Chapter 5

Emergency Pharmacology

Chapter Goal

- Understand basic principles of pharmacology, & develop drug profiles for common emergency medications

Learning Objectives

- Differentiate among chemical, generic (nonproprietary), trade (proprietary), & official names of drugs
- Describe historical trends in pharmacology
- Describe schedules of drugs established by Drug Enforcement Administration
- List 5 main sources of drug products
- Describe how drugs are classified
Learning Objectives

- List authoritative sources for drug products
- Discuss special considerations in drug treatment with regard to pregnant, pediatric, & geriatric patients
- Discuss EMT-I’s responsibilities & scope of management pertinent to administration of medications
- Identify specific anatomy & physiology pertinent to pharmacology

Learning Objectives

- List & describe general properties of drugs
- List & describe liquid & solid drug forms
- List & differentiate routes of drug administration
- Differentiate between enteral & parenteral routes of drug administration
- Describe mechanisms of drug interactions
- List & differentiate phases of drug activity, including pharmaceutical, pharmacokinetic, & pharmacodynamic phases

Learning Objectives

- Describe pharmacokinetics, pharmacodynamics, theories of drug action, drug-response relationships, factors altering drug responses, predictable drug responses, iatrogenic drug responses, & unpredictable adverse drug responses
- Differentiate among drug interactions
- Discuss procedures & measures to ensure security of controlled substances administered by EMT-I
- Discuss considerations for storing drugs
Learning Objectives

- List the components of drug profile
- List drugs an EMT-I may administer in pharmacological management plan according to local protocol
- Integrate pathophysiological principles of pharmacology with patient assessment
- Synthesize patient history information & assessment findings to form field impression
- Synthesize field impression & implement pharmacological management plan

Introduction

- Quick decisions—difference between life & death
- Professional & legal responsibility
- Local protocol will dictate
- Drugs EMT-I may administer
  - Uses
  - Range of dosages
  - Methods of administration
  - Side effects

Introduction

- Essential to commit to memory:
  - Actions
  - Indications
  - Dosages
  - Side effects
  - Contraindications
  - Full understanding of safety precautions & legal aspects
Pharmacology & Drug Nomenclature

- What drugs are & how they work
  - Any substance when taken changes body’s functions
  - Commonly used in medicine
  - Available in many forms
  - Administered in variety of ways

Pharmacology & Drug Nomenclature

- What drugs are & how they work
  - Pharmacology:
    - Study of drugs
    - Actions
    - Dosages
    - Side effects

Pharmacology & Drug Nomenclature

- What drugs are & how they work
  - Pharmaceutical companies required to list:
    - Chemical compounds
    - Actions
    - Dosages
    - Side effects
    - Indications
    - Contraindications
Pharmacology & Drug Nomenclature

- What drugs are & how they work
  - Helpful hint
    - Prescription: written direction for preparation & administration of drug
    - Usually dispensed on order of physician
    - Some states—nurse practitioners, physician assistants
  - 4 names
    - Chemical
    - Generic
    - Official
    - Trade

Drug Legislation

- Pure Food & Drug Act
- Federal Food, Drug, & Cosmetic Act
- Harrison Narcotic Act of 1914
- Narcotic Control Act of 1956
- Controlled Substances Act of 1970

Drug Legislation

- Controlled substances established by Drug Enforcement Administration
  - Schedule I
  - Schedule II
  - Schedule III
  - Schedule IV
  - Schedule V
Regulating Agencies

- The Food and Drug Administration (FDA)
- Federal Trade Commission (FTC)
- Drug Enforcement Administration (DEA)
- The Public Health Service of U.S. Department of Health & Human Services

Sources of Drugs

- Plants
- Animals
- Minerals or mineral products
- Synthetic sources
- Microorganisms

Drug Classification

- By body system affected
- Class of agent identifies how drugs affect particular body systems
- Mechanism of action is how drug works physiologically
Sources of Drug Information

- Physician’s Desk Reference (PDR)
- American Hospital Formulary Service
- Compendium of Drug Therapy
- American Medical Association Drug Evaluation

Sources of Drug Information

- Drug inserts

Other
- Reference books
- Personal digital assistant (PDA)
- Internet

Standardization of Drugs

- Drugs sold must meet & maintain high standards
  - Therapeutic results
  - Patient safety
  - Packaging safety

- To meet standards drugs must go through strict & accurate testing
  - Assay method
  - Bioassay methods
  - FDA responsible for final approval
Special Considerations

- Pregnant patients
  - Benefits weighed against risks to fetus
  - Potential to harm fetus
  - Teratogenic effects
  - Metabolism in liver
  - FDA has established scale

Special Considerations

- Pediatric patients
  - Drug dosage based on
    - Child’s weight
    - Body surface area
  - Infants have immature livers & kidneys
  - Volume overload is serious problem

Special Considerations

- Geriatric patients
  - Drug-induced illness common
  - Polypharmacy
  - Absorption
  - Distribution
  - Therapeutic index
Scope of Management

- Basic principle of medicine:
  - “Primum non nocere”—“First do no harm”
  - Medications used
    - Among most potent
    - No room for error
  - Held responsible for:
    - Safe & therapeutically effective drug administration

- Procedures in using drug therapy
  - Use correct precautions & techniques
  - Observe & document
  - Keep current
  - Establish & maintain professional relationships
  - Understand pharmacology
  - Perform evaluations
  - Seek drug reference literature
  - Take drug history
  - Consult with medical control

Nervous System Components
Nervous System Components

Autonomic Nervous System

- Sympathetic division
  - Originates in brain
  - Primary effect—prepare for “flight or fight”
    - ↑ HR
    - Bronchiole dilation
    - ↑ Metabolism & strength
  - Sympathetic receptors
    - Alpha (α)-adrenergic
    - Beta (β)-adrenergic
  - Drugs that affect sympathetic nervous system
    - Sympathetic agonists
    - Beta blockers

- Parasympathetic division
  - Originates in brain
  - Causes increased activity in gut
  - Drug that affects parasympathetic nervous system
    - Atropine—acetylcholine antagonist
    - Muscarine
    - Pilocarpine
    - Organophosphates
    - Physostigmine
    - Neostigmine
    - Edrophonium
General Properties of Drugs

- Drugs commonly categorized by effects
  - Drug action
  - Drug effect

- Drug actions achieved by physiochemical interaction between drug and certain tissue components
  - Exert multiple actions
  - Do not confer new functions on tissue or organ
    - Only modify existing functions

General Properties of Drugs

- Drugs that interact with receptors:
  - Agonists
  - Antagonists
  - Partial agonists

- Once administered—go through 4 stages:
  - Absorption
  - Distribution
  - Biotransformation
  - Excretion

Drug Forms

- Most medications are injected in liquid form

- Available in unit-dose packages that contain:
  - Amount for single dose
  - Proper form for administration
  - Labeled with:
    - Trade name
    - Generic name
    - Precaution
    - Instructions for storage
    - Expiration date

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Drug Absorption

Routes for Drug Administration

- Route of administration crucial
  - Affects rate at which onset of action occurs
  - May affect therapeutic response
- Given for either local or systemic effects
- Selected because of:
  - Cost
  - Safety
  - Speed

Routes for Drug Administration

- Certain drugs may be:
  - Administered by only one route
  - Toxic if given by particular route
  - Not effective if given by certain route
  - Given for either local or systemic effects
  - Absorbed only by certain route
Routes for Drug Administration

- Intravenous
  - Common in prehospital setting
  - Quickest actions
  - Can be most hazardous

- Intramuscular
  - Common in nonemergency setting
  - Muscles highly vascular—absorption rapid

Routes for Drug Administration

- Enteral
  - Oral
  - Rectal

- Percutaneous
  - Topical
  - Sublingual
  - Buccal
  - Ocular
  - Nasal
  - Aural

Routes for Drug Administration

- Parenteral
  - Intravenous
  - Subcutaneous
  - Intramuscular
  - Intraosseous
  - Intradermal
  - Umbilical

- Pulmonary
  - Inhalation
  - Endotracheal
Mechanisms of Drug Action

- Local effect
- Systemic effect
- Therapeutic effect

Pharmacokinetics

- Movement of drugs
  - Absorption
  - Distribution
  - Metabolism
  - Excretion
Pharmacokinetics
- Distribution
- Metabolism

Pharmacokinetics
- Excretion

Pharmacodynamics
- Study of effects of drugs on body
- Receptor theory
Pharmacodynamics

- Drug-response factors
  - Effects of drug can be determined by measuring:
    - Plasma level profile
    - Biological half-life
    - Therapeutic threshold
    - Therapeutic index

- Factors altering drug responses:
  - Age
  - Body mass
  - Gender
  - Environment & time of administration
  - Existing pathology

Pharmacodynamics

- Predictable responses
  - Desired actions vs. side effects

- Iatrogenic responses
  - Mimic naturally occurring disease states
Pharmacodynamics: Unpredictable Responses

- Synergism
- Potentiation
- Antagonism
- Hypersensitivity
- Idiosyncratic reaction
- Tolerance
- Drug allergy
- Delayed reaction
- Anaphylactic reaction
- Cross-tolerance
- Drug dependence
- Tachyphylaxis
- Cumulative effect
- Drug toxicity

Drug Interactions—Variables

- Absorption
- Competition for plasma protein binding
- Drug metabolism or biotransformation
- Action at receptor site
- Renal excretion
- Alteration of electrolyte balance
- Drug-drug interactions
- Drug-induced malabsorption of foods & nutrients
- Food-induced malabsorption of drugs
- Alteration of enzymes
- Alcohol consumption
- Cigarette smoking
- Food-initiated alteration of drug excretion
- Drug incompatibilities

Drug Interactions

- Examples
  - Bronchodilators
  - Diuretics
  - Procainamide
  - Antihypertensives
  - Amiodarone
  - Opioid analgesic
  - Aspirin
Drug Profile Components

- Drug names
- Body system
- Class of agent
- Mechanism of action
- Drug actions, pharmacokinetics, & indications
- Contraindications & side effects
- Dosage
- Routes of administration
- How supplied
- Special considerations

Drugs Administered by EMT-I

- Adenosine
- Aspirin
- Albuterol
- Atropine sulfate
- Dexamethasone
- Diazepam
- 50% dextrose
- Epinephrine
- Furosemide
- Ipratropium

Drugs Administered by EMT-I

- Isoetharine
- Lidocaine
- Metaproterenol
- Methylprednisolone
- Morphine sulfate
- Naloxone
- Nitroglycerin
- Salmeterol
- Terbutaline
- Triamcinolone
Summary

- A drug is any substance that, when taken into body, changes one or more bodily functions
- Drugs may have as many as 4 names, including chemical, generic, official, & trade names
- Drugs may have natural sources, such as plants, minerals, or animals, or they may be synthesized in laboratory

Summary

- Consumers in U.S. are protected by several regulations regarding drugs
- Liquid drugs administered into body via subcutaneous, intramuscular, or intravenous (IV) routes are called parenteral drugs
- The routes used by EMT-I to administer drugs include sublingual, IV, subcutaneous, inhalation, endotracheal, & transdermal
- Administering drugs carries tremendous responsibility

Questions?