

**Maryland Fire and Rescue Institute
Drill of the Month – March 2002**

**EMT-B Pharmacology
Instructor Guide**

Topic: EMT-B Pharmacology

Time Required: Three Hours

Materials:

- Oxygen delivery system
- Oral glucose
- Activated charcoal
- Sample medication containers
- Inhaler trainer/simulator
- Epinephrine auto injector trainer/simulator

References:

- Emergency Care, 9th Edition, Brady
- Emergency Care of the Sick and Injured, 8th Edition, Jones and Bartlett
- Maryland Medical Protocols for Emergency Services Providers, January 1, 2002, Maryland Institute for Emergency Medical Services Systems

PREPARATION:

Motivation:

Unknown medical problems make up a large percentage of EMS responses. An understanding of these conditions, quick recognition and rapid, efficient administration of appropriate medications are important to the successful recovery of the patient.

Objective (SPO): 1-1

The student will be able to identify, from memory and without assistance, common medical conditions encountered by EMT-Bs, the medications used to treat them and the proper administration of these medications, in accordance with the appropriate medical protocols.

Overview:

- General Pharmacology and Terminology
- Medication Names
- Routes of Administration
- Medication Forms
- Medications on Ambulances
- Prescribed Medications

EMT-B Pharmacology

- SPO 1-1 The student will be able to identify, from memory and without assistance, common medical conditions encountered by EMT-Bs, the medications used to treat them and the proper administration of these medications, in accordance with the appropriate medical protocols.
- 1-1 Describe the components and terminology of general pharmacology.
- 1-2 Describe the names of medications.
- 1-3 Describe the routes of administration for medications.
- 1-4 Describe the forms of medications.
- 1-5 Describe the medications carried on ambulances and demonstrate proper administration techniques.
- 1-6 Describe prescribed medications commonly carried by patients and demonstrate proper administration techniques.

I. Components and Terminology (1-1)

- A. Pharmacology
 - 1. Study of the characteristics and effects of medications
 - 2. Medication
 - a. chemical substance
 - b. used to treat or prevent disease
 - c. used to relieve pain
 - 3. Drug
 - a. used interchangeably for medication
 - b. sounds “illegal” or “illicit”
 - c. refrain from using when interviewing patient or family
 - 4. Dose
 - a. amount of medication given
 - b. depends upon patient’s age and size
 - c. depends upon the desired action
 - 5. Action
 - a. therapeutic effect that is expected
 - 1) nitroglycerin dilates blood vessels
 - 6. Indications
 - a. therapeutic uses for a medication
 - b. specific signs or circumstances when it is appropriate to administer the medication
 - 7. Contraindications
 - a. specific signs or circumstances when it is NOT appropriate to administer the medication
 - b. may harm the patient
 - c. would have no positive effect on the patient’s condition
 - 8. Side effects
 - a. any action other than the desired one
 - b. may occur even if administered properly
 - c. also known as adverse effects

II. Medication Names (1-2)

- A. Trade Name
 - 1. Brand name given by the manufacturer
 - 2. Medication may have many trade names
 - a. dependant upon how many manufacturers

- b. Advil, Nuprin and Motrin are all ibuprofen
 3. Proper noun so name is capitalized
- B. Generic Name
1. Original chemical name
 2. Often used as the name of the medication
 - a. nitroglycerin
 3. Name is not capitalized
 4. Listed in United States Pharmacopoeia (USP)
- C. Prescription Medications
1. Requires physician order
 2. Distributed by pharmacist
- D. Over-the-Counter (OTC) Medications
1. Purchased directly from retail source
 2. Many prescription medications now available OTC
 - a. Zantac

III. Routes of Administration (1-3)

- A. Intravenous (IV) injection
1. Injected directly into a vein
 2. Enters the bloodstream immediately
 3. Fastest way to deliver a medication
 4. Not all medications can be given IV
 - a. aspirin, oxygen
- B. Oral
1. Per os (PO)
 - a. taken by mouth
 2. Enters bloodstream through digestive system
 3. May take up to 1 hour
- C. Sublingual (SL)
1. Under the tongue
 2. Enters the bloodstream through the oral mucous membrane
 3. Generally in system within minutes
 4. Example is nitroglycerin tablets
- D. Intramuscular (IM) injection
1. Injected into the muscle
 2. Quick absorption due to muscle's blood vessels

3. Some medications may be slow release from the muscles
 4. Not all medications can be given IM
 - a. tissue damage
 - b. uneven, unreliable absorption
- E. Intraosseous (IO)
1. Injected into the bone
 2. Enters the bloodstream through the bone marrow
 3. Requires drilling a needle into the bone
 - a. very painful
 - b. may be used in unconscious patients from cardiac arrest or shock
 - c. most commonly used in children
- F. Subcutaneous (SC) injection
1. Injected beneath the skin
 - a. in tissue between skin and muscle
 2. Absorbed very slowly
 3. Effects of medication lasts longer
 4. Example is daily insulin shot
- G. Transcutaneous
1. Enters through the skin
 2. Produces a slow, long-lasting effect
 3. Examples are nitroglycerin and nicotine patches
- H. Inhalation
1. Medication is inhaled into the lungs
 2. Relatively quick absorption
 3. Some medications work in the lungs
 4. Minimizes the effects on other body tissues
 5. Comes in many forms
 - a. aerosols
 - b. fine powders
 - c. sprays
- I. Per rectum (PR)
1. Delivered by the rectum
 2. Often used with children
 - a. easier administration
 - b. more reliable absorption

IV. Medication Forms (1-4)

- A. Tablets and Capsules
 - 1. Most adult medication comes in this form
 - 2. Capsules
 - a. gelatin shell
 - b. if powder filled
 - 1) shell can be pulled apart
 - c. if liquid filled
 - 1) shell is sealed
 - 2) shell usually soft
 - 3. Tablets
 - a. compressed under high pressure
 - b. medication of mixed with other materials
 - c. some dissolve very quickly
 - 1) sublingual nitroglycerin
 - d. most dissolve slowly in the digestive system

- B. Solutions and Suspensions
 - 1. Solution
 - a. liquid mixture
 - b. made up of one or more substances
 - c. cannot be separated by filtering or allowing to stand
 - d. can be given by almost any route
 - 2. Suspension
 - a. solids are ground into fine particles
 - b. distributed through a liquid by shaking or stirring
 - c. solids will not dissolve in the liquid
 - d. will separate if filtered or allowed to stand
 - e. must be shaken prior to administration
 - f. usually administered orally

- C. Metered-Dose Inhalers
 - 1. Used to administer very small droplets or particles
 - 2. Absorbed through the lungs
 - 3. Delivers the same dose every time
 - 4. Usually suspensions
 - a. must be shaken well before use
 - 5. Commonly used in respiratory illnesses

- D. Topical Medications
 - 1. Applied to the skin surface
 - a. affect only that area
 - 2. Lotions

3. Creams
 4. Ointments
 5. Contain various liquids, oils, medications
 - a. absorption rates vary
- E. Transcutaneous Medications
1. Transdermal medication
 - a. designed to be absorbed through the skin
 - b. usually intended for systemic or whole-body effects
 - c. EMTB can absorb them also
 - 1) nitroglycerin paste
 - d. also applied with adhesive patches
 - 1) nitroglycerin
 - 2) nicotine
- F. Gels
1. Semi-liquid substance
 2. Administered orally
 3. Generally the consistency of paste or creams but are clear (transparent)
- G. Gases for Inhalation
1. Neither solid nor liquid
 2. Most commonly used is oxygen

V. Medications Carried on Ambulances (1-5)

(Much of the information in this section is Maryland specific. It is important that you always comply with your EMS system protocols.)

- A. Activated Charcoal
1. Indications
 - a. poisoning by mouth
 2. Actions
 - a. adsorb some poisons
 - 1) bind them to the surface of the charcoal
 - b. prevent absorption by the body
 - c. suspension often contains Sorbitol
 - 1) complex sugar
 - 2) acts as a laxative to move substance through the digestive system
 3. Adverse Effects
 - a. may indirectly induce vomiting

- b. may cause nausea
 - 4. Precautions
 - a. does not absorb all drugs
 - b. does not absorb all toxic substances
 - 5. Contraindications
 - a. altered mental status
 - b. patients who have received an emetic
 - c. ingestion of acids or alkalis
 - 6. Dosage
 - a. administration requires Medical Consultation
 - b. adult
 - 1) 1 gram/ kg or
 - 2) 0.5 gram/lb
 - c. pediatric
 - 1) 1 gram/ kg or
 - 2) 0.5 gram/lb
 - 7. Administration
 - a. Medical Consultation required
 - b. shake container thoroughly
 - c. persuade patient to drink the “muddy” liquid
 - 1) a covered container and straw may help
 - d. insure container is shaken or stirred just prior to ingestion
 - e. record name, dose, route and time of administration
- B. Ipecac
- 1. Indications
 - a. overdose of ingested poison in alert patients
 - 2. Actions
 - a. causes vomiting
 - 3. Adverse Effects
 - a. emesis may precipitate convulsions
 - b. retching may cause syncope
 - 4. Precautions
 - a. must be followed by large amounts of water
 - b. must protect the patient from aspiration
 - 5. Contraindications
 - a. altered mental status
 - b. ingestion of caustics
 - c. ingestion of petroleum products
 - d. patients less than 9 months old

6. Dosage
 - a. administration requires Medical Consultation
 - b. adult
 - 1) over 12 years of age
 - a) 30 ml orally followed by large amounts of water
 - c. pediatric
 - 1) 1 – 12 years of age
 - a) 15 ml orally followed by large amounts of water
 - 2) 9 – 12 months of age
 - a) 10 ml orally followed by large amounts of water
7. Administration
 - a. Medical Consultation required
 - b. have patient drink liquid
 - c. have patient drink several glasses of water
 - d. be prepared for vomiting
 - e. be prepared to maintain a patent airway
 - f. record name, dose, route and time of administration

C. Oral Glucose

1. Indications
 - a. altered mental status with unknown diabetic history
 - b. unconscious for an unknown reason
 - c. altered mental status with known diabetic history
2. Actions
 - a. counteract the effects of hypoglycemia
 - b. simple sugar easily absorbed by the body
 - c. increases blood sugar
3. Adverse Effects
 - a. not clinically significant
4. Precautions
 - a. patient without gag reflex may aspirate
5. Contraindications
 - a. not clinically significant
6. Dosage

- a. adult
 - 1) 10 – 15 grams of glucose paste
 - 2) administer between gum and cheek
- b. pediatric
 - 1) 10 – 15 grams of glucose paste
 - 2) administer between gum and cheek
 - 3) may be accomplished through several small administrations
- 7. Administration
 - a. assess patient
 - b. place glucose on tongue depressor between gum and cheek or
 - c. patient self administers between gum and cheek
 - d. perform ongoing assessment
 - e. record name, dose, route and time of administration

D. Oxygen

- 1. Indications
 - a. all medical patients
 - b. all trauma patients
- 2. Actions
 - a. enhances cell function
 - b. prevents hypoxia
- 3. Adverse Effects
 - a. high concentration may reduce respiratory drive in COPD patients
 - 1) monitor carefully
- 4. Precautions
 - a. never withhold oxygen from anyone who needs it
 - b. give with caution to COPD patients
 - c. simple or partial rebreather face masks must supply minimum of 6 lpm
 - d. non-rebreather face masks must supply minimum of 12 lpm
- 5. Contraindications
 - a. none
- 6. Dosage
 - a. adult
 - 1) 12 – 15 lpm via non-rebreather mask or

- 2) 2 – 6 lpm via nasal cannula, unless otherwise directed
- b. pediatric
 - 1) 12 – 15 lpm via non-rebreather mask or
 - 2) 2 – 6 lpm via nasal cannula, unless otherwise directed
- 7. Administration

Device	Flow Rate	Concentration
Nasal Cannula	2 – 6 lpm	24 – 44%
Venturi Mask	Variable	24 – 50%
Partial Rebreather Mask	6 – 10 lpm	35 – 60%
Simple Face Mask	6 – 10 lpm	35 – 60%
Pocket Mask	12 – 15 lpm	50 – 60%
Non-Rebreather Mask	12 – 15 lpm	80 – 100%
Bag-Valve-Mask	12 – 15 lpm	90 – 100%

E. Epinephrine Auto-Injector

- 1. Indications
 - a. moderate to severe allergic reaction with respiratory distress
 - b. mild allergic reaction with history of life-threatening allergic reaction
 - c. pediatric patients with severe asthma
- 2. Actions
 - a. increases heart rate
 - b. increases blood pressure
 - c. decreases muscle tone of bronchiole tree
 - d. dilates passages in lungs
 - e. constricts blood vessels
- 3. Adverse Effects
 - a. tachycardia/palpitations
 - b. angina
 - c. headache
 - d. nausea/vomiting
 - e. dizziness
 - f. hypertension
 - g. nervousness/anxiety
 - h. tremors
- 4. Precautions
 - a. requires Medical Consultation in pregnant patients unless
 - 1) patient is in severe allergic reaction

- 2) patient is in severe asthma
5. Contraindications
 - a. none in the presence of anaphylaxis
6. Dosage
 - a. adult
 - 1) 0.3 mg IM
 - a) Medical Consultation required prior to administration to adult asthma patients
 - b. pediatric
 - 1) 0.15 mg IM
 - c. additional doses require Medical Consultation
7. Administration
 - a. insure medication is not discolored
 - b. Medical Consultation if required
 - c. remove cap from auto-injector
 - d. place tip against patient's thigh
 - 1) lateral aspect
 - 2) midway between waist and knee
 - e. push firmly against thigh until injector activates
 - f. hold at least 10 seconds
 - g. record name, dose, route and time of administration
 - h. properly dispose of auto-injector

VI. Patient Prescribed Medications (1-6)

(Much of the information in this section is Maryland specific. It is important that you always comply with your EMS system protocols.)

- A. Metered Dose Inhalers (Albuterol, Proventil, Ventolin)
 1. Indications
 - a. signs and symptoms of respiratory distress
 - b. bronchospasms/wheezing associated with
 - 1) asthma
 - 2) chronic bronchitis
 - 3) emphysema
 - 4) allergic reactions (anaphylaxis)
 2. Actions

- a. bronchodilator
 - 1) enlarge constricted bronchial tubes
- 3. Adverse Effects
 - a. tachycardia/palpitations
 - b. hypertension
 - c. angina
 - d. nervousness/anxiety
 - e. tremors
 - f. dizziness
 - g. headache
 - h. sweating
 - i. nausea/vomiting
 - j. sore throat
- 4. Precautions
 - a. may cause severe bronchospasm from repeated excessive use
 - b. patient must have own physician-prescribed inhaler
- 5. Contraindications
 - a. inhaler not prescribed for the patient
- 6. Dosage
 - a. adult
 - 1) maximum of 2 doses (4 puffs) over 30 minutes
 - b. pediatric
 - 1) maximum of 2 doses (4 puffs) over 30 minutes
 - c. additional doses require Medical Consultation
- 7. Administration
 - a. obtain patient's prescribed inhaler
 - b. assure right patient, right medication, right dose, right route
 - c. check expiration date
 - d. check if patient has already taken any medication prior to your arrival
 - e. assure inhaler is at room temperature
 - f. shake inhaler several times
 - g. have patient exhale deeply
 - h. have patient place lips around inhaler
 - i. depress the inhaler as patient begins deep inhalation
 - j. ask patient to hold breath as long as comfortable
 - k. reattach oxygen

- l. administer 2nd puff after a few breaths
 - m. record name, dose, route and time of administration
- B. Epinephrine Auto-Injector
- 1. Indications
 - a. moderate to severe allergic reaction with respiratory distress
 - b. mild allergic reaction with history of life-threatening allergic reaction
 - c. pediatric patients with severe asthma
 - 2. Actions
 - a. increases heart rate
 - b. increases blood pressure
 - c. decreases muscle tone of bronchiole tree
 - d. dilates passages in lungs
 - e. constricts blood vessels
 - 3. Adverse Effects
 - a. tachycardia/palpitations
 - b. angina
 - c. headache
 - d. nausea/vomiting
 - e. dizziness
 - f. hypertension
 - g. nervousness/anxiety
 - h. tremors
 - 4. Precautions
 - a. requires Medical Consultation in pregnant patients unless
 - 1) patient is in severe allergic reaction
 - 2) patient is in severe asthma
 - 5. Contraindications
 - a. none in the presence of anaphylaxis
 - 6. Dosage
 - a. adult
 - 1) 0.3 mg IM
 - a) Medical Consultation required prior to administration to adult asthma patients
 - b. pediatric
 - 1) 0.15 mg IM
 - c. additional doses require Medical Consultation
 - 7. Administration

- a. Obtain patient's prescribed auto-injector
- b. insure medication is not discolored
- c. Medical Consultation if required
- d. remove cap from auto-injector
- e. place tip against patient's thigh
 - 1) lateral aspect
 - 2) midway between waist and knee
- f. push firmly against thigh until injector activates
- g. hold at least 10 seconds
- h. record name, dose, route and time of administration
- i. properly dispose of auto-injector

C. Nitroglycerin

1. Indications
 - a. patient must have own physician-prescribed nitroglycerin
 - b. chest pain
2. Actions
 - a. increases blood flow to the heart
 - 1) relieve vascular spasms
 - 2) dilate arteries
 - 3) relaxes veins so less blood is returned to the heart
3. Adverse Effects
 - a. hypotension
 - b. headache
 - c. dizziness
 - d. tachycardia
4. Precautions
 - a. reassess blood pressure before and after administration
 - b. if systolic pressure drops more than 20 mmHg, Medical Consultation is required before further administration
5. Contraindications
 - a. Blood pressure below 90 mmHg systolic
 - b. heart rate less than 60
 - c. medication not prescribed for the patient
 - d. pediatric patient under the age of 12 years
 - e. Viagra™ ingestion with the last 24 hours

6. Dosage
 - a. adult
 - 1) one tablet or one spray sublingually
 - a) repeat in 3 – 5 minutes if pain persists
 - 2) maximum of 3 doses (patient and EMT-B administered)
 - b. pediatric
 - 1) not indicated
 - a) contraindicated under age 12
 - c. additional doses require Medical Consultation
7. Administration
 - a. perform focused patient assessment for cardiac patient
 - b. assess blood pressure
 - 1) systolic > 100
 - c. obtain patient prescribed medication
 - d. assure right medication, right patient, right dose, right route
 - e. check expiration date
 - f. question patient about last dose taken
 - g. question patient about taking Viagra™ in last 24 hours
 - h. assist patient or place medication under tongue
 - i. have patient close mouth with tablet under tongue until dissolved
 - j. recheck blood pressure
 - k. record name, dose, route and time of administration
 - l. perform reassessment and give additional doses per protocol

SUMMARY:

Review:

- General Pharmacology and Terminology
- Medication Names
- Routes of Administration
- Medication Forms
- Medications on Ambulances
- Prescribed Medications

Remotivation:

Assignment:

EVALUATION: