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Clinical significance of selected biomarkers of inflammatory and congestive processes in heart failure

Introduction

Heart failure (HF) is a common disease with an incidence of more than 10% in the population over 70 years of age. HF also affects non-cardiac organs as seen in the reported signs and symptoms. According to the latest guidelines of the European Society of Cardiology, this disease entity should be defined as a clinical syndrome, not a single diagnosis.

Due to the varied etiology of HF and its different clinical phenotypes, it is extremely important to select an appropriate set of biomarkers that may be helpful in the differential diagnosis of heart failure, risk stratification and treatment modification. Moreover, the commonly used biomarker should meet the relevant criteria, such as: high sensitivity and specificity, standardization, repeatability and universal availability, also for economic reasons.

Purpose

The aim of the study is to assess the usefulness of biomarker determination in clinical practice in patients diagnosed with heart failure.

Materials and methods

The study was based on a retrospective analysis of 59 women and 63 men with HF hospitalized between November 2021 and April 2023 at the Department of Non-Invasive Cardiology of the Medical University of Lodz. The mean age of the patients was 72 ±8.96 years. Statistical analysis was performed using Statistica 13.1PL (StatSoft, Tulsa, USA). The analysis was performed in the groups of exacerbation of HF vs stable HF.

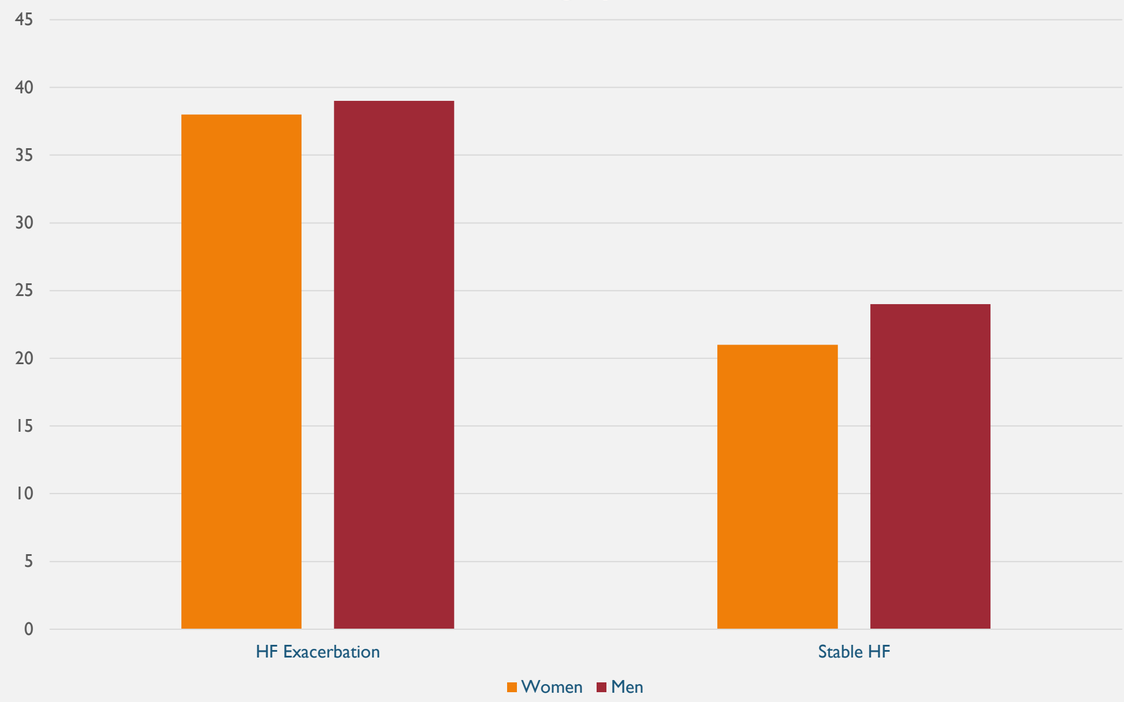
Results

Significant differences between HF patients with and without exacerbation were observed not only in renal parameters [creatinine, estimated glomerular filtration rate (eGFR)] or other laboratory test results [non-HDL cholesterol, haemoglobin (Hb)], but also in iron deficiency (ID) biomarkers [transferrin saturation (TSAT) 19.77 ± 6.39 vs 27.27 ± 7.60] and congestion/inflammatory biomarkers (high-sensitivity troponin (hs-TnT) 24.00; IQR: 17.00-41.00 vs 12.00; IQR: 10.00-23.00; p=0.000127; N-terminal pro B-type natriuretic peptide (NT-proBNP) 1468.00; IQR: 664.00- 3271.00 vs 359.00; IQR: 192.00-903.00 p<0.0001 and carbohydrate antigen 125 (CA 125) 17.40; IQR:10.20-43.40 vs 12.70; IQR: 9.10-22.90; p=0.0441) as well as in ID (76% vs 24%; p= 0.0060) or chronic kidney disease (CKD) prevalence (83% vs 17%; p=0.0008). However, there was no significant difference in diabetes status or glycemic parameters. Spearman's rank correlation analysis revealed negative correlation between number of hospitalisations due to HF in last 12 months and Hb (r = -0.2473; p = 0.0047), ferritin (r =-0.1790; p = 0.0433), TSAT (r= -0.3786; p= 0.0103), eGFR (r=- 0.373618; p<0.0001), but positive correlation between number of hospitalisations due to HF in last 12 months and RDW (r = 0.3070; p = 0.0004), hs-TnT (r=0.3279; p=0.0002), NT-proBNP (r=0.4261; p<0.0001) and CA 125 (r=0.2697; p=0.0022).

Conclusions:

Our results indicate multi-morbidity of hospitalised HF patients and the need for a holistic approach to the patient, as well as a diverse set of biomarkers., with the principle of personalization. The outcomes emphasized and confirmed the significance of ID screening and the role of hsTnT, NT-proBNP and CA 125 in risk stratification. However, the long-term results are needed to confirm a proper management of HF patients during hospitalization.

Demographics



Variable	Stable HF	HF exacerbation	P value
HGB, g/dL (SD)	13.67 (1.87)	12.58 (1.50)	0.0006
HCT, % (SD)	40.25 (5.14)	38.08 (4.25)	0.0127
MCHC, g/dL (SD)	33.91 (1.04)	33.01 (1.12)	< 0.0001
RDW, % (IQR)	13.40 (12.80-14.00)	14.80 (13.60-16.10)	<0.0001
ferritin, µg/L (IQR)	138.00 (78.90-277.00)	97.55 (52.00-202.00)	0.0757
TSAT, % (SD)	27.27 (7.60)	19.77 (6.39)	0.0008
serum iron, µg/dL (IQR)	14.21 (3.89)	10.54 (3.79)	0.0029
glucose, mmol/L (IQR)	5.70 (5.18-6.68)	5.70 (5.08-6.47)	0.5214
HbA1c, % (IQR)	6.39 (5.83-6.76)	6.28 (5.78-6.81)	0.5271
creatinine, µmol/L (IQR)	85.30 (71.50-109.00)	109.30 (85.20-140.70)	0.0024
urine, mmol/L (IQR)	6.77 (5.56-8.80)	8.44 (6.66-11.29)	0.0013
uric acid, µmol/L (SD)	358.75 (81.34)	372.08 (98.92)	0.4424
GFR, ml/min/1,73m (SD)	62.17 (19.16)	50.97 (18.43)	0.0017
TC, mmol/L (SD)	4.12 (1.15)	3.61 (0.99)	0.0110
LDL, mmol/L (IQR)	1.91 (1.55-3.01)	1.62 (1.30-2.26)	0.0208
HDL, mmol/L (SD)	1.35 (0.31)	1.2351 (0.33)	0.0503
non-HDL, mmol/L (IQR)	2.51 (2.11-3.48)	2.22 (1.84-2.83)	0.0148
triglycerides, mmol/L] (IQR)	1.24 (0.98-1.52)	1.13 (0.85-1.55)	0.2985
hsTnT, ng/L (IQR)	12.00 (10.00-23.00)	24.00 (17.00-41.00)	0.0001
NT-proBNP, pg/mL (IQR)	359.00 (192.00-903.00)	1468.00 (664.00-3271.00)	<0.0001
hs-CRP, mg/l (IQR)	1.86 (0.52-4.29)	2.34 (1.21-6.88)	0.0718
CA-125, U/ml (IQR)	12.70 (9.10-22.90)	17.40 (10.20-43.40)	0.0441
Iron deficiency (%)	15 (24)	47 (76)	0.0060
Diabetes mellitus (%)	21 (38)	34 (62)	0.7880
Chronic kidney disease (%)	7 (17)	35 (83)	0.0008

Table 1. Baseline characteristics

Pairs of variables	N	R Spearman	P value
Hb & HF hospitalisations in the last 12 months	129	-0.2473	0.0047
Ferritin & HF hospitalisations in the last 12 months	128	-0.1790	0.0433
TSAT & HF hospitalisations in the last 12 months	45	-0.3786	0.0103
eGFR & HF hospitalisations in the last 12 months	129	- 0.3736	< 0.0001
RDW & HF hospitalisations in the last 12 months	129	0.3070	0.0004
hsTnT & HF hospitalisations in the last 12 months	128	0.3279	0.0002
NT-proBNP & HF hospitalisations in the last 12 months	129	0.4261	<0.0001
CA-125 & HF hospitalisations in the last 12 months	127	0.2697	0.0022

Table 2. Spearman's rank correlation analysing the interaction between different variables and HF hospitalisations in the last 12 months