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Correlation of Inflammation, Lipidogram and Clinical Readings in Chronic Heart Failure Patients

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Introduction (I)

- **Traditional model** of heart failure (HF) pathophysiology: HF with reduced ejection fraction (HFrEF) has been mainly attributed to ischemic left ventricular remodeling [1-3], whereas HF with preserved ejection fraction (HFpEF) has been attributed to hypertension [4-7].
- **Novel paradigm** of chronic HF (CHF) pathogenesis: metabolism-related concomitant diseases play a crucial role in systemic pro-inflammatory condition maintenance in HFpEF [5,8-14].

Introduction (II)

- Inflammatory processes are presented as regulated by platelet-induced activation of blood leukocytes.
- Neutrophils take part in maintaining a pro-inflammatory state in the pathophysiology of HF [15].
- Hypercholesterolemia is stated to heighten neutrophil production, which contributes to accelerated cardiovascular inflammation [16].
- Identification of inexpensive, reliable, and most importantly, rapid prognostic markers of HF.
- HF pathogenesis differences in different HF phenotypes remain to be investigated.

Aim

To determine differences in **complete blood count**, **C-reactive protein (CRP)** concentration, **lipidogram** and **clinical readings** between CHF without previous MI groups according to EF and between HFrEF groups according to MI presence in CHF development history and correlations between these readings.

Methods

- 4 groups of patients were analyzed **(n = 266)**.
- **Period:** from January 1, 2018 to February 1, 2021 (Hospital of Lithuanian University of Health Sciences Kauno klinikos Cardiology department).
- 208 patients diagnosed with CHF who had had no documented history of previous myocardial infarction (MI) were divided into two groups according to left ventricular ejection fraction (LVEF): **LVEF ≥ 50%, n = 117** and **LVEF < 50%, n = 91**.
- Additionally, 149 HFrEF patients were separated into two additional groups: those who had had no MI (n = 91) and those with MI (n = 58).
- **Exclusion criteria:** malignancies, chronic obstructive pulmonary disease, bronchial asthma, autoimmune diseases, stage 4–5 chronic kidney disease (CKD, with eGFR < 30 ml/min/1.73^2), acute infections, i.e., **common chronic or acute systemic inflammation supporting conditions**.

Results (I)

Laboratory findings	LVEF ≥ 50 % without MI, n=117	LVEF < 50 % without MI, n=91	p - value
RBC, 10^{12}/l	4.59 (0.57)	4.61 (0.65)	0.791
HGB, g/l	137 (87-165)	136 (77-183)	0.477
MCHC, g/l	337.32 (10.60)	331.46 (13.13)	**0.004***
PLT, 10^{9}/l	202 (73-326)	204.5 (113-1097)	0.053
RDW-CV, %	13.6 (11.5-16.9)	14.7 (12.6-19.1)	**0.001***
MPV, fl	9.85 (1.37)	10.13 (1.19)	0.222

LVEF – left ventricular ejection fraction, MI – myocardial infarction, RBC – red blood cells, HGB – hemoglobin concentration, MCHC – mean corpuscular hemoglobin concentration, PLT – platelets, RDW-CV – red cell distribution width, MPV – mean platelet volume

** Statistically significant values ($p < 0.05$)*

Results (II)

Laboratory findings	LVEF ≥ 50 % without MI, n=117	LVEF < 50 % without MI, n=91	p - value
NEU, %	58.20 (12.40)	61.12 (10.40)	0.137
NEU, 10^9/l	4.00 (1.42-15.53)	4.05 (1.47-9.61)	0.434
LYM, %	30.48 (10.87)	26.98 (9.08)	**0.045***
LYM, 10^9/l	1.98 (0.72)	1.78 (0.59)	0.071
MON, %	9.1 (4.7-13.7)	9.4 (3.2-15.9)	0.101
MON, 10^9/l	8.78 (2.69)	9.52 (2.81)	0.121
LYM/MON	3.33 (1.22-9.33)	3 (0.44-6.5)	**0.011***
CRP, mg/l	4.92(6.21)	7.51(12.29)	0.099

LVEF – left ventricular ejection fraction, MI – myocardial infarction, NEU – neutrophils, LYM – lymphocytes, MON – monocytes, LYM/MON – lymphocyte-to-monocyte ratio, CRP – C-reactive protein concentration

** Statistically significant values ($p < 0.05$)*

Results (III)

Laboratory findings	LVEF < 50 % without MI, n=91	LVEF < 50 % with MI, n=58	p - value
Total cholesterol, g/l	4.35 (2.46-7.10)	3.9 (2.72-6.71)	**0.016***
LDL, g/l	2.97 (1.53-5.5)	2.52 (1.36-4.42)	0.101
HDL, g/l	0.96 (0.44-2.2)	0.92 (0.56-1.97)	**0.010***
TG, g/l	1.25 (0.39-3.28)	1.24 (0.51-6.78)	0.672
AC	3.55 (1.23-6.06)	3.25 (1.21-6.39)	0.591
CRP, mg/l	6.9 (1.46-62.97)	7 (1-33.99)	**0.012***

LVEF – left ventricular ejection fraction, MI – myocardial infarction, LDL – low-density lipoprotein concentration, HDL – high-density lipoprotein concentration, TG – triglyceride concentration, AC – atherogenic coefficient, CRP – C-reactive protein concentration

** Statistically significant values ($p < 0.05$)*

Results (IV)

- **Neutrophil count** correlated with **PLT** (r_s=0.278, p=0.001) and **weight** (r_p=0.196, p=0.024).
- **Lymphocyte count** correlated with **PLT**, **RDW-CV** (r_s=0.200, p=0.018; r_s=-0.223, p=0.032) and **body mass index** (r_p=0.186, p=0.032).
- **RDW-CV** and **monocyte count** correlated with **NT-proBNP** and **serum creatinine** (r_s=0.358, p=0.034; r_s=0.424, p<0.001 and r_s=0.354, p=0.012; r_s=0.205, p=0.018 respectively).

r_p – A Pearson's correlation was run to determine the relationship between variables
r_s – A Spearman's correlation was run to determine the relationship between variables

Results (V)

- **Total cholesterol concentration** correlated with lymphocyte-to-monocyte ratio **(LYM/MON)**, **monocyte** percentage, **lymphocyte** percentage and count (r_s=0.534, p<0.001; r_s=-0.312, p=0.029; r_s=0.355, p=0.012; r_s=0.397, p=0.004 respectively).
- **LVEF** correlated with **MCHC** and **RDW-CV** (r_s=0.273, p=0.001; r_s=-0.404, p<0.001).

r_p – A Pearson's correlation was run to determine the relationship between variables
r_s – A Spearman's correlation was run to determine the relationship between variables

Conclusion

1. **MCHC** and **lymphocyte** percentage were lower and **RDW-CV** was higher in the HFrEF group without of MI; **CRP concentration** was higher in HFrEF with MI in comparison with the group without MI;
2. **HDL cholesterol concentration** was lower and **CRP concentration** was higher in the HFrEF group with MI in comparison with the group without MI; total cholesterol concentration correlated with LYM/MON;
3. **Monocyte**, **lymphocyte count** and **their ratio** correlated with patients' condition reflected readings **NT-proBNP**, **serum creatinine**, **uric acid** concentrations.

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