W4444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444

UNIT TERMINAL OBJECTIVE

1-3 At the completion of this unit, the EMT-Critical Care Technician student will be able to understand the basic principles of pharmacology and be able to develop a drug profile for common emergency medications.

COGNITIVE OBJECTIVES

At the completion of this unit, the EMT-Critical Care Technician student will be able to:

1-3.1 Review the specific anatomy and physiology pertinent to pharmacology. (C-1)
1-3.2 Discuss the standardization of drugs. (C-1)
1-3.3 Differentiate among the chemical, generic (nonproprietary), and trade (proprietary) names of a drug. (C-3)
1-3.4 List the four main sources of drug products. (C-1)
1-3.5 Describe how drugs are classified. (C-1)
1-3.6 List the authoritative sources for drug information. (C-1)
1-3.7 Discuss special consideration in drug treatment with regard to pregnant, pediatric and geriatric patients. (C-1)
1-3.8 Discuss the EMT-Critical Care Technician's responsibilities and scope of management pertinent to the administration of medications. (C-1)
1-3.9 List and describe general properties of drugs. (C-1)
1-3.10 List and describe liquid, solid, and gas drug forms. (C-1)
1-3.11 List and differentiate routes of drug administration. (C-3)
1-3.12 Differentiate between enteral and parenteral routes of drug administration. (C-3)
1-3.13 Describe mechanisms of drug action. (C-1)
1-3.14 List and differentiate the phases of drug activity, including the pharmaceutical, pharmacokinetic, and pharmacodynamic phases. (C-3)
1-3.15 Describe pharmacokinetics, pharmacodynamics, theories of drug action, drug-response relationship, factors altering drug responses, predictable drug responses, iatrogenic drug responses, and unpredictable adverse drug responses. (C-1)
1-3.16 Discuss considerations for storing drugs. (C-1)
1-3.17 List the components of a drug profile. (C-1)
1-3.18 List and describe drugs which the EMT-Critical Care Technician may administer in a pharmacological management plan according to local protocol. (C-1)
1-3.19 Discuss procedures and measures to ensure security of controlled substances the EMT-Critical Care Technician may administer. (C-1)

AFFECTIVE OBJECTIVES

At the completion of this unit, the EMT-Critical Care Technician student will be able to:

1-3.20 Defend medication administration by an EMT-Critical Care Technician to effect positive therapeutic affect. (A-3)

PSYCHOMOTOR OBJECTIVES

None identified for this unit.

S))))))

W44444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444444

DECLARATIVE

I. Names of drugs
   A. Drugs - chemical agents used in the diagnosis, treatment, or prevention of disease
   B. Pharmacology - the study of drugs and their actions on the body
   C. Chemical name - a precise description of the drug's chemical composition and molecular structure
   D. Generic name or non-proprietary name
      1. Official name approved by the FDA
      2. Usually suggested by the first manufacturer
   E. Trade or proprietary name - the brand name registered to a specific manufacturer or owner
   F. Official name - the name assigned by USP

II. Sources of drugs
   A. Plants
      1. Alkaloids
      2. Glycosides
      3. Gums
      4. Oils
   B. Animals and humans
   C. Minerals or mineral products
   D. Chemical substances made in the laboratory

III. Drug classification
   A. By body system
   B. Class of agent
   C. Mechanism of action

IV. Sources of drug information
   A. AMA Drug Evaluation
   B. Physician's Desk Reference (PDR)
   C. Hospital Formulary (HF)
   D. Drug inserts
   E. Other texts, sources

V. Standardization of drugs
   A. Standardization is a necessity
   B. Techniques for measuring a drug's strength and purity
      1. Assay
      2. Bioassay
   C. The Unites States Pharmacopeia (USP)
      1. Official volumes of drug standards
   D. Other reference books and guides

VI. Special considerations in drug therapy
   A. Pregnant patients

S))))))

1. Before using any drug during pregnancy, the expected benefits should be considered against the possible risks to the fetus
2. The FDA has established a scale (Categories A, B, C, D, and X) to indicate drugs that may have documented problems in animals and/ or humans during pregnancy
3. Many drugs are unknown to cause problems in animals and/ or humans during pregnancy
4. Pregnancy causes a number of anatomical and physiological changes
5. Drugs may cross the placenta or through lactation

B. Pediatric patients
1. Based on the child's weight or body surface area
2. Special concerns for neonates
3. Length-based resuscitation tape

C. Geriatric patients
1. The physiological effects of aging can lead to altered pharmacodynamics and pharmacokinetics

VII. The scope of management
A. EMT-Critical Care Technicians are held responsible for safe and therapeutically effective drug administration
B. EMT-Critical Care Technicians are personally responsible - legally, morally, and ethically - for each drug they administer
C. EMT-Critical Care Technicians
1. Use correct precautions and techniques
2. Observe and document the effects of drugs
3. Keep their knowledge base current to changes and trends in pharmacology
4. Establish and maintain professional relationships
5. Understand pharmacology
6. Perform evaluation to identify drug indications and contraindications
7. Seek drug reference literature
8. Take a drug history from their patients including
a. Prescribed medications
(1) Name
(2) Strength
(3) Daily dosage
b. Over-the-counter medications
c. Vitamins
d. Drug reactions
9. Consult with medical direction

D. Safety considerations and procedures
1. Concentrate on the task
2. Assure medical control physician understands the situation (you are his/her eyes and hears on the scene)
3. Assure medical control physician's orders are clearly understood (question orders that don't make sense for the situation)
4. Repeat orders back to medical control physician to confirm before administering a medication

S))))))

5. **Read medication label carefully (at least three (3) times**
6. **Double check all calculations before administering (especially for prepackaged medications)**
7. **Use correct, properly operating equipment**
8. **Handle medications carefully to avoid dropping or breaking**
9. **Exercise aseptic procedures**
10. **Check incompatibility problems**
11. **Monitor the symptoms of overdose and take corrective measures, as necessary**
12. **Document on the PCR the medication name, dosage, route, time given and patient's response**
13. **Properly dispose of the needles in a sharps container and do not recap needles or angiocaths**

VIII. Nervous system components
- A. Central nervous system
- B. Peripheral nervous system
  - 1. Peripheral nervous system characteristics
- C. Somatic system
- D. Autonomic nervous system (ANS)
  - 1. Autonomic nervous system characteristics
    - a. Parasympathetic and sympathetic characteristics
    - b. Autonomic antagonists
    - c. Physiological antagonism between sympathetic and parasympathetic discharge - organ responses
- E. Sympathetic branch of ANS
- F. Parasympathetic branch of ANS
- G. Direction of sympathetic influences
- H. Altering neurotransmission with drugs
  - 1. Modification of chemical transmission by drugs
- I. Receptor location and selective drug action
  - 1. Autonomic neurotransmitters
  - 2. Acetylcholine (cholinergic) receptor locations
  - 3. Norepinephrine (adrenergic) receptor locations
- J. Biological model systems and receptor characterization
- K. Receptor structure
- L. Synaptic control mechanisms

IX. General properties of drugs
- A. Drugs do not confer any new functions on a tissue or organ in the body, they only modify existing functions
- B. Drugs in general exert multiple actions rather than a single effect
- C. Drug action results from a physiochemical interaction between the drug and a functionally important molecule in the body
- D. Drugs that interact with a receptor to stimulate a response are known as agonists
- E. Drugs that attach to a receptor but do not stimulate a response are called antagonists
- F. Drugs that interact with a receptor to stimulate a response, but inhibit other responses are called

S))))))

partial agonists

G. Once administered, drugs go through four stages
   1. Absorption
   2. Distribution
   3. Metabolism
   4. Excretion

X. Drug forms
   A. Liquid drugs
      1. Solutions
      2. Tinctures
      3. Suspensions
      4. Spirits
      5. Emulsions
      6. Elixirs
      7. Syrups
   B. Solid drug forms
      1. Pills
      2. Powders
      3. Tablets
      4. Suppositories
      5. Capsules
   C. Gas forms

XI. Overview of the routes of drug administration
   A. The mode of drug administration affects the rate at which onset of action occurs and may affect the therapeutic response that results
   B. The choice of the route of administration is crucial in determining the suitability of a drug
   C. Drugs are given for either their local or systemic effects
   D. The routes of drug administration are categorized as
      1. Drugs administered by the inhalation route
         a. Nebulized medications
      2. Enteral (drugs administered along any portion of the gastrointestinal tract)
         a. Sublingual
         b. Buccal
         c. Oral
         d. Rectal
         e. Nasogastric
      3. Parenteral (any medication route other than the alimentary canal)
         a. Subcutaneous
         b. Intramuscular
         c. Intravenous
         d. Intrathecal
         e. Pulmonary
         f. Intralingual
         g. Intradermal

S))))))

- h. Transdermal
- i. Umbilical
- j. Intraosseous
- k. Nasal
- 4. Endotracheal

XII. Mechanisms of drug action
- A. To produce optimal desired or therapeutic effects, a drug must reach appropriate concentrations at its site of action
- B. Molecules of the chemical compound must proceed from point of entry into the body to the tissues with which they react
- C. The magnitude of the response depends on the dosage and the time course of the drug in the body
- D. Concentration of the drug at its site of action is influenced by various processes, which are divided into three phases of drug activity
  - 1. Pharmaceutical
    - a. Disintegration of dosage form
    - b. Dissolution of drug
  - 2. Pharmacokinetic
    - a. Absorption
    - b. Distribution
    - c. Metabolism
    - d. Excretion
  - 3. Pharmacodynamic
    - a. Drug-receptor interaction

XIII. Pharmacokinetics
- A. Passive transport
- B. Active transport
- C. Absorption
  - 1. Variables that affect drug absorption
    - a. Nature of the absorbing surface
    - b. Blood flow to the site of administration
    - c. Solubility of the drug
    - d. pH
    - e. Drug concentration
    - f. Dosage form
    - g. Routes of drug administration
    - h. Bioavailability
  - 2. Mechanisms involved in absorption
    - a. Diffusion
    - b. Osmosis
    - c. Filtration
- D. Distribution
  - 1. Drug reservoirs
    - a. Plasma protein binding

S))))))

b. Tissue binding
2. Barriers to drug distribution
a. Blood-brain barrier
b. Placental barrier
E. Biotransformation
1. Active metabolites
2. Inactive metabolites
F. Excretion
1. Organs of excretion
a. Kidneys
b. Intestine
c. Lungs
d. Sweat and salivary glands
e. Mammary glands

XIV. Pharmacodynamics
A. Theories of drug action - most drugs produce their effects by one of the following ways
1. Drug-receptor interaction
a. Agonists
b. Antagonists
c. Affinity
d. Efficacy
e. Types of receptors
(1) Beta
(2) Alpha
(3) Dopaminergic
(4) Others
2. Nonspecific drug interaction
B. Drug-response relationship
1. Plasma level profile of a drug
2. Biologic half-life
3. Therapeutic threshold or minimum effective concentration
4. Therapeutic index
C. Factors altering drug responses
1. Age
2. Body mass
3. Sex
4. Environmental milieu
5. Time of administration
6. Pathologic state
7. Genetic factors
8. Psychologic factors
D. Predictable responses
1. Desired action
2. Side effects
E. Iatrogenic responses

S))))))

F. Unpredictable adverse responses
   1. Drug allergy (medications frequently implicated in allergic reactions)
   2. Anaphylactic reaction
   3. Delayed reaction ("serum sickness")
   4. Hypersensitivity
   5. Idiosyncracy
   6. Tolerance
   7. Cross tolerance
   8. Cumulative effect
   9. Drug dependence
   10. Drug interaction
   11. Drug antagonism
   12. Summation (addition or additive effect)
   13. Synergism
   14. Potentiation
   15. Interference

XV. Drug interactions
   A. Variables influencing drug interaction include
      1. Intestinal absorption
      2. Competition for plasma protein binding
      3. Drug metabolism or biotransformation
      4. Action at the receptor site
      5. Renal excretion
      6. Alteration of electrolyte balance
   B. Drug-drug interactions
   C. Other drug interactions
      1. Drug-induced malabsorption of foods and nutrients
      2. Food-induced malabsorption of drugs
      3. Alteration of enzymes
      4. Alcohol consumption
      5. Cigarette smoking
      6. Food-initiated alteration of drug excretion
   D. Drug incompatibilities - occur when drugs are mixed before administration

XVI. Drug storage
   A. Certain precepts should guide the manner in which drugs are secured, stored, distributed, and accounted for
   B. Refer to local protocol
   C. Drug potency can be affected by
      1. Temperature
      2. Light
      3. Moisture
      4. Shelf life
   D. Applies also to diluents

S))))))

XVII. Security of controlled substances
- A. Procedures and measures to ensure the security of controlled substances
- B. Local protocols, requirements, and documentation

XVIII. Components of a drug profile
- A. Drug names
- B. Classification
- C. Mechanisms of action
- D. Indications
- E. Pharmacokinetics
- F. Side/ adverse effects
- G. Routes of administration
- H. How supplied
- I. Dosages
- J. Contraindications
- K. Considerations for pediatric patients, geriatric patients, pregnant patients, and other special patient groups
- L. Other profile components

XIX. Drugs used in pharmacological management plans (drugs appear in generic name)
- A. Acetylsalicylic acid
  1. Drug names
  2. Classification
  3. Mechanism of actions
  4. Pharmacokinetics
  5. Indications
  6. Contraindications
  7. Side/ adverse effects
  8. Routes of administration
  9. How supplied
  10. Dosages
  11. Special considerations
- B. Adenosine
  1. Drug names
  2. Classification
  3. Mechanism of actions
  4. Pharmacokinetics
  5. Indications
  6. Contraindications
  7. Side/ adverse effects
  8. Routes of administration
  9. How supplied
  10. Dosages
  11. Special considerations
- C. Atropine sulfate
  1. Drug names

2. Classification
3. Mechanism of actions
4. Pharmacokinetics
5. Indications
6. Contraindications
7. Side/ adverse effects
8. Routes of administration
9. How supplied
10. Dosages
11. Special considerations

D. Benzodiazepine
1. Drug names
2. Classification
3. Mechanism of actions
4. Pharmacokinetics
5. Indications
6. Contraindications
7. Side/ adverse effects
8. Routes of administration
9. How supplied
10. Dosages
11. Special considerations

E. Bretylium Tosylate
1. Drug names
2. Classification
3. Mechanism of actions
4. Pharmacokinetics
5. Indications
6. Contraindications
7. Side/ adverse effects
8. Routes of administration
9. How supplied
10. Dosages
11. Special considerations

F. Bronchodilators (Beta 2 agonists)
1. Suggested commonly administered medications
   a. Albuterol
   b. Ipratropium
   c. Isoetharine
   d. Metaproterenol
   e. Salmeterol
   f. Terbutaline
   g. Triamcinolone
   h. Others
2. Commonly administered adjunctive medications to bronchodilator therapy
   a. Dexamethasone

S))))))

b. Methylprednisolone
c. Others
3. Classification
4. Mechanism of actions
5. Pharmacokinetics
6. Indications
7. Contraindications
8. Side/ adverse effects
9. Routes of administration
10. How supplied
11. Dosages
12. Special considerations

G. Dextrose 50%
1. Drug names
2. Classification
3. Mechanism of actions
4. Pharmacokinetics
5. Indications
6. Contraindications
7. Side/ adverse effects
8. Routes of administration
9. How supplied
10. Dosages
11. Special considerations

H. Dopamine
1. Drug names
2. Classification
3. Mechanism of actions
4. Pharmacokinetics
5. Indications
6. Contraindications
7. Side/ adverse effects
8. Routes of administration
9. How supplied
10. Dosages
11. Special considerations

I. Epinephrine (1:1000)
1. Drug names
2. Classification
3. Mechanism of actions
4. Pharmacokinetics
5. Indications
6. Contraindications
7. Side/ adverse effects
8. Routes of administration
9. How supplied

S))))))

10. Dosages
11. Special considerations

J. Epinephrine (1:10,000)
1. Drug names
2. Classification
3. Mechanism of actions
4. Pharmacokinetics
5. Indications
6. Contraindications
7. Side/ adverse effects
8. Routes of administration
9. How supplied
10. Dosages
11. Special considerations

K. Furosemide
1. Drug names
2. Classification
3. Mechanism of actions
4. Pharmacokinetics
5. Indications
6. Contraindications
7. Side/ adverse effects
8. Routes of administration
9. How supplied
10. Dosages
11. Special considerations

L. Glucagon
1. Drug names
2. Classification
3. Mechanism of actions
4. Pharmacokinetics
5. Indications
6. Contraindications
7. Side/ adverse effects
8. Routes of administration
9. How supplied
10. Dosages
11. Special considerations

M. Lidocaine HCl 2%
1. Drug names
2. Classification
3. Mechanism of actions
4. Pharmacokinetics
5. Indications
6. Contraindications
7. Side/ adverse effects

S))))))

8. Routes of administration
9. How supplied
10. Dosages
11. Special considerations

N. Magnesium Sulfate

1. Drug names
2. Classification
3. Mechanism of actions
4. Pharmacokinetics
5. Indications
6. Contraindications
7. Side/ adverse effects
8. Routes of administration
9. How supplied
10. Dosages
11. Special considerations

O. Morphine sulfate

1. Drug names
2. Classification
3. Mechanism of actions
4. Pharmacokinetics
5. Indications
6. Contraindications
7. Side/ adverse effects
8. Routes of administration
9. How supplied
10. Dosages
11. Special considerations

P. Naloxone

1. Drug names
2. Classification
3. Mechanism of actions
4. Pharmacokinetics
5. Indications
6. Contraindications
7. Side/ adverse effects
8. Routes of administration
9. How supplied
10. Dosages
11. Special considerations

Q. Nitroglycerin

1. Drug names
2. Classification
3. Mechanism of actions
4. Pharmacokinetics
5. Indications

S))))))

6. Contraindications
7. Side/ adverse effects
8. Routes of administration
9. How supplied
10. Dosages
11. Special considerations

R. Sodium Bicarbonate

1. **Drug names**
2. **Classification**
3. **Mechanism of actions**
4. **Pharmacokinetics**
5. **Indications**
6. **Contraindications**
7. **Side/ adverse effects**
8. **Routes of administration**
9. **How supplied**
10. **Dosages**
11. **Special considerations**

S. Thiamine

1. **Drug names**
2. **Classification**
3. **Mechanism of actions**
4. **Pharmacokinetics**
5. **Indications**
6. **Contraindications**
7. **Side/ adverse effects**
8. **Routes of administration**
9. **How supplied**
10. **Dosages**
11. **Special considerations**

XX. Other medications used under local jurisdiction

S))))))