disorders, postmenopausal hot flashes, adjunct medication during anesthesia, treatment of migraines, and attention deficit-hyperactivity disorder. Clonidine has not received approval by the Food and Drug Administration (FDA) for these purposes.

Alpha$_1$-adrenergic blocking agents are used in the treatment of hypertension, BPH, vasospastic disorders, and persistent pulmonary hypertension in the newborn. Nonselective alpha-blocking agents are not used as antihypertensive drugs except in hypertension caused by excessive catecholamines. Excessive catecholamines may result from overdosage of adrenergic drugs or from pheochromocytoma, a rare tumor of the adrenal medulla that secretes epinephrine and norepinephrine and causes hypertension, tachycardia, and cardiac dysrhythmias. Although the treatment of choice for pheochromocytoma is surgical excision, alpha-adrenergic blocking drugs are useful adjuncts. They are given before and during surgery, usually in conjunction with beta blockers. Nonselective alpha blockers also are used in vascular diseases characterized by vasospasm, such as Raynaud's disease and frostbite, in which they improve blood flow. Phentolamine (Regitine) also can be used to prevent tissue necrosis from extravasation of potent vasoconstrictors (eg, norepinephrine, dopamine) into subcutaneous tissues.

Beta-Adrenergic Blocking Drugs

Clinical indications for use of beta-blocking agents are mainly cardiovascular disorders (ie, angina pectoris, cardiac tachyarrhythmias, hypertension, myocardial infarction, congestive heart failure, and glaucoma).

In angina, beta blockers decrease myocardial contractility, cardiac output, heart rate, and blood pressure. These effects decrease myocardial oxygen demand (cardiac workload), especially in response to activity, exercise, and stress. In dysrhythmias, drug effects depend on the sympathetic tone of the heart (ie, the degree of adrenergic stimulation of the heart that the drug must block or overcome). The drugs slow the sinus rate and prolong conduction through the AV node, thereby slowing the ventricular response rate to supraventricular tachyarrhythmias.

In hypertension, the actions by which the drugs lower blood pressure are unclear. Possible mechanisms include reduced cardiac output, inhibition of renin, and inhibition of sympathetic nervous system stimulation in the brain. However, the drugs effective in hypertension do not consistently demonstrate these effects—in other words, a drug may lower blood pressure without reducing cardiac output or inhibiting renin, for example. After myocardial infarction, the drugs help protect the heart from reinfarction and decrease mortality rates over several years. A possible mechanism is preventing or decreasing the incidence of catecholamine-induced dysrhythmias. In congestive heart failure (CHF), beta blockers have a limited role and require careful monitoring on the part of the physician and the nurse. Administration of beta blockers may acutely worsen the condition of persons with congestive heart failure by blocking the sympathetic stimulation that helps to maintain cardiac output. However, in selected patients who are able to tolerate the effects of beta blockers, the drugs are beneficial. For these patients, beta blockers decrease the risk of sudden cardiac death and may reduce ventricular remodeling that accompanies CHF and leads to further deterioration of cardiac function.

In glaucoma, the drugs reduce intraocular pressure by binding to beta-adrenergic receptors in the ciliary body of the eye and decreasing formation of aqueous humor.

Propranolol (Inderal) is the prototype of beta-adrenergic blocking agents. It is also the oldest and most extensively studied beta blocker. In addition to its use in the treatment of hypertension, dysrhythmias, angina pectoris, and myocardial infarction, propranolol is used to treat a wide variety of other conditions. In hypertrophic obstructive cardiomyopathy, it is used to improve exercise tolerance by increasing stroke volume. In pheochromocytoma, it is used in conjunction with an alpha-blocking agent to counter the effect of excessive catecholamine secretion, preventing tachycardia and dysrhythmias. Propranolol is useful in treating dissecting aortic aneurysms by decreasing systolic blood pressure. Propranolol decreases heart rate, cardiac output, and tremor in patients with hyperthyroidism. It is also useful, by an unknown mechanism, for the prevention of migraine headaches. Propranolol is not helpful in acute attacks of migraine headaches. The drug also relieves palpitation and tremor associated with anxiety and stage fright, but it is not approved for clinical use as an antianxiety drug. Some patients experiencing alcohol withdrawal may also benefit from the administration of propranolol.

In cirrhosis of the liver, research indicates that propranolol may decrease the incidence of the initial episode of bleeding esophageal varices, prevent rebleeding episodes, and decrease the mortality rate due to hemorrhage.

Contraindications to Use

Alpha$_2$ agonists are contraindicated in clients with hypersensitivity to the drugs, and methyldopa is also contraindicated in clients with active liver disease. Alpha-adrenergic blocking agents are contraindicated in angina pectoris, myocardial infarction, and stroke. Beta-adrenergic blocking agents are contraindicated in bradycardia, heart block, and asthma and other allergic or pulmonary conditions characterized by bronchoconstriction. Although new research has shown that beta blockers can be beneficial to selected clients with mild to moderate chronic heart failure, the drugs have not been proven safe for people older than 80 years of age or those with severe heart failure.

INDIVIDUAL ANTIADRENERGIC DRUGS

These drugs are described in the following sections. Trade names, clinical indications, and dosage ranges are listed in Drugs at a Glance: Alpha-Adrenergic Agonists and Blocking