How to manage CHF:	**Correction of reversible causes:** ○ Ischemia ○ Valvular heart disease ○ Thyrotoxicosis and other high output status ○ Shunts ○ Arrhythmia(A fib, flutter, PJRT (permanent junctional reciprocating tachycardia))
	Medications (see below)
	General lifestyle modification: ○ Sodium restriction (less than 4 g/day) ○ Weight loss ○ Smoking cessation ○ Restrict alcohol use ○ Exercise program ○ All patients should monitor weight daily to detect fluid accumulation. ○ Annual influenza vaccine and pneumococcal vaccine recommended

Treatment of Systolic dysfunction

Class	Thiazide Diuretics (modest potency)	Loop diuretics (most potent)	Aldosterone antagonist	ACEI	Digitalis Glycosides	B Blockers	Vasodilator
drugs	▪ Hydrochlorothiazide ▪ Chlorthalidone ▪ Metolazone	▪ Furosemide(Lasix) ▪ Bumex ▪ Torsemide	▪ Spironolactone ▪ Eplerenone is an alternative to spironolactone (does not cause gynecomastia).	▪ Captopril ▪ Enalapril ▪ Ramipil ▪ Lisinopril	▪ Digoxin ▪ Digitoxin	▪ metoprolol, ▪ bisoprolol, ▪ carvedilol.	▪ Hydralazine ▪ isosorbide dinitrates
MOA	Block Na reabsorbtion in loop of henle and distal convoluted tubules	Inhibit chloride reabsorption in ascending limb of loop of Henle results in natriuresis(↑Na excretion in urine), kaliuresis(↑K excretion in urine), and metabolic alkalosis	K+ Sparing Agents	▪ block the R-A-A system by inhibiting the conversion of angiotensin I to angiotensin II →vasodilation and ↓ Na retention. ▪ ↓ Bradykinin degradation ↑ its level → ↑ PG secretion & ↑ nitric oxide→vasodilation.	▪ +ve inotropic effect (↑ cardiac contaction) (↑ intracellular Ca & enhancing actin-myosin cross bride formation (binds to the Na-K ATPase → inhibits Na pump → ↑ intracellular Na → ↑ Na-Ca exchange) ▪ -ve chronotropic effect = ↓heart rate by vagal stimulation. ▪ Arrhythmogenic effect	▪ slow heart rate, which allows the left ventricle to fill more completely	▪ Hydralazine (arteriodialtor) ▪ isosorbide dinitrates (venodilator)
uses	• Recommended for patients with systolic failure and volume overload • Have not been shown to reduce mortality or improve prognosis, just for symptom control. Goal is relief of signs and symptoms of volume overload(dyspnea, peripheral edema)		• Spironolactone may improve survival in CHF patients due to the effect on RAAS with subsequent effect on myocardial remodeling and fibrosis. • Spironolactone is proven effective only for more advanced stages of CHF(classes III and IV).	▪ All patients with systolic dysfunction should be on an ACE inhibitor even if asymptomatic. ▪ improve survival in CHF patients(Delay onset & progression of HF in pts with asymptomatic LV dysfunction &↓ cardiac remodeling.	▪ The role of digitalis has declined somewhat because of safety concern ▪ Recent studies have shown that digitals does not affect mortality in CHF patients but causes significant (Reduction in hospitalization & Reduction in symptoms of HF)use with **sever** CHF &AFib.	▪ Now they are the main stay in treatment on CHF & may be the only medication that shows substantial improvement in LV function ▪ In addition to improved LV function multiple studies show improved survival ▪ The only contraindication is severe decompensated CHF	• Can be used in patients who cannot tolerate ACE inhibitors • The combination of hydralazine and isosorbide dinitrate has been shown to improve mortality in selected patients with CHF. But not as effective as ACEI.
Side effects	▪ ineffective with GFR < 30 /min ▪ Pre-renal azotemia ▪ Skin rashes ▪ Neutropenia ▪ Thrombocytopenia ▪ Hyperglycemia ▪ ↑ Uric Acid ▪ Hepatic dysfunction	▪ pre-renal azotemia ▪ Hypokalemia ▪ Skin rash ▪ ototoxicity	Need to Monitor serum potassium and renal function **Other K sparing: Triamterene & amiloride** (acts on distal tubules to ↓ K secretion)	▪ Angioedema ▪ Hypotension ▪ Renal insuffiency ▪ Rash ▪ Cough **NOTE:** Angiotensin II receptor blockers **(LOSARTAN,CANDESARTAN,VALSARTAN)** (Can be used in certain conditions when ACE I are contraindicated (angioneurotic edema, cough))but should not replace ACE inhibitors if patient tolerates an ACE inhibitor.	Narrow therapeutic to toxic ratio. **Non cardiac manifestations:** ▪ Anorexia, ▪ Nausea, vomiting, ▪ Headache, ▪ Xanthopsia sotoma (visual disturbance in which objects appear yellow) ▪ Disorientation **Cardiac manifestations:** Digoxin toxicity can induce literally every arrhythmia except for **rapidly** conducted atrial arrhythmias (atrial fibrillation and atrial flutter). The classic arrhythmias seen during digoxin toxicity include atrial tachycardia, bidirectional ventricular tachycardia and atrial fibrillation with a slow ventricular response.		

Diastolic dysfunction: Few therapeutic options available; patients are treated symptomatically			
Beta-blockers have clear benefit and should be used	Diuretics are used for symptom control (volume overload)	Digoxin and spironolactone should NOT be used.	ACE inhibitors and ARBs—benefit is not clear for diastolic dysfunction

medications are contraindicated in patients with CHF:		
Antidiabetic: ▪ Metformin—may cause potentially lethal lactic acidosis ▪ Thiazolidinediones—causes fluid retention	NSAIDs may increase risk of CHF exacerbation	Some antiarrhythmic agents that have negative ionotropic effects

Non- pharmacological treatment(devises)			
implantable cardioverter defibrillators(ICD)	**Implantable ventricular assist devices**	**Biventricular pacing**	**Artificial Heart**
▪ An ICD lowers mortality by helping prevent sudden cardiac death (which is the most common cause of death in CHF). ▪ Indication: ventricular tachyarrhythmia	Also known as heart pump. A **ventricular assist device** (VAD) is a mechanical pump that supports heart function and blood flow	Indication: (only in patient with LBBB & CHF) also called Cardiac resynchronization therapy uses a special kind of pacemaker, called a biventricular pacemaker, designed to treat the delay in heart ventricle contractions. It keeps the right and left ventricles pumping together by sending small electrical impulses through the leads.	▪ It has become more widely used since the advances in immunosuppressive treatment ▪ Survival rate o 1 year 80% - 90% o 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 Sudden cardiac death
- Most common cause of Sudden cardiac death in HF patients is ventricular tachyarrhythmia