

CONGESTIVE HEART FAILURE



Muhammad Al-Shorbagy, PhD

Pharmacology & Toxicology
Faculty of Pharmacy, Cairo University
mshorbagydr@staff.cu.edu.eg

Background

- HF is the final common pathway for several common illnesses especially hypertension and coronary artery disease.
- HF is currently the leading diagnosis and cause of hospitalizations among patients 65 years and older.

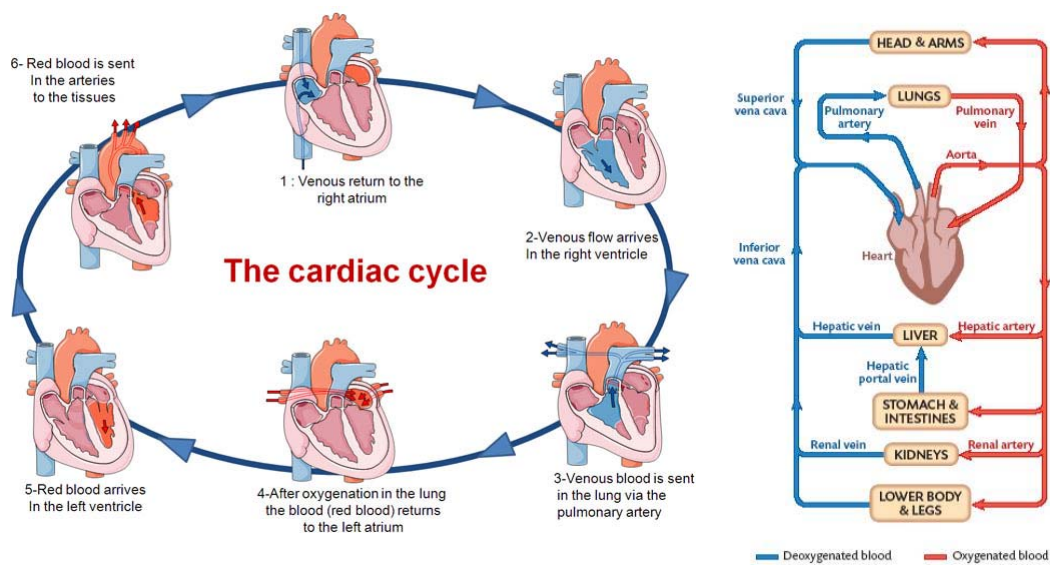
Role of nursing



- Nurses assess a patient's cognitive function and knowledge of heart failure to help them develop essential skills to manage their disease.
- The goal is to partner with patients for better outcomes.

3

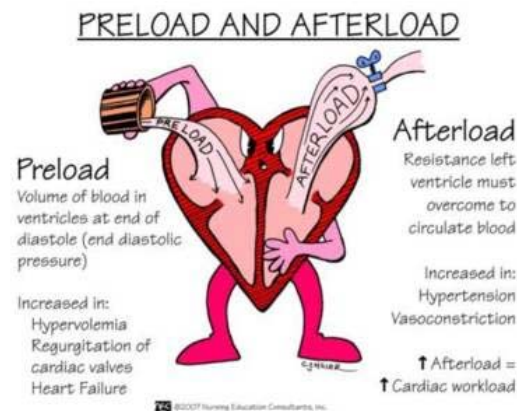
The Cardiac Cycle



4

Factors affecting Cardiac output (CO)

- Preload (ventricular filling)
- Afterload (degree of resistance of blood ejection from the heart)
- Cardiac contractility (force)
- Heart rate (beat/min)



What is heart failure?

- It is the inability of the heart to pump blood adequately to the tissues

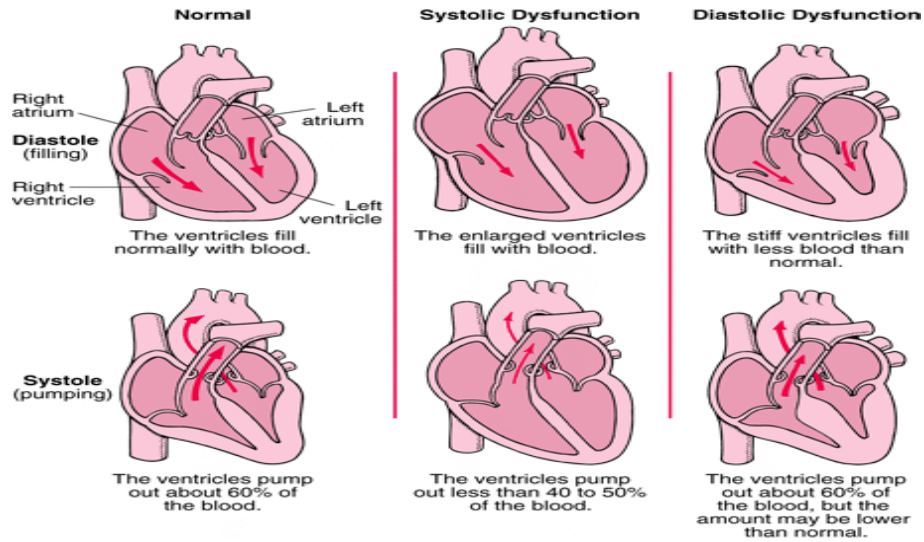
Categories

- **Systolic dysfunction:** appear during the contraction phase as a decrease in contractility and ejection fraction (EF%).
- **Diastolic dysfunction:** ventricular muscles are not flexible so filled with small blood volume. EF% is normal but the volume pumped is lower than normal

EF= pumped volume by ventricles/original volume in ventricles
(evaluated by Echocardiogram: normal EF>50%)

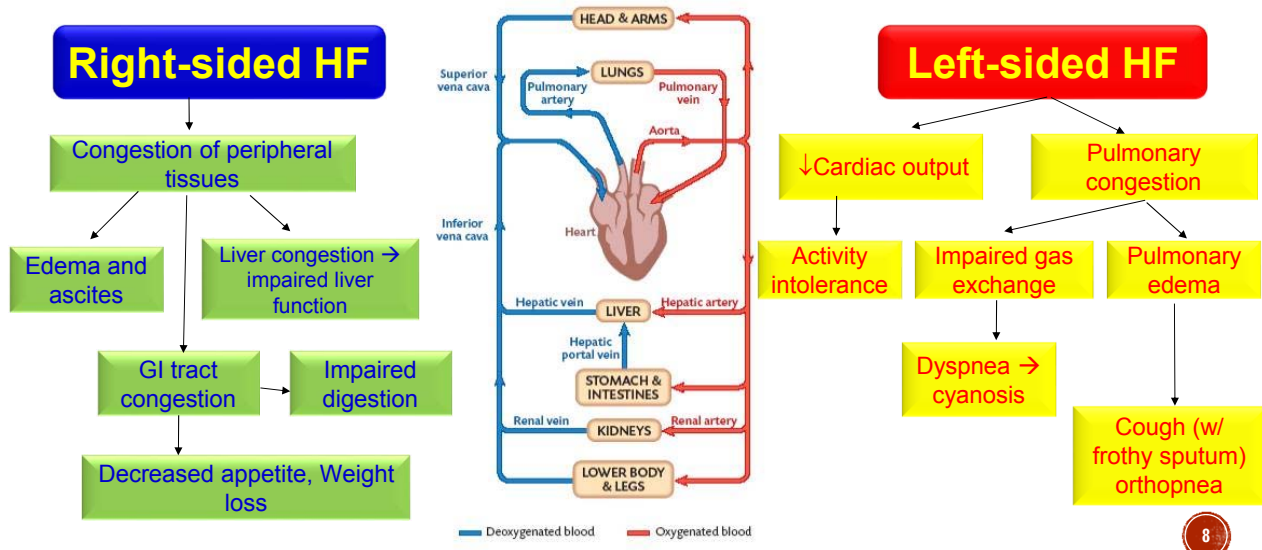
6

Systolic and Diastolic HF



7

Signs & Symptoms of HF



8

Signs & Symptoms of Right-sided HF



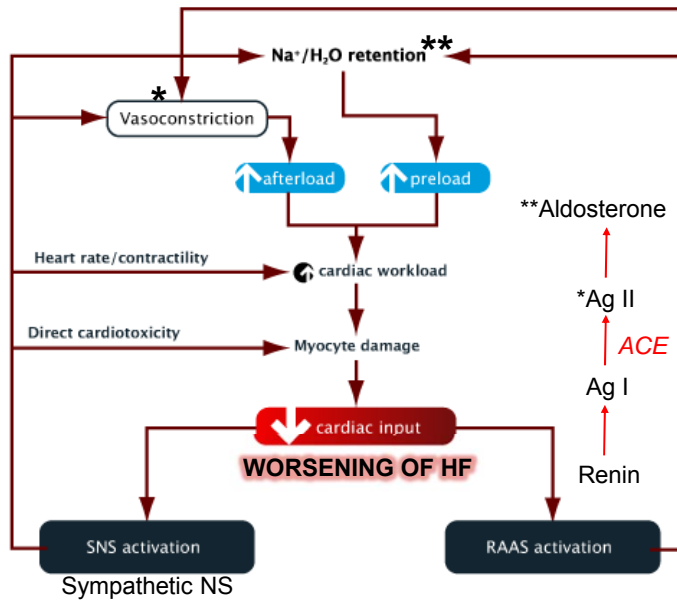
Jagular vein distension



Peripheral edema

9

Compensatory mechanisms for HF



10

Management of HF

Life style modifications

- **Salt restriction** (prevent sodium/water retention)
- **Exercises** (help decrease preload)
- **Smoking and alcoholism** (decrease afterload)
- **Body weight (daily weight)** (to check water retention)
- **Supportive stockings** (to control oedema)

11

Management of HF

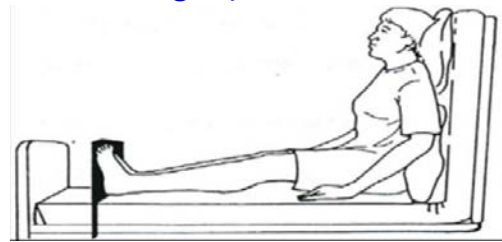
Drug Management

Drug	Action	Examples
ACE (angiotensin-converting enzyme) Inhibitors	Primary drug of choice: block angiotensin II and aldosterone production, dilate vessels, prolong life Side effect: cough	Lisinopril, enalapril, captopril (-pril)
Angiotensin II receptor blockers (ARBs)	Similar to ACE inhibitors. More tolerable for most patients because has no cough side effects.	Valsartan, losartan (-sartan)
Diuretics	Help kidneys eliminate salt and water → decreased fluid volume to relieve the heart's workload. Side effect: hypokalemia (↓K⁺)	Furosemide, hydrochlorothiazide
Beta-blockers	Slows heart rate and blocks excessive heart stimulation. Use with caution (<i>might decrease CO and worsen case</i>)	Metoprolol (-olol)
Anticoagulants	Prevent formation of blood clots.	Heparin
Vaso-/arteriodilators	Decrease pre-/after load	Nitrates - hydralazine
Positive inotropic drugs	Increase force (not the rate) of heart beats	Digoxin - dopamine

12

Nursing care of patients with HF

- Maintain the patient in **high fowler's position**
- Elevate extremities except when the patient is in acute distress
- Frequently monitor vital signs
- Change position frequently
- Restrict fluids as ordered (monitor weight)



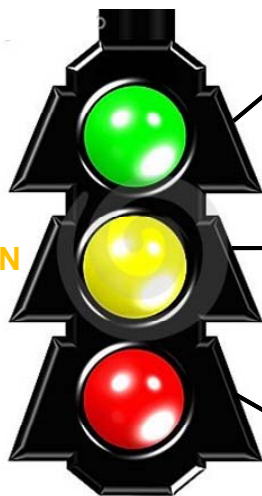
13

Action plan and follow up

GO

CAUTION

STOP



No change in symptoms
 No cough or wheeze - Breathing is good
 Usual strength and activity
 Weight is stable

Weight gain
 Have to sleep sitting up (orthapnea)
 Start coughing at night
 Notice swelling in ankles or any part of your body
 Become tired faster or feel losing energy
 Wheezing (noisy breathing)

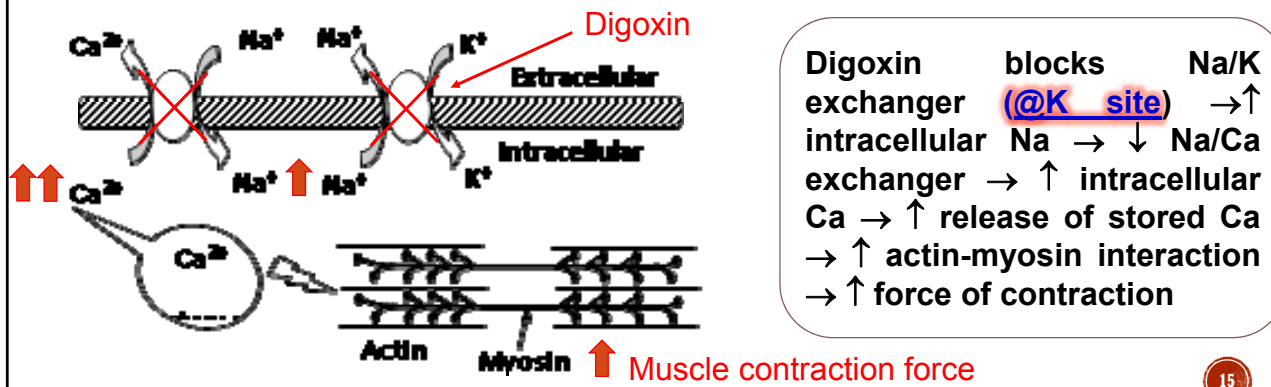
Trouble breathing
 Pain or tightness in chest
 Fainting
 Feel worried or like something bad will happen

14

Cardiac glycosides: Digitalis (e.g: DIGOXIN)

Pharmacological actions

1. Mechanical effect (\uparrow force of contraction)



15

Cardiac glycosides: Digitalis (e.g: DIGOXIN)

Pharmacological actions

1. Mechanical effect (\uparrow force of contraction)

Potassium relation to therapeutic efficacy of digoxin:

Digoxin competes with K for the exchanger

- **If K⁺ levels are low** \rightarrow digoxin will work unopposed \rightarrow $\uparrow\uparrow\uparrow$ therapeutic effect of digoxin and may reach toxicity so **hypokalemia** \rightarrow $\uparrow\uparrow\uparrow$ **digoxin toxicity**.
- **If K⁺ levels are high** \rightarrow K⁺ will displace digoxin from its binding site \rightarrow $\downarrow\downarrow$ therapeutic effect of digoxin **so hyperkalemia** \rightarrow $\downarrow\downarrow\downarrow$ **digoxin activity**.

16

Cardiac glycosides: Digitalis (e.g: DIGOXIN)

Pharmacological actions

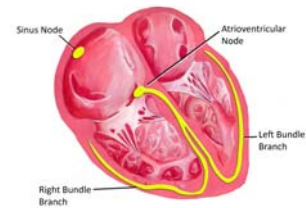
2. Electrical effect

A. Action on heart rate

Digoxin decreases HR (beneficial to decrease cardiac work)

B. Action on conductivity

Digoxin decreases conduction of impulses from atria to ventricles through the atrioventricular node (AVN) (may cause heart block at toxic doses)



17

Cardiac glycosides: Digitalis (e.g: DIGOXIN)

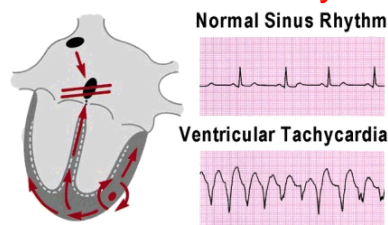
Pharmacological actions

2. Electrical effect

C. Action on automaticity

Regular dose: decreased automaticity

Toxic dose: increased automaticity → ventricular arrhythmia



18

Cardiac glycosides: Digitalis (e.g: DIGOXIN)

Pharmacological actions

3. Gastrointestinal tract (GIT)

Local irritation – nausea – vomiting - diarrhea

4. Central nervous system (CNS)

Toxic dose: **hallucinations – yellow vision**

5. Hormonal

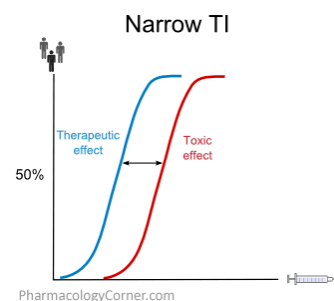
In males: **may cause enlargement of breast**

19

Cardiac glycosides: Digitalis (e.g: DIGOXIN)

Pharmacokinetics

- Digoxin is eliminated by **renal excretion** (check renal condition of the patient).
- Digoxin has a **narrow therapeutic range** (the difference between the therapeutic and toxic doses is small), so **toxicity levels may be reached easily**.



Cardiac glycosides: Digitalis (e.g: DIGOXIN)

Dosing

- **Early digitalization: use a large dose of digoxin (loading dose) to reach optimum blood levels.**
- **Maintenance dose: a smaller but continuous dose of digoxin is then used to keep blood levels within the therapeutic range.**

21

Cardiac glycosides: Digitalis (e.g: DIGOXIN)

Side effects

1. **GIT effects (anorexia, nausea, vomiting, diarrhea).**
2. **CNS effects (Hallucinations & yellow vision).**
3. **Heart (Bradycardia, heart block, & ventricular arrhythmias).**

22

Cardiac glycosides: Digitalis (e.g: DIGOXIN)

Toxicity

Predisposing factors

1. **Hypokalemia ($\downarrow K^+$) \rightarrow $\uparrow\uparrow$ digoxin toxicity.**
2. **Kidney failure \rightarrow $\uparrow\uparrow$ digoxin level \rightarrow $\uparrow\uparrow$ digoxin toxicity.**
3. **Heart disease.**

23

Cardiac glycosides: Digitalis (e.g: DIGOXIN)

Toxicity

Management of toxicity

1. **Stop administration of digitalis & K^+ -depleting diuretics.**
2. **Monitoring of K^+ , and give KCl (K -competes \rightarrow digoxin).**
3. **Antiarrhythmic drugs as lidocaine and phenytoin to control ventricular arrhythmia.**
4. **Atropine to control the bradycardia and AV block.**
5. **Administer digoxin antibodies**

24

Cardiac glycosides: Digitalis (e.g: DIGOXIN)

Drug interactions

1. **Thiazide & loop diuretics: hypokalemia** → ↑ digoxin toxicity.
2. **ACE inhibitors** → hyperkalemia → ↓ therapeutic response of digoxin.
3. **Quinidine (antiarrhythmic): displaces digoxin from plasma protein binding sites** → ↑ digoxin toxicity.
4. **Cholestyramine, Kaolin, Pectin, Sulfasalazine** → ↓ absorption of digoxin

25

CASE STUDY

Chief Complaint: 62-year-old woman with shortness of breath and swelling.

History: A.M., a 62-year-old woman with a history of rheumatic fever while in her twenties, presented to her physician with complaints of increasing shortness of breath ("dyspnea") upon exertion. She also noted that the typical swelling she's had in her ankles for years has started to get worse over the past two months, making it especially difficult to get her shoes on toward the end of the day. In the past week, she's had a decreased appetite, some nausea and vomiting, and tenderness in the right upper quadrant of the abdomen.

On physical examination, Martha's jugular veins were noticeably distended.

26

CASE STUDY

Questions

1. You examine A.M.'s abdomen and find that she has an enlarged liver ("hepatomegaly") and a moderate degree of ascites (water in the peritoneal cavity). Explain these findings.
2. She is advised to wear support stockings. Why would this help her?
3. How might A.M.'s body compensate for the above condition?
4. A.M. is started on a medication called digoxin. Why was she given this medication, and how does it work?