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THE PATHOGENETIC SIGNIFICANCE OF VARIOUS COMORBID CONDITIONS IN THE DEVELOPMENT OF CHRONIC HEART FAILURE

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Abstract: *Comorbid conditions are highly prevalent among patients with heart failure and represent an important characteristic of this patient population. The most common concomitant conditions identified during the one-year observation period were coronary artery disease (60%), atrial fibrillation (36%), type 2 diabetes mellitus (34%), chronic kidney disease (36%), and a history of myocardial infarction (43%).*

Keywords: *comorbidity, chronic heart failure, myocarditis, vasoconstrictor systems, vasodilator systems.*

The aim of the study is to investigate and evaluate the role of comorbidity in the development of chronic heart failure.

Object of the study. The study analyzed 203 patients diagnosed with chronic heart failure who were treated in the Heart Failure Department of the Bukhara Regional Branch of the Republican Specialized Scientific and Practical Medical Center of Cardiology from January 2023 to December 2025.

Subject of the study. The study was based on the results of modern clinical and laboratory investigations, including complete blood count, blood biochemical analysis (total protein, urea, creatinine, lipid profile, glucose, and glycated hemoglobin), coagulogram, and urinalysis. Instrumental investigations included electrocardiography and echocardiography. The study also included the assessment of clinical condition using the Clinical Condition Assessment Scale (CCAS) according to Mareev, as well as the evaluation of quality of life using the SF-36 questionnaire.

Research methods. Modern clinical, laboratory, instrumental, and statistical methods were used in the study.

Materials and methods of the study. The study analyzed 203 patients with a diagnosis of chronic heart failure (CHF) who were treated in the Heart Failure Department of the Bukhara Regional Branch of the Republican Specialized Scientific and Practical Medical Center of Cardiology from January 2023 to December 2025. Of the 203 patients included in the prospective study, 107 (52.7%) were men and 96 (47.3%) were women. The study excluded patients younger than 18 years and older than 89 years, as well as patients with a primary diagnosis of atrial fibrillation, other cardiac rhythm and conduction disorders, hypertensive crisis, oncological diseases, severe renal or hepatic diseases, musculoskeletal disorders, and systemic connective tissue diseases (rheumatic diseases).

The study employed clinical and laboratory examination methods, including complete blood count, biochemical blood analysis (total protein, urea, creatinine, lipid profile, glucose, and glycated hemoglobin), coagulogram, and urinalysis. Instrumental examinations included electrocardiography (ECG) and echocardiography (EchoCG). The Clinical Condition Assessment Scale (CCAS) according to Mareev and the SF-36 questionnaire for assessing quality of life were also used.

Analysis of Patients by Age and Sex. Based on the main objective of the study, the age and sex characteristics of the 203 patients who directly participated in the research were analyzed (Figure 1).

Among male patients with chronic heart failure (CHF), the largest proportion belonged to the 60–74-year age group, comprising 46 patients (43.0%). The 45–59-year age group included 44 patients (41.1%), the 75–89-year age group included 11 patients (10.3%), and the 18–44-year age group included 6 patients (5.6%). Among female patients with CHF, the largest proportion was also observed in the 60–74-year age group, comprising 46 patients (48.0%). The 45–59-year age group included 37 patients (38.5%), the 75–89-year age group included 10 patients (10.4%), and the 18–44-year age group included 3 patients (3.1%). During the study, the structure of comorbid conditions in patients was compared according to the left ventricular ejection fraction (LVEF) in chronic heart failure. Based on LVEF, the patients were divided into three groups: reduced LVEF (LVEF <40%), mildly reduced LVEF (LVEF 40–49%), and preserved LVEF (LVEF ≥50%) (Table 1).

Table 1.

Comorbid Conditions in Patients According to Left Ventricular Ejection Fraction in Chronic Heart Failure

Comorbid condition	CHF (Chronic Heart Failure) LVEF (Left Ventricular Ejection Fraction)< **40%** reduced LVEF **(n=25)**		CHF LVEF **40-49%** mildly reduced LVEF **(n=65)**		CHF **≥ 50%** preserved LVEF **(n=113)**		**Total, n=203**	
	M (n=20)	F (n=5)	M (n=44)	F (n=21)	M (n=43)	F (n=70)	M (n=107)	F (n=96)
Respiratory diseases (COPD, BA)	5 2,4%	1 0,5%	6 2,9%	3 1,5%	8 3,9%	14 6,7%	19 9,3%	18 8,9%
Cardiovascular diseases (IHD, CHF, hypertension)	20 9,8%	5 2,4%	44 21,7%	21 10,3%	43 21,2%	70 34,4%	107 52,7%	96 47,3%
Type 2 diabetes mellitus (T2DM)	15 7,4%	4 1,9%	21 10,3%	10 4,9%	20 9,6%	24 11,8%	56 27,6%	38 18,7%
Diseases of the digestive system (gastritis, pancreatitis, cholecystitis, NAFLD)	0	0	1 0,5%	2 1,0%	2 1,0%	5 2,4%	3 1,5%	7 3.4%
Musculoskeletal diseases (osteoarthritis, rheumatoid arthritis)	0	0	0	0	1 0,5%	1 0,5%	1 0,5%	1 0,5%
Iron deficiency anemia (mild and moderate severity)	0	0	7 3,4%	8 4%	16 7,8%	32 15,7%	23 11,3%	40 19,7%
Overweight and obesity (grades 1, 2, and 3)	20 9,6%	5 2,4%	34 16,7%	21 10,3%	37 18,2%	54 26,6%	91 44,8%	80 39,4%

The data presented in Table 1 demonstrated a significantly high prevalence of comorbid conditions across the CHF groups. Cardiovascular diseases ranked first, followed by overweight and all grades of obesity in second place, diabetes mellitus in third place, iron deficiency anemia in fourth place, respiratory diseases in fifth place, diseases of the digestive system in sixth place, and

musculoskeletal diseases in seventh place. These findings indicate that, particularly in patients with cardiovascular diseases, overweight and obesity, and diabetes mellitus, it is necessary to assess the overall clinical condition, stratify risk factors alongside CHF, and develop an individualized treatment and rehabilitation plan.

Risk factors were also studied in all 203 patients with CHF who participated in the study (Table 2).

Table 2.

Risk Factors in Patients with SLE

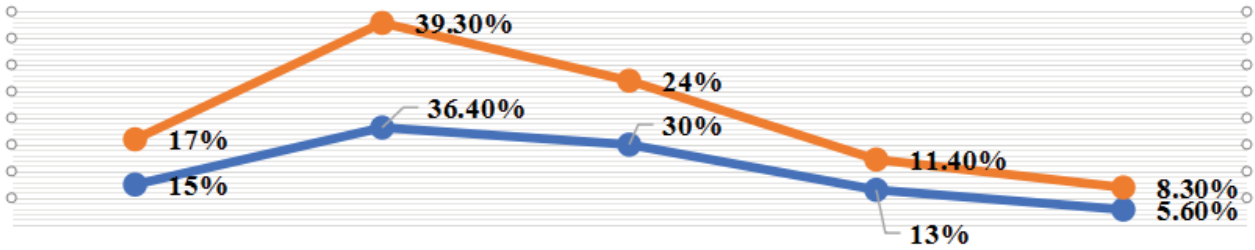
№	**Risk Factors** Smoking (tobacco use)	**Total, n=203**			
		Female patients with SLE (n=107)		**Female patients with SLE (n=96)**	
		abs	**%**	**abs**	**%**
1	Alcohol consumption	21	19,6%	7	7,3%
2	Smoking (tobacco use)	33	30,8 %	24	25%
3	Physical inactivity (sedentary lifestyle)	53	49,5%	65	67,7%

According to Table 2, an analysis of the distribution of risk factors among patients with SLE by sex showed that the most prevalent risk factor was physical inactivity (hypodynamia), which was reported in 53 male patients (49.5%) and 55 female patients (57.3%). Physical inactivity was 1.03 times more frequent among women than among men. Overall, physical inactivity was observed in 108 patients (53.2%), indicating that lifestyle-related factors play a leading role in this population group.

Smoking (tobacco use) ranked second among the risk factors, occurring in 33 male patients (30.8%) and 24 female patients (25.0%). Overall, smoking was reported in 57 patients (28.1%). The proportion of smokers among men was slightly higher than among women, by 1.4-fold.

Alcohol consumption was relatively less common, being reported in 21 male patients (19.6%) and 7 female patients (7.3%). Overall, this risk factor was observed in 28 patients (13.8%), with alcohol consumption being three times more frequent among men than among women.

To further investigate the study population, body mass index (BMI) was determined in all 203 patients, and the prevalence of overweight and different degrees of obesity was analyzed (Figure 2).



Body Weight, Obesity, and Atherogenic Index

Figure 2. Assessment of Overweight and Degrees of Obesity in Patients

According to Figure 2, overweight and all degrees of obesity were several times more prevalent than normal body weight. Overweight was observed 2.4 times more frequently in men (36.4% vs. 15%) and 2.3 times more frequently in women (39.3% vs. 17%). Similarly, grade 1, grade 2, and grade 3 obesity were more prevalent than normal body weight in both sexes. Grade 1 obesity was observed 2.0 times more frequently in men (30% vs. 15%) and 1.4 times more frequently in women

(24% vs. 17%). Grade 2–3 obesity was also more common, occurring 1.2 times more frequently in men (18.6% vs. 15%) and 1.1 times more frequently in women (19.7% vs. 17%).

The mean atherogenic index in male patients with SLE was 6.46 ± 0.12, compared with 5.55 ± 0.14 in female patients. This value was 1.16 times higher in men than in women ($p < 0.001$).

The atherogenic index, as an indicator of lipid metabolism disorders, was 1.16 times higher in male patients with SLE than in female patients. This finding highlights the need for enhanced treatment and preventive measures aimed at addressing lipid metabolism disorders and reducing cardiovascular risk in patients with SLE. According to the SF-36 questionnaire, the analysis of quality of life among female patients showed that a very low quality of life (0–10 points) was observed in 3 patients (3%), a low quality of life (11–20 points) in 46 patients (48%), a moderate quality of life (21–26 points) in 46 patients (48%), and a good quality of life (27–30 points) in only 1 patient (1%). Thus, 96% of female patients had a low or moderate quality of life. Among male patients, a very low quality of life was observed in 20 patients (18.6%), a low quality of life in 46 patients (43%), a moderate quality of life in 33 patients (31%), and a good quality of life in 8 patients (7.4%). This finding indicated that severe clinical conditions were observed six times more frequently among male patients than among female patients. In all male and female patients with SLE included in the study group, the overall clinical condition according to the Mareev Clinical Condition Assessment Scale (CCAS) was analyzed using mean values (Table 3).

Table 3.

Analysis of the mean values of the overall clinical condition according to the Mareev Clinical Condition Assessment Scale (CCAS) in male and female patients with SLE

Groups (according to LVEF)	Men (n=107)	Women (n=96)	Total (n=203)	Expected FC	p
SLE, LVEF <40% (reduced)	11.24 ± 1.82	10.95 ± 1.94	11.1 ± 1.5	FC III–IV	<0.05
SLE, LVEF 40–49% (mid-range)	6.86 ± 1.35	7.15 ± 1.42	7.0 ± 1.0	FC II–III	<0.05
LVEF ≥50% (preserved)	3.32 ± 0.81	3.49 ± 0.85	3.4 ± 0.6	FC I–II	<0.05

Note: *$p < 0.05$ indicates a statistically significant difference compared with the groups being compared.*

The data presented in Table 3, based on the Mareev Clinical Condition Assessment Scale, also confirmed a direct relationship between cardiac pump function and clinical condition. In the group with LVEF <40%, the mean Mareev scale score was 11.1 ± 1.5 points, corresponding to functional class III–IV. In the group with LVEF of 40–49%, the mean score was 7.0 ± 1.0 points, corresponding to functional class II–III. In patients with LVEF ≥50%, the Mareev scale score was 3.4 ± 0.6 points, corresponding to functional class I–II. Thus, a decrease in cardiac pump function was associated with an increase in the severity of the clinical condition by up to 3.2-fold.

According to the gender analysis, among patients with LVEF <40%, complications were recorded four times more frequently in men than in women; in the LVEF 40–49% group, the rate was 1.7 times higher in men, while in the LVEF ≥50% group, it was 1.5 times higher. This finding indicates that, in the setting of reduced cardiac pump function, hemodynamic and rhythm disturbances may develop more frequently in men.

The findings of the study indicate the need to develop a point-based clinical risk stratification model for patients with SLE, incorporating comorbid conditions and aimed at individualizing preventive measures.

Based on the obtained data, the patients were divided into three main risk groups, and a risk stratification model for chronic heart failure (CHF) was developed (Table 4).

Table 4.

Risk Stratification Model for Chronic Heart Failure

Risk group	LVEF	Charlson Index	Mareev Scale	Quality of life	Clinical characteristics of CHF
Low risk	≥50%	3–4 points	≤4 points	Moderate/ Good	Stable condition
Intermediate risk	40–49%	4–5 points	5–8 points	Low	Subcompensated state
High risk	<40%	≥6 points	≥9 points	Very low	Decompensated state (high risk of complications)

Point-Based Clinical Stratification Model for Chronic Heart Failure

The scientific novelty of the proposed model is based on the following concepts:

1. The comorbidity index is assessed.
2. The severity index of chronic heart failure (CHF) is determined.
3. The overall risk score is calculated.

Overall, the model incorporates an individualized risk stratification system based on the integrated assessment of comorbidities and functional status. This approach may help standardize clinical decision-making, improve prognostic assessment, and individualize treatment in patients with CHF. The comprehensive therapeutic approach demonstrated not only beneficial effects in controlling clinical symptoms but also a clinically meaningful contribution to the restoration and improvement of patients' quality of life and daily functioning.

Conclusions: Based on the results of the study entitled **"Assessment of the Pathogenetic and Prognostic Significance of Various Comorbid Conditions in the Development of Chronic Heart Failure"**, the following conclusions were drawn:

In patients with chronic heart failure (CHF), the disease was predominantly observed in the 60–74-year age group (43.0–8.0%). Cardiovascular comorbidities were present in 100% of patients, while overweight and obesity were recorded in 83.3–85.0% and type 2 diabetes mellitus in 39.5–52.3% of cases, confirming a high burden of comorbid conditions in CHF. Iron-deficiency anemia was 2.04 times more frequent in women than in men, while atrial fibrillation was 3.5 times more frequent, demonstrating the clinical significance of gender differences. Physical inactivity was observed in 53.2% of patients, smoking in 28.1%, and alcohol consumption in 13.8%. The atherogenic index was 1.16 times higher in men, demonstrating the important role of modifiable risk factors. ECG findings of left ventricular hypertrophy in 40.4% and left bundle branch block in 21.7% of patients confirmed structural and functional abnormalities associated with CHF.

Patients with preserved LVEF (≥50%) had quality-of-life scores 3–3.5 times higher than those in the LVEF <40% group, while the clinical condition assessment score according to the Mareev scale was 3.2 times lower. Cardiovascular complications were recorded in 12.8% of patients and were 2.1 times more frequent in men than in women, while mortality was two times higher in men, confirming the presence of sex-related differences. A decrease in cardiac pump function was associated with a 1.5–4-fold increase in the risk of complications, a marked deterioration in quality of life, and an increased incidence of decompensation. These findings support the combined assessment of LVEF, the SF-36 questionnaire, and the Mareev scale as important diagnostic and prognostic criteria for early risk stratification in CHF.

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