Heart Failure

- Heart failure describes the clinical syndrome that develops when the heart cannot maintain adequate output, or can do so only at the expense of elevated ventricular Filling pressure.
- The heart cannot meet the functional need of the body
- In mild to moderate forms of heart failure, symptoms occur only when the metabolic demand increases during exercise or some other form of stress.
- In severe heart failure, symptoms may be present at rest.
- In clinical practice, heart failure may be diagnosed when a patient with significant heart disease develops the signs or symptoms of a low cardiac output, pulmonary congestion or systemic venous congestion at rest or on exercise.
- It elicit a number of neural, hormonal& renal responses.

Epidemiology

- Heart failure predominantly affects the elderly; the prevalence rises from 1%in those aged50–59years to over10%in those aged 80–89years.
- In the UK ,most patients admitted to hospital with heart failure are more than70years old.
- Although the outlook depends, to some extent, on the underlying cause of the problem, untreated heart failure generally carries a poor prognosis; approximately50%of patients with severe heart failure due to left ventricular dysfunction will die within2years.
- An accurate diagnosis is important because treatment of the underlying cause may reverse heart failure or prevent its progression.

Incidence of Heart Failure and its Prognosis

- Heart failure is the leading cause of hospitalization of patients over 65 years in age.
- 15millionnew cases of Heart failure estimated each year worldwide.
- Rapidly increasing number because of the aging population.
- Despite many new advances in drug therapy and cardiac assist devices, the prognosis for chronic heart failure remains very poor.

Pathogenesis

Heart failure occurs when cardiac output fails to meet the demands of the circulation.

Cardiac output is determined by :

- preload (the volume and pressure of blood in the ventricles at the end of diastole),
- Afterload (the volume and pressure of blood in the ventricles during systole)
- Myocardial contractility.

Cause of heart failure

1. Coronary artery disease. Narrowed arteries may limit your heart's supply of oxygen-rich blood, resulting in weakened heart muscle.
2. Heart attack.
3. Heart valve disease.
4. High blood pressure.
5. Irregular heartbeats.
6. Congenital heart disease.
7. Diabetes.

Ventricular dysfunction

- Ventricular dysfunction is the most common cause of heart failure. This can occur because of impaired systolic contraction due to myocardial disease, or diastolic dysfunction where there is abnormal ventricular relaxation due to a stiff, non-compliant ventricle. This is most commonly found in patients with left ventricular hypertrophy.
- Systolic dysfunction and diastolic dysfunction often coexist, particularly in patients with coronary artery disease. Ventricular dysfunction reduces cardiac output, which, in turn, activates the sympathetic nervous system(SNS)and renin–angiotensin–aldosterone system(RAAS).
- Under normal circumstances ,activation of the SNS and RAAS supports cardiac function but, in the setting of impaired ventricular function, the consequences are negative and lead to an increase in both after load and preload (Fig.16.25). A vicious circle may then be established because any additional fall in cardiac output causes further activation of the SNS and RAAS, and an additional increase in peripheral vascular resistance.

High-output failure

- Sometimes cardiac failure can occur in patients without heart disease due to a large arteriovenous shunt, or where there is an excessively high cardiac output due to beri-beri, severe anemia or thyrotoxicosis.

Valvular disease

- Heart failure can also be caused by valvular disease in which there is impaired filling of the ventricles due to mitral or tricuspid stenosis; where there is obstruction to ventricular out flow, as occurs in aortic and tricuspid stenosis and hypertrophic cardiomyopathy; or as the result of ventricular overload secondary to valvular regurgitation.

- **Three types of heart failure are recognized.**

1-leftsidedheartfailure
2-rightsidedheartfailure
3-Biventricularheartfailure

Left heart failure

-This is characterized by a reduction in left ventricular output and an increase in left atrial and pulmonary venous pressure.
-If left heart failure occurs suddenly–for example, as the result of an acute MI–the rapid increase in left atrial pressure causes pulmonary oedema.

Right heart failure

-This is characterized by a reduction in right ventricular output and
An increase in right atrial and systemic venous pressure.
-The most common causes are chronic lung disease, Pulmonary embolism and pulmonary valvular stenosis.
-The term 'corpulmonale' is used to describe right heart failure
That is secondary to chronic lung disease.

Biventricular heart failure

-In bi ventricular failure, both sides of the heart are affected.
-This may occur because the disease process, such as dilated cardiomyopathy or ischemic heart disease ,affects both ventricles or because disease of the left heart leads to chronic elevation of the left atrial pressure, pulmonary hypertension and right heart failure.

The disease causes HF can classify into two main groups:
1. Cardiac(inherited heart disease)
2. Extra cardiac :
   - Pressure over load (hypertension)
   - Volume over load (hypervolemia due to water & sodium retention)

Acute left heart failure

- Acute left heart failure presents with a sudden onset of dyspnea at rest that rapidly progresses to acute respiratory distress, and orthopnea .
- Often there is a clear precipitating factor, such as an acute MI, which may be apparent from the history. The patient appears agitated, pale and clammy.
- The peripheries are cool to the touch and the pulse is rapid, but in some cases there may be an inappropriate bradycardia that may contribute to the acute episode of heart failure.
- The BP is usually high because of SNS activation, but may be normal or low if the patient is in cardiogenic shock.
- The jugular venous pressure (JVP) is usually elevated, particularly with associated fluid overload or right heart failure.
- In acute heart failure, there has been no time for ventricular dilatation and the apex is not displaced. A 'gallop' rhythm, with a third heart sound, is heard quite early in the development of acute left-sided heart failure.
- A new systolic murmur may signify acute mitral regurgitation or ventricular septal rupture.
- Chest examination may reveal crepitations at the lung bases if there is pulmonary oedema, or crepitations throughout the lungs if this is severe. There may be an expiratory wheeze.

Chronic heart failure

- Patients with chronic heart failure commonly follow a relapsing and remitting course, with periods of stability and episodes of decompensation, leading to worsening symptoms that may necessitate hospitalization.
- The clinical picture depends on: the nature of the underlying heart disease, the type of heart failure that it has evoked the changes in the SNS and RAAS that have developed
- Low cardiac output causes fatigue, restlessness and a poor effort tolerance; the peripheries are cold and the BP is low. To maintain perfusion of vital organs, blood flow is diverted away from skeletal muscle and this may contribute to fatigue and weakness.
- Poor renal perfusion leads to oliguria and uremia.
- Pulmonary oedema due to left heart failure presents with dyspnea and inspiratory crepitations over the lung bases.
- In contrast, right heart failure produces a high JVP with hepatic congestion and dependent peripheral oedema.

- Chronic heart failure is sometimes associated with marked weight loss (cardiac cachexia), caused by a combination of anorexia and impaired absorption due to gastrointestinal congestion, poor tissue perfusion due to a low cardiac output, and skeletal muscle atrophy due to immobility.

Investigations

Designed to discover the underlining ,severity and complications.

✓ ECG
- Determine the etiology(Ischemic Heart Disease, Valvular heart disease, Cardiomyopathy).
- Assess the severity(measuring the ejection fraction EF >55%)
- Follow up response to treatment.

✓ chest X-ray
✓ Urea, creatinine, electrolytes(Na , K, Mg)
✓ Hemoglobin , PCV.
✓ Thyroid function test.
✓ Brain natriuretic peptide (BNP) is elevated in heart failure and can be used as a screening test in breathless patients and those with edema

Management of acute heart failure

- Acute heart failure with pulmonary oedema is a medical emergency that should be treated urgently.
- The patient should initially be kept rested, with continuous monitoring of cardiac rhythm, BP and pulse oximetry.
- Intravenous opiates can be of value in distressed patients but must be used sparingly, as they may cause respiratory depression
- inotropic agents such as dobutamine (2.5–10 μg/kg/min) may be required to augment cardiac output, particularly in hypotensive patients.
- Insertion of an intra-aortic balloon pump may be beneficial in patients with acute cardiogenic pulmonary oedema and shock.

Management of chronic heart failure:

Education

Drug treatment

A wide variety of drug treatments are now available for the treatment of heart failure. Drugs that reduce preload are appropriate in patients with high end-diastolic filling pressures and evidence of pulmonary or systemic venous congestion, whereas those that reduce afterload or

increase myocardial contractility are more useful in patients with signs and symptoms of a low cardiac output.

1- Diuretics: promote urinary sodium and water excretion, leading to a reduction in blood plasma volume, which in turn reduces preload and improves pulmonary and systemic venous congestion. They may also reduce afterload and ventricular volume, leading to a fall in ventricular wall tension and increased cardiac efficiency. Although a fall in preload (ventricular filling pressure) normally reduces cardiac output.

2-Mineralocorticoid receptor antagonists, such as spironolactone is potassium-sparing diuretics (may cause Hyperkalemia).

3- Angiotensin-converting enzyme inhibitors (ACE-inhibitors)

4- Angiotensin receptor blockersARBs

5- Vasodilators

Venodilators, such as nitrates, reduce preload, and arterial dilators, such as hydralazine, reduce Afterload. Their use is limited by pharmacological tolerance and hypotension

6- Beta-adrenoceptor blockers:

Beta-blockade helps to counteract the deleterious effects of enhanced sympathetic stimulation and reduces the risk of arrhythmias and sudden death. When initiated in standard doses β- blockers may precipitate acute-on-chronic heart failure, but when given in small incremental doses they can increase ejection fraction, improve symptoms, reduce the frequency of hospitalization and reduce mortality in patients with chronic heart failure.

7- Digoxin

can be used to provide rate control in patients with heart failure and atrial fibrillation.

8- Amiodarone

This is a potent anti-arrhythmic drug that has little negative inotropic effect and may be valuable in patients with poor left ventricular function.

Non-pharmacological treatments

1- Implantable cardiac defibrillators

These devices are indicated in patients with symptomatic ventricular arrhythmias and heart failure

2- Resynchronization devices

In patients with marked intraventricular conduction delay, cardiac Resynchronization devices may be helpful. Here, both the LV and RV are paced simultaneously to generate a more coordinated left ventricular contraction and improve cardiac output. This is associated with improved symptoms and survival.

3- Coronary revascularization

Coronary artery bypass surgery or Percutaneous Coronary intervention.

4- Cardiac transplantation

Cardiac transplantation is an established and successful treatment for patients with intractable heart failure. Coronary artery disease and dilated cardiomyopathy are the most common indications.

5-Ventricular assist devices

Cardiac cachexia

- Chronic heart failure is sometimes associated with marked weight loss.
- Anorexia and impaired absorption due to gastrointestinal congestion
- Poor tissue perfusion due to a low cardiac output
- Skeletal muscle atrophy due to immobility

complications of Heart failure

1. Renal failure.
2. Hypokalaemia.
3. Hyperkalaemia.
4. Hyponatraemia- It is a poor prognostic sign.
5. Impaired liver function.
6. Thromboembolism (DVT)
7. Atrial and ventricular arrhythmias, electrolyte changes (e.g. Hypokalaemia, hypomagnesaemia), underlying structural heart disease, pro-arrhythmic effects of increased circulating catecholamines , drugs (e.g. Digoxin)