Diagnosis and management of heart failure

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**Abstract**

Heart failure is a condition in which the heart becomes weak and unable to pump blood properly to provide the body with enough oxygen. Common causes of heart failure include coronary artery disease (a previous myocardial infarction), high blood pressure, atrial fibrillation (irregular heart rhythm), and valvular heart disease. Left ventricular ejection fraction (LVEF) is an important basis for the diagnosis, treatment and prognosis of heart failure. The clinical distinctions are HFrEF, HFmrEF, and HFpEF (the cut-off points are ≤ 40%, 41-49%, ≥ 50%), although the cut-off points of these LVEFs are not consistent in different ages and medical societies, and the presence or absence of HFmrEF remains controversial; however, the normal value of LVEF is 52-72% (male) and 54-74% (female). Studies have shown that the mortality rate is the lowest when the LVEF is 60-65%, and both LVEF <60% and LVEF >65% were associated with increased mortality.

**Keywords**: heart failure; HFrEF(heart failure with reduced ejection fraction); HFmrEF; HFpEF(heart failure with preserved ejection fraction).

**Introduction**

Heart failure is a systemic disease, clinically characterized by cardiac hypertrophy, coronary heart disease, and ventricular enlargement; the main groups of heart failure are elderly, female, obese, obstructive sleep apnea, hypertension, and chronic kidney disease CKD, atrial fibrillation, concentric hypertrophy and decreased elasticity of the heart, decreased left ventricular volume LVEDV, increased pressure LVEDP, pulmonary hypertension, etc. [1]; the relationship between heart failure and prognosis is the J curve: the mortality rate is the lowest when the LVEF is 60-65% , increased mortality for both LVEF < 60% and LVEF > 65%. Heart failure does not reflect right heart failure: the majority is secondary to left heart failure and predicts a poor prognosis [2]. The prognosis of heart failure has nothing to do with clinical treatment. Although RCT studies have found that only SGLT2i and MRA are effective for HFpEF[2,3], in clinical practice, doctors will use SGLT2i, MRA, ACEI/ARB/ARNI, type B Sympathetic blockers, diuretics, etc., but the pathophysiology of heart failure is quite diverse (aging, cardiomyopathy, endothelial cell dysfunction, sympathetic nerve stimulation, stimulation of renin-corticosterone system, renal absorption of sodium and water increase) [3].

**Common clinical symptoms of heart failure**

Common clinical symptoms of heart failure include[4]: 1. Dyspnea: Dyspnea occurs immediately after physical activity, and in severe cases, even lying in bed or resting will also feel dyspnea. 2. Lower extremity edema: Typical edema is symmetrical and occurs in both calves or ankles. 3. Orthopnea: Severe heart failure patients will feel dyspnea when lying flat, which can be relieved by sitting up or raising the pillow. 4. Paroxysmal nocturnal dyspnea: The patient is easy to wake up from sleep, breathing hard and wheezing, which needs to be relieved by sitting up or opening the window to breathe fresh air. 5. Cough: A large amount of fluid accumulates in the lung branches and stimulates the mucous membrane. It may be a dry cough, or a large amount of frothy and bloodshot sputum may be coughed up. 6. Brain hypoxia: It may be due to the decrease of cardiac output, which causes insufficient blood flow in the brain, resulting in the inhibition of brain function (such as anxiety, restlessness, memory impairment, nightmares, insomnia or dizziness and other symptoms). 7. Hepatomegaly: Symptoms of right upper quadrant pain are easy to appear. 8. Loss of appetite: Liver stagnation of blood and swelling of the liver caused by right heart failure, resulting in abdominal distension in the right upper abdomen, which affects appetite [4,-6].

**Epidemiology and clinical diagnosis of heart failure**

Heart failure can be divided into three types according to the left ventricular ejection fraction LVEF (Left ventricular ejection fraction)[7]:

1. LVEF≤40%: Heart failure with low systolic fraction HFrEF (Heart failure with reduced ejection fraction) often occurs after coronary artery disease and extensive myocardial damage. In terms of overall treatment, treatment suggestions are mainly given for patients with decreased systolic fraction.

2. LVEF ≥ 50%: This is normal systolic fraction. Heart failure HFpEF (Heart failure with preserved ejection fraction) usually progresses slowly and is related to age and metabolic diseases. 3. LVEF is between 41-49%: common clinical symptoms of heart failure include dyspnea, orthopnea, paroxysmal nocturnal dyspnea, nocturnal cough, reduced cardiopulmonary activity, brain hypoxia, decreased urine and lower extremity edema wait [8]. Heart failure has nothing to do with symptoms: severe symptoms can occur regardless of LVEF. Although patients with HFrEF and HFmrEF can predict the improvement of symptoms by the increase of LVEF, patients with HFpEF cannot predict the improvement of symptoms by the decrease of LVEF [9]. The new definition in 2020 is symptoms/symptoms caused by cardiac structural/functional abnormalities (CXR, electrocardiogram, cardiac ultrasound) combined with increased BNP, systemic/pulmonary congestion (abandoning the Framingham diagnostic criteria)[ ]; according to this definition, severe CKD and Dyspnea caused by fluid overload in dialysis patients is not CHF (because the symptoms can be improved by large amounts of diuretics or dialysis). There are several disadvantages in using LVEF to distinguish heart failure; first, the normal value is unknown: although the normal value of LVEF is traditionally considered to be 52-72% (male), 54-74% (female)[10], secondly, different measurement methods (heart Ultrasound, single photon emission computed tomography (SPECT, MRI) results are not consistent: even the inter-measurement variability of the same method can cause differences in classification, and the results of ultrasound are also inconsistent between different examiners[11].

**Newest Clinical recommendations for heart failure**

In 2022, the treatment guidelines for the HFrEF population will be guided by drug therapy (guideline-directed medical therapy), and a total of 4 drugs are recommended for the treatment of heart failure[12]: SGLT2 inhibitor (originally used to treat diabetes), ACEI (Angiotensin converting enzyme inhibitor) /ARB (Angiotensin II receptor blocker)/ARNI (angiotensin receptor neprilysin inhibitor), beta-blocker, MRA (Mineralocorticoid receptor /aldosterone antagonist)[13]; generally clinically, angiotensin converting enzyme inhibitor/angiotensin will be given depending on the severity Receptor blockers are used to dilate peripheral arteries and veins to reduce vascular resistance, thereby reducing the load on the heart and reducing water retention [13]. Beta blockers: reduce cardiac work and ease the burden on the heart [14-16]. Diuretics: The function is to excrete excess water in the body to reduce the burden on the heart [17]. Foxglove: The function is to make the heart contract more powerfully, which can improve the patient's symptoms, but cannot prolong the survival. When combined with atrial fibrillation, it can slow down the heartbeat and reduce palpitations, but it may cause bradycardia[18-20]. For patients with heart failure, the first choice for the treatment of EF between 41-49% is diuretics, followed by SGLT2i (drugs for diabetes, which is also effective for heart failure), antihypertensive drugs: ACEi, ARB and AENI, MRA, type B Sympathetic blockers, etc.[21,22].

**Conclusion**

Heart failure is due to abnormal systolic or diastolic function of the heart, and the heart cannot output enough blood to meet the metabolic needs of various organs in the body. With the development of the disease, patients are often hospitalized due to the deterioration of symptoms, which affects the quality of life; therefore, slowing the deterioration of the disease, reducing mortality, and improving disease-related symptoms are the main goals of the treatment of heart failure [1,22]; according to the statistics data of the National Health Insurance, about 22,000 people in Taiwan are hospitalized every year due to severe heart failure. Without stable and regular treatment or changes in lifestyle, the rate of rehospitalization within 3 months is as high as 30%, and the mortality rate within 5 years is close to 50%, which is higher than the mortality rate of many cancers.

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