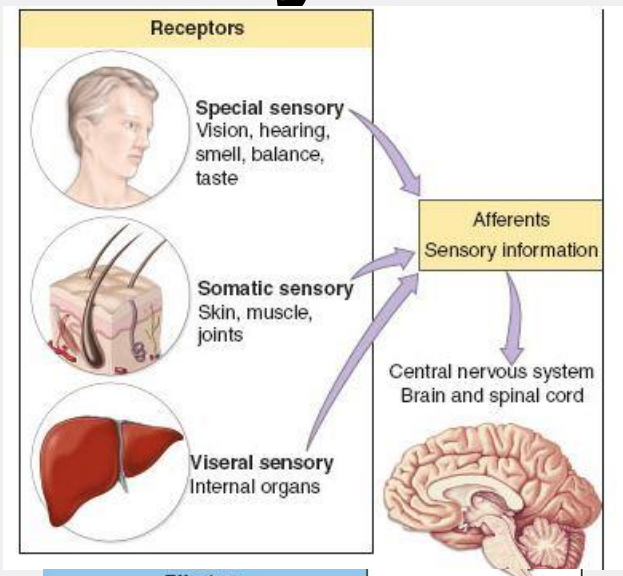
Introduction to Clinical Pharmacology

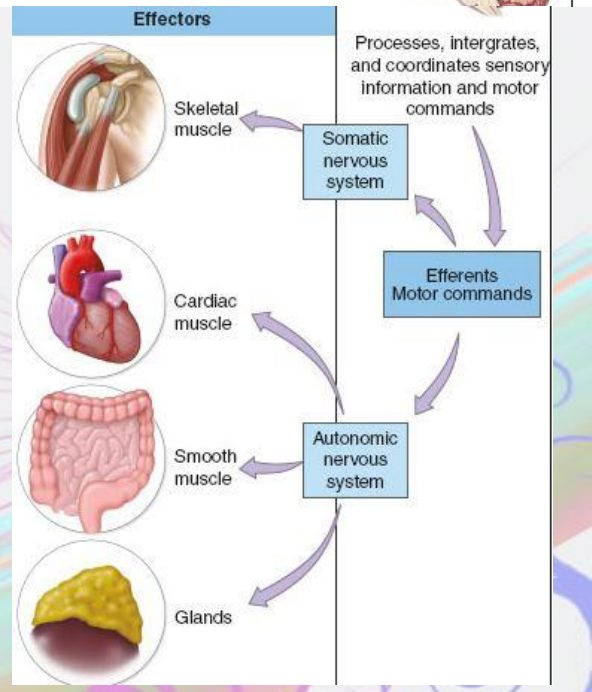
Chapter 23
Adrenergic Drugs

Sympathetic Nervous System

Drugs That Affect the Peripheral Nervous System

- Neurotransmission is a very complex concept and is key to how many drugs work in the body
  - drugs are used to enhance or block the nerve impulses as they travel through the rest of the body
  - nerves connect the brain to all parts of our body
  - nerve pathways are segmented with a terminal end and message “jumps” across the gap (or synapse) to a receptor on the beginning of the next nerve by using neurotransmitter(s)
  - the synaptic are is where drugs work
  - nerve pathways called the afferent nerves (the incoming pathway)
  - the efferent nerves (outgoing pathway) from the brain to the various organs or tissues



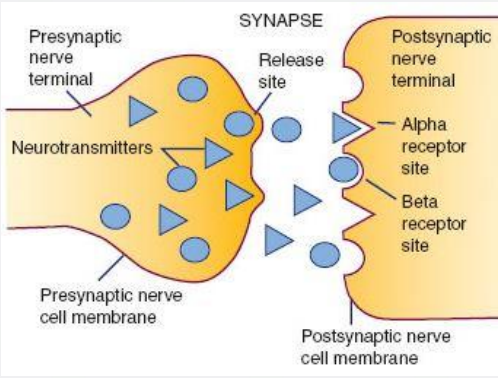


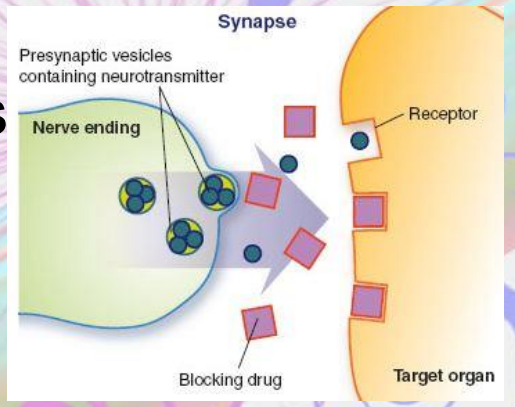
Drugs That Affect the Peripheral Nervous System

- The peripheral nervous system (PNS) is a complex network of nerves from the spinal cord to the organs and other body structures
  - PNS is divided into two branches, the **somatic nervous system** and the **autonomic nervous system**
  - **somatic branch** concerned with sensation and voluntary movement such as heat, pain, cold, and pressure
  - **autonomic branch** concerned with functions essential to the survival of the organism (body) such as breathing, cardiac, etc

Drugs That Affect the Peripheral Nervous System

- The autonomic nervous system is divided into the sympathetic and the parasympathetic branches
  - **sympathetic branch** tends to regulate the expenditure of energy and activates when the organism is confronted with stressful situations
  - **sympathetic system** is also called the adrenergic branch
  - antiadrenergic drugs, adrenergic blocking drugs, or sympatholytics
  - major body systems affected by adrenergic blocking drugs is the heart and vascular system
  - **parasympathetic branch** of the autonomic nervous system conserve body energy and is partly responsible for such activities as slowing the heart rate, digesting food, and eliminating bodily wastes
  - **parasympathetic branch** known as cholinergic branch





Adrenergic Drugs – Main Vasopressors

Adrenergic Drugs: Actions #1

- Produce the following responses in varying degrees:
  - CNS: wakefulness; quick reaction to stimuli; quickened reflexes
  - Metabolism: increased use of glucose, liberation of fatty acids—adipose tissue
  - Heart: increase in heart rate
  - Autonomic nervous system: relaxation—smooth muscles of bronchi; constriction of blood vessels; sphincters—stomach; dilation—coronary blood vessels; decrease gastric motility

Adrenergic Drugs: Actions #2

- Adrenergic nerve receptors:
  - Organ affected by sympathetic nervous system depends on which postsynaptic nerve receptor sites are activated
  - Adrenergic nerves: alpha (α) or beta (β) receptors
  - Drugs that act on receptors are selective or nonselective
  - Isoproterenol: acts on β receptors; selective drug
  - Epinephrine: nonselective drug; acts on both α and β receptors

Receptor	Site	Effect
$Alpha_1$	Peripheral blood vessels	Vasoconstriction of peripheral blood vessels
$Alpha_2$	Presynaptic neuron	Regulates release of neurotransmitters; decreases tone, motility, and secretions of gastrointestinal tract
$Beta_1$	Myocardium	Increased heart rate, increased force of myocardial contraction
$Beta_2$	Peripheral blood vessels	Vasodilation of peripheral vessels
	Bronchial smooth muscles	Bronchodilation

Adrenergic Drugs: Uses #1

- Adrenergic drugs used for treatment of:
  - Hypovolemic, septic shock; allergic reactions; ventricular arrhythmias; respiratory distress
  - Control of superficial bleeding during surgical and dental procedures of mouth, nose, throat, and skin; nasal congestion; and glaucoma
  - Cardiac decompensation and arrest; hypotension
  - Temporary treatment of heart block

Adrenergic Drugs: Uses #2

- Used as vasoconstricting adjunct to local anesthetics to prolong anesthetic action in the tissues
- Shock: state of inadequate tissue perfusion
  - Symptoms: supply of arterial blood, oxygen flowing to cells, tissues is inadequate
  - Counteract symptoms: body initiates physiologic mechanisms

Adrenergic Drugs: Uses #3

- Untreated: compensatory mechanisms of body fail, irreversible shock occurs, death follows
- Types of shock: hypovolemic shock, cardiogenic shock, distributive shock

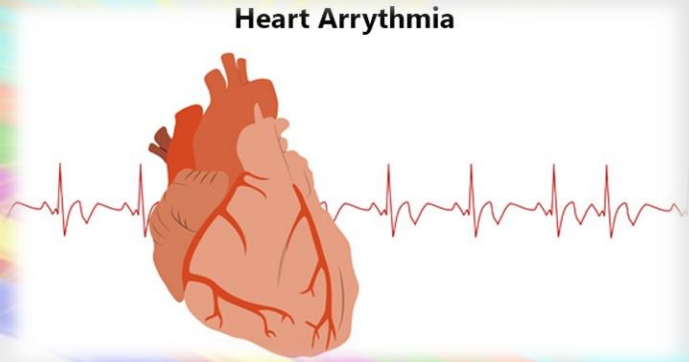
Type[a]	Description
Hypovolemic	Occurs when the blood volume is significantly diminished. *Examples:* hemorrhage; fluid loss caused by burns, dehydration, or excess diuresis
Cardiogenic–obstructive shock	Occurs when cardiac output is insufficient and perfusion to the vital organs cannot be maintained. *Examples:* a result of acute myocardial infarction, ventricular arrhythmias, congestive heart failure, or severe cardiomyopathy Obstructive shock is categorized with cardiogenic shock. It occurs when obstruction of blood flow results in inadequate tissue perfusion. *Examples:* pericardial tamponade, restrictive pericarditis, and severe cardiac valve dysfunction
Distributive (vasogenic) shock	Occurs when there are changes to the blood vessels causing dilation, but no additional blood volume. The blood is redistributed within the body. This category is further differentiated: • Septic shock—circulatory insufficiency resulting from overwhelming infection (e.g., central line infection) • Anaphylactic shock—hypersensitivity resulting in massive systemic vasodilation (e.g., drug allergic reaction) • Neurogenic shock—interference with PNS control of blood vessels (e.g., spinal cord injury)

Adrenergic Drugs: Uses #4

- Shock results:
  - Decrease in cardiac output, hypoxia, decrease in arterial blood pressure, reabsorption of water by kidneys
  - Increase in carbon dioxide in blood, decrease in oxygen in blood
  - Increased concentration of intravascular fluid
- In cardiogenic shock adrenergic drug may be used with a vasodilating drug
- Vasodilator: improves myocardial performance; adrenergic drug maintains blood pressure

Adrenergic Drugs: Adverse Reactions

- Depend on drug used, dose administered; individualized patient response
- Adverse reactions include:
  - Cardiac arrhythmias; headache; nausea; vomiting; increase in blood pressure
  - Epinephrine: increase tremor, rigidity in older adults with Parkinson disease



Adrenergic Drugs: Contraindications and Precautions #1

- Contraindicated in patients:
  - With hypersensitivity
  - Isoproterenol: tachyarrhythmias, heart block caused by digitalis toxicity, ventricular arrhythmias, angina pectoris
  - Dopamine: pheochromocytoma, unmanaged arrhythmias, ventricular fibrillation

Adrenergic Drugs: Contraindications and Precautions #2

- Contraindicated in patients (cont.)
  - Epinephrine: narrow-angle glaucoma, local anesthetic adjunct in fingers, toes
  - Norepinephrine: hypotensive—blood volume deficits
  - Midodrine causes severe hypertension: patients—lying down, supine hypertension

Adrenergic Drugs: Contraindications and Precautions #3

- Used cautiously in patients with:
  - Coronary insufficiency
  - Cardiac arrhythmias, angina pectoris
  - Hyperthyroidism, diabetes
  - Occlusive vascular disease
  - Prostatic hypertrophy

Adrenergic Drugs: Interactions

Interactant drug	Effect of interaction
Antidepressants	Increased sympathomimetic
Oxytocin	Increased risk of hypertension

Nursing Process: Assessment #1

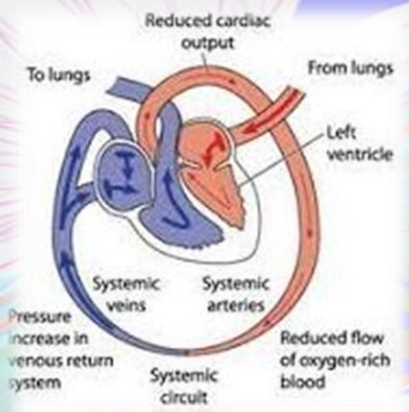
- **Preadministration assessment:**
  - Identify and record blood pressure, pulse rate and quality, respiratory rate and rhythm
  - Assess the symptoms, problems, or needs before administering drug and record any subjective or objective data in the patient's chart
  - Emergencies occur: then nurse must make assessments quickly and accurately

Nursing Process: Assessment #2

- **Ongoing assessment:**
  - Observe for effect of drug, such as improved breathing of patient with asthma, or response of blood pressure with administration of vasopressor
  - Evaluate, document drug effect, take and document vital signs
  - Notify primary health care provider of adverse reactions

Nursing Process: Planning

- Nursing Diagnoses
  - **Risk for Allergy Response** related to response to substance trigger (insect sting, drug allergy, specific food)
  - **Ineffective Tissue Perfusion** related to hypovolemia, blood loss, impaired distribution of fluid, impaired circulation, impaired transport of oxygen across alveolar and capillary bed, other (specify)
  - **Decreased Cardiac Output** related to altered heart rate and/or rhythm
  - **Disturbed Sleep Pattern** related to adverse reactions (nervousness) to the drug and the environment



Nursing Process: Implementation #1

- Promoting an optimal response therapy:
  - Exercise great care in calculation, preparation of drugs as adrenergic drugs are potentially dangerous
  - Report, document any complaint patient may have while taking adrenergic drugs; report adverse effects such as development of cardiac arrhythmias immediately, anorexia
  - Management of shock is aimed at providing basic life support; drugs used: antibiotics, inotropes, hormones

Nursing Process: Implementation #2

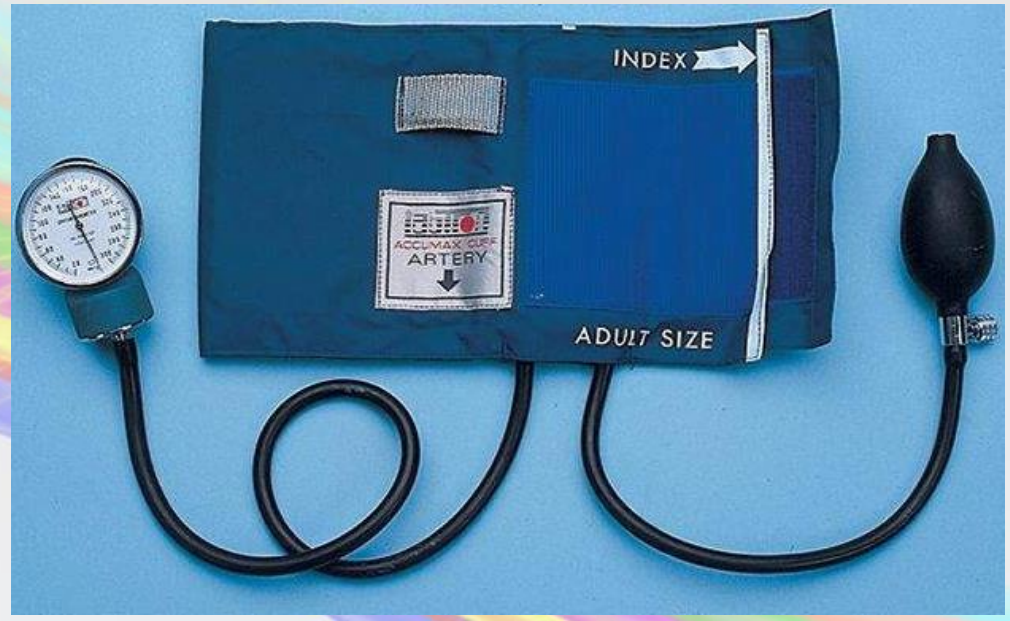
- Monitoring and managing patient needs:
  - Ineffective tissue perfusion:
    - Potential problem with tissue perfusion: Adrenergic drug for hypotension, blood pressure becomes too high
    - Ineffective tissue perfusion: decreased oxygen, inability of body to nourish cells

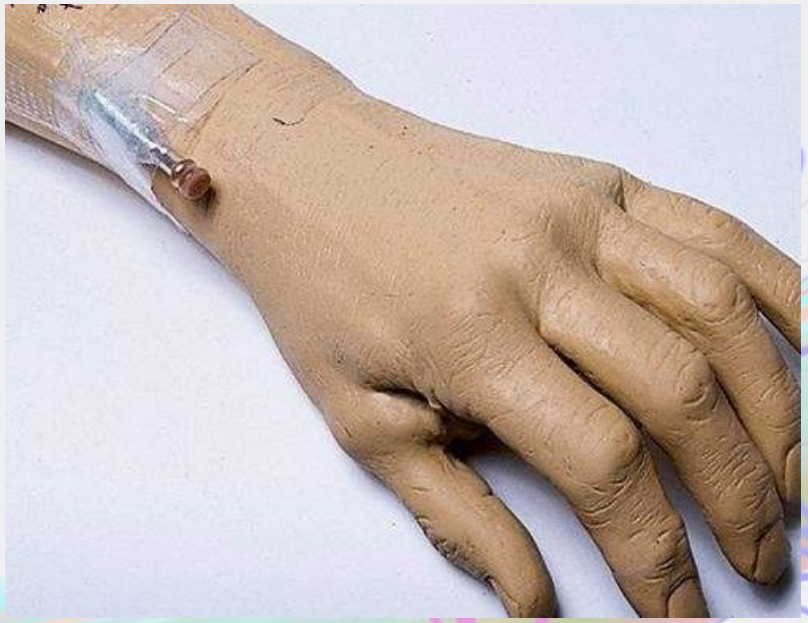
Nursing Process: Implementation #3

- Monitoring and managing patient needs (cont.)
  - Considerations while administering potent vasopressors dopamine, norepinephrine:
    - Electronic infusion pump: administer drugs
    - Do not mix dopamine with other drugs
    - Administer norepinephrine, dopamine only via IV route

Nursing Process: Implementation #4

- Monitoring and managing patient needs (cont.)
  - Monitor blood pressure continuously
  - Adjust rate: blood pressure
  - Readjustment of rate flow: IV solution necessary
  - Inspect needle site, surrounding tissues at frequent intervals



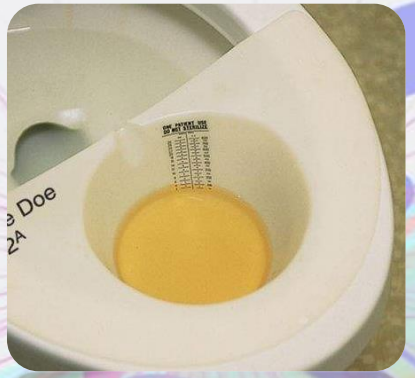


Nursing Process: Implementation #5

- Monitoring and managing patient needs (cont.)
  - Never leave patient receiving drugs unattended
  - Monitoring: shock—vigilance on part of nurse

Nursing Process: Implementation #6

- Monitoring and managing patient needs (cont.)
  - Decreased cardiac output:
    - Heart rate, stroke volume determine cardiac output
    - Stroke volume: contractile state of heart, amount of blood in ventricle available to be pumped out



Nursing Process: Implementation #7

- Monitoring and managing patient needs (cont.)
  - Shock: monitor vital signs; determine severity of shock
  - Progressive fall in blood pressure: serious
  - Nurse reports any progressive fall in blood pressure to primary health care provider

Nursing Process: Implementation #8

- Monitoring and managing patient needs (cont.)
  - Disturbed sleep pattern:
    - Critical care setting: daily pattern of activities is usually disrupted
    - Patients can easily get confused regarding daytime
    - Causes great deal of stress in patient

Nursing Process: Implementation #9

- Monitoring and managing patient needs (cont.)
  - Identify circumstances: nurse taking vital signs during night or turning overhead light on during night
  - Weigh importance of monitoring status, vital signs, providing comfort interventions
  - Explain reason for close monitoring of vital signs

Nursing Process: Implementation #10

- Educating the patient and family:
  - Educating patient receiving midodrine:
    - Patients: severe orthostatic hypotension
    - Importance of taking drug during daytime hours

Nursing Process: Implementation #11

- Educating the patient and family (cont.)
  - The suggested dosing schedule for the administration of midodrine is shortly before arising in the morning, midday, and late afternoon (not after 6:00 p.m.).
  - Control supine hypertension, potentially fatal adverse reaction: patient need not become fully supine
  - Explain that patient should sleep with head of bed elevated

Nursing Process: Evaluation

- The therapeutic effect is achieved
- Adverse reactions identified; reported to primary health care provider; managed successfully
- Patient verbalizes understanding of treatment modalities and drug regimen; importance of continued follow-up care