



Heart Failure

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Definition



It is a common clinical syndrome with symptoms caused by impaired ability of one or both ventricles to pump at a normal pressure due to a structural or functional cardiac disorder.



HF is largely a clinical diagnosis that is based upon a careful history and physical examination



It is an age-related disease



Classification of HF



New York Heart
Association (NYHA)
functional classification

Canadian
Cardiovascular Society
functional classification



NYHA functional classification



Class 1: patients with cardiac disease but without resulting limitations of physical activity. (ordinary physical activity does not cause symptoms)

Class 2: patients with cardiac disease resulting in slight limitation of physical activity. (comfortable at rest, ordinary physical activity results in symptoms)

Class 3: patients with cardiac disease resulting in marked limitation of physical activity. (comfortable at rest, less than ordinary physical activity causes symptoms)

Class 4: patients with cardiac disease resulting in inability to carry on any physical activity without discomfort. (symptoms may be present at rest)



ACC/AHA stages of Heart Failure



Stage A: at risk for heart failure but without structural heart changes (patients with DM, CAD, HTN, vascular disease)

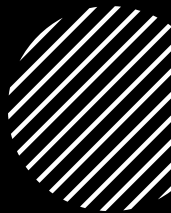
Stage B: structural heart disease (reduced ejection fraction, left ventricular hypertrophy, chamber enlargement) but without heart failure symptoms

Stage C: structural heart disease with current or prior heart failure symptoms

Stage D: refractory heart failure requiring advanced intervention (biventricular pacemaker, left ventricular assist device, transplantation)



Canadian Cardiovascular society functional classification



Class 1: ordinary physical activity, does not cause symptoms

Class 2: slight limitation of ordinary activity

Class 3: marked limitation of ordinary physical activity

Class 4: inability to carry on any physical activity without discomfort, symptoms may be present at rest



Other classifications



Systolic dysfunction – heart failure with reduced ejection fraction (HFrEF) – often secondary to ischemia/MI or dilated cardiomyopathy



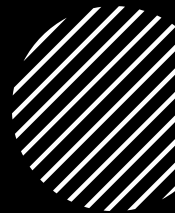
Diastolic dysfunction – heart failure with preserved ejection fraction (HFpEF) – often secondary to myocardial hypertrophy



Heart failure with mild range ejection fraction



Types of heart failure



Left sided heart failure – usually caused by coronary artery disease

Right sided heart failure – generally develops as a result of advanced left-sided heart failure, pulmonary hypertension, PE, or COPD

Biventricular heart failure (congestive heart failure)

High cardiac output heart failure

Diagnosis



Ro'a Abofares
Sara Mrshed

General Clinical features of heart failure

symptoms

- Nocturia, Fatigue, Dizziness, Syncope , Headache, Oliguria, Peripheral cyanosis, low systolic BP, weak pulse

Physical examination findings

- Tachycardia, various arrhythmias
- S3/S4 gallop on auscultation
- Pulsus alternans



LEFT SIDED HEART FAILURE

Symptoms OF PULMONARY CONGESTION

Dyspnea

Orthopnea

Exertional Cough

paroxysmal nocturnal dyspnea

PULMONARY EDEMA

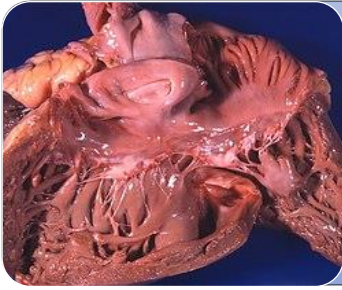
- recurrent chest infection hemoptysis , pleural effusion

Physical Examination Findings

Bilateral basilar rales

Laterally displaced apical heartbeat

Coolness and pallor of lower extremities



RIGHT SIDED HEART FAILURE

Symptoms of fluid retention and increased CVP

Peripheral pitting edema

Hepatic venous congestion
(abdominal pain, jaundice)

GI (dyspepsia ,
malabsorption) , Ascites

Physical examination findings

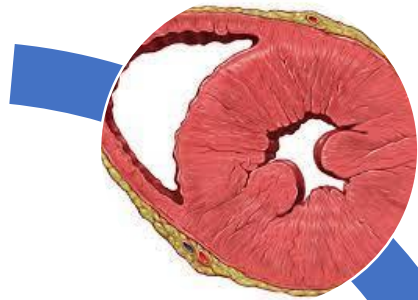
Kussmaul sign

Jugular venous distention

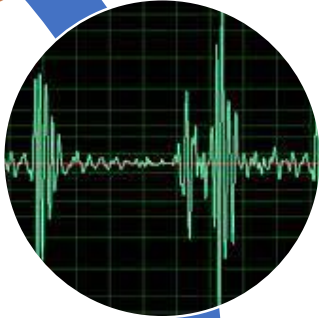
Hepatosplenomegaly

Hepatojugular reflux

Cardia signs



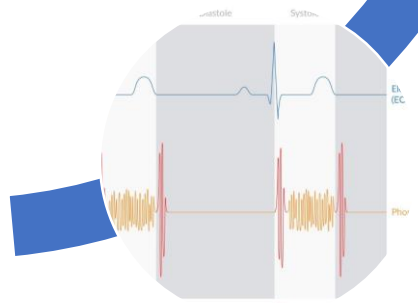
Right ventricular hypertrophy



gallop



Tachycardia



murmur on MR

DETERMINING PROGNOSIS IN HF

Low ejection fraction

Low sodium

CKD

Anemia

Elevated troponin

Elevated brain natriuretic peptide (BNP)

Increased width of QRS complex

Persistence sinus tachycardia

NYHA class 3 or 4

High norepinephrine and catecholamine levels

NYHA CLASSIFICATION

NEW YORK HEART ASSOCIATION (NYHA)
HEART FAILURE CLASSIFICATION

CLASS I
NO LIMITATION OF PHYSICAL ACTIVITY; ORDINARY PHYSICAL ACTIVITY DOES NOT CAUSE SYMPTOMS

CLASS II
SLIGHT LIMITATION OF PHYSICAL ACTIVITY; COMFORTABLE AT REST; ORDINARY PHYSICAL ACTIVITY CAUSES SYMPTOMS

CLASS III
MARKED LIMITATION OF PHYSICAL ACTIVITY; COMFORTABLE AT REST, BUT LESS THAN ORDINARY ACTIVITY CAUSES SYMPTOMS

CLASS IV
SEVERE LIMITATION AND DISCOMFORT WITH ANY PHYSICAL ACTIVITY; SYMPTOMS PRESENT EVEN AT REST




Investigations

- Blood test
- Chest X-ray
- ECG
- ECHO
- Cardiac catheterization



Blood Test

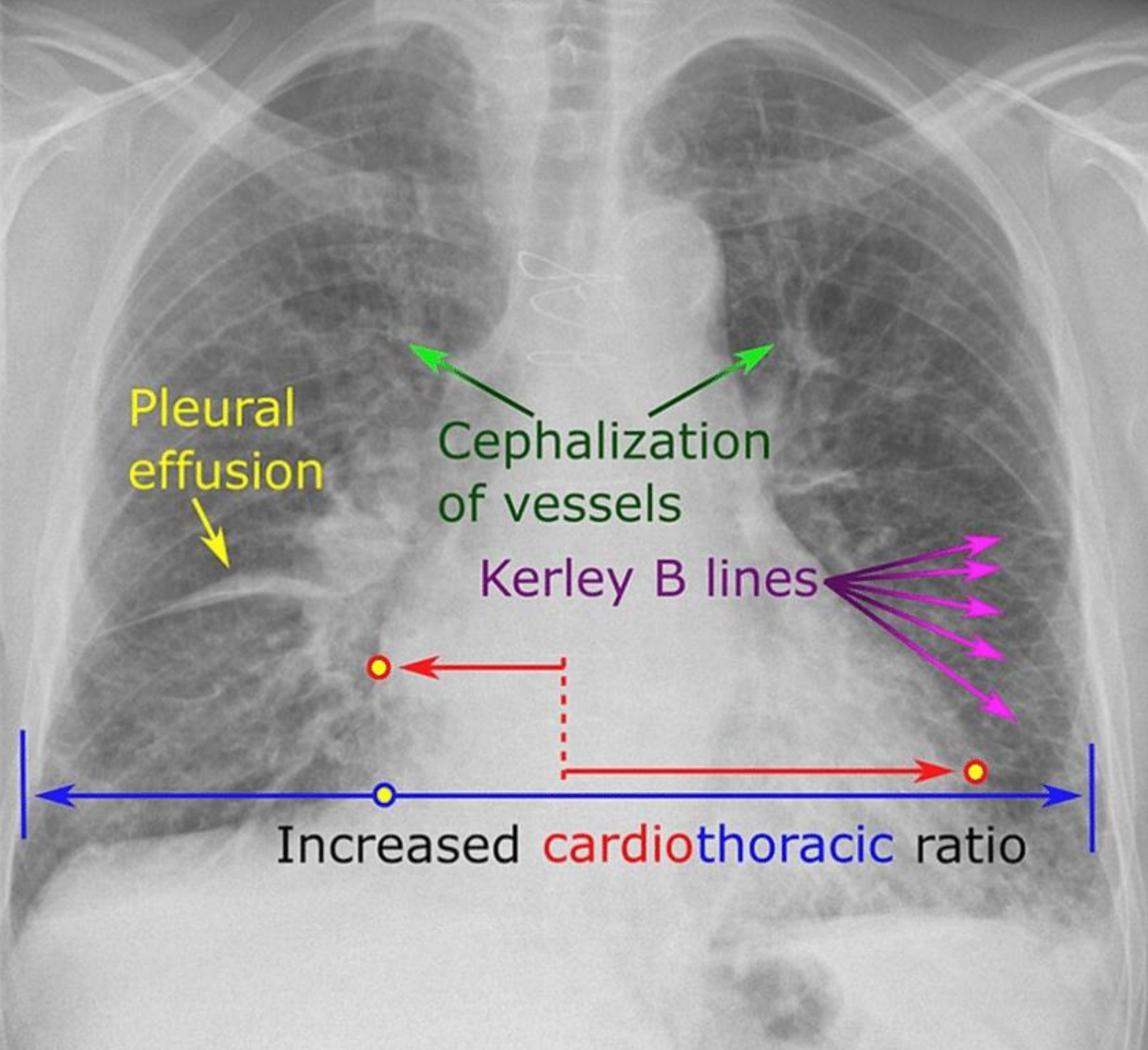
- Complete blood count (CBC)
- Urinalysis (UA)
- Serum electrolyte levels
- Kidney function tests(KFTs): Blood urea nitrogen (BUN)and creatinine levels
- Coagulation profile : PT, PTT, INR
- Fasting blood glucose levels
- Liver function tests (LFTs)
- Cardiac enzymes & B-type natriuretic peptide (BNP)
- and N-terminal pro-B-type (NT-proBNP) natriuretic



Arterial blood gases

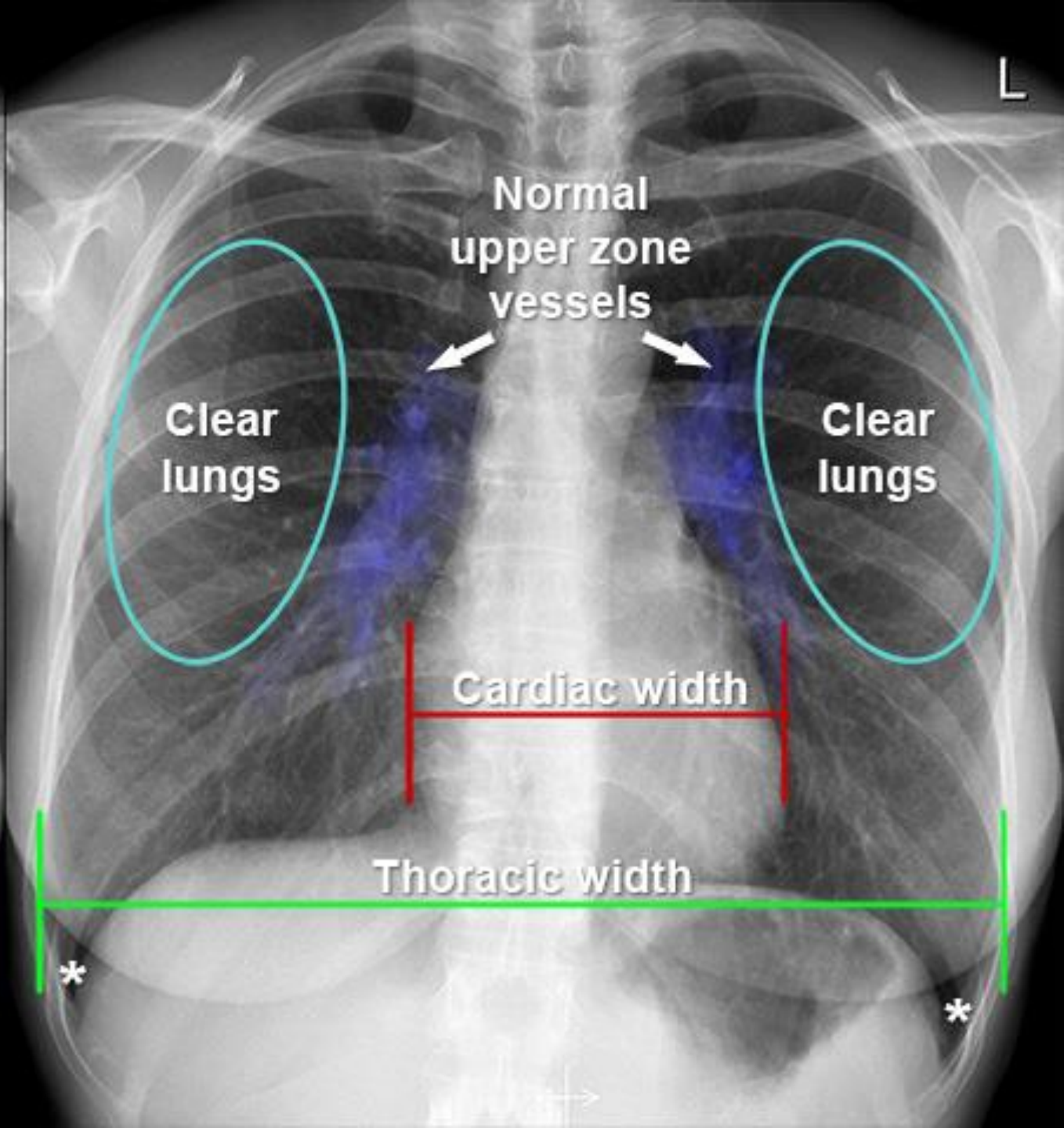
(ABG)

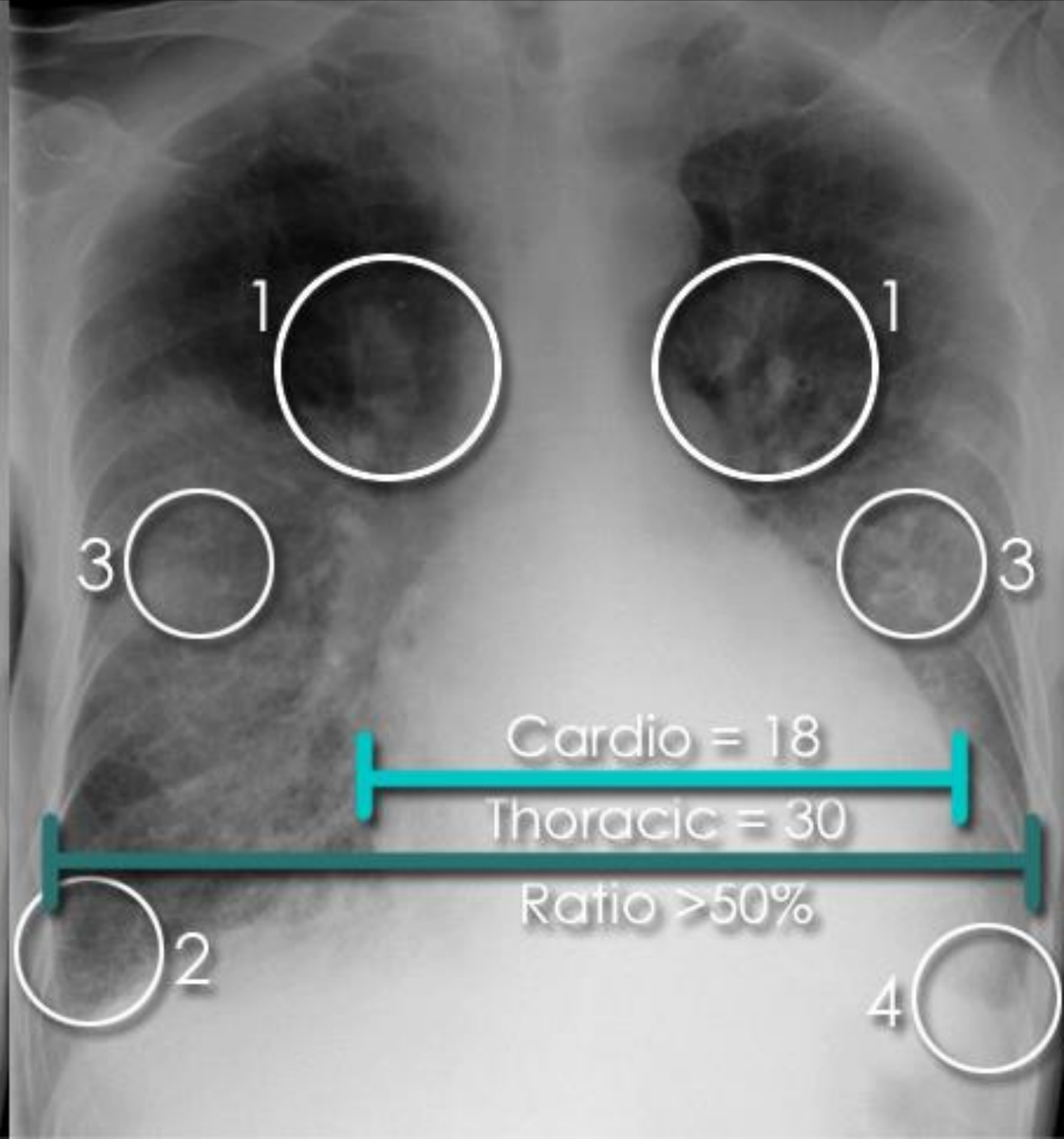
- In the setting of acute heart failure, ABG measurement is rarely performed.
- Indications include severe respiratory distress, and evidence of acidosis.



Chest X-ray

- ABCDE
- A- Alveolar edema “Bat’s wings sign”.
- B- Kerley B lines “ interstitial edema”.
- C- cardiomegaly “ increase cardiothoracic ratio”.
- D- Dilated prominent upper lobe vessel .
- E- Effusion “pleural effusion”.





Electrocardiography

- The ECG doesn't confirm or exclude HF.
- ECG may show :
- Left atrial enlargement and LVH .
- ECG may show the cause of HF , e.g: IHD.
- ECG may show the precipitating factor, e.g arrhythmias .



Echocardiograph y

Transthoracic

Transesophageal

Stress echo

Initial test of choice .

*Should be considered in all patient
with/suspected HF.*

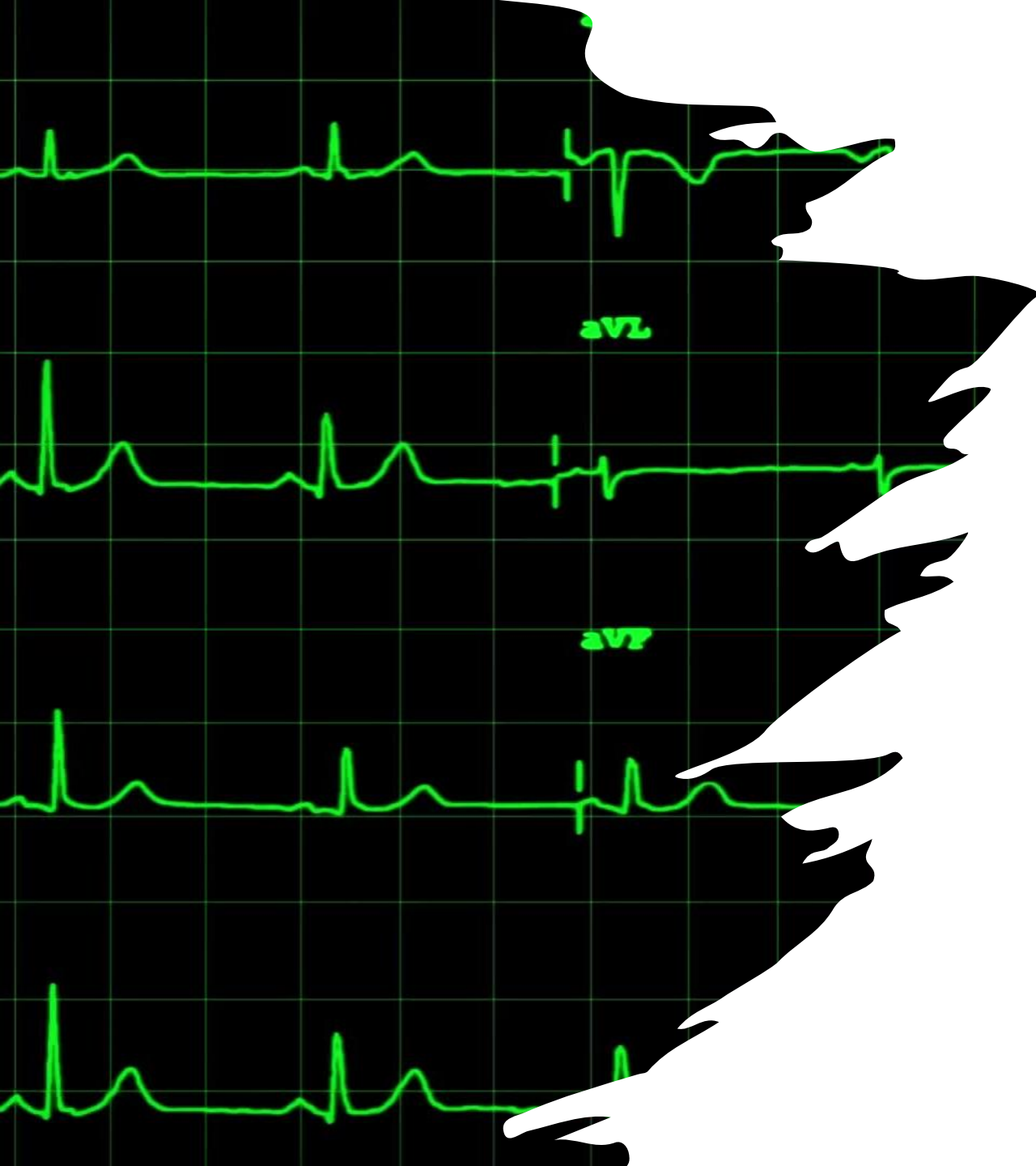


Echocardiograph y

Chamber dilataion or hypertrophy.

Measures COP & ejection fraction"very important" .

Structural/ valvular abnormalities



Cardiac catheterization and coronary angiography

- To diagnose or evaluate the cause of HF.
- Recently is less commonly performed .

Management

Salem Abu Mahfouz



Goals of Therapy

01

Reduce severity of symptoms

02

Reduce morbidity & mortality

03

Attenuate the process of adverse remodelling of the left ventricle

General Management

- Management of causes & associated conditions such as
 - Ischemic Heart Disease
 - Valvular Disease
 - Cardiomyopathy
 - Hypertension
 - Diabetes Mellitus
 - Arrhythmias & Conduction system disease
- Follow-up & Preventative Care

Care Coordination & Referral

- Self-Management
 - Cessation of Smoking
 - Abstain or restrict alcohol consumption along with illicit drug use
 - Reduction of sodium intake to <3 g/day
 - Restrict fluid intake to 1.5 – 2 L/day
 - Avoid Obesity
- Referral
 - Indicated when patients exhibit a trigger

Triggers for heart failure patient referral to a specialist/program

1. New-onset HF (regardless of EF) for evaluation of etiology, guideline-directed evaluation and management of recommended therapies, and assistance in disease management
2. Chronic HF with high-risk features, such as development of 1 or more of the following risk factors:
 - Need for chronic IV inotropes
 - Persistent NYHA functional class III to IV symptoms of congestion or profound fatigue
 - Systolic blood pressure ≤ 90 mmHg or symptomatic hypotension
 - Creatinine ≥ 1.8 mg/dL or BUN ≥ 43 mg/dL
 - Onset of atrial fibrillation, ventricular arrhythmias, or repetitive ICD shocks
 - 2 or more emergency department visits or hospitalizations for worsening HF in prior 12 months
 - Inability to tolerate optimally dosed beta blockers, ACEI/ARB/ARNI, and/or aldosterone antagonists
 - Clinical deterioration as indicated by worsening edema, rising biomarkers (BNP, NT-proBNP, others), worsened exercise testing, decompensated hemodynamics, or evidence of progressive remodeling on imaging
 - High mortality risk using validated risk model for further assessment and consideration of advanced therapies
3. To assist with management of GDMT, including replacement of ACEI or ARB therapy with ARNI for eligible patients, or to address comorbid conditions such as chronic renal disease or hyperkalemia, which may complicate treatment
4. Persistently reduced LVEF $\leq 35\%$ despite GDMT for ≥ 3 months for consideration of device therapy in those patients without prior placement of ICD or CRT, unless device therapy contraindicated
5. Second opinion regarding etiology of HF; for example:
 - Evaluation for potential ischemic etiology
 - Suspected myocarditis
 - Established or suspected specific cardiomyopathies, eg, hypertrophic cardiomyopathy, arrhythmogenic right ventricular dysplasia, Chagas disease, restrictive cardiomyopathy, cardiac sarcoidosis, amyloid, aortic stenosis
 - Valvular heart disease with or without HF symptoms

6. Annual review for patients with established advanced HF in which patients/caregivers and clinicians discuss current and potential therapies for both anticipated and unanticipated events, possible HF disease trajectory and prognosis, patient preferences, and advanced care planning

7. Assess the possibility of participation in a clinical trial

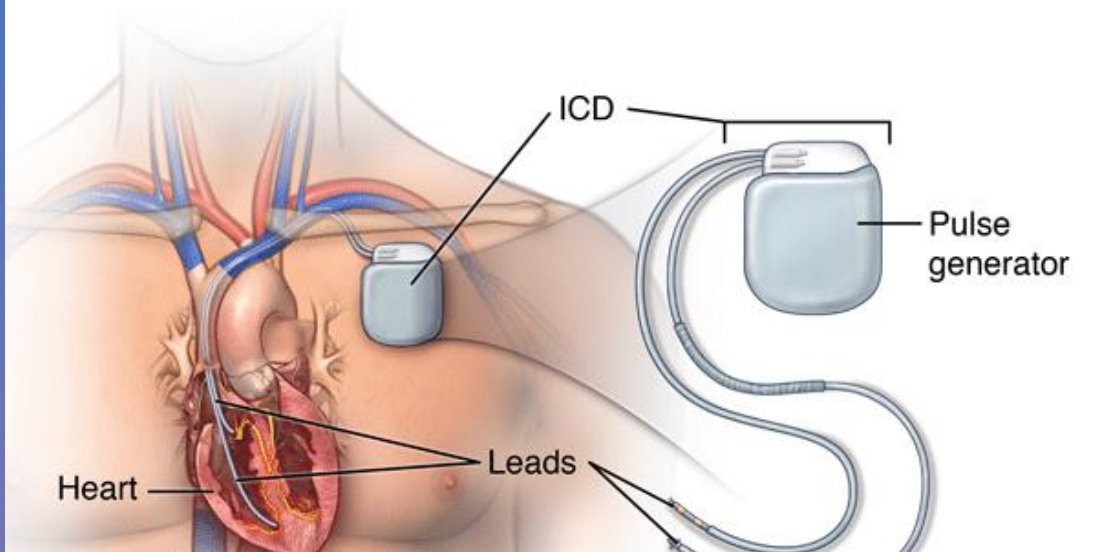
Pharmacologic Therapy

- Improvement of symptoms & prolongation of patient survival have both been seen with the use of multiple medications
- Primary Therapy
 - Described in table (1)
- Secondary Therapy
 - Provided to patients who cannot tolerate components of the primary regimen, or those who still have HF symptoms while on optimum primary therapy
 - Described in table (2)
- Antithrombotic Therapy

Type of therapy	Role in therapy	Drug	Typical initial dose (oral)	Target dose	Minimum dose titration interval
Renin-angiotensin system inhibitors/neprilysin inhibitors	Preferred	Sacubitril-valsartan (ARNI)	24/26 to 49/51 mg twice daily*	97/103 mg twice daily	Double dose after 1 to 2 weeks or as tolerated [¶]
	Alternatives	Lisinopril	2.5 to 5 mg once daily	20 to 40 mg once daily	
		Ramipril	1.25 to 2.5 mg once daily	10 mg once daily	
		Enalapril	2.5 mg twice daily	10 to 20 mg twice daily	
		Captopril	6.25 mg three times daily	50 mg three times daily	
		Trandolapril	1 mg once daily	4 mg once daily	
		Losartan	25 to 50 mg once daily	150 mg once daily	
		Candesartan	4 to 8 mg once daily	32 mg once daily	
Valsartan	20 to 40 mg twice daily	160 mg twice daily			
Beta blockers	Preferred	Carvedilol	3.125 mg twice daily	≤85 kg: 25 mg twice daily	Double every 2 weeks [¶]
				>85 kg: 50 mg twice daily	
		Carvedilol CR	10 mg once daily	80 mg once daily	
		Metoprolol succinate CR	12.5 to 25 mg once daily	200 mg once daily	
Bisoprolol	1.25 mg once daily ^Δ	10 mg once daily			
Mineralocorticoid receptor antagonists	Preferred	Spirololactone	12.5 to 25 mg once daily	25 to 50 mg once daily or in two divided doses	Double every 4 weeks [¶]
		Eplerenone	25 mg once daily	50 mg once daily	
SGLT2 inhibitors	Preferred	Dapagliflozin	10 mg once daily	Fixed dose	
		Empagliflozin	10 mg once daily		
	Alternative	Canagliflozin	100 mg once daily		

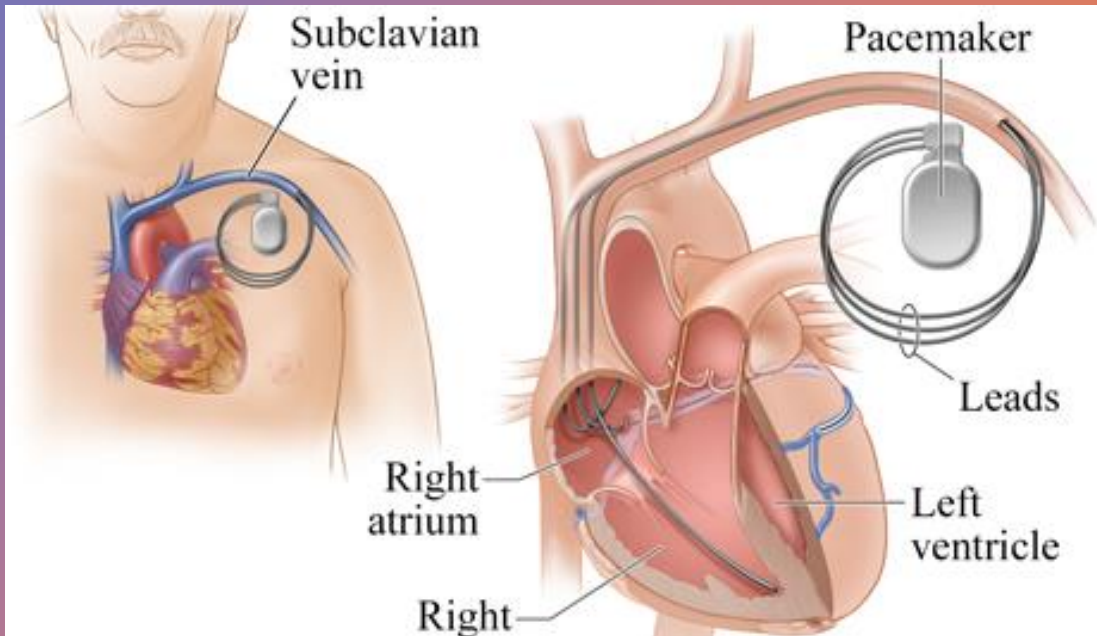
Type of therapy	Role in therapy	Typical initial dose (oral)	Target dose	Minimum dose titration interval
Isosorbide dinitrate plus hydralazine	Alternative to ARNI, ACE inhibitor, ARB; additional therapy for persistent symptoms; antihypertensive	20 mg isosorbide dinitrate plus 25 mg hydralazine three times daily	40 mg isosorbide dinitrate plus 100 mg hydralazine three times daily	2 to 4 weeks or as tolerated
Isosorbide dinitrate/hydralazine fixed-dose combination pill		20 mg/37.5 mg three times daily	40 mg/75 mg three times daily	
Ivabradine	Additional therapy for persistent symptoms; most appropriate for patients in sinus rhythm with HR \geq 70 bpm despite maximal beta blocker therapy	2.5 to 5 mg twice daily	7.5 mg twice daily	2 weeks or as tolerated
Vericiguat	Additional therapy for persistent symptoms; rarely used	2.5 mg once daily	10 mg once daily	2 weeks or as tolerated
Digoxin	Additional therapy for persistent symptoms; rarely used	0.0625 to 0.25 mg once daily*	Dose based on serum digoxin level*	

Implantable cardioverter defibrillator (ICD)



Device Therapy

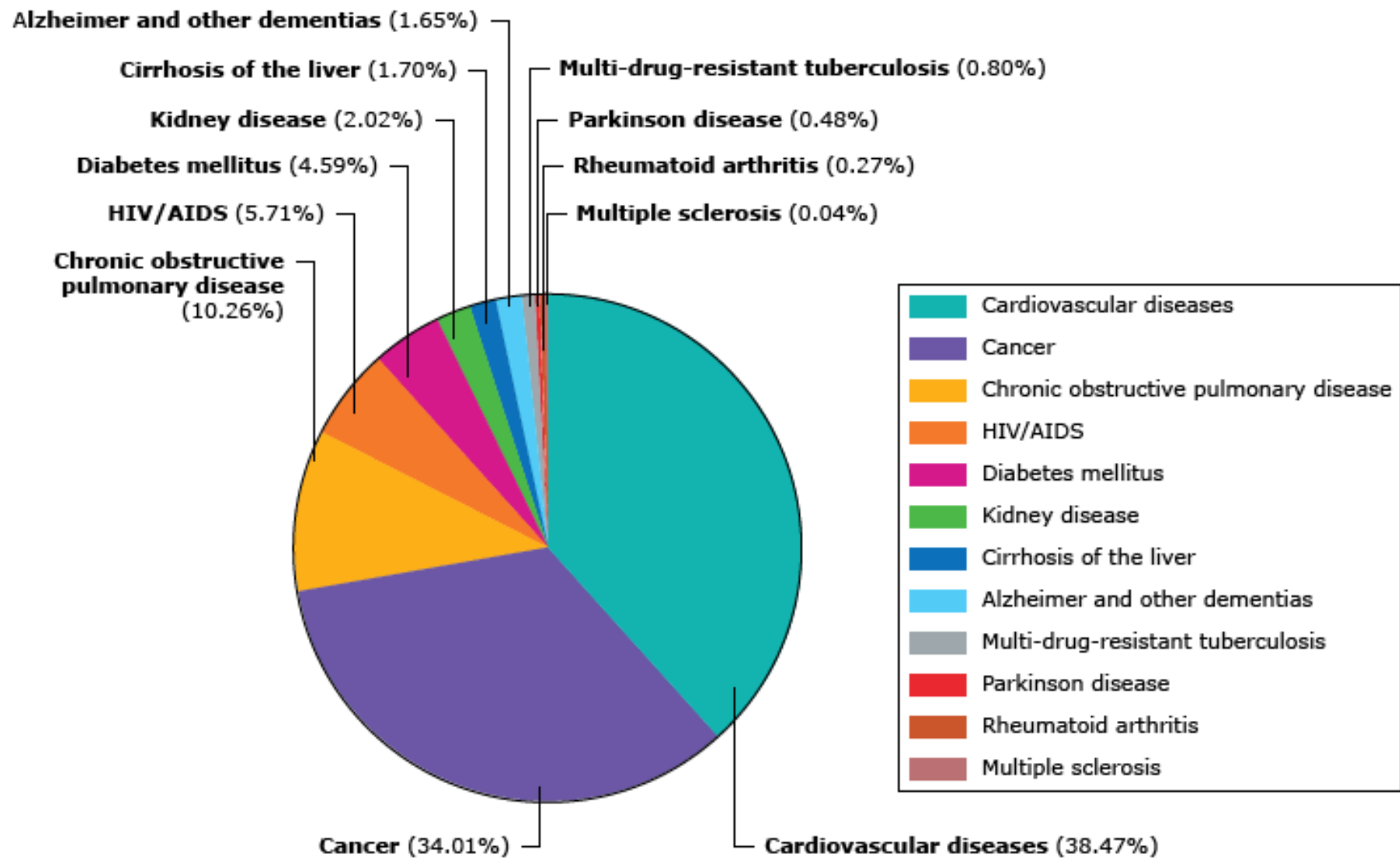
- Patients who meet the specific criteria may benefit from implantable cardioverter-defibrillator (ICD) or a cardiac resynchronization pacemaker



Palliative Care

- Interdisciplinary approach that focuses on improving quality of life through various ways
- Plays a vital role in HF patients with very advanced disease & usually provided by palliative care specialists

Primary palliative care skills	Subspecialty palliative care skills
Assessment/treatment of physical symptoms	
<ul style="list-style-type: none"> ▪ Basic pain management ▪ Basic management of other physical symptoms ▪ Basic use of adjuvant pain relievers ▪ Equianalgesic dose conversion 	<ul style="list-style-type: none"> ▪ Management of refractory pain ▪ Management of other refractory symptoms ▪ Methadone transition when large doses of opioids are being used ▪ Patients with addiction problems and serious illness
Psychological, social, cultural, and spiritual aspects of care	
<ul style="list-style-type: none"> ▪ Basic management of depression/anxiety ▪ Exploration of psychosocial suffering ▪ Basic exploration of spiritual and religious views ▪ Basic exploratory family meeting 	<ul style="list-style-type: none"> ▪ Management of more complex depression, anxiety, grief, and existential distress ▪ Severe religious/spiritual suffering
Serious illness communication issues	
<ul style="list-style-type: none"> ▪ Exploring patient goals in light of circumstances ▪ Making recommendations about code status ▪ Seeking consensus among treating professionals ▪ Seeking consensus among the patient and family 	<ul style="list-style-type: none"> ▪ Dying patients who want "everything" ▪ Major conflict among family members ▪ Major conflict among treating teams ▪ Requests about assisted dying
Care coordination	
<ul style="list-style-type: none"> ▪ Coordinating care among specialists ▪ Clearly defining the primary treating team ▪ Managing transitions to hospice care ▪ Managing transitions out of the hospital 	<ul style="list-style-type: none"> ▪ Transition to hospice with no clear provider ▪ Patient/family major resistance to discharge ▪ Conflict with the designated outpatient provider

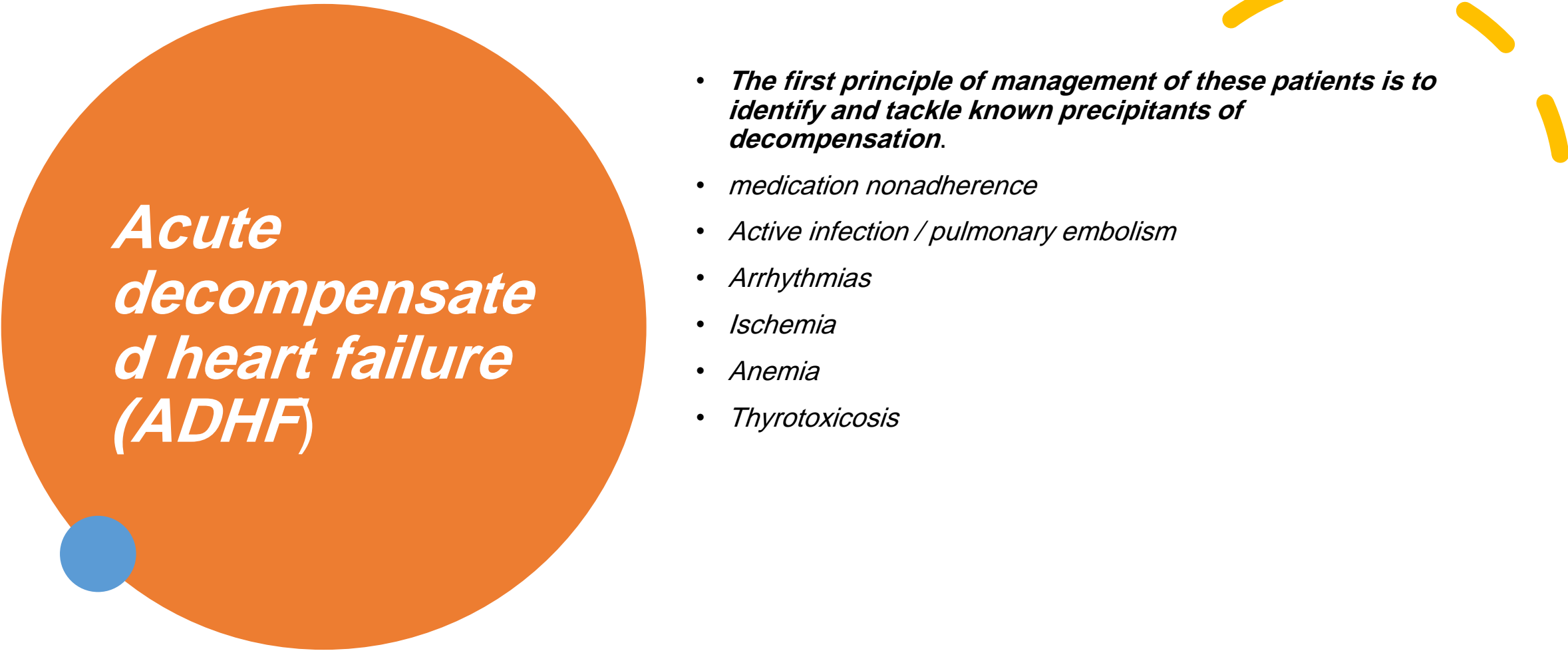


N = 19,228,760.



Management of Acute Decompensated HF

Mohammad Al Damen



Acute decompensate d heart failure (ADHF)

- *The first principle of management of these patients is to identify and tackle known precipitants of decompensation.*
- *medication nonadherence*
- *Active infection / pulmonary embolism*
- *Arrhythmias*
- *Ischemia*
- *Anemia*
- *Thyrotoxicosis*

Precipitating factors

I. Medication related :

- a) Non adherent to HF medications
- b) Medication that causes Na/water retention (corticosteroids)
- c) Alcohol abuse

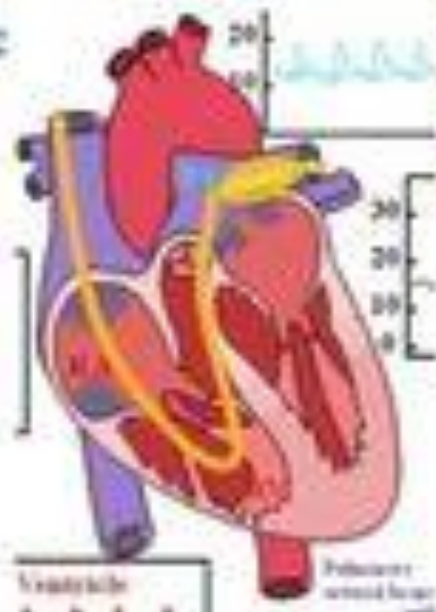
II. Diseases related:

- a) Pulmonary embolism
- b) Myocardial ischemia
- c) Non adherent to fluid restrictions
- d) Uncontrolled hypertension.

Diagnosis

1. Medical History: history of HF.
2. Hemodynamic parameters: PCWP (pulmonary Capillary Wedge pressure) & CI (Cardiac Index)

- A) PCWP:



1) Normal PCWP: 8-12 mmHg

2) ADHF > 18 mmHg

3) Target 15-18 mmHg: to ensure optimal filling pressure

Diagnosis

- B) CI (COP/ Body surface Area) :
- Normal : 2.8-3.6 L/min/m²
- ADHF < 2.2 L/min/m²

• Subsets of ADHF

I. Subset I
(warm & dry)
PCWP < 18
CI > 2.2 L/min/m²

II. Subset II
(warm & wet)
PCWP > 18 mmHg
CI > 2.2 L/min/m²

III. Subset III
(Cold & dry)
PCWP < 18
mmHg
CI < 2.2 L/min/m²

VI. Subset IV
(Cold & wet)
PCWP > 18
CI <
2.2 L/min/m²



1

Administer **oxygen** in patients with capillary oxygen saturation < 90% or partial pressure of oxygen in arterial blood (PaO₂) < 60 mm Hg.



2

Administer **IV loop diuretics** (such as furosemide) to treat symptoms of fluid overload. low-dose dopamine infusion may be considered in addition to loop diuretic.



3

Measure serum electrolytes, urea nitrogen, and creatinine during titration of heart failure medications (including diuretics and renin-angiotensin-aldosterone system inhibitors)



4

Use **invasive hemodynamic monitoring** with pulmonary artery catheter to guide therapy in patients with suspected heart failure in whom fluid status cannot be determined from clinical assessment



- For patients that have significant dyspnea despite supplemental oxygen and aggressive diuresis:

- Consider **vasodilators** (IV nitroglycerin) as adjunct to diuretics to relieve dyspnea in absence of symptomatic hypotension.
- **noninvasive positive pressure ventilation.**
- Consider cautious use of **IV opiates** (morphine) in particularly distressed, anxious patients to relieve symptoms and improve breathlessness.

For patients with borderline or low blood pressure with documented severe systolic dysfunction

- Consider short-term, continuous **IV inotropic** support (such as dopamine/ dobutamine)

Ventilatory support:

-Consider **noninvasive ventilation** in patients with respiratory distress (respiratory rate > 25 breaths/minute, transcutaneous oxygen saturation < 90%)

-start as early as possible to improve breathlessness and reduce rate of mechanical endotracheal intubation

- **Intubation** recommended if unable to noninvasively manage respiratory failure leading to:

- Hypoxemia (partial pressure of oxygen in arterial blood < 60 mm Hg)
- Hypercapnia (partial pressure of carbon dioxide in arterial blood > 50 mm Hg)
- Acidosis (pH < 7.35)



Pulmonary Edema

- Acute heart failure with pulmonary edema 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 and exacerbation of hypoxemia and hypercapnia.

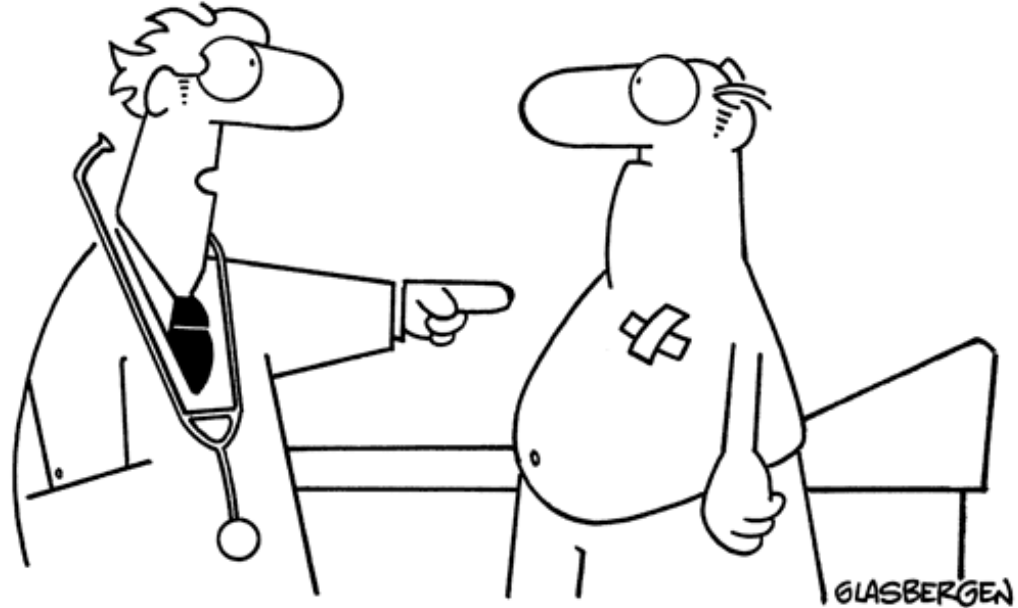
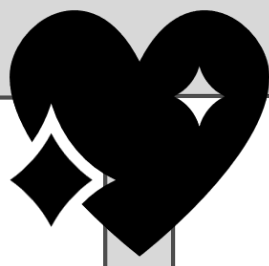


- The key elements of the management of pulmonary edema:



16.15 Management of acute pulmonary oedema

Action	Effect
Sit the patient up	Reduces preload
Give high-flow oxygen	Corrects hypoxia
Ensure continuous positive airway pressure (CPAP) of 5–10 mmHg by tight-fitting mask	Reduces preload and pulmonary capillary hydraulic gradient
Administer nitrates: IV glyceryl trinitrate (10–200 µg/min) Buccal glyceryl trinitrate 2–5 mg	Reduces preload and afterload
Administer a loop diuretic: Furosemide (50–100 mg IV)	Combats fluid overload
*The dose of nitrate should be titrated upwards every 10 mins until there is an improvement or systolic blood pressure is < 110 mmHg.	



“Whenever your cholesterol gets too high, a sensor will send out a signal that automatically locks the kitchen door and turns on your treadmill.”



“Cholesterol is good for you. It clogs your veins so you don’t bleed as much when you get a cut!”