Congestive Heart Failure

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ABSRACT:
Heart failure is a complex clinical syndrome in which the heart cannot pump enough blood to meet the body's requirements. It results from any disorder that impairs ventricular filling or ejection of blood to the systemic circulation. Patients usually present with fatigue and dyspnea, reduced exercise tolerance, and fluid retention (pulmonary and peripheral edema). This activity reviews the evaluation and management of congestive heart failure and highlights the role of the healthcare team in improving care for patients with this condition.

KEYWORDS: Etiology, epidemiology, pathophysiology, signs & symptoms, risk factors, Diagnosis, treatment.

I. INTRODUCTION:

Heart failure is a complex clinical syndrome that results from a functional or structural heart disorder impairing ventricular filling or ejection of blood to the systemic circulation. It is by definition a failure to meet the systemic demands of circulation. Heart failure remains a highly prevalent disorder worldwide with a high morbidity and mortality rate. It has an estimated prevalence of 26 million people worldwide and contributes to increased healthcare costs worldwide. Multiple different diseases can cause heart failure. The etiology of heart failure varies the treatment plan to some degree; however, most of the treatment recommendations are based on the presence of heart failure alone, regardless of the cause[1].

Classification of heart failure is based on symptoms and calculated left ventricular ejection fraction (LVEF). Heart failure due to left ventricular dysfunction is categorized into heart failure with reduced ejection fraction (HFrEF), heart failure with preserved ejection fraction (HFpEF), and heart failure with mid-range ejection fraction (HFmrEF). The latter may consist of mixed left ventricular dysfunction (a combination of systolic and diastolic heart failure). The definition of HFrEF has varied among different studies and guidelines but is generally defined as an ejection fraction (EF) of less than 40%. Heart failure with preserved ejection fraction (HFpEF) is generally defined as heart failure with an EF of greater than 50%. HFmrEF is defined as heart failure with an EF of 40% to 50%.

Heart failure can severely decrease the functional capacity of a patient and increase mortality risk. It is imperative to diagnose and effectively treat the disease to prevent recurrent hospitalizations, improve quality of life, and enhance patient outcomes. The treatment of heart failure requires a multifaceted approach involving patient education, optimal medical regimen to improve cardiac contractility, and prevention/limitation of exacerbations. An interprofessional team approach is warranted to optimize patient care.[2]

ETIOLOGY:

Congestive heart failure is caused by structural abnormalities of the heart, functional abnormalities, and other triggering factors. Historically, an overwhelming majority of the cases were due to coronary artery disease and myocardial infarction. Over time, coronary artery disease and diabetes mellitus have become the predominant predisposing factors for heart failure. Other structural causes of congestive heart failure (CHF) include hypertension, valvular heart disease, uncontrolled arrhythmia, myocarditis, and congenital heart disease. Diastolic heart failure with impaired ventricular filling can be caused by restrictive cardiomyopathies and constrictive pericarditis, in addition to the etiologies identified above.[3]

It is important to identify etiologies of decompensated heart failure, as they contribute to

most of the morbidity and mortality associated with the disease. The most common cause of decompensated congestive heart failure is inappropriate drug treatment, dietary sodium restriction, and decreased physical activity. Uncontrolled hypertension is the second most common cause of decompensated heart failure Uncontrolled tachyarrhythmias in patients with underlying congestive heart failure can promptly lead to CHF exacerbations.

Another group of diseases associated with "congestive heart failure" leads to high-output cardiac failure. This, by definition, is not an impairment in cardiac function but a failure of the heart to meet the increased systemic demands due to extracardiac diseases. Common etiologies of this type of congestive heart failure include severe anemia, thyrotoxicosis, obesity, nutritional deficiencies (thiamine deficiency, etc.), and pregnancy.
The above-mentioned list of etiologies is not an all-inclusive list but a broad categorization of various etiologies.[4]

EPIDOMOLOGY:

Approximately 6.2 million people in the United States had clinically manifested heart failure from 2013 to 2016. By some reports, the incidence rate has plateaued; however, the prevalence increases as more patients receive therapy. This has not translated to improved quality of life or a decrease in the number of hospitalizations for patients with heart failure. According to the Global Health Data Exchange registry, the current worldwide prevalence of CHF is 64.34 million cases. This translates to 9.91 million years lost due to disability (YLDs) and 346.17 billion US dollars in healthcare expenditure. Age is a major determinant of HF. Regardless of the cause or the definition used to classify patients with heart failure (HF), the prevalence of HF increases steeply with age. The registry also notes a predilection for race with a 25% higher prevalence of HF in patients of African-American descent than Caucasians. According to the American Heart Association, heart failure is still the primary cause of hospitalization in the elderly population and accounts for 8.5% of cardiovascular-related deaths in the United States. The report states a higher incidence and prevalence of heart failure among African Americans, Hispanic Americans, Native Americans, and recent immigrants from developing nations. According to the Candesartan in Heart Failure Assessment of Reduction in Mortality and

Morbidity (CHARM program), the prevalence of HF is relatively greater in younger patients, which was attributed to obesity as the cause. The incidence of heart failure in men doubles with each 10-year age increase after the age of 65, whereas in women, for the same age cohort, the incidence triples.

International statistics regarding the epidemiology of HF are similar to those of the United States. The incidence increases dramatically with age, and metabolic risk factors along with a sedentary lifestyle are major risk factors. Ischemic cardiomyopathy, along with hypertension, is a major cause of HF in developing countries. The notable difference based on a review of small cohort studies from these nations is a higher prevalence of isolated right heart failure. The theoretical cause of this is thought to be due to the higher prevalence of tuberculous, pericardial disease, and lung disease. There is a lack of robust data to verify these claims.[5]

PATHOPHISIOLOGY:

Congestive heart failure (CHF) is a condition in which the heart is unable to pump enough blood to meet the needs of the body's tissues. CHF can have various causes, such as coronary artery disease, valve problems, congenital defects, or infections. CHF can affect the left ventricle, the right ventricle, or both[1].
The pathophysiology of CHF involves several mechanisms that try to compensate for the reduced cardiac output, but eventually lead to worsening of the condition. Some of these mechanisms are:

- Sympathetic nervous system activation: The body senses the low blood pressure and increases the heart rate and contractility to improve the stroke volume. However, this also increases the oxygen demand of the heart and can cause arrhythmias, ischemia, and hypertrophy[1].
- Renin-angiotensin-aldosterone system activation: The kidneys respond to the low blood flow by releasing renin, which converts angiotensinogen to angiotensin I. Angiotensin I is then converted to angiotensin II by angiotensin-converting enzyme (ACE). Angiotensin II causes vasoconstriction and stimulates the release of aldosterone from the adrenal glands. Aldosterone causes sodium and water retention, which increases the blood volume and pressure. However, this also increases the preload and afterload of the heart, which can worsen the heart failure[1].

- Ventricular remodeling: The chronic stress on the heart causes changes in the shape and size of the ventricles. The myocardial fibers become stretched, thin, and weak, resulting in dilation of the chambers. The ventricular walls also become thicker and stiffer, resulting in hypertrophy. These changes reduce the compliance and efficiency of the heart[1].

- Neurohormonal and cytokine activation: The heart failure triggers the release of various hormones and inflammatory mediators, such as norepinephrine, epinephrine, endothelin, nitric oxide, tumor necrosis factor-alpha, interleukins, and others. These substances have various effects on the cardiovascular system, such as vasoconstriction, vasodilation, inflammation, apoptosis, fibrosis, and oxidative stres.[6]
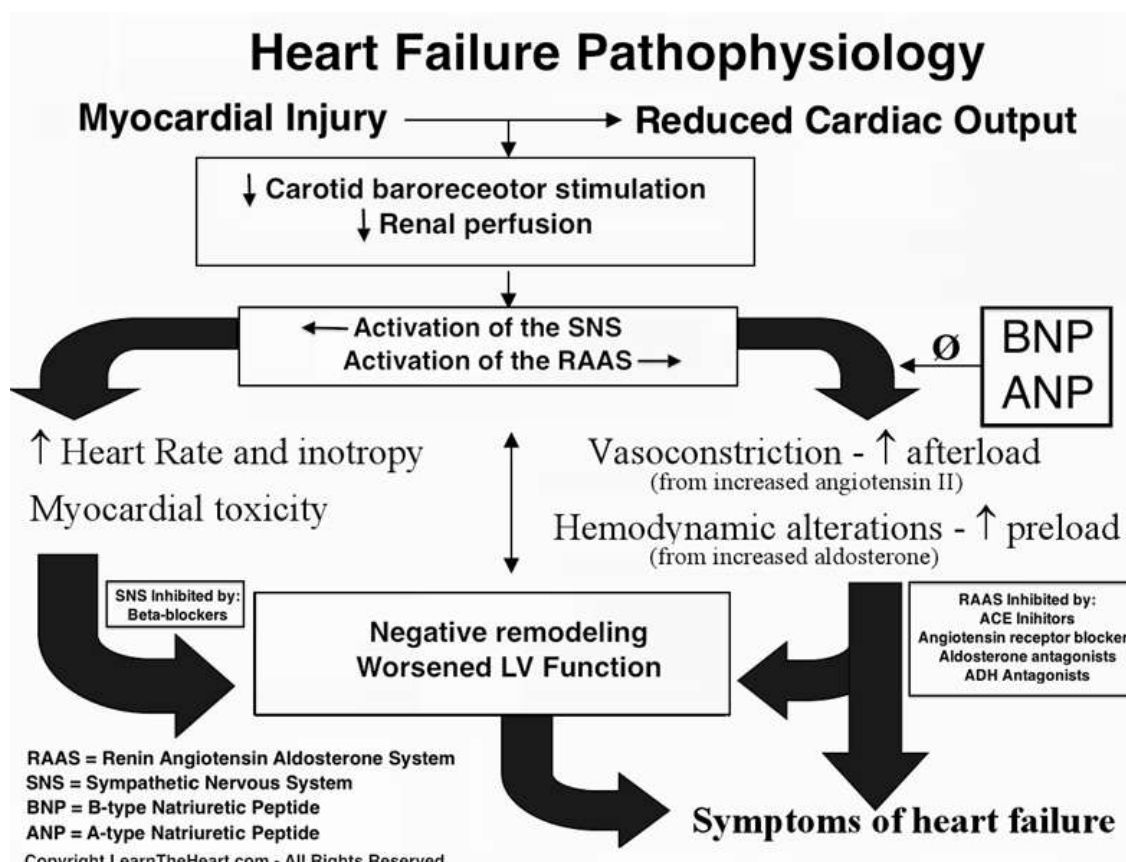
SIGNS AND SYMPTOMS OF CHF:
Congestive heart failure symptoms include:
- Shortness of breath.
- Waking up short of breath at night.
- Chest pain.
- Heart palpitations.
- Fatigue when you're active.
- Swelling in your ankles, legs and abdomen.
- Weight gain.
- Need to urinate while resting at night.
- A dry, hacking cough.
- A full (bloated) or hard stomach.
- Loss of appetite or upset stomach (nausea).

Sometimes, you may have mild symptoms of congestive heart failure or none at all. This doesn't mean you don't have heart failure anymore. Symptoms of heart failure can range from mild to severe and may come and go.
Unfortunately, congestive heart failure usually gets worse over time. As it worsens, you may have more or different signs or symptoms.[7]

RISK FACTORS OF CHF:
1. Diabetes
2. Obesity
3. High blood pressure
4. Heart attack
5. Coronary artery disease

6. Heart valve disease
7. Irregular heartbeats
8. Congenital heart disease
9. Sleep apnea
10. Viruses
11. Smoking
12. Alcohol abuse
13. Age
14. Gender
15. Genetics/family history
16. Ethnicity[8]

DIAGNOSIS:

The diagnosis and classification of heart failure are primarily based on the presence/severity of symptoms and physical exam findings. It is imperative to obtain a detailed history of symptoms, underlying medical conditions, and functional capacity/exercise tolerance to adequately treat the patient. The most commonly reported symptom is shortness of breath. Further qualification of this symptom is essential to help elucidate potential causes of heart failure and to determine the plan of care for the patient. Shortness of breath must further be classified to determine if it is related to exertion, positional changes (orthopnea), and whether it is acute or chronic. Other commonly reported symptoms of HF include chest pain, palpitations, anorexia, and fatigue. Some patients may present with a recumbent cough which may be due to orthopnea.

Physical examination of patients with heart failure requires a comprehensive assessment. The general appearance of patients with severe, chronic heart failure or those with acutely decompensated heart failure will include anxiety, diaphoresis, and poor nutritional status. The classical finding of pulmonary rales translates to heart failure of moderate to severe intensity. Wheezing may be present in acute decompensated heart failure. As the severity of pulmonary congestion increases, frothy and blood-tinged sputum may be seen. It is important to note that the absence of rales does not exclude pulmonary congestion. Jugular venous distention is another classical finding which must be assessed in all patients with HF. A paradoxical increase in jugular venous distention with respiration (Kussmaul sign) may be seen. In patients with elevated left-sided filling pressures, hepatojugular reflux (distention of the jugular vein after applying pressure over the liver with the patient lying at a 45° angle) will be seen. Peripheral edema is present in severe heart failure and will be seen if a substantial degree of volume overload is present.

Cardiac findings in patients with HF include S3 gallop, pulsus alternans, and accentuation of P2. An S3 gallop is the most significant and early finding associated with HF. In decompensated dilated cardiomyopathy, mitral and tricuspid regurgitation murmurs will be noted[9].

Framingham Diagnostic Criteria for Heart Failure :

The commonly used Framingham Diagnostic Criteria for Heart Failure requires the presence of 2 major criteria or 1 major and 2 minor criteria to make the diagnosis of heart failure. This diagnostic tool is highly sensitive for the diagnosis of heart failure but has a relatively low specificity. The Framingham Diagnostic criteria are as follows:.

Major Criteria
- Acute pulmonary edema
- Cardiomegaly
- Hepatojugular reflex
- Neck vein distention
- Paroxysmal nocturnal dyspnea or orthopnea
- Pulmonary rales
- Third heart sound (S3 Gallop)
- Weight loss of 4.5 kg or more in 5 days in response to treatment
- Central venous pressure greater than 16 cm of water
- Radiographic cardiomegaly

Minor Criteria
- Ankle edema
- Dyspnea on exertion
- Hepatomegaly
- Nocturnal cough
- Pleural effusion
- Tachycardia (heart rate greater than 120 beats per minute)
- A decrease in vital capacity by one third the maximal value recorded[10]

New York Heart Association Functional Classification :

Based on symptoms, the patients can be classified using the New York Heart Association (NYHA) functional classification as follows:
- Class I: Symptom onset with more than ordinary level of activity
- Class II: Symptom onset with an ordinary level of activity

- Class III: Symptom onset with minimal activity
- Class IIIa: No dyspnea at rest
- Class IIIb: Recent onset of dyspnea at rest
- Class IV: Symptoms at rest[11]

DIFFERENTIAL DIAGNOSIS:
Diseases that may present with clinical features of volume overload and/or dyspnea are in the differential for HF. These include:
- Acute renal failure
- Acute respiratory distress syndrome (ARDS)
- Cirrhosis
- Pulmonary fibrosis
- Nephrotic syndrome
- Pulmonary embolism (PE)[12]

STAGING:
ACC/AHA Heart Failure Stages :
- Stage A: Patients at high risk for HF but have no symptoms or structural heart disease
- Stage B: Patients have structural heart disease but are asymptomatic
- Stage C: Patients have structural heart disease plus symptoms
- Stage D: Patients have refractory HF that requires modified interventions

Management Recommendations by ACC/AHA According to HF Stages :
- Stage A: Reduction of risk factors and aggressive treatment of comorbidities
- Stage B: Aggressive risk factor reduction and treatment with an angiotensin-converting enzyme inhibitor/angiotensin-receptor blocker (ACEI/ARB) and/or beta-blocker.
- Stage C: Combination goal-directed therapy with ACEI/ARBs or angiotensin receptor–neprilysin inhibitors (ARNIs), beta-blockers, and loop diuretics for fluid retention. The most recent AHA/ACC update from 2017 added a class IIa recommendation for ivabradine in patients with stage C HF.
- Stage D: Goal-directed medical therapies indicated for stage C and consideration for heart transplantation. In patients with advanced disease and decreased life expectancy, palliative care discussions and advance directive planning should be considered. [13]

TREATMENT:
Treatment of heart failure may depend on the cause. Treatment often includes lifestyle changes and medicines. If another health condition is causing the heart to fail, treating it may reverse heart failure.

Some people with heart failure need surgery to open blocked arteries or to place a device to help the heart work better.

With treatment, symptoms of heart failure may improve.[14]

Medications:
A combination of medicines may be used to treat heart failure. The specific medicines used depend on the cause of heart failure and the symptoms. Medicines to treat heart failure include:

- **Angiotensin-converting enzyme (ACE) inhibitors:** These drugs relax blood vessels to lower blood pressure, improve blood flow and decrease the strain on the heart. Examples include enalapril (Vasotec, Epaned), lisinopril (Zestril, Qbrelis) and captopril.
- **Angiotensin II receptor blockers (ARBs):** These drugs have many of the same benefits as ACE inhibitors. They may be an option for people who can't tolerate ACE inhibitors. They include losartan (Cozaar), valsartan (Diovan) and candesartan (Atacand).
- **Angiotensin receptor plus neprilysin inhibitors (ARNIs):** This medicine uses two blood pressure drugs to treat heart failure. The combination medicine is sacubitril-valsartan (Entresto). It's used to treat some people with heart failure with reduced ejection fraction. It may help prevent the need for a hospital stay in those people.
- **Beta blockers:** These medicines slow the heart rate and lower blood pressure. They reduce the symptoms of heart failure and help the heart work better. If you have heart failure, beta blockers may help you live longer. Examples include carvedilol (Coreg), metoprolol (Lopressor, Toprol-XL, Kapspargo Sprinkle) and bisoprolol.
- **Diuretics:** Often called water pills, these medicines make you urinate more frequently. This helps prevent fluid buildup in your body. Diuretics, such as furosemide (Lasix, Furoscix), also decrease fluid in the lungs, so it's easier to breathe.

Some diuretics make the body lose potassium and magnesium. Your health care provider may recommend supplements to treat this. If you're taking a diuretic, you may have regular

blood tests to check your potassium and magnesium levels.

- **Potassium-sparing diuretics:**Also called aldosterone antagonists, these drugs include spironolactone (Aldactone, Carospir) and eplerenone (Inspra). They may help people with severe heart failure with reduced ejection fraction (HFrEF) live longer.

Unlike some other diuretics, these medicines can raise the level of potassium in the blood to dangerous levels. Talk to your health care provider about your diet and potassium intake.

- **Sodium-glucose cotransporter-2 (SGLT2) inhibitors:** These medicines help lower blood sugar. They are often prescribed with diet and exercise to treat type 2 diabetes. But they're also one of the first treatments for heart failure. That's because several studies showed that the medicine lowered the risk of hospital stays and death in people with certain types of heart failure — even if they didn't have diabetes. These medicines include canagliflozin (Invokana), dapagliflozin (Farxiga), and empagliflozin (Jardiance).
- **Digoxin (Lanoxin):**This drug, also called digitalis, helps the heart squeeze better to pump blood. It also tends to slow the heartbeat. Digoxin reduces heart failure symptoms in people with HFrEF. It may be more likely to be given to someone with a heart rhythm problem, such as atrial fibrillation.
- **Hydralazine and isosorbide dinitrate (BiDil):** This drug combination helps relax blood vessels. It may be added to your treatment plan if you have severe heart failure symptoms and ACE inhibitors or beta blockers haven't helped.
- **Vericiguat (Verquvo):** This medicine for chronic heart failure is taken once a day by mouth. It's a type of drug called an oral soluble guanylate cyclase (sGC) stimulator. In studies, people with high-risk heart failure who took this medicine had fewer hospital stays for heart failure and heart disease-related deaths compared with those who got a dummy pill.
- **Positive inotropes:**These medicines may be given by IV to people with certain types of severe heart failure who are in the hospital. Positive inotropes can help the heart pump blood better and maintain blood pressure. Long-term use of these medicines has been linked to an increased risk of death in some

people. Talk to your health care provider about the benefits and risks of these drugs.
- **Other medicines:** Your health care provider may prescribe other medicines to treat specific symptoms. For example, some people may receive nitrates for chest pain, statins to lower cholesterol or blood thinners to help prevent blood clots.[15]

Your health care provider may need to change your medicine doses frequently. This is more common when you've just started a new medicine or when your condition is getting worse.
You may be admitted to the hospital if you have a flare-up of heart failure symptoms. While in the hospital, you may receive:
- Medicines to relieve your symptoms.
- More medicines to help your heart pump better.
- Oxygen through a mask or small tubes placed in your nose.

If you have severe heart failure, you may need to use supplemental oxygen for a long time.
Surgery or other procedures
Surgery or other treatment to place a heart device may be recommended to treat the problem that led to heart failure.
Surgery or other procedures for heart failure may include:
- **Coronary bypass surgery:**You may need this surgery if severely blocked arteries are causing your heart failure. The surgery involves taking a healthy blood vessel from the leg, arm or chest and connecting it below and above the blocked arteries in the heart. The new pathway improves blood flow to the heart muscle.
- **Heart valve repair or replacement:**If a damaged heart valve causes heart failure, your provider may recommend repairing or replacing the valve. There are many different types of heart valve repair. The type needed depends on the cause of the heart valve problem.

Heart valve repair or replacement may be done as open-heart or minimally invasive surgery.
- **Implantable cardioverter-defibrillator (ICD):**An ICD is used to prevent complications of heart failure. It isn't a treatment for heart failure itself. An ICD is a device similar to a pacemaker. It's implanted under the skin in the chest with wires leading through the veins and into the heart.

The ICD monitors the heartbeat. If the heart starts beating at a dangerous rhythm, the ICD tries to correct the beat. If the heart stops, the device shocks it back into regular rhythm. An ICD can also work as a pacemaker and speed up a slow heartbeat.

- **Cardiac resynchronization therapy (CRT):** Also called biventricular pacing, CRT is a treatment for heart failure in people whose lower heart chambers aren't pumping in sync with each other. A device sends electrical signals to the lower heart chambers. The signals tell the chambers to squeeze in a more coordinated way. This improves the pumping of blood out of the heart. CRT may be used with an ICD.

- **Ventricular assist device (VAD):** A VAD helps pump blood from the lower chambers of the heart to the rest of the body. It's also called a mechanical circulatory support device. Although a VAD can be placed in one or both lower chambers of the heart, it's usually placed in the lower left one.

- Sometimes, a VAD is used as a permanent treatment for people who have heart failure but who aren't good candidates for a heart transplant.

- **Heart transplant:**Some people have such severe heart failure that surgery or medicines don't help. These people may need to have their hearts replaced with a healthy donor heart.

- A heart transplant isn't the right treatment for everyone. A team of health care providers at a transplant center helps determine whether the procedure may be safe and beneficial for you[16]

II. CONCLUSION:

CHF stands for congestive heart failure, a condition that occurs when the heart muscle is weakened and cannot pump enough blood to meet the body's needs. CHF can be caused by various factors, such as coronary artery disease, high blood pressure, diabetes, infections, etc. CHF can lead to complications such as kidney disease, liver damage, arrhythmias, etc. CHF can also affect the quality of life and increase the risk of death.

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