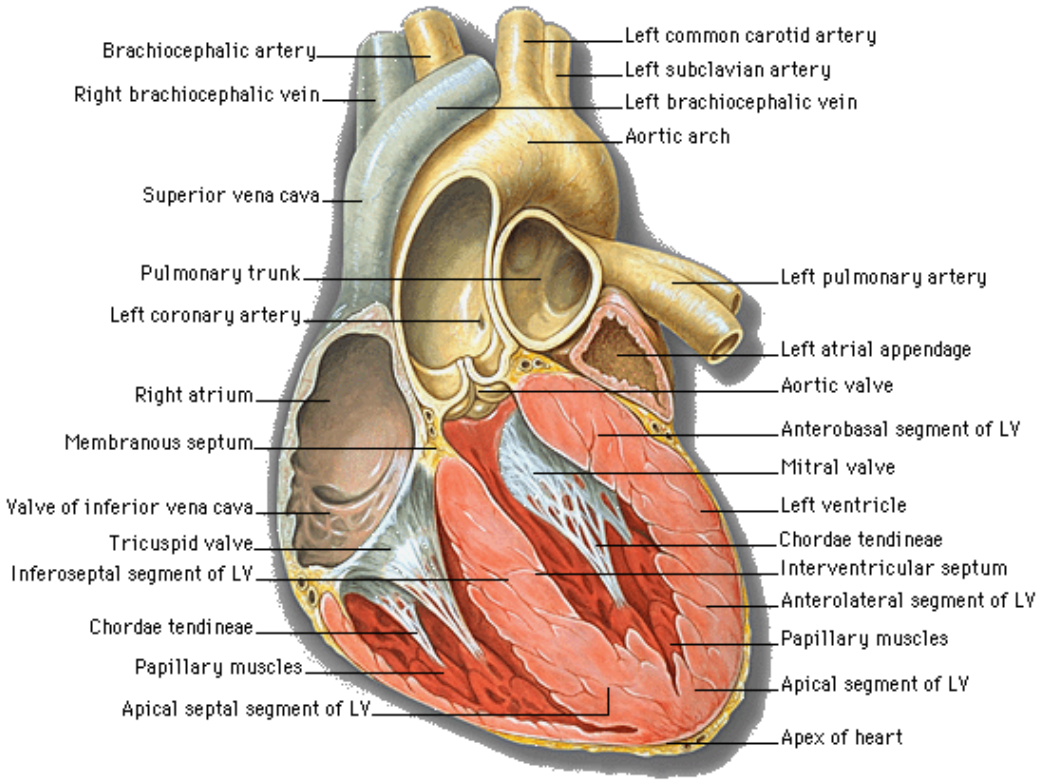
Lesson 7

Medications Used for the Circulatory System



Ace Inhibitors

Ace Inhibitors	
Drugs in this class include:	• Enalapril • Lisinopril • Captopril • Accupril • Quinapril • Benazopril • Fosinopril

The angiotensin converting enzyme (ACE) inhibitors are so named because they work by blocking the conversion of angiotensin I to angiotensin II in the lung. Angiotensin II is a potent hormone that constricts arterioles and raises blood pressure. Thus, ACE inhibitors act to lower the blood pressure. Aside from being used as **antihypertensive** drugs, ACE inhibitors are particularly well suited for patients with congestive heart failure by lowering the net resistance in the vascular bed, thereby facilitating the heart's task of pumping blood. ACE inhibitors have actually been found to prolong the lifespan

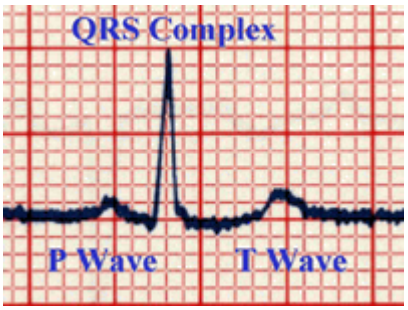
of patients with congestive heart failure. ACE inhibitors also have effects on blood vessels that seem to counteract the process of atherosclerosis and have been shown to reduce heart attack, stroke, and mortality in patients with coronary artery disease.

Some ACE inhibitors may cause the annoying side effect of a dry, hacking cough. Some patients, particularly elderly patients with kidney disease, cannot tolerate ACE inhibitors because of their effects on blood potassium levels and effects on the kidneys.

Antiarrhythmics

Antiarrhythmics	
Drugs in this class include:	• Amiodarone • Sotalol • Disopyramide • Digoxin • Procainamide • Quinidine

There are many different classes of antiarrhythmics and their uses are tailored toward the specific arrhythmia being treated.



Digoxin is a very commonly used antiarrhythmic. Digoxin has a slowing effect on the heart rate and for this reason is used in the treatment of atrial fibrillation and atrial flutter, arrythmias which characteristically are associated with rapid and erratic heart rates. Digoxin does not suppress or prevent these arrhythmias but only works to slow them down and relieve the symptoms of palpitations, or “heart pounding.” Digoxin also helps a weakened heart muscle to pump more efficiently and is used in the treatment of congestive heart failure. Digoxin is cleared from the body by the kidneys. Therefore, its levels must be closely monitored in patients with kidney disease.

Amiodarone and sotalol are antiarrhythmics that are used to treat atrial arrhythmias (atrial fibrillation and atrial flutter) as well as ventricular arrhythmias (ventricular fibrillation). These drugs are very effective in suppressing arrhythmia. Amiodarone and sotalol are very potent and may themselves cause various rhythm disturbances and may interact with other drugs. These drugs are monitored very closely and are usually prescribed only by a cardiologist. Sotalol also has beta blocker activity. Amiodarone has several potential toxicities, including liver, lung, and thyroid toxicity.
Procainamide, quinidine, and disopyramide are frequently used to treat atrial arrhythmias. Procainamide also is effective in ventricular arrhythmias.

Blood Thinners

Blood Thinners	
Drugs in this class include:	• Aspirin (ASA) • Warfarin • Clopidogrel • Ticlopidine

Aspirin (ASA) is a very weak blood thinner and works by blocking the activity of blood platelets, which are the blood cells responsible for clotting. ASA has been shown to reduce the incidence of heart attack and for this reason is one of the most common drugs used to treat coronary artery disease.
Clopidogrel and ticlopidine, like ASA, are blockers of blood platelets, but are much more potent than ASA. Clopidogrel and ticlopidine are primarily prescribed by cardiologists after a coronary stent procedure, to prevent clotting of the newly placed stent. The drugs are usually prescribed for a period of 3-4 weeks following stenting, then discontinued. Clopidogrel and ticlopidine, in rare cases, may cause a rash. In extremely rare cases, these two drugs may also cause low blood counts. Clopidogrel and ticlopidine are also effective in prevention of stroke in patients with atherosclerosis of the carotid arteries.
Abciximab, eptifipitide, tirofiban are potent platelet function blockers. These drugs are given intravenously and are used only in the hospital. They are commonly used in the treatment of unstable angina and heart attack. They are also used as adjunctive treatment during angioplasty and stent procedures and reduce the incidence of heart attack after complex angioplasty.

Warfarin (Coumadin) is a very potent blood thinner that acts by blocking the blood clotting proteins. Warfarin has no effect on blood platelets. Warfarin is primarily used in the treatment of atrial fibrillation, an abnormality in the heart rhythm that predisposes to blood clot formation in the heart which may lead to stroke. Warfarin use significantly reduces the risk of stroke in patients with atrial fibrillation. Warfarin is also used in patients who have artificial metallic heart valve prostheses. Warfarin interacts with many other commonly used drugs and even certain foods, especially leafy green vegetables. Warfarin blood levels must be very closely monitored, usually every 2 to 4 weeks, to avoid overthinning or underthinning of the blood.

Beta Blockers

Beta Blockers	
Drugs in this class include:	• Atenolol • Metoprolol • Propranolol • Sotalol • Bisoprolol • Carvedilol • Timolol • Nadolol • Betaxolol • Pindolol • Labetolol

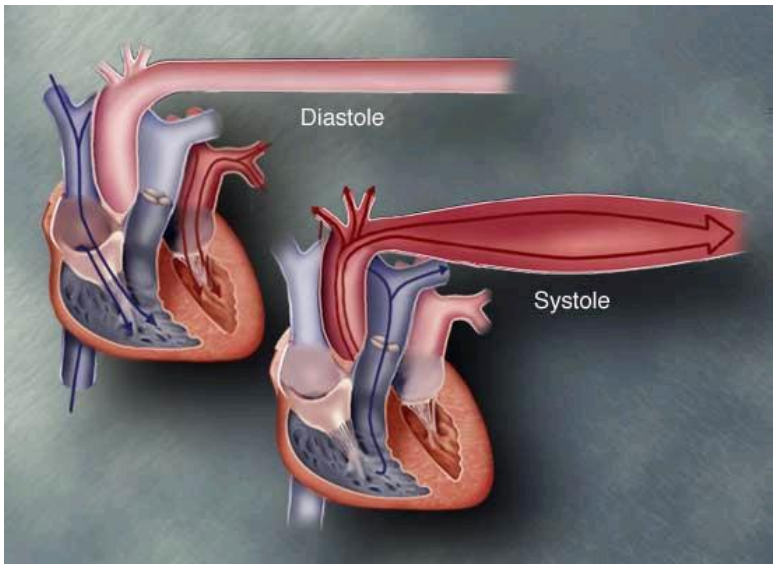
The beta blockers are an important class of drugs that are used in the treatment of coronary artery disease, congestive heart failure (CHF), and arrhythmia. These drugs block the beta receptors in the heart. Since the beta receptors regulate heart rate and the vigor with which the heart muscle cells contract (contractility), these drugs lower heart rate and blood pressure, effectively decreasing the work of the heart.

Beta blockers have been shown to lo wer mortality in patients with myocardial infarction.

Beta blockers also slow the progression of congestive heart failure (CHF) and prolong lifespan in patients with CHF. Since beta blockers have a slowing effect on the heart rate, they help suppress many cardiac arrhythmias. The more common side effects of beta blockers include fatigue, lack of energy, nightmares, and slow heart rate. Some male patients experience impotence with these drugs. Patients with asthma or emphysema may not be able to tolerate beta blockers because of an increase in symptoms of shortness of breath and wheezing.

Calcium Channel Blockers

Calcium Channel Blockers	
Drugs in this class include:	• Nifedipine • Diltiazem • Verapamil • Amlodipine • Felodipine • Isradapine • Nicardipene • Nimodipine • Bepridil



The calcium channel blockers are commonly used in the treatment of **hypertension**, arrhythmia, and angina. Calcium channel blockers block the movement of calcium into smooth muscle cells in vessel walls. Since calcium is required for muscle contraction, the calcium channel blockers cause relaxation and dilatation of arteries. By t his mechanism, calcium channel blockers lower the blood pressure.

Since these drugs also dilate the coronary arteries, they are also used in the treatment of angina. Some of the calcium channel blockers have a slowing effect on the heart rate and are used in the treatment of arrhythmia. The more common side effects of these drugs include leg swelling, constipation, dizziness, and weakness.

Many calcium channel blockers come in an extended release or sustained release preparation (XL, SR) that is convenient for once a day dosing. These tablets should not be cut in half or crushed, as this would affect the rate of drug release into the bloodstream.

Diuretics

Diuretics	
Drugs in this class include:	• Furosemide (Lasix) • Hydrochlorothiazide • Torsamide • Bumetanide • Acetazolamide • Spironolactone

Diuretics work on the kidneys and cause them to excrete sodium in the urine. When sodium is excreted, water follows passively and the end result is an increase in urine production. This effect is a desirable one in the setting of conge stive heart failure, where a weakened heart causes the body to retain water. Many (but not all) diuretics cause potassium to be lost in the urine. For this reason potassium supplements are frequently prescribed with diuretics. Diuretics may slightly raise levels of serum cholesterol.

Nitrates

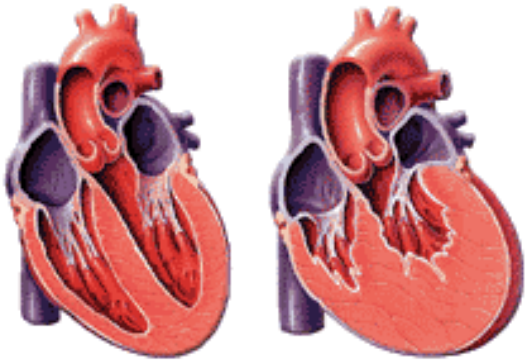
Nitrates	
Drugs in this class include:	• Isosorbide Dinitrate • Isosorbide Mononitrate • Nitroglycerin (NTG)

Nitrates are vasodilators of the coronary arteries and thus are frequently used for relief of chest pain in patients with coronary artery disease and angina. Nitrates are also used in congestive heart failure to diminish symptoms of shortness of breath. Nitrates do not reduce mortality in coronary artery disease or congestive heart failure. Their use is principally for symptom relief.

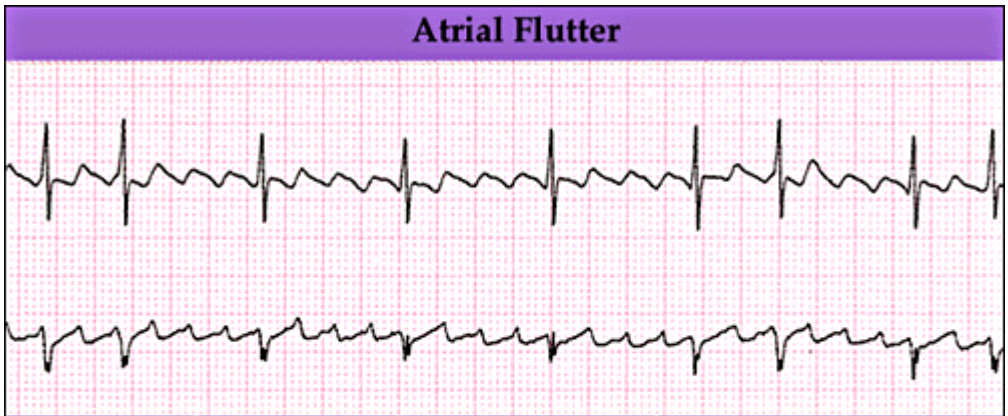
Digitalis

Digitalis	
Drugs in this class include:	• Digoxin

Digoxin is a well known drug extracted from the foxglove plant. Digoxin has the effect of increasing the heart's ability to contract. For this reason, digoxin is frequently used in **congestive heart failure (CHF).** In patients with chronic CHF, digoxin use reduces the frequency of CHF exacerbations that would require hospitalization. Digoxin does not reduce mortality from CHF, however. Digoxin also has antirrhythmic effects and is used most notably in the setting of **atrial fibrillation**, to slow down and control a very rapid and erratic heart rate. Digoxin is excreted by the kidneys and therefore its levels must be very closely monitored in patients with kidney disease.



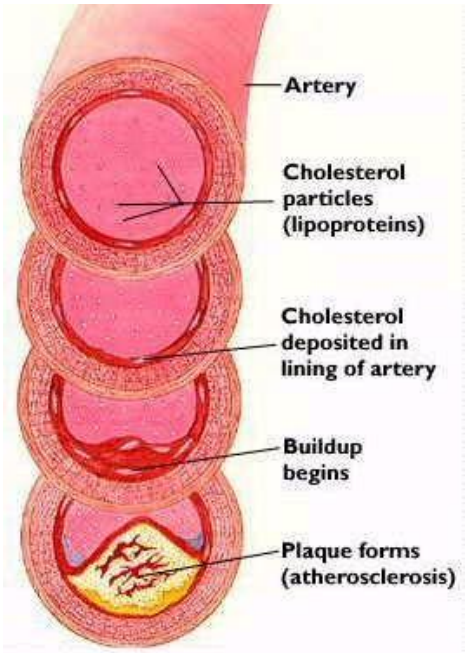
Normal Heart Congestive Heart



Heart Rate	Rhythm	P Wave	PR interval (in seconds)	QRS (in seconds)
A: 220-430 bpm V: <300 bpm	Regular or variable	Sawtoothed appearance	N/A	<.12

Cholesterol-Lowering Medicines

Cholesterol-Lowering Medicines	
Drugs in this class include:	• Lovastatin • Simvastatin • Atorvostatin • Pravastatin • Niacin • Cholestyramine • Gemfibrozil



The cholesterol-lowering medications have potent effects on lowering the LDL ("bad") cholesterol. Some of these drugs also have the bonus effect of raising the HDL ("good") cholesterol. The "statin" class of cholesterol-lowering drugs in particular have gained widespread use in recent years. This class of drugs has been shown to reduce the incidence of heart attack and death in patients with high cholesterol and coronary artery disease. The **statin** drugs have some important side effects including muscle aches and cramps, muscle inflammation and damage (rare), and liver toxicity.