L6: Heart Failure

(Prognosis & Management)

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MEDICINE 433

objectives

1. Diagnostic tests of HF.
2. Different treatment of HF.
3. Side effects of medication of HF.
4. Management of cardiac risk factors for HF.
5. Role of devices and life style in HF treatment.

Color index: Step up to medicine, slide, Female's note , Male's note , Davidson,

Management

- **Aims of therapy:**
  - ✓ Reduce symptoms & improve quality.
  - ✓ Reduce hospitalization.
  - ✓ Reduce mortality.
    - Pump failure
    - Sudden cardiac death
- **Correction of reversible causes:**
  - Ischemia
  - Valvular heart disease
  - Thyrotoxicosis and other high output status
  - Shunts
  - Arrhythmia
    - A fib, flutter, PJRT
  - Medications
    - Ca channel blockers, some antiarrhythmic

#The main therapy fo heart failure patients are :

ACEIs or ARbs → vasodilators

Beta Blockers → decrease heart rate

Aldosterone Antagonist or Diuretics → decrease fluid retenstion

-Mitral stenosis is less likely to cause HF.
-left atrial dilation can cause atrial fibrillation

A- Systolic dysfunction

1. General lifestyle modification:

- Sodium restriction (less than 4 g/day).
- Weight lost
- Smoking cessation
- Restrict alcohol use
- Exercise program
- All patients should monitor weight daily to detect fluid accumulation.
- Annual influenza vaccine and pneumococcal vaccine recommended.

Hypertension
is a common cause of CHF and should be treated.
Goal is to reduce preload and afterload

A- Systolic dysfunction

2. Thiazide Diuretics ,The most effective symptomatic relief	
Drugs	1. Hydrochlorothiazide—modest potency. 2. Chlorothiazide 3. Metolazone 4. Indapamide 5. Chlorthalidone
MOA	Act by promoting the renal excretion of salt and water by blocking tubular reabsorption of **Na and Cl.**
indications	1. Most effective to patients with moderate to severe CHF. 2. Recommended for patients with systolic failure and volume overload. 3. Don't reduce mortality or improve prognosis, just for symptoms relief of volume overload (dyspnea, peripheral edema).
Side Effects	Pre-renal azotemia Skin rashes Neutropenia Thrombocytopenia Hyperglycemia ↑ Uric Acid Hepatic dysfunction

A- Systolic dysfunction

2. Loop diuretics, The most effective symptomatic relief	
Drugs	1. Furosemide (Lasix)—most potent. " monitor for renal function and check for hypokalemia" 2. Bumex (Bumetanide) 3. Torsemide
MOA	**Inhibit chloride reabsortion in ascending limb of loop of Henle** results in natriuresis, kaliuresis and metabolic alkalosis
indications	1. Most effective to patients with moderate to severe CHF. 2. Recommended for patients with systolic failure and volume overload. 3. Don't reduce mortality or improve prognosis, just for symptoms relief of volume overload (dyspnea, peripheral edema).
Side Effects	pre-renal azotemia Hypokalemia Skin rash ototoxicity

in sever heart failure, combination of loop and thiazide diuretics

A- Systolic dysfunction

3. K+ Sparing Agents*			
Drugs	**1. Triamterene & amiloride:**	2. **Spironolactone** (aldosterone antagonist)	3. Eplerenone
MOA	acts on distal tubules to ↓ K secretion	A potassium sparing diuretic that acts by antagonism of aldosterone in the distal renal tubules	aldosterone receptor antagonist similar to spironolactone
indications		**1. Prolong survival** in selected patients with CHF. 2. Monitor serum K and renal function. 3. Spironolactone is proven effective only for **more advanced stages of CHF (classes III and IV).**	1. is an alternative to spironolactone (does not cause gynecomastia).
Note	reduces morbidity and mortality in patients with class III or IV heart failure. It is contraindicated in renal failure.		

A- Systolic dysfunction

4. ACE inhibitors	
Drugs JUST FOR YOU	quina**pril**, perindo**pril**, rami**pril**, capto**pril**, benaze**pril**, trandola**pril**, fosino**pril**, lisino**pril**, moexi**pril**, enala**pril**
MOA	They block the R-A-A system by inhibiting the conversion of angiotensin I to angiotensin II → vasodilation and ↓ Na retention.
indications	1. Ace Inhibitors were found to improve survival in CHF patients. 2. Delay onset & progression of HF in pts with asymptomatic LV dysfunction ↓ cardiac remodeling 3. Decrease preload and afterload
Side Effects	1. Angioedema 2. Hypotension 3. Renal insuffiency. 4. Cough + rash
Contraindication	1. Pregnency 2. with Spironolactone 3. Sever renal failure

A- Systolic dysfunction

4. ACE inhibitors:	
combination	•The combination of B blockers and an ACE inhibitors required for patient with LVEF (ejection fraction) less than 40% either symptomatic or asymptomatic. •The combination of a diuretic and an ACE inhibitor should be the initial treatment in most symptomatic patients. •ACE inhibitors reduce mortality, prolong survival, and alleviate symptoms in mild, moderate, and severe CHF "for all classes NYHA I-IV
Note	**Always start at a low dose to prevent hypotension.** **Monitor BP, potassium, BUN, and creatinine.**

A- Systolic dysfunction

5. Angiotensin II receptor blockers (ARBs)

Drugs	1. Cande**sartan** 2. Val**sartan**
indications	**Used in patients unable to take ACE inhibitors due to side effect** of cough or angioneurotic edema, but should **not** replace ACE inhibitors if patient tolerates an ACE inhibitor.

6. β-blockers*

*in HF patient with sever pulmonary edema we should avoid using B blockers because it suppresses the normal reflux of tachycardia which is it a good thing in case of edema

Drugs	Not all beta-blockers are equal. There is evidence only for 1. metoprolol, 2. bisoprolol, 3. carvedilol.
Indications	**Proven to decrease mortality in patients with post-MI heart failure.** ➢ **Reported to improve symptoms of CHF** *better than ACE*; may slow progression of heart failure by slowing down tissue remodeling. The decrease in heart rate leads to decreased oxygen consumption. **Beta-blockers also have antiarrhythmic and anti-ischemic effect.** ➢ Should be given to ***stable*** **patients** with mild to moderate CHF (class I, II, and III) unless there is a **non-cardiac contraindication.**

! carvedilol leads to significant improvement in survival compared with metoprolol.

A- Systolic dysfunction

7. Digitalis

MOA	1. +ve inotropic effect by ↑ intracellular Ca & enhancing actin-myosin cross bride formation **(binds to the Na-K ATPase → inhibits Na pump** → ↑ intracellular Na → ↑ Na-Ca exchange 2. Vagotonic effect 3. Arrhythmogenic effect
Indications	•Positive inotropic agent •Useful in systolic dysfunction with **atrial fibrillation (Afib).** •In case of A/V block or severe bradycardia → **atropine** followed by temporary PM if needed •In life threatening arrhythmia → digoxin-specific fab antibodies •Provides short-term symptomatic relief (used to control dyspnea and will decrease frequency of hospitalizations) but **has *not* been shown to improve mortality.** **• For patients with EF < 40%, who continue to have symptoms despite optimal therapy (with ACE inhibitor, beta-blocker, aldosterone antagonist, and a diuretic).**
Note	Serum digoxin level should be checked periodically.

Signs of digoxin toxicity:

- **GI**: Nausea/vomiting, Anorexia
- **Cardiac**: Ectopic(ventricular) beats, AV block (usually 2nd degree), Afib, Sinus bradycardia and arrest, Atrial tachycardia with A/V Block, Development of junctional rhythm in patients with a fib, PVC's, VT/ V fib (bi-directional VT)
- **CNS**: Visual disturbances, Disorientation, Headache, Xanthopsia sotoma

A- Systolic dysfunction

8. Hydralazine and isosorbide dinitrates	
indications	Can be used in patients who cannot tolerate ACE inhibitors.
combination	The combination of hydralazine and isosorbide dinitrate has been shown to improve mortality in selected patients with CHF. But not as effective as ACE inhibitors and require inconvenient dosing schedules.

The following medications are contraindicated in patients with CHF:

Metformin	may cause potentially lethal lactic acidosis.
Thiazolidinediones	causes fluid retention.
NSAIDs	may increase risk of CHF exacerbation.
Glitazone	may precipitate HF.
Some antiarrhythmic agents that have negative ionotropic effects	

Calcium channel blockers (CCB) play no role in treatment of CHF and some may actually raise mortality. However, **amlodipine** and **felodipine** are safe to use in CHF if CCBs are needed for another indication (e.g., hypertension or angina).

Dobutamine used for plumonary eodema

A- Systolic dysfunction

9. Positive inotropic agents	
Drugs	dopamine, dobutamine, milrinone, amrinone
indications	1. These are the drugs that improve myocardial contractility 2. Several studies showed ↑ mortality with oral inotropic agents 3. So the only use for them now is in acute sittings **as cardiogenic shock**

10. Anticoagulation	
Drugs	**coumadine**
indications	1. Atrial fibrillation 2. H/o embolic episodes 3. Left ventricular apical thrombus

11. Antiarrhythmics (coumadine)	
indications	1. Most common cause of SCD in these patients is ventricular tachyarrhythmia 2. Patients with h/o sustained VT or SCD → ICD implant 3. Patients with non sustained ventricular tachycardia • Correction of electrolytes and acid base imbalance • In patients with ischemic cardiomyopathy → ICD implant is the option after r/o acute ischemia as the cause • In patients wit non ischemic cardiomyopathy management is ICD implantation

Management

The following devices have been shown to reduce mortality in select patients:

- **An ICD** *(implantable cardioverter defibrillator)* lowers mortality by helping prevent sudden cardiac death . It is indicated for class II or III symptoms despite optimal medical treatment.

- **An CRT** *(Cardiac resynchronization therapy):* This is biventricular pacemaker, indicated for patient not responding to thearby in the following situations:
  - sever mitral regurgitation
  - NYHA class III HF
  - Systolic HF
  - Non-reversible cause
  - Left bundle branch block (QRS>120 ms)

NOTE: Most patients who meet criteria for CRT are also candidates for ICD and receive a combined device.

B- Diastolic dysfunction

1. **Beta-blockers have clear benefit and should be used.**

2. **Diuretics are used for symptom control (volume overload).**

3. **Digoxin and spironolactone should NOT be used.**

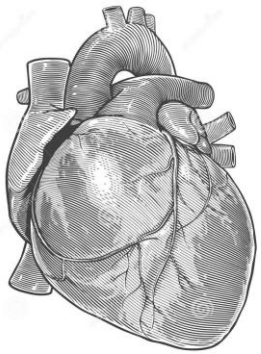
4. **ACE inhibitors and ARBs—benefit is not clear for diastolic dysfunction.**

Monitoring a patient with CHF:

1. **Weight** —unexplained weight gain can be an early sign of worsening CHF
2. **Clinical manifestations** (exercise tolerance is key); peripheral edema
3. **Laboratory values** (electrolytes, K, BUN, creatinine levels; serum digoxin, if applicable)

Most common cause of death from CHF is sudden death from ventricular arrhythmias. Ischemia provokes ventricular arrhythmias.

Quick Hits!



Standard treatment of CHF includes a **loop diuretic**, **ACE inhibitor**, and **beta-blocker**. Depending on severity and patient factors, other medications such as digoxin, hydralazine/nitrate, spironolactone may be added.

Medications that have shown to lower mortality in CHF:

- ACE inhibitors and ARBs.
- Beta-blockers.
- Aldosterone antagonists (spironolactone).
- Hydrazaline, plus nitrate.

The overall 5-year mortality for all patients with CHF is about 50%.

C- General principles in treatment of CHF

- No one simple treatment regimen is suitable for all patients. The following is a general guide line, but the order of therapy may differ among patients and/or with physician preferences.

Mild CHF (NYHA classes I to II):	Mild to Moderate CHF (NYHA classes II to III):	Moderate to Severe CHF (NYHA classes III to IV):
• Mild restriction of sodium intake(no-added-saltdietof4gsodium)and physical activity. • Start a **loop diuretic** if volume overload or pulmonary congestion is present. • Use an **ACE inhibitor** as a first-line agent.	•Start a diuretic (loop diuretic) and an ACE inhibitor •Add a **b-blocker** if moderate disease (class II or III) is present and the response to standard treatment is suboptimal.	•Add digoxin (to loop diuretic and ACE inhibitor) •Note that digoxin may be added any time for symptoms relief only in patients with systolic dysfunction**. (it does not improve mortality.)** •In patients with class IV symptoms who are still symptomatic despite the above, adding **spironolactone** can be helpful.

Management

○ Ventricular assist device (VAD):

- These devices may allow for a patient requiring continuous hospitalization to eventually be discharged with relatively straight forward out patient follow up. Patients may live with these devices for a year or more.

- Life long anticoagulation with heparin or warfarin is essential without exceptions as these devices are very thrombogenic.

From Kumar and Clark's Clinical Medicine

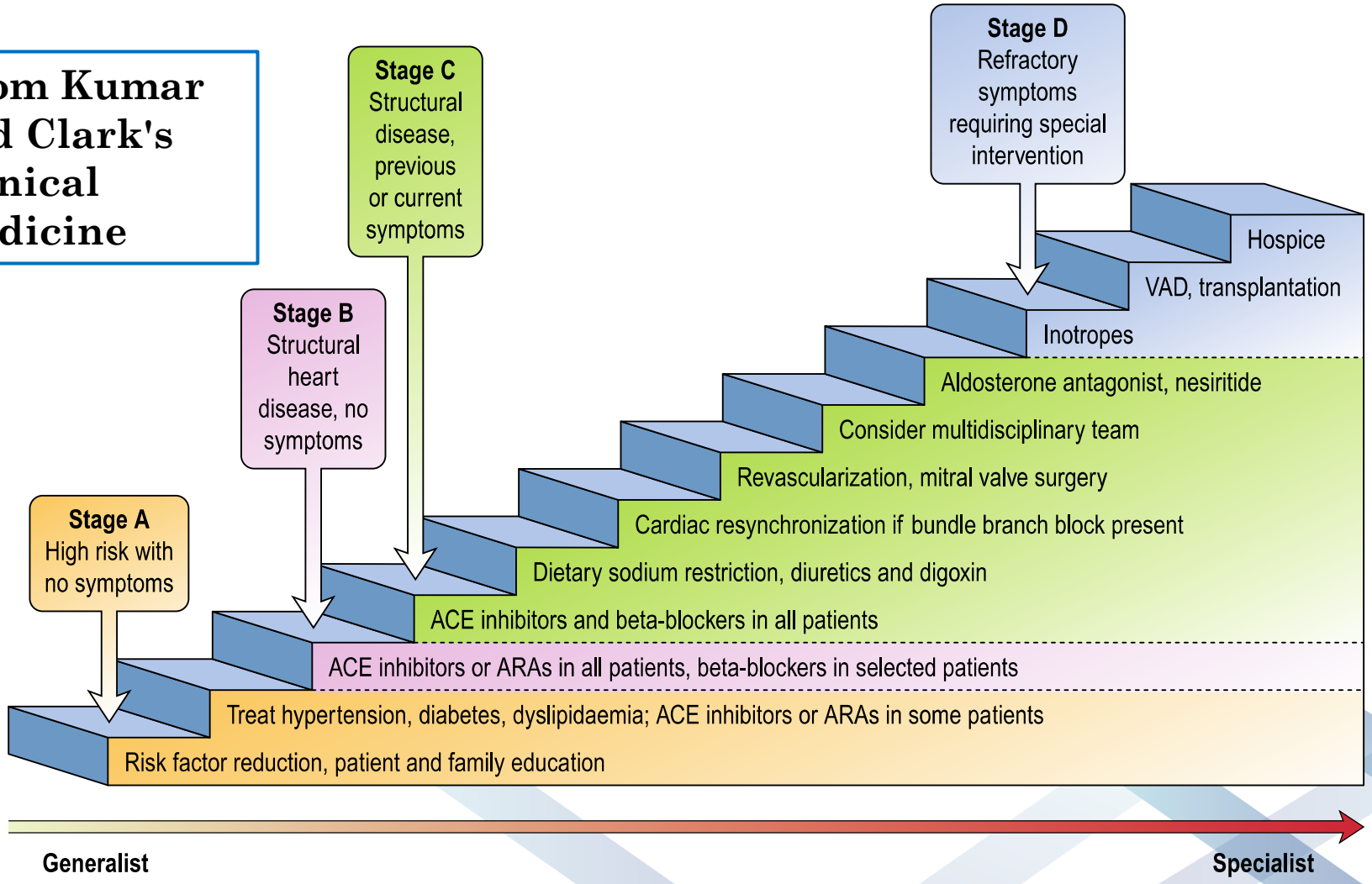


Figure 14.54 Stages of heart failure and treatment options for systolic heart failure. ARA, angiotensin II receptor antagonist; ACE, angiotensin-converting enzyme; VAD, ventricular assisted device.

Management

New Methods:

- Implantable ventricular assist devices
- Biventricular pacing (only in patient with LBBB & CHF)
- Artificial Heart

Cardiac Transplant:

- It has become more widely used since the advances in immunosuppressive treatment
- Survival rate
  - 1 year 80% - 90%
  - 5 years 70%

Prognosis

- Annual mortality rate depends on patients symptoms and LV function.
- 5% in patients with mild symptoms and mild ↓ in LV function.
- 30% to 50% in patient with advances LV dysfunction and severe symptoms.
- 40% – 50% of death is due to SCD.

MCQs

1- Which one of the following is the mechanism of action of loop diuretics (Furosemide)??

A. Block Na reabsorbtion in loop of henle and distal convoluted tubules
B. Inhibit Cl reabsortion in ascending limb of loop of Henle
C. acts on distal tubules to ↓ K secretion
D. Aldosterone antagonist

2- 48-years old known CHF , he's on (Diuretics , ACE inhibitors, beta blockers) Recently he develops a dry cough. Which one of the following drugs caused this side effect?

A. Furosemide (loop diuretic)
B. losartan (AIIR blockers)
C. enalapril (ACE inhibitors)
D. carvedilol (beta-blockers)

3- Which one of the following drugs reduce the morbidity rate (hospitalization, HF symptoms) but dose not effect the mortality rate ?

A. Metoprolol
B. Digoxin
C. Spironolactone
D. Captopril

MCQs

4- CHF patient on medication, suddenly he develops Nausea, vomiting, Headache, ECG shows Atrial tachycardia with A/V Block. Which one of the following drugs caused this side effect?

A. carvedilol
B. Spironolactone
C. Digoxin
D. enalapril

5- A 55-years old man presents with gradually increasing shortness of breath and leg swelling that occurred while on a business trip. He has congestive heart failure, which has caused fatigue and shortness of breath if he walks a block or climbs a flight of stairs. BP is 140/90; there is no jugular venous distention or gallop, and only minimal pedal edema. An Echocardiogram shows Left ventricular ejection fraction is 45%. Current medication include aspirin and simvastatin . the patient desires to keep medication to minimum. What additional treatments are indicated at this time?

A. Spironolactone
B. An ACE inhibitors and a beta-blockers
C. Digoxin
D. Furosemide
E. An implantable defibrillator

MCQs

6- the patient has 4 chamber dilatation with a left ventricular EF of 15% he has moderate mitral regurg and moderate tricuspid regurg, with an estimated pulmonary artery pressure of 70mm Hg. He has a moderate pleural effusion, elevated Liver Function Tests, hypokalemia and hypomagnesaemia, his bb is 115/60, HR 110 bpm, respiratory rate is 30, Oxygen saturation on room air is 88%, initial therapy should include all of the following except:

A. IV loop diuretics
B. Digoxin
C. ACE inhibitors
D. Beta blockers
E. Electrolyte replacement

7- 55-year-old patient presents to you after a 3-day hospital stay for gradually increasing shortness of breath and leg swelling while away on a business trip. He was told that he had congestive heart failure, but is asymptomatic now, with normal vital signs and physical examination. An echocardiogram shows an estimated ejection fraction of 38%. The patient likes to keep medications to a minimum. He is currently on aspirin and simvastatin. Which would be the most appropriate additional treatment?

A. Begin an ACE inhibitor and then add a beta-blocker on a scheduled basis.
B. Begin digoxin plus furosemide on a scheduled basis.
C. Begin spironolactone on a scheduled basis.
D. Begin furosemide plus nitroglycerin.
E. Given his preferences, no other medication is needed unless shortness of breath and swelling recur.

Answers: 1-B 2-C 3-B 4-C 5-B 6-D 7-A

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Medicine is a science of uncertainty and an art of probability