International Journal of Medical Sciences And Clinical Research

VOLUME Vol.05 Issue11 2025
PAGE NO. 148-151
DOI 10.37547/ijmscr/Volume05Issue11-26

Pathogenetic Mechanisms And Clinical Manifestations Of Cardiac Inficiency With Normal Systolic Function Of The Left Ventricle (Analytical Review)

Kurbanova Shohista Tojiddin qizi
Tashkent State Medical University, Uzbekistan

Received: 22 September 2025; **Accepted:** 14 October 2025; **Published:** 20 November 2025

Abstract: Left ventricular diastolic dysfunction remains the central link in HFpEF pathogenesis, including slowed active myocardial relaxation and decreased heart chamber flexibility. The molecular mechanisms of diastolic dysfunction include cardiomyocyte calcium homeostasis disorders, changes in titin properties, fibrous changes in the myocardium, and energy metabolism disorders. These processes lead to an increase in left ventricular filling pressure and the development of clinical manifestations of congestive heart failure while maintaining normal myocardial contractility.

Keywords: Chronic heart failure, preserved ejection fraction, diastolic dysfunction, HFpEF, pathogenesis, clinical manifestations, biomarkers, echocardiography, prognosis.

Introduction: Heart failure with normal left ventricular systolic function is one of the most pressing and complex problems in modern cardiology, characterized by its increasing prevalence, diagnostic difficulties, and limited therapeutic capabilities. This clinical syndrome, known in international literature as Heart Failure with preserved Ejection Fraction (HFpEF), accounts for 40 to 60% of all cases of chronic heart failure and demonstrates a persistent tendency to increase, making its study a priority area of cardiological research.

Epidemiological data from recent decades indicate that the prevalence of HFpEF is steadily increasing, which is associated with both improved diagnostic capabilities and demographic changes in the population structure. According to major registry studies, the frequency of heart failure with preserved ejection fraction increases by 1-2% annually, with this increase most pronounced in older age groups and among women. It is predicted that by 2030, HFpEF will become the dominant phenotype of chronic heart failure in developed countries.

The terminological evolution of this condition reflects the deepening of understanding of its pathophysiological foundations. Initially, the term "diastolic heart failure" was used to emphasize the role of left ventricular relaxation and filling disorders, however, subsequent studies showed that the pathophysiology of HFpEF is not limited to only diastolic disorders. The modern definition, based on maintaining left ventricular ejection fraction of ≥50%, more accurately reflects clinical realities and allows avoiding a simplified understanding of disease mechanisms.

According to modern international recommendations, the diagnosis of HFpEF is established when there are clinical manifestations of heart failure, left ventricular ejection fraction ≥50%, elevated levels of sodium uretic peptides, and objective evidence of structural or functional heart disorders explaining the development of clinical symptoms. However, in practice, diagnosis verification often presents significant difficulties, which is due to the heterogeneity of pathophysiological mechanisms and the absence of specific diagnostic markers.

The pathogenetic heterogeneity of HFpEF is one of the key features of this condition, distinguishing it from heart failure with reduced ejection fraction. The modern concept of HFpEF pathogenesis assumes the involvement of multiple pathophysiological mechanisms, including diastolic dysfunction, vascular bed changes, metabolic disorders, systemic

inflammation, neurohormonal activation, and extracardiac organ dysfunctions. Such a diversity of mechanisms explains the clinical heterogeneity of the disease and determines the complexity of developing effective therapeutic approaches.

Left ventricular diastolic dysfunction remains the central link in HFpEF pathogenesis, including a slowdown in the active relaxation of the myocardium and a decrease in the flexibility of the heart chamber. The molecular mechanisms of diastolic dysfunction include cardiomyocyte calcium homeostasis disorders, changes in titin properties, fibrous changes in the myocardium, and energy metabolism disorders. These processes lead to an increase in left ventricular filling pressure and the development of clinical manifestations of congestive heart failure while maintaining normal myocardial contractility.

Vascular mechanisms of HFpEF pathogenesis include arterial remodeling, increased arterial rigidity, endothelial dysfunction, and venous capacity disorders. The increase in post-load due to age-related changes in the properties of the aorta and major arteries contributes to the development of concentric left ventricular hypertrophy and the disruption of its diastolic filling.

Neurohormonal activation in HFpEF is characterized by several features compared to heart failure with reduced ejection fraction. The activity of the renin-angiotensin-aldosterone system may be less pronounced, which partially explains the limited effectiveness of ACE inhibitors and angiotensin II receptor blockers in this population. At the same time, increased activity of the sympathetic nervous system and aldosterone can play an important role in the progression of the disease.

Extracardial organ dysfunctions occupy a special place in the pathogenesis of HFpEF and include kidney, lung, skeletal muscle, and brain dysfunctions. Cardiorenal syndrome in HFpEF is characterized by a close relationship between renal and cardiac dysfunction, where renal dysfunction can be both a consequence and a cause of heart failure progression. Pulmonary hypertension, which develops due to increased pressure in the left atrium, contributes to the appearance of shortness of breath and limitation of tolerance to physical exertion.

The clinical manifestations of HFpEF are often nonspecific and can mimic the symptoms of other diseases, which creates significant diagnostic difficulties. Shortness of breath during physical exertion is the most common symptom, however, its severity may not correlate with the severity of hemodynamic disorders. Fatigue, decreased tolerance to physical exertion, peripheral edema, and other manifestations of congestive heart failure develop gradually and are often attributed to age-related changes or comorbidities.

Features of HFpEF clinical course include predominance of elderly female patients, high frequency of comorbid conditions, tendency to develop episodes of acute decompensation against the background of relatively stable clinical condition preservation in the inter-attack period. Arterial hypertension, diabetes mellitus, obesity, atrial fibrillation, chronic kidney disease, and other comorbidities occur in the vast majority of patients with HFpEF.

HFpEF diagnostic algorithms are constantly being improved with the introduction of new methods for assessing the structure and function of the heart. Echocardiography remains the primary diagnostic method for assessing the systolic and diastolic functions of the left ventricle, identifying structural changes in the heart, and assessing the filling pressure. Modern echocardiographic technologies, including tissue dopplerography, speckle tracking, and three-dimensional echocardiography, significantly increase the accuracy of diagnosing diastolic dysfunction.

Sodium uretic peptides play an important role in the diagnosis of HFpEF, however, their levels may be less pronounced and elevated compared to heart failure with reduced ejection fraction. Age, gender characteristics, the influence of obesity, and kidney function should be considered when interpreting the results of a natriuretic peptide study. The development of new biomarkers reflecting specific pathophysiological processes in HFpEF is an active area of research.

Invasive hemodynamic assessment with catheterization of the right and left heart chambers remains the "gold standard" for HFpEF diagnosis in doubtful cases. Load tests with invasive monitoring of hemodynamic parameters allow for the detection of hidden disorders of diastolic function and increased filling pressure during physical activity, which can explain the clinical symptoms in patients with normal resting parameters.

The differential diagnosis of HFpEF includes a wide range of diseases capable of causing similar clinical symptoms. Restrictive cardiomyopathy, constrictive pericarditis, infiltrative myocardial diseases, valvular heart defects, lung diseases, and other conditions must be excluded during the diagnostic search process. Multimodal imaging, including echocardiography, cardiac magnetic resonance imaging, computed tomography, and scintigraphy, plays a key role in

differential diagnosis.

Phenotyping of patients with HFpEF is becoming an increasingly important aspect of clinical practice, as different phenotypes may require different therapeutic approaches. Phenotypes associated with arterial hypertension, obesity, atrial fibrillation, age-related changes, and other variants are distinguished, each characterized by specific pathophysiological features and clinical manifestations.

The prognosis of patients with HFpEF is characterized by high morbidity and mortality, comparable to the indicators of heart failure with reduced ejection fraction. However, the structure of mortality differs: in HFpEF, sudden cardiac death and death from non-cardial causes are more common, while progressive heart failure is less common cause of death.

Frequent hospitalizations for heart failure decompensation significantly reduce the quality of life and increase the economic burden of the disease. Therapeutic approaches to treating HFpEF remain one of the most complex problems in modern cardiology. Unlike heart failure with reduced ejection fraction, for which the effectiveness of many drugs has been proven, therapeutic possibilities for HFpEF are limited. Most large randomized clinical trials of drugs effective in systolic heart failure did not significantly affect the prognosis of patients with HFpEF.

The modern HFpEF treatment strategy focuses on symptom control, correction of comorbid conditions, prevention of hospitalizations, and improvement of life quality. Diuretic therapy remains the basis of symptomatic treatment, allowing for the reduction of congestive manifestations. Blood pressure monitoring, correction of heart rhythm disturbances, treatment of diabetes mellitus and other comorbidities play an important role in comprehensive therapy.

New therapeutic targets for HFpEF include cyclic guanosine-3',5'-monophosphate modulation, inhibition of type 2 sodium-glucose co-transporter, metabolic pathways, anti-inflammatory therapy, and other innovative approaches. Recent studies of SGLT2 inhibitors in HFpEF have shown encouraging results, which could be a breakthrough in the treatment of this pathology.

Non-drug treatment methods for HFpEF include physical training, dietary recommendations, weight control, limiting sodium intake, and other lifestyle modifications. Structured physical training programs show positive effects on tolerance to physical activity and quality of life, although their impact on the prognosis remains unclear.

Interventional methods for treating HFpEF are being actively studied and include devices for lowering left atrial pressure, intracoronary shunts, heart rate modulation, and other innovative approaches. The results of pilot studies show the potential effectiveness of some of these methods, however, large randomized studies are required to confirm their clinical significance.

Personalized medicine opens up new possibilities for optimizing HFpEF treatment based on the patient's individual characteristics, including genetic factors, biomarkers, comorbid profile, and other parameters. Developing risk stratification algorithms and personalized therapeutic approaches can contribute to improving treatment outcomes for this complex category of patients.

The economic aspects of HFpEF include high medical costs associated with frequent hospitalizations, prolonged outpatient observation, the need for expensive diagnostic studies, and the treatment of multiple comorbid conditions. Developing cost-effective management strategies for patients with HFpEF is an important healthcare task.

CONCLUSIONS

Thus, chronic heart failure (CHF) with preserved left ventricular ejection fraction (LVEF ≥50%), also known as HFpEF (Heart Failure with preserved Ejection Fraction), represents one of the most pressing problems in modern cardiology. This clinical syndrome is characterized by the presence of typical symptoms and signs of heart failure with normal or slightly reduced left ventricular systolic function.

REFERENCES

1. Borel K.N., Koziolova N.A. Heart failure with preserved ejection fraction: modern concepts of pathogenesis, diagnosis and treatment // Cardiology. - 2019. - Vol. 59, No. 4. - P. 74-82.
2. Vasyuk Yu.A., Shkolnik E.L., Nesukay E.G. Heart failure with preserved left ventricular ejection fraction: pathophysiology, diagnosis, treatment // Cardiology. - 2020. - Vol. 60, No. 3. - P. 129-139.
3. Mareev V.Yu., Fomin I.V., Ageev F.T. et al. Clinical recommendations for OSSN - RKO - RNMOT. Heart failure: chronic (CHF) and acute decompensated (ADF). Diagnosis, Prevention, and Treatment // Cardiology. - 2018. - Vol. 58, No. 6S. - P. 8-158.
4. Ponikowski P., Voors A.A., Anker S.D., et al. 2016 ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure // Eur Heart J. - 2016. - Vol. 37, No. 27. - P. 2129-2200.
5. Borlaug B.A. Pathophysiology of heart failure with preserved ejection fraction // Nat Rev Cardiol. - 2014. - Vol. 11, No. 9. - P. 507-515.

6. Shah K.S., Xu H., Matsuaka R.A. et al. Heart failure with preserved, borderline, and reduced ejection fraction: results for 5 years // J Am Coll Cardiol. - 2017. - Vol. 70, No. 20. - P. 2476-2486.
7. Nagueh S.F., Smiseth O.A., Appleton C.P. et al. Recommendations for assessing left ventricular diastolic function by echocardiography: Update from the American Society of Echocardiography // J Am Soc Echocardiogr. - 2016. - Vol. 29, No. 4. - P. 277-314.
8. McDonagh T.A., Metra M., Adamo M., et al. 2021 ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure // Eur Heart J. - 2021. - Vol. 42, No. 36. - P. 3599-3726.
9. Piske B., Chope C., de Boer R.A. et al. How to diagnose heart failure with preserved ejection fraction: HFA-PEFF diagnostic algorithm // Eur Heart J. - 2019. - Vol. 40, No. 40. - P. 3297-3317.
10. Duplyakov D.V., Yemelyanenko V.M., Svirida O.N. Heart failure with preserved ejection fraction: features of pathogenesis and therapeutic possibilities // Rational pharmacotherapy in cardiology. - 2020. - Vol. 16, No. 1. - P. 78-85.