UNIT 9

HEART FAILURE

Heart failure

- **CHF is defined** as the pathophysiologic state in which the heart is unable to pump blood at a rate commensurate(proportionate) with the body's metabolic needs (oxygen delivery).
- **Heart failure** occurs when the heart cannot deliver adequate cardiac output to meet the metabolic needs of the body.

Factors Affecting Cardiac Performance

- **Cardiac output depends on: stroke volume and heart rate.**
- **Stroke volume** is dependent on three important factors:
- **preload,**
- **afterload and**
- **contractility.**

Factors Affecting Cardiac Performance

- **Preload:**
- Preload (volume overload, End Diastolic Volume).
- preload (such as in VSD, PDA, or valvular insufficiency).
- **Afterload:**
- Afterload is the resistance (pressure) against which the heart must pump blood: e.g; systemic vascular resistance.
- Afterload (such as with aortic stenosis, pulmonary stenosis, or coarctation of the aorta)
- **Contractility**
- Contractility (Cardiac Performance Independent of Preload or Afterload)
- **Volume overload is the most common cause of CHF in children**

Compensatory mechanisms in heart failure

(1) Cardiac compensation

- increased HR and cardiac contractility
- Cardiac dilatation (The Frank-Starling mechanism)
- Myocardial hypertrophy

(2) Systemic compensation

- Increase the blood volume
- Redistribution of blood flow
- Increase of erythrocytes
- Increased ability of tissues to utilize oxygen

(3) neurohormonal compensation

- Sympathetic nervous system
- Renin-angiotensin system
- Atrial natriuretic peptide; endothelin

Etiology of Heart Failure

Fetus	Premature Neonate
Severe anemia (hemolysis, fetal-maternal transfusion)	Fluid overload
Supraventricular tachycardia	PDA
Ventricular tachycardia	VSD
Complete heart block	
Atrioventricular valve insufficiency	
Full-Term Neonate	**Infant-Toddler**
Asphyxial cardiomyopathy	Left-to-right cardiac shunts (VSD)
Left-sided obstructive lesions (coarctation of aorta)	Metabolic cardiomyopathy
Transposition of great arteries	Acute hypertension (hemolytic-uremic syndrome)
Viral myocarditis	Supraventricular tachycardia
Anemia	Kawasaki disease
Supraventricular tachycardia	
Complete heart block	
Child-Adolescent	
Rheumatic fever	Acute hypertension (glomerulonephritis)
Viral myocarditis	Thyrotoxicosis
Endocarditis	Cor pulmonale (cystic fibrosis)
Arrhythmias	Chronic upper airway obstruction (cor pulmonale)
Cardiomyopathy	

Etiology of Heart Failure

- In the **first weeks** of life, CHF is most commonly due to an excessive afterload being placed on the myocardium.
- CHF presenting **around 2 months** of age is usually due to increasing left-to-right shunts of congenital heart defects that become apparent as the pulmonary vascular resistance decreases.
- Acquired heart disease, such as myocarditis and cardiomyopathy, can present at any age.

Classification of heart failure

(1) According to **the course** of disease

1) Acute HF
2) Chronic HF

(2)According to **the severity**

1) mild HF or complete compensation
2) middle HF or incomplete compensation
3) severe HF or decompensation

3)According to **the cardiac output (CO)**

1) **Low-output HF**: due to volume overload, pressure overload & contractility problems.
2) **High-output HF:** Heart Rate is primarily affected;**3A**(Anemia, Arrythmia, AV Fistula)

(4) According to **the location** of heart failure

1) Left -side heart failure (LHF)
2) Right-side heart failure (RHF)
3) Biventricular failure (whole heart failure)

(5)According to **the function** impaired

1) systolic failure :Myocarditis, hypertension
2) Diastolic failure: restrictive cardiomyopathy, cardiac tamponate.

CLINICAL MANIFESTATIONS

- Clinical presentation of CHF in infants includes poor feeding, failure to thrive, tachypnea, and diaphoresis with feeding.
- Older children may present with shortness of breath, easy fatigability, and edema.
- **The physical examination findings depend on whether pulmonary venous congestion, systemic venous congestion, or both are present.**
- Tachycardia, a gallop rhythm, and thready pulses may be present with **either cause.**
- **If left-sided failure** is predominant, tachypnea, orthopnea, wheezing, and pulmonary edema are seen.
- **If right-sided failure** is present, hepatomegaly, edema, and distended neck veins are present.

IMAGING STUDIES

- **chest x-ray:** cardiomegaly.
- **ECG**: Arrhythmias
- An **echocardiogram** assesses the heart chamber sizes, measures myocardial function accurately, and diagnoses congenital heart defects when present.

Treatment principles

- (1) Correct the underlying causes of HF
- (2) Diet; (low salt and high calories)
- (3) Digitals; Improve the cardiac contractility
- (4) Diuretics; Reducing preload: frusemide
- (4) Dilators; Reducing afterload; ACE
- Remember 4 D

Treatment of Heart Failure

General Care	
Rest	Reduces cardiac output
Oxygen	Improves oxygenation in presence of pulmonary edema
Sodium, fluid restrictions	Decreases vascular congestion; decreases preload

Other	
Transplantation	Removes diseased heart
Carvedilol	β-blocking agent

Treatment of Heart Failure

General Care	
Rest	Reduces cardiac output
Oxygen	Improves oxygenation in presence of pulmonary edema
Sodium, fluid restrictions	Decreases vascular congestion; decreases preload

Other	
Transplantation	Removes diseased heart
Carvedilol	β-blocking agent

Diuretics; Reducing preload

Diuretics	
Furosemide	Salt excretion by ascending loop of Henle; reduces preload; afterload reduced if hypertension improves; may also cause venodilation
Combination of distal tubule and loop diuretics	Greater sodium excretion

Improve the cardiac contractility

Inotropic Agents	
Digitalis	Inhibits membrane Na^+, K^+-ATPase and increases intracellular Ca^{2+}, improves cardiac contractility, increases myocardial oxygen consumption
Dopamine	Releases myocardial norepinephrine plus direct effect on β-receptor, may increase systemic blood pressure; at low infusion rates, dilates renal artery, facilitating diuresis

Dilators; Reducing afterload

Afterload Reduction	
Hydralazine	Arteriolar vasodilator
Nitroprusside	Arterial and venous relaxation; venodilation reduces preload
Captopril/enalapril	Inhibition of angiotensin-converting enzyme; reduces angiotensin II production

SURGICAL MANAGEMENT

HEART TRANSPLANTATION:

- ✓ When the heart is irreversibly managed and no longer functions adequately and when the client is at risk of dying, cardiac transplantation and use of an artificial heart to assist or replace the failing heart are measures
- ✓ A **heart transplant**, or a **cardiac transplant**, is a surgical transplant procedure performed on patients with end-stage heart failure or severe coronary artery disease when other medical or surgical treatments have failed of last resort.

CARDIOMYOPLASTY

- **Cardiomyoplasty** is a surgical procedure in which healthy muscle from another part of the body is wrapped around the heart to provide support for the failing heart.
- Most often the latissimus dorsi muscle is used for this purpose.
- A special pacemaker is implanted to make the skeletal muscle contract. Cardiomyoplasty is related to damaged myocardium remodeling.

VENTRICULAR ASSIST DEVICE (VAD):

- It is a Electromechanical device for assisting cardiac circulation, which is used either to partially or to completely replace the function of a failing heart.
- The function of VADs is different from that of artificial cardiac pacemakers; some are for short-term use, typically for patients recovering from myocardial infarction (heart attack) and for patients recovering from cardiac surgery

MANAGEMENT

- NURSING MANAGEMENT
- PALLIATIVE CARE
- CARDIAC REHABILITATION EXERCISE

NURSING MANAGEMENT :

- The objective of nursing intervention will be:
- 1. Improving cardiac output
- 2. Improving gas exchange
- 3. Restoring fluid volume balance
- 4. Improving activity tolerance
- 5. Supporting the patient experiencing hopelessness and
- 6. Educating the patient and family regarding care.

PALLIATIVE CARE

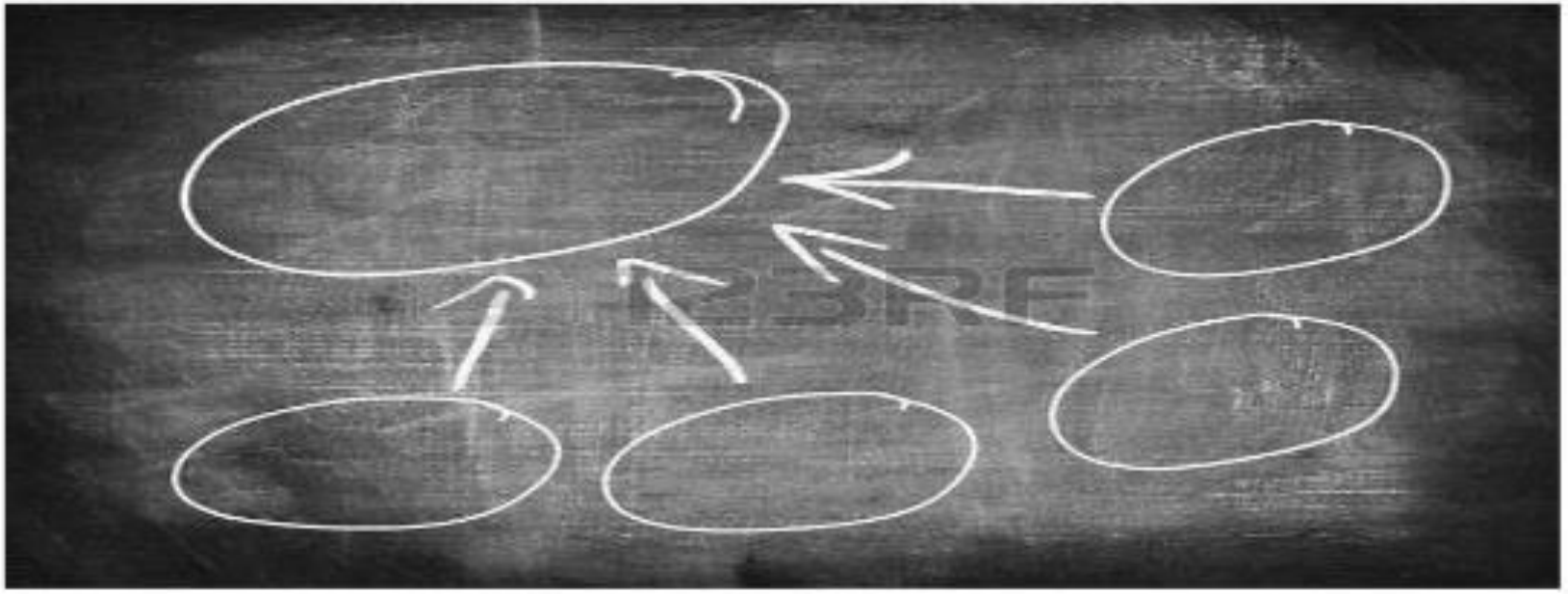
- **Fatigue and Breathlessness**
- Fatigue and breathlessness are common problems at the end of life.
- Other symptoms may include tightness in the chest, feeling as if you are not getting enough air, or even feeling like you're being smothered.
- Family or caregivers can help by:
- Encouraging the person to sit upright
- Increasing the airflow in a room by using a fan or opening a window
- Helping the person relax and not panic

Cardiac rehab is a medically supervised program that includes

- Exercise training,
- Education on heart-healthy living and lifestyle, and often counseling to reduce stress.
- For many people with HF, cardiac rehab plays a critical role in improving their quality and length of life.
- With regular access to coaching and medical staff, rehab can do a lot to help you on the road to better heart health and reduce your chances of future heart problems

CONCLUSION

- Living with HF is a challenge to the sufferers of this condition. It also represents a significant burden for the caregivers. The effective management of HF is achieved through optimal medical therapy.




Thank
You!