SOLUTION
CARDIOVASCULAR DRUGS

Behind the Scene- Cardiovascular is a merger of two important system of our body- cardiac system and vascular system. Cardiac system, control contraction, relaxation, and generation of pace in heart. In addition, vascular system is responsible of proper blood circulation.

"Cardiovascular drugs are those drugs which are intended for restoring the normal and healthy physiological function of heart and blood vessels"

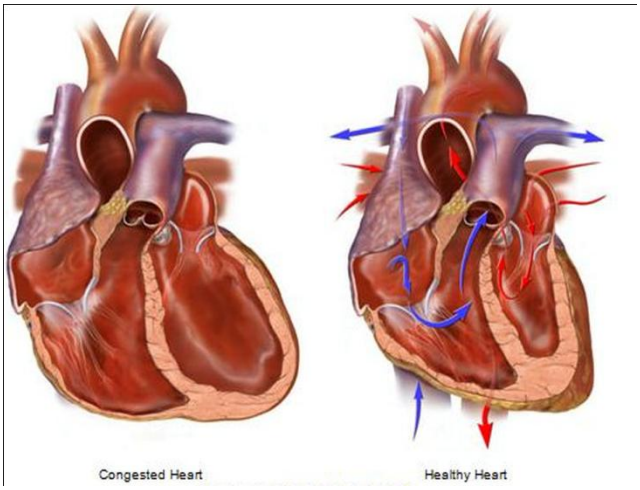
CONGESTIVE HEART FAILURE

For GPAT and other Pharmacy exam point of view below are the most important points-

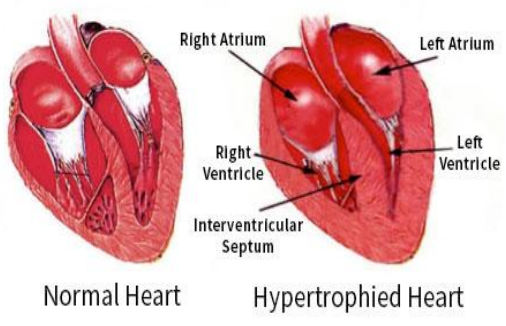
1. Heart failure is basically of two types according to their functional abnormalities-

   Lower output failure- As name indicates, this heart failure is due heart low efficiency to propel low amount of blood to the circulatory system and this is due to decreased contractility of heart.

   High output failure- there are several condition in which our body demands more amount of blood to get more amount of oxygen with it, so out heart tries to supply more blood by increasing force of contraction. Although even in increased heart output body's demand remains unfulfilled.



2. Acute heart failure is condition in which heart is not able to pump blood effectively. In addition, this condition is treated with Positive Ionotropic drugs.
3. Increased sympathetic activity → stimulation of β1 receptor → cardiac output ↑
4. Angiotensin II (Vasoconstriction) and Aldosteron (Salt-water retention) are responsible for left ventricular hypertrophy.



5. Strategy for the treatment of heart failure- (1) using diuretics to reduce the fluid accumulation in body (2) increasing contractility of heart by Positive Ionotropic drugs.
6. Loop diuretics like- furosemide and bumetanide are the choice for CHF
7. Mostly used Ionotropic drugs in CHF are- dobutamine, dopamine, inodilaors, and cardiac glycosides.
8. Dobutamine is given by intravenous route and its half-life is about two mints.
9. Cardiac glycoside contain sugar (Glycon) and non-sugar moity (Aglycon) and they are obtained from *digitalis purpurea*

10. Cardiac glycoside include- digoxin, digitoxin, strophanthin and ouabain
11. Cardiac glycoside is Positive Ionotropic drugs but they do not increase heart rate or oxygen consumption.
12. Digoxin is only Positive Ionotropic drugs which is given orally
13. Raised extracellular K^+ decrease the binding of cardiac glycoside
14. Pharmacokinetic profile of digoxin

S.N.	Source	*digitalis purpurea*
1	Oral Absorption-	About 60-80%
2	Plasma Protein Binding	25%
3	Volume of Distribution	500 L/kg
4	Plasma Half life	40 Hrs
5	Elimination	Renal excretion
6	Care should be taken	In kidney disease
7	Toxicity	Nausea, Vomiting, arrhythmia, arterial flutter
8	Rare adverse effects	Gynaecomastia (Brest Enlargement in Man) Xanthopsia (yellow Vision)

15. Lignocane is the drug of choice in ventricular arrhythmia
16. Quinidine and calcium channel blockers decrease renal clearance hence increase toxicity as they retain inside the body.
17. Antacids, metoclopamide, and sulfasazine decreased the absorption of digitalis in GIT.
18. Nitrates preferentially dilates veins → Reduced preload
19. Hydralazine, minoxidil, and calcium channel blocker are preferentially dilate arteries → ~~after~~ load ↓
20. Most widely used beta blocker in CHF is carvedilol

HYPERTENSION

1. Hypertension is a persistent condition at which blood pressure increase from normal level (120/80 somewhere 140/90)
2. Drugs for the treatment of hypertension –

S.N.	Class	Example of Drugs
01	Alfa Blocker	Doxazocin, Prazocin, Terazocin
02	Diuretics-	Amiloride, Bumetanide, Chlorthalidone, Eplerenone, Furosemide, Hydrochlorothiazide, Metolazone, Spirenolactone, Triametrene
03	Beta Blocker	Atenolol, Carvedilol, Labetolol, Metoprolol, Nadolol, nebivolol, propranolol, Timolol.
04	ACE Inhibitor	Benazepril, Captopril, Enalapril, Fosinopril, linsopril, Moexipril, Quinopril, Ramipril.
05	Angiotensin Receptor Blocker	Azilasartan medoxomil, Candesartan, Eprosartan, Irbesartan, Losartan, Olmesartan, Telmisartan, Valsartan
06	Renin Inhibitor	Aliskiren
07	Calcium channel Blocker	Amlodipin, Diltiazem, Felodipin, Isradipin, Nicardipin, Nifedipin, Nislodipin, Verapamil.
08	Other Drugs	Clonidine, Diazoxide, Hydralazine, Labetolol, Alfa methyldopa, minoxidil, Sodium nitropruside

3. Sodium ion increases the blood pressure by increasing the stiffness of blood vessels and thus Total peripheral resistance.
4. Thiazide are the first line drug in hypertension
5. Thiazide should used at low dose only because its high dose is not extra effective.
6. Indapamide is the only drug used for the treatment of hypertension in diabetic patient whereas other thiazides are contraindicated.
7. Indapamide can used in gout patients as it inhibit re absorption of uric acid in nephron.
8. Stimulation of α_2 receptor in CNS leads to decrease in sympathetic outflow where as stimulation of β receptor give opposite effects.
9. Methyl dopa is a prodrug
10. Methyl dopa can cause hemolytic anemia as side effects
11. Hexamethonium and trimethaprin are the example of ganglion blocker and is used as antidotes for nicotine poisoning.
12. Mecamylamine is ganglion blocker and used in smoking cessation.
13. Vasodilator drugs work by opening potassium channel by releasing nitric oxide.
14. Minoxidil is a pro drug and it gets activated in liver as minoxidil sulphate by phase II reaction
15. Sodium nitropruside and hydralazine act by releasing nitric oxide from endothelial which cause vasodilatation.
16. Nicardipin is longest acting parentral calcium channel blocker and it is drug of choice for hypertensive emergency

17. Two main types of adrenergic receptor blocker are- α (Alfa) and β (Beta) Alfa 1 is present on smooth muscle of blood vessels and cause vasoconstriction. Whereas Beta 1 is, found in myocardium and cause increase in heart rate and cardiac output.
18. Prazocin, Terazocin and Doxazocin are selective Alfa1 blocker and they are used in the treatment of patient of hyper tension and hyperplasia of prostate.
19. Mechanism of action for beta blocker-
    - Inhibition of cardiac Beta 1 receptor leading to decreased cardiac output.
    - Decrease in rennin release
    - Inhibition of central and peripheral sympathetic outflow

20. Drugs cause vasodilatation by opening potassium channel and releasing nitric oxide, by blocking calcium channel
21. Major side effect of vasodilator is tachycardia and headache due to dilation of cerebral blood vessels.
22. Hydralazine is metabolized by acetylating
23. Calcium channel blocker that used in hypertension block L type of calcium channels in blood vessels
24. Amlodipin has longest half life
25. Verapamil has maximum depression effects on heart and is cause vasodilatation by blocking calcium channels.
26. Calcium channel blocker are avoided or contraindicated in sinus syndrome, CHF and along with beta-blocker.
27. Angiotensinogen is secreted from liver and it is get converted into angiotensin I
28. Renin is secreted by JG cells of kidney
29. Bradykinin is involved in the causation of dry cough and angioedema
30. Perindopril is longest acting and captopril is shortest acting ACE Inhibitor drug.
31. All ACE inhibitors are prodrugs except captopril and linsopril.
32. Most visible side effects of ACE are dry mouth.
33. Angiotensin receptor blocker has anti-platelet activity
34. Telmisartan is longest acting drug and eprosartan is shortest acting angiotensin receptor blocker.
35. Classification of hypertension according to JNC VIII

S.N.	Blood Pressure Classification	Systolic Blood Pressure (mmHg)	Diastolic Blood Pressure (mm Hg)
01	**Normal**	**<120**	**<80**
02	Pre hypertension	120-139	80-89
03	**Stage 1 hypertension**	**140-159**	**90-99**
04	Stage 2 hypertension	>160	>100

36. First line drugs for hypertension include- thiazide, ACE inhibitor, ARB, and Calcium channel blocker.
37. ACE inhibitor and ARB should not be given simultaneously

38. Safe antihypertensive drugs during pregnancy

Mnemonics	Drugs with classification
Better	Beta blocker- cardio selective and labetalol
Mother	Methyl Dopa
Care	Clonidine
During	Dihydropyridine, calcium channel blocker,
Hypertensive	Hydralazine, Drug of choice in emergency
Pregnancy	Prazocin and other Alfa blocker

39. All nitrates undergo very high first pass metabolism except Isosorbide mono nitrate
40. Nitrates like Glyceryl trinitrate, isosorbide dinitrate, isosorbide mononitrate, and amyl nitrate are important compound in this category.
41. This drugs act by releasing NO, which increase cGMP, and results in Venodilation.
42. Nitroglycerine and isosorbide dinatrate sublingually used for aborting the acute attack of angina.
43. All nitrate undergo very high first pass metabolism except IMN (100%)
44. Molsidomine is emerging agent in this category

45. Beta-blockers are the only antianginal drugs that decrease mortality in patients with CAD.
46. Ranolazine can cause QT prolongation
47. Ivabradine is a new drug for angina
48. Potassium is the main ion, which determines the RMP of cardiac cells.
49. Beta-blocker reduces cardiac output.
50. Pentazocine and pethidine should not be used for myocardial infarction because they cause tachycardia.

References-

1. KDT
2. Garg and Gupta
3. Lippincott
4. FSK Barar
5. Goodman
6. Tipnis & Bajaj
7. Tortora
8. Youtube and many more