



# Heart failure: Clinical manifestations, Etiology, Risk factors, Diagnosis and Treatment in adults

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## Abstract

**Background:** Heart failure, a complex cardiac condition, arises when the heart's ability to pump blood diminishes, leading to insufficient oxygen and nutrients delivery to the body's organs and tissues. In this paper, we discussed about heart failure disease, its symptoms, etiology and risk factors, epidemiology, pathophysiology, diagnosis, and treatment.


**Methods:** I have to discuss about heart failure disease, its symptoms, etiology and risk factors, epidemiology, pathophysiology, diagnosis, and treatment.

**Results:** Heart failure, often a late-stage consequence of various processes, especially ischemic heart disease, carries a poor prognosis, with mortality rates similar to common cancers. Diagnosis relies on history and physical assessment, while imaging and lab findings assist in confirmation. The New York Heart Association classification may be employed.

**Conclusion:** Heart failure is a severe condition where the heart can't pump blood effectively due to causes like coronary artery disease or hypertension. Treatment includes lifestyle changes, meds, and surgery. Early diagnosis and treatment are essential for improving quality of life.

**Keywords:** Congestive heart failure, symptoms, etiology, risk factors, treatment

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## Introduction

Congestive heart failure (CHF) is the clinical syndrome resulting from the structural or functional inability of the heart to meet the body's basic metabolic needs at normal pressures. CHF can occur with the left or right ventricle, and frequently both [1] as shown in **Figure – 1**.

### Pathophysiology of Heart Failure

The heart may not provide tissues with adequate blood for metabolic needs, and cardiac-related elevation of pulmonary or systemic venous pressures may result in organ congestion. This condition can result from abnormalities of systolic or diastolic function or, commonly, both. Although a primary abnormality can be a change in cardiomyocyte function, there are also changes in collagen turnover of the extracellular matrix. Cardiac structural defects (eg, congenital defects, valvular disorders), rhythm abnormalities (including persistently high heart rate), and high metabolic demands (eg, due to thyrotoxicosis) also can cause HF. [2]

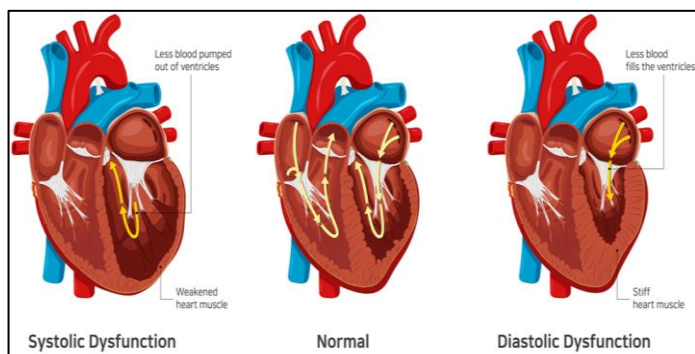
### Signs and Symptoms of Heart Failure

Manifestations of heart failure differ depending on the extent to which the LV and RV are initially affected. Clinical severity varies

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significantly and is usually classified according to the New York Heart Association (NYHA) system (see table NYHA Classification of Heart Failure); the examples of ordinary activity may be modified for older, debilitated patients. Because HF has such a broad range of severity, some experts suggest subdividing NYHA class III into IIIA or IIIB. Class IIIB is typically reserved for those patients who recently had a heart failure exacerbation. The American College of Cardiology/American Heart Association has advocated a staging system for HF (A, B, C, or D) to highlight the need for HF prevention.

**Figure-1 Overview of normal heart, systolic and diastolic heart failure [27]**



**A:** High risk of HF but no structural or functional cardiac abnormalities or symptoms; **B:** Structural or functional cardiac abnormalities but no symptoms of HF; **C:** Structural heart disease with symptoms of HF; **D:** Refractory HF requiring advanced therapies (eg, mechanical circulatory support, cardiac transplantation) or palliative care. Severe LV failure may cause pulmonary edema or cardiogenic shock. [2]

**Epidemiology of heart failure:** In the US, about 5.8 million people suffer from CHF. Acute decompensated CHF leads to about 1 million hospitalizations per year, and about 30% of patients discharged from the hospital with CHF will be readmitted within 90 days. Heart failure incidence increases with age. [3]

**Types of heart failure:** Several classification categories have been developed to classify heart failure. These include, acute vs. chronic, left vs. right sided, high output vs. low output, and systolic vs. diastolic heart failure.

**Acute and Chronic:** The sudden emergence of heart failure's symptoms is influenced by rapid onset, often caused by abrupt anatomical or functional heart damage, insufficient time for compensatory mechanisms. This results in severe congestion symptoms, primarily acute pulmonary edema, or hypoperfusion like cardiogenic shock. Unlike chronic HF, this form lacks global fluid retention, weight gain, and cardiomegaly, which typically characterize it. Chronic heart failure is the predominant type with intermittent acute decompensations, as discussed in this work, unless stated otherwise.

**Left and Right Heart Failure:** This describes clinical presentations primarily caused by pulmonary venous congestion in left heart failure or systemic congestion in right heart failure. Left heart failure leads to progressive dyspnea, orthopnea, cough when lying down, and paroxysmal nocturnal dyspnea, while right heart failure is marked by jugular venous distension, hepatomegaly, ascites, and edema.

**Systolic and Diastolic Heart Failure** Classic heart failure is often characterized by left ventricle (LV) systolic dysfunction, seen as LV dilation and reduced ejection fraction, primarily affecting middle-aged or older men with ischemic heart disease. Yet, typical heart failure symptoms with preserved LV systolic function are equally common, especially in elderly individuals, primarily women, with a history of hypertension. These patients typically exhibit LV filling abnormalities, often with myocardial hypertrophy but no cavity dilation. [4]

### Risk Factors

**Age:** The incidence of heart failure and left-ventricular dysfunction increases with age. [5] **Race:** CHF occurs more frequently in Black Americans than in white Americans. This is thought to be due to socioeconomic factors as well as higher prevalence of resistant hypertension and type 2 diabetes. [6] **History of coronary artery disease:** Left ventricular dysfunction often results from ischemic injury to the myocardium. **History of cardiomyopathy:** Family or personal history of dilated, hypertrophic, or restrictive cardiomyopathy. **Diabetes:** Diabetes accelerates the progression of coronary artery disease as well as left ventricular remodeling, both of which contribute to systolic as well as diastolic dysfunction. **Smoking:** Smoking dramatically raises risk for atherosclerotic cardiovascular disease and thus heart failure.

**History of rheumatic fever or valvular heart disease:** **Hypertension:** Pulmonary hypertension generally leads to right-sided heart failure, whereas systemic hypertension leads to left-sided heart failure. **Alcohol abuse:** Alcohol may lead to dilated cardiomyopathy.

**Pericardial disease:** **Obesity:** Hypertension, type 2 diabetes, and left ventricular hypertrophy are commonly found in patients with a body mass index (BMI) > 30 kg/m<sup>2</sup>. Heart failure incidence increases by 5% for men and 7% for women for every 1-point increase in BMI above 25 kg/m<sup>2</sup>. [7] Surprisingly, however, BMI appears to have an inverse association with CHF-related mortality in most studies. In a study of more than 7,500 individuals, a linear increase in CHF mortality has been found to occur with a BMI below 30 kg/m<sup>2</sup>. Persons with heart failure and a BMI of 25 to 29.9, 22.5 to 24.9, and < 22.5 had a mortality risk approximately 120%, 145%, and 170% greater than those with a BMI > 30 kg/m<sup>2</sup>. [8]

**Obstructive sleep apnea:** Untreated obstructive sleep apnea results

in frequent nighttime apneic episodes, leading to deoxygenation. Over time, it causes irreversible pulmonary disease and both right- and left-sided systolic failure, considered one of the least reversible causes of congestive heart failure (CHF). [9]

**Diagnosis:**

Diagnosis is based on history and physical examination. Imaging and lab results are used to support the diagnosis. The New York Heart Association classification system describes the functional limitations of heart failure:

**Class I:** Symptoms (e.g., fatigue, dyspnea, palpitations) are experienced on heavy exertion.

**Class II:** Symptoms occur with mild to moderate levels of exertion.

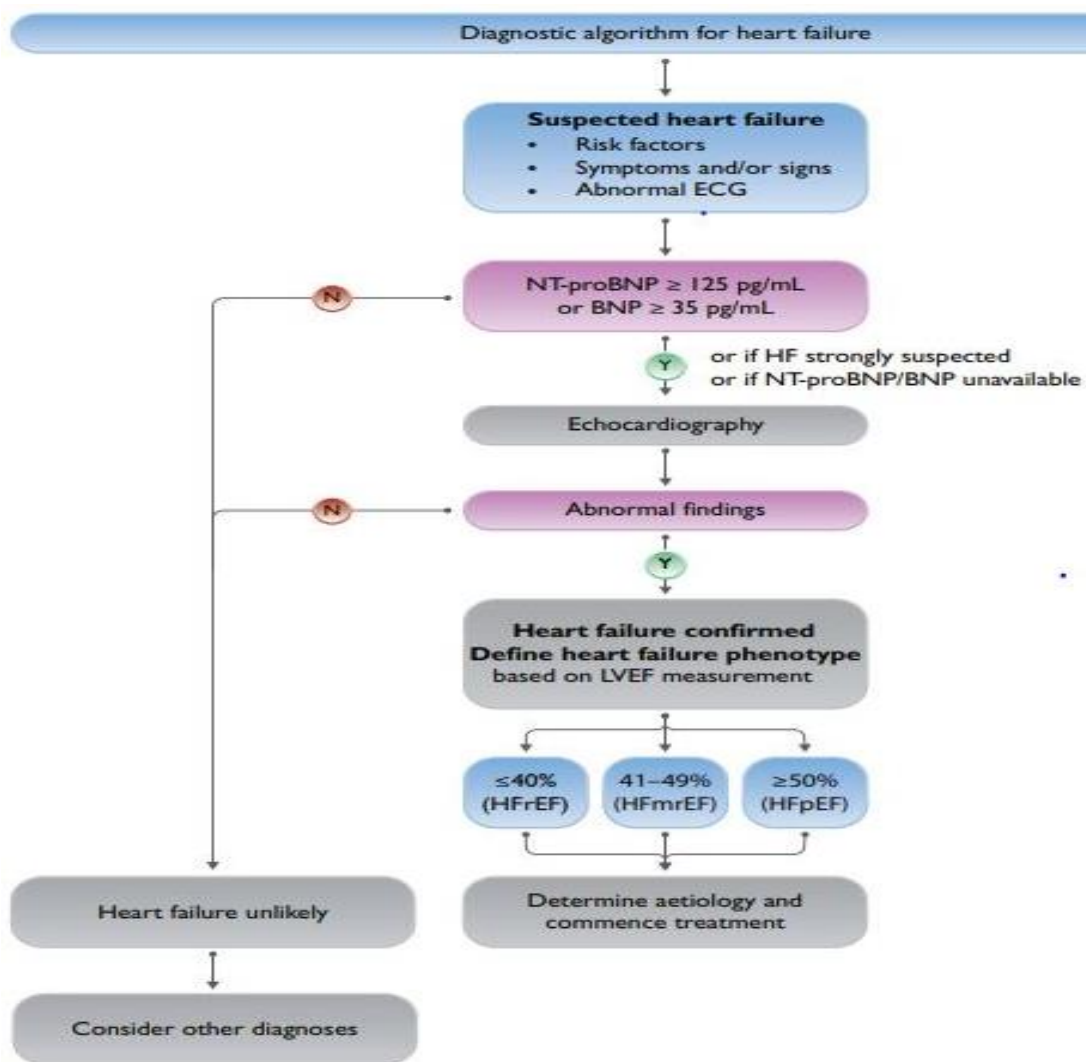
**Class III:** Symptoms occur with less than ordinary exertion.

**Class IV:** Symptoms occur with any exertion or at rest. [9]

**Diagnostic Tools 2D and Doppler echocardiogram:**

The 2D and Doppler echocardiogram serves as a prevalent method

**Figure -2** Flowchart Showed the diagnostic algorithm for heart failure [2]



to assess cardiac function, encompassing ventricular performance, valvular function, chamber size, and heart failure causes like MI, valvular disease, and cardiomyopathies.

**Chest x-ray:** It can identify intrinsic pulmonary disease, pulmonary edema, and pleural effusions. It can also estimate the degree of cardiac enlargement but is much less accurate than echocardiography.

**Electrocardiogram:** It may reveal MI, dysrhythmias, conduction abnormalities, or left ventricular hypertrophy. Measurement of circulating concentrations of brain natriuretic peptide (BNP), which is produced by the heart, is increasingly used to diagnose and assess the degree of heart failure and monitor treatment effects.

**Blood tests:** Standard tests, like a complete blood count and comprehensive metabolic panel, are common. Additional tests are ordered when clinically necessary to identify the cause. HF with no known origin often necessitates evaluation for coronary heart disease through methods like exercise stress testing, noninvasive imaging, or cardiac catheterization. [10]

BNP = B-type natriuretic peptide; ECG = electrocardiogram; HFmrEF = heart failure with mildly reduced ejection fraction; HFpEF = heart failure with preserved ejection fraction; HFrEF = heart failure with reduced ejection fraction; LVEF = left ventricular ejection fraction; NT-proBNP = N-terminal pro-B type natriuretic peptide. The abnormal echocardiographic findings are described in more detail in the respective sections on HFrEF, HFmrEF, and HFpEF shown in **Figure – 2**.

### Treatment of heart failure:

Treatment of chronic HF should target the underlying disorder: hypertension, coronary artery disease, diabetes. Certain medications (e.g., Calcium channel blockers, NSAIDs, metformin, thiazolidinediones) may worsen heart failure. Heart failure with preserved ejection fraction is more difficult to treat. Treatment strategies overlap with systolic failure in some cases (i.e., treatment of hypertension, diuretic use for pulmonary symptoms, rate control in atrial fibrillation, and treatment of ischemic CHD), but additional treatment strategies are still being researched. [11, 12]

**Loop diuretics** (e.g., furosemide, torsemide, bumetanide) serve as key components in treating symptomatic heart failure, regardless of ejection fraction status. While they don't lower mortality rates, they effectively manage volume overload, reduce hospitalization needs, and enhance quality of life. However, it's essential to recognize that patients may develop tolerance, necessitating dose adjustments. Consequently, adopting dietary restrictions and lifestyle modifications is crucial to prevent excessive reliance on these medications. [13]

**Angiotensin-converting enzyme inhibitors (ACEIs):** such as enalapril and lisinopril, are the preferred initial treatments for heart failure. They lower mortality in those with reduced ejection fraction by reducing blood pressure and inhibiting the renin-angiotensin axis, thereby averting cardiac remodeling and worsening heart function. [13]

**Beta-blockers:** like carvedilol, metoprolol succinate, and bisoprolol, are also first-line treatments for all heart failure categories, not limited to patients with coronary artery disease or hypertension. They have demonstrated efficacy in decreasing heart failure mortality. [14]

**Angiotensin II receptor blockers (ARBs):** including losartan, candesartan, and irbesartan, are generally comparable to ACEIs and are often used if cough-related side effects limit ACEI use. Combining an ACEI and an ARB is discouraged, as it can lead to renal impairment and potentially hazardous electrolyte imbalances. For individuals identifying as Black with class III or IV heart failure (according to the New York Heart Association), there's evidence suggesting a positive response to hydralazine and isosorbide dinitrate when initial therapy proves ineffective. [15]

**Aldosterone blockers:** such as spironolactone and eplerenone, have demonstrated the ability to reduce heart failure mortality when included in standard treatment. However, patients need careful monitoring for hyperkalemia and impaired renal function. [14]

**Anticoagulants:** like warfarin, aspirin, and clopidogrel are generally not recommended in reduced ejection fraction cases unless there's a specific indication, such as concurrent atrial fibrillation or left ventricular thrombus. Clinical trials indicate that while anticoagulation decreases thrombotic events, it's outweighed by an increased risk of significant bleeding in cases of coronary artery disease alongside left ventricular dysfunction, adhere to coronary artery disease guidelines concerning anticoagulation. [16]

**Digoxin:** an oral inotropic agent, offers symptomatic relief but no improvement in overall mortality for decompensated heart failure patients. A narrow therapeutic range necessitates careful dosing, as high serum digoxin levels can elevate mortality and trigger various arrhythmias. It may benefit patients with persistent symptoms despite optimal treatment with diuretics, ACEIs or ARBs, and beta-blockers, particularly if atrial fibrillation is present. However, digoxin is ineffective for diastolic dysfunction and requires dosage adjustments for older patients, those with renal dysfunction, and those using medications affecting digoxin levels. [17]

**Calcium channel blockers:** like verapamil and amlodipine, are



contraindicated for patients with substantial ventricular impairment.

[18] **Statins:** regarding statins, there is currently no evidence demonstrating a reduction in mortality or symptomatic improvement when prescribed exclusively for heart failure treatment. [18] **Surgical**

**treatment of heart failure:** The utilization of implantable cardioverter-defibrillators (ICDs) in surgical procedures has demonstrated a reduction in mortality attributed to life-threatening dysrhythmias among high-risk patients, especially those who possess documented dysrhythmias and/or exhibit severe systolic dysfunction, usually characterized by an ejection fraction below the range of 30-35%. [19] **Cardiac transplant:** In cases of end-stage heart failure, cardiac transplantation may become an imperative medical intervention. For severely debilitated patients, left ventricular assist devices are employed as a transitional measure in the journey towards cardiac transplantation. [19] **Cardiac rehabilitation:** It should be approved by a physician and overseen by an exercise physiologist. Exercise and conditioning improve function, reduce hospitalization, and enhance life quality but lack evidence for mortality reduction. Rest leg elevation is advised, and compression stockings aid edema control and fluid removal, with variable outcomes requiring individualized therapeutic assessment in heart failure patients. [19]

**Nutritional Considerations:** Previously, HF prevention and treatment centered on restricting sodium intake to prevent fluid overload. While sodium control remains crucial, macronutrient nutrition now appears more pivotal for prevention, with a newfound emphasis on avoiding foods rich in saturated fat. A heart-healthy diet rich in fruits, vegetables, and fish also plays a significant role. Certain dietary supplements, such as thiamine and coenzyme Q10, have demonstrated benefits. Increased red meat consumption, regardless of previous MI, raises heart failure risk, with a 25% increase in the highest intake group. [20] The Physicians Health Study discovered an escalating risk of heart failure among those who consumed fried foods. Those who ate them daily faced a twofold higher risk than those who had them less than weekly. [21] Meat, eggs, and fried foods, sources of advanced glycation end products, are linked to HF severity and predict cardiac events in these patients independently. [22] Healthful dietary patterns, encompassing Mediterranean and DASH styles, as well as low-meat, high-unsaturated fat, and fish-rich diets, are linked to notable heart failure risk reduction. [23] In a study of 34,000 women, consuming five or more daily servings of fruits and vegetables was associated with a 20% reduced risk of heart failure. Vegetables provided more protection than fruits. [24] Limiting excessive sodium intake is vital for lowering heart failure risk. However, the extent of sodium restriction in confirmed CHF cases is contentious. Recent guidelines by the American College of Cardiology contentious. Recent guidelines by the American College of Cardiology Foundation and the American Heart Association have shifted sodium restriction from a class I (standard care) to class IIa (reasonable care). Furthermore, stringent low-salt diets (up to 1500 mg/day) are advised

for Stage A and B CHF patients exclusively. [25] The Heart Failure Society of America recommends a salt restriction to less than 2,000 mg/day for patients with moderate to severe CHF. [26] This level of intake reduces hospital readmissions for CHF, while higher intakes increase the need for urgent transplantation. [27]

The researcher believes that, however, heart failure is a progressive disease, but HF patients can prolong survival, improve cardiac function, relieve chronic symptoms, prevent recurring decompensation, and reduce hospital stays by following a low-sodium diet, fluid limits, eating healthy diet, using medications as the cardiologist prescribed, decrease stress and doing regular exercise. As well as family support is vital point for cardiac rehabilitation for HF patients.

## Conclusions

The conclusion of this article of heart failure disease [28, 29] are listed below: What are the symptoms and its effects are listed out in the following table.

	Systolic HF	Diastolic HF
<b>Symptoms</b>	Shortness of breath, fatigue, cough, swollen ankles/feet, weight gain, decreased exercise tolerance	Shortness of breath, fatigue, cough, swollen ankles/feet, weight gain, decreased exercise tolerance
<b>Etiology</b>	Decreased contractility of the left ventricle, causing decreased ejection fraction (EF)	Impaired relaxation or stiffness of the left ventricle, causing increased filling pressures and preserved EF
<b>Diagnosis</b>	Echocardiogram, chest X-ray, blood tests, electrocardiogram (ECG)	Echocardiogram, chest X-ray, blood tests, electrocardiogram (ECG)
<b>ECG findings</b>	Reduced voltage, ST-T wave changes, arrhythmias such as atrial fibrillation	Left atrial enlargement, LVH, abnormal relaxation patterns such as pseudonormalization or restrictive filling
<b>Treatment</b>	Medications (e.g., ACE inhibitors, beta blockers, diuretics), lifestyle modifications (e.g., salt restriction, weight loss, exercise), surgery (e.g., valve replacement)	Medications (e.g., ACE inhibitors, beta blockers, diuretics), lifestyle modifications (e.g., salt restriction, weight loss, exercise), surgery (e.g., valve replacement)
<b>Prognosis</b>	Typically associated with worse prognosis due to decreased ability to pump blood effectively, leading to more severe symptoms and a higher risk of complications. Can be improved with appropriate treatment.	Can also have significant prognosis, particularly in patients with underlying conditions such as hypertension, obesity, or diabetes. Can be improved with appropriate treatment.

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Here, **BOS** – Bayan Omar Sharif; **BMR** – Bashir Mohammed Rasul

**Conflict of Interest:** The authors didn't have any kind of conflict of interest in this study.

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