Chapter 7
Principles of Pharmacology

Unit Summary

After students complete this chapter and the related course work, they will understand the significance and characteristics of general pharmacology and will be able to identify, describe, and demonstrate the steps for assisting/administering medications carried by the EMT.

National EMS Education Standard Competencies

Pharmacology
Applies fundamental knowledge of the medications that the EMT may assist/administer to a patient during an emergency.

Principles of Pharmacology
• Medication safety (pp 227–228)
• Kinds of medications used during an emergency (pp 229–239)

Medication Administration
• Self-administer medication (pp 228–229)
• Peer-administer medication (pp 228–229)
• Assist/administer medications to a patient (pp 228–229)

Emergency Medications
• Names (p 222)
• Effects (pp 221–222)
• Actions (p 222)
• Indications (p 222)
• Contraindications (p 222)
• Complications (p 222)
• Routes of administration (pp 222–224)
• Side effects (p 222)
• Interactions (p 230–231)
• Dosages for the medications administered (p 221)

Knowledge Objectives

1. Explain the actions of medications on the body, and define the terms pharmacodynamics, intended effects, and indications. (pp 221–222)
2. Explain and give examples of medication contraindications, and define the terms side effects, unintended effects, and untoward effects. (p 222)

3. Discuss the differences between a generic medication name and a trade medication name, and provide an example of each. (p 222)

4. Describe the enteral and parenteral routes of medication administration, and explain how they differ. (pp 222–223)

5. Describe the following routes of medication administration and discuss their individual rates of absorption: rectal, oral, intravenous, intraosseous, subcutaneous, intramuscular, inhalation, sublingual, and transcutaneous. (pp 222–224)

6. Explain the solid, liquid, and gas forms of medication, provide examples of each, and discuss how the form of a medication dictates its route of administration. (pp 224–227)

7. Explain the “six rights” of medication administration, and describe how each one relates to EMS. (pp 227–228)

8. Describe the role of medical direction in medication administration, and explain the difference between direct orders (online) and standing orders (off-line). (pp 228–229)

9. Discuss the circumstances surrounding the administration of medication, including peer-assisted medication, patient-assisted medication, and EMT-administered medication. (p 229)

10. Give the generic and trade names, actions, indications, contraindications, routes of administration, side effects, interactions, and doses of 10 medications that may be administered by an EMT in an emergency as dictated by state protocols and local medical direction. (pp 229–239)

11. Describe the medication administration considerations that must be applied to special populations, including pediatric, geriatric, and pregnant patients. (pp 229, 236, 238)

12. Describe the steps an EMT should follow when dispensing epinephrine to a patient using an auto-injector. (p 236)

13. Explain why determining what prescription and OTC medications a patient is taking is a critical aspect of patient assessment during an emergency. (p 239)

Skills Objectives

1. Demonstrate the process an EMT should follow when following the six rights of medication administration. (p 228)

2. Demonstrate how to administer oral medication to a patient. (pp 232–234, Skill Drill 7-1)

3. Demonstrate the administration of aspirin to a patient with chest pain. (pp 232–234, Skill Drill 7-1)

4. Demonstrate the administration of oral glucose to a patient with hypoglycemia. (pp 232–234, Skill Drill 7-1)

5. Demonstrate how to assist a patient with the sublingual administration of a medication. (pp 234–235)

6. Demonstrate how to administer epinephrine by injection. (pp 235–237)

Lecture

I. Introduction
A. Administering medications is a serious business.

B. Used appropriately, medications may alleviate pain and improve a patient’s well-being.

C. Used inappropriately, medications may cause harm and even death.

D. As an EMT, you will:
   1. Administer medications
   2. Help patients self-administer medications
   3. Ask patients about medication use and allergies
   4. Report patient information to hospital personnel

E. EMTs who do not understand how medications work place themselves and patients in danger.

II. How Medications Work

A. Medical definitions
   1. Pharmacology: The science of drugs, including their ingredients, preparation, uses, and actions on the body.
   2. Medication: A chemical substance used to prevent disease or relieve pain.
   3. Pharmacodynamics: The process by which medication works on the body.
      a. Receptors are located throughout the body. These are sites on cells where chemicals can bind and cause reactions. When medications are given, they bind to these sites and either stimulate the receptor sites and cause a reaction or block the sites and prevent other chemicals from attaching.
      b. A medication can either increase or decrease a normal function of the body.
   4. Agonist: Medication that causes stimulation of receptors.
   5. Antagonist: Medication that binds to a receptor and blocks other medications.
   6. Dose: The amount of the medication that is given; depends on:
      a. Patient’s weight
      b. Patient’s age
      c. Desired action of the medication
   7. Action: The therapeutic effect that a medication is expected to have on the body.
   8. Indications: Reasons or conditions for which a particular medication is given.
   9. Contraindications: When a medication would either harm the patient or have no positive effect.
   10. Side effects: Any actions of a medication other than the desired ones.
      a. Unintended effects: Effects that are undesirable but pose little risk to the patient.
      b. Untoward effects: Effects that can be harmful to the patient.

B. Medication names
   1. The generic name is usually the original chemical name of a medication.
      a. Generic names are not capitalized.
      b. Some medications (ie, nitroglycerin) are called by their generic name more often than their trade name.
   2. The trade name is the registered brand name that a manufacturer gives to a drug.
      a. Example: Tylenol or Lasix
b. Trade names begin with a capital letter.
c. One drug may have more than one trade name.

3. Prescription drugs are distributed only by pharmacists and require a physician’s order.

4. Over-the-counter (OTC) drugs may be purchased directly without a prescription.

5. Other kinds of drugs
   a. Street drugs (e.g., heroin, cocaine)
   b. Herbal medications
   c. Enhancement drugs
   d. Vitamin supplements

6. Any medication that a patient takes can be pharmacologically active and can cause an effect, so ask patients about any medications or drugs they are taking.

C. Routes of administration

1. Enteral medications enter the body through the digestive system.
   a. Often in pill or liquid form such as cough medicine

2. Parenteral medications enter the body by some other means.
   a. Often in liquid form administered through needles or syringes

3. Absorption is the process by which medications travel through body tissues to the bloodstream.

4. Common routes of administration
   a. Per rectum (PR)
      i. By rectum
      ii. Frequently used with children
      iii. Easy to administer; provides reliable absorption
      iv. Often used with medications for nausea and vomiting
   b. Oral (PO)
      i. By mouth
      ii. Enters the bloodstream through the digestive system
      iii. Takes as long as 1 hour for absorption to occur
      iv. Pros
         (a) Noninvasive
         (b) Less expensive than parenteral routes
      v. Cons
         (a) Unpredictability of medication absorptions
         (b) Absorption affected by upset stomach or diarrhea
   c. Intravenous (IV) injection
      i. Into the vein
      ii. Fastest delivery but cannot be used for all medications
   d. Intramuscular (IM) injection
      i. Into the muscle
      ii. Requires drilling a needle into the outer layer of bone
      iii. Requires drilling a needle into the outer layer of bone
      iv. Painful
         (a) Often reserved for patients who are unconscious as a result of cardiac arrest or extreme shock
         (b) May be used for children who have less available (or difficult to access) IV sites
e. Subcutaneous (SC, SQ, or sub-Q) injection
   i. Beneath the skin
   ii. Injection given into the tissue between the skin and muscle
   iii. Because there is less blood here than in the muscles, SC medications generally absorb more slowly and have longer-lasting effects.
   iv. Examples
      (a) Daily insulin injections
      (b) Some forms of epinephrine
f. Intramuscular (IM) injection
   i. Into the muscle
   ii. Usually absorbed quickly
   iii. Not all medications can be administered by the IM route.
   iv. Examples
      (a) EpiPen or Twinject auto-injector
      (b) Mark-1 auto-injector
   v. Possible problems
      (a) Damage to muscle tissue
      (b) Uneven, unreliable absorption (especially in people with decreased tissue perfusion or who are in shock)
g. Inhalation
   i. Breathed into the lungs
   ii. Absorbed into the bloodstream quickly
   iii. Minimizes the effects of the medication in other body tissues
   iv. Forms
      (a) Aerosols
      (b) Fine powders
      (c) Sprays
h. Sublingual (SL)
   i. Under the tongue
   ii. Enters through the oral mucosa under the tongue and is absorbed into the bloodstream within minutes
   iii. Faster than the oral route and protects medications from chemicals in the digestive system (ie, acids that can weaken or inactivate them)
   iv. Examples
      (a) Nitroglycerin tablets
i. Transcutaneous (transdermal)
   i. Through the skin
   ii. Applied as a patch to the skin
   iii. Longer-lasting effect than other routes
   iv. Examples
      (a) Nicotine patch
      (b) Nitroglycerin patch
j. Intranasal (IN)
   i. Relatively new format for the delivery of medication
   ii. Medication is pushed through a specialized atomizer device called a mucosal atomizer device (MAD).
   iii. Liquid medication is turned into a spray and is administered into a nostril.
   iv. Quick absorption
   v. Example
III. Medication Forms

A. The form of a medication usually dictates the route of administration.
   1. For example, a tablet or spray cannot be given through a needle.
   2. The manufacturer chooses the form to ensure:
      a. Proper route of administration
      b. Timing of its release into the bloodstream
      c. Effects on the target organs or body systems

B. Basic medication forms
   1. Tablets and capsules
   2. Solutions and suspensions
   3. Metered-dose inhalers (MDIs)
   4. Topical medications
   5. Transcutaneous medications
   6. Gels
   7. Gases for inhalation

C. Tablets and capsules
   1. Most medications given by mouth are in tablet or capsule form.
   2. Capsules are gelatin shells filled with powder or liquid medication.
   3. Tablets often contain other materials that are mixed with the medication and compressed.
   4. A medication that must be swallowed is less useful in an emergency.
   5. The digestive tract provides slower delivery.

D. Solutions and suspensions
   1. A solution is a liquid mixture of one or more substances that cannot be separated simply.
   2. Solutions can be given by almost any route.
      a. When given by mouth, solutions may be absorbed from the stomach fairly quickly because the medication is already dissolved (eg, SL delivery of a nitroglycerin spray).
      b. Many solutions can be given as an IV, IM, or SC injection.
   3. A suspension is a mixture of finely ground particles that are distributed evenly throughout a liquid by shaking or stirring but do not dissolve.
      a. Suspensions separate if they stand or are filtered
      b. Important to shake or swirl a suspension before administration
      c. Usually administered by mouth (eg, antibiotic for pediatric patient or activated charcoal)
      d. Occasionally given rectally or applied directly to the skin (eg, calamine lotion)
      e. May be given via IM or SC injection (eg, hormone shots or vaccinations)

E. MDIs
   1. Liquids or solids that are broken into small enough droplets or particles may be inhaled.
2. Spray canister directs such substances through the mouth and into the lungs.
3. Delivers the same amount of medication each time it is used
4. Often used for respiratory illnesses such as asthma or emphysema

F. Topical medications
1. Include lotions, creams, ointments
2. Applied to the skin surface and only affect that area
3. Lotions contain the most water and are absorbed rapidly.
4. Ointments contain the least water and are absorbed slowly.
5. Examples
   a. Lotion: Calamine lotion
   b. Ointment: Neosporin ointment

G. Transcutaneous medications
1. Also referred to as transdermal medications
2. Unlike topical medications, which only affect an intended site, many transdermal medications have systemic (whole-body) effects.
3. Designed to be absorbed through skin (transcutaneously)
4. Examples:
   a. Nitroglycerin paste
   b. Adhesive patch
      i. Nitroglycerin
      ii. Nicotine
   iii. Some pain medications
   iv. Some contraceptives
5. If you touch the medication with your skin, you will absorb it just like the patient.

H. Gels
1. Semiliquid
2. Administered in capsules or through plastic tubes
3. Usually have the consistency of pastes or creams but are transparent (clear)
4. Example: oral glucose for patient with diabetes

I. Gases for inhalation
1. Neither solid nor liquid
2. Usually delivered through nonrebreathing mask or nasal cannula
3. Most often are given in an operating room
4. Most common medication in gas form used outside the operating room is oxygen.

IV. General Steps in Administering Medication
A. Only administer medications with an order to do so from medical control.
B. Medical control may inform you to administer medications:
   1. Directly
   2. Off-line or indirectly via protocols and standing orders
   3. Online via telephone or radio

C. Follow the “six rights.”
   1. Right patient: Ensure that the patient who needs the medication is the person who receives the medication.
   2. Right medication: Verify the proper medication and prescription.
   3. Right dose: Verify the form and dose of the medication.
   4. Right route: Verify the route of the medication.
   5. Right time: Check the expiration date and condition of the medication.

V. Medication Administration and the EMT

A. Your unit may carry:
   1. Oxygen
   2. Oral glucose
   3. Activated charcoal
   4. Aspirin
   5. Epinephrine

B. Over the years, EMTs have been allowed increasing responsibility to work with medications.

C. Many departments have strict controls on when an EMT is allowed to administer a medication.
   The circumstances are:
   1. Peer-assisted
      a. You administer medication to yourself or your partner.
      b. Example: You were exposed to a toxic agent.
      c. Typically auto-injector form
   2. Patient-assisted
      a. You assist the patient with administering his or her own medication.
      b. Examples
         i. Nitroglycerin
         ii. EpiPen auto-injectors
         iii. MDI bronchodilator
   3. EMT-administered
      a. EMT directly administers the medication to the patient.
      b. The patient may be severely confused or unable to understand the need for the medication.
      c. Examples
         i. Oxygen
D. It is important to understand that the medication itself does not necessarily dictate whether you will be assisting or actually administering.

1. Medical control, state guidelines, and local protocols will be the determining factors that define the role of the EMT.
2. Refer to your local standards to obtain a listing of how and when EMTs can administer medications.

VI. Medications Used by EMTs

A. State, department, and medical director will define what medications are carried on your ambulance.

1. 2009 National EMS Education Standards recognize that some regions of the country may need their EMTs involved in the administration of additional medications (aside from oxygen, oral glucose, activated charcoal, aspirin, and epinephrine).
2. Examples
   a. Acetaminophen
   b. Ibuprofen
   c. Diphenhydramine

B. Oral medications (see Skill Drill 7-1)

1. Considerations
   a. Advantages
      i. Ease of access
      ii. Comfort level
   b. Disadvantages
      i. Digestive tract can be easily affected by foods, stress, and illness.
      ii. Speed of movement of food through the tract dramatically changes the speed of absorption.

2. Activated charcoal
   a. Many poisonings involve overdoses taken by mouth.
   b. Activated charcoal keeps the drugs from being absorbed by the body by adsorption (binding the drug to its surface).
   c. Is ground into a very fine powder to provide the greatest surface area for binding
   d. Is frequently suspended with sorbitol (a sugar), which has a laxative effect that causes the medication and the charcoal to move quickly through the digestive system
   e. Is administered by mouth (may be unappealing to patients, so use a covered container and ask the patient to drink the fluid through a straw)
   f. May stain
      i. Use protective clothing over uniform.
      ii. Protect patient’s clothing.
   g. Should not be given to patients who:
      i. Have altered LOC (risk of aspiration)
      ii. Have ingested an acid, an alkali, or a petroleum product

3. Oral glucose
a. Glucose is a sugar that cells use for energy; necessary for brain cells

b. Hypoglycemia
   i. Is defined as extremely low blood glucose
   ii. Can be caused by an excess of insulin

c. Oral glucose can counteract the effects of hypoglycemia.

d. An EMT can give glucose only by mouth.
   i. Available as a gel designed to be spread on the mucous membranes between the cheek and gum
   ii. Not as quick as injections (for hospital personnel, AEMTs, and paramedics)

4. Aspirin
   a. Purposes
      i. Antipyretic (reduces fever)
      ii. Analgesic (reduces pain)
      iii. Anti-inflammatory (reduces inflammation)
      iv. Inhibits platelet aggregation (clumping), which is useful during a potential heart attack
   b. Contraindications
      i. Hypersensitivity to aspirin
      ii. Preexisting liver damage, bleeding disorders, and asthma
      iii. Children during episodes of fever-causing illnesses

C. Sublingual medications

1. Considerations
   a. Advantages
      i. Easy to talk with awake and alert patients and advise them to place a pill under their tongue
      ii. The head and face receive large amounts of blood flow, so absorption rates are relatively quick.
   b. Disadvantages
      i. Any medication placed in the mouth requires constant evaluation of the airway.
      ii. Must also be alert to any signs of choking on the pill
      iii. Should not be used if the patient is uncooperative or unconscious.

2. Nitroglycerin
   a. Many cardiac patients carry fast-acting nitroglycerin to relieve angina pain.
   b. Nitroglycerin increases blood flow by relieving the spasms and causes arteries to dilate by relaxing muscles of coronary arteries and veins.
   c. It also relaxes veins throughout the body so that less blood is returned to the heart, decreasing workload and blood pressure.
   d. Before administration
      i. Check blood pressure before administering nitroglycerin.
         (a) If the systolic blood pressure is less than 100 mm Hg, nitroglycerin may have a harmful effect.
         (b) Even a patient who has adequate blood pressure should sit or lie down with the head elevated before taking this medication (to avoid fainting).
         (c) If a significant drop in blood pressure occurs and the patient feels dizzy or sick, lay the patient down and raise the legs.
      ii. Obtain order or follow local protocol to administer.
   e. If nitroglycerin no longer brings relief to a person for whom it has previously worked, the person may be experiencing an MI instead of an angina attack.
i. Ask how much nitroglycerin the patient needed in the past to relieve pain and how much was taken this time.
ii. Report this information to medical control.

f. Can have potentially fatal interactions with:
i. Sildenafil (Viagra)
ii. Tadalafil (Cialis)
iii. Vardenafil (Levitra)
iv. Any other medication that is used for the treatment of erectile dysfunction within the previous 24 hours

g. Effects
i. Relaxes the muscular walls of coronary arteries and veins
ii. Results in less blood returning to the heart
iii. Decreases blood pressure
iv. Relaxes arteries throughout the body
v. Often causes a mild headache after administration

h. Administration by tablet
i. Usually taken sublingually
ii. Place the tablet under tongue, where it dissolves.
iii. Patient should experience a slight tingling or burning sensation.
   (a) If not, medication may have lost potency because of aging or improper storage.
   (b) Be sure to check the expiration date on the bottle.
iv. Should be stored in its original glass container with the cap screwed on tightly.
   (a) What looks like cotton in the container is actually rayon.
   (b) Real cotton in the container can absorb nitroglycerin, reducing potency.
   (c) Do not place other medications in the container.
   (d) Avoid exposure to light, heat, or air.
   (e) Note any drug storage concerns in the patient’s medical history.

i. Administration by metered-dose spray
i. Deposits medication on or under the tongue
ii. One spray equals one tablet.
iii. Do not use a spacer with the metered-dose canister.

j. Administration considerations (for both tablet and spray)
i. Wait 5 minutes for a response before repeating the dose.
ii. Closely monitor the patient’s vital signs, particularly the blood pressure.
iii. Give repeated doses per medical control and/or local protocol.
iv. Always wear gloves (medication can be absorbed by your skin).
  v. If the patient is having chest pain, you may be able to apply oxygen—call medical control or follow standing orders before helping to administer the patient’s nitroglycerin.
   vi. Know and understand local protocols.

D. Intramuscular medications

1. Considerations
a. Advantages
i. Provides quick and easy access to the circulatory system without the need for placing a needle within a vein
ii. Blood flow to the muscles is relatively stable even during circumstances of severe illness or injury.

b. Disadvantages
i. Use of a needle (and subsequent pain)
ii. Patients may fear pain or injury.

2. Epinephrine (adrenaline)
   a. Main hormone that controls the body’s fight-or-flight response
   b. Primary medication an EMT will deliver IM
   c. Sympathomimetic (mimics the effect of the sympathetic nervous system)
   d. Released inside the body when there is sudden stress
   e. Also known as adrenaline
   f. Effects
      i. Increases heart rate
      ii. Constricts blood vessels, causing increased blood pressure
      iii. Dilates passages in the lungs
      iv. Eases breathing problems in asthma or allergic reactions
      v. May maintain blood pressure in allergic reaction
   g. Should not be given to patients who:
      i. Have hypertension
      ii. Are suffering from hypothermia
      iii. Are experiencing a myocardial infarction
      iv. Are not wheezing
      v. Have no signs of respiratory compromise or hypotension
   h. Administering epinephrine by injection (permitted in some states)
      i. Used to treat life-threatening anaphylaxis
         (a) Insect venom or other allergens cause the body to release histamine.
         (b) Histamine may:
            (1) Reduce blood pressure
            (2) Cause wheezing from bronchial spasms and swelling of the airway tissues (edema)
            (3) Make it difficult for the patient to breathe
      ii. Epinephrine acts as a specific antidote to histamine by:
         (a) Constricting the blood vessels
         (b) Allowing blood pressure to rise
         (c) Reducing swelling
            (1) Dilating air passages to increase flow of air
      iii. Epinephrine may be dispensed from an auto-injector
         (a) Automatically delivers a preset amount of the medication (usually 0.3 mg)
      iv. Side effects
         (a) Causes a burning sensation where it is injected
         (b) Increases heart rate
      v. Some services do not permit EMTs to carry epinephrine but do allow them to assist patients in administering their own epinephrine.
      vi. EMTs may assist patients in administering epinephrine through their own MDIs for bronchospasm.

E. Inhalation medications

1. Oxygen
   a. All cells, especially those in the heart and brain, need oxygen to function properly.
   b. Oxygen should be administered when a patient is not breathing or is having trouble getting air.
   c. Generally administered:
      i. Via a nonrebreathing mask at 10 to 15 L/min
Chapter 7: Principles of Pharmacology

2. Preferred method
   a. Via nasal cannula at 2 to 6 L/min
      i. For patients who cannot tolerate a nonbreathing mask
      ii. Oxygen flows through two small, tubelike prongs that fit into the patient’s nostrils.
      iii. Can provide up to 44% inspired oxygen if the flowmeter is set at 6 L/min.
   b. Can provide up to 90% inspired oxygen
   c. Must also provide artificial ventilations if the patient is not breathing (using bag-mask device at 15 L/min)
   d. Ensure that there are no open flames, lit cigarettes, or sparks in the area in which you are administering oxygen.

2. MDIs and nebulizers
   a. Used to administer liquid medications that have been turned into a fine mist by a flow of air or oxygen
   b. Medication is atomized, breathed into the lungs, and delivered to the alveoli
   c. Advantages
      i. Blood flow to the alveoli is very high.
      ii. Absorption rates are very close to those found with IV medications.
      iii. Fast and relatively easy route to access
      iv. Commonly used because of convenience and portability
   d. Disadvantages
      i. Patient needs to be cooperative and control breathing
      ii. Cannot be used for unconscious patients
   e. An EMT could use a nebulizer for more severe problems.

3. Medications administered using an MDI.
   a. Usage
      i. For respiratory conditions that are severe enough to require epinephrine
      ii. MDIs are more narrowly focused on the lungs.
   b. An MDI requires a great deal of coordination to administer.
      i. May be difficult to achieve when a person is having trouble breathing
      ii. Patients must aim properly and spray just as they start to inhale.
   c. Using a spacer (adapter) to avoid spray misdirection
      i. Most of the medication tends to end up on the roof of the patient’s mouth.
      ii. A spacer fits over the inhaler like a sleeve.
      iii. A spacer has an opening for the inhaler at one end and a mouthpiece on the other end.
      iv. The patient sprays the prescribed dose into the chamber and then breathes in and out of the mouthpiece until the mist is completely inhaled.
   d. Trade names of some asthma inhalers
      i. Primatene Mist
      ii. Bronitin Mist
      iii. Bronkaid Mist
      iv. Medihaler-Epi
   e. Beta-2 agonists
      i. Cousins of epinephrine that produce fewer side effects
      ii. Act more specifically than epinephrine on the bronchi of the lungs, causing dilation with a lesser effect on the heart
      iii. Examples
         a. Metaproterenol (Alupent or Metaprel)
(b) Albuterol (Proventil or Ventolin)

f. Patients may be prescribed many types of MDIs.
   i. There are at least 20 different MDIs on the market.
   ii. Patients may be prescribed three to six different individual medications.
   iii. Examples
       (a) Corticosteroids
       (b) Mucolytics
       (c) Cell stabilizers
   iv. The only medication that will be effective during an acute attack of shortness of breath will be short-action bronchodilators (eg, Albuterol [Proventil or Ventolin])

g. Read the label of the MDI before you use or assist the patient in using it.

VII. Patient Medications

A. Patient assessment includes finding out medications your patient is currently taking.

B. This information may provide vital clues to patient’s condition.
   1. May help guide your treatment
   2. May be extremely useful to the emergency department physician
   3. Can help you determine a chronic or underlying condition when a patient is unable to relate his or her medical history

C. Discover what the patient takes and transport the medications or a list of them with you to the emergency department.

D. Ask about any nonprescription drugs (eg, OTC, herbal, or illegal drugs)

VIII. Summary

A. Pharmacology is the science of drugs, including their ingredients, preparation, uses, and actions on the body.

B. Medications may be administered through the following routes:
   1. Per rectum (PR)
   2. Oral (per os, PO)
   3. Intravenous (IV) injection
   4. Intraosseous (IO) injection
   5. Subcutaneous (SC) injection
   6. Intramuscular (IM) injection
   7. Inhalation
   8. Sublingual (SL)
   9. Transcutaneous (transdermal)
   10. Intranasal (IN)

C. Routes of administration often determine the speed with which the medication takes effect.

D. There are seven forms of medication:
1. Tablets and capsules
2. Solutions and suspensions
3. Metered-dose inhalers (MDIs)
4. Topical medications
5. Transcutaneous (transdermal) medications
6. Gels
7. Gases for inhalation

E. The administration of any medication requires approval by medical control, through direct orders given online or standing orders that are part of the local protocols.

F. Be familiar with the six general steps of administering any medication (rights of medication administration).
   1. Right patient
   2. Right medication
   3. Right dose
   4. Right route
   5. Right time
   6. Right documentation

G. EMS units may carry several medications:
   1. Activated charcoal
   2. Oral glucose
   3. Aspirin
   4. Epinephrine
   5. Oxygen

H. Knowing what medications a patient takes is important to:
   1. Provide vital clues about your patient’s condition
   2. Inform you of any chronic or underlying conditions
   3. Guide your treatment
   4. Report to the emergency department physician
Post-Lecture

This section contains various student-centered end-of-chapter activities designed as enhancements to the instructor’s presentation. As time permits, these activities may be presented in class. They are also designed to be used as homework activities.

**Unit Assessment**

1. Effects caused by medications that are other than the desired ones are called ______________.

2. What route delivers medication through the skin?

3. Activated charcoal is an example of what form of medication?

4. When should activated charcoal be administered?

5. List the three medications an EMT is allowed to administer to patients.

6. List three medications that an EMT may assist with.

7. What is an indication for the administration of oral glucose?

8. What is the minimum blood pressure for the administration of nitroglycerin?

9. What are the actions of epinephrine?

10. When using a metered-dose inhaler, when should the canister be pressed?
Knowledge Objectives