

UNIT 2

DRUGS AND NURSING IMPLICATIONS



Today's nurse needs to have a firm foundation in pharmacology. Important aspects of current nursing practice deal with effectiveness of medications, detecting adverse effects, drug interactions, and incorporating client teaching concerning drug use. Clients, including pregnant women and nursing mothers, should be taught adverse effects of drugs and not to take OTC drugs or herbals while on prescribed medication without consulting their physician.

*This unit, *Drugs and Nursing Implications*, provides a review of all major drug classifications. The first part of the unit contains a review of pharmacokinetics, drug administration, and calculations. Keep in mind that pediatric drug doses typically are calculated per kilograms of body weight. Following these introductory concepts, multiple choice questions for each drug classification are provided.*

Each major drug classification is represented by a prototype drug. A review of action, use, adverse effects, nursing implications, discharge teaching (where applicable), and related drugs is in chart form when appropriate or otherwise listed with pertinent comments. At times, a prototype drug may not be used because one particular drug might not represent a drug group. For example, in the laxative drug group, there is not one single representative or prototype drug. If no prototype drug is used, this is indicated under the drug classification.

UNIT OUTLINE

- 8 Factors Affecting Drug Action
- 10 Drug Administration
- 23 Central Nervous System Drugs
- 37 Autonomic Nervous System Drugs
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- 104 Vitamins and Minerals
- 106 Herbs and Herbal Health Products
- 108 Vaccines and Toxoids



Factors Affecting Drug Action

DEFINITION OF A DRUG

- A. According to the Food and Drug Administration (FDA), a drug is any substance used to diagnose, cure, mitigate, treat, or prevent a condition or disease.
- B. Drugs come from three main sources: plants (e.g., digoxin), animals (e.g., insulin), and synthetic chemicals (e.g., meperidine).
- C. Most of the drugs used today are synthetic chemicals and are associated with fewer allergic reactions.

FACTORS AFFECTING DRUG ACTION

Absorption

- A. Absorption refers to the time the drug enters the body until it enters the bloodstream.
- B. Many factors affect the rate and amount of absorption.
 - 1. Dosage form
 - 2. Route of administration
 - a. Parenteral: absorption generally rapid
 - b. Intravenous (IV) and intra-arterial (IA): most rapid absorption
 - c. Intramuscular (IM) and subcutaneous (SC)
 - 1) Absorption is relatively fast if given in an aqueous base but can be delayed if given in an oil base
 - 2) Speed of absorption depends on condition of blood flow
 - 3) Impaired peripheral circulation and shock will delay absorption
 - d. Intradermal: absorption is slow and confined to area injected (e.g., purified protein derivative—PPD)
 - e. Oral: rate and degree of absorption can vary depending on GI motility, presence of food in stomach, gastric pH, and use of other drugs
 - 3. Lipid solubility: affects absorption as it passes through gastric intestinal mucosa.
 - 4. Gastrointestinal (GI) motility
 - a. Stomach empties more slowly with food and will delay oral drug absorption.
 - b. Most oral drugs are best absorbed if given before meals or between meals.
 - 1) Diarrhea can cause drugs not to be absorbed

- 2) Constipation may delay drug absorption, potentially causing toxicity

Distribution

- A. Once in bloodstream, drugs are distributed within the body. Distribution can take as long as several hours, depending on blood flow (in various areas of the body) and cardiac output.
- B. Plasma-protein binding
 - 1. Medications connect with plasma proteins (primarily albumin) in vascular system.
 - 2. Strong attachments have a longer period of drug action.
 - 3. Clients with reduced plasma proteins such as in kidney or liver disease could receive a heightened drug effect.
- C. Volume of distribution
 - 1. Client with edema has an enlarged area in which a drug can be distributed and may need an increased dose.
 - 2. Smaller dose may be needed for client with dehydration.
- D. Barriers to drug distribution: prevent some medications from entering certain body organs.
 - 1. Blood-brain barrier
 - a. Helps preserve homeostasis in brain.
 - b. To pass through this barrier, drug must be lipid soluble and loosely attached to plasma protein.
 - 2. Placental barrier
 - a. Shields fetus from possibility of adverse drug effects.
 - b. Many substances (drugs, nicotine, alcohol) do cross placental barrier.
- E. Obesity: body weight plays a role in drug distribution because blood flows through fat slowly, thus increasing time before drug is released.
- F. Receptor combination
 - 1. A receptor is an area on a cell where drug attaches and response takes place.
 - a. Receptor is usually protein or nucleic acid.
 - b. Other substances that can be receptors are enzymes, lipids, and carbohydrate residues.
 - 2. Drugs can have an agonist or antagonist effect.
 - a. Agonist will connect itself to the receptor site and cause pharmacological response.

- b. Antagonist will attempt to attach, but because attachment is uneven, there is no drug response.
- 3. There can be competition at receptor site when more than one drug tries to occupy it.

Metabolism

- A. Process of metabolism is a sequence of chemical events that change a drug after it enters the body.
- B. Liver is principal site of drug metabolism.
- C. Oral medications
 - 1. Go directly to the liver via the portal circulation before entering systemic circulation.
 - 2. Many medications become entirely inactivated by the liver the first time they go through it.
- D. Age
 - 1. Age of an individual influences metabolism of drugs.
 - 2. Infants and elderly have reduced ability to metabolize some drugs.
- E. Nutrition: liver enzymes involved in metabolism rely on adequate amounts of amino acids, lipids, vitamins, and carbohydrates.
- F. Insufficient amounts of major body hormones such as insulin or adrenal corticosteroids can reduce metabolism of drugs in liver.

Excretion

- A. Process by which drugs are eliminated from body
 - 1. Drugs can be excreted by kidneys, intestines, lungs, mammary, sweat, and salivary glands.
 - 2. Most important route of excretion for most drugs is kidneys.
- B. Renal excretion
 - 1. Carried out by glomerular filtration and tubular secretion, which increase quantity of drug excreted.
 - 2. Another renal process that results in excretion is tubular reabsorption.
 - a. Drug metabolites in urine can be reverted back into bloodstream.
 - b. Decreases quantity of drug excreted.
- C. Drugs can affect elimination of other drugs
 - 1. Example: probenecid is sometimes administered with penicillin to prevent excretion of penicillin and thus increase effects of penicillin.
 - 2. Example: antacids increase elimination of aspirin, thus decreasing its effects.
- D. Blood concentration levels
 - 1. Affect drug elimination
 - 2. When peak blood level of drug is reached, excretion becomes greater than absorption and blood levels of drug begin to drop.

- E. Half-life: time required for total amount of drug to decrease by 50%.

Accumulation

- A. Therapeutic levels
 - 1. Important goal is for drug to reach therapeutic levels and maintain therapeutic level.
 - 2. Can be maintained when liver or renal function remain unchanged.
- B. Loading dose
 - 1. Sometimes given to raise therapeutic level quickly before drug has chance to be eliminated.
 - 2. For client safety, loading doses are given in several smaller doses over short periods of time.
 - 3. Once therapeutic level is achieved, a smaller daily maintenance dose is given to maintain therapeutic levels; digoxin may be given this way.
- C. Toxicity: occurs when drug is eliminated more slowly than it is absorbed, causing excessive drug concentration.

Underlying Disease

- A. Disease can lead to variable drug response.
- B. Diseases that may affect drug response
 - 1. Cardiovascular disease
 - 2. Gastrointestinal disease
 - 3. Liver disease
 - 4. Kidney disease

Client's Age

- A. Pediatric: drug dosages are based on body weight—milligrams per kilogram (mg/kg).
- B. Geriatric: careful drug history should be obtained, including over-the-counter (OTC) drugs to determine whether there are drug interactions or adverse effects.



Sample Questions

1. What is the result of taking antibiotics with food?
 1. Prevent side effects.
 2. Enhance action of drug.
 3. Delay rate of absorption.
 4. Increase rate of absorption.
2. What occurrence may be caused due to the decreased serum albumin levels in the elderly?
 1. Toxic drug effects.

2. Enhanced absorption.
 3. Enhanced drug distribution.
 4. An increase in the therapeutic effects.
3. If a central nervous system (CNS) depressant is administered to an infant, toxic effects can occur due to what action?
1. Increased drug absorption.
 2. Increased drug distribution.
 3. Decreased drug half-life.
 4. Decreased drug excretion.



Answers and Rationales

1. 3. Taking food will decrease the rate of absorption. Furthermore, taking dairy products with an antibiotic such as tetracycline will cause calcium (Ca⁺) to bind to the drug and decrease absorption.
2. 1. Toxic drug effects occur because there is less albumin or protein for the drug to bind to in the elderly.
3. 3. The blood-brain barrier is not fully developed in infants and CNS depressants can readily penetrate.



Drug Administration

ASSESSMENTS APPROPRIATE TO ALL MEDICATION ADMINISTRATION

- A. Confirm client diagnosis and appropriateness of medication.
- B. Identify all concurrent medications.
- C. Identify any potential contraindications or allergies.
- D. Identify client's knowledge of medications.

ANALYSIS

Nursing diagnoses for the client receiving medications may include:

- A. Risk for injury related to side effects of medications.
- B. Deficient knowledge: drug effects related to lack of previous experience.
- C. Noncompliance related to side effects, financial, or other difficulties, limiting ability to take medications.

PLANNING AND IMPLEMENTATION

- A. Identify appropriate goals such as, "Client will explain rationale for medication prior to discharge."
- B. Prepare and administer medications according to the following principles.

TECHNIQUES OF DRUG ADMINISTRATION

General Principles for All Medications

- A. Verify all new or questionable orders on the medication administration record (MAR) against physician orders for completeness.
- B. Prepare medications in a quiet environment.
- C. Wash your hands. Observe standard precautions, as appropriate.
- D. Collect all necessary equipment, including straws, juice or water, stethoscope.
- E. Review MAR for each client carefully to ensure safety: note medication, dosage, route, expiration date, and frequency.
- F. Research drug compatibilities, action, purpose, contraindications, side effects, and appropriate routes.
- G. Find medication for individual client and calculate dosage accurately. Confirm normal range of dose, particularly in pediatrics.
- H. Check expiration date on medication and look for any changes that may indicate decomposition (color, odor, and clarity).
- I. Compare label three times with the medication to decrease risk of error.
 1. When removing package from drawer
 2. Before preparing medication
 3. After preparing medication
- J. Check need for prn medications.
- K. Be sure medications are identified for each client.
- L. Check for any allergies and perform all special assessments before administration.

- M. Confirm client's identity by checking at least two of the three possible mechanisms for identification to ensure safety.
 1. Ask client his name.
 2. Check client's identi-band and ask him to state his date of birth.
 3. Check bed tag (this is least reliable method).
 - N. Provide privacy, if needed.
 - O. Inform client of medication, any procedure, technique, purpose, and client teaching as applicable.
 - P. Stay with client until medication is gone; do *not* leave medication at bedside.
 - Q. Assist client as needed, and leave in position of comfort.
 - R. Give medication within 30 minutes of prescribed time.
 - S. Chart administration immediately in ink.
 - T. Circle initials and document rationale if drug not administered.
 - U. Report any errors immediately and complete appropriate institutional documentation.
 - V. Liquid medications—all routes of administration—must *not* be mixed together unless compatibility is verified.
 - W. Observe for any reactions and document both positive and negative responses.
 - X. Observe the five "rights": give the right *dose* of the right *drug* to the right *client* at the right *time* by the right *route*.
 - Y. To ensure safety do not give a medication that someone else prepared. Institution policies may require having a colleague double check medications such as insulin and heparin. If you are unsure in any way, have a colleague verify.
 - Z. If using a computer-controlled dispensing system, follow agency policy for administration and documentation.
- 3. To reduce chance of contamination, place any removable lids open side up; place necessary medications into cap of container; transfer to med cup; replace lid and container.
 - E. Prepare liquid medications.
 1. Shake liquid medications, if necessary, to mix.
 2. Pour away from bottle label.
 3. Read liquid amount at meniscus of med cup at eye level to ensure accuracy.
 4. If needed, a syringe may be used to measure and administer liquid medications.
 5. Wipe lip of bottle with damp towel to prevent stickiness.
 6. Replace lid and container.
 7. Do not administer alcohol-based products, such as elixirs, to alcohol-dependent persons.
 - F. Sit client upright to enhance swallowing.
 - G. Have client swallow medication except with the following:
 1. Sublingual (SL) route: have client place medication under tongue (high rate of absorption). Do not allow fluids for 30 minutes following administration.
 2. Buccal route: have client place medication between gum and cheek. Do not allow fluids for 30 minutes following administration.
 3. Iron: have client use straw to prevent staining teeth.
 - H. Stay with client until medication is gone. Use gloves if you need to place your finger in client's mouth.
 - I. Special concerns
 1. Use a calibrated dropper, nipple, or syringe to give medications to an infant.
 2. Keep infant at 45° angle.
 3. See whether medication is available in liquid form if client is a child or unable to swallow solid medication.
 4. Be sure not to use a child's favorite food, as this may result in distrust.
 5. If using an NG or stomach tube for medication administration, check for correct placement before administration and follow medication with water. Be sure to check for food interaction.

Administration of Oral Medications

- A. Special assessment: assess client's knowledge level, diet status, oral cavity, and ability to swallow medication.
- B. Use agency equipment to crush tablets, if appropriate. In general, enteric-coated tablets should not be crushed. Only scored tablets can be broken.
- C. With the exception of time-release capsules, capsule contents may be mixed with food to enhance swallowing.
- D. Prepare solid medications (tablets, capsules, etc.).
 1. All solid medications can be placed in one medicine cup unless an assessment needs to be made before administering a particular medication (e.g., blood pressure, apical pulse).
 2. Unit dose containers can remain in original individual package.

Administration of Rectal Drugs

- A. Special assessment: assess client's bowel function and ability to retain suppository/enema.
- B. Obtain suppository from storage area or refrigerator.
- C. Provide privacy.
- D. Position client left laterally.
- E. Put on glove or finger cot.
- F. Moisten suppository with water-soluble lubricant.

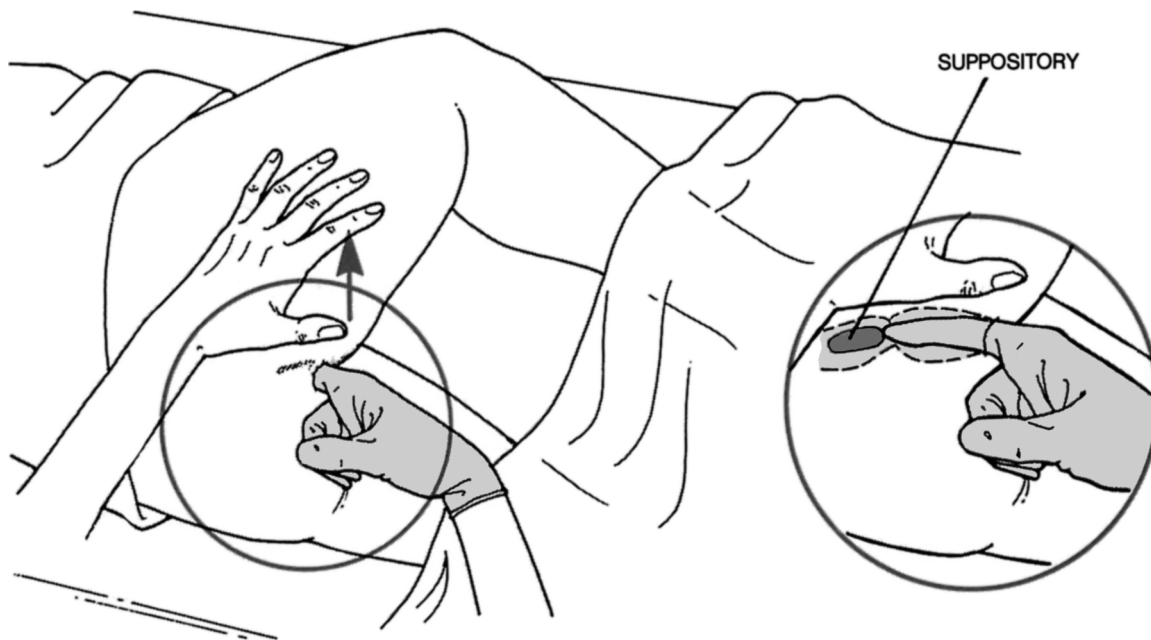


Figure 2-1 A rectal suppository is inserted about 2 inches in adults so it will be placed in the internal anal sphincter

- G. Insert suppository, tapered end first, approximately 2 inches (to pass internal sphincter) (Figure 2-1).
- H. Hold buttocks together.
- I. Encourage client to retain suppository for 10–20 minutes to allow suppository to melt.
- J. If drug administered via enema, have client retain solution 20–30 minutes.

Administration of Nasal Medications

- A. Have client blow nose to clear mucus.
- B. Position client so that head can be tilted back to aid in gravitational flow or in specific position to reach sinuses.
- C. Push up on tip of nostril.
- D. Place dropper or atomizer angled slightly upward just inside nostril; be careful not to touch nose with applicator.
- E. Squeeze atomizer quickly and firmly or instill correct number of drops.
- F. Remind client to keep head tilted for 5 minutes.
- G. Inform client the drops may produce an unpleasant taste.
- H. Leave tissues with client; instruct just to wipe nose, not blow, to allow for absorption.
- I. Special concerns
 1. If client aspirates and begins to cough, sit client upright, stay until client's distress is relieved.
 2. If client is an infant, lay infant on its back.

Administration of Inhalants

- A. Special assessment: monitor vital signs before and after treatments.
- B. Have client inhale and exhale deeply.
- C. Have client place lips around mouthpiece without touching and inhale medication until lungs are fully inflated. Inhale slowly and deeply while depressing the top of the canister, close mouth, hold breath 10 seconds, then exhale. A specially designed spacer device is available to assist the client who may have difficulty with this.
- D. Have client remove mouthpiece, hold breath as long as able, and then exhale completely.
- E. If necessary, repeat procedure until medication is gone. Allow 2–5 minutes between inhalations.
- F. Wash mouthpiece with warm water.
- G. Special concerns
 1. Have tissues handy; encourage expectoration of sputum.
 2. Be sure client is aware that coughing is expected after treatment.
 3. If mouth is placed directly on inhaler, it is possible that the tongue will absorb medication, resulting in inadequate dosing and tongue irritation.

Administration of Ophthalmic Medications

- A. Check solution for color and clarity before administering.

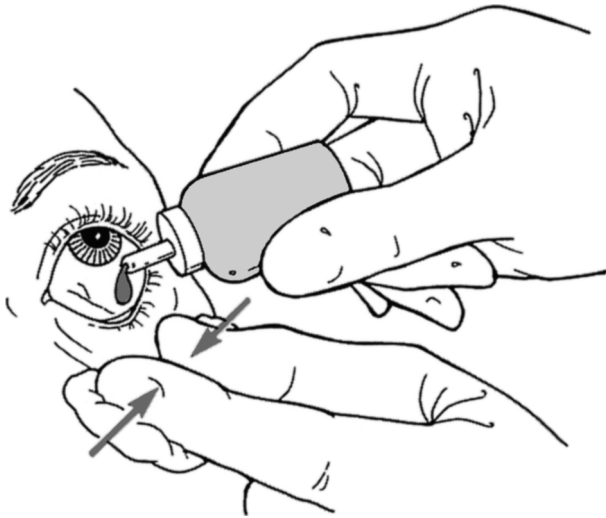


Figure 2-2 Instilling eye drops

- B. Warm solution in hands before administration.
- C. Have client lie on back or sit with head turned to affected side to aid in gravitational flow.
- D. Cleanse eyelid and eyelashes with sterile gauze pad soaked with physiologic saline. Assess eye condition.
- E. Have client look up.
- F. Assist client in keeping eye open by pulling down on cheekbone with thumb or forefinger and pulling up on eyelid. Be sure lower conjunctiva is exposed (Figure 2-2).
- G. Place necessary number of drops into lower conjunctiva near outer canthus (less sensitive than cornea).
- H. If using ointment, squeeze into lower conjunctiva moving from inner to outer canthus (Figure 2-3).
 - 1. Do not touch eye with applicator.
 - 2. Twist tube to break medication stream.
- I. Have client blink 2–3 times.

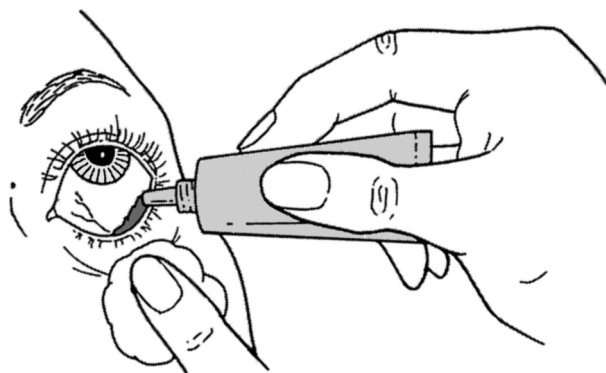
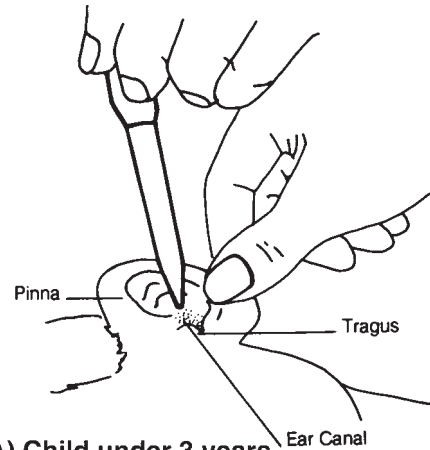


Figure 2-3 Instilling eye ointment

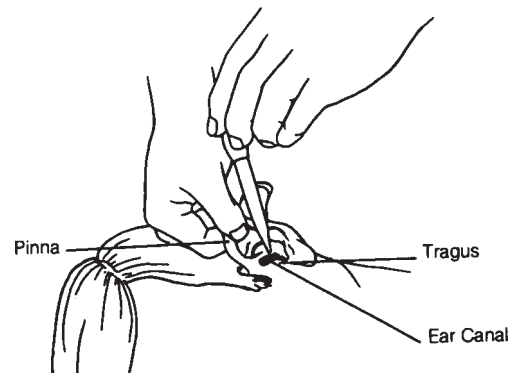
- J. Wipe away any excess medication starting from inner canthus.
- K. Repeat if necessary using clean tissue.
- L. Special concerns
 - 1. Ophthalmic medications are for individual clients; droppers and ointments should not be shared.
 - 2. Restrain infants and children if necessary.

Administration of Otic Medications

- A. Warm medication in hands prior to administration.
- B. Put on gloves.
- C. Have client turn to unaffected side to aid gravitational flow.
- D. Clean outer ear using a wet gauze pad. Assess ear condition.
- E. Straighten ear canal by pulling pinna up and back for adults or down and back for infants and children under 3 (Figure 2-4).



(A) Child under 3 years



(B) Adult

Figure 2-4 Administering ear drops

- F. Instill necessary number of drops along side of canal without touching ear with dropper.
- G. Maintain position of ear until medication has totally entered canal.
- H. Have client remain on side for 5–10 minutes to allow medication to reach inner ear.
- I. Cotton may be used to keep medication in canal, but only if it is premoistened with medication.
- J. Repeat procedure for other ear if necessary.
- K. Special concern: restrain infants and children if necessary.

Administration of Topical Agents

- A. Provide privacy and expose only appropriate area to promote comfort.
- B. Cleanse area of old medications using gauze pads with soap and warm water.
- C. Use gloves and gauze, tongue depressor, or sterile applicator, if integument broken.
- D. Assess area for any changes or contraindications of application.
- E. Spread medication over site evenly and thinly.
- F. If necessary, cover area loosely with a dressing.
- G. Special concerns
 1. Clients often receive topical agents for image-altering problems. Applying the medication offers a good opportunity to talk about these problems and to share information about improvements.
 2. When applying nitroglycerin ointment, take client's blood pressure 5 minutes before and after application.
 3. Use gloves to administer medication to prevent self-absorption.
 4. When using transderm patches, use gloves to avoid inadvertent drug absorption. Remove backing and place patch in area with little hair. Press edges down to secure patch.

Administration of Vaginal Medications

- A. Provide privacy.
- B. Put on gloves.
- C. Have client void.
- D. Place client on a bedpan in dorsal recumbent position with hips and knees flexed (Figure 2-5).
- E. Cleanse perineum with warm, soapy water, working from outer to inner position.
- F. Moisten applicator tip with water-soluble lubricant or just water.
- G. Separate labia to insert applicator approximately 2 inches, angled downward and back.
- H. Instill medication.
- I. If giving douche, dry client's buttocks; otherwise have client remain in position approximately 15–20 minutes (there is no sphincter to hold suppository in place).
- J. Wash applicator with warm, soapy water.
- K. Provide client with pads if needed.

Administration of Parenteral Medications

General Principles

- A. Special assessments for parenteral medications:
 1. Assess area for presence of lesions, rashes, or abscesses prior to administration.
 2. Assess for discomfort or impaired mobility, which may affect site selection.
 3. Assess client ability for self-injection, if appropriate.
- B. Select appropriate needle size and syringe.
 1. Use tuberculin 1 mL syringe for volumes less than 1 mL.
 2. Needle lumen must be larger for solutions with increased viscosity.
- C. When medication comes in a vial, cleanse rubber stopper with alcohol wipes/swab.
- D. Without contaminating plunger, draw up air equal to the amount of medication needed.
- E. Inject the air into the vial to prevent negative pressure and aid in aspirating medication.
- F. Remove the appropriate amount of medication (the vial may be multidose).
- G. Check to ensure no air bubbles are present; if bubbles are a problem, draw up slightly more medication than is needed, return all medication to vial, and withdraw medication again or tap syringe until air is all collected at top of barrel and can be expelled.

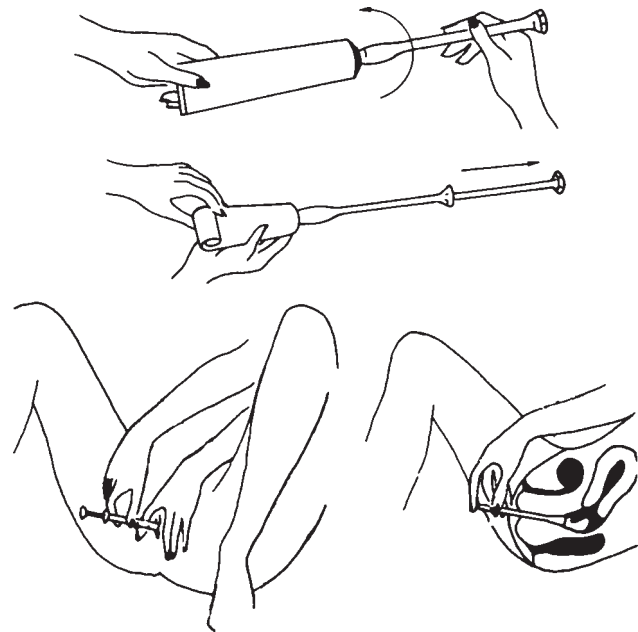


Figure 2-5 The client should be in a dorsal recumbent position for the administration of vaginal creams

- H. When using an ampule: tap neck to force medication into ampule, wrap neck with alcohol wipe/swab, snap off top away from self, place needle into ampule to withdraw medication. A filter needle should be used to avoid glass shards. Discard filter needle after use into sharps container.
- I. When mixing a powder, use a filter needle when drawing up medication. Reconstitute according to manufacturer's recommendations.
- J. Replace protective cover on needle before proceeding, using a one-hand scoop method.
- K. Select appropriate site, avoiding bruised or tender areas; rotate sites as much as possible.
- L. Cleanse site with alcohol wipe/swab to decrease contamination. Use gloves to avoid contact with blood.
- M. Insert needle quickly with bevel up, leaving a small amount of needle showing, and release hold (to decrease pain).
 1. With the exception of heparin and insulin, aspirate to check for blood.
 2. If blood present, remove needle and start again.
 3. When giving medications IV, a blood return is desired.
- N. Inject medication slowly.
- O. Quickly withdraw needle and immediately place pressure over the site with a new swab. Massage area if giving Z-track injection.
- P. Dispose of syringe in appropriate manner, but do not recap. Utilize safety cover for needle, if available, before placing in sharps container.
- Q. Record site when documenting medication.
- R. Variations on preparing medications
 1. Disposable injection systems have already-prepared cartridges with attached needle appropriate to route and viscosity. To add medication, add sterile air from cartridge to vial, then add medication from vial to cartridge.
 2. When combining two medications from an ampule and a vial, first determine appropriate volumes, as well as total volume. Withdraw appropriate volume of medication from vial, followed by medication in ampule.
 3. When combining medications from two vials, determine appropriate volume for each drug and total volume. Inject air into vial A, then into vial B. Withdraw medication from vial B, then return to vial A.

Subcutaneous (SC) Administration

- A. Use size 25 g to 27 g, 1/2–1-inch needle, maximum volume 1.5 mL.
- B. Put on gloves.
- C. Pinch skin to form SC fold.
- D. Insert needle at 45° angle in thigh or arm or 90° angle in abdomen (to avoid entering muscle) (Figure 2-6).
- E. Possible sites
 1. Lateral aspect of upper arm
 2. Anterior thigh
 3. Abdomen: 1 inch away from umbilicus
 4. Back, in scapular area

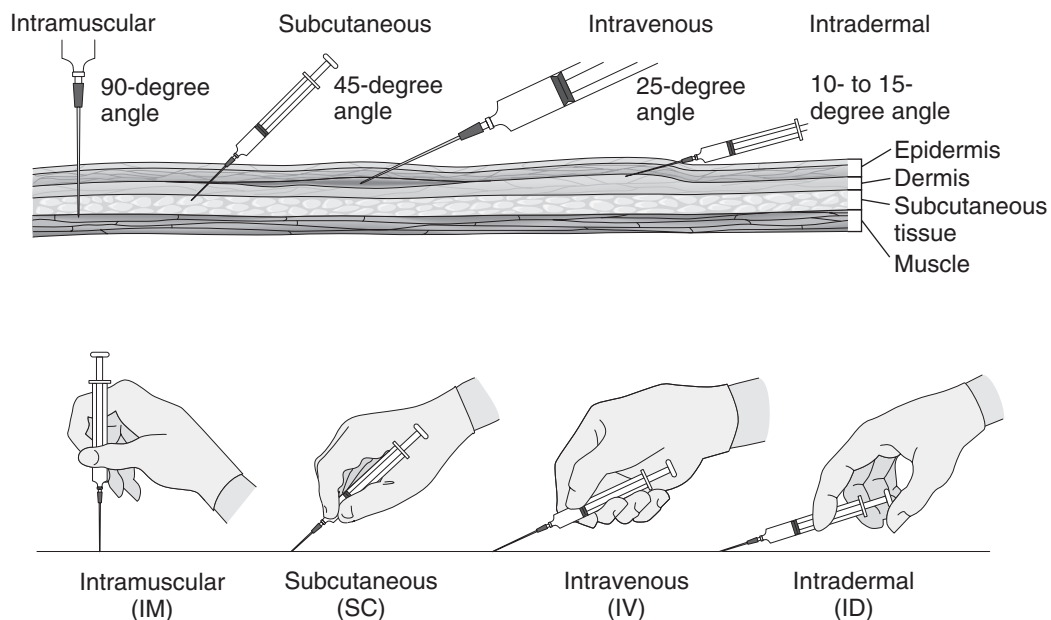


Figure 2-6 Angles of injections

Hypodermoclysis

- A. A method of giving large volume solutions SC at a slow rate.
- B. Reserved for clients unable to receive fluids IV.
- C. Gloves must be worn.

Intradermal Administration

- A. Use size 26 g to 27 g, 1-inch needle on a 1 mL or tuberculin syringe (volume will be approximately 0.1 mL).
- B. Put on gloves.
- C. Stretch skin taut.
- D. Insert needle at 10–15° angle approximately 1–2 mm depth with needle bevel upward.
- E. Possible sites
 - 1. Ventral forearm
 - 2. Scapula
 - 3. Upper chest
- F. When wheal appears, remove needle; do not massage site.

Intramuscular (IM) Administration

- A. Use size 18 g to 23 g, 1–2-inch needle, maximum volume 5 mL.
- B. Put on gloves.
- C. Stretch skin taut.
- D. Insert needle at 90° angle.
- E. Possible sites
 - 1. Gluteus minimus (ventrogluteal): landmarks are anterior-superior iliac spine, iliac crest, greater trochanter of femur.
 - 2. Vastus lateralis (anterior thigh) (Figure 2-7): a handbreadth above the knee and below greater trochanter; good site for children.

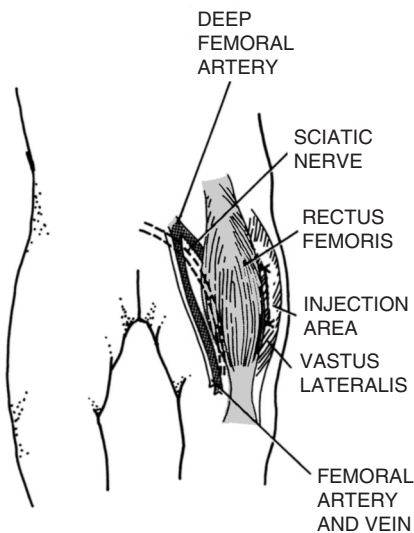


Figure 2-7 Anterior view of the location of the vastus lateralis muscle in a young child

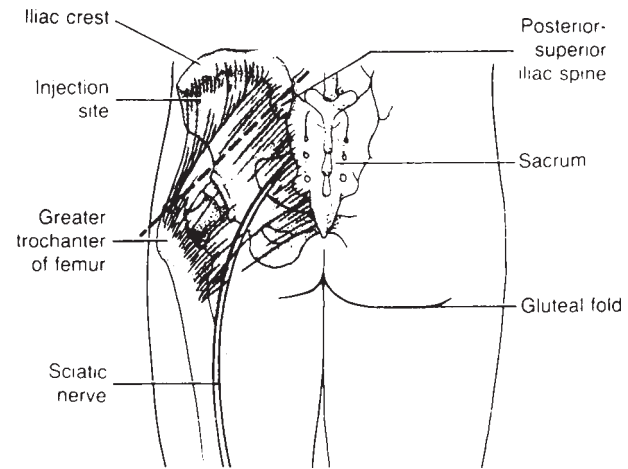


Figure 2-8 When using the dorsogluteal site, injection is made into the gluteus medius muscle

- 3. Rectus femoris (medial thigh): a handbreadth above knee and below greater trochanter; good site for infants and self-injection.
- 4. Gluteus medius (dorsogluteal) (Figure 2-8): landmarks are posterior superior iliac spine, iliac crest, greater trochanter of femur.
- 5. Deltoid (Figure 2-9): landmarks are acromium process, axilla base; for small doses less than 2 mL only.
- F. Z-track injection (IM variation) for irritating solutions.
 - 1. Needle size: replace needle used to draw up medication with one 2–3 inches long, 20–22 g.
 - 2. Pull skin away from site laterally with nondominant hand to ensure medication enters muscle.
 - 3. Wait 10 seconds after injecting medication before withdrawing needle.
 - 4. Release skin; do not massage (seals needle track).
 - 5. Encourage physical activity.
 - 6. Possible sites: gluteus medius best, but may use any IM site except deltoid.
- G. A 45° angle may be sufficient for infants and children.

Administration of Intravenous (IV) Medications

- A. General principles
 - 1. Check site for complications (redness, swelling, tenderness).
 - 2. Check for blood return.
 - 3. Prepare medication according to manufacturer's specifications.
 - 4. Appropriate tubing selection varies according to institution policy. Generally, rates greater

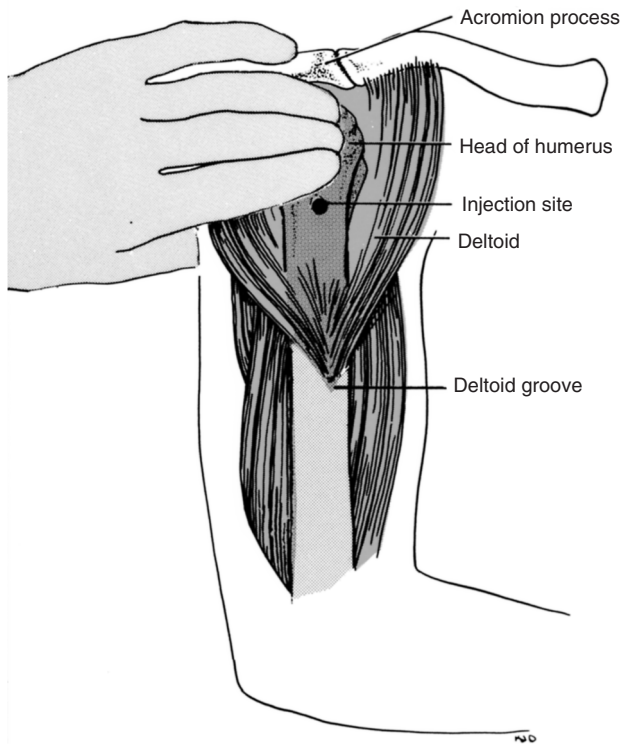


Figure 2-9 Deltoid injection site

- than or equal to 12 hours require macrotubing (60 gtts/mL), all others require macrotubing (10, 15, or 20 gtts/mL).
5. Gloves should be worn when contact with blood or other body fluids is a possibility.
- B.** A scheduled routine flushing of the IV site is required to check for patency and if intravenous catheter is still in the vein. Flushing is also done before and after intermittent medications. Site may be called: male adapter, heplock, heparin lock, capped jelco, INT.
1. Clean injection port with alcohol at each step.
 2. Use SASH method to give medication.
 - a. S: flush with 2–3 mL saline.
 - b. A: administer medication at prescribed rate using either the needleless system, a blunt needle, or a short needle with a gauge equal to or smaller than catheter (25 g ½ in).
 - c. S: flush with 2–3 mL saline (maintain positive pressure to prevent blood back-up into catheter).
 - d. If a central line (CVP) or PICC line is present, then an additional flush of Heplock flush is administered (to prevent blood clotting in line). Most facilities protocol require the use of 10-cc syringes for all flushes in CVPs or PICCs due to the less pressure force exerted on the lines.

- C. Secondary piggyback/add-a-line (added to an existing IV line) (Figure 2-10).
 1. With regulator turned off, spike tubing into IV bag with medication.
 2. Squeeze drip chamber; fill halfway with solution.
 3. Run fluid through tubing.
 4. If using add-a-line tubing, lower main IV bag on hanger provided, otherwise hang bag at same level as primary bag.
 5. Swab most proximal port with alcohol for add-a-line systems, otherwise lower port is acceptable.
 6. Attach 20 g 1-inch needle to tubing, if a needleless system is not being used.
 7. Insert needle into injection port.
 8. Regulate rate with control and watch to count drops.
 9. When medication absorbed, main line will start to drip again.
 10. Turn off secondary tubing.
 11. Return main bag to original position.
 12. Special concerns
 - a. Be sure to label tubing with date.
 - b. Use new tubing every 24–72 hours (according to institution policy).
- D. Intravenous push medications
 1. Using an appropriately sized needle, prepare medication as ordered.
 2. Cleanse injection port with alcohol or other appropriate cleanser.
 3. Unless otherwise recommended, turn off primary IV bag; flush with saline if indicated.
 4. Insert needle and administer medication at prescribed rate.
- E. Electronic regulators
 1. Syringe infusers
 - a. Check for drug compatibility, flush with saline if necessary.
 - b. Place syringe into infuser and prime appropriate tubing with prepared medication.
 - c. Secure unit and activate unit according to manufacturer's recommendations.
 2. Pumps and controllers
 - a. Prime tubing according to manufacturer's recommendations; do not purge when attached to client.
 - b. Prior to connecting IV to client, check to determine if tubing allows gravity free-flow. If it does, be sure to turn off regulator.
 - c. Connect tubing to client and turn on electronic regulator.
 - d. Confirm alarm function by keeping tubing clamped while machine is turned on. Do not turn off alarms.
 - e. Follow manufacturer's directions for deactivating alarm and starting IV flow.
 - f. Explain regulator and alarms to client.
 - g. Confirm flow rate with hourly checks on client, fluid, and regulator.

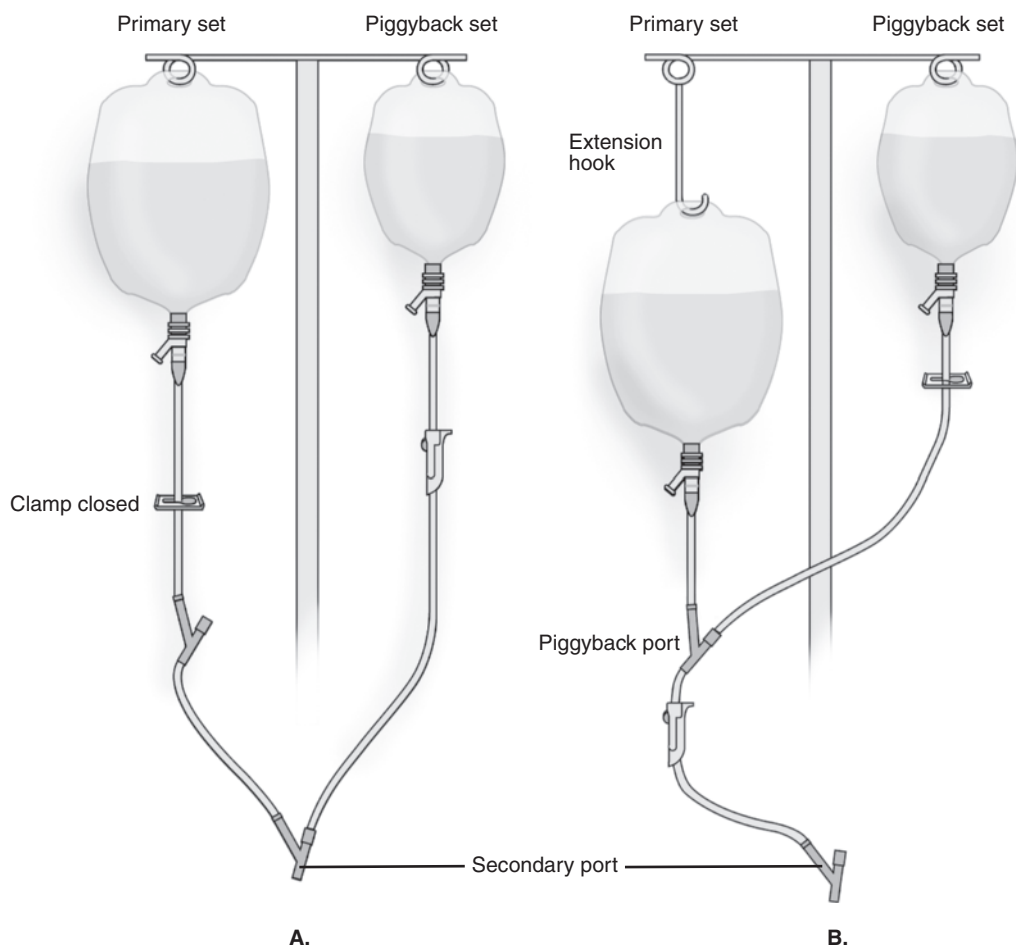


Figure 2-10 (A) In this setup, the tubing to the primary set is clamped to allow the piggyback unit to empty first. The tubing on the primary setup is unclamped once the piggyback unit empties. (B) In this setup, the primary bottle is hung on an extension hook to allow the piggyback unit to empty first. The primary unit then begins to empty

MEDICATION CALCULATIONS

Conversions

Conversions need to be made within systems (from one measurement to another) and also among systems (from apothecary to metric or household to metric).

Conversions within Systems

A. Metric system

1. Based on decimal system, basic unit is 10.

2. Units of measurement are
 - a. Meter (m) for length
 - b. Gram (g) for weight
 - c. Liter (l or L) for volume
3. Multiples and fractions of 10 are identified by prefixes (Table 2-1).
 - a. 0.001 liter would then be equal to 1 milliliter (mL).
 - b. 1000 grams would be equal to a kilogram (kg).
4. Commonly used terms of weight include kilogram, gram, milligram, and microgram.

Table 2-1 Metric Prefixes Denoting Multiples and Fractions of 10

	Multiples			Measure	Fractions			Micro
Decimal Metric	1000 Thousands Kilo-	100 Hundreds Hecto-	10 Tens Deka-	LGM	0.1 Tenths Deci-	0.01 Hundredths Centi-	0.001 Thousandths Milli-	.000001 Millionths Micro-

Table 2-2 Household Units of Liquid Measure

60 drops (gtts) = 1 teaspoon (tsp)
3 tsp = 1 tablespoon (tbsp)
6 tsp = 1 ounce (oz)
2 tbsp = 1 oz
6 oz = 1 teacup
8 oz = 1 glass
8 oz = 1 measuring cup

5. Commonly used terms of volume include liter and milliliter. *Note: A cube measuring 1 cm per side holds one milliliter, so a cubic centimeter (cc) equals a milliliter (mL): 1 cc = 1 mL.*
6. To convert within the metric system, set up a ratio with the conversion factor on the right and the desired information on the left, cross multiply, divide to find X, and complete needed math. Remember to keep ratios equal: whatever is done to one side must be done to the other.
7. Example: convert 5000 mg to g
 - a. 1000 mg = 1 g
 - b. $\frac{5000 \text{ mg}}{X} = \frac{1000 \text{ mg}}{1 \text{ g}}$
 - c. $(X) (1000 \text{ mg}) = (5000 \text{ mg}) (1 \text{ g})$
 - d. $\frac{(X) (1000 \text{ mg})}{(1000 \text{ mg})} = \frac{(5000 \text{ mg}) (1 \text{ g})}{(1000 \text{ mg})}$
 - e. X = (5) (1 g)
 - f. X = 5 g
 - g. 5000 mg = 5 g
- B. Household system
 1. Approximate measures that vary according to manufacturer, temperature.
 2. Common units include teaspoon (tsp), tablespoon (tbsp), ounce (oz), cup, and drop (gtt) (Table 2-2).
 3. Conversions within the system are the same.
 4. Example: convert 3 tsp to drops
 - a. 60 drops = 1 tsp
 - b. $\frac{3 \text{ tsp}}{X} = \frac{1 \text{ tsp}}{60 \text{ gtts}}$
 - c. $(1 \text{ tsp}) (X) = (3 \text{ tsp}) (60 \text{ gtts})$
 - d. $\frac{(1 \text{ tsp}) (X)}{1 \text{ tsp}} = \frac{(3 \text{ tsp}) (60 \text{ gtts})}{1 \text{ tsp}}$
 - e. X = 180 gtts

Conversions from One System to Another

- A. Conversions are done in the same manner. Some of the equivalents must be memorized (Table 2-3).
- B. Example: convert 90 gtts to ml
 1. 15 gtts = 1 mL
 2. $\frac{90 \text{ gtts}}{X} = \frac{15 \text{ gtts}}{1 \text{ mL}}$
 3. $(15 \text{ gtts}) (X) = (90 \text{ gtts}) (1 \text{ mL})$

Table 2-3 Approximate Equivalents to Remember

Household	Metric
1 drop (gtt)	= .06 milliliter (mL)
15 drops (gtt)	= 1 mL [1 cc]
1 teaspoon (tsp)	= 5 (4) mL
1 tablespoon (tbsp)	= 15 mL
2 tbsp	= 30 mL
1 ounce (oz)	= 30 mL
1 teacup (6 oz)	= 180 mL
1 glass (8 oz)	= 240 mL
1 measuring cup (8 oz)	= 240 mL
2 measuring cups (1 pint)	= 500 mL

4. $\frac{(15 \text{ gtts}) (X)}{15 \text{ gtts}} = \frac{(90 \text{ gtts}) (1 \text{ mL})}{15 \text{ gtts}}$
5. X = 6 mL

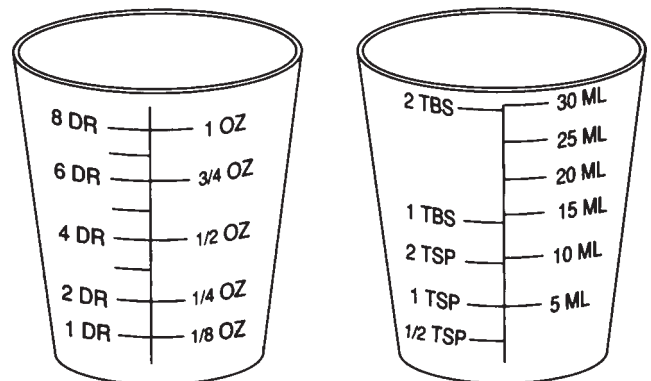
Dosage Calculations

- A. Calibrated containers are available for oral liquids (Figure 2-11), and liquid injectables (Figure 2-12).
- B. Formula for calculations

$$\frac{\text{ordered amount of drug}}{\text{amount of drug on hand}} = \frac{\text{unknown quantity needed (X)}}{\text{known quantity of drug}}$$
- C. Be sure all conversions are done first. The technique of using ratios is the same.

Technique

- A. Dosage calculation for scored tablet
 1. 2000 mg of a drug is ordered. It is available as a scored tablet containing 4 grams.
 2. Calculation
 - a. Convert 4 grams into mg
 1. $\frac{4 \text{ g}}{X \text{ mg}} = \frac{1 \text{ g}}{1000 \text{ mg}}$
 2. 4000 = X Therefore, 4 g = 4000 mg

**Figure 2-11** Disposable medicine containers

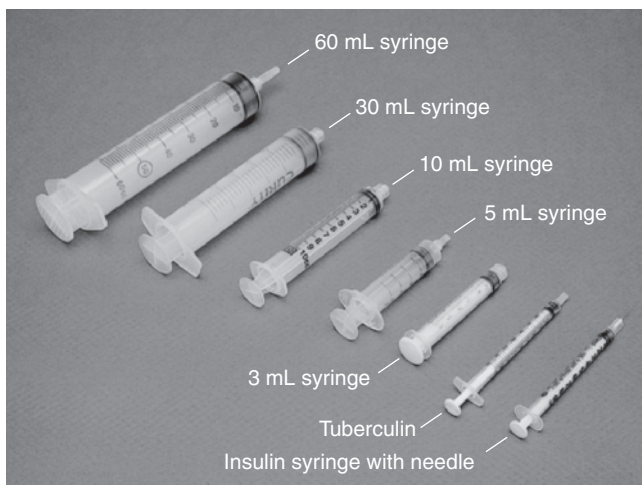


Figure 2-12 Commonly used syringes (not to scale)

b. Now calculate dosage

1.

$$\frac{2000 \text{ mg (ordered amt)}}{4000 \text{ mg (amt on hand)}} = \frac{X \text{ (unknown quantity)}}{1 \text{ tablet (known quantity)}}$$

2. $2000 \text{ mg} = 4000 \text{ mg } X$

Divide each by 4000

3. $\frac{2000 \text{ mg}}{4000 \text{ mg}} = \frac{4000 \text{ mg}}{4000 \text{ mg}}$

4. $\frac{2000 \text{ mg}}{4000 \text{ mg}} = X$

5. $X = 0.5 \text{ tablet}$

3. Give $\frac{1}{2}$ tablet.

B. Dosage calculation for liquid

1. The order is for potassium chloride (KCl) 20 mEq. The bottle is labeled KCl elixir 10 mEq/mL. How many mL will be given?

a. Ordered amount of drug is 20 mEq; amount of drug on hand is 10 mEq.

b. Unknown quantity is X; known quantity of drug on hand is 1 mL.

2. Calculations

a. $\frac{20 \text{ mEq}}{10 \text{ mEq}} = \frac{X}{1 \text{ mL}}$

b. $(10 \text{ mEq}) (X) = (20 \text{ mEq}) (1 \text{ mL})$

c. $\frac{(10 \text{ mEq}) (X)}{10 \text{ mEq}} = \frac{(20 \text{ mEq}) (1 \text{ mL})}{10 \text{ mEq}}$

d. $X = 2 \text{ mL}$

3. Give 2 mL potassium chloride.

C. Dosage calculation for a capsule

1. The order reads: Phentoin Sodium capsules (Dilantin) gr V orally. Available is a bottle labeled Dilantin 100 mg per capsule. How many capsules will be given?

2. Calculations

a. First, convert gr 5 to mg

1) $1 \text{ gr} = 60 \text{ mg}$

2) $\frac{5 \text{ gr}}{1 \text{ gr}} = \frac{X \text{ mg}}{60 \text{ mg}}$

3) $X = 300 \text{ mg}$

b. Now calculate the dosage

1) $\frac{\text{ordered amt is } 300 \text{ mg}}{\text{amt on hand } 100 \text{ mg}} =$

$$\frac{X \text{ (unknown) capsules}}{1 \text{ (known) capsules}}$$

2) $300 \text{ mg} = X$

$100 \text{ mg} = 1$

3) $100 X = 300$

4) $X = 3$

3. Give 3 capsules.

D. Dosage calculation for parenteral medications

1. Order reads: Furosemide (Lasix) 35 mg IV. The vial is labeled 40 mg = 4 mL. How many mL should be given?

2. Calculations

a. $\frac{(\text{ordered amt}) 35 \text{ mg}}{(\text{amt on hand}) 40 \text{ mg}} = \frac{(\text{unknown quantity})}{4 \text{ mL (known quantity)}}$

1) $\frac{35 \text{ mg}}{40 \text{ mg}} = \frac{X}{4 \text{ mL}}$

2) $40 X = 140$

3) $X = 3.5$

b. Give 3.5 mL

c. Another method:

1) $\frac{(\text{ordered amt}) (\text{known quantity})}{(\text{amt on hand})}$

2) $\frac{(35 \text{ mg}) (4 \text{ mL})}{(40 \text{ mg})} = 3.5 \text{ mL}$

E. Dosage calculation for units (some medications such as heparin and penicillin are ordered in units)

1. The order is penicillin 750,000 units. The vial reads 300,000 units/2 mL. How many mL will be given?

2. Ordered amount of drug is 750,000 units; amount of drug on hand is 300,000 units.

3. Unknown quantity is X; known quantity is 2 mL.

4. Calculations

a. $\frac{750,000 \text{ units}}{300,000 \text{ units}} = \frac{X}{2 \text{ mL}}$

b. $(300,000 \text{ units}) (X) = (750,000 \text{ units}) (2 \text{ mL})$

c. $\frac{300,000 X}{3,000,000 \text{ units}} = \frac{1,500,000}{300,000}$

d. $X = \frac{150}{30}$

e. $X = 5 \text{ mL}$

5. Give 5 mL penicillin.

F. Dosage calculation for powders that need to be reconstituted by adding sterile water or normal saline solution (the total amount of solution is used for calculations)

- Mefoxin 1 g is ordered; mefoxin 2 g is on hand. Add 4.3 mL to equal 5 mL solution.
- Ordered amount of drug is 1 g; amount of drug on hand is 2 g.
- Unknown quantity is X; known quantity is 5 mL.
- Calculations
 - $\frac{1 \text{ g}}{2 \text{ g}} = \frac{X}{5 \text{ mL}}$
 - $(2 \text{ g})(X) = (5 \text{ mL})(1 \text{ g})$
 - $\frac{(2 \text{ g})(X)}{2 \text{ g}} = \frac{(5 \text{ mL})(1 \text{ g})}{2 \text{ g}}$
 - $X = 2.5 \text{ mL}$
- Give 2.5 mL mefoxin.

G. Dosage calculation in children (pediatric dosages)

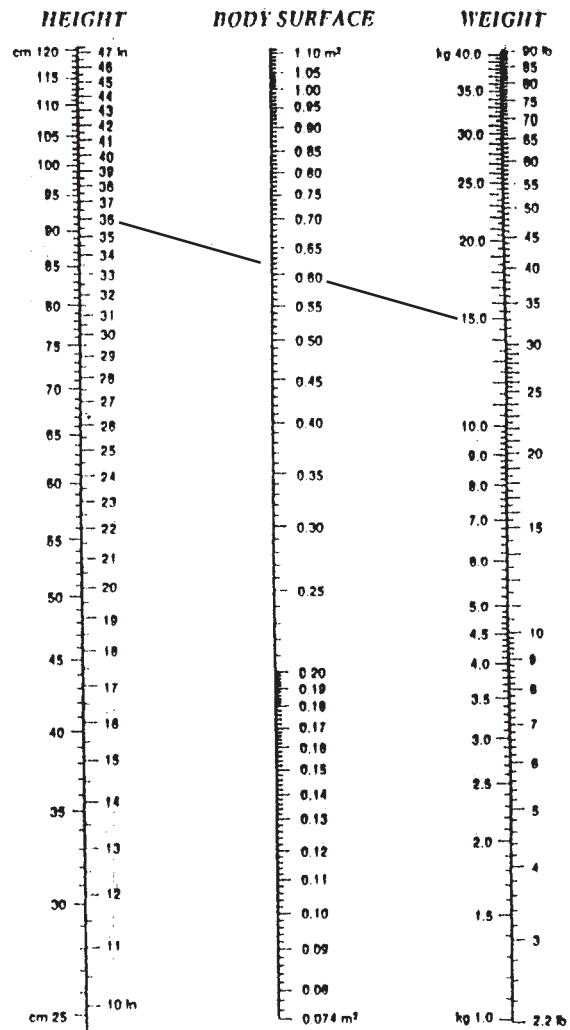
- Body surface area (BSA): most accurate method for calculating pediatric dosages
 - West nomogram, Figure 2-13, if BSA is not known: draw a line from height on the nomogram; the point of intersection on surface area is the BSA.
 - Formula using surface area (m^2)

$$\frac{\text{surface area (m}^2\text{)}}{1.73 \text{ m}^2} \times \text{adult dose} = \text{child dose}$$
 - Example of calculating a pediatric dosage using BSA:
 - The adult dose is 100 mg Demerol; the child weighs 20 kg and is 40 inches tall.
 - BSA is 0.77 m^2
 - Calculations
 - $\frac{0.77^2}{1.73 \text{ m}^2} \times 100 \text{ mg} = X$
 - $0.45 \times 100 \text{ mg} = X$
 - $45 \text{ mg} = X$
 - Child's dose is 45 mg.
- Pediatric dosages may also be calculated by weight (mg/kg)
 - Example: the order is for phenobarbital 2 mg/kg of body weight; the client weighs 25 kg.

- Calculations
 - $\frac{2 \text{ mg}}{X} = \frac{1 \text{ kg}}{25 \text{ kg}}$
 - $(1 \text{ kg})(X) = (2 \text{ mg})(25 \text{ kg})$
 - $\frac{(1 \text{ kg})(X)}{1 \text{ kg}} = \frac{(2 \text{ mg})(25 \text{ kg})}{1 \text{ kg}}$
 - $X = 50 \text{ mg}$
- Give 50 mg of phenobarbital.

H. Dosage calculation for IV medications

- Macrodrop
 - More commonly used in adult IVF (intravenous fluid) administration
 - In order to calculate the flow rate, need to know drop factor: 10, 15, or 20 gtt/mL



Nomogram for determining body surface of children from height and weight. ($S = W^{0.425} \times H^{0.725} \times 71.84$, or $\log S = \log W \times 0.425 + \log H \times 0.725 + 1.8564$ [S = body surface in cm^2 ; W = weight in kg; H = height in cm]).

Figure 2-13 Nomogram. In this example, a child who weighs 15 kilograms and is about 92 centimeters in height has a body surface area of .60 square meter. (Source: "A Formula to Estimate the Approximate Surface Area if Height and Weight Be Known" by D. Dubois and E. F. Dubois, 1916, *Archives of Internal Medicine*, 17, p. 863. Modified with permission.)

- Microdrop
 - More commonly used for children, elderly or critically ill where exact control is required
 - Drop factor is always 60 gtt/mL



Sample Questions

3. Formula for calculation
$$\frac{\text{amount of solution}}{\text{time in minutes}} \times \text{Drop factor} = \text{gtt/min}$$
4. Example: the order is for 1000 mL NS over 8 hours; drop factor is 10 gtt/mL
- a. Calculation
- 1) $\frac{1000 \text{ mL}}{480 \text{ min}} \times \frac{10 \text{ gtt/mL}}{\text{mL}} = X$
 - 2) $\frac{1000 \text{ mL/gtt}}{480 \text{ min}} = 20.8 \text{ gtt/min}$
 - 3) $X = 20.8 \text{ gtt/min}$
5. The same formula can be used for IVs requiring microdrop rates, or the following formula can be used:
mL/hour = microdrops/min
This formula works because the drop factor for microdrop tubing is always 60 microgtts/mL and an hour is 60 minutes.
- a. Example: order is for 1000 mL D₅NS over 24 hours. Drop factor is 60 gtt/mL
- b. Calculation with the first formula
- 1) $\frac{1000 \text{ mL}}{1440 \text{ min}} \times \frac{60 \text{ gtt}}{\text{mL}} = X$
 - 2) $\frac{(1000 \text{ mL}) \times (60 \text{ gtt})}{1440 \text{ min/mL}} = 41.66$
 - 3) $X = 41.66 \text{ gtt/min}$
- c. Cannot give a partial drop, so rate is 42 gtt/min.
- d. Calculation with the second formula
- 1) First determine the mL/hour:
$$\frac{\text{total volume}}{\text{total hours}}$$
 - 2) $\frac{1000 \text{ mL}}{24 \text{ hours}} = 42 \text{ mL/hour} = 42 \text{ gtt/min}$
6. Readjusting IV rates may be necessary when the prescribed rate for an existing IV is changed
- a. Formula for calculation
$$\frac{\text{amount of solution remaining}}{\text{remaining hours in minutes}} \times \text{drop factor}$$
- b. Example: the order is to infuse remaining 700 mL over 3 hours; drop factor is 15 gtt/mL.
- c. Calculation
- 1) $\frac{700 \text{ mL}}{180 \text{ min}} \times \frac{15 \text{ gtt}}{\text{mL}} = X$
 - 2) $\frac{700 \text{ mL} \times 15 \text{ gtt}}{180} = 58.33$
 - 3) $\frac{700 \text{ gtt}}{12 \text{ min}} = 58.3 \text{ gtt/min}$
- d. Cannot give partial drop, so run IV at 58 gtt/min.
4. The order reads Digoxin 0.375 mg once daily. The bottle reads Digoxin 0.25 mg per tablet. How much should the nurse administer?
5. The order is chloral hydrate 200 mg. The bottle reads chloral hydrate 0.1 g/capsule. Give _____ capsules.
6. The order is penicillin 50,000 units. The vial reads penicillin 500,000 units. Add 4.3 mL to yield 5 mL. Give _____ mL.
7. The order is ampicillin 0.4 mg/kg. Client weighs 38.5 pounds. The bottle reads ampicillin 10 mg/mL. Give _____ mL.
8. Phenytoin (Dilantin) 5 mg/kg is ordered for a 40-pound child. It is to be administered in three equal doses. The drug is available in an oral suspension containing 125 mg/mL. How many mL should be administered per dose?
9. The order is for 1.2 million units of penicillin G (Bicillin) IM. Available is 600,000 units/mL. How much should the nurse administer?
10. Order is for 2500 mL D₅W over 24 hours. Drop factor is 15 gtt/mL. Run IV at _____ gtt/minute.
11. Order is for 2000 mL D₅W over 24 hours. Drop factor is 60 gtt/mL. Run IV at _____ gtt/minute.
12. Enoxaparin sodium (Lovenox) 25 mg SC q 12 hours is ordered. The label reads 30 mg /0.3 mL. How much should the nurse administer?
13. The order is for meperidine 50 mg IM q 4 hours prn. The label reads meperidine 75 mg/mL. How much should the nurse administer?
14. An adult is on continuous IV heparin therapy for thrombophlebitis. The IV contains 15,000 units of heparin in 500 mL of 5% dextrose (D₅W) at the rate of 20 mL per hr. How many units per hour is the client receiving?
1. 60 units.
 2. 25 units.
 3. 600 units.
 4. 700 units.

15. The order is for Ancef 1 gram IV in 50 cc 5% dextrose (D₅W) to run in over 30 minutes every 6 hours. The administration set delivers 10 gtt/cc. What should the drip rate be?
1. 8 gtt/min.
 2. 15 gtt/min.
 3. 17 gtt/min.
 4. 25 gtt/min.



Answers and Rationales

4. 1.5 tablets. The formula to use is:

$$\frac{\text{ordered amt}}{\text{amt on hand}} \times \text{quantity}$$

$$\frac{0.375}{0.25} \times 1 \text{ tablet} = 1.5 \text{ tablets}$$

5. 2 capsules. First convert grams to mg.

$$1000 \text{ mg} = 1 \text{ g}$$

$$1000 \text{ mg} \times 0.1 = 100 \text{ mg}$$

Then use ordered over amount on hand times quantity.

$$\frac{200 \text{ mg}}{100 \text{ mg}} \times 1 \text{ capsule} = 2 \text{ capsules}$$

6. 0.5 mL. The formula to use is ordered over amount on hand times volume.

$$\frac{50,000 \text{ units}}{500,000 \text{ units}} \times 5 \text{ mL} = 0.5 \text{ mL}$$

7. 0.7 mL. First convert pounds to kg. 38.5 pounds divided by 2.2 pounds/kg = 17.5 kg. Calculate total mg to be given.

$$\frac{0.4 \text{ mg}}{\text{kg}} \times 17.5 \text{ kg} = 7 \text{ mg}$$

Then use ordered over amount on hand times volume.

$$\frac{7 \text{ mg}}{10 \text{ mg}} \times 1 \text{ mL} = 0.7 \text{ mL}$$

8. 1.2 mL/dose. First convert pounds to kg. Divide 40 pounds by 2.2 pounds/kg for a weight of 18.18 kg. Multiply 5 mg/kg for a total daily dose of 91 mg. Calculate the dose using ordered over amount on hand times volume.

$$\frac{91 \text{ mg}}{125 \text{ mg}} \times 5 \text{ mL} = 3.6 \text{ mL total daily dose}$$

$$\text{Divide } 3.6 \text{ mL by } 3 \text{ doses} = 1.2 \text{ mL/dose.}$$

9. 2 mL.

$$\frac{1,200,000 \text{ units}}{600,000 \text{ units}} \times 1 \text{ mg} = 2 \text{ mL}$$

10. 26 gtt/min. Divide 2500 mL by 24 hours. Then divide the result by 60 minutes per hour and multiply by 15 gtt/mL.
11. 83 gtt/min. Divide 2000 mL by 24 hours for 83 mL/hour. This is divided by 60 min/hour and multiplied by 60 gtt/mL for a total of 83 gtt/min.
12. 0.25 mL. Ordered amount is 25 mg. Available is 30 mg in 0.3 mL.
- $$\frac{0.25 \text{ mg}}{0.30 \text{ mg}} \times 0.3 \text{ mL} = 0.25 \text{ mL}$$
13. 0.67 mL. Ordered amount is 50 mg. Available is 75 mg/mL.
- $$\frac{50 \text{ mg}}{75 \text{ mg}} \times 1 \text{ mL} = 0.66667 \text{ mL}$$
14. 3. Divide 500 mL by 20 mL to determine the number of hours of the infusion: 25 hours. Next, divide 25 hours into 15,000 units to get units/hour: 600 units of heparin/hour.
15. 3. $\frac{\text{total volume infused}}{\text{time in minutes}} \times \text{drop factor} = \text{gtt per minute}$
- $$\frac{50 \text{ mL}}{30 \text{ minutes}} \times \frac{10 \text{ gtt}}{1 \text{ mL}} = 16.6 = 17 \text{ gtt/min}$$



Central Nervous System Drugs

LOCAL ANESTHETICS

- A. Prototype: Lidocaine (Xylocaine)

1. Action. Amide-type anesthetic that blocks nerve conduction; metabolized by hepatic

enzymes; produces temporary loss of sensation and motion in a limited area of the body.

2. Use. Topical anesthesia, regional anesthesia (Unit 4), antiarrhythmic (discussed in Cardiovascular Drugs).

3. Adverse effects. Drowsiness, dizziness, light-headedness, restlessness, numbness of lips and tongue; headache with spinal anesthesia; hypotension, bradycardia, cardiovascular collapse; convulsions; tinnitus; muscle weakness; anaphylaxis; respiratory depression.
 4. Nursing implications
 - a. Force fluids with spinal anesthesia.
 - b. When used for spinal or epidural anesthesia, should be preservative free.
 - c. Monitor VS, and keep siderails up.
 - d. Epinephrine, a vasoconstrictor, may be added to lidocaine (Xylocaine).
 - e. May interfere with swallowing reflex.
 - f. Discard drug without preservatives after immediate use.
 - g. Due to adverse effects, elderly clients should be closely monitored.
 - h. Do not use discolored, cloudy solutions.
- B.** Related drugs. See Table 2-4.



Sample Questions

16. Why is epinephrine added to local anesthetic preparations?
 1. Prolong anesthetic action.
 2. Lower blood pressure.
 3. Prevent arrhythmias.
 4. Increase blood flow to injection site.
17. A client complains of a severe sore throat after the extraction of 2 wisdom teeth. Viscous lidocaine (Xylocaine) is ordered. Which of the following should be included in client teaching concerning the use of viscous lidocaine (Xylocaine)?
 1. Take viscous lidocaine (Xylocaine) with fluids to soothe sore throat.
 2. Instruct client to use a humidifier while taking viscous lidocaine (Xylocaine).

Table 2-4 Local Anesthetics

Drug	Use	Adverse Effects	Nursing Implications
Procaine (Novocain)	Nerve block Spinal anesthesia Infiltration anesthesia	Anaphylaxis is seen more with ester-type anesthetics	<ul style="list-style-type: none"> • Procaine is an ester-type anesthetic metabolized by esterase found in plasma • Emergency resuscitation equipment should be available • Monitor VS (see lidocaine [Xylocaine])
Benzocaine (Americaine)	Topical anesthesia	See procaine (Novocain) and lidocaine (Xylocaine)	<ul style="list-style-type: none"> • Benzocaine (Americaine) is similar to procaine (Novocain) and is an ester-type anesthetic • Commonly found in OTC preparations to treat sunburn, rashes, sore throats, and hemorrhoids
Mepivacaine (Carbocaine)	Infiltration nerve block anesthesia	See lidocaine (Xylocaine)	<ul style="list-style-type: none"> • Amide-type local anesthetic that has two times the potency and toxicity of lidocaine
Bupivacaine (Marcaine)	Epidural blocks Infiltration anesthesia Peripheral nerve block	See lidocaine (Xylocaine)	<ul style="list-style-type: none"> • Long-acting amide-type anesthetic • Toxicity seen more often in children and elderly
Etidocaine (DuraneSt)	Infiltration anesthesia Peripheral nerve block Central neural blocks	See lidocaine (Xylocaine)	<ul style="list-style-type: none"> • Analgesia effects last 1½–2 times longer than lidocaine

3. Advise client to wait 60 minutes before eating after drug application.
4. Encourage client to take viscous lidocaine (Xylocaine) with food to reduce GI distress.



Answers and Rationales

16. 1. Epinephrine prolongs anesthetic action, while shortening the onset of action and reducing blood flow to injection site.
17. 3. Viscous lidocaine (Xylocaine) can interfere with swallowing reflex and clients should wait at least 60 minutes after use before eating.

NON-NARCOTIC ANALGESICS AND ANTIPYRETICS

- A. Prototype: salicylates
Acetylsalicylic Acid (aspirin) (ASA)
1. Action
 - a. Analgesia: inhibits formation of prostaglandins involved with pain. Analgesia also occurs by action of hypothalamus and blocking generation of pain impulses.
 - b. Antipyretic: inhibits formation of prostaglandins in production of fever. Aspirin acts on the hypothalamus to produce vasodilation.
 - c. Anti-inflammatory: inhibits prostaglandin synthesis causing anti-inflammatory action.
 - d. Antiplatelet action occurs when aspirin inhibits prostaglandin derivative, thromboxane A₂.
 2. Use. Mild to moderate pain; control of fever; inflammatory conditions; reduce TIA occurrence; reduce risk of MI in men with unstable angina.
 3. Adverse effects. Tinnitus, confusion, dizziness—all are symptoms of salicylism; drowsiness; epistaxis, bleeding, bruising; edema, hypertension; nausea, vomiting, diarrhea, gastritis; hypersensitivity; hypoglycemia, sweating; impaired renal function; respiratory alkalosis and metabolic acidosis are associated with aspirin toxicity.
 4. Nursing implications
 - a. Clients with history of nasal polyps, asthma, rhinitis, chronic urticaria have high incidence of aspirin hypersensitivity.
 - b. Clients with diabetes should have glucose monitored.

- c. Monitor CBC, prothrombin time, kidney and liver function studies for clients on long-term therapy.
- d. Additive effect for clients on anticoagulant.
- e. Stop therapy 1 week before surgery.
5. Discharge teaching
 - a. Drink plenty of fluids to prevent salicylate crystalluria.
 - b. Take with glass of water, antacid, milk, or food to reduce gastric irritation.
 - c. Parents should not give to children or adolescents with flu or chickenpox because Reye's syndrome may occur.
 - d. Report signs of bleeding and bruising to physician.
 - e. Discontinue use if tinnitus, dizziness, or GI distress occur.
 - f. Pregnant women should not use.
 - g. Do not crush enteric-coated tablets.
 - h. Do not ingest large amounts of alcohol as this increases risk of GI bleeding.

B. Related drugs. See Table 2-5.

- C. Prototype: acetaminophen (Tylenol)
1. Action. Analgesic and antipyretic action (see aspirin); does not have anti-inflammatory or antiplatelet action.
 2. Use. Mild to moderate pain, fever control.
 3. Adverse effects. Rash, thrombocytopenia, liver toxicity. Toxicity can occur 2–24 hours after ingestion.
 4. Nursing implications
 - a. Monitor liver and kidney function, and CBC periodically for clients on long-term therapy.
 - b. Can cause psychological dependence.
 - c. Antidote: acetylcysteine (Mucomyst)
 5. Discharge teaching. Notify physician if no relief of symptoms within 5 days of therapy.



Sample Questions

18. Which of the following should be included in teaching concerning the administration of indomethacin (Indocin)?
 1. Have periodic ophthalmic examinations.
 2. Take on an empty stomach.
 3. Take aspirin for headache relief.
 4. Eat high-fiber foods to prevent constipation.
19. In comparing aspirin to acetaminophen (Tylenol), what is true pertaining to Tylenol?
 1. It is contraindicated in clients with peptic ulcer disease.
 2. It is contraindicated in clients with asthma.
 3. It is as effective as aspirin for reducing fever.

Table 2-5 Nonsteroidal Anti-Inflammatory Drugs (NSAIDs)*

Drug	Use	Adverse Effects	Nursing Implications
Ibuprofen (Motrin, Advil)	Relief of mild to moderate pain Primary dysmenorrhea Rheumatoid and osteoarthritis	May cause sodium or water retention Thrombocytopenia, hemolytic anemia Acute renal failure, hematuria Can elevate liver enzymes	<ul style="list-style-type: none"> • Do not take with aspirin • Take with food or with milk to decrease GI distress • Monitor liver enzymes
Naproxen (Naprosyn)	Rheumatoid and osteoarthritis Ankylosing spondylitis Primary dysmenorrhea Acute gout attacks Juvenile diabetes	See aspirin and ibuprofen (Motrin)	<ul style="list-style-type: none"> • See aspirin and ibuprofen (Motrin)
Indomethacin (Indocin)	Close patent ductus arteriosus in premature infant Acute gouty arthritis Moderate severe refractory rheumatoid and osteoarthritis Ankylosing spondylitis	GI distress, anorexia Severe headache Corneal cloudiness, visual field changes	<ul style="list-style-type: none"> • Clients need to have periodic ophthalmic examinations • Do not take aspirin; see aspirin
Piroxicam (Feldene)	Acute or long-term management of rheumatoid or osteoarthritis	Higher incidence of GI bleeding	<ul style="list-style-type: none"> • See aspirin, indomethacin (Indocin), and ibuprofen (Motrin)
Ketorolac (Toradol)	Short-term pain management	Risk of renal impairment and GI bleeding in prolonged use	<ul style="list-style-type: none"> • Do not give longer than 5 days • Anaphylaxis can occur with first dose
Celecoxib (Celebrex)	Primary dysmenorrhea Acute pain Rheumatoid and osteoarthritis	Peripheral edema Abdominal pain Upper respiratory infection	<ul style="list-style-type: none"> • Separate administration with magnesium or aluminum containing antacids by 2 hours • Monitor liver enzymes, renal function, H & H and electrolytes
Valdecoxib (Bextra)	Primary dysmenorrhea Osteoarthritis Adult rheumatoid arthritis	Anemia Fluid retention Increased blood pressure	<ul style="list-style-type: none"> • Can take without regard to food • Do not take aspirin or other NSAIDs with this medication

*NSAIDs are prostaglandin Inhibitors

4. It has a stronger anti-inflammatory effect than aspirin.
20. Which condition is an indication for aspirin use?
 1. Asthma.
 2. TIA.
 3. Gout.
 4. Nasal polyps.
21. Which drug is the drug of choice used to treat primary dysmenorrhea?
 1. Acetaminophen (Tylenol).
 2. Piroxicam (Feldene).
 3. Indomethacin (Indocin).
 4. Ibuprofen (Motrin).



Answers and Rationales

18. **1.** Indomethacin (Indocin) may cause visual field changes or corneal cloudiness. Clients should have periodic ophthalmic examinations to monitor for visual change.
19. **3.** Acetaminophen (Tylenol) is as effective as aspirin in reducing fever. Both have similar antipyretic actions.
20. **2.** Due to aspirin's antiplatelet effect, aspirin can be used to decrease TIA.
21. **4.** Ibuprofen (Motrin) is the drug of choice to treat primary dysmenorrhea.

NARCOTIC ANALGESICS

A. Prototype: morphine sulfate

1. Action. Acts on opioid receptors in CNS and induces sedation, analgesia, and euphoria.
2. Use. Relief of moderate to severe pain, preoperative and/or postoperative medication, pain relief in MI, relief of dyspnea occurring in pulmonary edema or acute left ventricular failure.
3. Adverse effects. Sedation, confusion, euphoria, impaired coordination, dizziness; urinary retention, constipation, hyperglycemia; respiratory depression; hypotension, tachycardia, bradycardia; nausea, vomiting, decreased uterine contractility; allergic reactions; tolerance, physical and psychological dependence; pupil constriction.
4. Nursing implications
 - a. Assess client's pain before giving medication.
 - b. Evaluate effectiveness of analgesic including onset and duration of response to medication.
 - c. Observe for signs of tolerance with prolonged use.
 - 1) Tolerance means that a larger dose of narcotic analgesic is required to produce the original effect.
 - 2) The first sign of tolerance is usually a decreased duration of effect of the analgesic.
 - d. Monitor respiratory rate and depth before giving drug, and periodically thereafter.
 - e. Encourage sighing, coughing, and deep breathing.
 - f. Warn ambulatory clients to avoid activities that require alertness.

- g. Advise client to change position slowly.
 - h. Check for signs of urinary retention.
 - i. Keep stool record and institute measures to prevent constipation; e.g., fluids, foods high in fiber, and activity as tolerated; administer stool softeners and laxatives as ordered.
 - j. Have narcotic antagonist (naloxone [Narcan]) available for reversal of effects if necessary.
 - k. Teach client not to drink alcoholic beverages while taking narcotics.
 1. Monitor for withdrawal symptoms and decrease dose slowly because these drugs may produce physical dependence.
 - m. Use special caution with clients with increased intracranial pressure, chronic obstructive pulmonary disease (COPD), alcoholism, severe hepatic or renal disease, and in elderly or debilitated clients who may not metabolize the drug efficiently.
5. Discharge teaching
- a. Take before pain intensifies to receive fullest analgesic effect.
 - b. No alcohol or CNS depressants should be taken.
 - c. No smoking or ambulating alone after drug has been taken.
 - d. Avoid activities requiring alertness.
- B. Related drugs. See Table 2-6.
- C. Narcotic agonists/antagonists
1. Examples: pentazocine (Talwin), nalbuphine (Nubain), butorphanol (Stadol), buprenorphine (Buprenex), fentanyl (Duragesic)
 2. Mechanism of action
 - a. Term "agonist" refers to the fact that they bind to opioid receptors to produce analgesia.
 - b. Term "antagonist" refers to the fact that they counteract the effects of the pure narcotic agonists (i.e., morphine, meperidine [Demerol]).
 3. Use. Relief of moderate to severe pain; may be used for clients who cannot tolerate pure narcotic agonists. Caution: May produce withdrawal in a client who has been taking pure narcotic agonists for a week or more.
 4. Adverse effects. Drowsiness, nausea, psychotomimetic effects, e.g., hallucinations; respiratory depression and constipation but less of a risk than with pure narcotic agonists such as butorphanol (Stadol), nalbuphine (Nubain), pentazocine (Talwin).
- D. Combination drugs
1. Some narcotics can be combined with other drugs.
 2. Examples of this would be codeine combined with Empirin, Fiorinal, or Tylenol.

Table 2-6 Narcotic Analgesics

Drug	Use	Comments
Codeine	Moderate to severe pain, cough relief	<ul style="list-style-type: none"> • Less potential for dependence than morphine sulfate • Take oral form with food • Monitor for cough suppression • Smoking can reduce pain relief • Cautious use with client on MAO inhibitor
Hydromorphone (Dilaudid)	Moderate to severe pain	<ul style="list-style-type: none"> • Take oral form with food • Mix with 5 mL of sterile water or normal saline for IV use • Smoking reduces pain relief
Meperidine (Demerol)	Moderate to severe pain, preoperative medication	<ul style="list-style-type: none"> • Take oral form with food • PO dose < 50% as effective as parenteral • IM preferred route for duplicate doses
Methadone (Dolophine)	Severe pain, narcotic withdrawal	<ul style="list-style-type: none"> • IM preferred route
Oxycodone Hydrochloride (Percocet, Percodan)	Moderate to severe pain	<ul style="list-style-type: none"> • Monitor liver and blood studies • Give oral form with food • High abuse potential
Oxycontin	Moderate to severe pain	<ul style="list-style-type: none"> • Monitor respirations • Take with food • Not intended for use as an “as needed” analgesic (See also oxycodone)

3. “Meperidine (Demerol) will be most effective if you take it before your pain becomes severe. This will decrease your needing excess amounts of a narcotic.”
 4. “Meperidine (Demerol) is ordered for you to help manage your pain. You really should take it.”
23. Before administering meperidine (Demerol) to a client, which assessment is most important for the nurse to make?
 1. Apical pulse rate.
 2. Respiratory rate.
 3. Blood pressure.
 4. Level of consciousness.
 24. Which adverse effect would the nurse expect to observe in a client receiving a narcotic analgesic?
 1. Urine retention.
 2. Diarrhea.
 3. Hypoglycemia.
 4. Hypertension.

Answers and Rationales

22. 3. Narcotic drugs should be taken before pain becomes intense so the client can receive the fullest analgesic effects. By adhering to this, the client will have good pain control and will not be requesting additional doses.
23. 2. Respiratory rate needs to be assessed before giving the client a narcotic as narcotics can have a life-threatening effect.
24. 1. An adverse side effect of narcotic analgesics is urinary retention. You would also monitor constipation, hyperglycemia, and hypotension.

Sample Questions

22. A client is 1 day post-op. She tells the nurse that she’s worried she will become addicted to painkillers so she wants to wait for the pain to become very intense before she takes anything. What is the best response by the nurse?
 1. “Meperidine (Demerol) is very addicting. You shouldn’t request pain medication unless you really need it.”
 2. “Meperidine (Demerol) is not appropriate for you. I’ll ask the physician to order a non-narcotic pain medication for you.”

NARCOTIC ANTAGONISTS

- A. Prototype: naloxone hydrochloride (Narcan)
 1. Action. Occupies opiate receptor sites and prevents or reverses effects of agonists such as morphine sulfate.
 2. Use. Postoperative respiratory depression caused by narcotics, therapy in suspected or confirmed narcotic overdose.
 3. Adverse effects. Excess dosage in narcotic depression: hypertension, tremors, reversal of

analgesia, hyperventilation, increases PTT. In too-quick reversal: nausea, vomiting; sweating, tachycardia.

4. Nursing implications
 - a. Emergency resuscitative equipment needs to be available.
 - b. Monitor VS, especially respirations.
 - c. Monitor client closely as activity of some narcotics last longer than that of naloxone hydrochloride (Narcan).
 - d. Monitor surgical clients for bleeding.
 - e. Withdrawal symptoms will be seen in client addicted to narcotics.
- B. Related drug: naltrexone (Trexan)
 1. Used in narcotic detoxification and to prevent readdiction in drug users.
 2. Initial treatment of overdose is naloxone hydrochloride (Narcan) and then naltrexone (Trexan) is given as it has a longer duration of action.
- C. Related drug: nalmefene (Revex)
 1. Used to treat opioid overdose.
 2. Can be given IM or SC if IV access is lost.



Sample Questions

25. Which of the following observations by the nurse indicates an adverse effect of naloxone hydrochloride (Narcan) on the client?
 1. Hypotension.
 2. Bradycardia.
 3. Tremors.
 4. Increased urine output.
26. Which client should have cautious use of naloxone hydrochloride (Narcan)?
 1. Meperidine (Demerol) addict.
 2. Client with brittle diabetes.
 3. Client with asthma.
 4. Postoperative radical neck.



Answers and Rationales

25. 3. Tremors are an adverse effect of naloxone hydrochloride (Narcan) and indicate an overdose of the drug.
26. 1. If naloxone hydrochloride (Narcan) is given to a client who is addicted to narcotics, the client will experience withdrawal syndrome. Thus, narcotic addicts should use this drug cautiously.

SEDATIVES AND HYPNOTICS

- A. Prototype for the Barbiturates: phenobarbital sodium (Luminal)
 1. Action. Hinders movement of impulses from the thalamus to the brain cortex, thus creating depression in the CNS, which can range from mild to severe. Considered a long-acting barbiturate.
 2. Use. Sedation, hypnosis, seizure disorders.
 3. Adverse effects. Dizziness, ataxia, drowsiness, “hangover,” anxiety, irritability, hand tremors, vision difficulties, insomnia; bradycardia, low blood pressure; chest tightness, wheezing, apnea, respiratory depression; nausea, vomiting, constipation; hypersensitivity reactions.
 4. Nursing implications
 - a. High doses for long periods of time can cause physical dependence.
 - b. Drug has extended half-life so steady plasma level may take 3–4 weeks of medication before occurring.
 - c. Give reconstituted solutions within 30 minutes of mixing.
 - d. Give IM deeply in large muscle mass and observe IM sites.
 - e. IV administration: client must be monitored constantly: take VS frequently; have emergency equipment available; monitor for extravasation at infusion site.
 - f. Pill can be crushed and mixed with food or fluid.
 - g. Will cause restlessness in client in pain.
 - h. Geriatric, pediatric, and debilitated clients can have paradoxical reactions.
 - i. Monitor liver and blood studies with long-term therapy.
 - j. Schedule IV drug under Federal Controlled Substances Act.
 - k. Many drug interactions.
 5. Discharge teaching
 - a. Drowsiness occurs in first few weeks of therapy and will decrease.
 - b. Avoid potentially dangerous activities until response to drug is known.
 - c. Alcohol is prohibited.
 - d. Do not alter dosing schedule or amount.
 - e. Do not stop abruptly.
 - f. Teratogenic. Prolonged use necessitates alternative contraception methods if taking birth control pills.
 - g. Do not keep at bedside due to potential for overdosing.
- B. Related drugs. See Table 2-7.

Note: actions, adverse effects, and nursing implications are similar to phenobarbital sodium (Luminal).

Table 2-7 Barbiturates

Drug	Use
Amobarbital sodium (Amytal) (intermediate acting)	Sedation, hypnosis, preoperative medication, labor, chronic and acute seizures
Butobarbital sodium (Butisol) (intermediate acting)	Sedation, hypnosis, preoperative medication
Pentobarbital sodium (Nembutal) (short acting)	Sedation, hypnosis, preoperative medication
Secobarbital sodium (Seconal) (short acting)	Hypnosis, preoperative medication
Thiopental sodium (Pentothal Sodium) (ultrashort acting)	Induction of general anesthesia, acute seizures, decrease of intracranial pressure in neurosurgery, narcoanalysis and narcosynthesis in psychiatry

- C. Prototype for Benzodiazepines (antianxiety agents): diazepam (Valium)
1. Action. Not fully understood. Depresses the CNS at the limbic system and reticular formation.
 2. Use. Anxiety disorders, acute alcohol withdrawal, muscle relaxant, tetanus, convulsive disorders, preoperative medication.
 3. Adverse effects. Dry mouth, constipation, urinary retention, photophobia and blurred vision; for other effects see adverse effects listed under pentobarbital sodium (Luminal).
 4. Nursing implications
 - a. Adverse effects typically dose related.
 - b. Two weeks of therapy needed before steady plasma levels seen.
 - c. Tablet can be crushed.
 - d. Do not mix with other drugs in the same syringe.
 - e. Cautious IV use as drug can precipitate in IV solutions.
 - f. IM should be deep into large muscle mass; rotate IM sites.
 - g. Parenteral administration can cause low blood pressure, increased heart rate, muscle weakness, and respiratory depression.
 - h. For extended therapy, monitor liver and blood studies.
 - i. Adverse effects more likely in geriatric clients.
 - j. Monitor I&O.
 - k. Schedule IV drug under Federal Controlled Substances Act.

5. Discharge teaching
 - a. Avoid alcohol.
 - b. Avoid potentially dangerous activities until response to drug is known.
 - c. Smoking decreases drug effect.
 - d. Avoid abrupt discontinuance of drug.
 - e. If pregnant or planning a pregnancy, discuss ending drug therapy with physician.
 - f. Long-term high dose use can cause physical dependence.
- D. Related drugs. See Table 2-8.
Note: actions, adverse effects, and nursing implications are similar to diazepam (Valium).
- E. Other sedative/hypnotic drugs
 1. Drugs which produce sedation and/or sleep that are not barbiturates or benzodiazepines.
 2. Examples
 - a. Buspirone (BuSpar): used for anxiety disorders.
 - b. Ethchlorvynol (Placidyl): used for short-term insomnia (lasting 1 week).
 - c. Zolpidem (Ambien): used for short-term insomnia (lasting 1 week).



Sample Questions

27. The nurse would monitor the client who has been given pentobarbital sodium (Nembutal) for which adverse effects?
1. Tachycardia.
 2. Hypertension.
 3. Dry mouth.
 4. Anxiety.

Table 2-8 Benzodiazepines

Drug	Use
Alprazolam (Xanax)	Anxiety
Clorazepate (Tranxene)	Anxiety
Flurazepam (Dalmane)	Hypnosis
Midazolam (Versed)	Preoperative medication, conscious sedation
Triazolam (Halcion)	Hypnosis
Chlordiazepoxide (Librium)	Anxiety, alcohol withdrawal
Clonazepam (Klonopin)	Seizures, restless leg syndrome, panic attacks
Lorazepam (Ativan)	Anxiety, preoperative medication

28. Which group should not receive barbiturates?
1. Children <5 years of age.
 2. Pregnant women.
 3. Adults prone to seizures.
 4. Adults with bleeding ulcers.



Answers and Rationales

27. 4. Anxiety is an adverse side effect.
28. 2. Barbiturates are teratogenic and are contraindicated for pregnant women.

ANTICONVULSANTS

- A. Several categories of drugs are used to treat seizure activity. Each group will be addressed and there will be no prototype.
1. Barbiturates (phenobarbital)
 - a. Used for generalized and absence seizures.
 - b. Refer to discussion under sedatives and hypnotics on barbiturates.
 2. Benzodiazepines (Diazepam [Valium])
 - a. Drug of choice for status epilepticus. Also used for absence seizures.
 - b. Refer to discussion under Sedatives and Hypnotics on Benzodiazepines.
 3. Hydantoins (phenytoin [Dilantin])
 - a. Action. Prevents dissemination of electrical discharges in motor cortex area of the brain.
 - b. Use. Tonic-clonic and complex partial seizures, status epilepticus, prevention of seizures that accompany neurosurgery.
 - c. Adverse effects. Confusion, slurred speech, slow physical movement; blood dyscrasias; nausea, vomiting, constipation; gingival hyperplasia; hirsutism; rash; acne; hypotension, circulatory collapse, cardiac arrest.
 - d. Nursing implications
 - 1) May take 7–10 days to achieve therapeutic serum concentration.
 - 2) Tablet can be crushed and should be mixed with food or fluid.
 - 3) Suspension must be shaken well.
 - 4) Can turn urine pink, red, or red-brown.
 - 5) IM route not recommended.
 - 6) Do not mix with other drugs.
 - 7) Monitor CBC, liver, thyroid, and urine tests.
 - 8) Gingival hyperplasia seen most often in children and adolescents.
 - 9) Stop drug immediately if a measles-like rash occurs.

- e. Discharge teaching
 - 1) Relate signs of fatigue, dry skin, deepening voice with extended therapy as drug can mask decreased thyroid reserve.
 - 2) Report jaundice as drug is metabolized in the liver and liver dysfunction causes elevated blood levels of drug.
 - 3) Abrupt drug withdrawal can cause seizures or status epilepticus.
 - 4) Withdraw gradually.
 - 5) Avoid potentially dangerous activities until drug response is known.
 - 6) Alcohol use can cause drug toxicity.
 - 7) Cautious use in pregnancy and lactation.
 - 8) Flu shot during therapy can increase seizure occurrence.
 - 9) Family members need instruction in care of client during a seizure.

4. Succinimides (ethosuximide [Zarontin]): used in treatment of absence seizures.
5. Acetazolamide (Diamox): diuretic used as an adjunct or alone in treatment of absence, tonic-clonic, or myoclonic seizures.
6. Carbamazepine (Tegretol)
 - a. Chemically similar to tricyclic antidepressants.
 - b. Used in treatment of tonic-clonic, complex partial, and mixed seizures.
7. Adjunct anticonvulsants
 - a. Valproic acid (Depakene)
 - 1) Used in treatment of absence seizures.
 - 2) Low incidence of side effects as compared to other anticonvulsants.
 - b. Felbamate (Felbatol): used to treat Lennox-Gastaut Syndrome in children and partial seizures.
 - c. Lamotrigine (Lamictal): used to treat partial seizures.
 - d. Gabapentin (Neurontin): used to treat partial seizures.



Sample Questions

29. The nurse should teach clients to watch for which common adverse effect of phenytoin (Dilantin)?
1. Alopecia.
 2. Edema.
 3. Gingival hyperplasia.
 4. Hallucinations.
30. What is the drug of choice for status epilepticus?
1. Phenytoin (Dilantin).
 2. Carbamazepine (Tegretol).
 3. Phenobarbital (Luminal).
 4. Diazepam (Valium).



Answers and Rationales

29. 3. Gingival hyperplasia is a common adverse effect of phenytoin (Dilantin) seen most often in children and adolescents.
30. 4. Diazepam (Valium) is the drug of choice for status epilepticus.

MUSCLE RELAXANTS

- A. Various drugs used to treat musculoskeletal problems. Three common drugs will be discussed. There will be no prototype drug.
1. Baclofen (Lioresal)
 - a. Mechanism of action not known but drug inhibits nerve activity in the spinal cord, thus decreasing spasms of skeletal muscles.
 - b. Used in multiple sclerosis and spinal cord injuries.
 - c. Adverse effects. CNS depression ranging from sedation to coma and seizures; urinary frequency; hirsutism, photosensitivity, acne-like rash; nausea and vomiting.
 - d. Nursing implications. May be taken with food, monitor ambulation, depressant effects will be increased if mixed with other CNS depressants, monitor VS, client should avoid potentially dangerous activities until response is known, do not abruptly withdraw.
 2. Carisoprodol (Soma)
 - a. Mechanism of action not known but is believed due to drug's central depressant action.
 - b. Used in cerebral palsy, muscle stiffness, and spasm found in various musculoskeletal disorders.
 - c. Adverse effects. Sedation; headache; syncope, tachycardia, postural hypotension; nausea, vomiting; hiccups, allergic reactions.
 - d. Nursing implications. May be taken with food, drowsiness is common effect and client may need dosage reduced, client should not take alcohol or other CNS depressants, do not abruptly stop, allergic reactions usually occur from the first to the fourth dose.
 3. Dantrolene (Dantrium)
 - a. Interferes with calcium release from the muscle, which causes a decrease in muscle contraction.

- b. Used for muscle spasms associated with cerebral vascular accident, spinal cord injury, cerebral palsy, and multiple sclerosis. Also given intravenously for malignant hyperthermia.
 - c. Adverse effects. Drowsiness; malaise, diarrhea; hepatotoxicity (in extended use at high doses).
 - d. Nursing implications. Capsule can be opened and contents can be mixed with juice or other liquid, monitor ambulation, liver and kidney function tests should be monitored, monitor IV site for extravasation, should be withdrawn after 45 days if no improvement has been seen.
4. Cyclobenzaprine (Flexeril)
- a. Acts on brainstem to reduce tonic somatic muscle activity.
 - b. Used for managing acute and painful muscle spasm.
 - c. Adverse effects. Dizziness, drowsiness, confusion, fatigue, headache, nervousness, blurred vision, arrhythmias, constipation, dyspepsia, nausea, unpleasant taste, urinary retention.
 - d. Nursing implications. Take with food, CNS depressant, drowsiness is common.



Sample Questions

31. Which statement indicates a need for more teaching about baclofen (Lioresal) by the nurse?
1. "I'll take my pills with my meals."
 2. "I'll drive myself to work each day."
 3. "I won't have wine with dinner anymore."
 4. "I'll use sunscreen when I go outside."



Answers and Rationales

31. 2. Due to the depressant effects of baclofen (Lioresal), the client should not engage in any potentially dangerous activities until the client response to the drug is known.

ANTIPSYCHOTIC AGENTS

- A. Prototype: phenothiazines (Chlorpromazine [Thorazine])
1. Action. Not fully understood, but is thought to block dopamine receptors in the brain.

Chlorpromazine causes a sedative effect known as a neuroleptic effect and antipsychotic effect. Also causes an antiemetic effect by depressing the chemoreceptor trigger zone (CTZ). Potentiates the effects of other CNS depressant drugs. Blocks peripheral acetylcholine (ACh) receptors, histamine (H₁) receptors, and alpha-adrenergic receptors. These actions cause anticholinergic, alpha-anti-adrenergic, and antihistamine effects that can produce adverse effects.

2. Use. Management of acute and chronic schizophrenia, manic phase of bipolar disorder, management of nausea and vomiting, control of excessive anxiety before surgery, treatment of acute intermittent porphyria, treatment of intractable hiccups, tetanus.
3. Adverse effects. Extrapyramidal symptoms; dizziness, sedation, seizures; orthostatic hypotension, tachycardia, arrhythmias; cholestatic jaundice; agranulocytosis; photosensitivity; anticholinergic effects: “Red, Hot, Dry, Blind, Mad”; urticaria; changes in menses and libido; potentiates CNS effects of narcotic analgesics, sedatives, hypnotics, and alcohol; neuroleptic malignant syndrome.
4. Nursing implications
 - a. Monitor blood pressure (standing, lying, and sitting), pulse, respirations, and I&O.
 - b. Wear gloves when handling parenteral or liquid form to prevent contact dermatitis.
 - c. Give deep IM injection into gluteal muscle and massage well.
 - d. Monitor client for extrapyramidal symptoms, which can occur 1–60 days after therapy is begun. Tardive dyskinesia can occur several months or years after therapy.
 - e. Monitor CBC, liver function studies, glucose levels, and urinalysis and encourage periodic ocular examinations.
 - f. Supervise ambulation to prevent falls until client develops a tolerance.
 - g. Protect drug from light.
5. Discharge teaching
 - a. Take with food or milk to decrease GI distress.
 - b. Take drug at bedtime.
 - c. Wear protective clothing and/or sunscreen before exposure to sun.
 - d. With initial therapy, change positions gradually to reduce orthostatic hypotension.
 - e. Report fever, sore throat to physician.
 - f. Stop or reduce cigarette smoking, as this shortens the half-life and higher doses may be needed.
 - g. Mix liquid form in juice, water, milk, or baby food.

- h. With long-term therapy, drug is gradually reduced before discontinuing therapy.
- i. Incompatible with many drugs. *Note: also review the anticholinergic drug atropine sulfate for nursing implications and discharge teaching.*

B. Related drugs. See Table 2-9.

Table 2-9 Phenothiazines

Drug	Use	Comments
Promethazine (Phenergan)	Pre- and postoperative sedation Prophylaxis for nausea, vomiting, motion sickness Adjunct to analgesics Allergic conditions	• Rarely causes extrapyramidal symptoms
Thioridazine (Mellaril)	Psychotic disorders Short-term use in depression Attention deficit disorder	• Rarely causes extrapyramidal symptoms
Fluphenazine (Prolixin) (Prolixin Decanoate)	Psychotic disorders	• Clients at great risk for extrapyramidal symptoms • Most potent phenothiazine
Haloperidol (Haldol)	Psychotic disorders Tourette’s syndrome Short-term treatment in hyperactive children	• Clients at great risk for extrapyramidal symptoms • Causes less sedation and hypotension
Mesoridazine (Serentil)	Schizophrenia Acute/chronic alcoholism	• Increased sedation but less risk of extrapyramidal symptoms
Thiothixene (Navane)	Psychotic disorders	• Clients at great risk for extrapyramidal symptoms
Pimozide (Orap)	Tourette’s syndrome	• Decreased sedation but increased risk of extrapyramidal symptoms
Molindone (Moban)	Psychotic disorders	• Clients at low risk for sedation and extrapyramidal symptoms



Sample Questions

32. The psychiatrist orders chlorpromazine (Thorazine) IM. If the medication is not properly handled, what effect could this have on the nurse?
1. Skin discoloration.
 2. Skin irritation.
 3. Headache.
 4. Dizziness.
33. Which of the following interventions should be included in a care plan concerning chlorpromazine (Thorazine) therapy?
1. Supervise ambulation.
 2. Take a hot bath to reduce agitation.
 3. Restrict fluid intake to prevent edema.
 4. Discontinue drug if sedation occurs.
34. Which phenothiazine is used specifically as an antiemetic and rarely causes extrapyramidal symptoms?
1. Thioridazine (Mellaril).
 2. Fluphenazine (Prolixin).
 3. Promethazine (Phenergan).
 4. Chlorpromazine (Thorazine).
35. Which antipsychotic agent is also used to treat Tourette's syndrome and causes less sedation than other phenothiazines?
1. Haloperidol (Haldol).
 2. Thioridazine (Mellaril).
 3. Fluphenazine (Prolixin).
 4. Chlorpromazine (Thorazine).

35. 1. Haloperidol (Haldol) is also used to treat Tourette's syndrome and causes fewer sedative effects than other phenothiazines.

Antipsychotic Agents (Continued)

- C. Prototype: lithium (lithium carbonate [Eskalith])
1. Action. Exact mode of action unknown. Thought to alter neurotransmitters in CNS that produce antidepressant and antimanic effects.
 2. Use. Treatment and prophylaxis of manic phase of bipolar disorder.
 3. Adverse effects. Confusion, restlessness, fatigue, weakness, hand tremors; arrhythmias, circulatory collapse, palpitations, hypotension; blurred vision; dry mouth, thirst, weight gain; nausea, diarrhea; leukocytosis.
 4. Nursing implications
 - a. Monitor serum lithium levels (blood tests usually done monthly).
 - b. Monitor for lithium intoxication.
 - c. Treatment for lithium intoxication includes IV therapy with normal saline, diuretics, and hemodialysis.
 - d. Monitor thyroid function studies periodically.
 - e. May take 1–2 weeks to achieve therapeutic effects.
 5. Discharge teaching
 - a. Drink 2.5–3 liters of fluid per day to relieve thirst and dry mouth.
 - b. Maintain sodium intake of 6–10 g daily to reduce lithium toxicity.
 - c. Take with food to decrease GI distress.
 - d. Do not drive or operate machinery until drug response established.
 - e. Report to physician: nausea, vomiting, edema, weight gain, tremors, and drowsiness (may be signs of lithium toxicity or hypothyroidism).
 - f. Record weight on a weekly basis.
- D. Related drugs: lithium citrate (Cibalith-S): available in liquid form



Answers and Rationales

32. 2. Handling the parenteral or liquid forms of chlorpromazine (Thorazine) may cause contact dermatitis, so gloves should be worn.
33. 1. Chlorpromazine (Thorazine) during initial use can cause orthostatic hypotension; ambulation should be supervised to prevent falls until tolerance develops.
34. 3. Promethazine (Phenergan) is used as an antiemetic and rarely causes extrapyramidal symptoms.



Sample Questions

36. Which of the following interventions should the nurse stress while a client is on lithium therapy?
1. Weigh self once a month.
 2. Restrict fluid intake to prevent edema.
 3. Do not restrict sodium intake.
 4. Avoid eating cheese and bananas and drinking wine.



Answers and Rationales

36. 3. Clients need to maintain sodium intake (usually 6–10 g daily) to prevent lithium toxicity.

Antipsychotic Agents (Continued)

- E. Prototype: tricyclic antidepressants (imipramine [Tofranil])
1. Action. Structurally related to phenothiazines. Blocks reuptake of the neurotransmitters norepinephrine and serotonin at the neuronal membrane, which increases and prolongs the response of the neurotransmitters.
 2. Use. Endogenous and reactive depression; childhood enuresis.
 3. Adverse effects. Sedation, confusion; anticholinergic effects; orthostatic hypotension, arrhythmias; clients recovering from an acute MI should not take drug; blood dyscrasias; extrapyramidal symptoms; gynecomastia; jaundice.
 4. Nursing implications
 - a. May take 2–4 weeks to achieve therapeutic effects. Monitor for suicidal tendencies.
 - b. Monitor CBC for clients on long-term therapy.
 - c. Monitor I&O.
 - d. Drug therapy is discontinued gradually.
 5. Discharge teaching
Take with food to decrease GI distress
Note: review the anticholinergic atropine sulfate for further nursing implications and discharge teaching as imipramine (Tofranil) has anticholinergic adverse effects
- F. Related drugs
1. Amitriptyline (Elavil)
 2. Nortriptyline (Aventyl): more useful in elderly clients due to fewer anticholinergic effects.
 3. Desipramine (Norpramin)
 4. Doxepin (Sinequan)
 5. Amoxapine (Asendin)



Sample Questions

37. Which of the following is included in client teaching concerning imipramine (Tofranil)?
1. Expect to see improvement of depression in 2–3 days.
 2. Stop taking drug if dizziness occurs.
 3. Do not drive or operate machinery.
 4. Take drug on an empty stomach.

38. When should the client expect to see improvement of depression while on imipramine (Tofranil)?
1. 1–2 days.
 2. 1 week.
 3. Several weeks.
 4. Immediately after first dose.



Answers and Rationales

37. 3. Imipramine (Tofranil) can cause drowsiness; the client should avoid driving or operating machinery.
38. 3. It takes several weeks (2–4 weeks) before clients may see improvement of depression.

Antipsychotic Agents (Continued)

- G. Prototype: monoamine oxidase inhibitors (MAO inhibitors) (phenelzine [Nardil])
1. Action. Inhibits MAO, which increases neurotransmitter levels (dopamine, norepinephrine, serotonin).
 2. Use. Neurotic and atypical depression.
 3. Adverse effects. Orthostatic hypotension; dry mouth, blurred vision, constipation; hypertensive crisis; liver dysfunction; leukopenia.
 4. Nursing implications
 - a. Monitor blood pressure while standing, sitting, and supine.
 - b. Interacts with many drugs.
 - c. Monitor I&O.
 - d. Therapeutic effectiveness takes 2–4 weeks.
 - e. Monitor liver function studies, glucose, and CBC.
 5. Discharge teaching
 - a. Avoid foods or beverages containing tyramine or tryptophan including: caffeine beverages, soy sauce, red wine, beer, cheese, yogurt, sour cream, raisins, bananas, avocado, herring, beef and chicken liver, Italian green beans.
 - b. Change position slowly.
- H. Related drugs
1. Tranylcypromine (Parnate): contraindicated in clients over age 60.
 2. Isocarboxazid (Marplan)



Sample Questions

39. Which foods/beverages should be avoided while taking phenelzine (Nardil)?
1. Cheese.
 2. Apples.
 3. Pasta.
 4. Cereal.

3. Citalopram (Celexa)
 4. Fluvoxamine (Luvox)
 5. Escitalopram (Lexapro)
- K. Miscellaneous antidepressants
1. Bupropion (Wellbutrin)
 2. Venlafaxine (Effexor)
 3. Nefazodone (Serzone)
 4. Trazodone (Desyrel)
 5. Clozapine (Clozaril)
 6. Olanzapine (Zyprexa)
 7. Risperidone (Risperdal)



Answers and Rationales

39. 1. Foods such as cheese that contain tyramine or tryptophan should be avoided while taking MAO inhibitors to prevent hypertensive crisis.

Antipsychotic Agents (Continued)

- I. Prototype: selective serotonin reuptake inhibitors (fluoxetine [Prozac])
1. Action. Blocks serotonin reuptake and increases transmission at serotonergic synapses.
 2. Use. Major depression; obsessive-compulsive disorder.
 3. Adverse effects. CNS stimulation, sexual dysfunction, nausea, headache, anorexia, weight loss, skin rash.
 4. Nursing implications
 - a. Can take up to 4 weeks to achieve therapeutic effects.
 - b. Interacts with warfarin (Coumadin).
 - c. Cannot be combined with monoamine oxidase inhibitors.
 5. Discharge teaching
 - a. Take in the morning.
 - b. Report skin rash immediately.
- J. Related drugs
1. Paroxetine (Paxil)
 2. Sertraline (Zoloft)



Sample Questions

40. Which statement indicates a need for more teaching by the nurse concerning fluoxetine (Prozac) therapy?
1. "I will take this medication in the morning."
 2. "I will use calamine lotion if I get a skin rash."
 3. "It will take a month before I feel better."
 4. "I will check with my physician before I take any other medications."



Answers and Rationales

40. 2. A skin rash resulting from use of fluoxetine (Prozac) indicates an allergic reaction and should be reported to the physician immediately.



Autonomic Nervous System Drugs

ADRENERGIC DRUGS

A. Prototype

Adrenergic drugs are divided into two groups, direct-acting and mixed-acting. The direct-acting contain most of the adrenergic drugs.

Direct-Acting Adrenergics

Nonselective (Alpha and Beta) Agonists

Prototype: Epinephrine (Adrenalin Chloride)

1. Action. Epinephrine (Adrenalin Chloride) has the same actions stimulated as the sympathetic nervous system. It increases the force of myocardial contraction; increases systolic blood pressure, cardiac rate and output; relaxes bronchial smooth muscle; inhibits histamine release; increases tidal volume and vital capacity; prevents insulin release and raises blood sugar; prevents uterine contractions and relaxes uterine smooth muscle; lowers intraocular pressure and decreases formation of aqueous humor; constricts arterioles in kidneys, mucous membranes, and skin; and dilates blood vessels in skeletal muscle.
2. Use. Treatment of anaphylaxis and bronchospasm, cardiac resuscitation, control or prevention of low blood pressure during spinal anesthesia, lengthening effects of local anesthesia, promotion of mydriasis, treatment of acute hypotension.
3. Adverse Effects. Systemic: anxiety, headache, fear, arrhythmias, hypertension, cerebral/subarachnoid hemorrhage, hemiplegia, pulmonary edema, insomnia, anginal pain in clients with angina pectoris, tremors, vertigo, sweating, nausea, vomiting, agitation, disorientation, paranoid delusions; prolonged use at high doses causes increased serum lactic acid levels, metabolic acidosis, and increased blood glucose. Local injection: necrosis at sites when injections are repeated. Nasal solution: stinging and burning locally, rebound congestion. Ophthalmic solutions: stinging on initial use, eye pain, headache, browache, blurred vision, photophobia, problems with night vision, pigment deposits in conjunctiva, cornea, and eyelids with prolonged use.

4. Nursing Implications

- a. Use great caution in preparing and calculating doses as this is a potent drug.
 - b. Tolerance occurs with extended use.
 - c. Solutions should be clear and colorless (except suspension for injection). Protect solutions from light, heat, and freezing.
 - d. Suspension for injection must be shaken well.
 - e. Rotate SC sites and monitor for necroses.
 - f. Have a fast-acting alpha-adrenergic blocker such as phentolamine (Regitine) or vasodilator such as nitrite available for excessive hypertensive reaction.
 - g. Have an alpha-adrenergic blocker available for pulmonary edema.
 - h. Have a beta-adrenergic blocker available for cardiac arrhythmias.
 - i. Monitor VS.
- ### 5. Discharge Teaching
- a. For inhalation products: do not exceed recommended dosage; take drug during second half of inspiration, take second inhalation 3–5 minutes after first dose.
 - b. For nasal solutions: do not use for more than 3–5 days; burning and stinging may occur initially but are transient.
 - c. For ophthalmic solution: slight stinging may occur initially but is usually transient; headache and browache are also transient.
 - d. Do not take any OTC medications without physician approval.

Prototype: norepinephrine bitartrate (Levophed)

1. Action. Norepinephrine bitartrate (Levophed) is an alpha and beta-1 receptor agonist and has no effect on beta-2 receptors. Its biggest action is seen on the cardiovascular system, where the following happens: an increase in total peripheral resistance (vasopressor response); and increased force, rate, and impulse conduction of the heart, which is usually overridden by activation of baroreceptors, thus causing bradycardia. Other actions are mydriasis and elevated blood glucose and insulin.
2. Use. Revives blood pressure in acute hypotensive states (sympathectomy, spinal anesthesia, poliomyelitis, septicemia, blood transfusion, drug reactions); adjunct in treatment of cardiac arrest.
3. Adverse effects. Bradycardia; cardiac arrhythmias; headache.

4. Nursing implications
 - a. Do not mix drug in 100% saline solutions (NS) as oxidation will occur. Mix in 5% dextrose solution or 5% dextrose in saline solution.
 - b. Give into large vein to prevent extravasation.
 - c. Do not infuse in femoral vein in elderly clients or those with occlusive vascular disease.
 - d. Check blood pressure every 2 minutes after start of infusion until desired blood pressure is attained; then check blood pressure every 5 minutes if infusion continued.
 - e. Monitor IV site for extravasation.
 - f. Have phentolamine (Regitine) available in case of extravasation. 5–10 mg of phentolamine (Regitine) in 10–15 mL of saline should be infiltrated into area.
 - g. Drug solution should be clear and colorless.
- c. Phentolamine (Regitine) should be available for hypertensive crisis seen in IV administration.
- d. Levodopa (L-Dopa) is used to decrease excess mydriatic effect.
- e. If systemic adverse effects are seen from nasal and eye use, stop drug and notify physician.
- f. Apply pressure to lacrimal sac of eye during and for 1–2 minutes after administration of eye drops.
- g. Incompatible with butacaine, oxidizing agents, ferric salts, metals, and alkalies.
- h. Wash hands after handling drug as blurred vision and unequal pupil size can result if drug-contaminated finger rubs eye.

5. Discharge teaching
 - a. Client should not change dose in any way.
 - b. If drug has been taken for 5 days without relief, notify physician.
 - c. Clear nasal passages before using nasal preparations.
 - d. Wear sunglasses after eye administration if eyes sensitive to light.
 - e. Call physician if eye sensitivity lasts more than 12 hours after drug has been given.
 - f. Ophthalmic solutions can stain contact lenses.
 - g. Tips and droppers of nasal solutions should be cleaned with hot water after each use.
 - h. Do not touch droppers of eye solutions.
6. Related drugs
 - a. Methoxamine (Vasoxyl): used for treating acute hypotension seen during surgery. It is given IV for immediate effect or IM for longer lasting effects.
 - b. Agents found in OTC cough, cold, and allergy remedies and in eye decongestant products include naphazoline, oxymetazoline, tetrahydrozoline, xylometazoline.

Selective Alpha Agonists

Prototype: phenylephrine (Neo-Synephrine)

1. Action. Phenylephrine (Neo-Synephrine) produces vasoconstriction and increased blood pressure. Topical application produces vasoconstriction of mucous membranes. Application to eye causes mydriasis and vasoconstriction and promotes flow of aqueous humor.
2. Use. Stabilizes blood pressure during anesthesia; vascular failure in shock; subdues paroxysmal supraventricular tachycardia; rhinitis of allergy and common cold; sinusitis; wide-angle glaucoma; ophthalmoscopic examination or surgery; uveitis.
3. Adverse effects. Eye tearing and stinging, headache, browache, blurred vision, increased sensitivity to light; nasal rebound congestion; nasal burning, stinging, dryness, and sneezing; palpitations, tachycardia, bradycardia (overdose); hypertension; trembling, sweating, feeling of fullness in the head; sleeplessness, dizziness, light-headedness, tingling in extremities.
4. Nursing implications
 - a. For IV infusion, check blood pressure, pulse, and central venous pressure every 2–5 minutes.
 - b. IV overdose can cause ventricular arrhythmias.

Nonselective Beta (Beta-1 and Beta-2) Agonists

Prototype: isoproterenol (Isuprel)

1. Action. Isoproterenol (Isuprel) has cardiovascular actions of vasodilation, which decreases diastolic blood pressure and peripheral resistance, and actions of increased cardiac output. Other actions are bronchodilation; raising levels of blood glucose, insulin, and free fatty acids; and causing release of renin from the kidney.

2. Use. Acute heart failure; management of intraoperative bronchospasm; additive treatment in cardiac arrest, AV heart block, Stokes-Adams syndrome; treatment of chronic bronchoconstriction; management of syncope; treatment of bronchospasm in COPD and asthma.
3. Adverse effects. Restlessness, anxiety, CNS stimulation, hyperkinesia, insomnia, tremors, irritability, vertigo, headache; arrhythmias, tachycardia, angina, blood pressure changes; pulmonary edema, respiratory difficulties; flushing, pallor, sweating; nausea, vomiting, heartburn.
4. Nursing implications
 - a. Tolerance can develop with prolonged use.
 - b. A beta-adrenergic blocker should be available if arrhythmias occur.
 - c. Client needs continuous ECG monitoring during IV administration.
 - d. IV infusion must be given via infusion pump with guidelines from the physician.
5. Discharge teaching
 - a. Client should not alter dosage.
 - b. Inhalation form should be taken during second half of inspiration; second inhalation should be taken 3–5 minutes later.
 - c. Client should not chew or swallow sublingual tablets.
 - d. Avoid OTC drugs unless approved by physician.
6. Related drugs
 - a. Isoxsuprine hydrochloride (Vasodilan) is used in cerebrovascular insufficiency and peripheral vascular disease. It is given to adults IM or PO.
 - b. Ritodrine (Yutopar) is used for management of preterm labor.
4. Nursing implications
 - a. Must be administered cautiously as even small errors can produce deleterious effects.
 - b. Always dilute drug if not prediluted.
 - c. Dose must be decreased by 1/10 in clients who have been receiving MAO inhibitors.
 - d. Do not mix with other drugs.
 - e. Protect drug from light.
 - f. Infuse into large vein.
 - g. Monitor for extravasation and have phentolamine (Regitine) available if this occurs.
 - h. Closely check blood pressure, urine output, and cardiac output.
5. Related drugs: Dobutamine (Dobutrex) is used in treatment of acute heart failure. It is given to adults via IV infusion.

Selective Beta-2 Agonists

All drugs in this group are similar so there will be no prototype. Two representative examples will be mentioned.

1. Metaproterenol sulfate (Alupent) is used to treat bronchial asthma and bronchospasm that accompanies emphysema and bronchitis. It is given orally and via metered-dose inhaler or inhalant solution to adults. Children 60 pounds or less receive syrup orally and children more than 12 years can receive inhalation therapy.
 - a. Adverse effects. CNS stimulation; cardiac arrhythmias, tachycardia, palpitations, changes in blood pressure; respiratory difficulties; sweating, pallor, flushing; nausea, vomiting, heartburn.
 - b. Nursing implications
 1. Tolerance can develop with prolonged use.
 2. Have a beta-adrenergic blocker available in case of arrhythmia.
 3. Give inhalant during second half of inspiration.
 4. Teach clients to not alter dose and not to take any OTC drugs without physician approval.
2. Terbutaline sulfate (Brethine): refer to data on metaproterenol sulfate (Alupent). It is given PO, SC, and via inhaler to adults and children more than 12 years.

Mixed-Acting Adrenergics

Prototype: ephedrine (various products)

1. Action. Ephedrine's actions are similar to the peripheral autonomic effects of

Selective Beta-1 Agonists

Prototype: dopamine hydrochloride (Intropin)

1. Action. Dopamine hydrochloride (Intropin) increases cardiac output and systolic blood pressure. In low doses it reduces renal vascular resistance, which increases glomerular filtration rate and urinary output.
2. Use. Corrects hemodynamic imbalance in shock caused by myocardial infarction, trauma, septicemia, congestive heart failure, and open heart surgery.
3. Adverse effects. Tachycardia, palpitations, hypotension, vasoconstriction; nausea, vomiting; dyspnea, headache; piloerection.

norepinephrine. The main effects of the drug are reduced nasal congestion, increased blood pressure, bronchodilation, cardiac stimulation, and stimulation of the CNS.

2. Use. Relief of allergies and mild asthma; therapy in shock and hypotension.
3. Adverse effects. Systemic with increased doses: headache, insomnia, nervousness; palpitations, tachycardia, arrhythmias, urinary retention; nausea, vomiting, anorexia; sweating, thirst. Topical use: burning, stinging, sneezing, dry nasal mucosa, rebound congestion. Overdose: confusion, delirium, convulsions, pyrexia, coma; hypertension; respiratory depression; paranoid psychosis; auditory and visual hallucinations.
4. Nursing implications
 - a. Parenteral solution must be clear and should be protected from light.
 - b. Monitor urine output.
 - c. Clients with cardiovascular problems need monitoring of cardiac response and blood pressure.
 - d. Client receiving IV ephedrine needs close monitoring of vital signs.
5. Discharge teaching
 - a. Client should not use nasal decongestant longer than 5 days.
 - b. Anxiety reaction can occur with extended use of systemic ephedrine.
 - c. Ephedrine is commonly abused. Client needs to be aware of adverse effects and proper use.
 - d. Client should not take any OTC preparations without consulting physician.
 - e. Insomnia is a common effect and doses should be spaced accordingly.
6. Related drugs: Metaraminol (Aramine); used for acute hypotension and can be given preoperatively to prevent hypotension; given SC, IM, or IV; given to adults and children.

42. Which nursing action is contraindicated while receiving IV dopamine hydrochloride (Intropin)?
 1. The nurse will monitor vital signs frequently.
 2. The nurse will check the IV infusion site frequently for extravasation.
 3. The nurse will infuse the drug via macrodrip tubing and will adjust the rate manually.
 4. The nurse will check client extremities for temperature and color.
43. A client experiences extravasation at the insertion site of dopamine hydrochloride (Intropin) IV. The infusion is stopped. What should be done next?
 1. Warm compresses should be applied to the IV site.
 2. An ice pack should be applied to the IV site.
 3. The extremity with the IV site should be elevated on two pillows.
 4. The IV site should be infiltrated with phentolamine (Regitine).
44. When high doses of dopamine hydrochloride (Intropin) are given IV for treatment of shock, what effect would the nurse be looking for?
 1. Increased blood pressure.
 2. Decreased heart rate.
 3. Increased respirations.
 4. Elevated body temperature.
45. Which drug produces effects that closely mimic high doses of dopamine hydrochloride (Intropin)?
 1. Atropine sulfate.
 2. Ephedrine.
 3. Isoproterenol (Isuprel).
 4. Norepinephrine (Levophed).

Sample Questions

41. What can the nurse expect if a low dose level of dopamine hydrochloride (Intropin) is given intravenously?
 1. A decrease in glomerular filtration rate.
 2. A decrease in the force of myocardial contractions.
 3. An increase in urine output.
 4. An increase in tactile sensation.

Answers and Rationales

41. 3. Dopamine hydrochloride (Intropin) at low doses causes dilation of renal and mesenteric arteries, which in turn causes increased urine output.
42. 3. Dopamine hydrochloride (Intropin) needs to be infused via a minib drip tubing and attached to an infusion pump for accurate administration.
43. 4. If extravasation occurs when dopamine hydrochloride (Intropin) is administered, the IV site should be infiltrated with phentolamine (Regitine) immediately after discontinuing the infusion.

44. 1. High doses of dopamine hydrochloride (Intropin) stimulate alpha-adrenergic activity, which causes increased blood pressure.
45. 4. Dopamine hydrochloride (Intropin) given in high doses has effects that closely mimic norepinephrine (Levophed).

5. Nursing implications
 - a. Take drug at beginning of migraine attack.
 - b. Avoid prolonged use.
 - c. Give antiemetics for nausea and vomiting.
 - d. Monitor extremities.
 - e. Pregnant client should not receive this drug.
 - f. Client should not increase dose of drug without consulting physician.
 - g. Use lowest effective dose.

ADRENERGIC BLOCKING AGENTS

- A. Prototype for alpha-adrenergic blocking agents: phentolamine (Regitine)
 1. Action. Phentolamine (Regitine) blocks alpha-1 receptors, thus causing blood vessel dilation; decreased blood pressure; increased cardiac output; miosis; increased tearing, mucus secretion, gastric acid secretion, and gastrointestinal motility.
 2. Use. Diagnosis of pheochromocytoma; management of hypertensive episodes in pheochromocytoma; treatment of extravasation from norepinephrine (Levophed) or dopamine hydrochloride (Intropin); adjunctive therapy in cardiogenic shock or other situations of decreased cardiac output.
 3. Adverse effects. Hypotension, orthostatic hypotension; MI, cerebrovascular occlusion (these effects can occur with hypotensive states that can occur after parenteral administration); tachycardia, arrhythmias; dizziness, weakness, flushing; nausea, vomiting, diarrhea; nasal stuffiness.
 4. Nursing implications
 - a. For parenteral administration client must be in supine position. Blood pressure and pulse should be checked every 2 minutes until stable.
 - b. Use reconstituted solutions immediately.
 - c. Have client lie down or put head down if feeling dizzy or light-headed.
 - d. Treatment for overdose: keep client lying down with head lowered, supportive measures, IV infusion of levarterenol (norepinephrine).
- B. Related drug: ergotamine tartrate (Ergomar)
 1. Along with adrenergic blocking activity, has a direct stimulatory effect on smooth muscle. It also decreases pulsation in cranial arteries and has emetic and oxytocic effects.
 2. Used for treatment of vascular headaches such as migraines or cluster headaches.
 3. Given to adults via sublingual or inhalation route.
 4. Adverse effects. Nausea, vomiting; numbness, tingling, and muscle pain in extremities; pulselessness in legs; precordial pain; transient tachycardia or bradycardia; ergotism (ergot poisoning); dependency and abuse.

Beta-Adrenergic Blocking Agents

Note: Refer to Beta Blockers in the section on Cardiovascular Drugs.

Timolol maleate (Timoptic) is an optic beta-adrenergic blocker. It decreases intraocular pressure whether glaucoma is present or not. It also decreases aqueous humor formation and increases aqueous humor outflow. It is used to treat glaucoma and hypertension. It is given orally and via eye drops to adult clients.



Sample Questions

46. A client calls the physician's office and states that she has vomited each time she has taken ergotamine tartrate (Ergomar). What is the nurse's best response?
 1. "Vomiting is a common adverse effect. Tell the physician so he can prescribe an antiemetic for you."
 2. "Stop taking the drug immediately. Vomiting is a toxic drug effect."
 3. "You must be allergic to the drug. Notify the physician."
 4. "Vomiting is a transient effect and it will eventually go away."
47. Which group of individuals would be excluded from receiving ergotamine tartrate (Ergomar)?
 1. Clients with diabetes.
 2. Clients with asthma.
 3. Clients suffering from alcoholism.
 4. Pregnant women.
48. Which of the following information would be excluded from the client teaching about ergotamine tartrate (Ergomar)?
 1. Take the drug as soon as you feel a migraine headache coming on.
 2. Have your blood pressure checked routinely when taking this drug.
 3. Increase the dose as needed to help control your migraines.

4. Tell the physician if you have any numbness or tingling in your toes and fingers.



Answers and Rationales

46. 1. Ergotamine tartrate (Ergomar) has emetic effects; vomiting is a common side effect. The client needs an antiemetic to help control this problem.
47. 4. Ergotamine tartrate (Ergomar) has oxytocic effects; it is contraindicated in pregnant women.
48. 3. Ergotamine tartrate (Ergomar) is a drug that is abused by clients by altering dosage amount. Only the physician should change the dose of the drug.

CHOLINERGICS

- A. Prototype: acetylcholine chloride (Miochol)
1. Action. A neurotransmitter that mediates synaptic activity in the nervous system; stimulates the vagus nerve and parasympathetic nervous system (PNS) causing vasodilation and cardiac depression; causes miosis of the eye as it contracts the iris sphincter muscle; contracts and relaxes the urinary bladder, causing micturition. Acetylcholine chloride (Miochol) is identical to synthesized acetylcholine (Ach).
 2. Use. To produce miosis in eye surgery.
 3. Adverse effects. Systemic absorption: hypotension, bradycardia; bronchospasm; flushing, sweating.
 4. Nursing implications
 - a. Reconstitute vial just before use and discard unused portion.
 - b. Shake vial gently to mix drug.
- B. Related drugs: Bethanechol chloride (Urecholine)
1. Used to treat postoperative urinary retention.
 2. See acetylcholine chloride (Miochol); also nausea, vomiting, diarrhea, abdominal cramping, dizziness, faintness; cholinergic crisis can occur with overdose.
 3. Nursing implications
 - a. Monitor VS, breath sounds, and I&O.
 - b. PO drug should be given one hour before meals or two hours after meals.
 - c. Never give IM or IV as drug may cause life-threatening effects.
 - d. Atropine sulfate is antidote.
 4. Discharge teaching
 - a. Encourage client not to drive or operate heavy machinery while taking drug.
 - b. Teach client to change positions slowly.

Note: Carbachol (*Isopto Carbachol*) and pilocarpine (*Almocarpine*) are discussed under Miotics in section on Eye Drugs.

- C. Prototype: acetylcholinesterase inhibitors: Neostigmine (Prostigmin)
1. Action. Neostigmine (Prostigmin) inhibits the neurotransmitter acetylcholine, which produces a cholinergic response, and produces reversible cholinesterase inactivation, which permits a prolonged effect of acetylcholine at cholinergic synapses.
 2. Use. Treatment and diagnosis of myasthenia gravis; prevention of postoperative abdominal distension; treatment and prevention of postoperative bladder distension; postoperative reversal of nondepolarizing muscle relaxants.
 3. Adverse effects. Nausea, vomiting, cramping, diarrhea, increased salivation; muscle tremor and weakness; dyspnea, bronchospasm, increased bronchial secretions, respiratory depression; hypo- or hypertension, arrhythmias, bradycardia; miosis; cholinergic crisis.
 4. Nursing implications
 - a. Keep atropine and emergency resuscitation equipment readily available, especially for parenteral use.
 - b. Monitor vital signs, breath sounds, I&O.
 - c. Report to physician if client does not void within 1 hour after receiving dose.
 5. Discharge teaching
 - a. Encourage client to take drug with food or milk if GI distress occurs.
 - b. Instruct client to keep a record of response to drug.
 - c. Instruct client to monitor and report adverse effects.
 - d. Advise client to wear a medic alert bracelet (for myasthenia gravis).
 - e. Instruct client to cough, breathe deeply, and perform range of motion exercises regularly.
- D. Related drugs
1. Pyridostigmine (Mestinon, Regonol): used to treat myasthenia gravis and postoperative reversal of nondepolarizing skeletal muscle relaxants. Additional adverse effects: rash; thrombophlebitis with IV use.
 2. Edrophonium chloride (Tensilon): used to diagnose myasthenia gravis.
 3. Tacrine (Cognex): used to treat mild to moderate Alzheimer's disease.
 4. Pilocarpine (Akarpine): used in open-angle glaucoma.
 5. Donepezil (Aricept): used in Alzheimer's disease.



Sample Questions

49. The client is prescribed bethanechol chloride (Urecholine). What information about this drug is important for the nurse to know?

1. IM or IV is the preferred route.
 2. Bethanechol chloride (Urecholine) should be given with food.
 3. Breath sounds should be monitored.
 4. Constipation is a frequent adverse effect.
50. Which drug would be given to treat neostigmine (Prostigmin) overdose?
1. Acetylcholine acetate (Miochol).
 2. Atropine sulfate.
 3. Bethanechol (Urecholine).
 4. Lidocaine (Xylocaine).



Answers and Rationales

49. 3. Breath sounds should be monitored to assess for wheezing and bronchospasm.
50. 2. Atropine sulfate, an anticholinergic, is the antidote for neostigmine (Prostigmin).

ANTICHOLINERGICS

- A. Prototype: atropine sulfate
1. Action. Atropine sulfate is a plant alkaloid derived from the atropa belladonna plant that blocks the neurotransmitter acetylcholine and inhibits parasympathetic actions.
 2. Use. To produce mydriasis and cycloplegia for eye examinations; treat uveitis; preoperative medication to reduce secretions and bradycardia; treat sinus bradycardia or asystole; hypermotility of GU tract; adjunct in treating asthmatic bronchospasm; GI disorders, peptic ulcer, GI hypermotility and biliary colic; antidote for overdoses of parasympathomimetic drugs; prevention of adverse effects when reversing neuromuscular blockade postoperatively with acetylcholine inhibitor; antidote to organophosphate pesticides.
 3. Adverse effects. Disorientation, restlessness, hallucinations, headache, dizziness; palpitation, hypertension or hypotension, ventricular tachycardia; blurred vision, photophobia; suppression of sweating; urinary hesitancy and retention, constipation; dry mouth; flushed, dry skin.
 4. Nursing implications
 - a. Do not give to clients with myasthenia gravis, acute glaucoma, prostatic hypertrophy.
 - b. Monitor VS, especially pulse and blood pressure and I&O.

- c. Monitor for constipation and check bowel sounds.
 - d. Monitor geriatric clients for CNS stimulation and heat stroke (infants and small children should also be monitored for heat stroke).
 - e. Smaller doses usually are given to geriatric clients due to adverse effects.
5. Discharge teaching
- a. Take drug 30 minutes before meals.
 - b. Eat foods high in fiber and drink plenty of liquids to overcome constipation.
 - c. Keep dental appointments as decreased salivation makes clients more prone to tooth decay.
 - d. Use good oral hygiene, i.e., rinse mouth, brush teeth, hard candy, saliva substitute, fluids.
 - e. Maintain periodic eye appointments to monitor for increased intraocular pressure.
 - f. Avoid hot baths and showers, sun, and heat to prevent heat stroke.
 - g. Change position gradually.
 - h. Do not drive or operate machinery.
- B. Related drugs. See Table 2-10.

Table 2-10 Anticholinergics

Drug	Use	Comments
Scopolamine	Preanesthetic medication (Transderm-scop) used for prophylaxis of motion sickness Mydriatic and cycloplegic for eye exam Irritable bowel syndrome, diverticulitis Management of postencephalitic parkinsonism	• Place transderm scop patch behind ear the night before trip. Replace patch after three days if more prolonged effects are needed.
Glycopyrrolate (Robinul)	Preanesthetic medication Adjunct in peptic ulcer disease therapy Reverse neuromuscular blockade	• Has fewer CNS effects than atropine. Do not mix with barbiturates or alkaline drugs.



Sample Questions

51. Which of the following effects of atropine sulfate would the nurse expect a client to exhibit?
1. Dry mouth.
 2. Increased bronchial secretions.
 3. Tachycardia.
 4. Miosis.
52. Which statement indicates that the client needs more teaching concerning the use of atropine sulfate?
1. "I will brush my teeth and see my dentist regularly."
 2. "I will eat low-residue foods to prevent diarrhea."
 3. "I will take my medication at least a half hour before meals."
 4. "I will stay in my air conditioned house on hot and humid days."



Answers and Rationales

51. 1. Atropine sulfate causes dry mouth and decreases secretions, which is why it is given as a preanesthetic.
52. 2. Atropine sulfate can cause constipation; high-fiber foods and fluids should be encouraged.

ANTIPARKINSON AGENTS

General Considerations

There are 2 major categories of antiparkinson's agents: (1) anticholinergics and (2) dopaminergic agents

- A. Antiparkinson drugs control rather than cure symptoms of Parkinson's. Antiparkinson agents can cause or worsen other disorders, and clients, especially the elderly, need to be closely monitored for adverse effects. Antiparkinson drugs are initiated and discontinued gradually. Drugs should not be abruptly withdrawn. Antiparkinson agents are contraindicated in clients with glaucoma, prostatic hypertrophy, duodenal ulcers, tachycardia, and biliary obstruction.
- B. Prototype: anticholinergics (trihexyphenidyl HCl [Artane]) This drug is similar to atropine sulfate.
1. Action. Blocks the neurotransmitter acetylcholine at certain cerebral synapses and inhibits parasympathetic responses.

2. Use. Treat Parkinson's disease, prevent or control antipsychotic drug-induced extrapyramidal tract symptoms.
 3. Adverse effects. Note phrase "Red, hot, dry, blind, mad"; dry mouth; constipation; tachycardia, hypotension; dizziness, drowsiness, confusion; decreased bronchial secretions; blurred vision, photophobia, acute glaucoma; urinary retention; suppression of sweating.
 4. Nursing implications
 - a. Drug can be taken before or after meals.
 - b. See atropine sulfate.
 - c. Drug should be gradually withdrawn.
 5. Discharge teaching. See atropine.
- C. Related drugs. See Table 2-11.
- D. Prototype: dopaminergic agents (levodopa [Larodopa])
1. Action. Levodopa (Larodopa) is a metabolic precursor of the catecholamine neurotransmitter dopamine that readily crosses the blood-brain barrier and restores dopamine levels in extrapyramidal centers.
 2. Use. Treat Parkinson's disease (except drug-induced Parkinson's).
 3. Adverse effects. Anorexia, nausea, vomiting; orthostatic hypotension, dizziness, headache; constipation, dry mouth; mydriasis; urinary retention, darkened urine; increase BUN, AST (SGOT), ALT (SGPT), LDH, bilirubin, alkaline phosphatase; decreased WBCs, hemoglobin, and hematocrit, decreased glucose tolerance; blurred vision; muscle twitching, blepharospasm, ataxia, increased hand tremors; disturbed breathing; confusion, anxiety, agitation.
 4. Nursing implications
 - a. Monitor vital signs and client for adverse effects.
 - b. Monitor client for behavior changes.
 - c. Monitor CBC, glucose, and kidney and liver function studies.
 - d. With long-term therapy levodopa (Larodopa) may lose its effectiveness and adjunctive drugs may be used.

Table 2-11 Antiparkinson Agent (Anticholinergic)

Drug	Use	Comments
Benzotropine Mesylate (Cogentin)	Treat Parkinson's disease and as adjunct with trihexyphenidyl HCl (Artane) Prevent or control drug-induced extrapyramidal tract symptoms	• Longer lasting sedative effects and muscle relaxation than trihexyphenidyl HCl (Artane)

5. Discharge teaching
 - a. Restrict foods high in Vitamin B₆ (pyridoxine) (i.e., liver, green vegetables, fortified cereals, whole grain cereals). Vitamin B₆ reverses therapeutic effects of levodopa (Larodopa).
 - b. Change positions gradually.
 - c. Do not abruptly stop taking drug as sudden withdrawal can lead to parkinsonian crisis.

- d. Do not take OTC medications without consulting physician.
 - e. Take drug between meals.
6. Related drugs. See Table 2-12.

Table 2-12 Antiparkinson Agents (Dopaminergic Agents)

Drug	Use	Comments
Carbidopa/ Levodopa (Senemet)	Treatment of Parkinson's disease	<ul style="list-style-type: none"> • Carbidopa prevents metabolism of levodopa and allows more levodopa for transport to brain. • Adverse CNS effects may occur sooner. • Levodopa (Larodopa) should be discontinued 8 hours before starting Senemet.
Bromocriptine (Parlodel)	Parkinson's Treatment of amenorrhea, galactorrhea Female infertility Suppression of postpartum lactation Acromegaly	<ul style="list-style-type: none"> • Treat Parkinson's. • Often given with levodopa (Larodopa) or carbidopa/levodopa (Senemet). • Give with food or milk. • Contraindicated in clients with hypersensitivity to ergot alkaloids. • Oral contraceptives antagonize effects of bromocriptine (Parlodel). Advise client to use another method of contraception. • This drug causes increased fertility. • Hypotension is a frequently seen adverse effect.
Ropinirole (Requip)	Idiopathic Parkinson's disease	<ul style="list-style-type: none"> • Directly stimulates dopamine receptors. • Given alone in early stages of Parkinson's disease and with levodopa (Larodopa) in later stages. • Give with food to decrease nausea. • Must be discontinued gradually. • Assess for hypotension as dose is increased. • Assess liver and renal function during treatment.



Sample Questions

53. Which adverse effect would be absent with trihexyphenidyl HCl (Artane) therapy?
 1. Dizziness.
 2. Dry mouth.
 3. Diarrhea.
 4. Suppression of sweating.
54. Which statement by the client indicates understanding of proper use of levodopa (Larodopa)?
 1. "If my symptoms get worse I will stop taking this drug."
 2. "I will not eat liver or boxed cereals."
 3. "If I have a cold I will take aspirin or a cold remedy."
 4. "I will eat foods low in residue to prevent diarrhea."
55. Which instruction should the nurse give to clients taking bromocriptine (Parlodel)?
 1. "Take 1 hour before meals."
 2. "Do not use birth control pills as contraceptives."
 3. "This drug causes infertility and use of contraceptives will not be necessary."
 4. "Adverse effects will be reduced if taken during the day."



Answers and Rationales

53. 3. Trihexylphenidyl HCl (Artane) is an anticholinergic that can cause constipation, not diarrhea.
54. 2. Vitamin B₆ (pyridoxine) reverses the therapeutic effects of levodopa (Larodopa); clients should restrict their intake of foods high in vitamin B₆ such as whole-grain cereals, fortified cereals, liver, green vegetables.
55. 2. Oral contraceptives antagonize the effects of bromocriptine (Parlodel). Another method of birth control should be used.



Drugs Affecting the Endocrine System

Refer also to Table 4-24, Hormone Functions.

ANTIDIABETIC AGENTS

A. Prototype: insulin

1. Action. Hormone that increases glucose transport across cell membranes; transforms glycogen into glucose, prevents breakdown of fats to fatty acids, and inhibits protein breakdown.
2. Use. Clients with Type 1 diabetes; Clients with Type 2 diabetes not controlled with oral hypoglycemic agents, diet, and exercise; Clients with Type 2 diabetes undergoing stressful situations: infection or surgery; pregnant women with diabetes emergency management of diabetic coma.
3. Adverse effects. Allergic reaction: local or systemic; hypoglycemia; ketoacidosis.
4. Nursing implications
 - a. There is a difference between insulin injection and insulin injection concentrated, for which 500 units = 1 mL.
 - b. Human insulins should only be mixed with each other.
 - c. IV insulin can be absorbed by the container or tubing.
 - d. Stable at room temperature for 1 month.
 - e. Do not inject cold insulin, causes lipodystrophy.
 - f. Drug solution should not be used if discolored or contains precipitate. Do not shake vial. Gently roll (all except regular insulin) vial between palms before drawing up medicine.
 - g. Check expiration date.
 - h. When mixing two insulins, rapid-acting insulin should be drawn up first.
 - i. Syringe must coordinate with strength of insulin.
 - j. Injection sites must be rotated.
 - k. Treat severe hypoglycemic reaction with glucagon or 10–50% IV glucose.
 - l. Treat ketoacidosis with IV insulin and IV fluids.
 - m. Diet is prescribed by physician.
 - n. Monitor blood glucose levels.
 - o. Fixed-combination insulins such as “70/30 insulin” are available. Contains 70% NPH and 30% regular insulin. “50/50 insulin” is also available and contains 50% NPH and 50% regular insulin.

- p. Insulin analog: insulin lispro (Humalog) is a synthetic insulin with a faster onset and shorter duration of action than human insulin.
- q. Injections should be given immediately after mixing two insulins.

5. Discharge teaching

- a. Available without a prescription (except insulin injection, concentrated). Prescription is needed for needles and syringes (depending on state law).
 - b. Change of insulin brand, type, etc., is done by physician.
 - c. In initial period of dosage regulation client may have visual problems. Should not get lens changes until vision is balanced.
 - d. Remove prefilled syringes from refrigerator 1 hour before administration.
 - e. Inject at a 90° angle if you can pinch an inch, otherwise inject at a 45° angle.
 - f. Report symptoms of reactions at injection site.
 - g. Know symptoms of hypoglycemic reaction and have some type of fast-acting carbohydrate available at all times.
 - h. If ill, continue taking insulin and drink freely noncaloric liquids. Notify physician if diet cannot be followed.
 - i. Monitor blood glucose at home and instruct on use.
 - j. Smoking decreases insulin absorption.
 - k. When traveling, needs to have necessary supplies.
 - l. Carry a medical identification card.
- B. Refer to Table 4-25, Characteristics of Insulin Preparations, Unit 4.



Sample Questions

56. The nurse is teaching the client about insulin injections. Which statement is correct?
1. Insulin needs to be shaken well before being drawn up into the syringe.
 2. Long-acting insulins are clear in color.
 3. When putting regular and NPH insulin in the same syringe, draw regular insulin up first.
 4. NPH is compatible with regular and lente insulin.
57. What information will the nurse instruct the client about minimizing local skin reactions to insulin?

1. Injecting it slowly.
 2. Always refrigerating it.
 3. Giving it in divided doses.
 4. Bringing it to room temperature before administering.
58. Which statement by the client indicates a need for further teaching by the nurse?
1. "I will inject my insulin at a 90° angle."
 2. "I will take more insulin when I go to my exercise class."
 3. "I will always have some kind of sugar with me in case I have a hypoglycemic reaction."
 4. "I will carefully draw up my doses of insulin."
- e. Monitor and teach symptoms of hypoglycemic reactions and how to treat.
 - f. Monitor blood and urine glucose levels.
5. Discharge teaching
- a. Reinforce that drug is not "oral" insulin and will control diabetes.
 - b. Use form of birth control other than oral contraceptives.
 - c. Alcohol can trigger a hypoglycemic reaction.
 - d. Cover body in sunshine. Use sunscreen.
 - e. Weigh weekly and report progressive gain.
 - f. Carry medical identification.
- B. Refer to Table 4-26, Oral Hypoglycemic Agents, Unit 4.

Answers and Rationales

56. 3. Regular insulin should be drawn up before NPH insulin when putting the two together in one syringe.
57. 4. Insulin should be at room temperature before injecting to decrease occurrence of lipodystrophy.
58. 2. Exercise increases glucose use in the body, so a decreased dose of insulin may be needed.

Oral Hypoglycemic Agents

- A. Prototype: tolbutamide (Orinase)
1. Action. Lowers blood glucose concentrations by stimulating secretion of endogenous insulin from beta cells in the pancreas. Increases peripheral sensitivity to insulin. From the class of sulfonylureas.
 2. Use. Type 2 diabetes: not controlled by diet and exercise, used with insulin in client with Type 2 diabetes when neither insulin nor oral hypoglycemic agents work well alone.
 3. Adverse effects. Hypoglycemia; increased chance of cardiovascular disease; anorexia, nausea, vomiting, diarrhea; hemolytic anemia; allergic skin rashes; photosensitivity; inappropriate ADH secretion.
 4. Nursing implications
 - a. Tablet can be crushed.
 - b. Monitor closely during initial therapy.
 - c. If client stabilized on tolbutamide (Orinase) is exposed to stress (infection, surgery), the oral agent may be discontinued and replaced by insulin.
 - d. Can transfer from one sulfonylurea to another easily.
59. The client tells the nurse that his brother has Type 1 diabetes and he takes insulin. The nurse is asked why his brother cannot take an oral antidiabetic agent. The nurse explains that oral antidiabetic agent. What explanation will the nurse give regarding oral antidiabetic agents in Type 1 diabetes?
1. He has little or no endogenous insulin that can be released.
 2. He is allergic to oral antidiabetic agents.
 3. He would need so much of an oral antidiabetic agent that it would be financially prohibitive for him to take one.
 4. He would have more episodes of hypoglycemia with oral antidiabetic agents.
60. Tolbutamide (Orinase) should not be taken if a person is allergic to what substance?
1. Penicillin.
 2. Insulin.
 3. Sulfa.
 4. Caffeine.
61. The client will need more teaching about tolbutamide (Orinase) if he makes which of the following statements?
1. "I will get a medic alert bracelet that says I'm a diabetic taking tolbutamide (Orinase)."
 2. "I'm glad I can still have wine with my meals."
 3. "If I go outside, I'll stay out of the sun or use sunscreen."
 4. "I know that tolbutamide (Orinase) will help control my diabetic condition."



Sample Questions



Answers and Rationales

59. 1. Oral antidiabetic agents can only work when the client has endogenous insulin, which is not the case in Type 1 diabetes.
60. 3. Clients who are allergic to sulfa cannot take tolbutamide (Orinase), which is a sulfonylurea.
61. 2. Alcohol combined with an oral hypoglycemic agent can trigger a hypoglycemic reaction.

PITUITARY HORMONES

- A. Prototype: hormone corticotropin (ACTH) (cosyntropin [Cortrosyn])
1. Action. Synthetic corticotropin that stimulates corticosteroid release from functional adrenal cortex.
 2. Use. As a diagnostic test to diagnose adrenal insufficiency.
 3. Adverse effects. (see Corticosteroids) Cushing's syndrome if given over a period of time, hypersensitivity reactions.
 4. Nursing implications. (see Corticosteroids) Administer deep IM.
- B. Prototype: ADH (antidiuretic hormone) (vasopressin [Pitressin]).
1. Action. Hormone released by posterior pituitary gland that regulates water metabolism and prevents dehydration. Has vasoconstrictor effect that elevates blood pressure. In diabetes insipidus a deficiency in ADH is characterized by polyuria and polydipsia. Vasopressin (Pitressin) acts as a replacement for ADH.
 2. Use. Replacement therapy for diabetes insipidus.
 3. Adverse effects. Hypersensitivity, anaphylaxis; water intoxication, hyponatremia; nausea, diarrhea, cramping; hypertension; nasal irritation, headache.
 4. Nursing implications
 - a. Monitor BP, weight, and I&O.
 - b. Vasopressin is available SC, IM, IV, and intra-arterially.
 5. Discharge teaching
 - a. Keep record of I&O, weight.
 - b. If URI and use drug intranasally, absorption may be affected.
 - c. Report sudden changes in output.
 - d. Drink water with dose to reduce GI distress.
- C. Related Drugs

1. Desmopressin (DDAVP)
 - a. Can be given PO, SC, IV, or intranasally; monitor for extravasation.
 - b. Keep refrigerated.
2. Lypressin spray (Diapid): given intranasally.



Sample Questions

62. Which of the following is the desired response of vasopressin (Pitressin)?
1. Lower urine specific gravity.
 2. Lower urine output.
 3. Treat hypotension.
 4. Control polyphagia.
63. A client complains of GI distress following administration of vasopressin (Pitressin). What instructions should the nurse provide to the client?
1. Eat crackers after taking the dose.
 2. Take a warm bath to reduce abdominal cramping.
 3. Lie down for 30 minutes following administration.
 4. Drink a glass of water with each dose.



Answers and Rationales

62. 2. The goal of vasopressin (Pitressin) is to lower urine output; replacement for the ADH hormone.
63. 4. Drinking a glass of water with each dose will decrease GI distress.

PITUITARY HORMONES (CONTINUED)

- D. Prototype: somatotropin (growth hormone) (somatotropin [Humatrope])
1. Action. Somatotropin stimulates growth of skin, connective tissue, and long bones.
 2. Use. Replacement therapy in children with growth retardation caused by lack of somatotropin.
 3. Adverse effects. Hyperglycemia; pain at injection site; myalgia; headache; hypercalciuria; allergic reactions.
 4. Nursing implications
 - a. Record height.
 - b. Monitor blood glucose.
 - c. Rotate IM sites. Do not give SC.
 - d. Store in refrigerator.
 - e. Discontinue if epiphyses have fused.
 5. Discharge teaching. Annual bone age assessment test.

CORTICOSTEROIDS

General Information

- A. The adrenal cortex secretes three natural steroids: glucocorticoids, mineralcorticoids, and adrenal androgens and estrogens.
1. Glucocorticoids (Cortisol)
 - a. Have anti-inflammatory effects.
 - b. Regulate carbohydrate, protein, and fat metabolism.
 2. Mineralcorticoids (Aldosterone, Desoxycorticosterone)
Regulate water and electrolyte metabolism.
 3. Adrenal androgens and estrogens
 - a. Supplement sex hormones from gonads.
 - b. Corticosteroids suppress immune response and affect all body systems.
- B. Prototype: hydrocortisone (Cortisol)
1. Action. Glucocorticoid, mineralcorticoid, and immunosuppressive actions.
 2. Use. Replacement therapy for adrenocorticoid insufficiency; anti-inflammatory for many allergic, inflammatory, or immunoreactive disorders.
 3. Adverse effects. Increased susceptibility to infection; hypokalemia, hypocalcemia; sodium and fluid retention; increased appetite, nausea, peptic ulcer; headache, hypertension, congestive heart failure; osteoporosis; acne, impaired wound healing, hirsutism, skin thinning; ecchymosis, petechiae; hyperglycemia, impaired glucose metabolism, growth retardation, menstrual disorders; glaucoma, cataract formation; mental disturbances, insomnia; thrombophlebitis; masks symptoms of infection.
 4. Nursing implications
 - a. Observe for mental changes.
 - b. Monitor BP, weight, I&O, blood glucose, and serum potassium.
 - c. IM use: inject deep IM. Do not give SC.
 - d. Corticosteroid doses are not interchangeable.
 - e. Corticosteroids are not abruptly withdrawn. Doses are tapered to allow the adrenal gland to function independently.
 5. Discharge teaching
 - a. Take drug before 9 A.M. (This causes less suppression on the adrenal cortex.)
 - b. Take with food or milk to decrease GI effects.
 - c. Never abruptly stop taking. This could precipitate acute adrenal crisis.
 - d. Eat foods high in potassium.
 - e. Avoid individuals with infections.
 - f. Restrict sodium, alcohol, and caffeine intake.

- g. Carry Medic Alert card.
 - h. Follow directions for topical use. Do not use an occlusive dressing, and apply ointment sparingly.
 - i. Rinse mouth after using inhaled steroids.
- C. Related drugs
1. Dexamethasone (Decadron)
 - a. Given IV to treat cerebral edema or allergic symptoms.
 - b. Betamethasone (Celestone)
 - c. Dexamethasone and betamethasone are 10–30 times more potent than hydrocortisone.
 - d. Both drugs can be inhaled to treat asthma.
 2. Methylprednisolone (Solu-Medrol) (has little mineralcorticoid action)
 - a. Prednisone (Deltasone)
 - b. Prednisolone (Delta-Cortef)
Note: All of these drugs are 4–5 times as potent as hydrocortisone. Prednisone and prednisolone have half the mineralcorticoid action of hydrocortisone.
 3. Fludrocortisone (Florinef)
 - a. An oral synthetic mineralcorticosteroid.
 - b. Used to treat Addison's disease.



Sample Questions

64. Which statement should be included in teaching concerning hydrocortisone (Cortisol) therapy?
1. Take aspirin to treat fever.
 2. Take hydrocortisone (Cortisol) before meals.
 3. Restrict caffeine and alcohol intake.
 4. Restrict potassium intake.
65. What occurrence is prevented by gradually discontinuing hydrocortisone (Cortisol)?
1. Anaphylaxis.
 2. Diabetic coma.
 3. Adrenal insufficiency.
 4. Cardiovascular collapse.



Answers and Rationales

64. 3. Hydrocortisone (Cortisol) can cause GI distress and even lead to a peptic ulcer with long-term use. Caffeine and alcohol can further increase GI distress and should be restricted.

65. 3. Adrenal insufficiency can occur with abrupt removal of corticosteroids. Corticosteroids are gradually discontinued so that the adrenal glands can begin to secrete corticosteroids independently.

THYROID HORMONES

A. Prototype: levothyroxine (Synthroid)

1. Other various agents used to treat hypothyroid conditions include desiccated thyroid; thyroglobulin (Prolid); liotrix (Thyrolar); liothyronine sodium (Cytomel).
2. Use. Replacement or substitution of diminished or absent thyroid function due to thyroid disease or thyroidectomy.
3. Adverse effects. Headache, nervousness, insomnia, irritability; palpitations, increased blood pressure, tachycardia, dysrhythmias, angina; weight loss, nausea, vomiting; menstrual irregularities; allergic skin reaction; heat intolerance.
4. Nursing implications
 - a. Baseline weight and thyroid studies.
 - b. Avoid aspirin use.
 - c. Protect from light.
 - d. Check pulse before taking.
5. Discharge teaching
 - a. Do not alter dosage.
 - b. Carry Medic Alert card.

2. Use. Management of hyperthyroidism.
3. Adverse effects. Hypothyroidism; agranulocytosis, thrombocytopenia, bleeding; nausea, vomiting, loss of taste; rash, urticaria, skin pigmentation; jaundice, hepatitis; nephritis.
4. Nursing implications
 - a. Take same time daily with respect to meals. Food can change absorption rate.
 - b. Drug response occurs 2–3 weeks after starting drug.
 - c. Therapy may last 6 months to several years with remission in 25% of clients.
 - d. Can be given during pregnancy. Stopped 2–3 weeks before delivery.
 - e. Do not nurse baby.
 - f. Check pulse daily.
5. Discharge teaching
 - a. Report signs of agranulocytosis (fever, chills, sore throat).
 - b. Report signs of bleeding promptly.
 - c. Ask physician about use of iodized salt and seafood in diet.

B. Related drugs

1. Methimazole (Tapazole): similar to propylthiouracil (PTU) except it is 10 times more potent. Given once daily due to long duration of action. Risk of hepatotoxicity is less.
2. Iodines: cause dose-related effects on thyroid function. Low doses necessary for thyroid function. High amounts inhibit thyroid function. Used to decrease size and vascularity of the thyroid before thyroid surgery, management of thyroid storm, treatment of hyperthyroidism, and treatment of thyroid cancer. Adverse effect: GI distress.



Sample Questions

66. What action should the nurse perform before administering levothyroxine (Synthroid)?
1. Check the client's pulse.
 2. Listen to the client's chest.
 3. Take the client's temperature.
 4. Assess the client's neuro status.



Answers and Rationales

66. 1. An adverse effect of levothyroxine (Synthroid) is tachycardia; the nurse should check the client's pulse before administration.

THYROID ANTAGONISTS

A. Prototype: propylthiouracil (PTU)

1. Action. Prevents synthesis of thyroid hormones. Partially prevents peripheral conversion of T_4 to T_3 .



Sample Questions

67. The client calls the physician's office and complains of chills, fever, and sore throat. Which nursing action is appropriate?
1. Tell the client it sounds like she has the flu and that she should drink lots of fluids, take aspirin, and get extra rest.
 2. Tell the client to come in immediately for a throat culture and blood work as this may be a serious drug reaction.
 3. Expect the physician to prescribe another thyroid antagonist drug as this is an allergic reaction.
 4. Tell the client that these are expected drug reactions and that they will subside in a few days.



67. 2. Symptoms of chills, fever, and sore throat while receiving propylthiouracil (PTU) require throat culture and blood work right away.

WOMEN'S AND MEN'S HEALTH AGENTS

- A. Prototype: progesterone (Progestin)
1. Action. Changes a proliferative endometrium into a secretory one; causes a change in consistency of cervical mucus; stops spontaneous uterine contractions.
 2. Use. Amenorrhea; abnormal uterine bleeding; endometrial cancer; prevention of conception.
 3. Adverse effects
 - a. In parenteral administration: Breakthrough bleeding, spotting, dysmenorrhea, breast tenderness; headache, dizziness; edema, thromboembolism, hypertension; nausea, vomiting, bloating, weight gain; jaundice; rash, hirsutism, acne, oily skin; vision changes.
 - b. Other effects: Hypertension; reduced glucose tolerance; thromboembolism in high doses in specific groups of women.
 4. Nursing implications
 - a. Take oral forms with food.
 - b. Monitor weight.
 - c. Monitor BP.
 - d. For intramuscular injection
 - 1) Inject deeply into gluteal muscle.
 - 2) Rotate injection sites.
 - 3) Shake vial to ensure uniform dispersion.
 5. Discharge teaching
 - a. Client should not smoke.
 - b. Client should have regular Pap tests and should do breast self-exam.
 - c. Client should report calf pain, breast lumps, or severe headache.
- B. Related drugs
1. Hydroxyprogesterone (Delalutin), medroxyprogesterone (Provera), and megestrolacetate (Megace).
 2. Oral contraceptives
 - a. Estrogen-progestin combinations
 - 1) Action. Suppress ovulation by preventing release of follicle-stimulating hormone (FSH) and luteinizing hormone (LH). Act directly on reproductive organs.
 - 2) Use. Prevention of pregnancy; amenorrhea; functional bleeding; endometriosis.
 - 3) Adverse effects. Same as for progesterone.
 - b. Progestin-only preparations
 - 1) Referred to as "minipills."
 - 2) Less effective than estrogen-progestin combinations.
 - 3) Action not understood.
 - 4) Adverse effects and nursing implications are same as for estrogen-progestin combinations.
 - 5) If two consecutive doses are missed, client must stop drug, use alternative birth control, wait until menses occurs, and start therapy again.
- C. Fertility agents
1. Prototype: clomiphene citrate (Clomid) given PO.
 2. Menotropins (Pergonal) given IM.
 3. Chorionic gonadotropin (A.P.L.) given IM.
 4. Action. Increases the release of gonadotropins and stimulates the growth and maturation of ovum.
 5. Use. Infertility, induces ovulation.
 6. Adverse effects. Multiple births, headache, tachycardia, nausea, vomiting, constipation, anxiety, DVT, breast pain, diplopia.
 7. Nursing implications. Monitor for adverse effects, support client and partner throughout their attempt to achieve fertility.
- D. Bisphosphonates
1. Alendronate (Fosamax).
 2. Tiludronate (Skelid).
 3. Action. Bisphosphonates inhibit normal and abnormal bone resorption of bone by decreasing osteoclast activity.
 4. Use. Prevention and treatment of osteoporosis in men and postmenopausal women, and Paget's disease.
 5. Adverse effects. Flatus, gastritis, acid regurgitation, dysphagia, muscle pain, constipation or diarrhea, and headache.
 6. Nursing implications
 - a. Alendronate: take in the morning with 8 ounces of water 30 minutes before meals or other medications. Sit upright after taking
- 4) Nursing implications
- a) Stop taking 1 week before surgery to decrease risk of thromboembolism.
 - b) If one menstrual period is missed and tablets were taken correctly, continue pills; if two periods are missed, stop pills and have pregnancy test; will need additional birth control method for first month of drug therapy.
 - c) Smoking increases risk of thromboembolism.
 - d) May take longer to conceive after stopping pills. See Nursing Implications for progesterone.

for at least 30 minutes to prevent esophageal irritation.

- b. Tiludronate: take on an empty stomach at least 2 hours before or after eating.
- E. Selective estrogen receptor modulators (SERMs)**
1. Raloxifene (Evista): used to prevent postmenopausal osteoporosis.
 2. Tamoxifen (Novadex): used for prevention and treatment of breast cancer.
 3. Action. SERMs work by stimulating estrogen receptors on bone and blocking estrogen receptors on breast tissue.
 4. Adverse effects. Hot flashes and leg cramps; can increase the risk of thromboembolism.
 5. Nursing implications. Periodically monitor CBC and platelet counts.
- F. Men's health agents**
1. Androgens: testosterone, danazol (Danocrine), fluoxymesterone (Halotestin), methyltestosterone (Android).
 2. Action. Stimulate spermatogenesis and maintenance of secondary sex characteristics, and stimulate the formation and maintenance of muscular and skeletal protein.
 3. Use. Primarily for replacement therapy; treatment of breast cancer in women.
 4. Adverse effects. Fluid retention, headaches, nausea, vomiting, constipation or diarrhea, acne, gynecomastia, priapism, depression, jaundice, and bleeding.
 5. Nursing implications. Available PO. Testosterone also available IM and transdermally. Give with food to decrease GI upset. Transdermal testosterone: Matrix type placed on the scrotum; reservoir patch placed on the abdomen, back, thighs, or upper arms. Matrix type doesn't need to be removed for bathing, sexual activity, or swimming; reservoir patch needs to be removed for these activities. For IM use give deep IM in the gluteus. Therapeutic effects may take 3–4 months and should not be abruptly discontinued.
- G. Androgen inhibitors: 5-Alpha-Reductase Inhibitor: finasteride (Proscar)**
1. Given orally to treat BPH and may take up to 6 months before relief of BPH symptoms occurs. May cause impotency, decreased libido, or ejaculatory dysfunction.
- H. Phosphodiesterase inhibitor: Sildenafil (Viagra), tadalafil (Cialis), vardenafil (Levitra)**
1. Given orally to treat male erectile dysfunction.
 2. Contraindicated in clients taking nitrates. Sildenafil potentiates hypotensive effects of nitrates. Adverse effects: flushing, headache, GI upset.
 3. Nursing implications. Take 1 hour before sexual intercourse. Clients with a history of cardiac disease or angina should use cautiously.



Sample Questions

- 68.** The client calls the gynecology clinic and states she thinks she is pregnant even though she has consistently taken her birth control pills. What would be the nurse's best response?
1. Continue taking the pills and see the physician.
 2. Stop taking the pills and see the physician.
 3. Continue taking the pills and see if menses occurs in the next cycle.
 4. Stop taking the pills for this cycle; wait 28 days and start them again.
- 69.** Which conditions could be present in clients who are prescribed the medication danazol (Danocrine)?
1. Infertility.
 2. Muscular dystrophy.
 3. Sexual dysfunction in men and women.
 4. Endometriosis and fibrocystic breast disease.



Answers and Rationales

- 68. 2.** If the client is taking birth control pills and believes she is pregnant, she should stop taking the pills and see the physician.
- 69. 4.** Danazol is given in the treatment of endometriosis and helps relieve the symptoms of fibrocystic breast disease.

OXYTOCICS

- A. Prototype: oxytocin (Pitocin)**
1. Action. Posterior pituitary gland hormone that may initiate labor by stimulating uterine smooth muscle contractions. Releases milk from breast in breastfeeding women.
 2. Use. Labor induction; control postpartum bleeding; treatment of incomplete abortion; stimulate breast milk ejection.
 3. Dose. IV infusion: add 0.5–2 milliunits/min, increase by 1–2 milliunits/min every 15–60 minutes until contraction pattern (maximum 20 milliunits/min). IV for uterine bleeding: 10–40 units to 1 liter of dextrose or electrolyte solution. IM: 10 units after delivery of placenta.
 4. Adverse effects. Water intoxication, hypotension; postpartum hemorrhage; PVCs, cardiac arrhythmias; uterine rupture; nausea, vomiting; hypertension, cardiovascular

Table 2-13 Oxytocin-Related Drugs

Drug	Use	Adverse Effects	Nursing Implications
Ergonovine (Ergotrate) Ergot Alkaloid (produce vasoconstriction and intense oxytocic effects)	Control late postpartum bleeding Treatment and prevention of postpartum and postabortion bleeding	Severe hypertension; bradycardia; nausea, vomiting; diarrhea	<ul style="list-style-type: none"> • Monitor BP, heart rate, and fundus • Notify physician if BP increases • Contraindicated to induce labor
Methylergonovine (Methergine)	Prophylaxis after delivery of placenta	Fewer adverse effects than ergonovine. See above.	<ul style="list-style-type: none"> • Never administer before delivery of placenta
Ergot Alkaloid (see above)	Management of postpartum bleeding		<ul style="list-style-type: none"> • See above

collapse; fetus: bradycardia, hypoxia, intracranial hemorrhage, death; anaphylactic reactions.

5. Nursing implications
 - a. Infusion pump for IV infusion.
 - b. Monitor BP, heart rate, I&O.
 - c. Use fetal monitor to monitor fetal heart rate and uterine contractions.
 - d. Notify physician and stop infusion if fetal or maternal distress. Place mother on left side.
 - e. Drug IV line should be piggybacked into a primary infusion line.
 - f. Physician should be readily available to manage maternal or fetal complications.

B. Related drugs. See Table 2-13.



Sample Questions

70. The nurse sets up an oxytocin (Pitocin) infusion. Which of the following are nursing considerations in caring for clients receiving oxytocin infusions?
 1. The nurse should increase the infusion by 3 milliunits/min every 15 minutes until there is a pattern of contractions.
 2. Time-tape the solution and use a microdrop tubing to monitor the rate.

3. Use an infusion pump and piggyback infusion into primary infusion line.
4. Monitor client's temperature every 15 minutes.

71. Which statement is correct regarding the reason why Methylergonovine (Methergine) is given?
 1. To induce labor.
 2. In the first stage of labor.
 3. After placental delivery.
 4. IV prophylactically to prevent postpartum hemorrhage.



Answers and Rationales

70. 3. Oxytocin (Pitocin) infusion should be administered on an infusion pump and piggybacked into a primary infusion line to control rate of infusion and to minimize/prevent potentially dangerous adverse effects of oxytocin (Pitocin).
71. 3. It is given after placental delivery because methylergonovine (Methergine) can cause uterine tetany.



Eye Drugs

MYDRIATICS AND CYCLOPLEGICS

- A. Prototype: atropine (Isopto Atropine)
 1. Action. An anticholinergic that causes mydriasis (dilation) of the pupil and

cycloplegia, which paralyzes the lens and eye muscles.

2. Use. Facilitate eye exams and treat uveitis.
3. Adverse effects. Photophobia, reduced lacrimation, impaired distant vision,

increased intraocular pressure, eye pain, blurred vision.

4. Nursing implications
 - a. Sunglasses to reduce photophobia.
 - b. Artificial tears for reduced lacrimation.
 - c. Elderly clients should be screened prior to receiving atropine—can increase intraocular pressure.
 - d. Should not drive until drug effects have worn off.
- B. Related drugs
 1. Sympathomimetic agents:
 - a. Apraclonidine (Iopidine)
 - b. Dipivefrin (Propine)
 2. Cyclopentolate (Cyclogyl)



Sample Questions

72. To reduce the chance of having systemic effects related to atropine, which intervention will be performed after administration?
 1. Place a warm compress over both eyes.
 2. Rinse the eye with water following instillation.
 3. Maintain pressure on inner canthus for 1–2 minutes.
 4. Have client wipe eyes with gauze after instillation.
73. Which of the following conditions should be assessed for prior to topical atropine application?
 1. Cataracts.
 2. Glaucoma.
 3. Uveitis.
 4. Conjunctivitis.
74. Which statement by the client indicates that he understands the instructions given following instillation of atropine?
 1. “My son will drive me home after the exam.”
 2. “If my eyes itch it’s OK to rub them.”
 3. “I plan to go to the beach after this appointment.”
 4. “I will mow the lawn as soon as I get home.”



Answers and Rationales

72. 3. Applying pressure to the inner canthus (lacrimal sac) will reduce systemic effects.

73. 2. Atropine can raise intraocular pressure. Clients with glaucoma have increased intraocular pressure and a further increase in intraocular pressure could lead to an acute crisis and blindness.
74. 1. Vision is temporarily impaired following the examination. This client should not drive, as distant vision is impaired.

MIOTICS

- A. Prototype: acetylcholine (Miochol)
 1. Action. A cholinergic drug that causes miosis (contraction) of the pupil and contraction of the ciliary muscle in the eye.
 2. Use. Decreases intraocular pressure in glaucoma and achieves miosis in cataract surgery.
 3. Adverse effects. Low toxicity after systemic absorption; transient hypotension, decreased heart rate; bronchospasm; flushing, sweating.
 4. Nursing implications
 - a. Reconstitute just before use due to instability of solution.
 - b. Systemic reactions treated with intravenous atropine.
- B. Related drugs
 1. Carbachol (Isopto Carbachol): Tell client of brief stinging in eye after use; symptoms of eye and brow pain, photophobia, and blurred vision will usually be lessened with prolonged use.
 2. Echothiophate (Phospholine Iodine): Solutions are unstable, client must wash hands before use.
 3. Pilocarpine (Pilocar, Isopto Carpine): Causes blurred vision and focusing difficulty. Client needs to understand that glaucoma treatment is long and needs adherence to prevent blindness; eyedropper tip should not be contaminated; clients with asthma and lung disorders should be observed for respiratory difficulties.
 4. Physostigmine (Isopto Eserine)
 - a. Beta blockers
 - 1) Betaxolol (Beoptic)
 - 2) Timolol (Timoptic)
 - b. Carbonic anhydrase inhibitors (CAIs): Indicated for treatment of glaucoma.
 - 1) Acetazolamide (Diamox)
 - 2) Dorzolamide (Trusopt)



Sample Questions

75. Eye medication that treats glaucoma has what effect?
1. Both mydriatic and miotic.
 2. Mydriatic.
 3. Miotic.
 4. Malaise.
76. Which statement made by the client indicates a need for more teaching about pilocarpine?
1. "I know a side effect of pilocarpine is blurred vision."
 2. "I won't touch the eyedropper tip of the pilocarpine to my eye when instilling the drops."

3. "I will stop the pilocarpine as soon as my vision improves."
4. "I know that pilocarpine can cause side effects in my eye as well in other areas of my body."



Answers and Rationales

75. **3.** Miotic eye medication causes a contraction of the eye pupil and contraction of the ciliary muscle, which helps to decrease intraocular pressure.
76. **3.** Treatment for glaucoma will continue throughout the client's life. Eye medication should not be discontinued.



Cardiovascular Drugs

CARDIAC GLYCOSIDES

- A. Prototype: digoxin (Lanoxin)
1. Action. Increases force of myocardial contraction (positive inotropic effect). Decreases rate of conduction (negative chronotropic effect) while increasing refractory period of the AV node. Positive inotropic effect improves blood supply to vital organs and kidneys, providing a diuretic effect. Has a slow onset and shorter duration of action than other cardiac glycosides. Is eliminated through the kidneys. Digoxin elixir is better absorbed by the GI tract than digoxin tablets.
 2. Use. Congestive heart failure (CHF); atrial fibrillation; atrial flutter; paroxysmal atrial tachycardia.
 3. Adverse effects. Cumulative with a narrow margin of safety. With toxicity there are many symptoms that make it difficult to distinguish from the condition being treated. Arrhythmias, bradycardia: arrhythmias more frequently seen in children; anorexia, nausea, vomiting, diarrhea; headaches, fatigue, confusion, insomnia, convulsions; visual disturbances: blurred vision, green or yellow tint or halos; hypersensitivity. Toxicity occurs more quickly in presence of a low serum potassium. Quinidine-digoxin reaction may occur. When digoxin is stabilized in clients receiving quinidine, serum digoxin levels could double, leading to possible toxicity.
 4. Nursing implications
 - a. Half-life is longer in elderly.
 - b. Monitor CBC, serum electrolytes, liver and renal function studies, and ECG.
 - c. Hold if apical rate is below 60 or greater than 120 beats per minute in adults, below 90 beats per minute in infants, or below 70 beats per minute in children up to adolescence.
 - d. Monitor I&O and daily weights; potassium levels. Encourage foods high in potassium.
 - e. Monitor serum digoxin levels therapeutic range (0.5–2.0 ng/mL).
 - f. Give after meals if GI distress.
 - g. Do not confuse digoxin with digitoxin (Crystodigin) as they are not the same.
 - h. IM injections are painful and absorption is erratic. Avoid IM injections if possible and give in large muscle mass.
 - i. Digoxin antidote: Digoxin Immune Fab (Digi-bind).
 5. Discharge teaching
 - a. Take radial pulse and notify physician if toxicity symptoms occur.
 - b. Take dose the same time each day and do not skip or double up on dose.
 - c. Daily weights.

Table 2-14 Review of Antiarrhythmic Drugs

Drug	Action	Adverse Effects	Nursing Implications
Quinidine	Depresses myocardial excitability; slows conduction time in atria and ventricles, prolongs P-R interval and QRS complex; prolongs refractory period; depresses myocardial contractility, reduces vagal tone. Used in atrial fibrillation and flutter ventricular tachycardia.	Hematologic/Dermatologic: Agranulocytosis; thrombocytopenia; purpura; urticaria CNS: vertigo; blurred vision; diplopia; confusion, syncope GI: vomiting; cramping CV: AV heart block; atrial or ventricular arrhythmias; hypotension; severe bradycardia; arterial embolism	<ul style="list-style-type: none"> • Administer drug with food to minimize GI symptoms (nausea and vomiting) • Carefully monitor electrolyte levels, blood counts, and kidney and liver function • Advise clients that diarrhea is common in early therapy and should disappear • Encourage client to report dizziness or faintness immediately • Instruct patient to avoid fatigue, excessive caffeine, alcohol, smoking, heavy meals, stressful situations, OTC medications
Procainamide (Pronestyl)	Depresses ectopic pacemakers; action on the heart similar to quinidine. Used to treat PVCs, ventricular tachycardia, and some atrial arrhythmias.	Same as quinidine, plus severe hypotension with parenteral use, possible development of a erythematous-like syndrome in some clients	<ul style="list-style-type: none"> • Inform client that drug may cause light-headedness and dizziness • Periodic ECG determinations and blood counts in clients on prolonged therapy
Lidocaine (Xylocaine)	Suppresses automaticity of ectopic pacemaker; shortens refractory period; decreases duration of action potential in Purkinje fibers; local anesthetic action. Used for acute ventricular arrhythmias.	CNS: dizziness; slurred speech; apprehension; muscle twitching; tremors; convulsions CV: hypotension, bradycardia Dermatologic: urticaria, peripheral edema	<ul style="list-style-type: none"> • Closely monitor IV flow rate to ensure maintenance of adequate plasma levels • Observe carefully for signs of CNS toxicity (e.g., confusion, tremors), particularly during IV infusion • Monitor cardiac function and blood pressure closely. IM use may increase CPK (creatine phosphokinase) levels
Disopyramide (Norpace)	Increases action potential duration and effective refractory period of the atria and ventricles which decreases automaticity and conduction velocity. Useful for PVCs and episodes of ventricular tachycardia.	CV: hypotension; precipitation or aggravation of CHF GU: urinary hesitancy CNS: dry mouth; blurred vision; fatigue, headache, malaise, dizziness GI: nausea, constipation	<ul style="list-style-type: none"> • Caution client to avoid driving until effects of drug are known because dizziness may occur • Monitor I&O because urinary retention may occur • Encourage use of hard candy to relieve dry mouth
Verapamil (Calan, Isoptin) Nifedipine (Procardia) Diltiazem (Cardizem)	Calcium channel blockers inhibit the influx of extracellular calcium ions into cardiac and smooth muscle cells. Antianginal effects include dilation of coronary arteries and arterioles. Verapamil also decreases the influx of calcium into the cardiac contractile and conduction cells of the SA and AV node. Useful in management of chronic, stable angina and treatment of supraventricular tachyarrhythmias.	CV: hypotension, bradycardia; palpitations, peripheral edema CNS: flushing; weakness; dizziness; light-headedness. GI: nausea; cramping; heartburn; constipation with verapamil Respiratory: dyspnea; cough; wheezing	<ul style="list-style-type: none"> • Carefully monitor blood pressure during initial therapy and whenever dosage changes are made because hypotension may occur • Monitor liver enzymes periodically during therapy • Be alert for signs of CHF, which can occur especially if client is also receiving a beta blocker
Digitalis	Stimulates the force of cardiac contraction with improvement of cardiac output. Decreases cardiac oxygen demands, diastolic heart size, and heart rate. Useful in treatment of CHF and certain arrhythmias, such as atrial fibrillation and atrial flutter.	Digitalis toxicity: CNS: headache, fatigue, malaise, drowsiness, muscle weakness, insomnia, agitation, seizures, paresthesias of hands and feet, personality changes, impaired memory, hallucinations CV: arrhythmias (all types are possible) ENT: yellow-green halos GI: anorexia, nausea and vomiting, abdominal distension and pain	<ul style="list-style-type: none"> • Closely observe client for signs of toxicity • Check with physician regarding what pulse rates (both high and low) should be used as indicators for withholding medication • Watch for changes in pulse rate (sudden increase above 120 or fall below 60) • Recognize signs of hypokalemia, which increases the incidence of digitalis toxicity • Encourage client to take digitalis at prescribed times only • Advise client that protracted diarrhea or vomiting can create an electrolyte imbalance and lead to digitalis toxicity • Recommend adherence to prescribed diet

- d. Avoid high-sodium foods. Increase dietary intake of potassium.
 - e. Separate digoxin from other pills in pillbox.
- B.** Related drugs: Phosphodiesterase inhibitors: milrinone (Primacor) and inamrinone (Inocor), used for short-term management of CHF. Also see Table 2-14.



Sample Questions

- 77.** What is the main action of cardiac glycosides?
1. Release free calcium with cardiac muscle.
 2. Increase the rate of impulse formation at the SA node.
 3. Decrease the conduction of electrical impulses in the heart.
 4. Decrease the force of myocardial contractions.
- 78.** What should the nurse teach the client about cardiac glycosides?
1. Avoid fruits with potassium.
 2. How to monitor the radial pulse.
 3. Always take digoxin on an empty stomach.
 4. Return to the health care provider in 1 year.
- 79.** Which lab value would be a concern to the nurse?
1. 0.5 ng/mL
 2. 1.0 ng/mL
 3. 1.5 ng/mL
 4. 2.2 ng/mL
- 80.** Which statement by the client will assure the nurse that the client understands teaching about the adverse effects of digoxin?
1. "I'll call the physician if my pulse is below 70."
 2. "If a rash develops, I'll apply a topical cream."
 3. "I will call the physician daily to report my weight."
 4. "I will notify the health care provider if vomiting or diarrhea develops."



Answers and Rationales

- 77. 1.** It is believed that free calcium is released within the cardiac muscle cell, potentiating the action of actin and myosin, which are the major proteins responsible for muscle contraction.

- 78. 2.** The client should be taught how to monitor the radial pulse, and to hold the medication if the pulse is less than 60 beats per minute for an adult, less than 70 for children, or less than 90 for an infant.
- 79. 4.** The normal range of digoxin is 0.5–2.0 ng/mL, with a toxic threshold of 2.5 ng/mL.
- 80. 4.** Vomiting and diarrhea are adverse effects of digoxin therapy and may also be symptoms of digoxin toxicity. The client should report this occurrence to the physician.

ANTIANGINAL DRUGS

- A.** Prototype: nitrites and nitroglycerin (Nitro-bid, Nitrodur, Nitrostat IV)
- 1.** Action. Dilates the peripheral vascular smooth muscles of smaller vessels, which decreases cardiac preload and afterload leading to decreased myocardial oxygen needs. Selectively dilates large coronary arteries, which helps to decrease anginal pain and hypoxia of the myocardium. Given by many different routes of administration including PO, SL, buccal, topical, transdermal. Tolerance may develop with continued use.
 - 2.** Use. Treatment and prophylaxis of angina pectoris. IV nitroglycerin manages congestive heart failure associated with acute MI and controls intraoperative hypotension or manages hypertension.
 - 3.** Dose (adults)
 - a.** SL: 0.15–0.6 mg at onset of attack or anticipation of attack.
 - b.** PO: Sustained release 2.5–2.6 mg TID or QID. Topical ointment: 1–2 inches every 8 hours up to 4–5 inches every 4 hours.
 - c.** Transdermal: 0.1–0.6 mg/hr, can increase up to 0.8 mg/hr; patch worn 12–14 hours/day.
 - d.** Spray: 1–2 sprays, can repeat every 5 minutes for 15 minutes.
 - e.** Buccal: 1 mg every 5 hours; dose and frequency increased as needed.
 - f.** IV: 5 mcg/min in 5% dextrose in water or 0.9% sodium chloride and titrate every 3–5 minutes until response.
 - 4.** Adverse effects. Headache, usually disappears with long-term therapy; flushing; hypotension, dizziness; reflex tachycardia; skin rash with ointment.
 - 5.** Nursing implications
 - a.** No more than 3 tablets SL should be taken in a 15-minute period (1 tablet every 5 minutes). If pain not relieved by 3 tablets over 15 minutes, could indicate an acute MI and physician should be contacted.

- b. Leave tablets at bedside and allocate a specific number of tablets in container. Instruct client to tell nurse when having an attack and number of tablets taken.
 - c. Sustained-release tablets or capsules should be taken 1 hour before meals or 2 hours after meals.
 - d. Nitroglycerin ointment should be applied to a hairless or shaved area to promote absorption. New site should be used with each new dose. Use ruled applicator paper that comes with ointment to measure dose. Wear gloves when applying ointment to applicator. Leave applicator paper on site. Cover the applicator paper with plastic wrap and secure with tape.
 - e. Transdermal nitroglycerin has aluminum backing and patch. Remove before defibrillation. Avoid standing near microwave ovens to prevent burns. Patches are usually applied in morning and removed in evening to prevent tolerance.
 - f. Dilute IV nitroglycerin in 5% dextrose or 0.9% sodium chloride. Avoid using polyvinyl chloride (PVC) plastic as it can absorb nitroglycerin. Non-PVC is provided by the manufacturer. IV use requires continuous hemodynamic monitoring.
6. Discharge teaching
- a. Rise slowly to prevent dizziness.
 - b. Store in original dark glass container in a cool place. Date bottle when opening and discard after 3 months.
 - c. Headache will discontinue with long-term use.
 - d. Keep diary of the number of anginal attacks and tablets taken.
 - e. Do not drink alcohol.
- B. Related drugs: Isosorbide dinitrate (Isordil): used to treat and prevent anginal attacks; given SL or PO.

- 2. Replace the transdermal patch every 8 hours.
- 3. Do not stand near microwave ovens while in use.
- 4. Put on an extra transdermal patch if chest pain occurs.

83. Which of the following should the nurse include in teaching about taking sublingual nitroglycerin?
- 1. To replace tablets on a yearly basis.
 - 2. Keep tablets in a moist warm environment.
 - 3. Take the tablet before exercise to prevent angina.
 - 4. Notify physician if after 5 consecutive doses the chest pain persists.



Answers and Rationales

81. 4. A headache is a frequently seen adverse effect that usually disappears with long-term therapy. The physician may order aspirin or acetaminophen for headache relief.
82. 3. The back of a transdermal nitroglycerin patch contains aluminum, which could cause burns to clients standing near microwave ovens or if defibrillation is needed.
83. 3. Nitroglycerin should be taken before exercise to prevent an anginal attack.

ANTIANGINAL DRUGS (CONTINUED)

- C. Prototype for Calcium Channel Blockers: verapamil (Calan, Isoptin)
- 1. Action. Inhibits myocardial oxygen demand by inhibiting the influx of calcium through muscle cell, which leads to reduced afterload and coronary vasodilation. Decreases myocardial contractility, causing peripheral vasodilation leading to decreased heart workload.
 - 2. Use. Angina; essential hypertension (PO form); cardiac dysrhythmias (IV use).
 - 3. Adverse effects. Constipation; nausea and vomiting; hypotension; bradycardia; AV block; dizziness.
 - 4. Nursing implications
 - a. Monitor VS, I&O, and ECG.
 - b. Encourage high-fiber foods and increased fluid intake (condition permitting).
 - 5. Discharge teaching
 - a. Take radial pulse before taking verapamil.



Sample Questions

81. The client states that he is getting headaches after taking nitroglycerin. How does the nurse interpret this occurrence?
- 1. Toxic effect.
 - 2. Symptom of tolerance.
 - 3. Hypersensitivity reaction.
 - 4. Adverse effect.
82. The physician decides to order nitroglycerin transdermal patches. Which instruction is important?
- 1. Remove patch when showering.

- b. Avoid caffeine.
 - c. Avoid driving or operating machinery/heavy equipment until response to drug is established.
 - d. Change positions slowly to decrease orthostatic hypotension.
 - e. Do not abruptly discontinue verapamil therapy as rebound angina could occur. Dose is generally tapered.
 - f. Continue with nitroglycerin therapy if prescribed.
6. Related drugs. See Table 2-14.



Sample Questions

84. A client is taking nitroglycerin with verapamil (Isoptin). What occurrence should the nurse watch for?
1. Hyperkalemia.
 2. Hypotension.
 3. Seizures.
 4. Insomnia.
85. Which statement by the client indicates understanding concerning the use of verapamil (Isoptin)?
1. "If I get dizzy I will stop taking the pills and call the physician."
 2. "I'm glad that I can continue to drink coffee."
 3. "I will only have to take the pills for a couple of weeks."
 4. "I will take my pulse before taking my pill."



Answers and Rationales

84. 2. Verapamil (Isoptin) reduces afterload and with concurrent use of nitroglycerin can cause hypotension.
85. 4. Clients should take pulse before taking verapamil (Isoptin) as this drug can cause bradycardia.

PERIPHERAL VASODILATORS

- A. Prototype: isoxsuprine HCl (Vasodilan)
Relaxation of the smooth muscle of blood vessels. Used to treat peripheral vascular disorders such as Raynaud's and Buerger's disease (thromboangitis obliterans), diabetic vascular disease, and varicose ulcers.

B. Antiplatelet agents

1. Dipyridamole (Persantine): Potent vasodilator that also decreases platelet aggregation and clotting time. Selectively dilates small resistance vessels of coronary vascular bed. Used in the prevention of thromboembolism in cardiac valve replacement surgery; also used in other thromboembolic disorders to decrease platelet aggregation. Adverse effects: headaches, dizziness, weakness, hypotension, GI distress, flushing, and skin rashes. Monitor BP. Other antiplatelets: Aspirin, cilostazol (Pletal), clopidogrel (Plavix), and ticlopidine (Ticlid).



Sample Questions

86. The client complains of nausea while taking isoxsuprine HCl (Vasodilan). What instruction will the nurse give the client?
1. Stop taking the medication and report this to the physician.
 2. Take an antacid with the isoxsuprine HCl (Vasodilan).
 3. Keep taking the drug as this effect is only transient.
 4. Report this to the physician so he can reduce the dose of isoxsuprine HCl (Vasodilan).



Answers and Rationales

86. 4. Adverse effects of isoxsuprine HCl (Vasodilan) are dose related and can be dealt with by reduction of the dose.

ANTIDYSRHYTHMICS

- A. Prototype: quinidine (Quinaglute) class 1A
1. Action. Alkaloid from the bark of the cinchona tree. Related to quinine, an antimalarial drug. Decreases myocardial excitability and slows conduction velocity, while prolonging the refractory period. PR interval and QRS complex may be prolonged. Has anticholinergic effects that reduce vagus nerve activity, which slows AV conduction.
 2. Use. Atrial dysrhythmias, atrial fibrillation, and atrial flutter; ventricular dysrhythmias.
 3. Adverse effects. Cinchonism: GI distress, tinnitus, visual disturbances, dizziness, headache; AV block, hypotension; thrombocytopenia; hypersensitivity; nausea, vomiting, diarrhea.

4. Nursing implications
 - a. Monitor ECG and VS, serum electrolytes, CBC, kidney and liver function.
 - b. Monitor serum quinidine levels. Normal range 3–6 mcg/mL.
 - c. Take an apical pulse.
 - d. Take with food if GI upset.
 - e. Clients taking digoxin and quinidine are more prone to digitalis toxicity.
 5. Discharge teaching
 - a. Take radial pulse before taking.
 - b. Report symptoms of cinchonism, palpitations, faintness, or breathlessness.
- B. Related drugs.** See Table 2-14.
1. Procainamide
 2. Disopyramide

Sample Questions

87. Which of the following adverse effects is unique to quinidine (Quinaglute)?
 1. SLE (systemic lupus erythematosus).
 2. Agranulocytosis.
 3. Cinchonism.
 4. Hypoglycemia.
88. What client teaching should be included concerning quinidine administration?
 1. Drink plenty of orange juice.
 2. Maintain a high-fiber diet.
 3. Take Pepto Bismol if diarrhea occurs.
 4. Take medication with meals.

Answers and Rationales

87. **3.** Cinchonism is a syndrome seen specifically when using quinidine; manifested by tinnitus, GI distress, dizziness, visual disturbances, and headache.
88. **4.** Taking quinidine with meals will decrease GI distress.

ANTIDYSRHYTHMICS (CONTINUED)

- C. Prototype: lidocaine (Xylocaine) class 1B**
1. Action. Prolongs refractory period in the myocardium and Purkinje fibers. Has little effect on atria. Depresses automaticity but therapeutic doses do not depress myocardial contractility. Also used as a local anesthetic.

2. Use. Ventricular arrhythmias, i.e., VT; VF; PVCs.
 3. Dose (given parenterally only)
 - a. Adult
 - 1) IV Bolus: 50–100 mg at a rate of 25–50 mcg/kg/minute; once arrhythmia controlled continue infusion of 1–4 mg/minute.
 - 2) IM: 200–300 mg and repeat in 60–90 minutes if needed.
 - b. Pediatric:
 - 1) IV: 1 mg/kg followed by an infusion of 30 mcg/kg/minute.
 4. Adverse effects. Drowsiness; CNS stimulation can develop leading to seizures; ventricular tachycardia, heart block, hypertension, bradycardia.
 5. Nursing implications
 - a. Monitor ECG, VS, neurologic status, and serum lidocaine levels.
 - b. Therapeutic lidocaine levels range between 1.5–6 mcg/mL.
 - c. Use an infusion pump.
 - d. Cardiac IV lidocaine should not contain preservatives or epinephrine.
 - e. Deltoid muscle is preferred for IM use.
 - f. Do not mix with other drugs.
- D. Related drugs**
1. Mexiletine (Mexitel): related to lidocaine
 2. Tocainide (Tonocard): related to lidocaine
 3. Phenytoin sodium (Dilantin)
Also see Table 2-15.
- E. Class IC drugs:** Both drugs given orally to treat ventricular dysrhythmias.
1. Flecainide (Tambacor)
 2. Propafenone (Rythmol)
- F. Class I A, B, C drugs**
1. Moricizine (Ethmozine): a sodium channel blocker used to treat life-threatening ventricular dysrhythmias; given orally.

Sample Questions

89. Which of the following statements is correct concerning the administration of phenytoin (Dilantin)?
 1. Phenytoin is administered by continuous infusion.
 2. Phenytoin can be mixed in dextrose solutions.
 3. 0.9% normal saline should be used to flush IV line and site before and after administration.
 4. Phenytoin is given by rapid IV push.

Table 2-15 Drugs Related to Lidocaine

Drug	Action	Use	Adverse Effects	Nursing Implications
Tocainide (Tonocard)	Oral analog of lidocaine (Xylocaine)	Ventricular arrhythmias	Drug-induced SLE; dyspnea; GI distress; see lidocaine	<ul style="list-style-type: none"> • Give with food to reduce GI distress • Avoid driving or operating heavy machinery until drug response known • Take radial pulse
Phenytoin sodium (Dilantin)	Also an antiepileptic drug; see lidocaine	Ventricular and supraventricular arrhythmias unresponsive to lidocaine or procainamide. Also used to treat digitalis-induced arrhythmias.	Drowsiness; slurred speech; ataxia; nystagmus; hypotension; agranulocytosis; rash; nausea, vomiting	<ul style="list-style-type: none"> • Should not be given with other antidysrhythmics • IV: do not mix with dextrose as crystallization can occur. Flush IV line with saline before and after administration. • Do not mix with other drugs • Monitor CBC • Therapeutic levels range between 10–20 mcg/mL

Answers and Rationales

89. 3. Phenytoin (Dilantin) has a high alkalinity and can precipitate easily. Flushing the IV line and site with 0.9% normal saline will minimize venous irritation and prevent precipitation.

ANTIDYSRHYTHMICS (CONTINUED)

- F. Prototype: bretylium (Bretylol) class III
1. Action. An antifibrillatory drug. Initially releases norepinephrine to increase conduction velocity and strengthen the heartbeat.
 2. Use. Life-threatening arrhythmias.
 3. Adverse effects. Hypotension, dizziness; worsening arrhythmias, hypertension; nausea, vomiting, diarrhea.
 4. Nursing implications
 - a. Monitor ECG, vital signs, I&O.
 - b. Gradually reduce dose.
 - c. Change position slowly.
- G. Related drugs
1. Amiodarone (Cordarone)
 - a. Given orally to treat chronic recurrent ventricular tachycardia or ventricular fibrillation that is unresponsive to other drugs.
 2. Ibutilide (Corvert): given parenterally to treat atrial dysrhythmias.
- H. Unclassified antidysrhythmic: Adenosine (Adenocard) is given IV to treat PSVT.

Sample Questions

90. Which adverse effect should the nurse monitor while a client is on maintenance bretylium therapy?
1. Hypotension.
 2. Tachycardia.
 3. Insomnia.
 4. Hearing loss.

Answers and Rationales

90. 1. Hypotension occurs because after the initial release of norepinephrine, bretylium blocks further release of norepinephrine.

BETA BLOCKERS (CLASS II)

- A. Prototype: propranolol (Inderal)
1. Action. Beta-adrenergic blocker that decreases heart rate, force of contraction, myocardial irritability, and conduction velocity, and depresses automaticity.
 2. Use. Cardiac arrhythmias caused by excessive cardiac stimulation of sympathetic nerve impulse; digitalis-induced arrhythmias; essential hypertension; angina pectoris; preoperative management of pheochromocytoma; prevention of migraine headaches.

3. Adverse effects. Dizziness, drowsiness, insomnia, depression; hypoglycemia; bronchospasm; bradycardia, heart block, hypotension; rash.
 4. Nursing implications
 - a. Take apical pulse.
 - b. Monitor I&O, daily weights.
 - c. Gradually reduce dose before discontinuing.
 - d. Pulse rate may not rise following exercise or stress, due to beta-blocking effects.
 5. Discharge teaching
 - a. Take radial pulse before administering drug.
 - b. Avoid alcoholic beverages.
 - c. Avoid cold exposure to extremities.
 - d. Change positions slowly.
- B. Related drugs**
- Note: "olol" is present in generic names.*
1. Esmolol (Brevibloc): class II antidysrhythmic, used to treat tachycardia, supraventricular tachycardia, atrial fibrillation, and atrial flutter.
 2. Nadolol (Corgard): used to treat essential hypertension and angina.
 3. Pindolol (Visken): used to treat essential hypertension.
 4. Timolol (Blocadren): used to treat essential hypertension.
 5. Atenolol (Tenormin): class II antidysrhythmic, also used to treat angina and hypertension.
 6. Metoprolol (Lopressor): class II antidysrhythmic, given after MI to decrease risk of sudden cardiac death, and also used to treat angina and hypertension.
 7. Sotalol (Betapase): class III antidysrhythmic, generally used to treat life-threatening ventricular dysrhythmias, i.e., ventricular tachycardia.



Sample Questions

91. Which occurrence should clients be monitored for if taking beta-adrenergic blocking agents?
1. Hyperglycemia.
 2. Heat intolerance.
 3. Respiratory difficulties, bradycardia.
 4. The development of arthritis.



Answers and Rationales

91. 3. Beta-adrenergic blocking agents reduce heart rate and force of contraction, as well as possibly causing bronchoconstriction.

CARDIAC STIMULANTS

- A.** Cardiac stimulants are also autonomic nervous system drugs. The autonomic nervous system drugs are discussed in more detail in a previous section in this unit.
- B.** Representative drugs
1. Atropine sulfate
 - a. Blocks vagal stimulation of the SA node in the heart, thus increasing heart rate. Acts systemically to block cholinergic activity throughout the body.
 - b. Cardiac uses: treatment of sinus bradycardia or asystole; management of symptomatic sinus bradycardia; diagnosis of sinus node dysfunction.
 - c. Adverse effects are related to blocking of cholinergic activity in the body.
 2. Isoproterenol (Isuprel)
 - a. Stimulates beta-1 adrenergic receptors in heart to increase cardiac output. Is also a bronchodilator.
 - b. Cardiac uses: cardiac standstill; carotid sinus hypersensitivity; Stokes-Adams syndrome; ventricular arrhythmias.
 - c. Adverse effects: headache, palpitations, dry mouth, flushing, sweating, and bronchial edema.

ANTICOAGULANTS

- A.** Prototype: anticoagulants hinder one or more steps of the coagulation process. They do not dissolve existing blood clots but prevent further coagulation from occurring.
- B.** Related drugs: low-molecular-weight heparin (LMWH). See Table 2-16 comparing Heparin and Warfarin sodium (Coumadin).
1. Enoxaparin (Lovenox)
 2. Dalteprin (Fragmin)
 3. Action. Enzymatically removes part of heparin molecule, making a smaller, more accurate heparin.
 4. Use. Prophylaxis in deep venous thrombosis (DVT) or pulmonary embolism (PE) especially after hip/knee or abdominal surgery.
 5. Adverse effects. Bleeding, anemia, and thrombocytopenia.
 6. Nursing implications. Assess and monitor for symptoms of bleeding. Special monitoring of bleeding times not necessary. Antidote: protamine sulfate.

Table 2-16 Comparison of Heparin and Warfarin (Coumadin)

	Heparin	Coumadin
Action	Blocks conversion of prothrombin to thrombin and fibrinogen to fibrin. Immediate action.	Blocks prothrombin synthesis. Action takes 12–24 hrs to occur.
Use	Prophylaxis and treatment of thrombosis and embolism. Anticoagulation for vascular and cardiac surgery. Prevention of clotting in heparin lock sets, blood samples, and during dialysis. Treatment of disseminated intravascular clotting syndrome (DIC). Adjunctive treatment of coronary occlusion with acute MI.	Prophylaxis and treatment of thrombosis and embolism. Atrial fibrillation with embolization. Adjunct in treatment of coronary occlusion and small cell carcinoma of lung with chemotherapy and radiation.
Dose	Adult: SC (deep, intrafat): initially, 10,000–20,000 units, then 8000–10,000 units every 8 hours or 15,000–20,000 units every 12 hours or as determined by coagulation test results. Intermittent IV injection: 10,000 units initially followed by 5000–10,000 units every 4–6 hours. Continuous IV infusion: inject 5000 units initially followed by 20,000–40,000 units/day in 1000 mL of sodium chloride solution. Pediatric: IV: Initially 50 units per kilogram. Maintenance: 50–100 units per kilogram IV drip every 4 hours.	Adult: Oral: 5–10 mg PO initially, then 2–10 mg PO per day based on PT or INR.
Adverse Effects	Hemorrhage, bruising, thrombocytopenia. Alopecia Osteoporosis Allergic reactions: fever, chills, urticaria, bronchospasm. Elevated AST (SGOT), ALT (SGPT).	Hemorrhage from any tissue or organ. Anorexia, nausea, vomiting, diarrhea. Hypersensitivity: dermatitis, urticaria, fever Jaundice, hepatitis Overdosage: petechiae, paralytic ileus; skin necrosis of toes (purple toes syndrome), and others tissues.
Antidote	Protamine sulfate <i>Laboratory test used to monitor therapy:</i> partial thromboplastin time (PTT)	Vitamin K <i>Laboratory tests used to monitor therapy:</i> prothrombin time (PT), INR
Nursing Implications	<ul style="list-style-type: none"> • Read label carefully as drug is supplied in differing strengths. • Do not give IM. • SC injection: given in fatty layer of abdomen or just above iliac crest; use 1/2"–5/8" needle after drawing heparin into syringe; do not inject within 2 inches of umbilicus, scars, or bruises; do not aspirate; do not massage injection site; rotate injection sites and document. • Continuous IV infusion should be given via IV volume control device. • Observe needle sites daily for signs of hematoma. • Monitor CBC, PTT and other coagulation tests. • Test stool for occult blood daily. • Have antidote protamine sulfate available. • Monitor VS. • Report: hematuria, bloody stools, hematemesis, bleeding gums, petechiae, nosebleed, bloody sputum. • Alcohol and smoking alter drug response. • Aspirin, antihistamines, ginseng, ginkgo biloba, and NSAIDs shouldn't be taken while on heparin therapy as these agents may cause platelet function interference. • Do not abruptly withdraw. • Generally followed with oral anticoagulant therapy. 	<ul style="list-style-type: none"> • Known for highest adverse drug interactions of all groups. • Tablet can be crushed and taken with any fluid. • Monitor prothrombin time (PT) and INR. • Have antidote vitamin K available. • Many drug interactions. • Smoking increases dose requirement.
Discharge Teaching	Heparin used only in hospital setting.	<ul style="list-style-type: none"> • Stress importance of not skipping doses. • Client will need to report frequently for blood tests. • Client shouldn't take any medication or herbals without checking first with physician. • Client should report signs of bleeding. • Use soft toothbrush; floss teeth with waxed floss. • Shave with electric razor. • Client should tell other health care personnel such as dentists, dental hygienists, etc., that he is taking Coumadin. • Client should carry medical identification (Medic Alert) stating name of drug, name of physician, etc. • Teach client measures to avoid venous stasis.



Sample Questions

92. Which action should the nurse perform while the client is on IV heparin?
1. Protect the medication from light.
 2. Use IM route if there are frequent intravenous site changes.
 3. Attach the IV heparin to an infusion pump.
 4. Explain to the client that stools may turn gray.
93. What should the nurse have readily available for a heparin overdose?
1. Platelets.
 2. Urokinase.
 3. Protamine sulfate.
 4. Vitamin K.
94. The client requests pain medication for a headache. The physician has ordered aspirin X grains PO every 4 hours for pain. What action should the nurse take?
1. Substitute Tylenol for the aspirin.
 2. Give the aspirin as ordered.
 3. Call the physician for a different pain reliever.
 4. Give 5 grains of aspirin now and 5 grains in 2 hours.
95. The nurse is teaching about warfarin sodium (Coumadin) therapy. Which statement by the nurse needs correcting?
1. "If you miss your daily dose of Coumadin, take 2 tablets the next day."
 2. "Use waxed dental floss while on Coumadin therapy."
 3. "Notify your physician before taking any other medication."
 4. "Avoid drinking alcohol in any form while on Coumadin therapy."

93. 3. Protamine sulfate is the antidote for heparin overdose.
94. 3. A client on heparin therapy should not take aspirin due to increased potential for bleeding. The nurse needs to contact the physician for a different pain medication.
95. 1. Changing dose of warfarin sodium (Coumadin) by missing a dose on one day and doubling the dose on the following day is unacceptable as it will negatively affect blood coagulation.

THROMBOLYTIC DRUGS

- A. Prototype: streptokinase (Streptase)
1. Action. Transforms plasminogen to plasmin which degrades fibrinogen, fibrin clots, and other plasma proteins.
 2. Use. Pulmonary emboli; coronary artery thrombosis; deep venous thrombosis; arteriovenous cannula occlusion.
 3. Adverse effects. Bleeding; allergic reaction; arrhythmias.
 4. Nursing implications
 - a. Start therapy as soon as possible after thrombus appears as thrombi older than 7 days react poorly to streptokinase.
 - b. When used in treatment of an acute MI, start therapy within 6 hours of attack. When used in treatment of a stroke, therapy should be started within a 3-hour window of the attack.
 - c. Heparin is discontinued before streptokinase is started.
 - d. Corticosteroids can be given to decrease allergic reaction.
 - e. Reconstitute streptokinase with normal saline (preferred solution) or 5% dextrose solution.
 - f. IM injections are contraindicated.
 - g. Monitor blood coagulation studies and VS.
 - h. Maintain bed rest while receiving drug.
 - i. Monitor for excessive bleeding every 15 minutes for the first hour of treatment, every 30 minutes for second to eighth hours, then every 8 hours.
 - j. Keep whole blood available.
 - k. Aminocaproic acid is the antidote for streptokinase.
- B. Related drugs
1. Alteplase (Activase)
 2. Anistreplase (Eminase)
 3. Reteplase (Retavase)
 4. Tenecteplase (TNKase)
 5. Urokinase (Abbokinase)



Answers and Rationales

92. 3. Continuous intravenous infusion of heparin needs constant monitoring to ensure accuracy in dose. An infusion pump or volume controller should be used for this purpose.



Sample Questions

96. What will the nurse assess during and after streptokinase treatment?
1. Urticaria.
 2. Diarrhea.
 3. Sore throat.
 4. Peripheral edema.



Answers and Rationales

96. 1. Streptokinase (Streptase) is a foreign protein and does cause allergic reactions. Urticaria would be a sign of this.

ANTILIPEMIC AGENTS

- A. Prototype: cholestyramine (Questran)
1. Action. Prevents the metabolism of cholesterol in the body.
 2. Use. Type IIa hyperlipoproteinemia; pruritus caused by partial biliary obstruction.
 3. Adverse effects. Constipation, nausea, and vomiting; deficiencies in fat-soluble vitamins A, D, K; rash and skin irritation; osteoporosis; headache, dizziness, syncope; arthritis; fever.
 4. Nursing implications
 - a. Monitor cholesterol and serum triglyceride levels.
 - b. Assess preexisting constipation problems.
 - c. Long-term use increases bleeding tendencies; oral vitamin K may be given prophylactically.
 5. Discharge teaching
 - a. Take with water or preferred liquid and dissolve.
 - b. Take before meals.
 - c. Eat a high-bulk diet low in cholesterol and saturated fats with increased fluids.
 - d. Do not omit doses or change dose intervals.
 - e. Do not take cholestyramine (Questran) at the same time as other medications as there will be interference with absorption.
 - f. Encourage exercise and weight loss.
 - g. Give for several months or years if it is effective.
- B. Related drugs
1. Colestipol (Colestid) is similar in action, use, adverse effects, and nursing implications to cholestyramine (Questran).

2. Reductase inhibitors: Atorvastatin (Lipitor), fluvastatin (Lescol), lovastatin (Mevacor), pravastatin (Pravachol), and simvastatin (Zocor) decrease cholesterol levels by stopping the body from making its own cholesterol. Used to treat hypercholesterolemia types IIa and IIb. Adverse effects: headache; insomnia, fatigue, blurred vision, myalgias, nausea, hepatotoxicity, elevated CPK, alkaline phosphatase, and transaminase. Nursing implications: monitor renal and hepatic studies; take with meals to increase absorption.
3. Gemfibrozil (Lopid) decreases triglycerides and increases HDL cholesterol. May cause diarrhea or GI upset.
4. Niacin: vitamin B₃ (Nicobid); reduces liver synthesis and reduces cholesterol and total lipid levels. Used in treatment of hyperlipidemia. Adverse effects: tingling, flushing, jaundice, GI upset, pruritus. Nursing implications: dosage is individualized. Niacin is an OTC preparation that should be taken under a physician's care.



Sample Questions

97. Which statement by the client indicates a need for more teaching about cholestyramine (Questran) by the nurse?
1. "I will continue going to exercise class."
 2. "I will take the drug after meals."
 3. "I will dissolve the drug in liquid before taking it."
 4. "I will increase the fiber in my diet."



Answers and Rationales

97. 2. Cholestyramine (Questran) should be taken before meals for better absorption.

ANTIHYPERTENSIVES

General Information for Administration of Antihypertensives

1. Primary objective of antihypertensive therapy is to control essential hypertension and maintain BP with minimal adverse effects.

2. Antihypertensives reduce peripheral resistance and decrease volume of circulating blood.
3. Orthostatic hypotension is a common adverse effect for all antihypertensives.
4. Should not be abruptly discontinued as rebound hypertension could occur.
5. Discharge instructions for all antihypertensives
 - a. Have adverse effects that may affect client compliance in taking medication. It is important for client to receive thorough teaching and support to maintain compliance.
 - b. Do not abruptly discontinue or skip doses of medications.
 - c. Change positions gradually; avoid alcohol, hot showers and baths.
 - d. Do not take OTC drugs without consulting physician.
 - e. Monitor weight and eat low-sodium foods.
 - f. Take BP and record in diary. Report changes to physician.
 - g. Do not drive or operate heavy machinery until drug effects are established.

Note: thiazide diuretics are discussed under Renal Drugs; MAO (monamine oxidase inhibitors) are discussed under Central Nervous System Drugs; beta blockers are discussed under Antiarrhythmics; and calcium channel blockers are discussed under Antianginal Drugs.

- A. Prototype: central acting antihypertensives (clonidine [Catapres])
 1. Action. Blocks sympathetic nerve impulses in brain, which causes decreased sympathetic outflow leading to decreased BP, vasoconstriction, heart rate, and cardiac contractility.
 2. Use. Used either alone or in combination with other antihypertensives.
 3. Adverse effects. Orthostatic hypotension; drowsiness, behavior changes; peripheral edema, CHF; Raynaud's phenomenon; impotence, urinary retention; dry mouth, constipation.
 4. Nursing implications
 - a. Monitor I&O, weight, and BP.
 - b. Monitor clients with a history of mental depression.
 5. Discharge teaching. Take last dose of medication in the evening to minimize drowsiness during the day.
- B. Related drugs. Methyl dopa (Aldomet): may cause blood dyscrasias and hepatotoxicity; monitor blood work and liver function tests.
- C. Prototype: alpha-adrenergic receptor blocker (prazosin [Minipress])

1. Action. Blocks alpha receptors in arterial smooth-muscle vasculature and mediates vasoconstriction.
2. Use. Essential hypertension and hypertension caused by pheochromocytoma.
3. Adverse effects. Postural hypotension and syncope with initial therapy; reflex tachycardia. See clonidine (Catapres).
4. Nursing implications. Monitor vital signs.
5. Discharge teaching
 - a. Take with food to reduce dizziness, light-headedness.
 - b. Take initial dose at bedtime to reduce effects of syncope.
 - c. Report sexual difficulties.
6. Related drugs
 - a. Doxazosin (Cardura)
 - b. Terazosin (Hytrin)
- D. Prototype: peripheral-acting antiadrenergic agents (reserpine [Serpalan])
 1. Action. Lowers BP by blocking norepinephrine in CNS and peripherally.
 2. Use. Rarely used due to its adverse effects and availability of other antihypertensives; agitated psychosis; essential hypertension with a diuretic; parenteral use to treat hypertensive emergencies.
 3. Adverse effects. Suicidal depression, drowsiness; nasal obstruction; increased incidence of breast cancer in women; impotence; decreased cardiac output, postural hypotension; diarrhea, increased gastric secretions.
 4. Nursing implications
 - a. Monitor for depression; obtain a mental health history for depression.
 - b. Assess for family history of breast cancer.
 - c. Administer with meals to reduce GI distress.
 - d. Monitor BP and I&O.
 - e. Rinse mouth or use hard candy for dry mouth.
 5. Related drugs. Guanethidine (Ismelin): antihypertensive agent rarely used due to its adverse effect; affects sympathetic nerve endings by releasing norepinephrine; and then interferes with release of norepinephrine; with initial use may see transient hypertension and elevated heart rate.
- E. Prototype: ACE inhibitor (angiotensin-converting enzyme inhibitor) (captopril [Capoten])
 1. Action. Lowers BP by inhibiting angiotensin-converting enzyme, which inhibits angiotensin II (vasoconstrictor) and indirectly reduces serum aldosterone levels.
 2. Use. Initial therapy of essential hypertension in clients with normal renal function; severe hypertension in clients with renal dysfunction; CHF.

3. Adverse effects. Blood dyscrasias; hypotension; proteinuria; hyperkalemia; rash; loss of taste perception.
 4. Nursing implications
 - a. Monitor CBC, electrolytes, and urinalysis.
 - b. Administer 1 hour before meals.
 5. Discharge teaching
 - a. Report fever, sore throat, and rash.
 - b. Use salt substitutes only if prescribed (many substitutes contain K+).
 6. Related drugs
 - a. Enalapril (Vasotec)
 - b. Lisinopril (Zestril)
 - c. Benazepril (Lotensin)
 - d. Fosinopril (Monopril)
 - e. Ramipril (Altace)
 - f. Losarten (Cozaar) and valsartan (Diovan): angiotensin II receptor blockers
- F. Prototype: direct-acting vasodilators (hydralazine [Apresoline])**
1. Action. Direct relaxation of arteriolar smooth muscle causing vasodilation.
 2. Use. Hypertension; parenteral hydralazine (Apresoline) is used in hypertensive emergencies.
 3. Adverse effects. Headache, dizziness, depression; tachycardia, angina, palpitations; lupus-like syndrome, rash, fever; weight gain, sodium retention; nausea, vomiting, anorexia.
4. Nursing implications
 - a. Monitor CBC, ANA titer, and LE preparation.
 - b. Clients receiving parenteral hydralazine (Apresoline) check BP and pulse every 5 minutes until stable while on parenteral agent.
 5. Related drugs
 - a. Minoxidil (Loniten)
 - 1) Has more adverse effects than hydralazine. May cause cardiac muscle lesions and hirsutism.
 - 2) Topical preparation (Rogaine) is available to treat baldness.
 - b. Nitroprusside (Nipride)
 - 1) Given IV to treat hypertensive emergencies.
 - 2) Should be administered in an infusion pump. IV tubing and container should be wrapped in aluminum foil to protect from light. VS, neuro checks, and I&O should be closely monitored.
 - c. Diazoxide (Hyperstat)
 - 1) Given IV to treat hypertensive emergencies.
 - 2) May cause hyperglycemia.
- See Table 2-17.

Table 2-17 Review of Antihypertensive Drugs

Drug	Action	Adverse Effects	Nursing Implications
Diuretics Thiazide diuretics Chlorothiazide (Diuril) Hydrochlorothiazide (Esidrex, Hydro Diuril, Oretic) Chlorthalidone (Hygroton) Metolazone (Zaroxolyn)	Block sodium reabsorption in ascending tubule of kidney; water excreted with sodium, producing decreased blood volume	Hyperuricemia, hyperglycemia, hypercalcemia, elevated BUN; hypokalemia, orthostatic hypotension, anorexia, nausea, vomiting, light-headedness, headache, drowsiness, rash	<ul style="list-style-type: none"> • Monitor I&O and observe for excessive diuresis. • Encourage client to make positional changes slowly to decrease occurrence of orthostatic hypotension. • Perform baseline and periodic determinations of electrolytes, BUN, uric acid, blood sugar, weight, and blood pressure. • If possible, administer in the morning to avoid nocturia. • Administer with food to minimize gastric distress. • Encourage inclusion of high-potassium foods in diet to decrease possibility of hypokalemia. Advise client to avoid high-sodium foods. • Stress the importance of taking the drugs regularly as prescribed.
Loop (High-Ceiling) diuretics Furosemide (Lasix) Ethacrynic acid (Edecrin) Bumetanide (Bumex)	Inhibit reabsorption of sodium and chloride at the proximal portion of ascending loop of Henle	Similar to thiazides but intensity differs. Hypocalcemia, hearing loss.	See above.

(continues)

Table 2-17 Review of Antihypertensive Drugs (continued)

Drug	Action	Adverse Effects	Nursing Implications
Potassium-sparing diuretic Spironolactone (Aldactone)	Antagonizes the effect of aldosterone on the tubular cells of the kidney; sodium excreted in exchange for potassium	Hyperkalemia, gynecomastia, hirsutism, irregular menses, rash, drowsiness or confusion	<ul style="list-style-type: none"> • Monitor I&O, blood pressure, and weight regularly. • Instruct client to be alert for signs of hyponatremia. • Inform client that swelling and tenderness of the breasts occur most often with prolonged therapy. • Monitor serum potassium levels daily during early stages of therapy. • Advise client to avoid excessive intake of potassium-rich foods.
Drugs acting on the CNS Methyldopa (Aldomet)	Metabolized into a false neurotransmitter displacing norepinephrine from its receptor sites; sympathetic activity reduced	Orthostatic hypotension, sedation, weakness, drowsiness, dry mouth, liver damage	<ul style="list-style-type: none"> • Advise slow positional changes and avoid prolonged standing in one position. • Inform client the drug may darken urine. • Advise client to observe for signs of liver dysfunction.
Clonidine (Catapres)	Stimulates alpha-adrenergic receptor in brain, causing inhibition of sympathetic vasoconstriction	Orthostatic hypotension, sedation, drowsiness, dry mouth, anxiety, depression	<ul style="list-style-type: none"> • Closely observe clients with prior history of mental depression because the drug may cause depressive episodes. • Advise slow positional changes. • Encourage client to dangle feet for a few minutes before standing.
Beta-Adrenergic Blockers Propranolol (Inderal) Nadolol (Corgard)	Reversible competitive blocking action at beta-adrenergic receptor sites. Results in decreased heart rate and force of contraction, slowed AV conduction, decreased plasma renin, and lowered blood pressure	Drowsiness, light-headedness, lethargy, cramping, nausea, and bradycardia	<ul style="list-style-type: none"> • Record I&O and client's weight and notify physician of any significant changes. • Advise client to rise slowly, avoid prolonged standing, and be careful when operating machinery. • Inform client that smoking may reduce effectiveness of drug. • Evaluate heart rate and rhythm before administration of the drug. • Warn client that alcohol may enhance the hypotensive effect of the drug. • Perform urinary protein estimates prior to therapy and at monthly intervals thereafter.
Drugs acting on renin-angiotensin system Captopril (Capoten) Enalapril (Vasotec)	Depresses the functioning of the renin-angiotensin-aldosterone mechanism by inhibiting angiotensin-converting enzyme (ACE) in the plasma	Rash, pruritus, proteinuria (mainly captopril), agranulocytosis (mainly captopril), excessive hypotension, blood dyscrasias	<ul style="list-style-type: none"> • Administer (captopril) one hour before meals. • Instruct client to report blood dyscrasias (sore throat, fever) and excessive hypotension (dizziness) and rashes immediately.
Vasodilators Hydralazine (Apresoline)	Direct relaxation of arteriolar smooth muscle producing decreased peripheral resistance	Headache, nausea, vomiting, diarrhea, sweating, palpitations, and tachycardia. Systemic lupus-like symptoms (high doses).	<ul style="list-style-type: none"> • Advise client that headache and palpitations may occur during early stages of therapy. • Perform periodic blood counts, LE cell preparations, and antinuclear antibody titer determinations. • Advise client to make positional changes slowly. • Observe clients receiving large amounts of hydralazine closely for signs of developing lupus-like reaction.



Sample Questions

- 98.** A client is started on prazosin (Minipress) 1 mg PO daily. Which client teaching instruction should the nurse stress?
1. Rise slowly from a lying or sitting position.
 2. Take the drug on an empty stomach.
 3. Force fluids to 2 liters/day.
 4. Take the medication in the morning.
- 99.** Which of the following should the nurse specifically assess for prior to clients starting on captopril (Capoten) therapy?
1. Depression.
 2. Renal dysfunction.
 3. Liver disease.
 4. Hyperglycemia.
- 100.** Which antihypertensive drug may be linked to breast cancer and may cause suicidal depression?
1. Guanethidine (Ismelin).
 2. Hydralazine (Apresoline).
 3. Reserpine (Serpalan).
 4. Clonidine (Catapres).
- 101.** Which of the following actions should the nurse take when administering nitroprusside (Nipride)?
1. Mix the solution in normal saline.
 2. Administer the drug by IV push.
 3. Monitor neuro checks and VS every hour.
 4. Wrap IV bottle and tubing with aluminum foil.
- 102.** Which side effect should the client be aware of when taking clonidine (Catapres)?
1. Anxiety.
 2. Diarrhea.
 3. Dry mouth.
 4. Irritability.



Answers and Rationales

- 98.** 1. As with most antihypertensives, initial therapy of prazosin (Minipress) may produce orthostatic hypotension; client should rise slowly.
- 99.** 2. Renal damage is an adverse response to captopril (Capoten) that is more apt to occur in clients with renal dysfunction.
- 100.** 3. Reserpine (Serpasil) has been known to cause suicidal depression; an increased incidence of breast cancer has also been noted with this drug.
- 101.** 4. Nitroprusside (Nipride) is sensitive to light and becomes less active; therefore the IV tubing and container should be covered.
- 102.** 3. Clonidine (Catapres) can cause dry mouth due to decreased salivary flow.



Renal Drugs

DIURETICS

- A.** Prototype: thiazide diuretics (hydrochlorothiazide (HCTZ) [Hydrodiruill])
1. Action. Blocks sodium reabsorption in the distal convoluted tubule, which prevents water reabsorption, increases urine output, and decreases blood volume. Potassium is also excreted.
 2. Use. Essential hypertension; edema associated with CHF.
 3. Adverse effects. Hypokalemia, hyponatremia; drowsiness; hyperglycemia; photosensitivity, hypersensitivity: thiazides are chemically related to sulfonamides; orthostatic hypotension, arrhythmias; anorexia, nausea, vomiting, diarrhea; agranulocytosis.
- 4.** Nursing implications
Monitor I&O, weights, and serum electrolytes, glucose, and BUN.
- 5.** Discharge teaching
- a. Take medication in the early morning and after meals to prevent GI distress.
 - b. Report symptoms of agranulocytosis such as fever, sore throat.
 - c. Change positions slowly.
 - d. Eat foods high in potassium (i.e., oranges, bananas, strawberries).
 - e. Take daily weights.

B. Related drugs

1. Metolazone (Zaroxolyn)
2. Chlorothiazide (Diuril)
3. Chlorthalidone (Hygroton)
4. Bendroflumethiazide (Naturetin)

- b. Monitor CBC, serum and urine electrolytes, BUN, blood glucose, uric acid.
 - c. Monitor VS closely when client receiving IM or IV administration. Client should be switched to oral preparation when practical.
 - d. IM injection is painful; use Z-track technique.
 - e. Infusion rate must be closely monitored. Should not be more than 4 mg per minute.
 - f. Elderly require close monitoring during active diuresis. Watch for fluid and electrolyte imbalances.
 - g. Monitor I&O.
 - h. Weigh client daily.
 - i. Monitor for hearing loss.
 - j. Monitor clients with diabetes closely.
 - k. Tablets slightly discolored are still considered potent; discolored parenteral solutions should be discarded.
 - l. Compatible with 5% dextrose in water, sodium chloride, and lactated Ringer's; use solution mixed with furosemide (Lasix) within 24 hours.
5. Discharge teaching
- a. Take dose early in day to avoid nocturia.
 - b. Usually allowed liberal salt intake; consult physician.
 - c. Caution client about orthostatic hypotension if on high dose of furosemide (Lasix) or on other antihypertensive agents.
 - d. Needs diet high in potassium and maybe a potassium supplement.
 - e. Stay out of the sun and use sunscreen.
6. Related drugs. Ethacrynic acid (Edecrin) and bumetanide (Bumex) are similar to furosemide (Lasix). Both drugs are used for treating edema and can be given orally and parenterally.



Sample Questions

103. Which statement by the client indicates that she needs more client teaching in regard to hydrochlorothiazide (Hydrodiuril) therapy?

1. "I will take my medication with orange juice."
2. "I will take my medication before going to bed."
3. "I will take my medication after meals."
4. "I will notify the physician if I have a sore throat."



Answers and Rationales

103. 2. Taking hydrochlorothiazide (Hydrodiuril) before going to bed may cause nocturia and interrupted sleep. The client needs to be taught to take the medication in the morning as the diuretic effect begins in 2 hours and peaks in 4 hours.

DIURETICS (CONTINUED)

C. Prototype: loop diuretics (furosemide [Lasix])

1. Action. Acts by inhibiting reabsorption of sodium and chloride at the proximal portion of the ascending loop of Henle, increasing water excretion. This drug is considered to be potent.
2. Use. Hypertension, pulmonary edema, edema seen with congestive heart failure, cirrhosis, and renal disease.
3. Adverse effects. Fluid and electrolyte imbalances: hypokalemia, hypochloremic alkalosis, hyperuricemia, hyponatremia, hypocalcemia, hypomagnesemia, hyperglycemia; nausea, vomiting, anorexia, constipation; diarrhea in children given high doses with sorbitol as the vehicle; jaundice, acute pancreatitis; polyuria, nocturia, urinary bladder spasm; dizziness, paresthesias, headache, blurred vision, irreversible hearing loss; leukopenia, anemia; orthostatic hypotension, cardiac arrhythmias; muscle spasms; photosensitivity, rash, pruritus.
4. Nursing implications
 - a. Can take with food.



Sample Questions

104. Which group of clients needs special monitoring by the nurse while receiving furosemide (Lasix) therapy?
1. Premature infants.
 2. Client with diabetes.
 3. Client with asthma.
 4. Clients with peripheral vascular disease (PVD).



Answers and Rationales

104. 2. Furosemide (Lasix) can cause hyperglycemia. Clients with diabetes need close monitoring of urine and blood glucose while on furosemide therapy.

DIURETICS (CONTINUED)

D. Prototype: carbonic anhydrase inhibitors (acetazolamide [Diamox])

1. Action. Promotes renal excretion of sodium, potassium, bicarbonate, and water via reduction of hydrogen ion secretion in the renal tubule cells of the kidney.
2. Use. Adjunct in treating congestive heart failure; adjunct in treating open-angle glaucoma to decrease intraocular pressure; acute mountain sickness; epilepsy.
3. Adverse effects. Nausea, vomiting, anorexia, melena, constipation; hematuria, renal colic, renal calculi, crystalluria; liver damage; fatigue, nervousness, drowsiness, dizziness, depression, headache, tremor, convulsions; transient myopia; bone marrow depression; urticaria, pruritus, rash, photosensitivity; weight loss, fever, acidosis; increased excretion of calcium, potassium, magnesium, and sodium; hyperglycemia; hyperuricemia.
4. Nursing implications
 - a. Can be taken with food.
 - b. Tablets (regular only, not sustained-release) can be crushed or dissolved in hot water. Will not dissolve in fruit juice.
 - c. Give in morning to avoid interrupting sleep.
 - d. Avoid IM route; alkalinity of solution causes pain.
 - e. Monitor clients for metabolic acidosis.
 - f. Monitor I&O and weight when using drug for edema.
 - g. Maintain fluid intake to prevent kidney stones.
 - h. Many adverse effects are dose related.
 - i. Monitor diabetic clients.
 - j. Potassium loss greatest in early treatment.
 - k. Observe for signs of hypokalemia; those at high risk for this are clients receiving other diuretics or digitalis glycosides, and the elderly.
 - l. Client may need a potassium supplement.
 - m. Monitor serum electrolytes, blood gases, urinalysis.
 - n. Parenteral solution should be used within 24 hours after reconstitution.
5. Discharge teaching
 - a. Do not interchange brands without asking physician.
 - b. Avoid excess salt intake.
 - c. Report any adverse effects.
 - d. Do not drive or perform other activities if experiencing CNS effects.
 - e. If taken in high doses or for long periods of time, client will need a diet high in potassium.

E. Prototype: potassium-sparing diuretics (spironolactone [Aldactone])

1. Action. Acts by blocking aldosterone receptors in the kidney tubule, thus causing excretion of water and sodium and potassium retention.

2. Use. Primary hyperaldosteronism; edema; treatment and prevention of hypokalemia; essential hypertension.
3. Adverse effects. Hyperkalemia; hyponatremia; gynecomastia; thirst, dry mouth, diarrhea; impotence, irregular menses, hirsutism; headache, dizziness, drowsiness, confusion; rash, urticaria.
4. Nursing implications
 - a. Give with food.
 - b. Tablet can be crushed.
 - c. Monitor serum electrolytes.
 - d. Diuretic effect may take until third day of therapy and may last 2–3 days after drug is stopped.
 - e. Monitor I&O and check for edema.
 - f. Weigh client daily.
 - g. Monitor blood pressure.
 - h. Adverse effects usually reversible if drug discontinued.
5. Discharge teaching
 - a. Teach signs of electrolyte imbalance and when to report.
 - b. Consult physician concerning potassium and sodium intake. Usually client should avoid a high-potassium diet.
6. Related drugs
 - a. Triamterene (Dyrenium): prevents sodium reabsorption in the distal tubule of the kidney, which causes retention of potassium and sodium and water. It is used to treat edema, hypertension, and hypokalemia. Adverse effects: hyperkalemia, renal calculi, nausea, vomiting, anorexia, diarrhea, headache, fatigue, rash, photosensitivity, and blood dyscrasias. Nursing implications: give the drug with food to decrease GI upset; give the drug in the morning, monitor I&O, body weight, serum electrolytes, and BUN; client should avoid foods high in potassium.
 - b. Amiloride (Midamor): resembles triamterene. The biggest difference is that it is much more potent than triamterene.

F. Prototype: osmotic diuretics (mannitol [Osmitol])

1. Action. Acts by increasing the osmotic pressure of the glomerular filtrate inside the renal tubules. This causes less reabsorption of fluid and electrolytes by the tubules and increased loss of fluid, chloride, and sodium.
2. Use. Prevention and treatment of acute renal failure; reduction of intracranial pressure; reduction of intraocular pressure; urinary excretion of drug overdoses.
3. Adverse effects. Nausea, anorexia, thirst; diuresis, urinary retention; dizziness, headache, convulsions; pulmonary

congestion; tachycardia, chest pain, high or low blood pressure; metabolic acidoses; hypokalemia, hyponatremia, hypochloremia, dehydration.

4. Nursing implications
- Test dose given to clients with advanced oliguria.
 - Monitor serum and urine electrolytes, central venous pressure, and renal function.
 - Accurate I&O every 30 minutes.
 - Monitor VS.
 - Monitor for signs of electrolyte imbalance.
 - Weigh client daily.
 - Avoid extravasation.
 - Drug may crystallize if exposed to low temperatures. Warm solution to dissolve crystals.
 - Solutions above 15% have tendency to crystallize. IV filter must be used for infusing solutions 15% and above.



Sample Questions

105. A client is receiving mannitol. The nurse is aware that mannitol will help to decrease what condition?
- Hypertension.
 - Hyperkalemia.
 - Peripheral edema.
 - Increased intracranial pressure.



Answers and Rationales

105. 4. Mannitol is used primarily in the treatment of intracranial pressure, but also to treat acute renal failure, where rapid reduction of pressure and volume is required.

POTASSIUM-REMOVING RESIN

- A. There is one drug in this category, sodium polystyrene sulfonate (Kayexalate).
- B. Characteristics of polystyrene sulfonate (Kayexalate)
- A resin that exchanges sodium ions for potassium ions in the large intestine.
 - Used in the treatment of hyperkalemia.
 - Given orally or rectally via high enema to both adults and children.
 - Nursing implications
 - Retain rectal suspension for at least 30–60 minutes.
 - Monitor for electrolyte deficiency.
 - Hypokalemia can occur.
 - Magnesium and calcium can also be lost.
 - Sodium may be retained.
 - Constipation can occur with oral administration.
 - Rectal administration helps prevent constipation.
 - Mix resin with sorbitol and water (never with oil).
 - Stop administration when serum potassium is 4–5 milliequivalents.



Respiratory Drugs

ANTI-ASTHMATIC DRUGS

- A. Prototype: theophylline
- Action. Classified as a methylxanthine; a bronchodilator that relaxes the bronchial smooth muscle cells. It also increases renal blood flow, thus producing a diuretic effect, and acts as a CNS stimulant.
 - Use. Emphysema; chronic bronchitis; asthma; CHF.
 - Adverse effects. CNS stimulation: irritability, nervousness, restlessness (*Note: children are*

more susceptible to developing CNS stimulation effects); tachycardia, hypotension, palpitations (*Note: shouldn't be used in clients with cardiovascular disease*); tachypnea, flushing; nausea, vomiting, GI distress (*Note: should not be used in clients with peptic ulcer disease or hyperthyroidism*); rectal irritation with rectal suppository use.

4. Nursing implications
- Monitor theophylline levels (10–20 mcg/mL).
 - Monitor vital signs and symptoms of toxicity.

- c. Clients who smoke tobacco and marijuana require higher doses of theophylline.
 - d. Administer with milk or meals if GI distress is present, otherwise give 1–2 hours before meals with water.
5. Discharge teaching
- a. Consult with the physician before taking OTC drugs.
 - b. Avoid excessive caffeine use.
 - c. Do not crush or chew time-released or enteric-coated preparations.
- B. Related drugs (See prototype: theophylline for adverse effects)
1. Aminophylline (Somophyllin)
 - a. Can be given PO, rectal, IV, or IM.
 - b. IM injection is painful and generally avoided.
 - c. IV infusion should not exceed 25 milligrams per minute.
 - d. Vital signs should be monitored.
 - e. Often used to treat severe bronchoconstriction.
 - f. Avoid mixing with other medications as it is incompatible with many medications.
 2. Theo-dur
 3. Slow-Bid
 4. Quibron-T
 5. Elixophylline

All of the above are derivatives of theophylline. Note: they are less potent than theophylline and dosage adjustments may be needed.

- C. Prototype: cromolyn sodium (Intal, Nasalcrom)
1. Action. Acts on lung mucosa to prevent histamine release. Classified as a mast cell stabilizer.
 2. Use. Prophylactically to reduce the number of asthmatic attacks. It is not used in the treatment of acute asthmatic attacks; to treat allergic rhinitis; ophthalmically to treat allergic disorders.
 3. Adverse effects. Bronchoconstriction; cough; nasal congestion; rash.
 4. Discharge teaching
 - a. Proper use of inhaler
 - 1) With spinhaler place capsule in container and exhale fully.
 - 2) Place mouthpiece between lips.
 - 3) Tilt head back.
 - 4) Inhale deeply and rapidly to cause the propeller to turn.
 - 5) Remove the inhaler.
 - 6) Hold breath a few seconds.
 - 7) Slowly exhale.
 - b. Capsules should not be swallowed or opened.

- c. Rinsing or gargling may reduce irritation in the mouth.
 - d. Discontinue use if an allergic reaction occurs.
- D. Leukotriene inhibitors: Zileuton (Zyflo), zafirlukast (Accolate), and montelukast (Singulair), used to prevent asthma attacks.



Sample Questions

106. Which statement by a client's mother best indicates her understanding of the use of cromolyn sodium?
1. "I will have him take this medication during an asthma attack."
 2. "I will open the capsule and dilute it in juice."
 3. "I will tell him to take a puff of medication upon exhalation."
 4. "I will have him use this medication to prevent asthma attacks."
107. Which adverse effect should a client's mother be alert for when administering theophylline?
1. Drowsiness.
 2. Irritability and restlessness.
 3. Constipation.
 4. Bradycardia.
108. Which of the following fluids should be avoided while taking theophylline?
1. Ginger ale.
 2. Apple juice.
 3. Hot chocolate.
 4. Milk.
109. The client's mother asks the nurse the purpose of offering theophylline. What is the nurse's best response?
1. "This drug decreases inflammation in the bronchi."
 2. "Theophylline's antihistamine effect will counteract bronchospasm."
 3. "This drug will help to facilitate removal of secretions."
 4. "Theophylline dilates the bronchial tree and will make breathing easier."



Answers and Rationales

106. **4.** Cromolyn sodium is effective in preventing asthma attacks because it prevents histamine release.
107. **2.** Irritability and restlessness are symptoms of CNS stimulation, which could lead to seizures. Children are very prone to CNS stimulation with this drug.
108. **3.** Hot chocolate contains caffeine, which can further increase CNS effects of theophylline.
109. **4.** Theophylline dilates the smooth muscle cells in the bronchi, which enhances breathing and counteracts bronchial constriction.

ANTIHISTAMINES

- A.** Antihistamines reduce histamine activity by blocking histamine receptor sites. They act within 15–30 minutes after administration but are eliminated slowly from the body. Antihistamines are used to suppress symptoms of histamine release in allergy. Other uses of antihistamines include rhinitis, colds, motion sickness, vertigo, Parkinson's disease, and as a sleep aid. It is important to remember to administer any antihistamine before an allergy attack to prevent histamine from occupying receptor sites and thus decreasing the severity of the attack. There are a few classes of drugs that contain antihistamine properties. Sedation is the most common adverse effect of antihistamines. Paradoxical excitation has been seen in children taking these drugs, and symptoms such as dizziness, confusion, sedation, and hypotension are seen in the elderly. There are also anticholinergic effects from antihistamines, which include dry nose, mouth, and throat; urinary retention; constipation; tachycardia; and blurred vision.
- B.** Chlorpheniramine maleate (Chlor-Trimeton): given PO, IM, SC, and IV. Available in a sustained-release form. There are increased depressant effects if taken with alcohol or other CNS depressants. Give oral forms with food if GI upset occurs.
- C.** Diphenhydramine HCl (Benadryl): given PO, IM, and IV. IM should be given deeply in a large muscle mass. Hypersensitivity reactions occur more with parenteral administration than with PO. Related drugs: Clemastine (Tavist) and dimenhydrinate (Dramamine).
- D.** Promethazine HCl (Phenergan): given PO, IM, rectally, and IV. Can be taken with food. Oral

administration for allergy usually given before meals (ac) or at bedtime (hs) as a single dose. Monitor respiratory function especially in children as drug can suppress cough reflex and thicken bronchial secretions. Can cause photosensitivity.

- E.** Second generation non-sedating antihistamines
1. Desloratadine (Clarinet)
 2. Fexofenadine (Allegra)
 3. Cetirizine (Zyrtec)



Sample Questions

110. What would the nurse teach the client to do to lessen the sedation effects of antihistamines?
1. Increase caffeine intake during the day.
 2. Take the antihistamine when going to bed.
 3. Take the antihistamine with a vitamin.
 4. Have a 2-hour nap in the morning and afternoon.
111. What is an adverse effect that is seen more often in children than adults who are taking antihistamines?
1. Dizziness.
 2. Dry mucous membranes.
 3. Constipation.
 4. CNS excitement.



Answers and Rationales

110. **2.** The sedation effects of antihistamines will be decreased if the client takes the drug at bedtime.
111. **4.** A side effect of antihistamines that is seen more commonly in children than adults is excitation of the central nervous system.

MUCOLYTICS

- A.** Acetylcysteine (Mucomyst)
1. Action. Reduces the viscosity of mucus in the bronchial tree.
 2. Use. Cystic fibrosis; acute and chronic bronchopulmonary diseases such as pneumonia, bronchitis, and emphysema; acetylcysteine is the antidote for acetaminophen (Tylenol) overdose.

3. Adverse effects. May cause bronchospasm in asthmatic clients and should be discontinued; stomatitis, nausea, vomiting.
4. Nursing implications
 - a. Suction equipment should be readily available.
 - b. Has a foul odor of “rotten eggs.”
 - c. Should rinse mouth after treatment.



Sample Questions

112. Which of the following should be available for clients receiving acetylcysteine?
1. A glass of water.
 2. Tracheostomy set-up.
 3. Suction set-up.
 4. Room deodorizer.



Answers and Rationales

112. 3. Acetylcysteine (Mucomyst) can cause an outpouring of copious secretions, which may cause gagging. Suction may be needed to facilitate the removal of secretions to prevent aspiration.

EXPECTORANTS AND ANTITUSSIVES

A. Expectorants

1. Expectorants reduce the viscosity of bronchial secretions, which allows for their removal from the lungs. They are used in the management of cough associated with the common cold and in the treatment of bronchitis.
2. Guaifenesin (Robitussin): can be given to adults and children. It increases the respiratory tract fluid thus reducing viscosity of secretions. It is the most frequently used OTC expectorant medication. Client should be told to increase fluid intake and add humidification. A common adverse effect is gastric upset, which is caused by its stimulatory effect on gastric secretions.
3. Terpin hydrate elixir: directly stimulates the bronchial secretory glands. Is often used as a vehicle for other cough medications. Terpin hydrate has a high alcohol content and shouldn't be given to alcoholics. Also shouldn't be given to children under 12 years.

B. Antitussives

1. Antitussives are given to reduce the force and amount of coughing. They can act centrally by suppressing the cough center in the brain or peripherally to reduce the susceptibility of irritant receptors to activity. Some antitussives contain narcotics. The antitussives are given for the symptomatic relief of nonproductive cough.
2. Dextromethorphan (Benlyn DM, Pertussin): This is the most frequently used non-narcotic antitussive. Because of its safety record, it is used for children as well as adults. Common adverse effects are dizziness, drowsiness, and nausea. It shouldn't be given to clients receiving MAO inhibitors.
3. Codeine: Due to its addicting capabilities, it should be given in the smallest dose possible to decrease adverse effects and tolerance. The client needs to be watched for signs of dependency. Common adverse effects are nausea, vomiting, and constipation. Encourage clients to increase fluid intake and take a laxative if constipation occurs. Provide for client safety due to codeine's sedative effects. If the client is taking other CNS depressants with codeine, there is an increased chance of CNS effects. Respiratory depression occurs at high doses. Observe respiratory rate and use cautiously in clients with asthma or emphysema.



Sample Questions

113. Which of the following points should be made regarding guaifenesin by the nurse?
1. Guaifenesin has a high incidence of adverse effects.
 2. Increase fluid intake to help liquefy and loosen secretions while taking guaifenesin.
 3. Guaifenesin has a high alcohol content.
 4. This drug can cause blood glucose level to rise.
114. In which situation would the use of an antitussive be inappropriate?
1. The client's cough is interfering with eating meals.
 2. The client's cough is associated with a suppurative lung disorder.
 3. The client's cough is the source of a complication such as a rib fracture.
 4. The client's cough is irritating to the respiratory tract.

115. Which adverse effect is associated with the use of high doses of codeine as an antitussive?
1. Diarrhea.
 2. Nasal congestion.
 3. Respiratory depression.
 4. Skin rash.

114. 2. An antitussive is not appropriate for a client with lung disease accompanied by increased sputum as pneumonia or atelectasis could occur.
115. 3. Respiratory depression is an adverse effect associated with use of codeine. It is a life-threatening effect.



Answers and Rationales

113. 2. Clients taking guaifenesin (Robitussin) need to increase fluid intake daily to help thin and loosen secretions. This allows the drug to be more effective.



Gastrointestinal Tract Drugs

HISTAMINE (H₂) ANTAGONISTS

A. Prototype: cimetidine (Tagamet)

1. Action. Decreases stomach acidity by impeding the action of histamine. Competes with histamine for occupancy of histamine (H₂) receptor sites on the parietal cells in the stomach and suppresses the release of gastric acid.
2. Use. Short-term treatment of active duodenal ulcer and benign gastric ulcer; decreased dose after ulcer has healed to inhibit reappearance; pathologic hypersecretory conditions, e.g., Zollinger-Ellison syndrome.
3. Adverse effects. Diarrhea, muscle pain, rash; CNS effects of dizziness, confusion, drowsiness, headache; changes in liver function studies; agranulocytosis and neutropenia; antiandrogenic effects (impotence and gynecomastia).
4. Nursing implications
 - a. Oral form should be taken with meals.
 - b. Antacids decrease absorption; give antacid 1 hour before or after administration.
 - c. Usual course of treatment for ulcer disease is 4–6 weeks.
 - d. Many drug interactions.
 - e. Watch for CNS changes particularly in the elderly as confusion is a major toxic effect.
 - f. Use cautiously with clients who have impaired renal or hepatic function.
 - g. Monitor CBC and liver function studies.

5. Discharge teaching. Smoking decreases effectiveness of cimetidine.

6. Related drugs. See Table 2-18.

B. Proton pump inhibitors

1. Prototype: omeprazole (Prilosec)
 2. Used to decrease gastric acid concentration in peptic ulcer and gastroesophageal reflux disease.
 3. Nursing implications
 - a. Do not chew, crush, or open capsule.
 - b. Can be administered with antacids.
 4. Related drugs. Esomeprazole (Nexium), lansoprazole (Prevacid), pantoprazole (Protonix), rabeprazole (Aciphex).
- C. Peptic ulcers caused by *Helicobacter pylori* are commonly treated with a combination of two antibiotics, a bismuth compound and a histamine antagonist or proton pump inhibitor.

Table 2-18 Other H₂ Antagonists

Drug	Nursing Implications
Ranitidine (Zantac)	<ul style="list-style-type: none"> • Avoid administration of antacids at same time. • Hemodialysis may reduce Zantac blood levels.
Famotidine (Pepcid)	<ul style="list-style-type: none"> • May be given with antacid dose. • Dosage modifications not necessary in elderly except with renal impairment.
Nizatidine (Axid)	<ul style="list-style-type: none"> • Can elevate serum salicylate levels in clients taking high doses of aspirin.



Sample Questions

- 116.** What is the primary action of cimetidine?
1. Suppresses the action of acetylcholine at the receptor responsible for histamine release.
 2. Decreases the pH of gastric fluids.
 3. Antagonizes the action of histamine at its H₂ receptor site.
 4. Neutralizes gastric secretions.
- 117.** An antacid is ordered in conjunction with the cimetidine. What instruction should the nurse give concerning concurrent use of an antacid with cimetidine?
1. Take both drugs together.
 2. Take both drugs with milk.
 3. Take both drugs with meals.
 4. Take the drugs 1 hour apart.
- 118.** Which statement made by the client best indicates his understanding of cimetidine therapy?
1. "I will stop taking cimetidine when my stomach pain is gone."
 2. "I will stop smoking."
 3. "I will take cimetidine on an empty stomach."
 4. "I know that cimetidine will turn my stools black."
- 119.** In elderly clients taking cimetidine, which adverse effect should the nurse be most concerned with?
1. Confusion.
 2. Diarrhea.
 3. Muscle pain.
 4. Constipation.



Answers and Rationales

- 116. 3.** Cimetidine (Tagamet) competes with histamine for occupancy of histamine (H₂) receptor sites on the parietal cells in the stomach.
- 117. 4.** Antacids decrease cimetidine absorption.

- 118. 2.** Smoking decreases the effectiveness of cimetidine (Tagamet) and is also contraindicated in ulcer disease.
- 119. 1.** Confusion is a major toxic effect in the elderly.

GASTROINTESTINAL (GI) ANTICHOLINERGICS

With the advent of H₂ antagonists, gastrointestinal anticholinergics are rarely used. H₂ antagonists have a more prolonged action and fewer side effects, and are considered more effective in treating gastric ulcers. Gastrointestinal anticholinergics delay gastric emptying time, which prolongs the action of antacids.

ANTACIDS

- A.** There are five antacid categories with the same action of neutralizing gastric acid. There are significant differences among each of the five categories; therefore, no individual antacid is considered a prototype. The categories are displayed in Table 2-19: magnesium, compounds of aluminum, sodium, calcium, alkaline, or a combination.
1. Use. Control ulcer pain; peptic ulcer; esophageal reflux; prophylaxis for Curling's ulcer.
 2. Nursing implications for all antacids
 - a. Shake liquid antacids prior to use.
 - b. Liquids tend to be more effective than tablets.
 - c. Tablets must be chewed completely before swallowing.
 - d. Take a sip of water following antacid administration to ensure passage to the stomach.
 - e. Large amounts of water will dilute the antacid.
 - f. Aluminum and magnesium combinations to reduce the side effects of diarrhea and constipation.
 - g. Do not take other oral drugs within 1–2 hours of an antacid.
 - h. Can interfere with the intended response of enteric-coated medications.
- B.** See Table 2-19 for categories and adverse effects.

Table 2-19 Antacids

Drug Categories	Adverse Effects	Nursing Implications
Magnesium-containing antacids Magnesium Hydroxide (Milk of Magnesia)	Diarrhea	<ul style="list-style-type: none"> • Doses greater than 1.5 mL may have a laxative effect. • Contraindicated in clients with renal failure. • Monitor for symptoms of hypermagnesemia, CNS changes, hypotension, nausea, vomiting.
Aluminum-containing antacids Aluminum Hydroxide (Amphogel)	Constipation	<ul style="list-style-type: none"> • Check serum for hypophosphatemia. • Monitor for fecal impaction and intestinal obstruction in elderly. • Aluminum can accumulate in CNS causing toxic effects; not given over a long period of time.
Sodium Carbonate/Bicarbonate Dihydroxyaluminum Sodium Carbonate (Rolaids)	Constipation, sodium retention	<ul style="list-style-type: none"> • Must chew tablet. • Not for long-term use.
Sodium Bicarbonate (Baking Soda)	Systemic alkalosis, bloating, sodium retention	<ul style="list-style-type: none"> • Contraindicated in congestive heart failure, hypertension, or sodium-restricted diets. • Monitor for milk-alkali syndrome, nausea, vomiting, headache, hypercalcemia, hypercalciuria, hypophosphatemia.
Calcium Carbonate (Tums, Maalox)	Acid rebound, milk-alkali syndrome, hypercalcemia, constipation	<ul style="list-style-type: none"> • Monitor for milk-alkali syndrome. • Not to be taken with milk or foods high in vitamin D.
Aluminum Magnesium combinations Magaldrate (Riopan)	Constipation or diarrhea, hypermagnesemia	<ul style="list-style-type: none"> • Other common antacids in this group are Maalox, DiGel, Gelusil. • Use cautiously in clients with impaired renal function and monitor magnesium levels.

Sample Questions

120. Which antacid is LEAST LIKELY to cause adverse effects?
1. Magnesium hydroxide (Milk of Magnesia).
 2. Aluminum hydroxide (Amphogel).
 3. Aluminum/magnesium combination (Maalox).
 4. Calcium carbonate (Tums).
121. What is one of the first effects that the nurse will tell the client to expect from taking Maalox?
1. Constipation.
 2. Decrease of gastric acid secretions.
 3. Alleviation of burning pain.
 4. Diarrhea.

Answers and Rationales

120. **3.** Antacid combinations containing aluminum and magnesium have reduced adverse effects as aluminum antacids cause constipation and magnesium antacids cause diarrhea.
121. **3.** Antacids such as Maalox neutralize gastric acidity, thus reducing pain. Constipation and diarrhea are adverse effects with antacids and may be decreased when taking a combination antacid acid such as Maalox.

ANTIDIARRHEAL AGENTS

- A. Antidiarrheal agents slow intestinal motility and propulsion. There are two categories of drugs to treat diarrhea.
1. Absorbents: act by binding drugs, digestive enzymes, toxins, bacteria which may be causing diarrheal condition.

2. Opiates: act by reducing the propulsive movement of small intestine and colon, causing dehydration of intestinal contents.
- B. Related drugs. See Table 2-20.



Sample Questions

122. The physician orders Lomotil 5 mg PO QID for diarrhea. What adverse effect of Lomotil must the nurse be alert for?
1. Urinary retention.
 2. Decreased peristalsis.
 3. Tinnitus.
 4. Diarrhea.
123. A client's daughter mentions to the nurse that her 6-year-old son often takes Pepto-Bismol for an upset stomach. What potential problem should the nurse reinforce that Pepto-Bismol could cause in children?
1. Interacts with multivitamins.
 2. Will cause anorexia.
 3. Has an antibiotic effect.
 4. Contains salicylate.



Answers and Rationales

122. 1. Lomotil contains atropine, which is an anticholinergic that can cause urinary retention.
123. 4. Pepto-Bismol contains small amounts of salicylate. Salicylates are connected with Reye's syndrome and are not recommended in children under the age of 18.

LAXATIVES

- A. Prototype: Laxatives either stimulate or change the consistency of stools. Five of the most common categories of laxatives are used to induce 1 or more bowel movements per day.
1. Use. Promote movement of feces through the bowel to prevent/treat constipation, prevent straining during defecation, or for preparation before diagnostic tests/surgery.
 2. Saline cathartics attract and hold large amounts of fluids thereby increasing the bulk of stools. The nurse needs to encourage fluid intake to prevent dehydration.

Table 2-20 Antidiarrheals

Category	Drug	Adverse Effects	Nursing Implications
Adsorbent	Bismuth subsalicylate (Pepto-Bismol)	Salicylate poisoning, impaction, darkening of stool and tongue	<ul style="list-style-type: none"> • Over-the-counter (OTC) preparation • Use cautiously with aspirin or other aspirin-containing drugs
	Kaolin and Pectin (Kaopectate)	Constipation, fecal impaction	<ul style="list-style-type: none"> • OTC preparation • Regular and concentrated suspensions • Extended use can cause disruption of nutrient absorption in body.
Opiate	Loperamide Hydrochloride (Imodium)	Toxic megacolon in clients with ulcerative colitis; drowsiness, dizziness, abdominal discomfort, constipation	<ul style="list-style-type: none"> • Synthetically related to meperidine (Demerol) • Shouldn't be taken together with other CNS depressants • Treat overdose with slurry of activated charcoal and watch for CNS depression.
	Diphenoxylate Hydrochloride with Atropine (Lomotil)	Sedation, flushing, palpitations, blurred vision, dry mouth, urinary retention	<ul style="list-style-type: none"> • Withhold in severe dehydration or electrolyte imbalance • Addiction possible in high doses and with prolonged use
	Opium Tincture (Paregoric)	Respiratory depression, physical and psychological dependence, mental impairment	<ul style="list-style-type: none"> • Reduced dose for elderly and clients with respiratory problems • Safety precautions • Give with 2–3 swallows of water to ensure passage to stomach

Table 2-21 Laxatives

Category	Drug	Adverse Effects	Nursing Implications
Saline	Magnesium citrate (Citroma)	Hypermagnesia in renal failure, nausea	<ul style="list-style-type: none"> • Laxation in 2–6 hrs • Available in effervescent form • Most effective on empty stomach and followed with a glass of water
	Magnesium hydroxide (Milk of Magnesia)	See magnesium citrate	<ul style="list-style-type: none"> • Lower doses act as antacid • Shake bottle before taking
	Glycerin (Glycerol)	Abdominal cramps, rectal discomfort	<ul style="list-style-type: none"> • Evacuation occurs in 15–30 minutes after enema/suppository
Bulk-forming	Methylcellulose (Citrucel, Cologel)	Fecal impaction, esophageal obstruction, nausea	<ul style="list-style-type: none"> • Laxation in 12–72 hrs • Take with 1 glass of water to prevent fecal impaction • Must not chew tablet form or take in dry powder form as it may cause esophageal obstruction
	Psyllium hydrophilic muciloid (Metamucil)	Same as above	Same as above
Lubricant	Mineral oil	Impairs absorption of fat-soluble vitamins and nutrients, lipid pneumonia	<ul style="list-style-type: none"> • Administer in an upright position • Do not take with meals, first given in evening • Retention enema is usually followed by a cleansing enema • Keep in refrigerator
Stool softener	Ducosate sodium (Colace)	Rare: rash, abdominal cramps	<ul style="list-style-type: none"> • Effective in 12–72 hrs • Take with plenty of fluids • Use caution with clients on sodium-restricted diets
Stimulant	Bisacodyl (Dulcolax)	Rare	<ul style="list-style-type: none"> • Effect in 12 hr PO, and 15 min.–1 hour in rectal form • PO drug given before breakfast or at bedtime • Do not take tablets within 1 hour of antacid or milk administration
	Cascara Sagrada	Large doses can cause hypokalemia, glucose intolerance, calcium deficiency, anorexia	<ul style="list-style-type: none"> • Could discolor urine • Effect in 6–12 hrs • Prolonged use can cause rebound constipation
	Castor oil (Emulsoil, Neoloid)	Rebound constipation, abdominal cramps, nausea, vomiting	<ul style="list-style-type: none"> • Effect in 2–3 hrs • Do not schedule within 2 hours of taking other oral drugs • Shake emulsion well • Give with juice or carbonated beverage to mask castor oil's unpleasant odor and taste
	Phenolphthalein (Ex-Lax, Feen-a-Mint, Correctol)	Rash, lupus-like syndrome	<ul style="list-style-type: none"> • Effect in 6–8 hrs • Urine/feces may have reddish discoloration • Usually given at bedtime • Effect could last 3–4 days • Discontinue if rash occurs
	Senna (Senokot)	Abdominal cramps, nausea	<ul style="list-style-type: none"> • Laxation in 6–10 hrs • Administer at bedtime • Urine/feces may have yellowish-brown or reddish-brown discoloration

3. Bulk-forming laxatives increase the bulk of the feces by stimulating mechanical peristalsis and are considered the safest of all the laxative groups.
 4. Lubricant laxatives coat the feces with an oil film and prevent the colon from reabsorbing water from the feces.
 5. Stool softeners prevent straining during defecation and prevent constipation by decreasing surface tension of feces.
 6. Stimulant laxatives stimulate peristalsis.
 7. Should not be given to clients with symptoms of nausea, vomiting, abdominal pain, symptoms of appendicitis, or intestinal obstruction.
 8. Used for a week or less to prevent rebound constipation and dependence.
 9. Appropriate fluid intake and a diet high in fiber will help promote proper bowel function.
- B. Related drugs. See Table 2-21.

Sample Questions

124. What group of laxatives would the nurse tell the client is considered the safest and most natural?
 1. Saline-cathartics group.
 2. Lubricant-laxative group.
 3. Stool-softener group.
 4. Bulk-forming laxative group.
125. The nurse should withhold a laxative from the client that has what condition?
 1. Nausea.
 2. Excess body weight.
 3. Increase in appetite.
 4. Painful defecation.

Answers and Rationales

124. **4.** Bulk-forming laxatives are considered the safest and most natural of all laxative groups because they are natural or semisynthetic substances, they produce stools that are formed normally, and are not absorbed systemically.
125. **1.** A client with nausea should never be given a laxative because this person is at risk for fluid and electrolyte imbalance.

ANTIEMETICS

A. Prototype: Antiemetics are given to prevent and treat nausea, vomiting, and nausea associated with motion

sickness, CNS, disorders, administration of certain drugs, and radiation therapy. There are five categories of antiemetics:

1. Antihistamines and anticholinergics: block acetylcholine and histamine H₂ receptors.
2. Neuroleptics: bind with dopamine
3. Prokinetics: stimulate acetylcholine to increase gastric emptying.
4. Serotonin-blocking agents: block transmission of afferent visceral and chemoreceptor triggers (mostly associated with chemotherapy).
5. Substance P Neurokinin-1 receptor antagonist: used in conjunction with serotonin antagonists and a corticosteroid. See Table 2-22.

Sample Questions

126. What nursing diagnosis would be appropriate for a client taking promethazine (Phenergan)?
 1. Disturbed body image.
 2. Diarrhea.
 3. Risk for injury.
 4. Chronic pain.

Answers and Rationales

126. **3.** Due to the side effect of drowsiness, the client needs to refrain from driving or operating dangerous machinery while taking this medication.

EMETICS

- A. Prototype: ipecac syrup
Not fully known but probably stimulates the CTZ and irritates the GI tract to induce vomiting, thus delaying the absorption time of toxic substances. Emesis should occur within 20–30 minutes.
1. Use. Stimulate vomiting for clients (in a hospital setting) who have taken toxic doses of oral medications, and poisons.
 2. Adverse effects. Fluid and electrolyte imbalance; stimulated and then suppressed nervous system; hypotension; persistent vomiting; aspiration.
 3. Nursing implications
 - a. Should not be given after charcoal administration as it antagonizes the effects.
 - b. Administer with water and monitor vital signs.
 - c. Repeat dose once if vomiting does not occur.

Table 2-22 Antiemetics

Category	Drug	Adverse Effects	Nursing Implications
Antihistamines	Diphenhydramine (Benadry) Antivert	Dry mouth, drowsiness Promethazine HO Phenergan	<ul style="list-style-type: none"> • If preventing nausea, give 30 minutes prior to noxious stimuli • Not compatible with lactated Ringer's IV solution
Anticholinergics	Scopolamine (Transderm-Scop)	Increased heart rate, disorientation	<ul style="list-style-type: none"> • Monitor VS
Neuroleptics	Chlorpromazine HCl (Thorazine) Prochlorperazine (Compazine)	Drowsiness, blurred vision, hypotension, Dizziness	<ul style="list-style-type: none"> • If IM, use large muscle • Do not give SC
Prokinetic	Metoclopramide (Reglan)	Anxiety	<ul style="list-style-type: none"> • Monitor for dehydration
Serotonin blockers	Dolasetron mesylate (Anzement) Ondansetron HCL (Zofran)	Headache, hypotension, GI upset	<ul style="list-style-type: none"> • Monitor BP • Give 30 min before chemo
Substance P neurokinin-1 receptor antagonist	Aprepitant	Asthenia, hiccups	<ul style="list-style-type: none"> • Give in morning • Use additional contraception

- d. If a client is younger than age 10 only one dose should be given.
- e. Should not be given to semiconscious or unconscious clients or clients having seizures.
- f. Should not be given if substance ingested is corrosive, petroleum-based, or cyanide.
- g. Not to be used in home setting.

B. Prototype: apomorphine HCl.
A CNS depressant and a controlled substance that is given subcutaneously. In adults is usually effective in 5–15 minutes. Clients who are allergic to morphine or other opiates should not take apomorphine.

Sample Questions

127. What action should the client perform after an accidental poisoning?
1. Drink milk.
 2. Drink water until vomiting occurs.
 3. Take laxatives.
 4. Call the Poison Control Center.

Answers and Rationales

127. **4.** The Poison Control Center should be called for instructions.

SUCRALFATE (CARAFATE)

- A.** Prototype: sucralfate (Carafate)
1. Action. Reacts with gastric acid to form a substance that adheres to the ulcer site to protect the ulcer from bile salts, pepsin, and acid. This permits healing.
 2. Use. Treatment of duodenal ulcer: short term (up to 8 weeks).
 3. Adverse effects. Diarrhea, constipation; gastric discomfort; dry mouth; pruritus, rash; back pain; dizziness, sleeplessness.
 4. Nursing implications
 - a. Separate administration from other drugs by 2 hours to decrease chance of interaction.
 - b. Take on an empty stomach.
 - c. Antacids should not be given within 1/2 hour before or after sucralfate dose.
 5. Related drug. Misoprostol (Cytotec).

- a. Protects stomach lining by increasing mucus and bicarbonate production and inhibiting secretion of gastric acid.
- b. Used to prevent NSAID and aspirin-induced ulcers in clients at high risk of complications from gastric ulcers.



Sample Questions

- 128.** By what mechanism does sucralfate enable the client's ulcer to heal?
1. Coating the stomach mucosa, thus preventing gastric acid irritation.
 2. Forming a paste-like substance at the ulcer site that serves as a protective barrier.
 3. Binding with all gastric contents to inactivate their function in the stomach.
 4. Attracting white and red blood cells to the stomach to increase circulation.

- 129.** Which of the following teaching points about sucralfate should the nurse emphasize to ensure success with the therapy?
1. Discontinue the drug if indigestion occurs.
 2. Use the drug on an as-needed basis if future ulcer problems occur.
 3. Constipation may occur with long-term use.
 4. Take the drug 1 hour before meals or 2 hours after meals and at bedtime.



Answers and Rationales

- 128. 2.** Sucralfate (Carafate) reacts with gastric acid and becomes a paste-like substance that forms a protective barrier at the ulcer site.
- 129. 4.** Sucralfate is more active in the lower-pH environment of an empty stomach. By taking the drug 1 hour before meals or 2 hours after meals, the stomach is empty and optimal results will be obtained from the drug.



Arthritis Drugs

ARTHRITIS DRUGS

- A. Prototype: auranofin (Ridaura)**
1. Action. Mechanism of action is unclear. This is the only group of drugs that may partially reverse or stop joint destruction.
 2. Use. These drugs are most effective early in rheumatoid arthritis.
 3. Adverse effects. Most common: skin rash, proteinuria, blood dyscrasias, gastric irritation, diarrhea. Nitroid crisis is an anaphylactic reaction that resembles effects of a large dose of nitroglycerin: i.e., flushing, severe hypotension, tachycardia, light-headedness.
 4. Nursing implications
 - a. Gold salts should not be given to clients with hepatic and renal disorders, hypertension, uncontrolled diabetes, or heart failure, or to clients receiving radiation therapy.
 - b. Baseline CBC must be checked prior to administration and checked throughout therapy.
 - c. Nitroid crisis is more apt to occur with IM injection of gold salts; therefore a test dose is given.
 - d. VS should be monitored and resuscitation equipment should be readily available with test dose.
 - e. Diarrhea is more severe with oral gold salts.
 - f. Oral auranofin is less toxic and better tolerated than IM.
 - g. Overdose of gold salts can be treated with dimercaprol (BAL).
 - h. Gold salts given IM are best given in the gluteal muscle.
- B. Other gold salts**
1. Aurothioglucose (Solganol)
 2. Gold sodium thiomalate (Myochrysin)
 3. Both drugs are given IM only. Noncompliance can be a problem with both drugs as weekly injections may be needed for several months.
- C. Antimalarials**
1. Chloroquine (Aralen)
 2. Hydroxychloroquine (Plaquenil)
 3. These drugs are used to treat malaria and rheumatoid arthritis that is unresponsive to NSAIDs.

4. Nursing implications
 - a. The nurse needs to remind clients that frequent ophthalmic examinations are required as visual impairment can occur.
 - b. The nurse must be alert for blood dyscrasia, GI distress, and dermatologic reactions.
- D. Other drugs
1. Adalimumab (Humira)
 2. Etanercept (Enbrel)
 3. Leflunomide (Avara)
 4. Infliximab (Remicade)
 5. Penicillamine (Cupriminell)
 6. These are newer antiarthritis agents used to treat rheumatoid arthritis that no longer responds to traditional therapy.



Sample Questions

130. When a client comes to the office for monthly visits, which of the following would be excluded from the nurse's assessment?
1. Assess client's skin.
 2. Examine client's oral cavity.
 3. Question client about any itching.
 4. Check client's blood sugar levels.
131. The client has been receiving auranofin for 2 months and is showing little clinical response to it; she is experiencing the following adverse effects of the drug: abdominal cramps, vomiting, diarrhea, and stomatitis. The physician decides to continue auranofin. What is the reason for this?
1. Side effects of auranofin are rare and will pass quickly.
 2. It will take several months of therapy with auranofin to achieve therapeutic effects.
 3. The physician is not sure of the best effects from auranofin because it is such a new form of treatment.
 4. Side effects of auranofin always occur just before the beginning of a therapeutic response to the drug.



Answers and Rationales

130. 4. Skin rashes, pruritus, and mouth lesions are all adverse effects of gold salts and need to be monitored frequently. Hyperglycemia has not been associated with gold salt therapy.

131. 2. It can take 6 months or longer for the gold salts to show a therapeutic response. Because of this, clients are left on gold salt therapy even though they are experiencing adverse effects before therapeutic response.

ANTIGOUT DRUGS

- A. Prototype: allopurinol (Zyloprim)
1. Action. Prevents the production of uric acid by inhibiting the enzyme xanthine oxidase.
 2. Use. Used to manage primary or secondary gout and to prevent attacks; used to treat clients with recurrent calcium oxalate calculi.
 3. Adverse effects. GI symptoms: nausea, vomiting, diarrhea; skin rash, maculopapular; hepatomegaly; drowsiness.
 4. Nursing implications
 - a. Discontinue use at first sign of skin rash.
 - b. Force fluids (1–2 liters) to help prevent formation of uric acid kidney stones.
 - c. Monitor liver function tests and CBC throughout therapy.
 - d. Administer drug after meals.
 5. Discharge teaching. Advise client not to drive.
- B. Prototype: colchicine (Novocolchine)
1. Action. Drug of choice to treat acute gout attacks and prophylaxis of recurrent gout. It decreases the inflammatory response to deposition of monosodium urate crystals.
 2. Adverse effects. Nausea, vomiting, diarrhea, abdominal pain; bone marrow depression; hair loss; rash; thrombophlebitis if given IV.
 3. Nursing implications
 - a. Do not give IM or SC as this causes severe irritation.
 - b. Monitor IV site.
 - c. Assess for rash.
 - d. Monitor CBC.
 - e. Take drug after meals.
 - f. Hair loss is reversible when drug is stopped.
 - g. During an acute attack is usually given every 1–2 hours until pain is relieved and should be stopped if nausea, vomiting, or diarrhea occurs.
 - h. No more than 12 tablets should be given in a 24-hour period.



Sample Questions

132. What instruction should the nurse give in regard to colchicine therapy?

1. The drug will be absorbed better if you take it on an empty stomach.
 2. You should limit your fluid intake while you're on this drug.
 3. No more than 12 colchicine tablets should be taken in a 24-hour period.
 4. If you have another gout attack, you need to wait 12 hours before taking colchicine.
- 133.** What client condition would alert the nurse to discontinue colchicine?
1. The client becomes dizzy.
 2. Diarrhea or vomiting occurs.
 3. Stools turn black.
 4. Serum uric acid level is below normal.
- 134.** In addition to treating gouty arthritis, which drug is also used to treat calcium oxalate stones?
1. Allopurinol (Zyloprim)
 2. Colchicine (Novocholchine)

3. Naproxen (Naprosyn)
4. Sulindac (Clinoril)



Answers and Rationales

- 132. 3.** In order for the client to be treated safely with colchicine (Novocolchine), not more than 12 tablets should be taken in a 24-hour period.
- 133. 2.** Diarrhea and vomiting are both early signs of colchicine toxicity. Other signs of early toxicity are anorexia, nausea, abdominal discomfort, and weakness. Colchicine should be stopped immediately before more serious toxicity occurs.
- 134. 1.** Allopurinol (Zyloprim) is used to manage and prevent gout attacks. A new use for this drug is treatment of calcium oxalate stones.



Antimicrobials

GENERAL INFORMATION

- A. Terminology**
1. Bacteriostatic: prevents multiplication and growth of bacterial organisms.
 2. Bactericidal: kills bacterial organisms.
- B. Cultures need to be obtained before initiating therapy.**
- C. Sites of action**
1. Agents that suppress bacterial cell wall synthesis: action creates a defect in bacterial cell wall structure and death of organism.
 2. Agents that suppress protein synthesis within the bacterial cell: action interferes with normal growth and reproduction of bacterial cell, which eventually causes its eradication.
 3. Agents that interfere with bacterial cell membrane permeability: action causes intracellular parts to escape and leads to bacterial cell death.
 4. Agents with antimetabolite action: action causes interference with a necessary metabolic process that the bacterial cell needs for normal growth and function.
- D. Need to be administered at regular intervals so therapeutic blood levels can be maintained. This will prevent development of resistant strains of organisms. An order for QID administration means giving the drug at 6-hour intervals.**
- E. Peak and trough levels**
1. Blood levels need to be high enough to be therapeutic but not so high that severe toxicity is caused.
 2. Peak: client's blood is drawn 1 hour after IM or 30 minutes after IV administration.
 3. Trough: client's blood is drawn just before next dose of antibiotic is given.
- F. Superinfection**
1. Infection occurring when client is receiving or has recently been given antibiotic treatment.
 2. Develops when normal bacterial flora are changed by the use of an antibiotic. Allows growth of bacteria that are resistant to the antibiotic being used.
- 5. Agents that inhibit nucleic acid synthesis: action involves the use of enzymes for reproduction that are not found in human cells.**

3. Clients more susceptible when placed on broad-spectrum antibiotics.
- G. Resistance**
1. Many bacteria have developed resistance to antibiotic therapy.
 2. Ways to prevent resistance
 - a. Use antibiotics only when necessary.
 - b. Do not use antibiotics to treat viral infections.
 3. Streptogramins: antibiotics to treat resistant strains of bacteria. Used to treat vancomycin resistant enterococcus (VRE) and methicillin resistant *S. aureus* (MRSA).
 - a. Quinupristin/dalfopristin (Synercid)
 - b. Linezolid (Zyvox)

AMINOGLYCOSIDES

- A. Prototype: gentamicin (Garamycin)**
1. Action. Acts by suppressing protein synthesis in bacterial cell. Bactericidal.
 2. Use. Serious gram-negative bacterial infections, eye infections.
 3. Adverse effects. Ototoxicity, nephrotoxicity, neuromuscular blockade, hypersensitivity, photosensitivity with topical preparations.
 4. Nursing implications
 - a. Cautious use in clients with decreased renal function, reduced hearing, dehydration, neuromuscular disorders.
 - b. Monitor hearing and balance.
 - c. Monitor renal function tests and I&O.
 - d. Client needs adequate hydration.
 - e. Safety precautions if there are vestibular nerve effects.
 - f. Monitor drug levels.
 5. Discharge teaching
 - a. Full course of treatment is essential.
 - b. Report problems with balance or hearing changes.
 - c. Avoid sunlight.
- B. Related drugs.** Amikacin (Amikin), kanamycin (Kantrex), neomycin (Neobiotic), streptomycin, tobramycin (Nebcin), netilmicin (Netromycin), paromomycin (Humatin). Kanamycin (Kanrex) and neomycin (Neobiotic) are given orally to prepare the bowel for surgery. Neomycin (Neobiotic) is given to persons in hepatic failure to reduce ammonia levels.

3. Bactericidal.
4. Anthelmintic.

- 136.** The nurse will assess the client daily for which of the following adverse effects of gentamicin (Garamycin)?
1. Constipation.
 2. Hearing loss.
 3. Tetany.
 4. Bradycardia.
- 137.** The nurse needs to monitor the client daily for the presence of superinfection. How is a superinfection defined in relation to an infection?
1. It has an increasing number of the organism's normal microbial competitors.
 2. It necessitates increased amount of antibiotics for treatment.
 3. It occurs if antibiotic therapy is abruptly stopped.
 4. It develops when an antibiotic alters the normal bacterial flora.



Answers and Rationales

- 135. 3.** Gentamicin (Garamycin) acts by suppressing protein synthesis in the bacterial cell. This effect is bactericidal.
- 136. 2.** Gentamicin (Garamycin) can cause auditory and vestibular damage. The nurse must assess the client daily for hearing loss while on this drug.
- 137. 4.** A superinfection occurs when normal bacterial flora are changed by the use of an antibiotic. This allows growth of bacteria that are resistant to the antibiotic currently being used.

PENICILLINS

- A. Prototype: penicillin G potassium (Pentids)**
1. Action. Inhibits cell wall synthesis of microorganisms. Bactericidal. Natural penicillin.
 2. Use. Systemic infections caused by gram-positive cocci; syphilis; prophylaxis for rheumatic fever and bacterial endocarditis.
 3. Adverse effects. Hypersensitivity reactions; GI upset; anemia, thrombocytopenia, leukopenia; nephritis; potassium poisoning; irritation at injection site.



Sample Questions

- 135.** What is the antibacterial action of gentamicin (Garamycin)?
1. Anti-inflammatory.
 2. Bacteriostatic.

4. Nursing implications
 - a. Monitor client for allergic reactions. Have emergency equipment available.
 - b. Clients with questionable serious penicillin allergy may be skin tested.
 - c. Give oral form on empty stomach.
 - d. Oral form should be taken with a full glass of water.
 - e. Monitor CBC, BUN, and creatinine.
 - f. Probenecid (Benemid) may be given to increase blood levels of penicillins.
 - g. Monitor IV and IM injection sites.
 - h. IV solutions are stable at room temperature for 24 hours only.
 5. Discharge teaching
 - a. Complete the therapy even if you feel well before the medicine is finished.
 - b. Oral doses should be taken around the clock.
 - c. Don't take for other infections.
- B. Related drugs**
1. Penicillinase-resistant penicillins
 - a. Used to treat infections caused by penicillinase-producing organisms.
 - b. Examples: nafcillin sodium (Nafcil, Unipen), cloxacillin (Tegapen), dicloxacillin (Oxapen)
 2. Aminopenicillins
 - a. Increased effectiveness against gram-negative organisms.
 - b. Examples: ampicillin (Amcill, Polycillin), amoxicillin trihydrate (Amoxil), bacampicillin (Spectrobid)
 3. Extended-spectrum penicillins
 - a. Structurally similar to ampicillin but have an increased spectrum of activity against gram-negative bacteria.
 - b. Examples: carbenicillin sodium (Geocillin), piperacillin sodium (Pipracil), ticarcillin (Ticar), mezlocillin (Mezlin)
 4. Penicillin/beta-lactamase inhibitor combinations
 - a. Combination of penicillin with beta-lactamase inhibitor which prevents destruction of penicillin by enzymes and extends the penicillin's spectrum of antimicrobial activity.
 - b. Examples: Amoxicillin/potassium clavulanate (Augmentin), piperacillin/tazobactam (Zosyn), ampicillin/sublactam (Unasyn), ticarcillin/clavulanate (Timentin)



Sample Questions

- 138.** Before giving a prescription for penicillin V potassium, the nurse reviews basic information

about penicillins. Which of the following statements is true?

1. Penicillins are well absorbed from the gastrointestinal tract after oral ingestion.
 2. Penicillins have a long half-life due to their extended excretion time.
 3. Extended-spectrum penicillins have an increased ability to penetrate outer membranes of gram-negative bacteria.
 4. Penicillins easily enter bacterial cell membranes due to their lipid solubility.
- 139.** Penicillin is ordered for a client. The physician also orders probenecid therapy. What will the nurse tell the client that the action of probenecid will do?
1. Prevent a hypersensitivity reaction to the penicillin.
 2. Enhance metabolism of the penicillin.
 3. Stimulate the immune system.
 4. Increase blood levels of the penicillin.



Answers and Rationales

- 138.** 3. Extended-spectrum penicillins enter the membranes of gram-negative organisms more readily than other penicillin groups.
- 139.** 4. Probenecid (Benemid) is given with penicillin to enhance therapeutic blood levels of the penicillin.

CEPHALOSPORINS

- A.** Prototype for first-generation cephalosporins: cefazolin sodium (Ancef). *Note: The cephalosporins are divided into four groups or "generations" based on their spectrums of activity.*
1. Action. Inhibits bacterial cell wall synthesis. Bactericidal.
 2. Use. Infections caused by gram-positive cocci; septicemia; bone, joint, and skin infections; prophylactic use in surgery; serious intra-abdominal infection.
 3. Adverse effects. Phlebitis at IV site; diarrhea, pseudomembranous colitis; hypersensitivity reactions; fungal overgrowth; discomfort at IM injection site; nephrotoxicity; hepatotoxicity; bone marrow depression.
 4. Nursing implications
 - a. Give IM injections deeply into large muscle masses; rotate sites.
 - b. Assess for history of penicillin allergy as there is a cross allergy between cephalosporins and penicillin.

- c. Dose will be reduced with renal impairment and decreased liver function.
 - d. Increased risk of renal toxicity if given with other nephrotoxic drugs.
 - e. Monitor renal, liver function studies, and I&O.
 - f. Prolonged IV administration can cause thrombophlebitis. Assess and rotate IV sites.
 - g. Probenecid therapy will increase blood levels of cephalosporin.
5. Discharge teaching
- a. Finish full course of therapy even if you feel well.
 - b. Promptly report diarrhea, rash, hives, difficulty breathing, unusual bleeding.
 - c. Report signs of superinfection.
6. Related drugs. Cephalexin (Keflex), cephalothin sodium (Keflin), cephapirin sodium (Cefadyl), cephadrine (Velosef).
- B.** Prototype for second-generation cephalosporins: cefoxitin sodium (Mefoxin)
- 1. Action. See action for cefazolin sodium (Ancef).
 - 2. Use. Infections caused by gram-negative and gram-positive bacteria; septicemia; pelvic, skin, and soft-tissue infections; prophylaxis in abdominal or pelvic surgery; gonorrhea.
 - 3. Adverse effects. See adverse effects for cefazolin sodium (Ancef).
 - 4. Nursing implications. Lidocaine used as diluent for IM injection and helps reduce pain of IM injection. See Nursing Implications and Discharge Teaching for cefazolin sodium (Ancef).
 - 5. Related drugs. Cefaclor (Ceclor), cefamandole naftate (Mandol), cefuroxime sodium (Ceftin), cefmetazole (Zefazone), cefonicid (Monocid), cefotetan (Cefotan), cefprozil (Cefzil), loracarbef (Lorabid).
- C.** Prototype for third-generation cephalosporins: cefotaxime (Claforan)
- 1. Action. See action for cefazolin sodium (Ancef).
 - 2. Use. Serious infections caused by gram-negative and gram-positive bacteria; meningitis, especially in neonates; uncomplicated gonorrhea.
 - 3. Adverse effects. See adverse effects for cefazolin sodium (Ancef).
 - 4. Nursing implications
 - a. Do not mix with aminoglycoside solutions. Give these drugs separately.
 - b. Protect IV solutions from light. See Nursing Implications and Discharge Teaching for cefazolin sodium (Ancef).
 - 5. Related drugs. Ceftazidime (Fortaz), ceftizoxime sodium (Cefizox), ceftriaxone

sodium (Rocephin), cefdinir (Omnicef), cefixime (Suprax), cefoperazone (Cefobid), cefotaxime (Claforan), cefpodoxime (Vantin), ceftibuten (Cedax).

- D.** Prototype for fourth-generation cephalosporins: cefepime (Maxipine).
- 1. Action. See action for cefazolin sodium (Ancef).
 - 2. Use. Urinary tract infections caused by *E. coli* or *Klebsiella*; skin infections caused by *S. aureus*; pneumonia caused by *S. pneumoniae*, *Pseudomonas aeruginosa* or *Enterobacter*.
 - 3. Adverse effects. See adverse effects for cefazolin sodium (Ancef).
 - 4. Nursing implications. Have Vitamin K available if hypoprothrombinemia develops. See Nursing Implications and Discharge Teaching for cefazolin sodium (Ancef).
 - 5. Related drug. Cefditoren (Spectracef).



Sample Questions

- 140.** What action do penicillins and cephalosporins have on bacteria?
- 1. Inhibiting bacterial cell wall synthesis.
 - 2. Preventing bacterial protein synthesis.
 - 3. Increasing permeability of bacterial membranes.
 - 4. Inhibiting metabolic processes in the bacterial cell.
- 141.** Which medication will increase the chance of developing nephrotoxicity if the client is taking cefazolin sodium also?
- 1. An antacid.
 - 2. Vitamin D.
 - 3. Dimenhydrinate (Dramamine).
 - 4. An aminoglycoside.
- 142.** Which statement by the client indicates a need for more teaching about cephalosporins by the nurse?
- 1. "I will take every bit of this medication even if I feel better."
 - 2. "I will tell the doctor if I have diarrhea, a rash, or any difficulty breathing."
 - 3. "I will continue to test my urine for glucose with Clinitest tablets."
 - 4. "I will tell the dentist that I'm taking a cephalosporin when I go for my appointment."

143. Which lab result is indicative of an adverse effect of cephalosporins?
1. Increased potassium.
 2. Decreased AST (SGOT) and ALT (SGPT).
 3. Elevated hemoglobin.
 4. Increased BUN and creatinine.

Answers and Rationales

140. 1. Penicillins and cephalosporins have the same action on bacteria: inhibition of bacterial cell wall synthesis.
141. 4. There is an increased risk of renal toxicity when cephalosporins are given with other nephrotoxic drugs such as diuretics and aminoglycosides.
142. 3. A diabetic client who is taking a cephalosporin drug will get a false-positive glucose reaction if Clinitest tablets are used in urine testing. The client needs to use Clinistix or Tes Tape for urine testing.
143. 4. Cephalosporins can cause renal toxicity for which an elevated BUN and creatinine would be indicative.

MACROLIDES

- A. Prototype: erythromycin base (E-Mycin)
1. Action. Inhibits protein synthesis in bacterial cell. Bacteriostatic. Has broad spectrum of activity.
 2. Use. Persons allergic to penicillin; Legionnaire's disease; mycoplasma pneumonia; intestinal dysenteric amebiasis; acne; staphylococcal and streptococcal infections.
 3. Adverse effects. Gastrointestinal irritation, reversible hearing loss, hepatitis, allergic reactions, superinfections.
 4. Nursing implications
 - a. Do not crush enteric-coated tablet.
 - b. Take on empty stomach with a full glass of water.
 - c. Do not give with acids.
 - d. Monitor liver function tests.
 - e. GI symptoms are dose related.
 - f. Give IM deeply into a large muscle mass.
 - g. IV must be diluted sufficiently and administered slowly to avoid venous irritation and thrombophlebitis.
- B. Related drugs. Erythromycin estolate (Ilosone), erythromycin gluceptate (Ilotycin), erythromycin

stearate, azithromycin (Zithromax), clarithromycin (Biaxin), dirithromycin (Dynabac).

Sample Questions

144. The client is allergic to penicillin. What explanation will the nurse tell the client that he can be given erythromycin?
1. Erythromycin is more easily absorbed from the GI tract than penicillin.
 2. Erythromycin has a spectrum of activity that is similar to penicillin.
 3. Erythromycin has fewer adverse effects than penicillin.
 4. Erythromycin is not as toxic to the body as penicillin.
145. Which statement by the client indicates a need for more teaching about erythromycin?
1. "If I notice any change in my hearing I will call the doctor."
 2. "I will take the erythromycin with orange juice."
 3. "I won't take the erythromycin with meals."
 4. "I won't crush the erythromycin tablets, I'll swallow them whole."

Answers and Rationales

144. 2. Erythromycin and penicillin have a similar spectrum of activity; so individuals who are allergic to penicillin can take erythromycin.
145. 2. Acidity decreases the activity of erythromycin; it should not be taken with acids such as fruit juices.

TETRACYCLINES

- A. Prototype: tetracycline hydrochloride (Achromycin V)
1. Action. Broad-spectrum drug with bacteriostatic action and, at higher doses, bactericidal action. Inhibits bacterial wall synthesis. Reduces free fatty acids from triglycerides, thus reducing acne lesions.
 2. Use. Chlamydia, mycoplasma, rickettsia, acne vulgaris, gonorrhea, spirochetes.

3. Adverse effects. Headache, dizziness; neutropenia; nausea, vomiting, diarrhea, colitis, abdominal cramping; hepatotoxicity; photosensitivity, hypersensitivity; superinfections; chelating to teeth and new bone.
 4. Nursing implications
 - a. Avoid use during pregnancy, in nursing women, and in children under age 8 as drug binds to calcium in teeth and new bone growth, which results in tooth discoloration of permanent teeth and retarded bone growth.
 - b. Give deep IM.
 - c. Monitor CBC and signs of liver toxicity.
 5. Discharge teaching
 - a. Avoid use with calcium supplements, antacids, iron, or dairy products as these may reduce tetracycline absorption.
 - b. Avoid the sun while taking drug and for a few days after therapy is terminated.
 - c. Use meticulous hygiene to reduce superinfections.
 - d. Complete prescribed course.
- B. Related drugs**
1. Doxycycline (Vibramycin): can be administered with food. Safe to use in clients with renal impairment.
 2. Minocycline (Minocin): can be taken with food. Dizziness and fatigue may occur.
 3. Demeclocycline (Declomycin): administer on an empty stomach. Foods high in calcium and iron interfere with absorption.
 4. Oxytetracycline (Terramycin): administer on an empty stomach. Food disrupts extent and rate of absorption.

Sample Questions

146. Which of the following should the nurse include in teaching about taking tetracyclines?
 1. Take tetracycline HCl with milk.
 2. Take tetracycline with food.
 3. Encourage sitting in sun to enhance tetracycline's effects.
 4. Take tetracycline before meals.
147. Which of the following adverse effects should the client report to the physician while taking tetracycline?
 1. Constipation.
 2. Hypertension.
 3. Tachycardia.
 4. Diarrhea.

Answers and Rationales

146. 4. Tetracycline is best absorbed on an empty stomach. Taking tetracycline with food or milk impairs absorption.
147. 4. Diarrhea should be reported to the physician, who can rule out diarrhea as a symptom of superinfection or an adverse effect.

CHLORAMPHENICOL

- A. Prototype: chloramphenicol (Chloromycetin)**
1. Action. A synthetic broad-spectrum agent. Primarily bacteriostatic but is bactericidal in higher doses. Inhibits protein synthesis.
 2. Use. *Haemophilus influenzae* meningitis, rickettsia, salmonella typhi, mycoplasma, bacteroides, typhoid fever. *Note: chloramphenicol (Chloromycetin) used only in severe infections when other antibiotics cannot be used due to its severe adverse effect of aplastic anemia.*
 3. Adverse effects. Aplastic anemia; neurotoxicity; gray-baby syndrome (seen in premature infants, newborns, and children less than 2 years old. Abdominal distention, vomiting, pallor, irregular respirations, circulatory collapse, and death can occur due to the infant's immature liver function); hypersensitivity; nausea, vomiting, enterocolitis; superinfections; bitter taste especially after IV injection.
 4. Nursing implications
 - a. Obtain and monitor baseline CBC, platelets, and serum iron.
 - b. Monitor children less than 2 years old for gray-baby syndrome.
 - c. Do not give by IM injection.
 5. Discharge teaching
 - a. Inform physician immediately of fever, fatigue, sore throat, or bruising.
 - b. Take drug on an empty stomach unless GI upset.
 - c. Notify physician and discontinue drug if symptoms of hypersensitivity occur.

Sample Questions

148. Which of the following changes in an infant should the nurse immediately report to the physician?
 1. Vomiting.
 2. Constipation.
 3. Flushing.
 4. Dry skin.



Answers and Rationales

148. 1. Abdominal distention and vomiting are early symptoms of gray-baby syndrome and should be reported immediately as this syndrome is life-threatening.

SULFONAMIDES

- A. Prototype: sulfisoxazole (Gantrisin)
1. Action. Prevents conversion of para-aminobenzoic acid (PABA) to folic acid, which is required for bacterial growth. Effects are usually bacteriostatic but can be bactericidal in high urinary concentrations.
 2. Use. Urinary tract infections, otitis media, nocardiosis (occurs in the lungs and spreads to skin, brain, and other areas), systemic infections, vaginitis, superficial eye infections.
 3. Adverse effects. Hypersensitivity; Stevens-Johnson syndrome (acute onset of fever, bullae on skin and ulcers on mucous membranes of lips, eyes, mouth, nasal passages, and genitalia. Pneumonia, joint pain, and prostration are also seen); fever 7–10 days after starting therapy may indicate sensitization or hemolytic anemia; renal dysfunction; hematologic reaction; GI reaction; photosensitivity.
 4. Nursing implications
 - a. Give oral form on empty stomach with full glass of water.
 - b. Observe skin for presence of rash, ulcers.
 - c. Monitor temperature.
 - d. Monitor I&O; force fluids; check urine pH; cautious use in clients with renal dysfunction; monitor renal function tests.
 - e. Monitor CBC.
 5. Discharge teaching
 - a. Avoid direct sunlight.
 - b. Complete full course of treatment.
 - c. Diabetics who take oral hypoglycemic agents need to be aware of increased chance of hypoglycemic reactions with use of sulfonamides.
 - d. Oral contraceptives may be unreliable while client is receiving sulfonamides. Alternate method of contraception should be used.
- B. Related drugs
1. Sulfasalazine (Azulfidine) used in treatment of ulcerative colitis. Contains aspirin, so is

contraindicated in clients allergic to salicylates.

2. Sulfamethorazole (Gantanol) can be given in combination with trimethoprim (Proloprim) as Septra or Bactrim. Used in treating urinary tract infections, bronchitis, and pneumocystis pneumonia.



Sample Questions

149. Eight days after taking sulfisoxazole, a child develops a fever. When the child's mother calls the pediatrician's office about this, what instructions will the nurse provide?
1. Reduce the dose of the sulfisoxazole.
 2. Have the child rest in bed.
 3. Call the pediatrician if more symptoms develop.
 4. Stop the sulfisoxazole and bring the child in to see the pediatrician today.



Answers and Rationales

149. 4. A fever 7–10 days after starting sulfisoxazole is an adverse effect of the drug that could indicate a sensitization to the drug or hemolytic anemia. The drug should be stopped and the client should see the physician as soon as possible.

URINARY ANTI-INFECTIVES

- A. The medications are dependent on the desired goal, whether the client has an acute, recurrent or chronic UTI.
1. Urinary anti-infectives are structurally different so there will be no prototype drug
 2. See Table 2-23.



Sample Questions

150. The client should be taught which of the following points about nitrofurantoin?
1. Take it on an empty stomach.
 2. You may experience nausea and vomiting.
 3. You can crush the tablet if it's too hard to swallow whole.
 4. It doesn't interact with any other drugs.

Table 2-23 Urinary Anti-Infectives

Drug	Use	Adverse Effects	Nursing Implications
Methenamine (Hiprex; Mandelamine)	Converted to formaldehyde (which is bactericidal) in the presence of acidic urine.	Nausea, vomiting, diarrhea, abdominal discomfort.	<ul style="list-style-type: none"> • Give with food or milk to prevent GI upset. • Avoid foods, fluids, and medications that alkalinize urine. • Monitor I&O. • Increase fluid intake. • Monitor liver function tests.
Nalidixic Acid (Neg Gram)	Bactericidal effect on gram-negative bacteria by preventing transmission of genetic information.	Headache, dizziness, vertigo, visual disturbances, photosensitivity.	<ul style="list-style-type: none"> • Minor CNS reactions are common and should decrease in 48 hours. • Client should wear sunglasses if bothered by bright lights. • Client should avoid sun exposure, wear sunscreen and appropriate clothing. • Give with food to decrease GI upset.
Nitrofurantoin (Macrochantin)	Interferes with carbohydrate metabolism of bacteria. Is bacteriostatic in low concentrations and bactericidal in high concentrations.	Pulmonary hypersensitivity, nausea, vomiting, lower extremity paresthesias.	<ul style="list-style-type: none"> • Monitor pulmonary status. • Give drug with milk or meals. • Monitor neurologic status. • Avoid tooth staining by not crushing tablets, dilute suspension, and rinse mouth after taking drug.
Phenazopyridine (Pyridium)	An azo dye excreted in the urine which provides a topical analgesic effect to the urinary tract.	Rash, headache, GI disturbances, reddish-orange discoloration of urine.	<ul style="list-style-type: none"> • Give after meals to prevent GI upset. • Tell client that urine may turn reddish-orange and can stain fabrics. • Stop drug if skin or sclera turn yellow which is a sign of drug accumulation.
Cinoxacin (Cinobac)	Prevents protein synthesis and DNA replication in bacterial cell.	Dizziness, headache, nausea, tinnitus.	<ul style="list-style-type: none"> • No breastfeeding while taking this drug. • Use carefully in clients with liver, kidney, and CNS disorders. • Give at evenly spaced time periods during each 24 hours of drug administration.



Answers and Rationales

150. 2. GI irritation is the most frequent adverse effect of nitrofurantoin (Macrochantin).

VANCOMYCIN HYDROCHLORIDE (VANCOCIN)

A. Prototype: vancomycin hydrochloride (Vancocin)

1. Action. Interferes with cell membrane synthesis and exhibits a bactericidal and bacteriostatic effect.

2. Use. Staphylococcus infections, pseudomembranous colitis, gram-positive organisms. Penicillin-G and methicillin-resistant bacteria.
3. Adverse effects. Ototoxicity, nephrotoxicity, hypersensitivity, thrombophlebitis, red-neck syndrome (flushing and hypotension from rapid IV infusion), superinfections.
4. Nursing implications
 - a. Monitor I&O.
 - b. Obtain and monitor renal and auditory function tests.
 - c. Administer IV slowly to prevent phlebitis, extravasation, red-neck syndrome.



Sample Questions

151. Which of the following is an important nursing consideration when administering IV vancomycin hydrochloride (Vancocin)?
1. Mix the dose in 50 mL of dextrose in water.
 2. Infuse over 30 minutes.
 3. Infuse over 60 minutes.
 4. Administer IV push.



Answers and Rationales

151. 3. IV vancomycin hydrochloride (Vancocin) should be given over 1 hour to help prevent thrombophlebitis and red-neck syndrome.

FLUOROQUINOLONES

- A. Prototype: ciprofloxacin (Cipro)
1. Action. Inhibits DNA-gyrase (an enzyme needed for replication of bacterial DNA). Bactericidal effect.
 2. Use. Pseudomonas infections, gram-negative urinary tract infections or gram-negative systemic infections.
 3. Adverse effects. Nausea, vomiting, diarrhea, flatulence; headache, tremors, confusion, dizziness, insomnia; fever; rash; elevated BUN, AST (SGOT), ALT (SGPT), creatinine; decreased WBC, hematocrit.
 4. Nursing implications
 - a. Administer with a large glass of water to prevent crystalluria.
 - b. Do not give with antacids.
 - c. Give 2 hours after meals.
- B. Related drugs. Norfloxacin (Noroxin), gatifloxacin (Tequin), levofloxacin (Levaquin), lomefloxacin (Maxaquin), moxifloxacin (Avelox), sparfloxacin (Zagam), trovafloxacin (Trevan).



Sample Questions

152. Which statement by the client indicates that she understands correct use of ciprofloxacin (Cipro)?
1. "I will take this drug with Maalox to prevent GI upset."
 2. "I will stop taking this drug when I no longer have pain upon urination."

3. "I will drink an 8-oz glass of water with this drug."
4. "I will take this drug with a cup of tea or coffee, as caffeinated beverages make this drug work more quickly."



Answers and Rationales

152. 3. Taking an 8-oz glass of water will help to prevent crystalluria.

ANTITUBERCULAR DRUGS

- A. Prototype: isoniazid (INH)
1. Action. Bacteriostatic and in high concentrations becomes bactericidal. Mechanism of action not known but is believed to interfere with lipid and nucleic acid biosynthesis in tubercle bacilli that are actively growing.
 2. Use. Initial treatment of tuberculosis; prophylactic treatment of tuberculosis in high-risk groups.
 3. Adverse effects. Peripheral neuritis; jaundice, elevation in liver function tests; nausea, vomiting; blood dyscrasias.
 4. Nursing implications
 - a. Assess neuromuscular function and give pyridoxine (vitamin B₆) to treat and/or prevent problems.
 - b. Regularly scheduled baseline liver function studies.
 - c. Monitor for hepatic dysfunction.
 - d. Take drug on empty stomach in a single daily dose.
 - e. Give drug with meals and divide daily dose into 3 equal parts if GI upset occurs.
 - f. Assess for bruising, bleeding, fever, sore throat.
 - g. Monitor CBC.
 5. Discharge teaching
 - a. Tyramine-containing foods may cause hypertensive crises, so should be avoided.
 - b. Avoid histamine-containing foods as may cause an exaggerated drug response.
 - c. Avoid use of alcohol.
 - d. May cause a feeling of euphoria. Plan rest periods and don't overdo.
 - e. Drug therapy must not be interrupted and must be continued for prescribed time.
- B. Related drugs. See Table 2-24.

Table 2-24 Drugs Commonly Used to Treat Tuberculosis

Drug and Dosage	Adverse Effects	Nursing Implications
Isoniazid (INH) 10 to 20 mg/kg (up to 300 mg) PO or IM daily, or 15 mg/kg PO or IM twice a week	Peripheral neuritis, a numbness and tingling in hands and feet. Vitamin B6 (pyridoxine) may be given to prevent or treat this condition. Hepatitis, with the risk increasing with age. Liver enzymes may be routinely monitored in elderly or symptomatic clients. Hyperexcitability may occur with single 300 mg dose.	<ul style="list-style-type: none"> Tell client to report signs of neuritis and hepatitis (anorexia, nausea, vomiting, jaundice, malaise, or dark urine). Isoniazid may interfere with phenytoin (Dilantin) metabolism, requiring a lower dose of the TB medication; should be taken on an empty stomach, and the client should not drink alcohol while on therapy.
Ethambutol (Myambutol) 15 to 25 mg/kg PO daily, or 50 mg/kg PO twice weekly	Optic neuritis, a loss of red-green color discrimination, and decreased visual acuity can occur with dosages of 25 mg/kg. Reversible, if medication discontinued. Skin rash.	<ul style="list-style-type: none"> Tell client to notify physician if vision blurs or if unable to see red or green. Use the drug with caution if a visual exam cannot be done and in clients with renal impairment.
Rifampin (Rifadin, Rimactane) 10 to 20 mg/kg (up to 600 mg) PO daily, or 600 mg PO twice a week	Body fluids (urine, tears, saliva, etc.) may turn orange. Hepatitis Flu-like syndrome Purpura (rare)	<ul style="list-style-type: none"> Tell clients to expect orange-tinged body fluids. Tell clients to report anorexia, nausea, vomiting, jaundice, malaise, or dark urine. Use the drug with caution in cases of liver disease. Rifampin affects the actions of other drugs, including anticoagulants, oral hypoglycemics, corticosteroids, oral contraceptives, and methadone.
Streptomycin 15 to 20 mg/kg (up to 1 g) IM daily or 25 to 30 mg/kg IM twice a week	Damage to cranial nerve VIII (vestibulocochlear). Damage to the vestibular portion causes dizziness, vertigo, tinnitus, and roaring in ears. Auditory damage causes loss of hearing at high frequency ranges. Renal toxicity.	<ul style="list-style-type: none"> Baseline renal and audiology studies may be obtained before therapy begins. Tell client to report any ringing, roaring, or fullness in ears. Help coordinate outpatient arrangements for IM injections, if necessary.
Pyrazinamide 20 to 40 mg/kg (up to 2 g) PO daily	Excess uric acid levels, which can cause gout or hepatitis.	<ul style="list-style-type: none"> Baseline uric acid and liver enzyme levels may be obtained; monitor uric acid and liver enzymes. Instruct patient to report any signs of gout (painful swelling in joints, chills, fever) and hepatitis (anorexia, nausea, vomiting, jaundice, malaise, and dark urine). Use with caution in clients who have liver disease, gout, or renal impairment.

Other drugs used: capreomycin (Capastat), kanamycin (Kantrex), ethionamide (Trecator-SC), para-amino-salicylic acid, and cycloserine (Seromycin).

Sample Questions

153. The nurse needs to tell the client which fact about rifampin?
- Rifampin increases the effectiveness of oral contraceptives.
 - Rifampin may cause soft-contact lenses to be permanently discolored.
 - Rifampin will increase the activity of coumarin-type oral anticoagulants.

- Rifampin is taken in the usual adult dose of 60 mg daily.

Answers and Rationales

153. 2. Rifampin (Rimactane) discolors body secretions such as sweat, urine, feces, and tears a red-orange color.



Antiviral Agents

ACYCLOVIR (ZOVIRAX)

- A. Prototype: acyclovir (Zovirax)
1. Action. Inhibits viral DNA replication. Does not cure herpes infections but decreases the severity and duration of herpes.
 2. Use. Herpes simplex virus 1 and 2, initial treatment of genital herpes infection.
 3. Adverse effects. Nausea, vomiting, diarrhea; rash; headache, vertigo; crystalluria; phlebitis at injection site; transient burning with topical use.
 4. Nursing implications
 - a. Do not give IV bolus. Give IV over 1 hour to prevent crystalluria and phlebitis.
 - b. Clients should drink plenty of fluids.
 5. Discharge teaching
 - a. Use topical preparation sparingly, and use rubber gloves when applying.
 - b. Avoid sexual contact while lesions are visible.
 - c. Drug does not cure herpes nor prevent transmission to others.
- B. Related drugs
1. Ribavirin (Virazole): Given by inhalation to treat respiratory syncytial virus (RSV) in hospitalized infants and small children. Inhalation of aerosol can be teratogenic.
 2. Zidovudine (AZT, Retrovir): Developed to control AIDS or ARC (AIDS-related complex) with *Pneumocystis carinii*. Causes leukocytopenia; monitor blood work.

3. Rimantadine (Flumadine). Used in treatment and prevention of influenza A.
4. Nevirapine (Viramune). Used with other antiviral agents to treat HIV in children and adults.
5. Indinavir (Crixivan). Used to treat adults with HIV.
6. Valacyclovir (Valtrex).



Sample Questions

154. Which statement concerning the use of acyclovir is correct?
1. Sexual relations can be resumed while using topical acyclovir.
 2. Acyclovir can be used for repeated genital herpes infections.
 3. Acyclovir should be given IV over 1 hour.
 4. Acyclovir prevents the recurrence of genital herpes.



Answers and Rationales

154. 3. IV acyclovir (Zovirax) should be given over 1 hour to prevent phlebitis and crystalluria.



Antifungal Agents

ANTIFUNGALS

- A. Prototype: amphotericin B (Fungizone)
1. Action. Fungicidal or fungistatic. Alters the fungal cell membrane permeability by binding to sterols. Clients must be monitored due to many toxic effects.
 2. Use. Candida infections, histoplasmosis, coccidiomycoses, blastomycosis, cryptococcoses.
 3. Adverse effects. Febrile reactions, nausea, vomiting; nephrotoxicity, hypokalemia, azotemia; thrombophlebitis; hypotension, tachycardia, or cardiovascular collapse with rapid infusion; blood dyscrasia; hypersensitivity.
 4. Nursing implications
 - a. Monitor CBC, BUN, creatinine, electrolytes.
 - b. Administer analgesics, antihistamines, prior to infusion to minimize febrile reactions.
 - c. Infuse drug slowly.
 - d. Monitor VS frequently.

- e. Monitor I&O.
- f. Administer potassium supplements.
- g. Do not mix with other drugs.

B. Related drugs

1. Nystatin (Mycostatin): Used to treat candida infections.
2. Griseofulvin (Grisactin): Used to treat ringworm infections. Adverse effects: headaches, blood dyscrasias, GI upset, rash from sunlight. Give on full stomach. Clients allergic to penicillin should use this drug with caution.
3. Fluconazole (Diflucan): Used to treat candida infections and cryptococcal meningitis.
4. Ketoconazole (Nizoral): Used to treat systemic fungal infections.
5. Terbinafine (Lamisil): Used to treat onychomycosis.



Sample Questions

155. Which electrolyte imbalance should the nurse monitor for while a client is on amphotericin B therapy?
1. Hyponatremia.
 2. Hypokalemia.
 3. Hyperkalemia.
 4. Hypercalcemia.



Answers and Rationales

155. 2. Hypokalemia can occur due to nephrotoxicity of this drug.



Anthelmintic Agents

ANTHELMINTICS

- A. The anthelmintics are a group of drugs that affect various systems within the worms, causing them to die. Most of these drugs are poorly absorbed in

the gastrointestinal tract. Approximately 98% of the drug remains effective as it passes through the GI tract and is excreted in the feces.

- B. See Table 2-25.

Table 2-25 Anthelmintics

Drug	Action	Use	Adverse Effects	Nursing Implications
Pyrantel (Antiminth)	Paralyzes intestinal tract of worm.	Roundworm, pinworm, hookworm	Nausea, vomiting, anorexia, abdominal cramps, diarrhea.	<ul style="list-style-type: none"> • Give with milk or fruit juice. • Entire dose must be taken at once. • Offer frequent, small meals.
Mebendazole (Vermox)	Inhibits glucose and other nutrient uptake of helminth.	Pinworm, roundworm, threadworm, hookworm	Abdominal cramping, occasional fever.	<ul style="list-style-type: none"> • Can be taken with or without food. • Tablet can be chewed or crushed. • Examine stool for presence of worms.
Thiabendazole (Mintezol)	Interferes with parasitic metabolism.	Threadworm, pinworm	Dizziness, drowsiness, headache, anorexia, nausea, malodor of urine.	<ul style="list-style-type: none"> • Give with food. • Chew tablets before swallowing. • Avoid activities such as driving and working with machinery.
Praziquantel (Biltricide)	Enhances permeability of the cell membranes of the parasite to calcium.	Shistosomes and flukes	Headache, dizziness, abdominal pain, increased liver enzymes.	<ul style="list-style-type: none"> • Give with food or liquids. • Do not chew. • Do not breastfeed.



Sample Questions

- 156.** How is mebendazole (Vermox) quite effective against pinworms?
1. It is active in the stomach where the pinworm eggs hatch.
 2. It is poorly absorbed in the GI tract and kills the pinworms that infect the intestines.
 3. Its systemic activity kills pinworms all over the body.
 4. It stimulates peristalsis causing the pinworms to be expelled before they reproduce.



Answers and Rationales

- 156. 2.** Pinworms infect the intestines. Mebendazole (Vermox) is poorly absorbed in the GI tract and therefore is quite effective against these helminths.



Antineoplastic Agents

ANTINEOPLASTIC AGENTS

- A. General considerations**
1. Combination of antineoplastic agents usually used to destroy cancer cells.
 2. Clients must be closely monitored due to many toxic adverse effects.
 3. Agents destroy cancer cells and may also kill normal cells.
- B. General adverse effects.** Nausea, vomiting, anorexia; diarrhea and constipation; stomatitis; alopecia; bone marrow depression (leukopenia, anemia, and thrombocytopenia); hepatic toxicity; hyperuricemia; fatigue.
- C. Nursing implications**
1. Handle antineoplastic agents carefully; mutagenic and possibly carcinogenic.
 2. Nurses should wear gloves, long-sleeved cover gown, protective goggles, and mask as appropriate.
 3. Monitor IV site closely to assess for extravasation and stop IV if it occurs.
 4. Treat used equipment as hazardous waste.
 5. Administer antiemetic if ordered prior to chemotherapy and up to 48 hours afterwards.
 6. Monitor CBC.
 7. Monitor I&O.
 8. Monitor liver and renal function studies.
 9. Inspect oral cavity daily.
- D. Discharge teaching**
1. Eat frequent, small portions of high-calorie, high-protein, bland, low-residue foods.
 2. Avoid highly seasoned foods, drink clear liquids if nauseated.

3. Frequent rest periods.
4. Expect alopecia and purchase scarves or wigs.
5. Report fever, use good hand-washing technique, avoid individuals with upper respiratory infections.
6. Use soft toothbrush and baking soda rinse to minimize stomatitis.
7. Use progressive relaxation exercises or guided imagery to help cope with nausea.

ALKYLATING AGENTS

- A. Prototype: cyclophosphamide (Cytosan)**
1. Action. Produces cytotoxic effects by damaging DNA and interfering with cell replication. Most effective against rapidly dividing cells.
 2. Use. Leukemias; multiple myeloma; neuroblastoma; ovarian, breast, lung cancers; Hodgkin's disease; Ewing's sarcoma.
 3. Adverse effects. Gonadal suppression, hemorrhagic and nonhemorrhagic cystitis.
 4. Nursing implications
 - a. Force fluids.
 - b. Assess for signs and symptoms of unexplained bleeding.
 - c. Assess leukocyte count frequently.
 - d. Monitor CBC, uric acid, electrolytes, thrombocytes, and hepatic and renal function at least twice a week.
 - e. Instruct client to report hematuria or dysuria immediately.
- B. Related drugs.** See Table 2-26.

Table 2-26 Alkylating Agents

Drug	Use	Comments
Cisplatin (Platinol)	Lymphoma; myeloma; melanoma; osteosarcoma; cervical, ovarian, testicular, lung, esophageal, prostatic cancers.	<ul style="list-style-type: none"> • Causes nephrotoxicity and ototoxicity, ensure adequate hydration and give diuretics prior to therapy. • Have client void every hour or insert Foley catheter before initiating treatment. • Assess for hearing deficits.
Busulfan (Myleran)	Polycythemia vera, chronic myelogenous leukemia.	<ul style="list-style-type: none"> • Discontinue drug when white blood cells (WBC) reach 15,000 mm³. • Monitor CBC as this drug can cause severe bone marrow depression.
Mechlorethamine HCl (Mustargen)	Hodgkin's disease, non-Hodgkin's lymphomas; lung cancer.	<ul style="list-style-type: none"> • Assess for edema, ascites, weight gain. • Assess for signs and symptoms of dehydration. • Wear gloves if applying solid preparation.
Thiotepa	Bladder, breast, and ovarian cancers.	<ul style="list-style-type: none"> • Decreased dose for renal or hepatic impairment and bone marrow depression. • Only given parenterally.
Chlorambucil (Leukeran)	Breast and ovarian cancer; non-Hodgkin's lymphomas; chronic lymphocytic leukemia.	<ul style="list-style-type: none"> • Assess CBC, WBC, and serum uric acid levels routinely. • Avoid IM injections when platelet count is low. • Urge client to drink 10–12 glasses of fluid per day. • Provide urine alkalinization if uric acid levels are increased.



Sample Questions

157. Which of the following should be included in client teaching about cyclophosphamide (Cytosan) therapy?
1. Omit dose if anorexic or nauseated.
 2. Drink plenty of water.
 3. Take cyclophosphamide with meals.
 4. Take cyclophosphamide before going to bed.
158. Which of the following medications might the physician order along with cyclophosphamide?
1. Metoclopramide (Reglan).
 2. Diphenhydramine HCl (Benadryl).
 3. Minoxidil (Loniten).
 4. Dexamethasone (Decadron).



Answers and Rationales

157. 2. Hemorrhagic and nonhemorrhagic cystitis are related to cyclophosphamide (Cytosan) therapy.

Drinking plenty of water and fluids reduces the risk of developing both types of cystitis.

158. 1. Metoclopramide (Reglan) is an antiemetic used to treat the nausea and vomiting that are adverse effects seen with cyclophosphamide (Cytosan) therapy.

ANTIMETABOLITES

- A. Prototype: methotrexate with leucovorin rescue
1. Action. Leucovorin calcium is a folic acid analog that interferes with mitotic process by blocking folinic acid.
 2. Use. Acute lymphoblastic leukemia; cancer of breast, lung, testes, ovary, head, and neck; choriocarcinoma.
 3. Adverse effects. See General Considerations. Intrathecal use may cause fever, headache, and vomiting.
 4. Nursing implications. Leucovorin calcium is frequently given to prevent toxicity when high doses of methotrexate are given.
 5. Discharge teaching. See General Considerations. Instruct client to avoid self-medication with OTC vitamins (folic acid and derivatives may alter drug response).

- B. Related drugs.**
1. 5-Fluorouracil (5-FU)
 2. Mercaptopurine (Purinethol)
 3. Cytarabine (Cytosar-U)
 4. Floxuridine (FUdR)
 5. Fludarabine (Fludara)



Sample Questions

- 159.** Which of the following drugs is given to prevent methotrexate toxicity?
1. Trimethobenzamide HCl (Tigan)
 2. Prednisone
 3. Allopurinol (Zyloprim)
 4. Leucovorin calcium
- 160.** Which of the following agents should be avoided by clients on methotrexate therapy?
1. Folic acid
 2. Vitamin C
 3. Iron
 4. Vitamin D



Answers and Rationales

- 159.** 4. Leucovorin calcium is a reduced form of folic acid that takes up binding sites to prevent methotrexate toxicity.
- 160.** 1. Folic acid can alter methotrexate response.

ANTIBIOTIC ANTINEOPLASTIC AGENTS

- A. Prototype: doxorubicin HCl (Adriamycin)**
1. Action. Attaches to DNA and prevents DNA synthesis in vulnerable cells.
 2. Use. Cancer of thyroid, lung, bladder, breast, and ovary; acute leukemia; sarcoma; Ewing's sarcoma; neuroblastoma; lymphomas.
 3. Adverse effects. Nausea, vomiting, stomatitis; ECG changes; agranulocytosis, leukopenia, thrombocytopenia; hyperpigmentation of skin and nails; alopecia.
 4. Nursing implications
 - a. Do not give SC or IM—local reaction and skin necrosis can occur.
 - b. IV use: reconstitute with normal saline or sterile water; reconstituted solution stable for 24 hours at room temperature or

48 hours if refrigerated; protect from sunlight; do not infuse in less than 5 minutes; red streaking over vein and facial flushing are signs of too-rapid administration.

- c. Do not mix with other drugs.
 - d. Monitor IV site; for local extravasation pour normal saline on area, apply a cold compress; infiltration with corticosteroid may be ordered.
 - e. Monitor CBC, serum uric acid levels, cardiac output (listen for S₃), weight.
 - f. Frequent mouth care.
 - g. Client needs sufficient fluids to prevent hyperuricemia.
 - h. Assist client with information on wigs and head coverings before hair loss starts.
 - i. Offer support to client to deal with drug therapy and diagnosis.
 - j. Wear gloves to prepare this drug. Wash skin with soap and water if powder or solution contacts skin.
 - k. Urine is red colored for 1–2 days after administration. Clears within 48 hours.
- B. Related drugs.** See Table 2-27.



Sample Questions

- 161.** While the client is receiving intravenous doxorubicin the nurse should monitor which of the following?
1. Chest X-rays.
 2. Sodium levels.
 3. Liver function studies.
 4. Electrocardiograms.
- 162.** What complaints would alert the nurse to stop the infusion of doxorubicin?
1. Headache and dizziness.
 2. Burning and pain at the infusion site.
 3. Upset stomach and heartburn.
 4. Light-headedness and confusion.
- 163.** Which nursing action is NOT appropriate for the client receiving doxorubicin?
1. Provide frequent mouth care for the client.
 2. Tell the client his urine will be red-tinged for the first couple of days after administration of the drug.
 3. Put the client on fluid restriction.
 4. Explain to the client he will lose his hair.

Table 2-27 Antibiotic Antineoplastic Agents

Drug	Action	Uses	Comments
Bleomycin Sulfate (Blenoxane)	Prevents DNA, RNA, and protein synthesis in cells Cell cycle specific in G2 and M phases.	Lymphomas, melanoma, cancers of head, neck, esophagus, lung, skin, penis, testes, vulva, cervix, anus.	<ul style="list-style-type: none"> • Pulmonary side effects of dyspnea, fever, rales, cough. • Febrile reaction usually occurs on first day of therapy. • Monitor respiratory status.
Dactinomycin (Actinomycin D)	Prevents synthesis of messenger RNA; cell cycle nonspecific.	Testicular cancer, melanoma, choriocarcinoma, Wilm's tumor, neuroblastoma, retinoblastoma, Ewing's sarcoma, Kaposi's sarcoma.	<ul style="list-style-type: none"> • Monitor IV site carefully. • Do not expose drug solution to direct sunlight.
Daunorubicin (Daunomycin)	Inhibits DNA synthesis; cell cycle specific in S-phase of cell cycle.	Acute myelocytic and lymphocytic leukemia.	<ul style="list-style-type: none"> • ECG changes can occur. • Urine turns red on day of administration. • Monitor IV site carefully • Never give IM or SC. • Do not mix with heparin.
Mitomycin (Mutamycin)	Prevents DNA and protein synthesis in cells; cell cycle nonspecific	Cancer of gastrointestinal tract, breast, lung, bladder, cervix.	• See Prototype Drug
Plicamycin (Mithramycin)	Prevents DNA synthesis; decreases serum calcium by unknown action; blocks action of parathyroid hormone.	Testicular cancer, hypercalcemia.	<ul style="list-style-type: none"> • Side effect of bleeding. • Monitor blood coagulation studies. • Monitor client for signs of hypocalcemia.



Answers and Rationales

- 161. 4.** Doxorubicin (Adriamycin) can cause ECG changes; the nurse should monitor electrocardiograms while the client is receiving this drug.
- 162. 2.** Intravenous infusion of doxorubicin (Adriamycin) should be stopped if the client complains of burning and pain at the infusion site. These signs are indicative of extravasation, which could lead to skin necrosis.
- 163. 3.** Fluids should not be restricted for a client receiving doxorubicin; this drug can cause hyperuricemia if fluid intake is not sufficient.

ANTINEOPLASTICS AFFECTING HORMONAL BALANCE

- A.** Mechanism of action of hormonal agents.
1. Exact mechanism is not completely understood.

2. Believed that hormonal agents hinder use of steroids necessary for cell growth.
 3. Hormonal therapy keeps cancer cells in resting phase, thus decreasing growth of tumor.
 4. No direct cytotoxic effect of hormonal agents so they are unable to cure cancer.
- B.** Estrogens (female hormones). See Table 2-28.
- C.** Androgens (male hormones) are also used as replacement therapy for growth and development of male sex organs and secondary sex characteristics in androgen-deficient males. See Table 2-29.
- D.** Antihormonal agents
1. Antiestrogen: Tamoxifen (Nolvadex)
 - a. Use. Advanced breast cancer in pre- and postmenopausal women.
 - b. Adverse effects. Most common are similar to signs of menopause (hot flashes and flushing); nausea, vomiting; temporary bone and tumor pain; temporary drop in WBC count.
 - c. Nursing implications. Monitor WBC count; tell premenopausal women to use contraception as short-term therapy causes ovulation.
 2. Antiadrenal: aminoglutethamide (Cytadren)
 - a. Use. Adrenal and metastatic breast cancer.

Table 2-28 Estrogens

Drug	Use	Adverse Effects	Nursing Implications
Diethylstilbestrol (DES)	Breast and prostate cancer.	Headache; vertigo; insomnia; nausea; weight changes; phlebitis; edema; uterine bleeding; feminization in males; changes in calcium and folic acid metabolism	<ul style="list-style-type: none"> • Monitor calcium levels. • Monitor males for signs of feminization. • Monitor salt intake and keep it reduced. • Weigh client daily.
Ethinyl Estradiol (Estinyl)	Breast and prostate cancer.	See Diethylstilbestrol (DES)	See Diethylstilbestrol (DES)

Table 2-29 Androgens

Drug	Use	Adverse Effects	Nursing Implications
Fluoxymesterone (Halotestin)	Breast and renal cancer	Nausea; vomiting; weight gain; edema and fluid retention; vaginal dryness and itching; acne; hypercalcemia if bone cancer present; masculinization of females	<ul style="list-style-type: none"> • Monitor client for masculinizing effects. • Monitor weight. • Low salt intake. • Restrict fluids if necessary. • Monitor blood pressure.
Testosterone Cypionate (Depo-Testosterone)	Breast cancer	See Fluoxymesterone (Halotestin)	<ul style="list-style-type: none"> • IM must be given deeply into gluteal muscle. • See Fluoxymesterone (Halotestin)

- b. Adverse effects. Drowsiness; anorexia, nausea; vomiting, severe pancytopenia; rash; and adrenal insufficiency.
 - c. Nursing implications. Possible replacement therapy with hydrocortisone and mineralocorticoids; monitor blood pressure, thyroid studies, and CBC; tell client that drug may cause drowsiness and orthostatic hypotension.
3. Gonadotropin releasing hormone: leuprolide (Lupron)
 - a. Use. Prostate cancer.
 - b. Adverse effects. Hot flashes, transient bone pain, rash, alopecia, cardiac arrhythmias, breathing difficulty, and hematuria.
 - c. Nursing implications. Monitor and rotate injection sites; only use syringes provided with drug; provide comfort measures.

3. Serum potassium.
4. Serum calcium.

165. Which statement about diethylstilbestrol made to a male client by the nurse is incorrect?
 1. “You may develop signs of increased masculinity while taking diethylstilbestrol.”
 2. “You need to decrease your salt intake while taking diethylstilbestrol.”
 3. “You will need to weigh yourself each day while taking diethylstilbestrol.”
 4. “You can experience vascular problems while taking diethylstilbestrol.”



Sample Questions

164. Which diagnostic test should the nurse monitor when the client is receiving diethylstilbestrol?
 1. Arterial blood gases.
 2. Liver enzymes.



Answers and Rationales

164. 4. Diethylstilbestrol (DES) can cause hypercalcemia; serum calcium levels need to be monitored.
165. 1. Diethylstilbestrol (DES) can cause signs of feminization in males, not increased masculinity in males.

Table 2-30 Mitotic Inhibitors

Drug	Use	Adverse Effects	Nursing Implications
Etoposide (VP-16; VePesid)	Lymphomas; acute nonlymphocytic leukemia; cancer of lung, testes, bladder, prostate, liver, uterus	Myelotoxic; nausea; vomiting; diarrhea; somnolence; peripheral neuropathy; hepatotoxicity	<ul style="list-style-type: none"> • Do not give IM or SC as will cause tissue necrosis. • Do not give IV push. • Avoid skin contact with this drug. • Hypotension can occur during administration; monitor blood pressure.
Vinblastine (Velban)	Lymphomas; cancer of testes, breast, kidney, head and neck, Kaposi's sarcoma	Peripheral neuropathies, paresthesias, neuritis, muscle pain and weakness, pain in tumor site, urinary retention	<ul style="list-style-type: none"> • Monitor CBC and platelets. • Frequent neuro checks. • Monitor for extravasation. • Monitor I&O.
Pacitaxel (Taxol)	Advanced ovarian cancer	Severe allergic reactions, bone marrow suppression, peripheral neuropathy, muscle pain	<ul style="list-style-type: none"> • Wear gloves when handling. • Premedicate client with a steroid and an H-1 and H-2 antagonist before administration. • Check blood pressure and pulse during administration.

MITOTIC INHIBITORS

- A.** Prototype: vincristine (Oncovin)
1. Action. Acts on cells undergoing mitosis, thus stopping cell division.
 2. Use. Acute leukemia; lymphomas; cancer of brain, breast, cervix, testes; Wilm's tumor.
 3. Adverse effects. Peripheral neuropathy; paresthesias; loss of deep tendon reflexes; jaw pain; cramps; muscle weakness; constipation; nausea, vomiting, stomatitis; phlebitis; alopecia; hyponatremia; leukopenia; photosensitivity.
 4. Nursing implications
 - a. Do not give IM or SC as tissue necrosis can occur.
 - b. For IV use, inject solution directly into vein or into tubing of running IV infusion. Infusion can be given over 1 minute.
 - c. Monitor bowel function.
 - d. Frequent neuro checks.
 - e. Monitor CBC and platelets.
 - f. Advise client to avoid overexposure to sun.
- B.** Related drugs. See Table 2-30.

2. "You won't lose any hair."
3. "You may have constipation."
4. "You won't have any breathing problems."



Answers and Rationales

- 166.** 2. Alopecia is an adverse effect of vincristine (Oncovin).

MISCELLANEOUS ANTINEOPLASTIC AGENTS

- A.** L-Asparaginase (Elspar)
1. Action. Enzyme that destroys asparagine, an amino acid necessary for protein synthesis of leukemia cells. Causes death to leukemia cells.
 2. Use. Acute lymphocytic leukemia.
 3. Adverse effects. Anorexia, nausea, vomiting, azotemia, hemorrhagic pancreatitis, rash, hyperglycemia, increased serum ammonia, anaphylaxis, and hepatotoxicity.
 4. Nursing implications
 - a. Monitor CBC, platelets, renal and pancreatic enzymes, coagulation studies, uric acid, blood glucose, and serum albumin.
 - b. Don't shake vial.
 - c. Only give drug in a clear solution; chance of hypersensitivity is increased with each dose.
- B.** Hydroxyurea (Hydrea)
1. Action. Urea derivative that kills granulocytes. Prevents DNA synthesis in cell cycle.



Sample Questions

- 166.** The client requests information about the adverse effects of vincristine. Which statement by the nurse would need correcting?
1. "You may experience muscle cramps and muscle weakness."

2. Use. Chronic myelogenous leukemia; malignant melanoma and cancers of the head, neck, ovary, and colon; sickle cell crisis.
 3. Adverse effects. Anemia, leukopenia, megaloblastosis, thrombocytopenia, anorexia, nausea, vomiting, and diarrhea.
 4. Nursing implications. Monitor CBC, platelets, liver and renal enzymes; encourage fluids.
- C. Procarbazine (Matulane)
1. Action. Similar to alkylating agents; inhibits RNA, DNA, and protein synthesis in the cell.
 2. Use. Hodgkin's disease, multiple myeloma, malignant melanoma, lung cancer, and brain tumors.
 3. Adverse effects. Anorexia, nausea, vomiting, leukopenia, thrombocytopenia, and altered reproductive potential.
 4. Nursing implications
 - a. Advise client to avoid alcohol, sedatives, narcotics, and tricyclic antidepressants (drug is an MAO inhibitor).
 - b. Restrict foods high in tyramines.
 - c. Monitor CBC, platelets, and liver enzymes.



Sample Questions

167. Your client is receiving L-asparaginase (Elspar) and complains of stomach pain. You will need to evaluate which laboratory test?
1. Platelet count.
 2. BUN.
 3. Serum amylase.
 4. Serum potassium.



Answers and Rationales

167. 3. Stomach pain may be a sign of pancreatitis, which is an adverse effect of L-asparaginase (Elspar). The nurse should monitor serum amylase as an elevation of this enzyme indicates a need to discontinue the drug.



Immunosuppressants

AZATHIOPRINE (IMURAN)

- A. Prototype: azathioprine (Imuran)
1. Action. Purine analog and derivative of mercaptopurine that antagonizes purine metabolism, interferes with nucleic acid synthesis, and alters antibody production. Immunosuppressant action not fully understood.
 2. Use. Adjunct to prevent rejection of renal transplants; severe rheumatoid arthritis.
 3. Adverse effects. Hypotension, pulmonary edema; hepatotoxicity; nausea, vomiting, diarrhea, stomatitis, anorexia; alopecia; bone marrow suppression, leukopenia, thrombocytopenia; hypersensitivity pancreatitis, skin rash; secondary infection.
 4. Nursing implications
 - a. Monitor CBC, liver and kidney function studies.
 - b. Monitor for symptoms of infection.
 - c. Monitor for symptoms of rejection.
 5. Discharge teaching
 - a. Take with food.
 - b. Report signs of infection and bruising.
 - c. Use good handwashing and hygiene and avoid individuals with URIs.
- B. Related drugs
1. Mycophenolate (CellCept)
 - a. Used to prevent and treat rejection of renal transplants.
 - b. Given orally.



Sample Questions

168. Which statement by the client indicates a need for further teaching in regard to azathioprine therapy?
1. "I will take one daily dose 1 hour before breakfast."
 2. "I should avoid individuals who have the flu or a cold."
 3. "I will notify the physician if I notice any bruising."
 4. "I will try to maintain good personal hygiene."



Answers and Rationales

168. 1. Azathioprine (Imuran) should be taken with food and in divided doses to reduce GI upset.

CYCLOSPORINE (SANDIMMUNE)

- A. Prototype: cyclosporine (Sandimmune)
1. Action. Exact immunosuppressant action unknown. Interferes with T-lymphocyte activity.
 2. Use. Prophylaxis for recipients of kidney, heart, and liver transplants to prevent organ rejection.
 3. Adverse effects. Nephrotoxicity; hepatotoxicity; hypertension; infections; tremors; leukopenia; diarrhea, nausea, vomiting; anaphylaxis in IV use; gum hyperplasia.
 4. Nursing implications
 - a. Monitor CBC, liver and kidney function studies.
 - b. With IV use epinephrine; resuscitation equipment should be available.
 - c. Protect IV infusion from light.
 - d. Mix PO medication in milk or orange juice at room temperature. Stir and drink immediately and rinse glass with more milk or juice to ensure that entire dose has been taken.

- e. Notify physician if bruising present or oliguria.
5. Discharge teaching. See Azathioprine (Imuran).
- B. Related drugs
1. Tacrolimus (Prograf)
 - a. Used to prevent rejection with kidney, heart, and liver transplants.
 - b. Given orally or IV.



Sample Questions

169. Which lab values should be monitored in clients receiving cyclosporine?
1. Electrolytes.
 2. Glucose.
 3. BUN and creatinine.
 4. Serum amylase.



Answers and Rationales

169. 3. Cyclosporine (Sandimmune) has nephrotoxic effects; therefore, BUN and creatinine levels should be monitored.



Vitamins and Minerals

Vitamins and some minerals are vital substances needed by the human body. Because nutrition plays an important role, they are primarily discussed in the nutrition section, Unit 4. Excessive quantities of vitamins can cause adverse effects. Treatment of poisonous minerals is included here as is fluoride, a treatment for prevention of dental caries.

VITAMINS

- A. General considerations related to vitamins.
1. Vitamins are necessary for body metabolism of carbohydrates, protein, and fat.
 2. Dosage of vitamins is stated in RDAs—recommended daily allowances.
 3. Fat-soluble vitamins accumulate in the body; therefore excessive amounts should not be taken.

- B. See Table 4-3, Vitamins, Unit 4.



Sample Questions

170. A client admits to taking Vitamin A in excess of 50,000 units daily. The nurse explains that this is considered an overdose and that he can get adequate amounts of vitamin A in his diet. What is an example of a good dietary source of vitamin A?
1. Spinach.
 2. Pork.
 3. Nuts.
 4. Tomatoes.



Answers and Rationales

170. 1. Dark green vegetables such as spinach are good food sources of vitamin A.

MINERALS

- A. General considerations related to minerals.
1. Minerals are essential components of living tissues.
 2. Dosage of minerals is stated in RDAs.
 3. Minerals are divided into 2 groups, major elements and micronutrients.
 - a. Major elements: calcium, phosphorus, magnesium, sodium, potassium, chloride, and sulfur.
 - b. Micronutrients: iron, copper, iodine, manganese, zinc, fluorine, cobalt, chromium, molybdenum, and selenium.
- B. See Table 4-2, Minerals, Unit 4.



Sample Questions

171. What information should the nurse provide the client regarding iron administration?
1. Take it with milk.
 2. Take it with meals.
 3. Take after meals with an antacid.
 4. Take with orange juice between meals.



Answers and Rationales

171. 4. Orange juice contains vitamin C which helps to absorb iron. Iron should be taken between meals for maximum absorption. *Note: sometimes iron is given with meals to decrease GI side effects, but absorption is reduced.*

HEAVY METAL ANTAGONISTS

- A. Heavy metals such as lead, iron, arsenic, gold, and mercury can have toxic effects. Heavy metal antagonists prevent or reverse poisoning by neutralizing the heavy metals. Toxic effects or poisoning can occur from drug overdose (e.g., gold salts or iron), or accidental ingestion of lead chips from lead-containing paint, or pesticide ingestion.
- B. Examples of heavy metal antagonists
1. Deferoxamine mesylate for iron intoxication
 - a. May turn urine red.
 - b. When given IV, use an infusion pump and monitor blood pressure frequently.
 - c. May cause hypotension, tachycardia, allergic reactions, and pain on injection.
 2. Edetate calcium disodium (Calcium EDTA). For lead poisoning; can cause renal toxicity. May increase intracranial pressure: do not give IV if lead encephalopathy.
 3. Dimercaprol (BAL in oil). Given IM in combination with calcium EDTA to treat lead poisoning. Also used to treat arsenic, mercury, and gold toxicity. Painful on injection and can cause hypertension and tachycardia in large doses.
 4. Edetate disodium (Disodium EDTA) for hypercalcemic crisis.



Sample Questions

172. What should be monitored when administering calcium EDTA for lead poisoning?
1. Liver function studies.
 2. Kidney function.
 3. Hemoglobin and hematocrit.
 4. Glucose levels.



Answers and Rationales

172. 2. Calcium EDTA can cause renal toxicity.



Herbs and Herbal Health Products

HISTORY

- A. Eighty percent of the world's population currently use herbs for some aspect of primary health care.
- B. Plants and plant products are still a common element today in the healing disciplines of ayurvedic (homeopathic) medicine, naturopathic (traditional oriental) medicine, and Native American groups.
- C. Americans embrace the use of herbs/herbal health products and spend approximately \$5 billion dollars a year on "natural" herbal products.
- D. Americans who use herbs/herbal health products are generally better educated and are holistically health oriented. These individuals are more likely to discuss and report their overall health status to their health care provider. Americans are also reluctant to tell health care providers of their herb use, are risking adverse interactions between herbs and their prescriptions, and are putting themselves at risk for surgery or any invasive procedure without disclosure of their herbs/herbal health products use.

SOURCE AND USE

- A. Herbs are flowering plants, shrubs, trees, moss ferns, fungus, seaweed or algae plants, or plant parts that are valued for medicinal qualities. Herbs and herbal health products are used in all shapes and forms.
- B. Common uses include infusions, teas, tablets (pills), lozenges, extracts, salves, balms, ointments, and oils.

NATURAL PHARMACY

- A. Herbs are considered to be pharmacologic remedies that are readily available over-the-counter for general

use. Herbs/herbal health products may be natural but not necessarily safe.

- B. Herbs are chemical compounds that are biologically active and as such require review and safety education before their use.
- C. Currently there is a lack of standardized and scientific data to support the general use of the herbs/herbal health products that are sold as nutritional supplements.
- D. These do not require FDA approval. The FDA requirements for the strength and purity of the supplement on the label are in the early stages.

COMPLICATIONS

- A. Toxic impurities and incorrectly mixed herbs have resulted in kidney failure and death.
- B. Allergic reactions and interaction with prescription drugs have also been reported.
- C. The FDA has become involved with herbs/herbal health products when there have been serious health issues and deaths as in the case of ephedra and cascara sagrada. See Table 2-31 for commonly used herbs and the possible side effects.

PROFESSIONAL RESPONSIBILITIES

The nurse, as a professional, should provide for clients the resources and client education materials that include common names and uses and side effects of herbs and herbal health products. The nurse must include in the health assessment interview open-ended questions regarding use of herbal supplements and OTC medications. The nurse must be aware of common herbs/herbal health products and their interaction with commonly prescribed medications.

Table 2-31 Commonly Used Herbs

Common Herbs	Common Use	Possible Clinical Side Effects
Ginkgo	Improve memory; increase blood circulation (peripheral and to the brain); treat bronchial, asthmatic, and pulmonary conditions	<ul style="list-style-type: none"> • Increased risk of bleeding • Changes in hemodynamic monitoring • Interference with antiseizure medications • GI distress
St. John's Wort	Antianxiety, anti-inflammatory, antidepressive, and sedative agent	<ul style="list-style-type: none"> • Decreased effectiveness of digoxin • Intensify or prolong effects of narcotics and anesthetic agents • Large doses may result in photosensitivity • Potential for constipation, abdominal cramps, dry mouth, fatigue, dizziness, insomnia, or restlessness
Ginseng	Increase physical stamina and mental concentration, enhance general health, stimulate CNS, decrease the advances of Alzheimer's disease, reduce tinnitus for those with chronic ringing in the ear	<ul style="list-style-type: none"> • Potential to falsely increase digoxin levels • Potential for bleeding in postmenopausal females • Potential for hypertension when combined with caffeine • May result in increased heart rates • Contraindicated in pregnancy and lactation
Garlic	Lower cholesterol and triglyceride levels and blood pressure; currently looked at for antioxidant, fibrinolytic, and antimicrobial properties destroying bacteria, fungi, and parasites	<ul style="list-style-type: none"> • Potential for dangerously low blood sugars when combined with diabetes medication • Potential for headaches and potentiate myalgia and fatigue • Potential for increased bleeding and bruising, especially for individuals taking anticoagulating medications
Feverfew	Prevent migraine headaches; decrease the number and severity of headaches; arthritis and rheumatic disease	<ul style="list-style-type: none"> • Potential for allergic reactions with allergies to ragweed, asters, chrysanthemums, or daisies • Potential for abdominal pain, glossitis, stomatitis, and allergic dermatitis; GI upsets and nervousness • Potential for interaction with thrombolytics, anticoagulants, and aspirin, increasing bleeding • Potential for dangerously high levels of heart rate and blood pressure if combined with Imitrex or other migraine medication • Potential for withdrawal syndrome in abrupt withdrawal, including rebound headaches, insomnia, fatigue, and nervousness • Contraindicated in pregnancy and lactation
Kava Kava	Nervousness, anxiety, or restlessness; used as a muscle relaxant, antispasmodic, anticonvulsant—psychotropic treatment for cystitis	<ul style="list-style-type: none"> • Potential for increased effects of certain antiseizure medications, intensifying psychoactive agents • Potentiate barbiturates and prolong effects of certain anesthetics • Potential for increased alcohol effects with risk of toxicity • Potential for allergic reactions—rash, GI discomfort, changes in ocular movement, and hepatotoxicity • Potential for increased risk of suicide for people with endogenous depression • Contraindicated in pregnancy and lactation
Licorice	Treat coughs and chills; expectorant; anti-inflammatory; antiallergic; treatment of, preventing, and healing stomach ulcers	<ul style="list-style-type: none"> • Potential for hypertension, swelling, or electrolyte imbalance • Potential for headaches, lethargy, and sodium and water retention in long-term use • Potential for potassium loss and possible heart failure

(continues)

Table 2-31 Commonly Used Herbs (continued)

Common Herbs	Common Use	Possible Clinical Side Effects
Ginger	Motion sickness, nausea, vomiting, and vertigo, stomachaches, to aid digestion, a mild stimulant to help promote circulation	<ul style="list-style-type: none"> • Potential for increased bleeding in clients already taking certain anticlotting medications, anyone at risk for hemorrhage • Contraindicated for treating morning sickness associated with pregnancy • Potential for CNS depression or dysrhythmia in overdose
Saw Palmetto	Enlarged prostate and urinary inflammations; mild diuretic	<ul style="list-style-type: none"> • Potential for GI upset, nausea, abdominal pain, hypertension, headache, urinary retention, and back pain • Potential for effects with other hormone therapies such as adrenergic drugs and oral contraceptives; may result in oral contraceptive failure • Reduces absorption of iron • Potential for false-positive prostate specific antigen test results • Contraindicated in pregnancy and lactation due to its hormonal effects
Valerian	Mild sleep aid, muscle relaxant, for relief of nervous stomachs, for stress relief, or as a sedative; decrease time to sleep, does not result in sleep hangover	<ul style="list-style-type: none"> • Potential for GI complaints, headache • Potential for excitatory effects, cardiac function disorders, and restless-sleepless states • Potential for increased effects of certain antiseizure medications • Potential for prolonging the effects of certain anesthesia agents • Potential for increased sedative effects of barbiturates • Potential to demonstrate an additive effect when used with benzodiazepines • Potential for hepatomegaly when combined with other herbs such as skullcap and mistletoe • Contraindicated in infants and pregnant women



Vaccines and Toxoids

VACCINES AND TOXOIDS

A. Vaccines and toxoids: general information

1. Given to prevent some infectious diseases and diseases transferred by animal bites and injuries.
2. Vaccine is composed of weakened or dead microorganisms that cause antibody formation.
3. Toxoid is a bacterial toxin that has reduced toxicity but can cause antibody formation.
4. Immunity is the ability to fight or conquer infection.
 - a. Natural immunity exists from birth and is a basic form of resistance to disease.
 - b. Acquired immunity occurs after birth. Can be active or passive. Involves the manufacture of antibodies against antigens

in the body. Takes time to develop and considered to be permanent. Acquired by the person having a specific disease or by inoculation with toxoid or vaccines. Passive immunity involves the individual receiving antibodies against antigens that have been formed someplace other than within the person. Is immediate but effects are short-lived. Is acquired through injection of serum containing antibodies.

5. If immunosuppressed, receiving corticosteroid therapy, or has an active infection, should not be inoculated.

B. Specific vaccines and toxoids

1. DPT (Diphtheria, Tetanus Toxoid, and Pertussis Vaccine). Produces active immunity by forming antibodies.

- a. DTwP Vaccine (Tri-Immunol). Contains diphtheria and tetanus toxoids and whole-cell pertussis vaccine.
 - b. DTaP Vaccine (Tripedia, Acel-Imune, Certiva, Infanix). Contains diphtheria and tetanus toxoids and acellular pertussis vaccine. Has fewer side effects and is more effective than DTwP. Recommended for all children, including those who began the series with DTwP.
 - c. Doses are given at 2 months, 4 months, 6 months, between 15 and 18 months, and 4 and 6 years.
2. MMR (Measles, Mumps, Rubella). Contains live attenuated virus. Should not be given during pregnancy. Give with caution to children who have a history of thrombocytopenia and anaphylactic-like reactions to eggs, neomycin, and gelatin.
 - a. Give between 12 and 15 months and 4 and 6 years. Second dose must be given before age 12.
 - b. DPT can be given with MMR.
 3. Inactivated Polio Vaccine (IPV). Contains inactivated viruses of all three polio serotypes. Four doses are given: at 2 months, at 4 months, between 6 and 18 months, and between 4 and 6 years. Has no serious adverse effects.
 4. Bacillus Calmette-Guerin Vaccine (BCG). Produces active immunity to tuberculosis (TB). Give to infants in countries where TB is endemic. Persons who have had BCG will have a positive purified protein derivative (PPD) test.
 - a. Also used to stimulate the immune system in treating cancer.
 - b. Should not be given to persons taking antituberculosis drugs.
 5. Hepatitis B Vaccine (Engerix-B). Effective against all types of hepatitis B and recommended for individuals at risk to contract hepatitis B. Now recommended for all children.
 - a. Does not prevent an unrecognized infection already present.
 - b. Two IM doses are given 1 month apart and a third dose is given 6 months after the first dose.
 6. Hemophilus Influenza B (Hibtiter). Given at 2, 4, and 6 months and booster at 15 months.
 7. Td (Adult Tetanus Toxoid and Diphtheria Toxoid). Give at age 14–16 years and repeated every 10 years.
 8. Varicella Virus Vaccine (Varivax). Contains live, attenuated varicella viruses. Has no serious adverse effects. A single dose should be given to children 12 to 18 months of age.
 9. Hepatitis A Vaccine (Havrix). Contains inactivated hepatitis A virus. Recommended where there is high risk for disease. Has no

serious adverse effects. First dose given at 12 months of age and second dose 6–12 months after.

10. Refer to Table 5-5, Recommended Schedule for Immunization, Unit 5.



Sample Questions

173. A 4-month-old child is brought to the clinic for the next set of immunizations. Which of the following would contraindicate receiving immunizations at this time?
 1. Delayed development.
 2. Weight loss.
 3. Anorexia.
 4. Active infection.



Answers and Rationales

173. 4. Any evidence of an active infection contraindicates immunization. Other contraindications for immunization are immunosuppression and corticosteroid therapy.

IMMUNE SERUMS

- A. Immune serums
 1. Provide passive immunity. They are antibodies that are formed in another person or animal and then given to the client. Offer immediate immunity but duration is short. Treatment considered to be only moderately effective.
 2. Hepatitis B immune globulin, human. Given as a prophylactic treatment after exposure to hepatitis B. Needs to be given to adults within 7 days of exposure and repeated in 28–30 days. Newborns are immunized at birth and then again at 3 and 6 months. Cautious use in persons with hypersensitivity to immune globulins. Adverse effects: tenderness at injection site and urticaria.
 3. Immune serum globulin (immunoglobulin). Given to nonimmunized persons to prevent or reduce severity of various infectious diseases and prophylactically in primary immune deficiencies. Adverse effects: pain and redness at the injection site.
 4. Tetanus immune globulin, human (Hypertet). Used if wound more than 24 hours old or if client has fewer than two previous tetanus toxoid injections. Is considered to be better

than antitoxin. Adverse effect: discomfort at the injection site.

5. Rho (D) immune globulin, human (RhoGAM). Given to Rh-negative mothers with Rh-positive fetus, and also given to Rh-negative women who have miscarriages or abortions. Must be given within 72 hours of delivery. Contraindicated in hypersensitivity to immune globulin. Adverse effect: local tenderness.



Sample Questions

174. The client is given the hepatitis B immune globulin serum, which will provide passive immunity. What is an advantage of passive immunity?
1. It has effects that last a long time.
 2. It is highly effective in treatment of disease.
 3. It offers immediate protection.
 4. It encourages the body to produce antibodies.
175. What common adverse effects will the nurse tell the client may be experienced after being given hepatitis B immune globulin?
1. Tachycardia and chest tightness.
 2. Heartburn and diarrhea.
 3. Dyspnea and upper respiratory infection.
 4. Pain and tenderness at the injection site.



Answers and Rationales

174. 3. Passive immunity provides immediate protection. Passive immunity is also short-lived, is limited in effectiveness, and does not stimulate the body to produce antibodies.
175. 4. The most common adverse effects of hepatitis B immune globulin are pain and tenderness at the injection site.

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