Chapter 11

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 461–463)

• Kinds of medications used during an emergency (pp 464–475)

Medication Administration

• Self-administer medication (pp 463–464)

• Peer-administer medication (pp 463–464)

• Assist/administer medications to a patient (pp 463–464)

Emergency Medications

• Names (p 456)

• Effects (pp 455–456)

• Actions (p 455)

• Indications (p 456)

• Contraindications (p 456)

• Complications (p 456)

• Routes of administration (pp 456–458)

• Side effects (p 456)

• Interactions (p 465–466, 475–476)

• Dosages for the medications administered (pp 455, 462, 465–466)

Knowledge Objectives

1. Define the terms pharmacodynamics, intended effects, indications, side effects, unintended effects, and untoward effects. (pp 455–456)

2. Explain medication contraindications; include an example. (p 456)

3. Explain the differences between a generic medication name and a trade medication name; provide an example of each. (p 456)

4. Differentiate enteral and parenteral routes of medication administration. (p 456)

5. Describe rectal, oral, intravenous, intraosseous, subcutaneous, intramuscular, inhalation, sublingual, and transcutaneous routes of medication administration; include the rates of absorption. (pp 457–458)

6. Explain the solid, liquid, and gas forms of medication and routes of administration; provide examples of each. (pp 459–461)

7. List the “six rights” of medication administration; include how each one relates to EMS. (pp 461–463)

8. Explain the difference between direct orders (online) and standing orders (off-line) and the role of medical control. (p 463)

9. Discuss the medication administration circumstances involving peer-assisted medication, patient-assisted medication, and EMT-administered medication. (pp 463–464)

10. Know 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 463–475)

11. Describe the medication administration considerations related to special populations, including pediatric, geriatric, and pregnant patients. (pp 464, 472–473)

12. State the steps to should follow when dispensing medications to a patient using an auto-injector. (p 471)

13. Explain why determining what prescription and over-the-counter medications a patient is taking is a critical aspect of patient assessment during an emergency. (pp 475–476)

14. State the steps to take if a medication error occurs. (p 477)

Skills Objectives

1. Apply the six rights of medication administration. (pp 461–463)

2. Demonstrate how to administer oral medication to a patient. (pp 464, 467–468)

3. Demonstrate how to administer aspirin to a patient with chest pain. (p 468)

4. Demonstrate how to administer oral glucose to a patient with hypoglycemia. (p 468)

5. Demonstrate how to assist a patient with the sublingual administration of a medication. (p 468)

6. Demonstrate how to administer a medication by auto-injector. (p 471)

7. Demonstrate how to administer an intranasal medication. (pp 471–472)

Readings and Preparations

Review all instructional materials including ***Emergency Care and Transportation of the Sick and Injured***, **Eleventh Edition**, Chapter 11, and all related presentation support materials.

Support Materials

• Lecture PowerPoint presentation

• Case Study PowerPoint presentation

• Equipment needed to perform the psychomotor skills presented in this chapter

• Samples of medications that the EMT may find in the home (may include medication inserts, labels, OTC bottles/boxes, and old prescription bottles with names blocked out)

• Samples of medications your local EMS agency carries

Enhancements

• Direct students to visit Navigate 2.

• Contact a local pharmacist and obtain current literature and package inserts for medications approved for EMTs to administer or assist in administering. These inserts can impress upon students the potency and potential hazards of these medications.

**Content connections:** Inform students that as they proceed to other lessons, they will be better able to apply their basic knowledge of pharmacology to specific conditions such as heart disease, hypertension, and diabetes.

**Cultural considerations:** Discuss cultural attitudes toward medications, keeping in mind that some cultures do not advocate taking medicine for pain and may have alternative ways of treating illness that might seem at odds with students’ perception of the norm. In addition, some cultures and religions may prescribe special dietary requirements that conflict with certain types and forms of medications (such as those made from animal products).

Teaching Tips

• Be careful not to assume that all students understand even the most basic information about medications. Levels of accurate understanding about medications may vary widely.

• Consider projecting a prescription label and an OTC medication label and having a short pretest to assess students’ ability to understand the labels.

Unit Activities

**Writing assignments:** Assign a “patient” to each student. The patient should have a medical history that includes medication. Ask students to research which medication(s) a patient with this condition might be taking (encourage use of both generic and trade names). Students should also research what the medication does in the body. Limit the assignments to the most common conditions and no more than two medications.

**Student presentations:** Ask pairs of students to discuss information about barriers to medication compliance and possible consequences. They should also propose solutions to this very real issue. Barriers of compliance include:

• Patient does not remember medication guidelines

• Patient does not understand the label (eg, patient cannot read, patient does not understand the language, patient has poor vision)

• Patient is not able to access the medication (eg, patient cannot open the bottle, patient is confined to bed)

• Patient is not able to afford the medication

**Group activities:** Assign each group one of the medications found on the EMT medications chart (**Table 11-4**). If possible, provide actual samples of the medication. In addition to presenting the facts about the medication, student groups can create a scenario in which the medication is used and present their skit to the class. Encourage students to role-play realistic parts such as the patient, the EMT, and family members.

**Medical terminology review:** Write a few paragraphs from the role of a fictional patient describing in everyday language his or her medication and its effects. For example:

*I’m taking this pill for my arthritis pain. It helps ease the pain and also reduces swelling in the joints. I’m supposed to take one in the morning and one at night. I have to be careful that I don’t get an upset stomach when I take this, because the doctor told me it could cause ulcers. The doctor said that if I’m going to be drinking any alcohol, I shouldn’t take the pill that day. Also, if I have any itching or vomiting, I should stop taking the medicine right away. The doctor also said that it might make me a little sleepy, but that it’s okay if that happens.*

Using the terminology presented in this chapter, students should be able to identify indications, untoward effects, side effects, dosage, contraindications, and intended effects of the medication. Consider adding a word list to the assignment to guide students.

Pre-Lecture

### You Are the Provider

“You Are the Provider” is a progressive case study that encourages critical thinking skills.

### Instructor Directions

**1.** Direct students to read the “You Are the Provider” scenario found throughout Chapter 11.

**2.** You may wish to assign students to a partner or a group. Direct them to review the discussion questions at the end of the scenario and prepare a response to each question. Facilitate a class dialogue centered on the discussion questions and the Patient Care Report.

**3.** You may also use this as an individual activity and ask students to turn in their comments on a separate piece of paper.

Lecture

I. Introduction

A. Medications are an important intervention available to you as an EMT.

B. Used appropriately, medications may alleviate pain and improve a patient’s condition.

C. Failure to administer medications safely and competently can lead to serious consequences for the patient, including 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. It is essential that you have the knowledge and skills to administer or assist in administration of these medications.

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 substance used to treat or prevent disease or relieve pain

3. Pharmacodynamics: the process by which medication works on the body

a. Different types of receptors are located throughout the body. These are sites on cells where medications or chemicals can bind and produce an effect. When medications are given, they bind to these sites and either stimulate the receptors to produce an effect or block the receptors to prevent other chemicals or medications from binding.

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 or chemicals from attaching

6. Dose: the amount of the medication that is given, which 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

a. Also referred to as the desired or intended effect

8. Indications: reasons or conditions for which a particular medication is given

9. Contraindications: situations in which a medication would either harm the patient or have no positive effect

 a. Absolute contraindications: situations in which a medication should never be given if the contraindication is present

 b. Relative contraindications: situations in which the benefits of administering the drug may outweigh the risks

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 a simple, clear, nonproprietary name.

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 brand name that a manufacturer gives to a drug.

a. Examples: Tylenol, 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. Recreational drugs (eg, heroin, cocaine)

b. Herbal remedies

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 and all 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

b. Medications administered via this route tend to be absorbed slowly and are not commonly used in an emergency setting.

2. Parenteral medications enter the body by some other means.

a. Often in liquid form administered through needles or syringes

b. Absorbed more quickly and offer a more predictable and measurable response

3. Absorption: 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

vi. Orally disintegrating tablets (ODTs) are put directly onto the tongue where they dissolve.

c. Intravenous (IV) injection

i. “Into the vein”

ii. Fastest delivery but cannot be used for all medications

d. Intraosseous (IO) injection

i. “Into the bone”

ii. Reaches the bloodstream through the bone marrow

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) Often 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 fatty tissue between the skin and muscle

iii. Because there is less blood in these tissues than in the muscles, SC medications are generally absorbed 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 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. Example: 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 mucosal atomizer device (MAD) that aerosolizes the liquid for delivery into the nostril.

iii. Liquid medication is aerosolized and is administered into a nostril.

iv. Quick absorption

v. Examples

(a) Flu vaccine

(b) Naloxone

k. **Table 11-1** lists common routes of medication administration and rates of absorption

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 the medication’s 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 and digested provides a slower route of delivery and is less useful in an emergency.

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

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. It is important to shake or swirl a suspension before its 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. Metered-dose inhalers

1. Liquids or solids that are broken into small enough droplets or particles may be inhaled.

2. A 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, and ointments

2. Applied to the skin surface and affect only 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. Designed to be absorbed through skin (transcutaneously)

2. Also referred to as transdermal medications

3. Unlike topical medications, which affect only the intended site, many transdermal medications have systemic (whole-body) effects.

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 a nonrebreathing mask or nasal cannula

3. Most often are given in an operating room

4. The most common medication in gas form used outside the operating room is oxygen.

IV. General Steps in Administering Medication

A. Medications should be administered only under the authorization of online or off-line medical direction.

B. Medical control may inform you to administer medications:

1. Off-line or indirectly via protocols and standing orders

2. 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.

6. Right documentation: Document your actions and the patient’s response.

D. Medication errors almost always result from failure to follow these six rights.

V. Medication Administration and the EMT

A. Your unit may carry:

1. Oxygen

2. Oral glucose

3. Activated charcoal

4. Aspirin

5. Epinephrine

B. You may give these medications only according to standing orders in a protocol or a direct order.

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

D. Many departments have strict guidelines on when an EMT is allowed to administer a medication. The circumstances are:

1. Peer-assisted administration

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 administration

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 medications

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

ii. Oral glucose

iii. Activated charcoal

iv. Nitroglycerin

v. Aspirin

E. The medication itself does not necessarily dictate whether you will be assisting with its administration or actually administering the drug.

1. Medical control, state guidelines, and local protocols determine which medications an EMT in your system may administer.

2. Refer to your local standards to obtain a listing of how and when EMTs can administer medications.

VI. Medications Used by EMTs

A. The state, department, and medical director will define which medications are carried on your ambulance.

1. The 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

1. Considerations

a. Advantages

i. Ease of access

ii. Comfort level

b. Disadvantages

i. The 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. Follow these steps to perform oral medication administration:

a. Take standard precautions.

b. Confirm the medication is not expired.

c. Obtain medical direction per local protocol.

d. Confirm that the patient has a patent airway and is able to swallow, and then instruct the patient to swallow or chew the medication.

e. Monitor the patient’s condition and document.

3. Activated charcoal

a. Many poisonings involve overdoses taken by mouth.

b. Activated charcoal reduces the amount of medication being absorbed by the body by binding the drug to its surface (adsorption).

c. Activated charcoal is ground into a very fine powder to provide the greatest surface area for binding.

d. If allowed by local protocol, you will carry a container with a premixed suspension of activated charcoal powder and water.

e. Activated charcoal 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.

f. Administered by mouth (may be unappealing to patients, so use a covered container and ask the patient to drink the fluid through a straw)

g. May stain

i. Use protective clothing over your uniform.

ii. Protect the patient’s clothing.

h. Should not be given to patients who:

i. Have altered level of consciousness (risk of aspiration)

ii. Have ingested an acid, an alkali, or a petroleum product

4. Oral glucose

a. Glucose is a sugar that cells use for energy; it is necessary for brain cells’ survival.

b. Hypoglycemia

i. 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)

iii. Also available as glucose tablets

e. Never administer oral medications to an unconscious patient or to one who is unable to swallow or protect the airway.

5. 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. Should not be given to children

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.

ii. Obtain orders or follow your local protocol to administer nitroglycerin.

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 erectile dysfunction (ED) medications taken within the past 24 hours:

i. Sildenafil (Viagra)

ii. Tadalafil (Cialis)

iii. Vardenafil (Levitra)

iv. Drugs for erectile dysfunction may be used by both men and women.

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 and/or burning under the tongue after administration

h. Administration by tablet

i. Usually taken sublingually

ii. Place the tablet under the tongue, where it dissolves.

iii. The patient should experience a slight tingling or burning sensation.

(a) If not, the medication may have lost its potency because of aging or improper storage.

(b) Be sure to check the expiration date on the bottle.

iv. Nitroglycerin 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 its 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 (the medication can be absorbed by your skin).

v. Reconfirm if the medication is still indicated for the patient.

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 that 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. Do not show signs of wheezing or airway obstruction due to an allergic reaction

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 over-release histamine.

(b) Over-release of 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 reverse the effects of histamines 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.

1. Administering naloxone by injection

 i. Used to reverse the effects of an opioid overdose

1. Can be administered by family members or caregivers to help reverse dangerous side effects of opioid overdose, such as life-threatening respiratory depression.

ii. Important considerations:

1. Consult medical direction to determine if EMTs are allowed to administer naloxone in your region. Always follow the local protocol. Consider requesting ALS assistance.
2. Find out if naloxone has been administered by a bystander prior to your arrival.
3. The effects of naloxone may not last as long as those of opioids. Repeat doses may be necessary.
4. Can cause severe withdrawal symptoms, including seizures and cardiac arrest
5. Consider your safety, as patients may become violent following naloxone administration.

iii. Begin administering naloxone in increments of 0.4 mg, then gradually increase based on the patient response or lack thereof.

**E. Intranasal medications**

1. Naloxone

a. Not all EMS departments use naloxone auto-injectors, due to their expense.

b. The most common technique for naloxone administration is via the intranasal route.

i. Other common routes of administration include intravenous and intramuscular.

ii. The same considerations listed for administering injectable naloxone apply when administering naloxone in any other form.

c. Steps to administer a medication intranasally:

i. Obtain medical direction per the local protocol.

ii. Confirm the correct medication and expiration date.

1. Attempt to determine if the patient is allergic to any medications.
2. Prepare the medication and attach the atomizer. *Never* use a needle.
3. Place the atomizer in one nostril, pointing up and slightly outward.
4. Administer a half dose (1 mL maximum) into each nostril.
5. Reassess the patient and document appropriately. If you do not have naloxone available, note that BVM ventilations provide necessary treatment to opioid overdose patients until definitive care can be reached.

F. Inhalation medications

1. Oxygen

a. By far the most commonly administered medication in the prehospital setting

b. All cells, especially those in the heart and brain, need oxygen to function properly.

c. Oxygen should be administered when a patient is not breathing or is having trouble getting air.

d. Generally administered:

i. Via a nonrebreathing mask at 10 to 15 L/min

(a) Preferred method

(b) Can provide up to 90% inspired oxygen

ii. Via nasal cannula at 2 to 6 L/min

(a) For patients who cannot tolerate a nonrebreathing mask

(b) Oxygen flows through two small, tubelike prongs that fit into the patient’s nostrils.

(c) Can provide up to 44% inspired oxygen if the flowmeter is set at 6 L/min

e. Must also provide artificial ventilations if the patient is not breathing (using a bag-valve mask [BVM] at 15 L/min)

f. Ensure that there are no open flames, lit cigarettes, or sparks in the area in which you are administering oxygen.

2. Metered-dose inhalers 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 or small-volume nebulizer (SVN)

a. Usage

i. For respiratory conditions that are not severe enough to require epinephrine

ii. Chemical “cousins” of epinephrine are more narrowly focused on the lungs.

iii. Delivered with an MDI or SVN

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. Use a spacer (adapter) to avoid spray misdirection.

i. A spacer fits over the inhaler like a sleeve.

ii. A spacer has an opening for the inhaler at one end and a mouthpiece on the other end.

iii. The patient sprays the prescribed dose into the chamber and then breathes in and out of the mouthpiece until the mist is completely inhaled.

iv. Spacer devices are especially useful with young children who have difficulty using an MDI.

d. SVNs are much easier to use than MDIs.

 i. Take longer to deliver the medication

 ii. Require an external air or oxygen source

1. An SVN can be more effective than an MDI in patients with moderate to severe respiratory distress.
2. Can be used while a patient is on CPAP and during BVM ventilation
3. Can be easily adapted to a nonrebreathing mask
4. Assisting a patient with an SVN:
5. Obtain medical direction per the local protocol.
6. Confirm the correct medication and expiration date.
7. Confirm that the patient is not allergic to the medication.
8. Add the appropriate medication and dose to the nebulizer reservoir and assemble the device according to the manufacturer’s instructions.
9. Connect the nebulizer machine or oxygen tank at 6 to 8 L/min.
10. Place the nebulizer in the patient’s mouth and instruct the patient to breathe until the medication is gone (usually about 5 minutes).
11. Reassess the patient and document appropriately.
12. Some patients use “rescue inhaler” MDIs to relieve bronchial spasms quickly.

a. Examples

i. Primatene Mist

ii. Bronitin Mist

iii. Bronkaid Mist

b. Cousins of epinephrine that produce fewer side effects

i. Act more specifically than epinephrine on the bronchi of the lungs, causing dilation with a lesser effect on the heart

ii. Examples

(a) Metaproterenol (Alupent or Metaprel)

(b) Albuterol (Proventil or Ventolin)

c. Respiratory patients may also use a maintenance or controller inhaler.

 i. Slow acting and meant to be taken regularly

 ii. Not useful for a patient suffering acute respiratory distress

 iii. Examples:

1. Fluticasone propionate (Flovent Diskus)
2. Budesonide (Pulmicort)
3. Mometasone furoate (Asmanex Twisthaler)
4. Beclomethasone dipropioate (Qvar)
5. Ciclesonide (Alvesco)

d. Patients may be prescribed several types of MDIs at once.

i. Dozens of different MDIs are available.

ii. The only medication that will be effective during an acute attack of shortness of breath will be fast-acting rescue inhalers (eg, albuterol [Proventil or Ventolin])

e. Always be sure you have the right medication for a patient with acute respiratory distress.

VII. Patient Medications

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

B. This information may provide vital clues to the 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 the patient to the emergency department.

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

VIII. Medication Errors

1. A medication error is inappropriate use of a medication that could lead to patient harm.
2. Could include incorrect communication of a dose or administration of an incorrect dose.
3. Rules-based error: administration of a medication that is outside one’s scope of practice
4. Knowledge-based error: choosing the wrong medication to administer
5. Skills-based error: using incorrect equipment or an incorrect procedure for administering a medication
6. If the circumstances of medication errors are understood, it may be possible to minimize them.
7. Ensure that the environment does not contribute to errors.
8. Ensure lighting is sufficient.
9. Organize the equipment.
10. Limit distractions as much as possible.
11. Consider using a “cheat sheet” to help yourself remember all crucial steps to medication administration.
12. Always stop to ask yourself, “Why am I doing this?”
13. If a medication error does take place:
14. Rapidly provide any appropriate patient care that is required.
15. Notify medical control as quickly as possible.
16. Follow your local protocols.
17. Document the incident thoroughly, accurately, and honestly.
18. Talk with your partner, supervisor, or medical director.
	1. Opportunities to learn
	2. Identify areas to target during quality improvement

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.

## Assessment in Action

This activity is designed to assist the student in gaining a further understanding of issues surrounding the provision of prehospital care. The activity incorporates both critical thinking and application of basic EMT knowledge.

### Instructor Directions

**1.** Direct students to read the “Assessment in Action” scenario located in the Prep Kit at the end of Chapter 11.

**2.** Direct students to read and individually answer the quiz questions at the end of the scenario. Allow approximately 10 minutes for this part of the activity. Facilitate a class review and discussion of the answers, allowing students to correct responses as may be needed. Use the quiz question answers noted below to assist in building this review. Allow approximately 10 minutes for this part of the activity.

**3.** You may wish to ask students to complete the activity on their own and turn in their answers on a separate piece of paper.

### Answers to Assessment in Action Questions

**1.** **Answer:** B generic name

**2.** **Answer**: A indications.

**3.** **Answer**: C side effects.

**4.** **Answer**: A Document the medication names and dosages.

**5.** **Answer**: D Drug interactions from this many medications are a concern.

**6.** **Answer**: B EMT-administered.

**7.** **Answer**: C Injection.

**8.** **Answer**: A The MDI route does *not* require an external oxygen source.

**9.** **Answer**: Medications delivered intravenously have the fastest onset of action because they are delivered directly into the bloodstream.

**10.** **Answer**: Many times patients may not consider OTC medications, vitamins, or herbal supplements important to mention because they are usually not prescribed by a physician. However, this information is crucial because OTC medications, vitamins, and herbal supplements frequently interact with prescription medications, which may be the cause of the patient’s problem or may contribute to it.

## Assignments

A. Review all materials from this lesson and be prepared for a lesson quiz to be administered (date to be determined by the instructor).

B. Read Chapter 12, “Shock,” for the next class session.