Adrenergic Drugs

Chapter 22

Presented by Laura Zdancewicz MSN, CRNP

The Nervous System

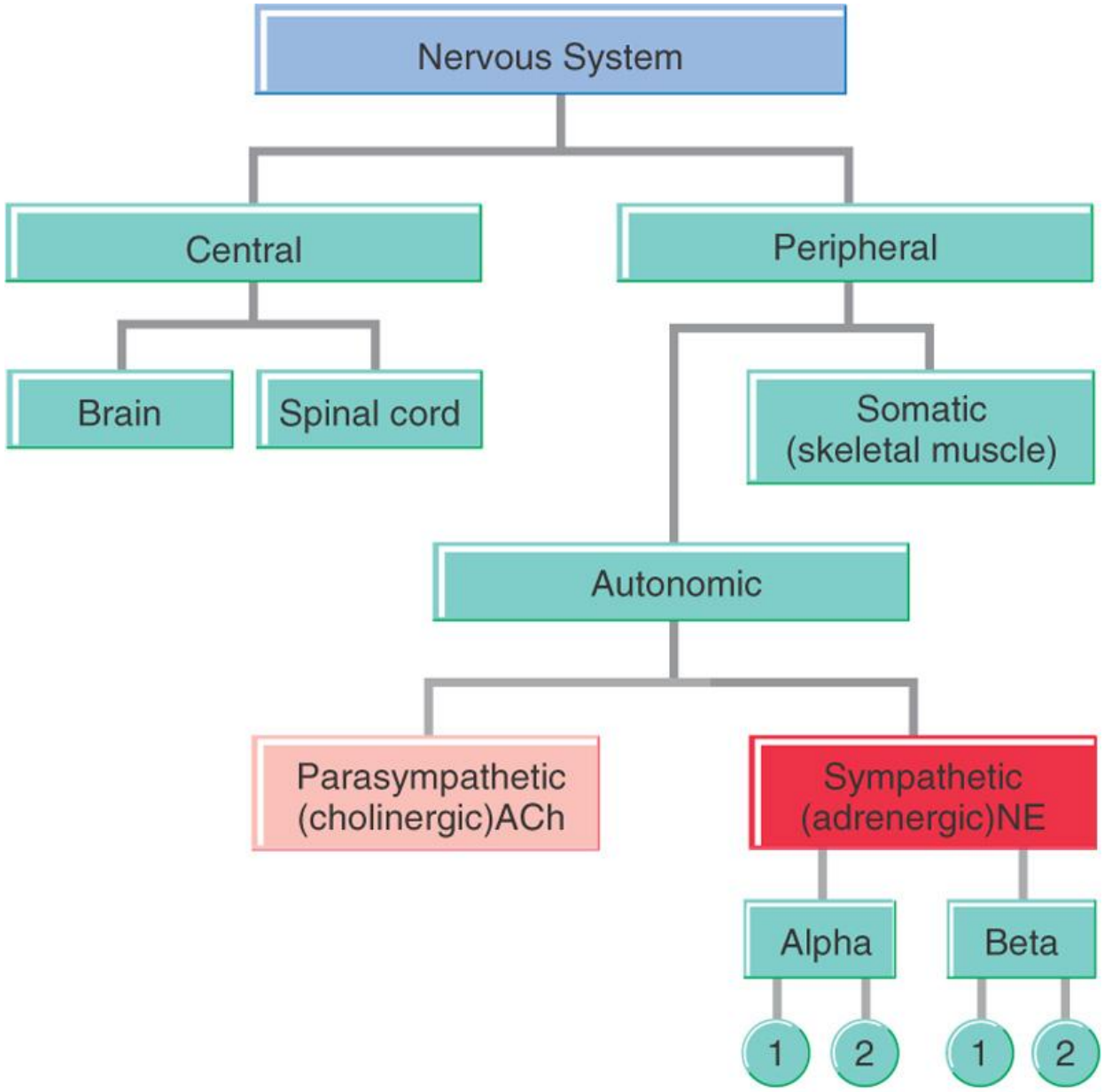
- Two main divisions
  - Central nervous system (CNS)
    - Consists of brain & spinal cord
    - Receives, integrates and interprets nerve impulses
  - Peripheral nervous system (PNS)
    - Term used to describe all nerves outside brain & spinal cord
    - Connects all parts of body with CNS

Peripheral Nervous System

- Somatic nervous system
  - Sensation
    - Sends messages to brain
      - Internal & external environment
        - » Heat, cold, pressure
  - Voluntary
    - Movement of skeletal muscles
      - Walking, chewing or dexterity
- Autonomic nervous system
  - Concerned with essential functions necessary to survival

Autonomic Nervous System

- Concerned with activity not consciously controlled
- Two divisions
  - Sympathetic
    - Stressful situations
  - Parasympathetic
    - Maintains homeostasis
    - Helps conserve body energy



Neurotransmitters

- Chemical substances
  - Neurohormones (catecholamines)
    - Released at nerve endings
      - Facilitate transmission of nerve impulses
    - Two from SNS
      - Epinephrine
        - » Adrenal medulla
      - Norepinephrine
        - » Secreted mainly at nerve endings of sympathetic nerve fibers

Adrenergic Drugs

- Mimic activity of SNS
  - Aka – sympathomimetic drugs
- Examples
  - Endogenous
    - Epinephrine, norepinephrine, dopamine
  - Synthetic
    - Isoproterenol, dobutamine, phenylephrine

Adrenergic Drugs

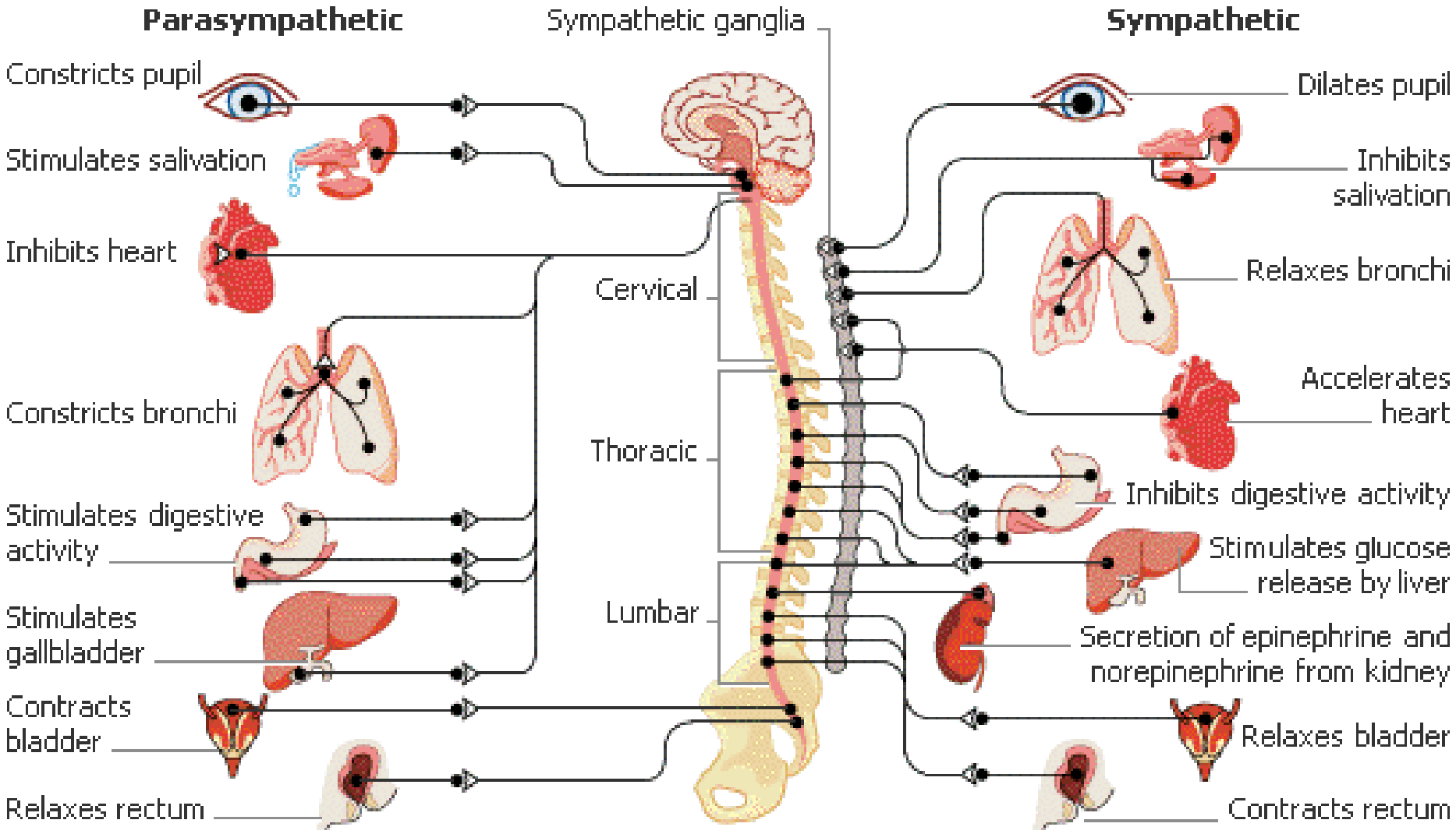
- Dopaminergic Receptors
  - An additional adrenergic receptor
  - Stimulated by dopamine
  - Causes dilation of the following blood vessels, resulting in *increased* blood flow
    - Renal
    - Mesenteric
    - Coronary
    - Cerebral

TABLE 17-1

ADRENERGIC RECEPTOR RESPONSES TO STIMULATION

Location	Receptor	Response
CARDIOVASCULAR		
Blood vessels	$Alpha_1/beta_2$	Constriction/dilation
Cardiac muscle	$Beta_1$	Increased contractility
Atrioventricular node	$Beta_1$	Increased heart rate
Sinoatrial node	$Beta_1$	Increased heart rate
ENDOCRINE		
Pancreas release	$Beta_1$	Decreased insulin
Liver	$Beta_2$	Glycogenolysis
Kidney	$Beta_2$	Increased renin secretion
GASTROINTESTINAL		
Muscle	$Beta_2$	Decreased motility
Sphincters	$Alpha_1$	Constriction
GENITOURINARY		
Bladder sphincter	$Alpha_1$	Constriction
Penis	$Alpha_1$	Ejaculation
Uterus	$Alpha_1/Beta_2$	Contraction/relaxation
RESPIRATORY		
Bronchial muscles	$Beta_2$	Dilation

Autonomic Nervous System



Adrenergic Drugs

Actions

- CNS
  - Wakefulness, quickened reactions/reflexes
- PNS
  - Relaxation of smooth muscle of bronchi
  - Constriction of blood vessels, sphincters of stomach, dilatation of coronary's
  - Decrease in gastric motility
- CVS
  - Increased heart rate
- Metabolism
  - Increased glucose use
  - Increased liberation of fatty acids from adipose tissue

Adrenergic Drugs

Adrenergic Nerve Receptors

- Either alpha (α) or beta (β) receptors
- Drugs may stimulate one or both
- Examples
  - Phenylephrine (Neo-Synephrine)
    - Acts primarily on α receptors
  - Isoproterenol (Isuprel)
    - Acts primarily on β receptors
  - Epinephrine
    - Acts on both α and β receptors

Adrenergic Drugs

Effects of the adrenergic receptors

RECEPTOR	SITE	EFFECT
α_1	Peripheral blood vessels	Vasoconstriction
α_2	Presynaptic neuron	Regulates release of neurotransmitter, ↓ tone, motility, & GI secretions
β_1	Myocardium	↑ heart rate, ↑ force of myocardial contraction
β_2	Peripheral blood vessels, bronchial smooth muscles	Vasoconstriction bronchodilation

Adrenergic Drugs

Indications

- Moderately severe to severe ↓ BP
- Control of superficial bleeding
- Bronchial asthma
  - Bronchial dilatation
- Cardiac decompensation and arrest
- Allergic reactions
- Temporary treatment of heart block

Adrenergic Drugs

Indications

- Reduction of intraocular pressure & mydriasis (pupil dilation)
  - Treatment of open-angle glaucoma
  - Alpha- or $beta_2$-receptors, or both
    - Examples
      - epinephrine and dipivefrin (Propine)
- Temporary relief of conjunctival congestion
  - Alpha-adrenergic receptors
  - Examples:
    - epinephrine
    - Phenylephrine (Neo-Synephrine, Sudafed PE)
    - naphazoline (AK-Con, Albalon)

Adrenergic Drugs

Indications

- Shock
  - Hypovolemic
    - ↓ extracellular fluid (hemorrhage, diarrhea)
  - Cardiogenic
    - When heart unable to maintain adequate oxygen perfusion
  - Septic
    - Overwhelming infection
  - Obstructive
    - Obstruction of blood flow causing inadequate tissue perfusion (PE, pericardial tamponade)
  - Neurogenic
    - Blockade of neurohumoral outflow(spinal cord injury)
    - rare

Adrenergic Drugs

Indications

Examples – used to treat shock:

- dobutamine
- ephedrine
- fenoldopam
- methoxamine
- phenylephrine
- dopamine
- epinephrine
- isoproterenol
- norepinephrine

Adrenergic Drugs

Other Examples:

- epinephrine
- ephedrine
- naphazoline
- phenylephrine
- albuterol
- isoproterenol
- terbutaline
  - Brethine
- levalbuterol
  - Xopenex
- salmeterol
  - Serevent

Adrenergic Drugs
Adverse Effects

- CNS
  - Headache, restlessness, excitement, insomnia, euphoria
- Cardiovascular
  - Palpitations (dysrhythmias), tachycardia, vasoconstriction, hypertension
- Other
  - Anorexia, dry mouth, nausea, vomiting, taste changes (rare)

Adrenergic Drugs
Adverse Effects

- CNS
  - Mild tremors, headache, nervousness, dizziness
- Cardiovascular
  - Increased heart rate, palpitations (dysrhythmias), fluctuations in BP
- Other
  - Sweating, nausea, vomiting, muscle cramps

Adrenergic Drugs
Interactions

- Anesthetic agents
- Tricyclic antidepressants
- MAOIs
- Antihistamines

Adrenergic Drugs
Interactions (cont'd)

- Thyroid preparations
- Antihypertensives

Adrenergic Drugs
Precautions

- Patients with ASVD (athrosclerotic vascular disease)
- Hyperthyroidism
- Prostatic hypertrophy
- Parkinson's dx
- Acute-closure glaucoma

Adrenergic Drugs
Nursing Implications

- Assess for allergies and history of hypertension, cardiac dysrhythmias, or other cardiovascular disease
- Assess renal, hepatic, and cardiac function before treatment

Adrenergic Drugs
Nursing Implications

- Perform baseline assessment of vital signs, peripheral pulses, skin color, temperature, and capillary refill. Include postural blood pressure and pulse
- Follow administration guidelines carefully

Adrenergic Drugs
Nursing Implications

Intravenous administration

- Check IV site often for infiltration
- Use clear IV solutions
- Use an infusion device/IV pump
- Infuse agent slowly to avoid dangerous cardiovascular effects
- Monitor cardiac rhythm

Adrenergic Drugs
Nursing Implications

With chronic lung disease:

- Instruct patients to avoid factors that exacerbate their condition
- Encourage fluid intake (up to 3000 mL per day) if permitted
- Educate about proper dosing, use of equipment (MDI, spacer, nebulizer), and equipment care

Adrenergic Drugs
Nursing Implications

- Salmeterol is indicated for *prevention* of bronchospasms, not management of acute symptoms
- Overuse of nasal decongestants may cause rebound nasal congestion or ulcerations
- Avoid OTC or other medications because of possible interactions

Adrenergic Drugs
Nursing Implications

- Administering two adrenergic agents together may precipitate severe cardiovascular effects such as tachycardia or hypertension
- Inform patients taking inhaled isoproterenol that their sputum or saliva may turn pink

Adrenergic Drugs
Nursing Implications

Monitor for therapeutic effects: (cardiovascular uses)

- Decreased edema
- Increased urinary output
- Return to normal vital signs
- Improved skin color and temperature
- Increased LOC

Adrenergic Drugs
Nursing Implications

Monitor for therapeutic effects (asthma):

- Return to normal respiratory rate
- Improved breath sounds, fewer rales
- Increased air exchange
- Decreased cough
- Less dyspnea
- Improved blood gases
- Increased activity tolerance

CHAPTER 18

Adrenergic-Blocking Agents

Adrenergic Blockers

- Bind to adrenergic receptors
  - Inhibit or block stimulation of the sympathetic nervous system (SNS)
  - Alpha-blockers and beta-blockers
- Have the opposite effect of adrenergic agents
- Also known as:
  - Adrenergic antagonists
  - Sympatholytics

Adrenergic Blockers (cont'd)

Sympatholytics inhibit—or LYSE—sympathetic neurotransmitters, such as norepinephrine and epinephrine

Classified by the type of adrenergic receptor they block

- Alpha$_1$and alpha$_2$-receptors
- Beta$_1$and beta$_2$-receptors

Adrenergic Blocking Drugs

4 Groups

- Alpha-adrenergic blocking drugs
  - Greatest effect on α receptors that control the vascular system
- Beta-adrenergic blocking drugs
  - Greatest effect on β receptors of the heart
- Antiadrenergic drugs
  - Block adrenergic nerve fibers within CNS or PNS
- Alpha/beta-adrenergic blocking drugs
  - Act on both α and β receptors

Review of Adrenergic Receptor Stimulation Effects

- $\alpha 1$ receptors
  - Site = peripheral blood vessels
  - Effect = vasoconstriction of peripheral vessels
- $\alpha 2$ receptors
  - Site = presynaptic neuron
  - Effect = regulates release of neurotransmitters; decreases tone, motility, and secretions of GI tract
- $\beta 1$ receptors
  - Site = myocardium
  - Effect = increase heart rate, increased force of myocardial contraction
- $\beta 2$ receptors
  - Site = peripheral blood vessels & bronchial smooth muscles
  - Effect = vasodilatation of peripheral vessels & bronchodilation

Alpha-blockers (Ergot alkaloids)

Drug Effects and Indications

- Constrict dilated arteries going to the brain (carotid arteries)
- Used to treat vascular headaches (migraines)
- Stimulate uterine contractions (oxytocics) and induce local vasoconstriction
- Used to control postpartum bleeding

Alpha-blockers

Drug Effects and Indications (cont'd)

- Cause both arterial and venous dilation, reducing peripheral vascular resistance and BP
- Used to treat hypertension
- Effect on receptors on prostate gland and bladder decreased resistance to urinary outflow, thus reducing urinary obstruction and relieving effects of BPH

Alpha-blockers
Drug Effects and Indications (cont'd)

- Used to control and prevent hypertension in patients with pheochromocytoma
- Phentolamine
  - Quickly reverses the potent vasoconstrictive effects of extravasated vasopressors such as norepinephrine or epinephrine.
  - Restores blood flow and prevents tissue necrosis

Alpha-Blockers: Side Effects

Body System	Side/Adverse Effects
Cardiovascular	Palpitations, orthostatic hypotension, tachycardia, edema, dysrhythmias, chest pain
CNS	Dizziness, headache, drowsiness, anxiety, depression, vertigo, weakness, numbness, fatigue

Alpha-Blockers: Side Effects (cont'd)

Body System	Side/Adverse Effects
Gastrointestinal	Nausea, vomiting, diarrhea, constipation, abdominal pain
Other	Incontinence, nosebleed, tinnitus, dry mouth, pharyngitis, rhinitis

Alpha-Blockers
Common Agents

- ergotamine tartrate (Ergostat)
- phenoxybenzamine HCl (Dibenzyline)
- phentolamine (Regitine)
- prazosin (Minipress)
- terazosin (Hytrin)
- tolazoline (Priscoline)

Beta-Blockers

- Block stimulation of beta-receptors in the SNS
- Compete with norepinephrine and epinephrine
- Selective and nonselective beta-blockers

also called

- Nonspecific or cardioselective beta-blockers

Beta-Receptors

$Beta_1$-receptors

- Located primarily on the heart
- Beta-blockers selective for these receptors are called cardioselective beta-blockers

Beta-Receptors (cont'd)

Beta$_2$-receptors

- Located primarily on smooth muscles of bronchioles and blood vessels

Nonspecific Beta-Blockers

Beta-blockers that block both $beta_1$- and $beta_2$-receptors

Mechanism of Action

Cardioselective ($beta_1$)

- Reduces SNS stimulation of the heart
- Decreases heart rate
- Prolongs SA node recovery
- Slows conduction rate through the AV node
- Decreases myocardial contractility, thus decreasing myocardial oxygen demand

Mechanism of Action (cont'd)

Nonspecific ($beta_1$ and $beta_2$)

- Effects on heart: Same as cardioselective
- Bronchioles: Constriction, resulting in narrowing of airways and shortness of breath
- Blood vessels: Vasoconstriction

Beta-Blockers
Indications

- Antiangina: Decreases demand for myocardial oxygen
- Cardioprotective: Inhibits stimulation from circulating catecholamines
- Antidysrhythmic Provide membrane stabilizing effects

Beta-Blockers
Indications (cont'd)

- Antihypertensive
- Treatment of migraine headaches
- Glaucoma (topical use)
  - Reduces production of aqueous humor in anterior chamber of the eye

Side Effects: Beta-Blockers

Body System	Side/Adverse Effects
Blood	Agranulocytosis, thrombocytopenia
Cardiovascular	AV block, bradycardia, **heart failure**, peripheral vascular insufficiency
CNS	Dizziness, mental depression, lethargy, hallucinations

Side Effects: Beta-Blockers

Body System	Side/Adverse Effects
Gastrointestinal	Nausea, dry mouth, vomiting, diarrhea, cramps, ischemic colitis
Other	Impotence, rash, alopecia, bronchospasm

Beta-Blockers
Examples

- acebutolol (Sectral)
- carvedilol (Coreg)
- labetalol (Trandate)
- metoprolol (Lopressor)
- atenolol (Tenormin)
- esmolol (Brevibloc)
- sotalol (Betapace)
- propranolol (Inderal)

Newer beta-blockers (once a day dosing):

- Betazolol and besoprolol

Antiadrenergic Drugs

- Actions
  - Inhibits release of norepinephrine form certain adrenergic nerve endings
- Examples
  - Prazosin (Minipress) – peripheral
  - Terazosin (Hytrin) - peripheral
  - Clonidine (Catapres) – central
  - Methyldopa (Aldomet) - central

Antiadrenergic Drugs (cont.)

- Uses
  - Hypertension
  - Cardiac arrhythmias
- Adverse effects
  - Dry mouth
  - Drowsiness, sedation
  - Anorexia,
  - Rash
  - Malaise, weakness

α/β - Adrenergic blockers

- Actions
  - Block stimulation of both receptors
    - Results in peripheral vasodilation
- Examples
  - Carvedilol (Coreg)
  - Labetalol (Normodyne)

α/β - Adrenergic blockers (cont.)

- Uses
  - Hypertension
  - Aids in reduction of the progression of CHF
- Adverse Effects
  - Fatigue, drowsiness, insomnia
  - Weakness
  - Hypotension

Adrenergic-Blocking Agents: Nursing Implications

- Assess for allergies and history of COPD, hypotension, cardiac dysrhythmias, bradycardia, HF, or other cardiovascular problems
  - Any preexisting condition that might be exacerbated by the use of these agents might be a *contraindication* to their use

Adrenergic-Blocking Agents: Nursing Implications

- Remember that alpha-blockers may precipitate hypotension
- Remember that some beta-blockers may precipitate bradycardia, hypotension, heart block, HF, and bronchoconstriction
- ALWAYS TAKE BP & PULSE PRIOR TO ADMINISTRATION!

Adrenergic-Blocking Agents: Nursing Implications

- Avoid OTC medications because of possible interactions
- Possible drug interactions may occur with:
  - Antacids (aluminum hydroxide type)
  - Antimuscarinics/anticholinergics
  - Diuretics and cardiovascular drugs
  - Neuromuscular blocking agents
  - Oral hypoglycemic agents

Adrenergic-Blocking Agents: Nursing Implications

- Encourage patients to take medications as prescribed
- These medications should never be stopped abruptly
- Report constipation or the development of any urinary hesitancy or bladder distention

Adrenergic-Blocking Agents: Nursing Implications

- Teach patients to change positions slowly to prevent or minimize postural hypotension
- Avoid caffeine (excessive irritability)
- Avoid alcohol ingestion and hazardous activities until blood levels become stable
- Patients should notify their physician if palpitations, dyspnea, nausea, or vomiting occurs

Adrenergic-Blocking Agents: Nursing Implications

Monitor for side effects, including:

- Hypotension
- Tachycardia (alpha blockers)
- Bradycardia
- Heart block
- HF
- Increased airway resistance
- Fatigue
- Lethargy
- Depression
- Insomnia
- Vivid nightmares

Adrenergic-Blocking Agents: Nursing Implications

Monitor for therapeutic effects

- Decreased chest pain in patients with angina
- Return to normal BP and P
- Other specific effects, depending on the use

Beta-Blocking Agents: Nursing Implications

- Rebound hypertension or chest pain may occur if this medication is discontinued abruptly
- Patients should notify their physician if they become ill and unable to take medication
- Inform patients that they may notice a decrease in their tolerance for exercise; dizziness and fainting may occur with increased activity. Notify the physician if these problems occur

Beta-Blocking Agents: Nursing Implications

Patients should report the following to their physician:

- Weight gain of more than 2 pounds (1 kg) within a week
- Edema of the feet or ankles
- Shortness of breath
- Excessive fatigue or weakness
- Syncope or dizziness