



FACULTY OF NURSING SCIENCES

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CONGESTIVE HEART FAILURE

Objectives

- Define and understand the key concepts and impact of Congestive heart failure
- Discuss the classification of Congestive heart failure
- Identify the risk factors and etiologies of Congestive heart failure
- Explain the pathophysiology of Congestive heart failure

Objectives

- Recognize the signs and symptoms manifested by the patient
- Understand the treatment options carried out in treating patients with Congestive heart failure
- Apply the nursing process in managing patients with Congestive heart failure

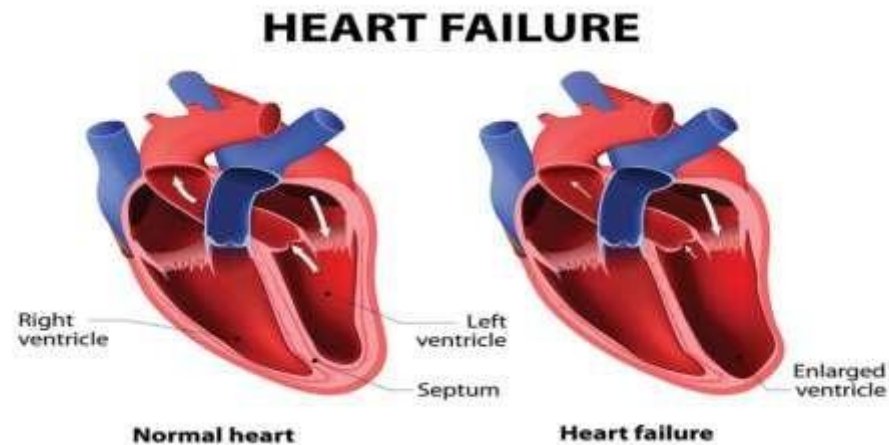
Introduction

- **Heart Failure-** Clinical syndrome ... can result from any structural or functional cardiac disorder that impairs ability of ventricle to fill with or eject blood
- **Impact**
The incidence and prevalence rates of heart failure are rising due to population, epidemiological and health transitions the prevalence of heart failure in India due to coronary heart disease, hypertension, obesity, diabetes and rheumatic heart disease

Definition

Heart Failure is defined as “ a complex clinical syndrome that results from any structural or functional impairment of ventricular filling(diastole) or ejection of blood. (systole) ”

(ACC/AHA-2013)



Key Concepts

Cardiac output (CO) = Stroke Volume (SV) x
Heart Rate (HR)

Becomes insufficient to meet metabolic needs of
body

SV – determined by preload, afterload and
myocardial contractility

Ejection Fraction (EF) (need to understand)

Classification of Heart Failure

1. Classification by Definition

- **Systolic Heart Failure**

- Characterized by reduced ejection fraction and enlarged ventricle size.
- Clinically present with left ventricular failure and marked cardiomegaly.

- **Diastolic Heart Failure**

- Characterized by increased resistance to filling due to increased filling pressures.
- Clinically present with pulmonary congestion with normal or slightly enlarged ventricles .

Classification -contd....

2. Classification Based On Ejection Fraction:

- **Heart Failure with reserved Ejection Fraction (HF rEF – Ejection fraction, ie $EF \leq 40\%$) .**
 - These patients will have systolic dysfunction and concomitant diastolic dysfunction.
 - Coronary artery disease is the major cause.

Classification - contd....

- **Heart Failure with Preserved Ejection Fraction (HFpEF – Ejection Fraction, ie EF 40 – 50%).**

These patients can be diagnosed by

- 1) clinical signs and symptoms
- 2) evidence of pEF or normal EF or previously rEF
- 3) evidence of abnormal LV diastolic dysfunction (echo / LV catheterisation)

Classification contd....

3. Classification Based On Cardiac Output

- **High Output Failure-**

- The normal heart fails to maintain normal or increased output conditions like anemia, hyperthyroidism, pregnancy.
- Usually right sided failure occurs followed by left sided failure with presence of shortened circulatory time.

- **Low Output Failure-**

- Heart fails to generate adequate output in conditions like cardiomyopathy, valvular heart disease, cardiac tamponade and bradycardia.

Classification -contd....

4. Right And Left Sided Heart Failure:

- **Right sided heart failure** is characterized by the presence of peripheral edema, raised JVP and hypotension and congestive hepatomegaly.
- **Left sided heart failure** – pulmonary edema is the striking feature. Other signs are tachypnea, tachycardia, third heart sound, pulsus alternans, cardiomegaly.
- **Congestive Cardiac Failure** – Characterized by combination of both left and right sided heart failure.

Classification -contd....

5. Forward and Backward Heart Failure

- **Forward Heart Failure-**

- This results from inadequate discharge of blood into arterial system leading to poor tissue perfusion and excess Na^+ reabsorption through RAAS.

- **Backward Heart Failure-**

- This results from failure of one or both ventricles to fill normally and discharge its contents, causing back pressure on the atria and venous system.

Factors Affecting Heart Pump

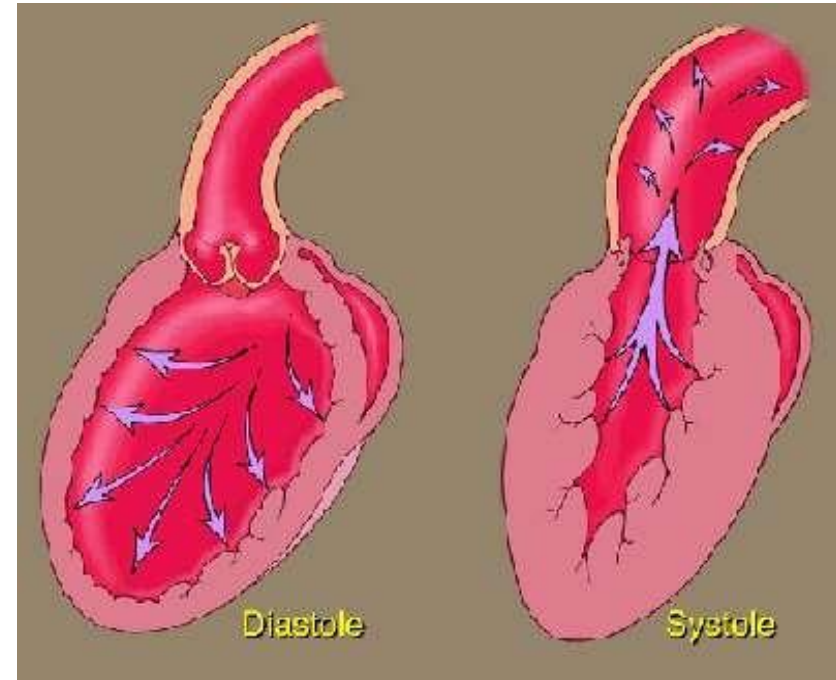
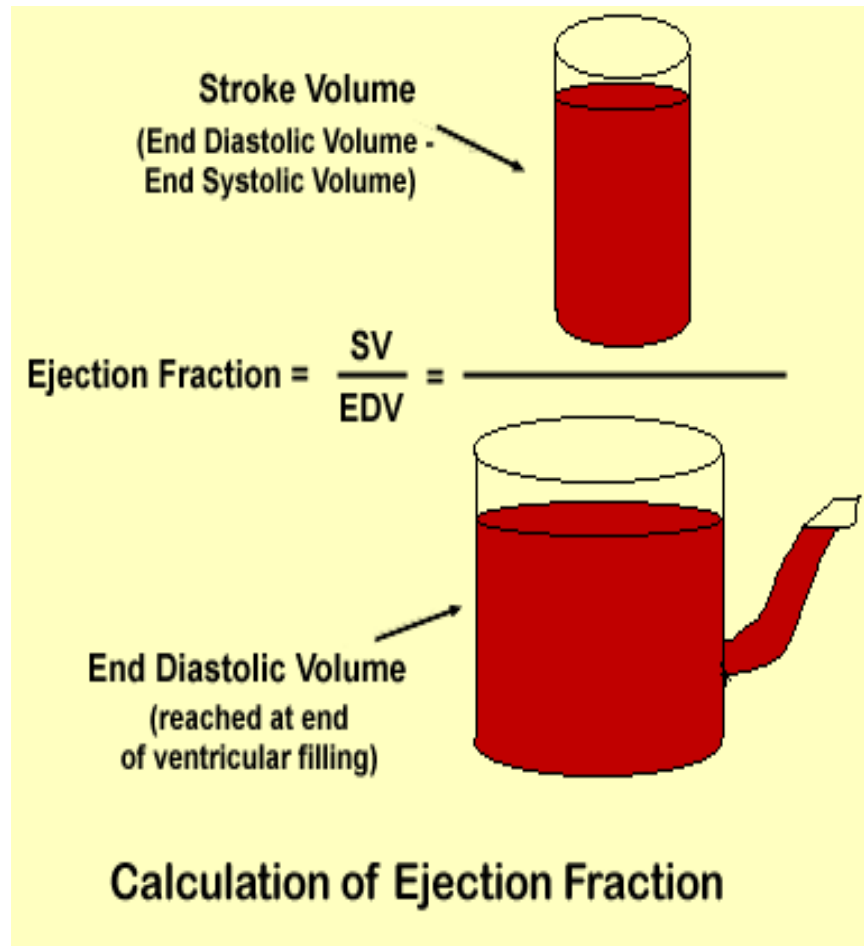
Effectiveness

Preload	Afterload
Volume of blood in ventricles at end diastole	Force needed to eject blood into circulation
Depends on venous return	Depends upon arterial BP, pulmonary artery pressure
Depends on compliance	Valvular disease increases afterload



Ejection Fraction (EF)

- ✓ One of the measurements used by physicians to assess how well a patient's heart is functioning
- ✓ "Ejection" refers to the amount of blood that is pumped out of the heart's main pumping chamber during each heartbeat
- ✓ "Fraction" refers to the fact that, even in a healthy heart, some blood always remains within this chamber after each heartbeat
- ✓ An ejection fraction is a percentage of the blood within the chamber that is pumped out with every heartbeat
- ✓ Normal EF = 55 to 75 percent



90ml/140ml = 64% (EF 55-65% normal)

Keys to Understand CHF

- All organs (liver, lungs, legs, etc.) return blood to heart
- When heart begins to fail/ weaken
- unable to pump blood forward
- fluid backs up
- Increase pressure within all organs

Organ response

LUNGS:

- congested → increase effort to breathe → fluid starts to escape into alveoli (pulmonary edema) → fluid interferes with O₂ exchange (hypoxia) → aggravates shortness of breath
- Shortness of breath during exertion → may be early symptoms
 - progresses → later require extra pillows at night to breathe (orthopnea) and experience "P.N.D." or paroxysmal nocturnal dyspnea

Keys to Understand CHF

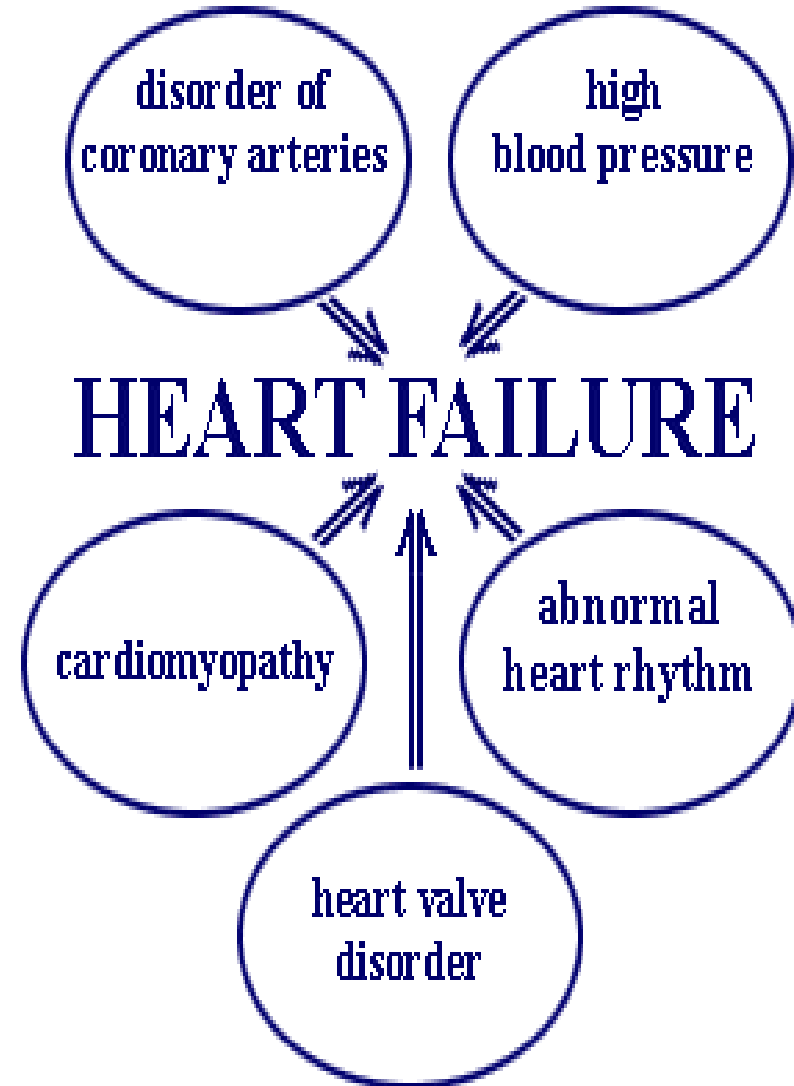
LEGS, ANKLES, FEET:

- Blood from feet and legs → back-up of fluid and pressure in these areas increases as heart unable to pump blood as promptly as received → increase in fluid within feet and legs (pedal/dependent edema) and increase in weight



Risk Factors

- **Primary risk factors**
 - Coronary artery disease (CAD)
 - Advancing age
- **Contributing risk factors**
 - Hypertension
 - Diabetes
 - Tobacco use
 - Obesity
 - High serum cholesterol
 - African American descent
 - Valvular heart disease
 - Hypervolemia



Etiology

- **Systolic Failure** - most common
 - Hallmark finding: Decrease in left ventricular ejection fraction $<40\%$ (EF)
 - Due to
 - Impaired contractile function (e.g., MI)
 - Increased afterload (e.g., hypertension)
 - Cardiomyopathy
 - Mechanical abnormalities (e.g., valve disease)

Etiology-contd....

Diastolic failure

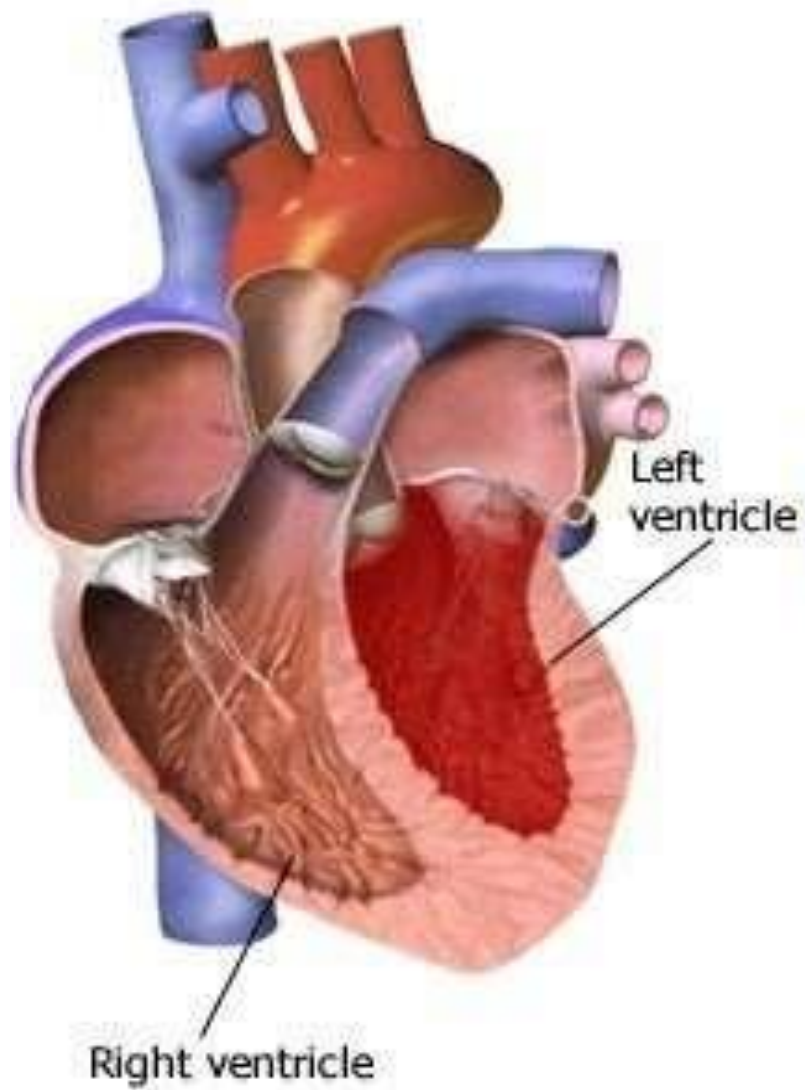
- Impaired ability of ventricles to relax and fill during diastole → decrease stroke volume and CO)

- Diagnosis based on presence of pulmonary congestion, pulmonary hypertension, ventricular hypertrophy

Etiology contd...

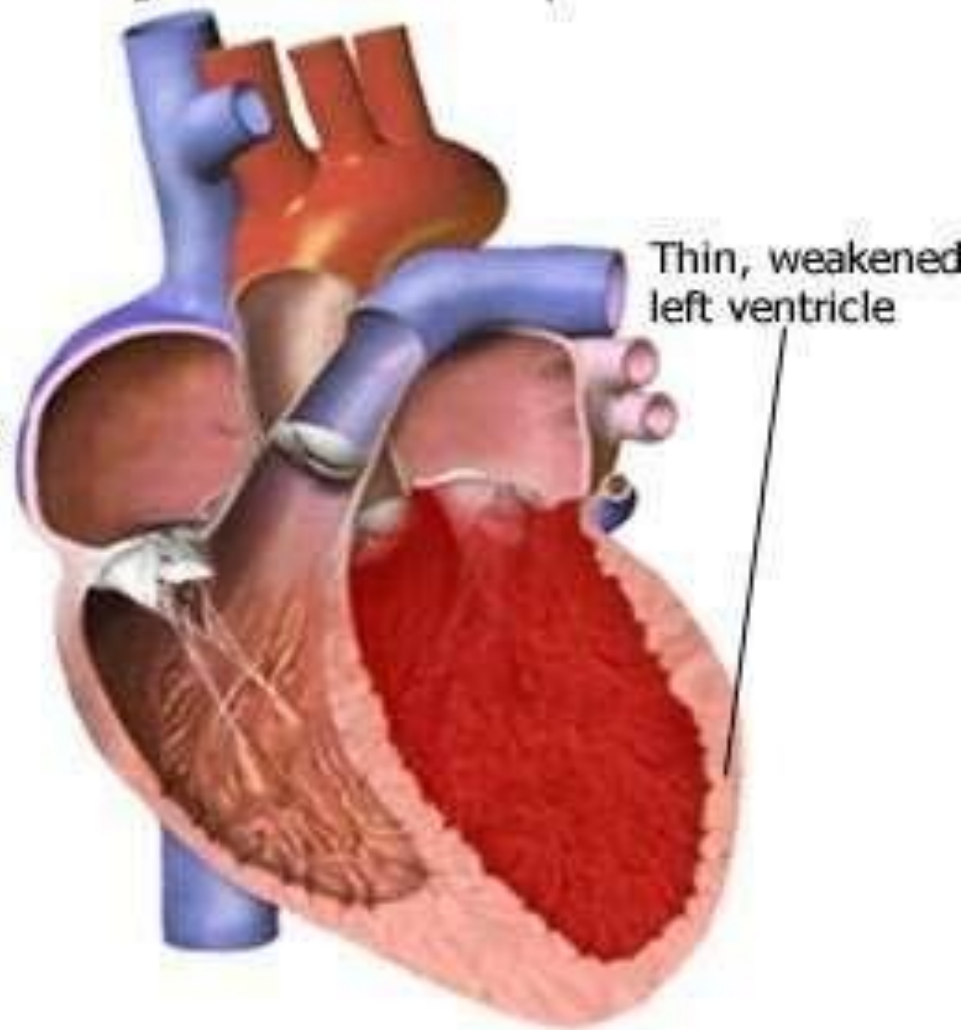
- **Mixed systolic and diastolic failure**
 - Seen in disease states such as dilated cardiomyopathy (DCM)
 - Poor EFs (<35%)
 - High pulmonary pressures
- **Biventricular failure**
 - Both ventricles may be dilated and have poor filling and emptying capacity

Normal



Enlarged Heart

A type of cardiomyopathy. An enlarged heart is a sign that the heart may be overworked.



Causes

1. Impaired cardiac function

- Coronary heart disease
- Cardiomyopathies
- Rheumatic fever
- Endocarditis

2. Increased cardiac workload

- Hypertension
- Valvular disorders
- Anemias
- Congenital heart defects

3. Acute non-cardiac conditions

- Volume overload
- Hyperthyroid, Fever, infection

Pathophysiology of Heart Failure

A. Cardiac compensatory mechanisms

1. Tachycardia
2. Ventricular dilation - Frank Starling's law

B. Homeostatic Compensatory Mechanisms

C. Myocardial hypertrophy

Activation of Sympathetic Nervous System (First line)

1. Vascular system resulting in vasoconstriction
2. Kidneys
 - i. Decrease renal perfusion → Renin angiotensin release
 - ii. Aldosterone release → Na and H₂O retention
3. Liver
 - i. Stores venous volume causing ascites, hepatomegaly

Pathophysiology -contd....

Counter Regulatory Response

Increase Na → release of Anti diuretic hormone (ADH) Release of atrial natriuretic factor (ANP) and BNP → Na and H₂O excretion – Thus prevents severe cardiac decompensation

Neuro hormonal responses:

Endothelin - stimulated by ADH, catecholamines and angiotensin II

- Arterial vasoconstriction
- Increase in cardiac contractility
- Hypertrophy

Pathophysiology-- contd....

- **Neurohormonal responses:** Proinflammatory cytokines (e.g., tumor necrosis factor)
- Released by cardiac myocytes in response to cardiac injury
- Depress cardiac function → cardiac hypertrophy, contractile dysfunction, and myocyte cell death

Counter Regulatory Response

- **Natriuretic peptides**: Atrial Natriuretic Peptide (ANP) and b-type natriuretic peptide (BNP)
 - Released in response to increase in atrial volume and ventricular pressure
 - Promote venous and arterial vasodilation, reduce
 - preload and afterload
 - Prolonged HF → depletion of these factors
- **Fluid overload** → Acute Decompensated Heart Failure/Pulmonary Edema

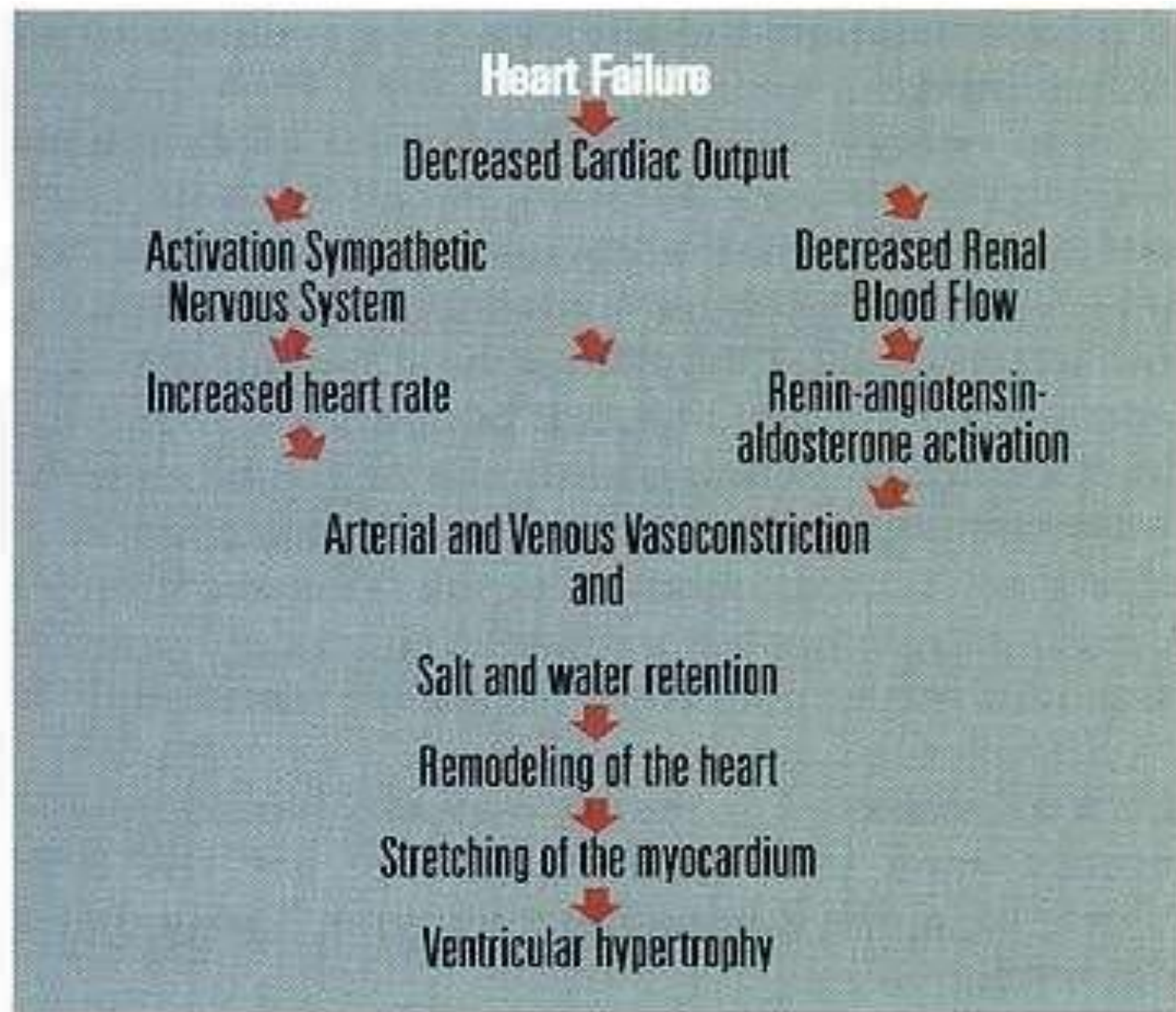


Figure 1. Heart Failure Cycle.

Classification Systems

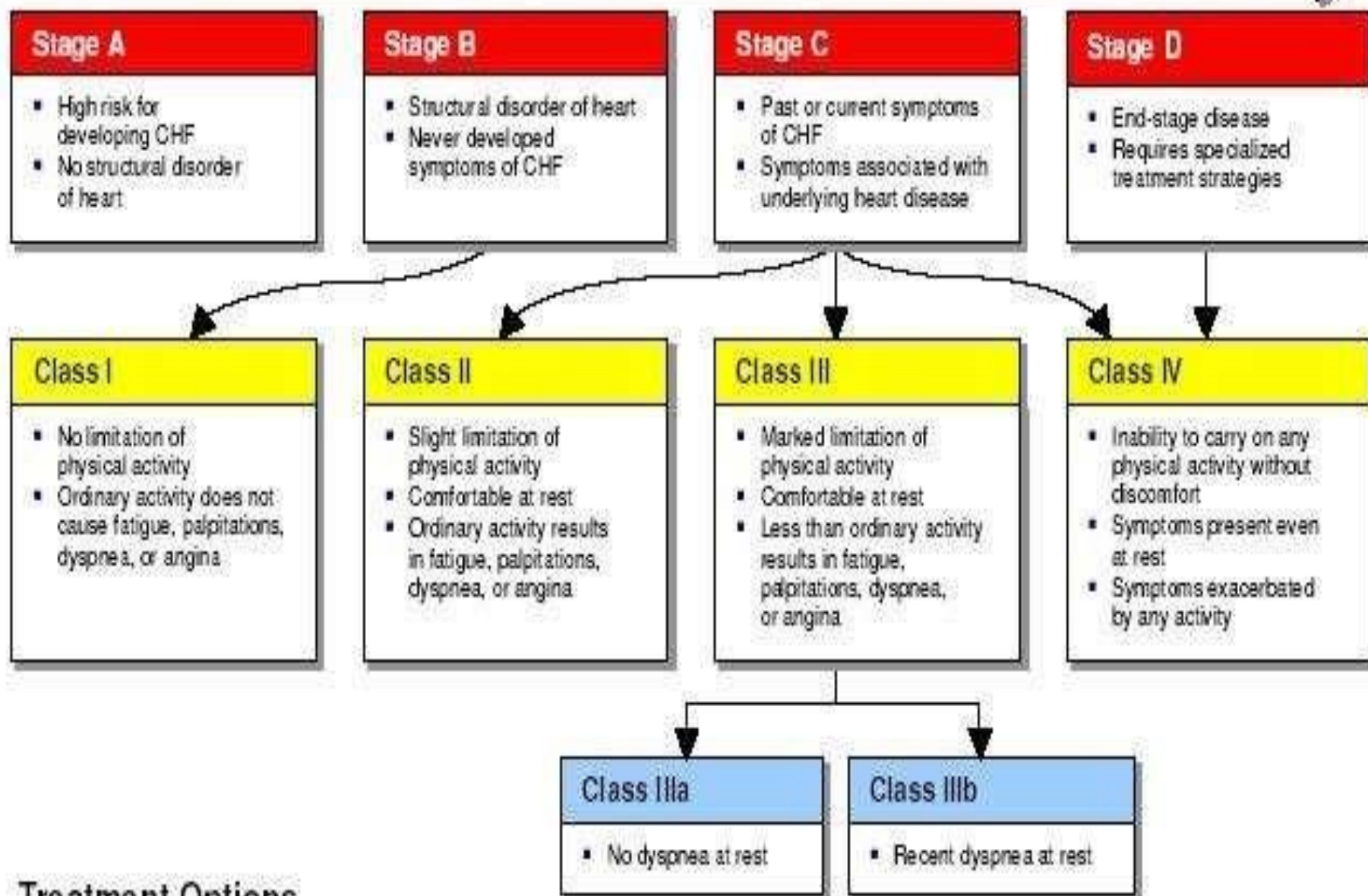
- New York Heart Association (NYHA)
Functional Classification of HF
 - Classes I to IV
- ACC/AHA Stages of HF (newer)
 - Stages A to D

Classification System

New York Heart Association (NYHA) Classification of Heart Failure

Class	Patient Symptoms
Class I (Mild)	No limitation of physical activity. Ordinary physical activity does not cause undue fatigue, rapid/irregular heartbeat (palpitation) or shortness of breath (dyspnea).
Class II (Mild)	Slight limitation of physical activity. Comfortable at rest, but ordinary physical activity results in fatigue, rapid/irregular heartbeat (palpitation) or shortness of breath (dyspnea).
Class III (Moderate)	Marked limitation of physical activity. Comfortable at rest, but less than ordinary activity causes fatigue, rapid/irregular heartbeat (palpitation) or shortness of breath (dyspnea).
Class IV (Severe)	Unable to carry out any physical activity without discomfort. Symptoms of fatigue, rapid/irregular heartbeat (palpitation) or shortness of breath (dyspnea) are present at rest. If any physical activity is undertaken, discomfort increases.

Increasing Severity



Treatment Options

Clinical Manifestations



Shortness of breath



Swelling of feet & legs



Chronic lack of energy



Difficulty sleeping at night due to breathing problems



Swollen or tender abdomen with loss of appetite



Cough with frothy sputum



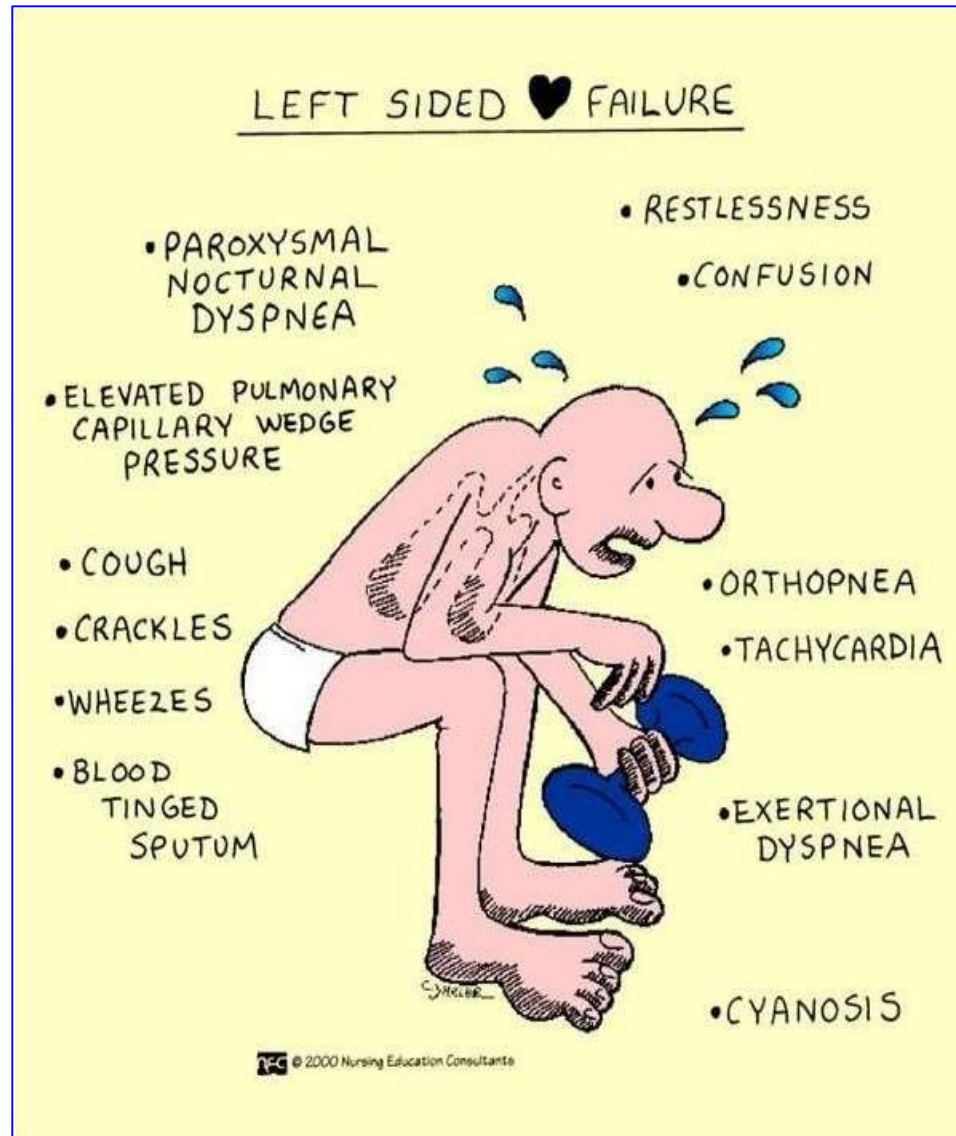
Increased urination at night



Confusion and/or impaired memory

Clinical manifestations contd...

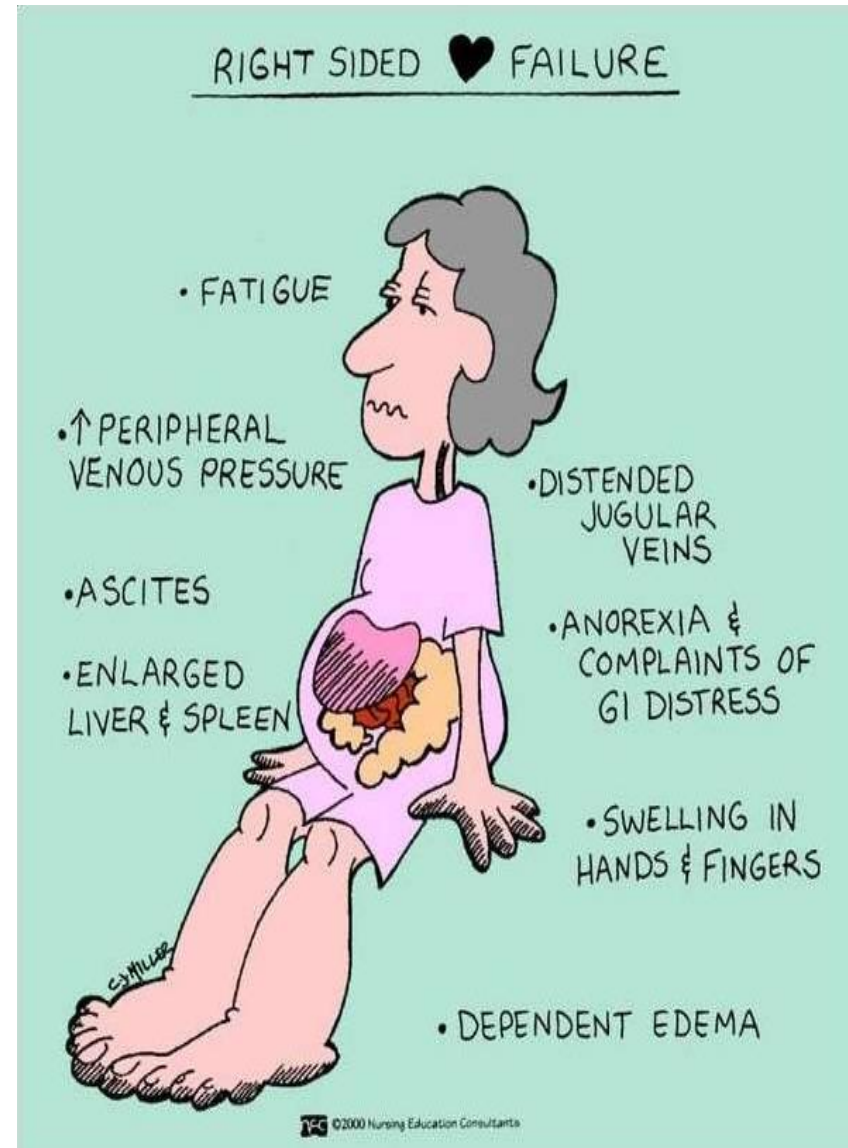
- Signs and symptoms
 - Dyspnea
 - Orthopnea & Paroxysmal Nocturnal Dyspnoea
 - Cheyne Stokes
 - Fatigue
 - Anxiety
 - Rales



Right Heart Failure

Signs and Symptoms

- Fatigue, weakness, lethargy
- weight gain
- Increase abdominal girth
- Anorexia
- Right upper quadrant pain
- elevated neck veins
- Hepatomegaly
- May not see signs of LVF



Congestive (mixed) Heart Failure Clinical Manifestations

Physical findings

- Orthopnea
- Dyspnea, Tachypnea
- Use of accessory muscles of respiration
- Cyanosis
- Cool and clammy skin
- S3 gallop rhythm

- Cough with frothy, blood-tinged sputum
- Breath sounds: Crackles, wheezes, rhonchi
- Tachycardia
- Hypotension/hypertension

Initial Evaluation

- **Primary goal** - Determine underlying cause
- Thorough history and physical examination – to identify cardiac and noncardiac disorders or behaviors that might cause or accelerate the development or progression of HF
- Volume status and vital signs should be assessed

Framingham Criteria for Dx of Heart Failure

- Major Criteria:
 - PND
 - JVD
 - Rales
 - Cardiomegaly
 - Acute Pulmonary Edema
 - S₃ Gallop
 - Positive hepatic Jugular reflex
 - ↑ venous pressure > 16 cm H₂O

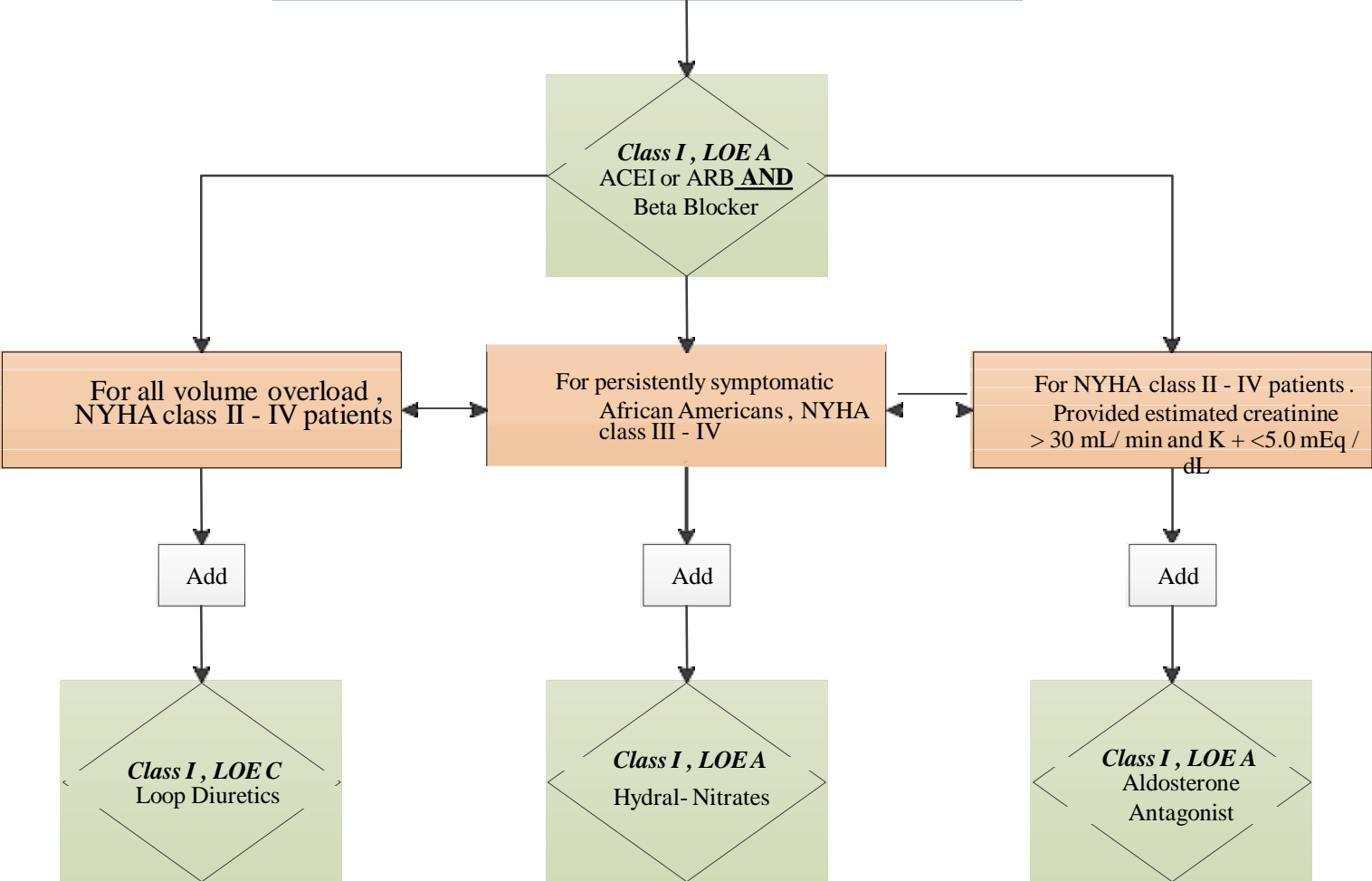
Diagnostic Tests

- Fasting lipid profile (FLP) • ECG
- liver function tests (LFT) • Chest X ray
- Thyroid-stimulating hormone (TSH) • Complete (CBC)
- Cardiac Troponins • Serum electrolytes calcium
- Beta natriuretic peptide (BNP) • magnesium) Glucose
- 14. Arterial Blood gas (ABG)

Diagnostic Tests

- 2-dimensional echocardiogram (2-D echo) with Doppler
- **Coronary angiography** if ischemia is likely cause of heart failure

**Heart Failure Stage C
NYHA Class I – IV
Treatment:**



Emergency Management

L-Lasix

O- Oxygen

A-ACE, ARBs, Aldactone, Amiodarone

D- Digoxin, Dobutamine, Dopamine

M- Morphine Sulfate

E- Extremities Down

General Measures

- Adequate Diabetes control
- Adequate BP control
- Weight reduction
- Quit smoking
- Avoid cardiotoxins
- Lipid management
- Bed rest
- Lifestyle modification
- Salt & Fluid Restriction
- Administer oxygen

Pharmacological Management

➤ **Drugs Used to improve Pump Performance:**

1. Digitalis/Cardiac glycosides

Digitalis is used as a first – line therapy in client with heart failure.

2. Dopamine and Dobutamine/ Inotropic agents

Dopamine and Dobutamine also are Inotropic agents. It is given to clients with sever low – output heart failure.

S.No	Dose	Action
1.	Low dose (less than 4mg/kg/min)	Increase blood flow to the kidney
2.	Moderate dose (4 – 8 mg/kg/min)	Increase heart rate, stroke volume & cardiac output
3.	Large dose (more than 8mg/ kg/min)	Increase heart rate & myocardial contractility

Pharmacological Management

- **Drugs Used to Reducing the workload of myocardium**

1. Diuretics

- **Furosimide** (20-40mg once or twice)
- **Hydrochlorothiazide** (25mg once or twice)
- **Metolazone** (2.5-5mg OD)
- **Spiroinolactone** (12.5-25 once or twice)
- Aim of diuretic therapy on outpatient is to decrease weight 0.5-1kg daily with adequate diuresis and adjust the dose accordingly until evidence of fluid retention resolved.
 - Then daily wt and adjust the dose accordingly.

Pharmacological Management

Drugs Used to Reducing the workload of myocardium

2. ACE Inhibitors

Capotopril: 6.25mg thrice till 50mg thrice a day

Enalapril : 2.5mg twice to 10- 20mg twice a day

Lisinopril: 2.5-5mg once to 20- 40mg once a day

Ramipril: 1.25-2.5mg once till 10mg once a day

C/I – Cr >3mg/dl, angioedema, pregnant,
hypotension (SBP<80mmHg), B/L RAS, inc.

K(>5mg/dl)

Pharmacological Management

- **Initiation:**

Start low dose – if tolerated then gradually increase in few days to weeks to target dose or max tolerable dose.

- Renal function monitoring before starting, 1-2weeks after and periodically thereafter and after changing dose
- ACE induced cough – 20%

Pharmacological Management

3. Angiotensin Receptor Blockers

When ACEI intolerant or alternative to ACEI AT1 receptor blocker can be substituted to ACEI with angioedema history but with caution (pt can develop angioedema with ARB as well)

Losartan:

25-50mg once till 50- 150mg once a day

Valsartan:

20-40mg twice till 160mg twice

Same initiation and monitoring as ACEI

Titration by doubling the dose

Pharmacological Management

- **4. Beta Blockers**
- To all pt with LV dysfunction
- Start early when symptoms improved
- Caution: Can worsen heart failure start low and go slow
- Start in low dose even during hospitalization (careful in pt require inotropic support) gradually increase dose in weeks duration and try to reach target dose

Pharmacological Management

- **Bisoprolol:** 1.25-2.5mg once till 10mg
- **Carvedilol:** 3.125mg twice till 50mg
- **Metoprolol Succinate:** 12.5mg once till 200mg
- Continue even Surgery not improved
- Abrupt withdrawal avoided
- **S/E:** fluid retention and worsening HF, slow heart rate, fatigue, blocks, hypotension (minimize by different dosing timings of BB and ACEI)

Management -

5. Aldosterone Receptor Antagonists

- **Indications:** NYHA II –IV $\leq 35\%$, no C/I (GFR > 30 2.5mg/dl male and 2.0mg/dl female, K < 5 mg/dl
- **Dosing :** Spironolactone 12.5 -25mg once till 50mg daily
- stop all K supplements,
- check K⁺ and Cr 2-3 days after starting then one week and every month for 3 months and every 3 month & when clinically indicated .

Contd....

- **Aldosterone Receptor Antagonists**

- Cycle restarted after changing dose of ARA or ACEI

Energy foods -High K containing food: Prunes, Cr: banana, salmon fish, dark green leafy vegetables, mushrooms, yogurt, white beans and dried apricot

S/E: Increase K⁺ (10-15%), gynecomastia

6 Cont...

- No mortality benefit, only decrease frequency of hospitalizations, Symptoms and HRQOL

- Don't stop digoxin if patient is not on ACEI or BB, but try to initiate them.

No loading required – usual dose 0.125-0.25mg daily (low dose 0.125mg alternate day if >70yrs, CKD, Low lean body mass 0.5-0.9 ng/dl plasma conc. (narrow therapeutic range)

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Pharmacological Management -Cont...

- **. DIGOXIN**
- S/E: Nausea, vomiting and diarrhea, visual disturbances (yellow-green halos and problems with color perception), supraventricular and ventricular arrhythmias

Pharmacological management - cont...

7. Hydralazine nitrate

Indication: African-American origin, NYHA III-IV,
(37.5mg hydralazine and 20mg ISDN) start one tab

TID to increase till 2tab TID

If given separately then both at least TID

Device therapy

Implantable Cardioverter Defibrillator (ICD)

–Nonischemic or ischemic heart disease (at least 40 days post-MI) with LVEF of $\leq 35\%$ with NYHA class II or III symptoms or NYHA 1 with EF $\leq 30\%$ on chronic medical therapy, who have reasonable expectation of meaningful survival for more than 1 year

Cardiac Resynchronization Therapy (CRT)

–Indicated for patients who have LVEF of 35% or less, sinus rhythm, left bundle-branch block (LBBB) with a QRS duration of 150 ms or greater, and NYHA class II, III, or ambulatory IV symptoms on GDMT

Mechanical Circulatory Support

Intraaortic balloon pump (IABP) therapy

- Used for cardiogenic shock
- Allows heart to rest

Ventricular assist devices (VADs)

- Takes over pumping for the ventricles
- Used as a bridge to transplant

Destination therapy-permanent, implantable VAD

Cardiomyoplasty- wrap latissimus dorsi around heart

Ventricular reduction -ventricular wall resected

Transplant/Artificial Heart

Complications

- Pleural effusion
- Atrial fibrillation (most common dysrhythmia)
 - Loss of atrial contraction (kick) – necessary for 20- 25% of cardiac output
 - Reduce CO by 20% to 25%
 - Promotes thrombus/embolus formation
- Increase risk for stroke

Complications

- High risk of fatal dysrhythmias (e.g., sudden cardiac death, ventricular tachycardia) with HF and an EF <35% HF lead to severe hepatomegaly, especially with RV failure

Fibrosis and cirrhosis (cardiac cirrhosis) - develop over time

- Renal insufficiency or failure (cardio renal syndrome)
- Cor -pulmonale

Nursing management

Nursing assessment:

Health History

- Focuses on the signs and symptoms of HF, such as dyspnea, shortness of breath, fatigue, and edema.
- Sleep disturbances, particularly interrupted by shortness of breath, may be reported.
- Enquire about the number of pillows needed for sleep,
- Explore s each patient's self-management strategies

Physical Examination

- The nurse auscultate the lungs to detect crackles and wheezes.
- The heart is auscultated for an S3 heart sound, a sign that the heart is beginning to fail and that increased blood volume fills the ventricle with each beat.
- HR and rhythm are also documented.
- JVD is also assessed; distention greater than 3 cm above the sternal angle is considered abnormal. .

Physical Examination

- Sensorium and level of consciousness must be evaluated.
- Assess dependent parts of the patient's body for perfusion and edema.
- Observe the skin to feel cool and appear pale or cyanotic
- The feet and lower legs are examined for edema; if the patient is supine in bed, the sacrum and back are also assessed for edema.

Physical Examination

- The nurse measures urinary output carefully to assess the effectiveness of diuretic therapy.
- Intake and output records are rigorously maintained, monitor for oliguria (less than 500 mL/24 h) or anuria (urine output less than 50 mL/24 h).

Physical Examination

- The patient is weighed at the same time of day, with the same type of clothing, and on the same scale.
- If there is a significant change in weight (ie, 2- to 3-lb increase in a day or 5-lb increase in a week), to be notified to the physicia

Nursing management - contd...

Possible nursing diagnoses:

- Activity intolerance and fatigue related to decreased CO
- Excess fluid volume related to the HF syndrome
- Anxiety related to breathlessness from inadequate oxygenation
- Powerlessness related to chronic illness and hospitalizations
- Ineffective therapeutic regimen management related to lack of knowledge

Nursing management contd..

Interventions for Promoting Activity Tolerance

- Reduced physical activity caused by HF symptoms leads to physical deconditioning that worsens the patient's symptoms and exercise tolerance.
- Prolonged bed rest should be avoided because of its deconditioning effects and risks such as pressure ulcers, venous thrombosis, and pulmonary embolism.
- 30 minutes of physical activity every day should be encouraged

Nursing management -contd..

- Exercise training to be promoted in order to increase functional capacity and decreasing dyspnea.
- The exercise regimen should include 5 minutes of warm-up activities followed by about 30 minutes of exercise at the prescribed intensity level.
- Barriers to performing other activities are identified, and methods of adjusting an activity to be discussed with the patient

Promoting Activity Tolerance contd...

Safety guidelines to be followed by the patient before exercises:

- Begin with a few minutes of warm-up activities.
- Avoid performing physical activities outside in extreme hot, cold, or humid weather.
- Ensure that you are able to talk during the physical activity; if you cannot do so, decrease the intensity of activity.

Promoting Activity Tolerance contd...

- Wait 2 hours after eating a meal before performing the physical activity.
- Stop the activity if severe shortness of breath, pain, or dizziness develops.
- End with cool-down activities and a cool-down period

Nursing management contd..

Interventions for Managing Fluid Volume:

- Oral diuretics should be administered early in the morning so that diuresis does not interfere with the patient's nighttime rest.
- The patient's fluid status is monitored closely by auscultating the lungs and monitoring daily body weight,
- Assist the patient to adhere to a low-sodium diet by avoiding high-sodium foods such as canned, processed, and convenience foods

Nursing management contd..

- The patient is positioned or taught how to assume a position that facilitates breathing.
- The lower arms are supported with pillows to eliminate the fatigue
- The nurse assesses the skin for breakdown and pressure ulcers and institutes preventive measures.
- Frequent changes of position, positioning to avoid pressure, and leg exercises may help prevent pressure ulcers.

Nursing management contd..

Interventions to Control Anxiety

- Patients will be restless and anxious and feel overwhelmed by breathlessness.
- These symptoms tend to intensify at night and may interfere with sleep.
- By decreasing anxiety, the patient's cardiac workload also will be decreased.
- Oxygen may be administered during an acute event to diminish the work of breathing and to increase the patient's comfort.
- When the patient exhibits anxiety, the nurse takes steps to promote physical comfort and provide psychological support.
- Family member's presence provides reassurance.

Nursing management contd..

- Monitoring and Managing Potential Complications with HF
- Many potential problems associated with HF therapy relate to the use of diuretics: Excessive and repeated diuresis can lead to hypokalemia
- In patients receiving digoxin, hypokalemia can lead to digitalis toxicity.
- Digitalis toxicity and hypokalemia increase the likelihood of dangerous dysrhythmias
- Patients may also develop low levels of magnesium, which can add to the risk of dysrhythmias.

Nursing management contd..

- Hyperkalemia may occur, especially with the use of ACE inhibitors, ARBs, or spironolactone.
- Prolonged diuretic therapy may produce hyponatremia, which results in disorientation, apprehension, weakness, fatigue, malaise, and muscle cramps.
- Volume depletion from excessive fluid loss may lead to dehydration and hypotension. ACE inhibitors and beta-blockers may contribute to the hypotension.
- Other problems associated with diuretics include increased serum creatinine and hyperuricemia which leads to gout.

Conclusion

In heart failure, the main pumping chambers of the heart (the ventricles) may become stiff and not fill properly between beats. In some cases of heart failure, the heart muscle may become damaged and weakened, and the ventricles stretch (dilate) to the point that the heart can't pump blood efficiently throughout the body.

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