

CARDIOVASCULAR AND RESPIRATORY PHARMACOLOGY

Recommended Total Curriculum Equivalent: 15 hrs.

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Learning Objectives for Introduction to Cardiovascular Drugs

Physiology and Pathophysiology: Review of Cardiovascular Physiology (2 hrs equivalent)

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

Discuss mechanisms of myocardial 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.

Antiarrhythmic Agents			
Recommended Curriculum Equivalent: 3.0 hr			
Drug Classes and Drugs to Consider (Major or Prototype Drugs Capitalized)			
A. CLASS I			B. CLASS II
Class IA	Class IB	Class IC	β-ADRENOCEPTOR ANTAGONISTS
QUINIDINE PROCAINAMIDE Disopyramide	LIDOCAINE Mexiletine	Moricizine Flecainide Propafenone	Atenolol ESMOLOL METOPROLOL PROPRANOLOL
C. CLASS III		D. CLASS IV	E. Others
Prolongation of Action Potential Duration		Calcium Channel Blockers	
AMIODARONE Sotalol Dofetilide		DILTIAZEM VERAPAMIL	ADENOSINE Atropine Digoxin
Learning Objectives for Management of Cardiac Arrhythmias			
<p>Physiology and pathophysiology: Introduction to Cardiac Electrophysiology and Pathophysiology</p> <p>Describe the ionic basis of the cardiac action potential.</p> <p>Discuss the role of specific ions and ionic conductances in the production and propagation of the cardiac action potential with emphasis on fast (sodium dependent) and slow (calcium dependent) responses and their relevance to specific cardiac tissue types.</p> <p>Review the electrophysiological differences between normal atrial and ventricular cardiac muscle cells and between specialized and normal cardiac cells.</p> <p>Describe how cardiac electrical activity is altered in the production of cardiac arrhythmias.</p> <p>Discuss the relationship between cellular cardiac electrical activity and the electrocardiogram.</p> <p>Describe the pathophysiologic mechanisms of cardiac arrhythmias (abnormal automaticity, triggered rhythms, reentrant rhythms and abnormal impulse conduction).</p> <p>Discuss the pharmacogenomics of long QT syndrome and the relationship of genetics to drug selection.</p> <p>Know the two forms of this disorder (i.e. drug-induced [or acquired LQT] and congenital) and which ion channels are responsible for each.</p>			

Mechanism of action

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.

Explain the molecular mechanism of action of each drug in each drug class.

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 alteration of slow (calcium-dependent) and fast (sodium-dependent) responses by antiarrhythmic drugs and how that relates to the use of specific agents in arrhythmias of different origins (ventricular vs. supraventricular).

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.

Actions on organ systems

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

Describe the effect of age on fast and slow channels.

Describe the indirect autonomic actions of these drugs.

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).

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.

Know the classes of drugs (both antiarrhythmic and non antiarrhythmic) that can produce acquired Long QT Syndrome (LQTS).

Therapeutic uses

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, and ventricular fibrillation).

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

Know that the therapeutic management of congenital Long QT Syndrome depends on the genotype, despite a uniform phenotype.

Notes

Objectives for Calcium-Channel Blockers are covered under Management of Hypertension.

Objectives for β -Adrenoceptor Antagonist Agents are covered under Autonomic Nervous System.

Management of Acute and Chronic Heart Failure				
Recommended Curriculum Equivalent: 2.0 hr				
Drug Classes and Drugs to Consider (Major or Prototype Drugs Capitalized)				
A. Renin-Angiotensin Aldosterone System			B. Other Peptide Systems	
ACE Inhibitors	Angiotensin Receptor Blockers	Aldosterone Antagonists	Metalloprotease Inhibitors	ANP Agents
CAPTOPRIL ENALAPRIL	LOSARTAN	SPIRONOLACTONE EPLERENONE	Omapatrilat Sampatrilat Fasidotrilat	Nesiritide
C. Sympathetic Agents		D. PDE Inhibitors	E. Vasodilators	
Antagonists	Agonists			
Bisoprolol CARVEDILOL METOPROLOL	DOBUTAMINE DOPAMINE	Milrinone Inamrinone	HYDRALAZINE Nitroprusside ISOSORBIDE DINTRATE NITROGLYCERIN	
F. Diuretics		G. Cardiac Glycosides		
FUROSEMIDE Thiazides SPIRONOLACTONE		DIGOXIN		
Principles and Learning Objectives for Management of Heart Failure				
<p>Physiology and pathophysiology: 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. Discuss the role of genetics and ethnicity in the physiology of heart failure and in the regulation of responsiveness to agents used in heart failure.</p>				
<p>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 Na⁺/Ca²⁺ 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.</p>				

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.

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 digoxin (onset and duration of action).

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

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

Adverse effects, drug interactions and contraindications

Describe the cardiac (delayed depolarizations and arrhythmias) and extracardiac manifestations of digoxin toxicity (digoxin levels > 2.0 ng/ml are associated with toxicity).

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.

Therapeutic uses

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.

Discuss the use of atrial natriuretic peptide agonists, endothelial receptor antagonists and metalloprotease inhibitors in the management of acute severe heart failure unresponsive to other agents.

Notes

Objectives for Renin-angiotensin aldosterone agents are covered under vasoactive peptides.

Objectives for Sympathetic nervous system drugs are covered under Autonomic Nervous System.

Management of Hypertension				
Recommended Curriculum Equivalent: 4.0 hr				
Drug Classes and Drugs to consider (Major or Prototype Drugs Capitalized)				
A. Renin-Angiotensin Aldosterone System				B. Endothelin Antagonists
Angiotensin Converting Enzyme Inhibitors	Angiotensin Receptor Blockers	Aldosterone Antagonists	Renin Inhibitor	
ENALAPRIL CAPTOPRIL LISINOPRIL	LOSARTAN VALSARTAN Candasartan	SPIRONOLACTONE Eplerenone	Aliskiren	Bosentan
C. Sympathetic Antagonist Agents				
Alpha		Beta		Mixed α and β
Non-selective	α_1 Selective	Nonselective	β_1 Selective	
PHENTOLAMINE PHENOXYBENZAMINE	PRAZOSIN Doxazosin	PROPRANOLOL Timolol Nadolol Pindolol	Atenolol METOPROLOL	LABETALOL CARVEDILOL
D. Diuretics	E. Vasodilators			
FUROSEMIDE THIAZIDES Aldosterone Inhibitors Potassium Sparing Diuretics	Venous		Arterial	Both
	Nitroglycerin ISOSORBIDE DINITRATE		DILTIAZEM HYDRALAZINE Minoxidil Diazoxide DIHYDROPYRIDINES (e.g. NIFEDIPINE) VERAPAMIL	NITROPRUSSIDE ACE INHIBITORS ARBS Alpha Blockers
F. Centrally Acting Agents			G. Hypertensive Emergency and Urgency	
CLONIDINE Alpha-methyl DOPA			Fenoldopam NITROPRUSSIDE Trimethaphan Nicardipine ESMOLOL	
Principles and Learning Objectives for Management of Hypertension				
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 aldosterone 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.				

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.

Actions on organ systems

Review the end organ effects of untreated 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).

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.

Adverse effects, drug interactions and contraindications

Describe the cardiac and extracardiac side effects of antihypertensive drugs, including reflex effects.
Describe the beneficial and adverse interactions between antihypertensive drugs and between antihypertensive drugs and other therapeutic agents.

Therapeutic uses

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).

Notes

Objectives for Renin-angiotensin aldosterone agents are covered under vasoactive peptides
Objectives for Sympathetic nervous system drugs are covered under Autonomic Nervous System

Drugs for the Treatment of Angina and Coronary Artery Disease

Recommended Curriculum Equivalent: 1.0 hr

Drug Classes and Drugs to consider (Major or Prototype Drugs Capitalized)

A. Beta Adrenoceptor Antagonists	B. Calcium Entry Blockers	C. Organic Nitrates	D. Metabolic Modulators
PROPRANOLOL METOPROLOL ATENOLOL	NIFEDIPINE NICARDIPINE Diltiazem Verapamil	NITROGLYCERIN ISOSORBIDE MONONITRATE Isosorbide Dinitrate	Ranolazine

Principles and Learning Objectives for Management of Angina and Coronary Artery Disease

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.

Mechanism 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.

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.

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 transdermal 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.

Adverse effects, drug interactions and contraindications

Describe the cardiac and extra-cardiac side effects of antianginal drugs with special reference to the interaction with drugs used to treat erectile dysfunction.

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

Therapeutic uses

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.

Notes

Objectives for Sympathetic nervous system drugs are covered under Autonomic Nervous System.

E. Drugs for the Treatment of Hyperlipidemias

Recommended Curriculum Equivalent: 1.0 hr

1. Drug Classes and Drugs to consider (Major or Prototype Drugs Capitalized)

A. BILE ACID SEQUESTRANTS	B. FIBRIC ACID DERIVATIVES	C. HMG CoA REDUCTASE INHIBITORS	D. OTHERS
CHOLESTYRAMINE Colesevalam Colestipol	GEMFIBROZIL Fenofibrate	ATORVASTATIN FLUVASTATIN LOVASTATIN PRAVASTATIN SIMVASTATIN Rosuvastatin	EZETIMIBE Omega-3 Fatty Acids Nicotinic Acid

2. Principles and Learning Objectives for the Management of Hyperlipidemias

A. Physiology and Pathophysiology: 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, LDL, lipoproteins).

Discuss the lipid profile characteristic of insulin-resistant diabetics.

Discuss genetic conditions leading to hyperlipidemia.

Describe the concept of “plaque stability”.

B. Mechanisms 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.

Discuss the advantages of combinations of agents in the management of hyperlipidemia.

Identify the putative role of antioxidants in the management of hyperlipidemia.

C. 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. Pharmacokinetics

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

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

E. 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. Therapeutic uses:

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).

G. Notes

Objectives for nicotinic acid are also found under Vitamins.

F. Thrombolytic and Hemorrhagic Agents in the Management of ST-Elevation Myocardial Infarction (STEMI)/Myocardial Infarction/Acute Coronary Syndrome and Chronic Treatment of Cardiovascular Diseases

Recommended Curriculum Equivalent: 1 hr

1. Drug Classes and Drugs to consider (Major or Prototype Drugs Capitalized)

A. ANTIPLATELET AGENTS

ADP Receptor Antagonists	Glycoprotein IIb/IIIa Receptor Antagonists	Others
CLOPIDOGREL Ticlopidine	ABCIXIMAB Eptifibatide Tirofiban	ASPIRIN Dipyridamole

B. ANTICOAGULANTS

Heparins	Orally Active Anticoagulants	Thrombin Inhibitors
HEPARIN ENOXAPARIN Dalteparin Tinzaparin Fondaparinux	WARFARIN	Bivalirudin Lepirudin Argatroban Ximelagatran

C. FIBRINOLYTICS

ALTEPLASE
Anistreplase
Retepase
STREPTOKINASE
Tenecteplase
UROKINASE

Mechanisms 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.

Actions on organ systems

Discuss the long-term use of antiplatelet agents (e.g. ASPIRIN 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 with drug-eluting stents).

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

Pharmacokinetics

Discuss the appropriate use of parenteral versus oral anticoagulants.

Discuss the route and time of administration of thrombolytic agents.

Adverse effects, drug interactions and contraindications

Discuss the treatment of warfarin overdose.

Discuss the management of heparin-induced thrombocytopenia (HIT) and the potential for heparin-induced thrombocytopenic thrombosis (HITT).

Therapeutic uses

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.

Notes

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

Drugs used for the Management of Asthma and COPD

Recommended Curriculum Equivalent: 1 hr

Drug Classes and Drugs to consider (Major or Prototype Drugs Capitalized)

A. Antiinflammatory Drugs		B. Leukotriene Modifiers		
Steroids	Modulators of Mast Cell Degranulation		Leukotriene Receptor Antagonists	5-LO Inhibitor
	Mast Cell Stabilizer	Anti-IgE		
BUDESONIDE BECLOMETHASONE FLUTICASONE	CROMOLYN	Omalizumab	Zafirlukast MONTELUKAST	Zileuton

C. Bronchodilators

β_2 Agonists		Methylxanthines	Muscarinic Receptor Antagonists
Short-Acting	Long-Acting	THEOPHYLLINE Aminophylline	Ipratropium TIOTROPIUM
ALBUTEROL Pirbuterol Terbutaline	SALMETEROL FOMOTEROL		

Principles and Learning Objectives for the Management of Respiratory Diseases

Physiology and Pathophysiology: 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 and differences between asthma, allergic rhinitis and chronic obstructive pulmonary disease and the treatments of each disorder.

Mechanisms 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.

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.

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.

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.

Therapeutic uses

Compare and contrast the management of acute and chronic asthma and chronic 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).

Discuss recently introduced guidelines for management of asthma (National Heart, Lung and Blood Institute) and COPD (Global Initiative for Obstructive Lung Disease [GOLD]).

Notes

For additional information and objectives see Management of Asthma and COPD in Autocoids Section.

H. Summary of Classes and Specific Cardiovascular Drugs to be Considered				
Primary Agents to be considered in each class are indicated by CAPITALIZATION				
1. Adenosine Diphosphate Receptor Antagonists				
CLOPIDOGREL Ticlopidine				
2. Adrenoceptor Agonists				
β-Adrenoceptor Agonists			β₂-Adrenoceptor Selective Agonists	
DOBUTAMINE Dopamine EPINEPHRINE Isoproterenol			ALBUTEROL Bitolterol FORMOTEROL Levalbuterol Metaproterenol Pirbuterol SALMETEROL Terbutaline	
3. Adrenoceptor Antagonists				
Alpha-Adrenoceptor Antagonists		Beta-Adrenoceptor Antagonists		
Nonselective	α₁-selective	Mixed	Nonselective	β₁-selective
PHEHTOLAMINE PHENOXYBENZAMINE Tolazoline	Doxasin PRAZOSIN TAMSULOSIN Terazosin	CARVEDILOL LABETALOL	Nadolol Penbutolol Pindolol PROPRANOLOL Sotalol Timolol	Acebutolol ATENOLOL Betaxolol Bisoprolol ESMOLOL METOPROLOL
4. Aldosterone Antagonists				
SPIRONOLACTONE Eplerenone				
5. Angiotension Converting Enzyme Inhibitors (ACEIs)				
BENZAEPRI CAPTOPRIL ENALAPRIL Enalaprilat FOSINOPRIL LISINOPRIL Moexipril Perindopril QUINAPRIL RAMIPRIL Trandolapril				
6. Angiotensin Receptor Antagonists (ARBs)				

Candesartan Eprosartan IRBESARTAN LOSARTAN Olmisartan Telmisartan VALSARTAN			
7. Antiarrhythmic Agents (Miscellaneous Mechanisms)			
ADENOSINE AMIODARONE Disopyramide Dofetilide Flecainide LIDOCAINE Mexiletine PROCAINAMIDE Propafenone QUINIDINE			
8. Antiasthmatic Agents (Miscellaneous Mechanisms)			
Mast Cell Stabilizers		Anti-IgE Agents	
CROMOLYN Nedocromil		Omalizumab	
9. Anticholesterolemic Agents			
Bile Acid Sequestrants	HMG CoA Reductase Inhibitors	Fibric Acid Derivatives	Miscellaneous Mechanisms
CHOLESTYRAMINE Colestipol Colesevelam	ATORVASTATIN FLUVASTATIN LOVASTATIN PRAVASTATIN SIMVASTATIN Rosuvastatin	Fenofibrate GEMFIBROZIL	Niacin Nicotinic acid EZETIMIBE
10. Anticholinergic Agents			
Nicotinic Receptor Antagonists (Ganglionic Blockers)		Muscarinic Receptor Antagonists	
Trimethaphan Hexamethonium (historical)		ATROPINE IPRATROPIUM Tiotropium	
11. Anticoagulant Agents			
Oral Anticoagulants	Heparins	Thrombin Inhibitors	

WARFARIN	HEPARIN ENOXAPARIN Dalteparin Tinzaparin Fondaparinux	Bivalirudin LEPIRUDIN Argatroban Ximelagatran	
12. Antiplatelet Agents			
Miscellaneous Mechanisms	Phosphodiesterase Inhibitors	Glycoprotein IIb/IIIa Inhibitors	ADP Receptor Antagonists
ASPIRIN Dipyridamole	Cilostazol	ABCIXIMAB Eptifibatide Tirofiban	CLOPIDOGREL Ticlopidine
13. Atrial Natriuretic Peptide Agonists			
Nesiritide			
14. Calcium Channel Blockers (Calcium Entry Blockers)			
Dihydropyridines	Phenylalkylamine	Benzothiazepines	Others
AMLODIPINE FELODIPINE Isradipine Nicardipine NIFEDIPINE Nimodipine Nisoldipine	VERAPAMIL	DILTIAZEM	Bepidil Flunarizine
15. Cardiac Glycosides			
DIGOXIN Digitoxin (historical)			
16. Centrally Acting Antihypertensive Drugs			
CLONIDINE Guanfacine Guanabenz Methyldopa Reserpine (historical)			
17. Corticosteroids (Inhaled)			
BECLOMETHASONE BUDESONIDE Flunisolide FLUTICASONE Mometasone Triamcinolone			
18. Diuretics			

Loop Diuretics	Thiazide Diuretics	Potassium-Sparing Diuretics	Osmotic Diuretics
Bumetanide Ethacrynic Acid FUROSEMIDE Torsemide	Chlorothiazide Chlorthalidone HYDROCHLOROTHIAZIDE INDAPAMIDE	Amiloride SPIRONOLACTONE Triamterene	Mannitol Urea
19. Endothelin Receptor Antagonists			
Bosentan			
20. Fibrates			
Fenofibrate GEMFIBROZIL			
21. Fibrinolytics			
ALTEPLASE Anistreplase Reteplase STREPTOKINASE Tenecteplase UROKINASE			
22. Glycoprotein IIb/IIIa Receptor Antagonists			
ABCIXIMAB Eptifibatide Tirofiban			
23. Leukotriene Modifiers			
Leukotriene Receptor Antagonists		5'-Lipoxygenase Inhibitors	
MONTELUKAST Zafirlukast		Zileuton	
24. Metabolic Modulators			
Ranolazine			
25. Metalloprotease Inhibitors			
Omapatrilat Sampatrilat Fasidotrilat			
26. Methylxanthines			
Aminophylline Pentoxifylline (only for intermittent claudication with peripheral vascular disease) THEOPHYLLINE			
27. Phosphodiesterase Inhibitors			

Inamrinone
Milrinone
Cilostazol

28. Vasodilators

Organic Nitrates

Amyl nitrite
Isosorbide dinitrate
ISOSORBIDE MONONITRATE
NITROGLYCERIN

Others (Miscellaneous Mechanisms)

Diazoxide
HYDRALAZINE
Minoxidil
NITROPRUSSIDE