

## Clinical And Prognostic Significance of Atherosclerosis in Patients with Chronic Heart Failure

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### Abstract

Chronic heart failure is one of the most important clinical problems in modern cardiology and internal medicine. It is associated with high morbidity, frequent hospitalization, reduced quality of life and increased mortality. Atherosclerosis is one of the main pathogenetic bases of cardiovascular diseases and contributes to the development of coronary artery disease, myocardial ischemia, myocardial infarction and progressive cardiac remodeling. In patients with chronic heart failure, the presence of atherosclerosis significantly worsens the clinical course of the disease, reduces myocardial perfusion, aggravates left ventricular dysfunction and increases the risk of adverse cardiovascular outcomes. The aim of this study was to evaluate the clinical and prognostic significance of atherosclerosis in patients with chronic heart failure. The study included 128 patients with chronic heart failure of functional classes II–IV. Clinical symptoms, lipid profile, C-reactive protein, glucose, creatinine, estimated glomerular filtration rate, electrocardiography and echocardiography were analyzed. The results showed that patients with atherosclerosis had more severe heart failure, lower left ventricular ejection fraction, more frequent diastolic dysfunction, arterial hypertension, atherogenic dyslipidemia and repeated hospitalization. These findings indicate that atherosclerosis should be considered an important clinical and prognostic factor in patients with chronic heart failure.

**Keywords:** *chronic heart failure, atherosclerosis, dyslipidemia, cardiovascular risk, left ventricular remodeling, inflammation, prognosis.*

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### Introduction

Chronic heart failure is a complex clinical syndrome caused by structural or functional abnormalities of the heart that impair its ability to provide adequate blood supply to tissues and organs. It is characterized by dyspnea, reduced exercise tolerance, peripheral edema, fatigue, palpitations and deterioration of quality of life. Chronic heart failure often develops as a consequence of ischemic heart disease, arterial hypertension, post-infarction cardiosclerosis, diabetes mellitus, obesity and renal dysfunction.

Atherosclerosis is one of the main pathogenetic mechanisms underlying cardiovascular diseases. It is characterized by lipid accumulation in the arterial wall, chronic inflammation, endothelial dysfunction, formation of fibrous plaques and narrowing of the vascular lumen. When atherosclerosis affects the coronary arteries, it leads to

myocardial ischemia, angina pectoris, myocardial infarction and, ultimately, chronic heart failure.

Chronic heart failure and atherosclerosis are closely interrelated pathological conditions. On the one hand, atherosclerosis impairs myocardial blood supply and promotes ischemic myocardial injury and remodeling. On the other hand, chronic heart failure is associated with hemodynamic disturbances, neurohormonal activation, systemic inflammation and oxidative stress, which may accelerate atherosclerotic progression.

In patients with chronic heart failure, atherosclerosis is often associated with a more severe clinical course. Such patients may have lower left ventricular ejection fraction, more frequent diastolic dysfunction, arrhythmias, arterial hypertension, renal dysfunction and recurrent decompensation. Therefore, early detection of atherosclerosis and assessment of cardiovascular risk in patients with chronic heart failure are of great clinical importance.

The development of atherosclerosis is influenced by several risk factors, including dyslipidemia, arterial hypertension, diabetes mellitus, smoking, obesity, sedentary lifestyle, advanced age and hereditary predisposition. Elevated low-density lipoprotein cholesterol, decreased high-density lipoprotein cholesterol and increased triglycerides accelerate the formation of atherosclerotic plaques. Increased inflammatory markers, such as C-reactive protein, may reflect plaque instability and increased risk of cardiovascular events.

Thus, studying the clinical and prognostic significance of atherosclerosis in patients with chronic heart failure is important for improving risk stratification, optimizing treatment strategies and preventing adverse cardiovascular outcomes.

### **Purpose of the Study**

The aim of this study was to evaluate the clinical and prognostic significance of atherosclerosis in patients with chronic heart failure and to determine its relationship with heart failure severity, lipid profile, inflammatory markers, left ventricular function and frequency of rehospitalization.

### **Materials and Methods**

The study included 128 patients diagnosed with chronic heart failure. The diagnosis of chronic heart failure was confirmed on the basis of clinical symptoms, medical history, physical examination, electrocardiography, echocardiography and laboratory findings. The age of the patients ranged from 46 to 84 years, with a mean age of  $64.8 \pm 7.6$  years. Among them, 72 were men and 56 were women. The duration of chronic heart failure ranged from 1 to 15 years.

Patients were classified according to the New York Heart Association functional classification. Functional class II was identified in 39 patients, functional class III in 63 patients and functional class IV in 26 patients. The main causes of chronic heart failure were ischemic heart disease, arterial hypertension, post-infarction cardiosclerosis, dilated cardiomyopathy and valvular heart disease.

The presence of atherosclerosis was assessed on the basis of medical history, clinical manifestations, electrocardiographic changes, lipid profile, signs of coronary heart disease, peripheral arterial disease, carotid artery ultrasound findings or previously performed instrumental investigations.

During clinical examination, dyspnea, exercise tolerance, chest pain, palpitations, peripheral edema, nocturnal dyspnea, arterial blood pressure, heart rate, body weight and body mass index were evaluated.

Laboratory examination included complete blood count, biochemical blood analysis, total cholesterol, low-density lipoprotein cholesterol, high-density lipoprotein cholesterol, triglycerides, glucose, creatinine, urea, estimated glomerular filtration rate and C-reactive protein.

Electrocardiography was used to assess signs of myocardial ischemia, rhythm disturbances, left ventricular hypertrophy and repolarization abnormalities. Echocardiography included evaluation of left ventricular ejection fraction, left ventricular dimensions, left atrial size, left ventricular hypertrophy, diastolic function, valvular status and signs of elevated pulmonary artery pressure.

Patients were divided into two groups. The first group included patients with chronic heart failure and atherosclerosis. The second group included patients with chronic heart failure without clearly expressed clinical and instrumental signs of atherosclerosis. Clinical symptoms, laboratory parameters, echocardiographic indicators and frequency of rehospitalization were compared between the groups.

Statistical analysis included calculation of mean values, standard deviations, percentage indicators and correlation coefficients. Differences were considered statistically significant at  $p < 0.05$ .

## Results

The study results showed that atherosclerotic vascular damage was detected in a large proportion of patients with chronic heart failure. Patients with atherosclerosis had a more severe clinical course of heart failure and more frequent unfavorable prognostic factors.

In the group with atherosclerosis, the proportion of patients with NYHA functional classes III–IV was higher than in the group without clearly expressed atherosclerosis. These patients more frequently had dyspnea, reduced exercise tolerance, chest pain, palpitations and peripheral edema.

Analysis of lipid profile showed that patients with atherosclerosis had higher levels of total cholesterol and low-density lipoprotein cholesterol, while high-density lipoprotein cholesterol levels were lower. Increased triglycerides were also more common in this group. These findings indicate that atherogenic dyslipidemia is an important factor in the development of atherosclerosis in patients with chronic heart failure.

C-reactive protein levels were higher in patients with atherosclerosis. This suggests that chronic low-grade inflammation is associated with both atherosclerotic

progression and severity of heart failure. Inflammation may promote plaque instability, endothelial dysfunction and myocardial remodeling.

Electrocardiographic examination revealed that patients with atherosclerosis more frequently had ischemic ST-T changes, left ventricular hypertrophy and rhythm disturbances. Extrasystoles, sinus tachycardia and atrial fibrillation were observed in some patients.

Echocardiographic findings showed that left ventricular ejection fraction was lower in patients with atherosclerosis. Left ventricular hypertrophy, left atrial enlargement and diastolic dysfunction were more common in this group. These results confirm the close association between atherosclerosis and structural-functional changes of the myocardium.

Renal function parameters were also worse in patients with atherosclerosis. Serum creatinine was higher and estimated glomerular filtration rate was lower in this group, indicating a cardiorenal-metabolic association between atherosclerosis, chronic heart failure and renal dysfunction.

Correlation analysis showed a relationship between low-density lipoprotein cholesterol, functional class of heart failure, C-reactive protein and left ventricular ejection fraction. As low-density lipoprotein cholesterol and C-reactive protein increased, the clinical course became more severe and left ventricular function decreased.

During follow-up, rehospitalization due to chronic heart failure decompensation was more frequent in patients with atherosclerosis. The most unfavorable clinical course was observed in patients with the combined presence of atherogenic dyslipidemia, elevated C-reactive protein, reduced left ventricular ejection fraction and renal dysfunction.

### **Discussion**

The findings of this study demonstrate that atherosclerosis has significant clinical and prognostic importance in patients with chronic heart failure. Patients with atherosclerosis had more severe heart failure, worse left ventricular function, more frequent dyslipidemia, higher inflammatory activity and increased rehospitalization rates.

The relationship between atherosclerosis and chronic heart failure can be explained by several pathogenetic mechanisms. Atherosclerotic plaques narrow the lumen of coronary arteries and reduce oxygen and nutrient delivery to the myocardium. Chronic myocardial ischemia decreases contractile function, promotes fibrosis and remodeling, and contributes to the progression of heart failure.

Dyslipidemia is one of the key mechanisms of atherosclerosis. Low-density lipoprotein particles enter the arterial wall, undergo oxidation and activate inflammatory processes. Macrophages absorb oxidized lipids and transform into foam cells. This leads to the formation and progression of atherosclerotic plaques.

Chronic inflammation also plays an important role in both atherosclerosis and heart failure. Elevated C-reactive protein reflects systemic inflammatory activity and may be associated with endothelial dysfunction, plaque instability and increased cardiovascular event risk. In this study, patients with higher C-reactive protein had a more severe course of heart failure, supporting this mechanism.

Lower left ventricular ejection fraction in patients with atherosclerosis may be interpreted as a clinical manifestation of ischemic myocardial injury and remodeling. Left ventricular hypertrophy and diastolic dysfunction may be related to arterial hypertension, increased vascular stiffness and structural myocardial changes.

Atherosclerosis, chronic heart failure and renal dysfunction form a mutually aggravating pathological chain. Heart failure reduces renal perfusion, while renal dysfunction promotes fluid retention and neurohormonal activation. Atherosclerosis may further impair renal arteries and microcirculation, increasing cardiorenal risk.

In clinical practice, atherosclerosis should be actively evaluated in patients with chronic heart failure, not only when coronary symptoms are present but also in all patients with risk factors. Lipid profile, blood pressure, glucose metabolism, renal function, electrocardiography and echocardiography should be regularly assessed.

Treatment should be comprehensive. Along with standard heart failure therapy, it is necessary to reduce atherosclerotic risk factors, correct dyslipidemia, control blood pressure, treat diabetes mellitus, stop smoking, reduce body weight and increase physical activity.

The results indicate that atherosclerosis is not merely a comorbid condition in chronic heart failure, but an important determinant of disease prognosis. Therefore, patients with chronic heart failure and atherosclerosis should be considered a high cardiovascular risk group and should receive individualized monitoring and preventive care.

### **Conclusion**

Atherosclerosis is common in patients with chronic heart failure and is associated with a more severe clinical course and unfavorable prognosis. Patients with atherosclerosis more frequently have dyspnea, reduced exercise tolerance, chest pain, peripheral edema and episodes of decompensation.

Atherosclerosis in patients with chronic heart failure is associated with reduced left ventricular ejection fraction, diastolic dysfunction, left ventricular hypertrophy and electrocardiographic signs of myocardial ischemia. These findings indicate that atherosclerotic disease plays an important role in myocardial remodeling and deterioration of cardiac function.

Atherogenic dyslipidemia, elevated C-reactive protein, arterial hypertension and renal dysfunction are unfavorable prognostic factors in the comorbidity of atherosclerosis and chronic heart failure. Combined assessment of these indicators allows early identification of high-risk patients.

Early detection of atherosclerosis, regular monitoring of lipid profile and inflammatory markers, assessment of coronary and peripheral vascular damage, and development of individualized treatment and prevention strategies are necessary in patients with chronic heart failure.

Thus, atherosclerosis has important clinical and prognostic significance in patients with chronic heart failure and should be included in comprehensive cardiovascular risk assessment.

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