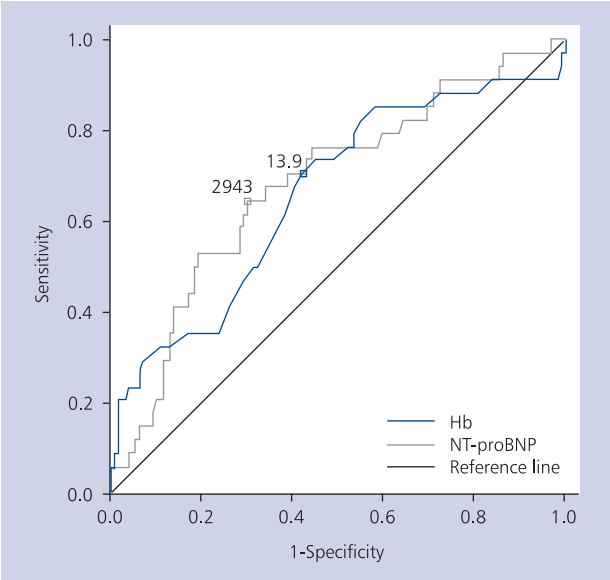

Figure 3. The receiver operating characteristic curve for haemoglobin (Hb) level at 12 months of follow-up; NT-proBNP — N-terminal pro-B-type natriuretic peptide

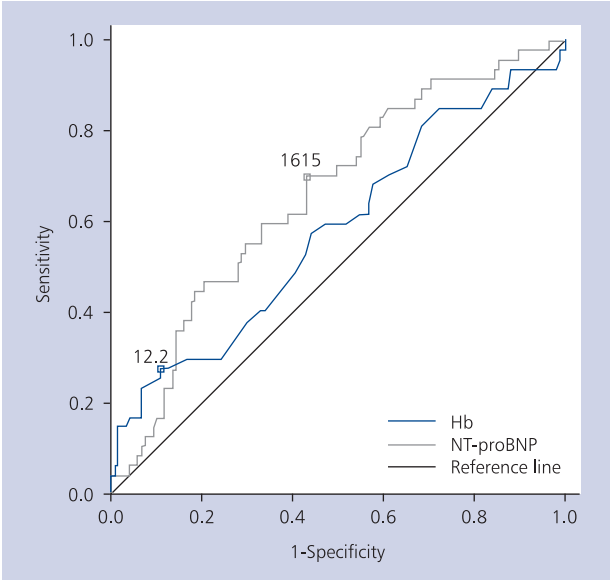

Figure 4. The receiver operating characteristic curve for haemoglobin (Hb) level at 24 months of follow-up; NT-proBNP — N-terminal pro-B-type natriuretic peptide

(cardiovascular death or admission due to HF) was evaluated, RDW was one of the parameters that showed the strongest correlation with the rate of the study endpoint. In the other patient population, the association between RDW and mortality was evaluated. RDW was shown to the strongest, excluding age, predictor of all-cause mortality [16]. Al-Najjar et al. [17] showed that the prognostic values of RDW is comparable to that of NT-proBNP level. The need to include RDW when stratifying risk in patients with CHF has been also evidenced by the studies by Aung et al. [18] and Cauthen et al. [19] which indicated that also the dynamics of RDW increase was associated with a higher rate of cardiovascular events.

The prevalence of anaemia in patients with CHF is high, ranging from 4% to 55% depending on the studied population and the definition of anaemia [20]. The prevalence of anaemia in this population is positively correlated with patient

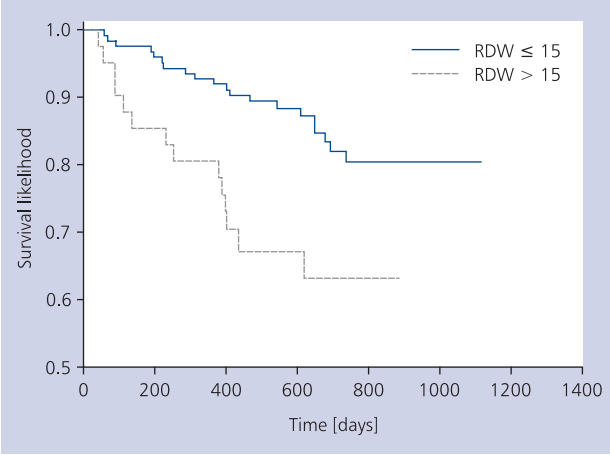

Figure 5. The Kaplan-Meier survival curve for red blood cell distribution width (RDW) stratified using the proposed cut-off value for 12 months of follow-up

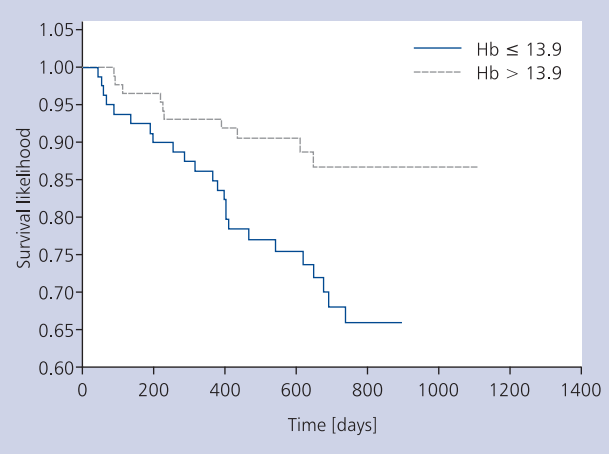

Figure 6. The Kaplan-Meier survival curve for haemoglobin level stratified using the proposed cut-off value for 12 months of follow-up

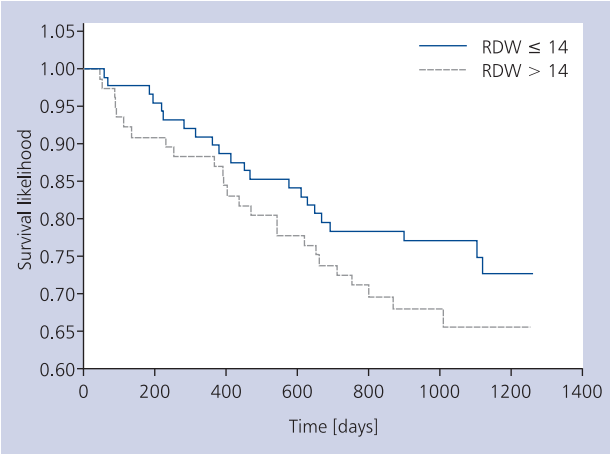

Figure 7. The Kaplan-Meier survival curve for red blood cell distribution width (RDW) stratified using the proposed cut-off value for 24 months of follow-up

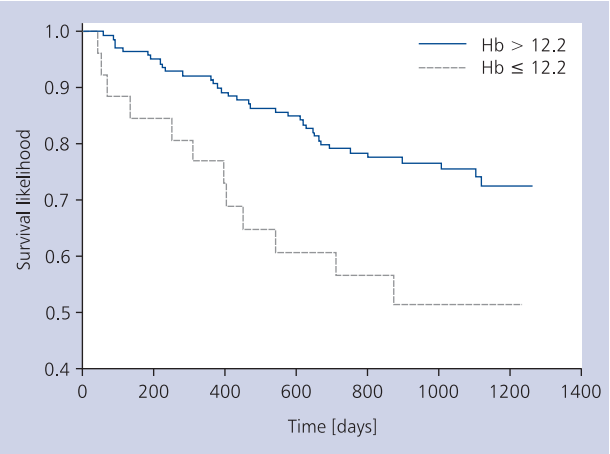

Figure 8. The Kaplan-Meier survival curve for haemoglobin level stratified using the proposed cut-off value for 24 months of follow-up

age, disease severity as evaluated using the NYHA class, LVEF, female gender, chronic kidney disease, and hypertension [9].

Many authors confirmed the correlation between anaemia and worse outcomes in patients with HF [17–19]. In the study by Anand et al. [10] which included 912 patients (mean age 62 ± 12 years, LVEF 22 ± 6%, mean Hb level 13.8 ± 1.6 g/dL), multivariate analysis showed a significant effect of anaemia on both the severity of HF symptoms and all-cause mortality. Compared to our study, data on the racial background of the included patients were not available, and the exclusion criteria did not included haemodynamically unstable patients, 30% of which were in NYHA class IIIb/IV [10]. In the study by Kosiborod et al. [20], medical records of 50,405 patients were evaluated. Similarly to our study, low Hb level was not shown to be an independent, statistically significant factor affecting all-cause mortality. Despite similar findings, the population studied by Kosiborod et al. [20] was significantly older (mean age 79.4 ± 0.05 years, patients < 65 years of age were included), with 84.44% of Caucasians, and haemodynamically unstable patient condition was not an exclusion criterion.

Our study is one of the first Polish publications on the prognostic value of RDW in patients with CHF and the first one to evaluate it prospectively over 2 years of follow-up. Our findings confirm few previous reports indicating that RDW may be a significant predictor of mortality in patients with CHF during 1-year follow-up. Haemoglobin level was not an independent prognostic factor and only a co-predictor of mortality during 1-year follow-up. Other red blood cell parameters evaluated in our study, i.e. MCV, MCH and MCHC, were

not found to be useful predictors of mortality in patients with CHF. The prognostic importance of RDW as an independent predictor of mortality appears to lose its statistical significance over longer-term follow-up. This finding may be related to the fact that during long-term follow-up, the only significant parameters are those clearly related to worse haemodynamics.

Limitations of the study

The findings of our study may not be applied to patients with decompensated systolic CHF, acute HF, and HF with preserved left ventricular function.

CONCLUSIONS

Baseline RDW and Hb level in patients hospitalised with the diagnosis of NYHA class II–IV CHF seem to be important predictors of mortality in this population. Among the red blood cell parameters, only RDW was shown to be an independent prognostic factor at 1 year of follow-up but it appeared to lose its significance during longer-term follow-up. These findings should be confirmed in multicentre studies in ethnically and culturally diverse populations of patients at various age. Assessment of baseline Hb level in patients hospitalised with the diagnosis of NYHA class II–IV CHF seems to be useful for stratification of mortality risk in this patient group.

Conflict of interest: *none declared*

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Znaczenie rokownicze rozpiętości rozkładu objętości erytrocytów i innych parametrów czerwonokrwinkowych u chorych z przewlekłą niewydolnością serca podczas dwuletniej obserwacji

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Streszczenie

Wstęp: Badania opublikowane w ciągu ostatniej dekady zdają się wskazywać na parametry czerwonokrwinkowe jako tanie, szybkie i proste narzędzia do określania rokowania pacjentów z przewlekłą niewydolnością serca (CHF). Poznanie dokładnego związku patofizjologicznego między zmianami wartości parametrów czerownokrwinkowych a CHF może dać wiele nowych możliwości terapeutycznych u pacjentów z CHF.

Cel: Celem pracy była ocena wartości rokowniczej rozpiętości rozkładu objętości erytrocytów (RDW) i pozostałych parametrów czerwonokrwinkowych oznaczanych w rutynowej morfologii krwi obwodowej podczas 2-letniej obserwacji, w grupie pacjentów z CHF, a także porównanie tej wartości z wartością rokowniczą tych parametrów w przypadku rocznego okresu obserwacji.

Metody: Grupę badaną stanowiło 165 pacjentów hospitalizowanych w II Klinice Kardiologii *Collegium Medicum* Uniwersytetu Mikołaja Kopernika z CHF w II–IV klasie wg *New York Heart Association* (NYHA). U wszystkich pacjentów z grupy badanej w pierwszym dniu hospitalizacji wykonano morfologię krwi obwodowej z oceną stężenia hemoglobiny, średniej objętości krwinki czerwonej (MCV), średniej masy hemoglobiny w krwince czerwonej (MCH), średniego stężenia hemoglobiny w objętości krwinek czerwonych (MCHC) oraz RDW. Obserwację pacjentów, która trwała łącznie 24 miesiące, prowadzono telefonicznie, co 3 miesiące od momentu włączenia pacjenta do badania. Punktem końcowym była śmiertelność ogólna.

Wyniki: Analizie poddano 165 pacjentów (mężczyźni: 83%, średni wiek: 60 ± 13 lat). W trakcie 24-miesięcznej obserwacji zmarło 47 (28,5%) pacjentów. Spośród parametrów czerwonokrwinkowych MCV, MCH i MCHC nie okazały się wartościowymi predyktorami zgonów w grupie chorych z CHF zarówno w 1-rocznym, jak i 2-letnim okresie obserwacji. W analizie jednoczynnikowej dla 1-rocznego okresu obserwacji stwierdzono istotny statystycznie wpływ następujących parametrów na wystąpienie punktu końcowego: hemoglobina ($p = 0,022$; HR = 0,80), RDW ($p = 0,004$; HR = 1,257), N-końcowy propeptyd natriuretyczny typu B (NT-proBNP; $p = 0,0001$; HR = 1), analiza wieloczynnikowa dla rocznego okresu obserwacji wykazała, że RDW i NT-proBNP są niezależnymi, istotnymi statystycznie czynnikami wpływającymi na wystąpienie zgonu. Analiza jednoczynnikowa dla 2-letniego okresu obserwacji wykazała istotny statystycznie wpływ na wystąpienie punktu końcowego następujących parametrów: frakcja wyrzutowa ($p = 0,018$; HR = 0,956), klasa NYHA ($p = 0,007$; HR = 0,378), RDW ($p = 0,044$; HR = 1,175), NT-proBNP ($p < 0,001$; HR = 1), natomiast analiza wieloczynnikowa 2-letniego okresu obserwacji wykazała, że NT-proBNP ($p = 0,006$; HR = 1) i klasa NYHA ($p = 0,024$; HR = 0,439) są niezależnymi, istotnymi statystycznie czynnikami wpływającymi na wystąpienie zgonu. Proponowany punkt odcięcia dla RDW w obserwacji 12-miesięcznej wyniósł 15,00% (AUC = 0,63; 0,523–0,737), natomiast dla okresu 24 miesięcy — 14,00% (AUC = 0,6; 0,504–0,697). W przypadku hemoglobiny proponowany punkt odcięcia w obserwacji 12-miesięcznej wyniósł 13,9 g/dl (AUC = 0.662; 0,553–0,77), natomiast dla okresu 24 miesięcy — 12,2 g/dl (AUC = 0.581; 0,482–0,681).

Wnioski: Oznaczane przy przyjęciu RDW i stężenie hemoglobiny u chorych hospitalizowanych z rozpoznaniem CHF w II–IV klasie wg NYHA wydają się istotnymi czynnikami rokowniczym wystąpienia zgonu w tej populacji pacjentów. Spośród parametrów czerwonokrwinkowych jedynie RDW okazał się niezależnym czynnikiem rokowniczym dla 1-rocznego okresu obserwacji, jednak jego znaczenie rokownicze zanika w obserwacji długoterminowej.

Słowa kluczowe: rozpiętość rozkładu objętości erytrocytów, przewlekła niewydolność serca, parametry czerwonokrwinkowe, hemoglobina

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