Chapter 12
Pharmacology

Objectives
- Define the terms drug and pharmacology
- Recall the four names given to a drug
- Identify the various laws and regulatory agencies that regulate drug administration
- Describe the five schedules of drugs established by the DEA

Objectives
- List the various references for drug information available to the EMT-I
- Describe the different sources of drugs
- List the common packaging of drugs used in the prehospital setting
- Define the terms drug action, drug effect, and pharmacokinetics
Objectives

- Relate the factors that influence drug action on the body
- Describe the different components of the autonomic nervous system
- Demonstrate how to use decimals with basic math problems
- Calculate dosages for various medications

Objectives

- Describe the various drug administration routes and recall the indications for each
- Recall the characteristics and indications for the various types of drug administration devices
- Demonstrate the techniques used to administer drugs in the prehospital setting
- List the common drugs administered by the EMT-I

Objectives

- Recall the indications, dosages, and administration routes of the primary drugs administered by the EMT-I
Nomenclature

- Drug
  - Substance taken into the body
  - Effects change to body functions
  - Prevents or treats disease or condition

- Pharmacology
  - Study of drugs and their effects and actions on the body

Nomenclature

- Four names given to drugs
  - Chemical
    - First name given
    - Exact description
  - Generic
    - Related to chemical name
    - Nonproprietary designation
  - Official name
    - Listed in official publications
  - Trade name
    - Registered by U.S. Patent Office

Drug Legislation

- Pure Food and Drug Act
- Federal Food, Drug, and Cosmetic Act
- Harrison Narcotic Act of 1914
- Narcotic Control Act
- Controlled Substances Act
Drug Legislation

- Federal Trade Commission
- Food and Drug Administration
- Drug Enforcement Administration
- Public Health Service

Drug Legislation

Drug Schedules

- Schedule I
  - Highest potential for abuse
  - No accepted medical use
  - Lack of accepted safety for use
  - Opium, marijuana, etc.
- Schedule II
  - High potential for abuse
  - Current accepted medicinal use
  - Psychologic or physiologic dependence
  - Requires written prescription; cannot be refilled
  - Morphine, codeine, etc.
- Schedule III
  - Limited potential for psychologic or physiologic dependence
  - Prescription may be called in
  - Have limited amount of opium, codeine, morphine
  - Paregoric, Tylenol with codeine, etc.
- Schedule IV
  - Lower potential for abuse than II or III
  - Prescription may be called in
  - Librium, Valium, etc.
**Drug Legislation**

**Drug Schedules**

- Schedule V
  - Lower potential for abuse than II, III, or IV
  - Relief of coughs, etc.
  - Contain limited narcotics
  - Lomotil, Robitussin-DAC, etc.

**References for Drug Information**

- *Physicians’ Desk Reference*
- *United States Pharmacopeia*
- *American Hospital Formulary*
- *Compendium of Drug Therapy*

**Sources of Drugs**

- Plants
- Minerals
- Animals
- Synthesized
Forms of Drugs

- Prefilled syringes
  - Intravenous
  - Intramuscular
  - Subcutaneous
  - Single-dose use

- Ampules
  - Drug withdrawn with a syringe
  - Single dose

- Vials
  - Withdrawn with a syringe
  - Multiple doses
  - Require reconstitution
Drug Actions and Effects

- Drug action
  - Cellular change effected by a drug

- Drug effect
  - Degree of drug’s physiologic change

- Pharmacokinetics
  - Movement of drugs through the body

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Drug Actions and Effects

- Local effect
  - Limited to area where administered

- Systemic effect
  - Pertains to the whole body

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Drug Actions and Effects

- Therapeutic effect
  - Drug’s desired effect

- Side effect
  - Unintended effect
Drug Actions and Effects

- Drug allergy
  - Person previously exposed and has developed antibodies
  - Anaphylactic reaction
    - Life-threatening reaction

Drug Actions and Effects

- Drug toxicity
  - Results from overdosage or buildup of drug

- Drug tolerance
  - Body becomes accustomed to drug

Drug Actions and Effects

- Factors influencing drug action
  - Age
    - Elderly people
    - Infants and children
  - Weight
    - Serves as guide for dosage
  - Gender
    - Different body compositions and hormone levels
Drug Actions and Effects—Pharmacokinetics

Drug Actions and Effects

- Drug interactions
  - Synergism
  - Potentiation
  - Antagonist

Autonomic Nervous System

- Sympathetic division
  - Originates in brain
  - Primary effects
  - Norepinephrine
  - Sympathetic receptors
  - Drugs that affect sympathetic division
Autonomic Nervous System

- Parasympathetic division
  - Originates in brain
  - Effects
  - Acetylcholine
  - Atropine

Review of Basic Arithmetic

- Decimals
  - Fraction whose denominator is power of 10
  - Expressed by placing point at left of numerator

Examples

- 2/10 = 0.2
- 25/100 = 0.25
- 2/100 = 0.02
- 3/100 = 0.03
Review of Basic Arithmetic

- Changing fractions to decimals
  - Divide numerator by denominator
  - Place decimal point same number of places to right as numerator

Review of Basic Arithmetic

- Examples
  - \( \frac{1}{4} = 0.25 \)
  - \( \frac{3}{8} = 0.375 \)
  - \( \frac{2}{3} = 0.667 \)
  - \( \frac{1}{12} = 0.08333 \)

Review of Basic Arithmetic

- Adding decimals
  - Align all decimal points in column and then add all numbers
  - Decimal point stays in same place after all numbers are added
Review of Basic Arithmetic

- Examples

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Review of Basic Arithmetic

- Subtracting decimals
  - Align decimal points in column, then subtract numbers
  - Decimal point stays in same place after numbers are subtracted

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Review of Basic Arithmetic

- Multiplying decimals
  - Multiply as you would whole numbers
  - After arriving at answer:
    - Count number of decimal places in multiplier and multiplicand
    - Count that number from right to left in product and place decimal point

Review of Basic Arithmetic

- Examples

  1.45 (multiplicand) x 0.33 (multiplier)
  435
  +435
  0.4785 (product)

Review of Basic Arithmetic

- Dividing decimals
  - Convert divisor to whole number by moving decimal point to right
  - Move decimal point in dividend same number of places to right as in divisor
  - Divide as usual
  - Place decimal point in answer (quotient) directly above decimal point in dividend
  - Carry out answer to three decimal places before rounding off to two places
Review of Basic Arithmetic

• Rounding off decimals
  ➢ First determine how many significant digits are required after decimal point
  ➢ Look at number to right of last number you want
  ➢ If number is 5 or greater, round preceding digit up to next digit
  ➢ If it is less than 5, leave preceding digit as is
  ➢ Drop remaining decimal place(s) from number

Examples
2.247 is rounded to 2.25
3.144 is rounded to 3.14
5.26 is rounded to 5.3
7.24 is rounded to 7.2
3.24 is rounded to 3.2

Systems for Measuring Drugs

• Two systems for measuring drug dosages
  ➢ Metric system
    ● Used throughout world
    ● Based on multiples of 10
  ➢ Apothecary system
    ● Used less frequently
    ● Being replaced by metric system
Math for Pharmacology and Drug Calculations

- Rules to convert within metric system
  - To change grams to milligrams multiply grams by 1000 or move decimal point three places to right
  - To change milligrams to grams divide milligrams by 1000 or move decimal point three places to left
  - To change milligrams to micrograms multiply milligrams by 1000 or move decimal point three places to right

- To change micrograms to milligrams divide micrograms by 1000 or move decimal point three places to left
- To change liters to milliliters multiply liters by 1000 or move decimal point three places to right
- To change milliliters to liters divide milliliters by 1000 or move decimal point three places to left

Routes for Drug Administration

- Sublingual
- Intravenous
- Subcutaneous
- Intramuscular
- Inhalation or endotracheal
- Transdermal
- Intraosseous
Drug Administration

Components of a syringe

Drug Administration

Various types of syringes

Drug Administration

Vials
- Packaged in single- or multidose amounts
- Confirm drug type, concentration, and dose
- Check for cloudiness and expiration date
- Clean rubber stopper with alcohol
Drug Administration

- Vials
  - Determine volume of drug to be withdrawn; draw that amount of air into syringe
  - Invert vial, insert needle through rubber stopper; inject air into vial
  - Withdraw desired amount of solution; remove needle from vial
  - Invert syringe; expel any trapped air
  - Reconfirm drug type, concentration, dose
  - Recap needle, being careful not to contaminate it

Video for Medication from a Vial

Drug Administration

- Ampules
  - Confirm drug type, concentration, dose
  - Check for cloudiness, expiration date
  - Shake ampule or tap stem and top to shift fluid to bottom
  - Place gauze square or alcohol wipe over bottle neck; snap top off
Drug Administration

- Ampules
  - Insert needle into solution without touching sides
  - Draw solution into syringe
  - Invert syringe; tap syringe barrel to get air bubbles to top
  - Push on plunger to expel air bubbles from syringe
  - Draw in medication and repeat if necessary
  - Recap needle; use caution to avoid contamination

Video for Medication from an Ampule

- Prefilled syringes
  - Confirm drug type, concentration, dose
  - Check for cloudiness, expiration date
  - If assembly is required, pop caps off syringe and drug cartridge, screw both together
  - Invert syringe; expel excess air
  - Reconfirm drug type; concentration, dose
  - Administer drug by desired route
Drug Administration

- Sublingual administration
  - Confirm medication administration
  - Record time
  - Watch for patient response

- Subcutaneous (SC) administration
  - Body substance isolation precautions
  - Identify need for medication
  - Contact medical direction
  - Reassure patient; check for allergies
  - Expose and cleanse area used for administration

- Contact medical direction; confirm order
- Write down order
- Reassure patient
- Check for allergies
- Select appropriate medication (check name, dosage, expiration date)
- Uncap container, remove indicated number of tablets
- Direct patient to place tablet underneath tongue
Drug Administration

- SC administration
  - To make sure needle does not go too deep, pinch skin and dart needle in rapidly at 45° angle

Drug Administration

- SC administration
  - Pull back on syringe plunger to aspirate for blood
  - If blood appears withdraw needle, apply firm pressure over site with sterile dressing
  - Select another site
  - Inject medication

Drug Administration

- SC administration
  - Apply pressure to site to disperse medication
Drug Administration

- SC administration
  - Dispose of needle and syringe in appropriate sharps container
  - Confirm medication administration
  - Record administration time
  - Watch for patient response

Video for Subcutaneous Drug Administration

Drug Administration

- Intramuscular (IM) administration
  - Take BSI precautions
  - Identify need for medication
  - Contact medical direction
  - Reassure patient
  - Check for allergies
  - Expose and cleanse area to be used
Drug Administration

- IM administration
  - Use deltoid muscle or upper outer quadrant of gluteal area
  - To make sure needle goes into muscle, stretch skin over injection site, insert needle at 90° angle
  - Pull back on syringe plunger to aspirate for blood

- If blood appears, withdraw needle; apply firm pressure over site
- Select another site
- Inject medication
- Apply circular pressure to injection site to disperse medication
- Dispose of needle/syringe in appropriate sharps container
- Confirm medication administration, record time - watch for patient response to medication

Video for Intramuscular Drug Administration
Drug Administration

- Intravenous (IV) administration
  - Cleanse medication site of IV tubing

Drug Administration

- IV administration
  - Insert needle into injection site

Drug Administration

- IV administration
  - Pinch IV tubing above injection site
**Drug Administration**

- IV administration
  - Administer medication

**Video for IV Drug Administration**

**Drug Administration—Endotracheal Administration**

- Preoxygenate patient
- Inject medication into ET tube
Drug Administration

- Aerosol administration
  - Mix drug with normal saline

Drug Administration

- Aerosol administration
  - Connect nebulizer to T-piece and mouthpiece
  - Connect to oxygen regulator

Drug Administration

- Aerosol administration
  - Have patient inhale slowly
  - Exhale after 3-5 sec
Drugs Administered by the EMT-I

- Activated charcoal
- Oral glucose
- Oxygen
- Prescribed inhalers
- Nitroglycerin
- Epinephrine autoinjector

Summary

- **A drug** is any substance that, when taken into body, changes one or more of body’s functions
- **A drug** may have as many as four names, including chemical, generic, official, and trade
- Drugs may come from natural sources such as plants, minerals, or animals, or they may be synthesized in laboratory
- U.S. consumers are protected by several regulations regarding drugs

Summary

- All drugs sold in United States must meet high standards for therapeutic results, patient safety, and packaging safety
- Drugs must be strictly and accurately tested, which may take years
- FDA is responsible for final approval of all drugs
- There are several references for drug information
Liquid drugs administered by subcutaneous, intramuscular, or intravenous routes are called parenteral drugs.

Parenteral drugs are packaged in prefilled syringes, ampules, and vials.

Routes to administer drugs include sublingual, intravenous, subcutaneous, inhalation, endotracheal, and transdermal.

Administering drugs carries tremendous responsibility.

EMT-I must be knowledgeable in actions, indications, dosages, administration procedures, and side effects of various drugs.

Wrong drug or wrong dose can be fatal.

EMT-I may administer certain drugs via protocol or standing orders, with or without contacting medical direction.

Questions?