

CARDIOVASCULAR AND RESPIRATORY PHARMACOLOGY (15)

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1. Review of Cardiovascular Physiology (2)

Review the properties of the heart including contractility (e.g. excitation-contraction coupling) and electrical activity (e.g. the action potential, automaticity, excitability, refractory period, conduction and the relationship to the electrocardiogram). Review the concepts of inotropism, chronotropism, dromotropism and lusitropism as they pertain to mechanism of action of commonly used drugs.

Review neuroendocrine properties of the heart (both response and output).

Discuss mechanisms of growth, hypertrophy and signal transduction.

Review the intrinsic and extrinsic regulation of the cardiovascular system.

Describe cardiac and vascular smooth muscle cellular pathobiology including mechanisms of apoptosis and responses to hypoxia, reperfusion, ischemia and mechanical and oxidative stress.

2. Drugs Used for Cardiac and Cardiovascular Therapy

A. Anti-Arrhythmic Agents (3)

1) **Drugs and Drug Classes to Consider:**

ADENOSINE

AMIODARONE

Atropine

β-ADRENOCEPTOR ANTAGONISTS (e.g. METOPROLOL, SOTALOL)

Bretylum

CALCIUM CHANNEL BLOCKERS (e.g. DILTIAZEM, VERAPAMIL)

Digoxin

Disopyramide

Dofetilide

Flecainide

Ibutilide

LIDOCAINE

Mexiletine

PROCAINAMIDE

Propafenone

QUINIDINE

2) **Principles and knowledge objectives:**

a) **Introduction to Cardiac Electrophysiology**

Describe the ionic basis of the cardiac action potential.

Discuss the role of specific ions and conductances in the production and propagation of the cardiac action potential.

Review the electrophysiological differences between normal atrial and normal ventricular cardiac muscle cells and between specialized and normal cardiac cells.

Describe how cardiac electrical activity is altered in the production of cardiac arrhythmias.

Discuss the relationship between cellular cardiac electrical activity and the electrocardiogram.

b) **Pharmacological Agents: Mechanism of action**

Describe the pathophysiologic mechanisms of cardiac arrhythmias (abnormal automaticity, triggered rhythms, reentrant rhythms and abnormal impulse conduction).

Classify antiarrhythmic drugs according to the Vaughn-Williams classification into classes I, II, III and IV including other miscellaneous agents, though recognizing the limitations of this classification system.

Describe the slow (calcium-dependent) and fast (sodium-dependent) responses, their relevance to sinoatrial, atrial, AV-nodal and ventricular tissues, and their alteration by antiarrhythmic drugs.

Describe the electrophysiologic actions of antiarrhythmic drugs in normal and abnormal myocardial and conduction tissue, and their effect on the phases of the cardiac action potential.

Describe the indirect autonomic actions of these drugs.

Describe the effect of age on fast and slow channels and on the agents affecting these channels.

Discuss the pharmacogenomics of long QT syndrome and the relationship of genetics to drug selection.

Know the two forms of this disorder (i.e. drug-induced [or acquired LQT] and congenital) and which ion channels are responsible for each.

Know the classes of drugs that can produce acquired LQTS and that the therapeutic management of congenital LQTS depends on the genotype, despite a uniform phenotype.

c) Pharmacological Agents: Actions on organ systems

Describe the relevant extracardiac actions of antiarrhythmic drugs with special reference to amiodarone.

d) Pharmacological Agents: Pharmacokinetics

Describe the routes of administration, biotransformation and excretion of selected antiarrhythmic drugs.

Describe the pharmacokinetics and time-course of the cardiac actions of antiarrhythmic drugs (onset and duration of action).

Discuss the impact of reduced cardiac output due to myocardial infarction and cardiomyopathy on drug half-life and pharmacodynamics.

Describe the influence of age on pharmacokinetic parameters, i.e., liver metabolism (lidocaine, procainamide, and propranolol) and elimination through kidney (digoxin and sotalol).

e) Pharmacological Agents: Therapeutic indications

Describe the use of antiarrhythmic drugs in supraventricular arrhythmias

(atrial flutter, atrial fibrillation, paroxysmal atrial tachycardia, junctional arrhythmias).

Describe the use of antiarrhythmic drugs in ventricular arrhythmias (ventricular premature beats, ventricular tachycardia, ventricular fibrillation).

Discuss the utility of antiarrhythmic drugs in combination with electrical cardioversion or implantable converters-defibrillators.

f) Pharmacological Agents: Adverse effects, drug interactions and contraindications

Describe the cardiac and extracardiac manifestations of toxicity from antiarrhythmic drugs.

Describe the beneficial and adverse interactions among antiarrhythmic drugs and between antiarrhythmic drugs and cardiac glycosides.

Describe the significance of electrolyte and acid-base imbalance in arrhythmia generation and their influence on antiarrhythmic drug action.

Describe the possible contraindications of antiarrhythmic drugs in the presence of heart block or congestive heart failure, and the precautions and contraindications in other conditions.

B. Management of Acute and Chronic Heart Failure (2)

1) Drugs and Drug Classes to Consider

ANGIOTENSIN CONVERTING ENZYME INHIBITORS (e.g. ENALAPRIL)

ANGIOTENSIN RECEPTOR ANTAGONISTS (e.g. LOSARTAN)
Inamrinone

ADRENOCEPTOR ANTAGONISTS (e.g. CARVEDILOL;
METOPROLOL)

ADRENOCEPTOR AGONISTS (e.g. DOBUTAMINE; DOPAMINE)
DIGOXIN

DIURETICS (e.g. Furosemide; SPIRONOLACTONE)

PHOSPHODIESTERASE INHIBITORS (e.g. INAMRINONE;
MILRINONE)

NESIRITIDE

VASODILATORS (e.g. HYDRALAZINE, NITROPRUSSIDE)

2) Principles and knowledge objectives

a) Introduction to cardiac inotropism

Describe the acute inotropic, dromotropic, and chronotropic effects of catecholamines (e.g. epinephrine, norepinephrine, dopamine, isoproterenol). Discuss the lusitropic actions of the catecholamines as they relate to normal and abnormal cardiac function.

Compare and contrast the management of acute and chronic heart failure.

Describe the basic pathophysiology of heart failure and the cardiac and extracardiac compensatory mechanisms that are activated.

b) Pharmacological Agents: Mechanism of action

Describe the effects of digoxin on myocardial contractility.

Explain the ionic basis for the mechanism of action of digoxin and the cardiac glycosides as a class of agents: discuss the roles of Na^+ , K^+ -ATPase inhibition and the $\text{Na}^+/\text{Ca}^{2+}$ exchanger.

Describe the electrophysiologic effects of digoxin on atrial and ventricular muscle and specialized conducting tissue.

Explain the significance of direct and indirect (autonomic) actions of digoxin.

Describe the positive inotropic effects of the β -adrenoceptor-agonists and phosphodiesterase inhibitors.

Explain the effects of adrenoceptor antagonists and ACE-inhibitors on cardiac function and ventricular remodeling in the setting of heart failure.

c) Pharmacological Agents: Actions on organ systems

Describe the hemodynamic actions of digoxin in the failing heart.

Describe the extracardiac actions of digoxin.

Explain the effects of vasodilators on preload and afterload.

Describe the extracardiac actions of the adrenoceptor agonists, adrenoceptor antagonists, phosphodiesterase inhibitors and ACE-inhibitors.

d) Pharmacological Agents: Pharmacokinetics

Describe the routes of administration, the extent of oral absorption and bioavailability, the routes of elimination and extent of biotransformation of digoxin and other drugs used in heart failure.

Relate these to physicochemical properties of digoxin.

Contrast the pharmacokinetics of digoxin in young and old patients.

Describe the time-course of the cardiac actions of cardiac glycosides (onset and duration of action) with special reference to pharmacokinetic differences between digoxin and digitoxin (used for descriptive purposes).

Explain the concept of digitalization (loading dose) and maintenance therapy.

Review the "plateau principle" with regard to maintenance therapy without a loading dose.

e) Pharmacological Agents: Therapeutic indications

Describe the use of digoxin in congestive heart failure and in atrial arrhythmias.

Describe the role of adrenoceptor agonists, adrenoceptor antagonists, vasodilators, diuretics and ACE-inhibitors in the treatment of acute and chronic heart failure.

f) Pharmacological Agents: Adverse effects, drug interactions and contraindications

Describe the cardiac (delayed depolarizations and arrhythmias) and extracardiac manifestations of digoxin toxicity (digoxin levels > 2.5 ng/ml).

Describe the significance of changes in serum electrolyte levels (potassium, sodium, calcium, magnesium) with regard to digoxin toxicity.

Discuss the potential adverse effects with concomitant use of diuretics (both potassium-sparing and potassium depleting) in the elderly or in patients with congestive heart failure, hypothyroidism and renal disease.

Describe the interactions of digoxin and quinidine, verapamil, and other relevant drugs.

Describe the cardiac and extracardiac side effects and limitations of the

antagonist agents, vasodilators, phosphodiesterase inhibitors, and ACE-inhibitors.

C. Antihypertensive and Related Drugs (4)

1) Drugs and Drug Classes to Consider

α -ADRENOCEPTOR ANTAGONISTS (e.g. PRAZOSIN; DOXAZOSIN)

ACE INHIBITORS (e.g. ENALAPRIL; BENAZEPRIL CAPTOPRIL; FOSINOPRIL; LISINOPRIL; QUINAPRIL)

ANGIOTENSIN RECEPTOR ANTAGONISTS (e.g. LOSARTAN; VALSARTAN; CANDASARTAN)

β -ADRENOCEPTOR ANTAGONISTS (e.g. ATENOLOL; PROPRANOLOL; TIMOLOL; NADOLOL; LABETOLOL)

CALCIUM CHANNEL BLOCKERS (e.g. AMLODIPINE; FELODIPINE; NICARDIPINE; NIFEDIPINE)

CENTRALLY ACTING ANTIHYPERTENSIVE AGENTS (e.g. CLONIDINE)

DIURETICS (e.g. HYDROCHLOROTHIAZIDE; INDAPAMIDE)

VASODILATORS (e.g. NITROPRUSSIDE; HYDRALAZINE)

D-1 Dopamine agonists (Fenoldopam mesylate) used in hypertensive emergencies

Endothelin Receptor antagonists (Bosentan)

2) Principles and knowledge objectives

a) Introduction to the Vascular System and its Regulation

Review the determinants of systemic arterial blood pressure including the role of the autonomic nervous system, the regulation of fluid volume and the renin-angiotensin system.

Describe the role of the central nervous system in the regulation of blood pressure.

Discuss the role of vascular endothelium and locally released regulators of vascular tone in the maintenance of blood pressure.

List the types of hypertension and the relative prevalence of each.

Describe the current views for the etiology of essential hypertension.

b) Pharmacological Agents: Mechanism of action

Discuss the mechanism of action of each of the several classes of agents used to manage hypertension according to the site of action within the pathogenesis of hypertension.

Describe the mechanism by which each antihypertensive drug or drug class exerts its therapeutic function.

c) Pharmacological Agents: Actions on organ systems

Review the end organ effects of hypertension and the beneficial effects achieved by therapeutic management of the disease.

Describe the actions of antihypertensive drugs on the heart, renal blood flow and renal function.

Describe the relevant actions of antihypertensive drugs in other organ systems (CNS, other).

d) Pharmacological Agents: Pharmacokinetics

Describe the use of antihypertensive drugs in mild, moderate and severe essential hypertension.

Describe the time-course of their antihypertensive activity (onset and duration of action) for each class of agents.

e) Pharmacological Agents: Therapeutic indications

Discuss the role of non-pharmacological treatment modalities in the management of hypertension.

Describe the use of antihypertensive drugs in mild, moderate and severe essential hypertension.

Describe the use of antihypertensive drugs in hypertensive emergencies and in pregnancy (e.g. eclampsia).

Describe the use of antihypertensive drugs in pheochromocytoma.

Discuss subgroups with special antihypertensive drug considerations (e.g. African-Americans, diabetics, isolated systolic hypertension esp. in elderly patients, renal failure patients).

f) Pharmacological Agents: Adverse effects, drug interactions and contraindications

Describe the cardiac and extracardiac side effects of antihypertensive drugs.

Describe the beneficial and adverse interactions between antihypertensive drugs and between antihypertensive drugs and other therapeutic agents.

D. AntiAnginal Drugs (1)

1) Drugs and Drug Classes to consider:

ANTIPLATELET AGENTS (e.g. Clopidogrel)
ADRENOCEPTOR ANTAGONISTS (e.g. PROPRANOLOL)
CALCIUM CHANNEL BLOCKERS (e.g. NIFEDIPINE)
VASODILATORS

2) Principles and knowledge objectives

a) Introduction to Coronary Blood Flow and its Regulation

Describe the normal regulation of coronary blood flow and the relationship to the events of the cardiac cycle.

Describe the normal determinants of cardiac oxygen consumption and supply.

Describe the basic pathophysiology of myocardial ischemia.

Explain the significance of atherosclerotic coronary artery disease and coronary artery spasm (Prinzmetal's) in the production of myocardial ischemia and angina pectoris.

b) Pharmacological Agents: Mechanisms of action

Describe the hemodynamic actions of antianginal drugs, including their coronary and peripheral vasodilator actions.

Describe the effects of each antianginal drug or drug class on the determinants of myocardial oxygen consumption (heart rate, myocardial wall tension, etc.) and/or oxygen supply (coronary blood flow).

Describe the effects of the antianginal drugs at the cellular level.

c) Pharmacological Agents: Actions on organ systems

Describe the cardiac actions of antianginal drugs (electrophysiologic,

coronary vasodilator, inotropic actions).

Describe the actions of antianginal drugs on the peripheral circulation (arterial, venous) and their effects on ventricular preload and afterload.

d) Pharmacological Agents: Pharmacokinetics

Describe the routes of administration, biotransformation and excretion of antianginal drugs.

Describe the significance of a "first-pass effect" for orally administered antianginal drugs and the rationale underlying sublingual, intranasal and patch administration of nitrates.

Describe the time-course of antianginal activity (onset and duration of action).

Describe the problem of dose intervals and tolerance development with the nitrates.

e) Pharmacological Agents: Therapeutic indications

Describe the use of antianginal drugs in classic (effort-related) angina pectoris and vasospastic angina pectoris.

Describe the concept of "myocardial preservation" and discuss the use of antianginal drugs in the context of acute myocardial infarction with particular emphasis on adrenoceptor antagonists.

f) Pharmacological Agents: Adverse effects, drug interactions and contraindications

Describe the cardiac and extra-cardiac side effects of antianginal drugs.

Describe the beneficial and adverse interactions between antianginal drugs and between antianginal drugs and other cardiovascular drugs.

E. Drugs for hyperlipidemias (1)

1) Drugs and Drug Classes to consider:

CHOLESTYRAMINE

Colestipol

FIBRIC ACID DERIVATIVES (e.g. GEMFIBROZIL, FENOFIBRATE)

HMG CoA REDUCTASE INHIBITORS (e.g. ATORVASTATIN, LOVASTATIN, PRAVASTATIN)

Nicotinic acid
Ezetimibe

2) Principles and Knowledge Objectives

a) Lipid Interactions with the Cardiovascular System

Discuss cholesterol synthesis, transport, export, excretion, and receptor mediated cellular uptake.

Review “normal” values for lipid levels.

Discuss the relevant hypotheses regarding the etiology of hyperlipidemias (e.g. intrinsic versus extrinsic elevations in plasma lipids).

Describe the basic pathophysiology of atherosclerotic vascular disease and its relationship to the hyperlipidemias (“cholesterol” or “infectious agent”).

Describe the types of hyperlipidemias (I, II, III, IV, and V) and the alterations in serum lipids in each type (triglycerides, cholesterol, LDL, HDL, lipoproteins).

Discuss the lipid profile characteristic of insulin-resistant diabetics.

Discuss genetic conditions leading to hyperlipidemia.

Describe the concept of “plaque stability”.

b) Pharmacological Agents: Mechanism of action

Describe the actions of each drug class on serum lipids, and compare and contrast the mechanism of each of these actions.

Characterize these agents according to their action to reduce lipid synthesis or enhance removal.

Identify the role of antioxidants in the management of hyperlipidemia.

c) Pharmacological Agents: Actions on organ systems

Describe the relevant actions of these drugs, other than on lipid metabolism (e.g. pleiotropic effects).

Discuss drug-induced alterations in plasma lipids (e.g. protease inhibitor-

induced hyperlipidemia; estrogen-induced hypolipidemia).

Discuss the role of the HMG CoA reductase inhibitors in preventing acute coronary events and stroke and as adjuncts in the management of dementia and other pathological disorders.

d) Pharmacological Agents: Pharmacokinetics

Describe the absorption, distribution, metabolism and excretion (ADME) of drugs used for hyperlipidemias.

Compare and contrast the pharmacokinetics of nicotinic acid and fibric acids.

e) Pharmacological Agents: Therapeutic indications

Describe the non-pharmacological management of hyperlipidemia (i.e. life style modifications and natural remedies that may benefit patients).

Describe the use of these agents in familial and acquired hyperlipidemias, and their efficacy in atherosclerotic vascular disease.

Discuss important multicenter clinical trial data documenting efficacy in multiple patient groups.

Discuss new National Cholesterol Education Program (NCEP) guidelines for lowering LDL.

Discuss the apparent lack of a threshold effect (lower is always better, even in the normal range of LDL).

f) Pharmacological Agents: Adverse effects, drug interactions and contraindications

Describe the cardiovascular and other systemic side effects of these drugs with special reference to the muscle and liver toxicities.

Describe the beneficial and adverse interactions between these drugs, and their interactions with digoxin, oral anticoagulants, and other relevant drugs.

F. Thrombolytic and Hemorrhologic Agents in the Management of Myocardial Infarction / Acute Coronary Syndrome and Chronic Treatment of Cardiovascular Diseases (1)

1) Drugs and Drug Classes to Consider

ADENOSINE DIPHOSPHATE RECEPTOR ANTAGONISTS (e.g. CLOPIDOGREL, TICLOPIDINE)

DIPYRIDAMOLE

GLYCOPROTEIN IIb/IIIa RECEPTOR ANTAGONISTS (e.g.

ABCIXIMAB, eptifibatide, tirofiban)

HEPARINS (e.g. ENOXAPARIN; HEPARIN)

WARFARIN

THROMBIN INHIBITORS (e.g. bivalirudin, lepirudin, argatroban, ximelagatran)

THROMBOLYTIC AGENTS (e.g. ALTEPLASE, anistreplase, reteplase, STREPTOKINASE, tenecteplase, UROKINASE)

2) Principles and Knowledge Objectives

a) Introduction to Coagulation and Thrombus Formation

See Section I Drugs Acting on the Blood and Blood-forming Organs for Thrombolytics, Anticoagulants and Antithrombotic Drugs.

Describe the physiology of hemostasis and the steps that are targets for drug use and drug development.

Describe the role of platelet aggregation in hemostasis.

Discuss the role and contribution of the intrinsic and extrinsic pathways in formation of fibrin.

Discuss the pathophysiology of thrombus formation in arteries and veins.

b) Pharmacological Agents: Mechanism of action

Describe the use of thrombolytic agents as first-line in the therapy of acute post-myocardial infarction and stroke. Discuss the role of acute catheter-mediated intervention as an alternative or complementary strategy.

Consider the spectrum of agents available for cardioprotection and plaque stabilization in the setting of acute coronary syndrome.

c) Pharmacological Agents: Action on Organ Systems

Discuss the long-term use of antiplatelet agents (e.g. ASPIRIN, PENTOXIPHYLLINE and clopidogrel) in patients with claudication associated with chronic occlusive peripheral arterial disease and stroke.

Describe the use of thrombolytic agents as first-line agents in the acute therapy of post-myocardial infarction and as adjuncts in the nonpharmacological management of coronary artery disease (e.g. surgical stent implantation).

Consider the proper use of morphine in the pain of MI, the long-term use of acetylsalicylic acid (antiplatelet activity) as prophylaxis and the use of adrenergic blocking agents for cardiac protection.

d) Pharmacological Agents: Pharmacokinetics

Discuss the appropriate use of parenteral versus oral anticoagulants.

Discuss the route and time of administration of thrombolytic agents.

e) Pharmacological Agents: Therapeutic Indications

Describe the use of thrombolytic and anticoagulant agents in the acute management of myocardial infarction.

Discuss the use of antiplatelet drugs, anticoagulant drugs, nitroglycerin, adrenergic blocking agents and angiotensin converting enzyme inhibitors as adjunctive agents in the management of myocardial infarctions.

f) Pharmacological Agents: Adverse effects, drug interactions and contraindications

Discuss the treatment of warfarin overdose.

Discuss the management of heparin-induced thrombocytopenia.

3. Management of Asthma and Chronic Obstructive Pulmonary Disease (1)

1. Drugs to Consider

ADRENOCEPTOR AGONISTS (e.g. ALBUTEROL; EPINEPHRINE; SALMETEROL; bitolterol; pirbuterol; levalbuterol; formoterol)

ANTICHOLINERGIC AGENTS (IPRATROPIUM; tiotropium)

CORTICOSTEROIDS (e.g. BECLOMETHASONE; BUDESONIDE; FLUTICASONE)

LEUKOTRIENE MODIFIERS (e.g. MONTELUKAST; ZAFIRLUKAST; ZILEUTON)

MAST CELL STABILIZERS (CROMOLYN; Nedocromil)

METHYLYXANTHINES (e.g. THEOPHYLLINE)

Omalizumab [anti IgE])

2. Principles and knowledge objectives

a) Introduction to Respiratory Physiology

Describe the endogenous chemical mediators and their receptors that function to regulate bronchial smooth muscle tone.

Describe the role of cyclic AMP, leukotrienes and nitric oxide in regulation of bronchiolar smooth muscle and pulmonary vasculature.

Describe the role of phosphodiesterases and the various isoenzymes of PDE (i.e. PDE4) in the function of bronchiolar smooth muscle and in the inflammatory process.

Identify the relationship of bronchial smooth muscle reactivity to the pathogenesis of asthma.

Characterize the role of the inflammatory process in the pathogenesis of asthma and chronic obstructive pulmonary disease (COPD).

Describe the similarities between asthma, allergic rhinitis and chronic obstructive pulmonary disease.

b) Pharmacological Agents: Mechanism of action

Describe the mechanism of action of each of the major classes of agents relative to the component of pathogenesis to distinguish between agents that modify the disease process versus those that relieve symptoms.

Discuss the use of combinations of agents in the chronic management of asthma.

Describe the use of agents to treat acute episodes of asthma and in the treatment of exercise-induced asthma.

Describe the use of various agents in the treatment of COPD.

c) Pharmacological Agents: Actions on organ systems

Describe the actions of agents used to treat asthma on smooth muscle versus inflammatory processes.

Describe the relevant actions of these drugs on other physiological systems.

d) Pharmacological Agents: Pharmacokinetics

Identify the factors that influence the plasma levels of theophylline.

Know the appropriate route of administration of the various bronchodilators relative to the physico-chemical characteristics and the pharmacological action of the drug.

Discuss the relative merits of inhalant administration versus oral or parenteral administration for the management of both episodic and chronic asthma.

e) Pharmacological Agents: Therapeutic indications

Compare and contrast the management of acute and chronic asthma and obstructive pulmonary disease.

Discuss the management of asthma in special patient populations (e.g. pediatric and pregnant and/or lactating females)

Discuss the emerging therapies for the management of asthma and chronic obstructive pulmonary disease (e.g. monoclonal antibodies).

Discuss the non-pharmacologic approaches to the management of asthma and COPD (e.g. smoking cessation and oxygen)

f) Pharmacological Agents: Adverse effects, drug interactions and contraindications

Discuss the adverse effects and contraindications for each class of agents.

Discuss the potential for allergic reactions to ipratropium in patients allergic to soy or peanut products.

List of Cardiovascular Drugs to Consider (Classes of Agents are identified in Bold Print and Primary Agents identified by CAPITALIZATION): *Indicates agents that are among the 200 most prescribed (prescriptions dispensed) agents in the US for 2003.

1. Adenosine Diphosphate Receptor Antagonists:

CLOPIDOGREL*

Ticlopidine

2. Adrenoceptor Agonists

β -Adrenoceptor Agonists:

DOBUTAMINE

Dopamine

EPINEPHRINE

Isoproterenol

β_2 -Adrenoceptor Agonists

ALBUTEROL*

Bitolterol

Formoterol

Isoetharine

Levalbuterol

Metaproterenol

Pirbuterol

Ritodrine

Salmeterol

Terbutaline

3. Adrenoceptor Antagonists

α -Adrenoceptor Antagonists

CARVEDILOL*

DOXAZOSIN*

LABETALOL

Phenoxybenzamine

Phentolamine

PRAZOSIN

TAMSULOSIN*

TERAZOSIN*

Tolazoline

β -Adrenoceptor Antagonists:

CARVEDILOL*

Carteolol

LABETALOL

Nadolol

Oxprenolol

Penbutolol

Pindolol

PROPRANOLOL*

Sotalol

Timolol

β_1 -Adrenoceptor Antagonists:

acebutolol
ATENOLOL*
Betaxolol
Bretylum
Bisoprolol
ESMOLOL*
METOPROLOL*

4. Angiotension Converting Enzyme Inhibitors (ACEIs):

BENAZEPRIL*
CAPTOPRIL*
ENALAPRIL*
Enalaprilat
FOSINOPRIL*
LISINOPRIL*
Moexipril
Perindopril
QUINAPRIL*
RAMIPRIL*
Trandolapril

5. Angiotensin Receptor Antagonists (ARBs):

Candesartan
Eprosartan
IRBESARTAN*
LOSARTAN*
Olmisartan
Telmisartan
VALSARTAN*

6. Antiarrhythmic Agents (Miscellaneous Mechanisms):

ADENOSINE
AMIODARONE*
Disopyramide
Flecainide
LIDOCAINE*
Mexiletine
PROCAINAMIDE*
Propafenone
QUINIDINE*

7. Antiasthmatic Agents (Miscellaneous Mechanisms):

CROMOLYN*
Nedocromil
Omalizumab

8. Anticholesterolemic Agents

Niacin
Nicotinic acid
Ezetimibe*

Bile Acid Sequestrants:

CHOLESTYRAMINE*
Colestipol

HMG CoA Reductase Inhibitors:

ATORVASTATIN*
FLUVASTATIN
LOVASTATIN*
PRAVASTATIN*
SIMVASTATIN*

9. Anticholinergic Agents (Muscarinic Receptor Antagonists)

ATROPINE
IPRATROPIUM*
Tiotropium

10. Anticoagulant Agents:

WARFARIN*

Heparins:

Dalteparin
ENOXAPARIN*
heparin

11. Antiplatelet Agents

ASPIRIN*
Dipyridamole
Cilostazol

12. Calcium Channel Blockers:

AMLODIPINE*
Bepridil
DILTIAZEM*
FELODIPINE*
Flunarazine
Isradipine
Nicardipine
NIFEDIPINE*
Nimodipine

Nisoldipine
VERAPAMIL

13. Cardiac Glycosides:

DIGOXIN*

Digitoxin (mainly for historical and illustrative purposes)

14. Centrally Acting Antihypertensives:

apraclonidine

CLONIDINE*

guanfacine

guanabenz

methyldopa

15. Corticosteroids:

BECLOMETHASONE*

Budesonide

DEXAMETHASONE*

Flunisolide

FLUTICASONE*

Mometasone*

TRIAMCINOLONE*

16. Diuretics:

Amiloride

Bumetanide

Chlorothiazide

Chlorthalidone

Eplerone

FUROSEMIDE*

HYDROCHLOROTHIAZIDE*

INDAPAMIDE

Metolazone

SPIRONOLACTONE*

Torsemide

Triamterene*

Aldosterone Antagonists

Eplerone

SPIRONOLACTONE*

17. Fibrates:

Fenofibrate*

GEMFIBROZIL*

18. Glycoprotein IIb/IIIa Receptor Antagonists:

ABCIXIMAB

Eptifibatide

Tirofiban

19. Leukotriene Modifiers:

MONTELUKAST*

ZAFIRLUKAST

ZILEUTON

20. Methylxantines:

Aminophylline

Dyphylline

Enprofylline

Oxtriphylline

Pentoxifylline

THEOPHYLLINE*

21. Phosphodiesterase Inhibitors:

Inamrinone

Milrinone

Cilostazol

22. Vasodilators:

Amyl nitrite

Diazoxide

Hydralazine

Isosorbide dinitrate

ISOSORBIDE MONONITRATE*

Minoxidil

NITROGLYCERIN

NITROPRUSSIDE