

RESP-1340: PHARMACOLOGY FOR RESPIRATORY CARE

Cuyahoga Community College

Viewing: RESP-1340 : Pharmacology for Respiratory Care

Board of Trustees:

March 2020

Academic Term:

Fall 2020

Subject Code

RESP - Respiratory Care

Course Number:

1340

Title:

Pharmacology for Respiratory Care

Catalog Description:

General principles of pharmacology and calculations of drug dosages. Discussion of pharmacologic principles and agents used in treatment of cardiopulmonary disorders.

Credit Hour(s):

2

Lecture Hour(s):

2

Lab Hour(s):

0

Other Hour(s):

0

Requisites

Prerequisite and Corequisite

RESP-1300 Respiratory Care Equipment and RESP-1310 Cardiopulmonary Physiology.

Outcomes

Course Outcome(s):

A. Evaluate specific information on various categories of drugs.

Objective(s):

1. Demonstrate an understanding of basic terminology for respiratory care pharmacology.
2. Identify the official drug publication in the U.S.
3. Identify four common sources of drug information.

Course Outcome(s):

B. Describe the basic principles of drug action emphasizing the pharmaceutical phase, pharmacokinetic phase and pharmacodynamic phase.

Objective(s):

1. Identify the three phases involved in drug action.
2. Identify five different routes of administration and give advantages and disadvantages of each route.
3. Identify the four processes involved in the pharmacokinetics phase.
4. Identify the essential concepts involved with the interaction of a drug molecule with its target receptor site.

Course Outcome(s):

C. Calculate and interpret adult dosages for medications given by respiratory care practitioners.

Objective(s):

1. Calculate dosages from percentage strength solutions.
2. Calculate the amount of solute per ml of solution given a ratio.
3. Calculate the ratio of drug to diluent given the amounts of drug and diluent or simple parts.
4. Calculate the amount or volume of drug needed given a medication order and the dose and amount of medication on hand.
5. Calculate a dosage based on a schedule (mg/Kg).
6. Identify correct dose and schedule for adult medications administered by respiratory care practitioners.
7. Convert from one unit to another within the metric system.

Course Outcome(s):

D. Differentiate between drugs affecting the autonomic nervous system, parasympathetic and sympathetic branch and their relationship to the heart and lungs.

Objective(s):

1. Describe the two branches of the autonomic nervous system.
2. Describe the effects that the sympathetic and parasympathetic branches of the ANS have on various body processes.
3. Identify drug representatives for parasympathomimetic (cholinergic) agents
4. Identify drug representatives of the parasympatholytic (anticholinergic/antimuscarinic) agents.
5. Identify sympatholytic (antiadrenergic) agents.
6. Identify drug representatives for sympathomimetic (adrenergic) agents.
7. Identify pharmacologic effects of beta sympathetic stimulation.
8. Identify and understand the mechanism of action on bronchial smooth muscle and skeletal muscle of the parasympatholytic drugs.
9. Identify the role of parasympathetic stimulation in the normal lung.
10. Name desirable characteristics in a sympathomimetic bronchodilator.
11. Identify the advantages and disadvantages of aerosol administration of the sympathomimetic bronchodilators.

Course Outcome(s):

E. Evaluate the use of drugs given by respiratory care practitioners based on mode of action, therapeutic effect, adverse reactions and side effects.

Objective(s):

1. Identify dosage forms available, pharmacologic action on the lung, onset, duration, side effects, precautions, pharmaceutical precautions (i.e. storage requirements), and generic and trade names for parasympatholytic bronchodilators.
2. Identify dosage forms available, pharmacologic action on the lung, onset, duration, side effects, precautions, pharmaceutical precautions (i.e. storage requirements), and generic and trade names for sympathomimetic drugs
3. Identify dosage forms available, pharmacologic action, side effects, precautions, pharmaceutical precautions (i.e. storage requirements), and generic and trade names for mucus controlling drugs.
4. Identify dosage forms available, pharmacologic action on the lung, onset, duration, side effects, precautions, pharmaceutical precautions (i.e. storage requirements), and generic and trade names for surface active agents.
5. Identify dosage forms available, pharmacologic action, side effects, precautions, pharmaceutical precautions (i.e. storage requirements), and generic and trade names for drug categories and types used in the treatment of pulmonary infections (antibiotics, antifungal agents, antituberculosis agents).
6. Identify dosage forms available, pharmacologic action on the lung, side effects, precautions, pharmaceutical precautions (i.e. storage requirements), and generic and trade names for drug categories and types used as anti-inflammatory agents delivered by aerosol administration and their application in clinical settings.

Course Outcome(s):

G. Compare drug categories and types used as skeletal muscle relaxants, their applications and clinical uses.

Objective(s):

1. Identify the mechanism of action and pharmacodynamics for the nondepolarizing neuromuscular blocking agents.
2. Identify the mechanism of action and pharmacodynamics for the depolarizing neuromuscular blocking agents.
3. Identify uses of neuromuscular blocking agents that relate to respiratory therapy/anesthesia

Course Outcome(s):

H. Compare drug categories and types which both stimulate and depress ventilation, their application and clinical uses.

Objective(s):

1. Describe the differences between sedatives and hypnotics
2. Identify the mechanism of action for the barbiturates.
3. Identify the primary uses of the barbiturates
4. Identify the mechanism of action for the minor tranquilizers (benzodiazepines)
5. Identify representatives of the minor tranquilizers (benzodiazepines)
6. Identify the two major classes of antipsychotic drugs
7. Identify the mechanism of action for the neuroleptic agents
8. Identify the cardiac and CNS adverse reactions associated with the neuroleptic agents
9. Identify the mechanism of action for the antidepressants
10. Identify the cardiac, CNS and neurologic adverse reactions associated with the antidepressants
11. Identify the mechanism of action for the narcotic analgesics
12. Identify adverse reactions or side effects associated with the narcotic analgesics
13. Identify the commonly used respiratory stimulants
14. Identify uses for the respiratory stimulants and whether that use is indicated or not.

Course Outcome(s):

I. Compare drug categories and types which directly and indirectly affect cardiovascular function (electrophysiology, hemodynamics) their application and clinical uses.

Objective(s):

1. Identify the mechanism of action for the cardiac glycosides and the inotropic and chronotropic effects
2. Identify the classes of antiarrhythmic drugs and several agents associated with each type
3. Identify the major classes of antihypertensive drugs and several representatives of each class
4. Identify the major mechanisms of action for the antihypertensive agents
5. Identify the two major drug classifications included in the coronary vasodilators
6. Identify the major indications for the coronary vasodilators
7. Identify the more common cardiac stimulants and/or vasoconstricting agents
8. Identify the more common drugs used in an emergency resuscitation attempt

Methods of Evaluation:

1. Quizzes
2. Examinations
3. Comprehensive test

Course Content Outline:

1. Basic terminology
 - a. Drugs
 - b. Pharmacology
 - i. pharmacokinetics
 - ii. pharmacodynamics
 - iii. toxicology
 - iv. therapeutics
 - v. pharmacogenetics
2. Legislation
 - a. Official publications
 - b. Legislation in U.S.A.

3. The naming of drugs
 - a. Chemical name
 - b. Code name
 - c. Generic name
 - d. Official name
 - e. Trade (proprietary) name
4. Sources of drug information
 - a. United States pharmacopeia, national formulary
 - b. AMA drug evaluations
 - c. PDR (Physician's Desk Reference)
 - d. Hospital formulary (ASHP)
 - e. The pharmacist
5. Sources of drugs
 - a. Chemical synthesis
 - b. Animal
 - c. Plant
 - d. Mineral (inorganic)
6. Development of a new drug
 - a. Animal studies
 - i. acute, subacute or chronic toxicities
 - ii. therapeutic index
 - iii. pharmacokinetic studies
 - b. Human studies
 - i. phase 1 - preliminary pharmacologic evaluation
 - ii. phase 2 - basic controlled evaluation for efficacy and safety
 - iii. phase 3 - extended clinical studies
7. Principles of drug action
 - a. Pharmaceutical phase
 - i. drug form (dosage form)
 - ii. route of administration
 1. determining factors
 - a. systemic or local effect
 - b. desired rate of onset and duration of action
 - c. stability of a drug in various body fluids
 - d. convenience vs. safety
 - e. the amount of drug to be given
 2. oral route of administration
 - a. advantages
 - b. disadvantages
 - c. dosage forms (or types)
 3. parenteral route of administration
 - a. advantages
 - b. disadvantages
 - c. dosage forms (or types)
 4. inhalation route of administration
 - a. advantages
 - b. disadvantages
 - c. dosage forms (or types)
 5. topical route of administration (mucous membranes)
 - a. advantages
 - b. disadvantages
 - c. types:
 6. topical route of administration (skin)
 - a. advantages
 - b. disadvantages
 - c. dosage forms (or types)
 - b. Pharmacokinetic phase

- i. absorption
 - 1. passive - requires no energy expenditure
 - 2. active requires energy
 - 3. bioavailability
- ii. distribution
- iii. metabolism
- iv. excretion
 - 1. renal
 - 2. liver-biliary excretion
 - 3. GI
 - 4. lungs
 - 5. other
- c. Pharmacodynamic phase
 - i. essential concepts
 - ii. lock-and-key analogy
 - 1. drug affinity
 - 2. drug efficacy
 - 3. agonist
 - 4. antagonist
 - iii. drug interactions
 - 1. additive
 - 2. synergistic
 - 3. potentiation
 - 4. antagonism
 - 5. partial antagonist
 - 6. cummulation
 - 7. tolerance
 - 8. tachyphylaxis
 - iv. therapeutic index
- 8. The prescription
 - a. Parts of a prescription
 - b. Administering a drug
 - c. Abbreviations
- 9. Calculating drug dosages and math problems
 - a. The metric system
 - i. unit of length
 - ii. unit of volume
 - iii. unit of weight
 - iv. prefixes
 - b. The apothecary system
 - i. unit of length
 - ii. unit of volume
 - iii. unit of weight
 - c. The avoirdupois system
 - d. Conversion between systems
 - i. approximate equivalents
 - ii. household equivalents
 - e. Drug dosage calculations
 - i. calculating dosages from prepared strength liquids, tablets, or capsules
 - ii. calculating dosages from percentage-strength solutions
 - iii. diluents and drug dosage strengths
 - f. Solutions definitions and terms
 - i. solution
 - ii. isotonic solution
 - iii. hypertonic solution
 - iv. hypotonic solution
- 10. Organization of the nervous system

- a. Central nervous system
 - i. the brain
 - ii. spinal cord
- b. Peripheral nervous system
 - i. somatic branches
 - 1. sensory (afferent)
 - 2. motor (efferent)
 - ii. autonomic nervous system
 - 1. parasympathetic branch
 - 2. sympathetic branch
 - 3. effects
- c. Neurotransmitters
 - i. acetylcholine
 - ii. norepinephrine
- d. Autonomic receptors
 - i. cholinergic
 - 1. muscarinic
 - 2. nicotinic
 - ii. adrenergic
 - 1. alpha1
 - 2. alpha2
 - 3. beta1
 - 4. beta2
 - 5. dopaminergic
- e. Terminology
 - i. parasympathomimetic (cholinergic)
 - ii. parasympatholytic (anticholinergic)
 - iii. sympathomimetic (adrenergic)
 - iv. sympatholytic (antiadrenergic)
- 11. Cholinergic receptor stimulants
 - a. Direct acting cholinergic stimulants
 - i. representatives
 - ii. pharmacokinetics
 - iii. pharmacologic effects
 - b. Indirect-acting cholinergic stimulants (anticholinesterases)
 - i. representatives
 - ii. pharmacokinetics
 - iii. pharmacologic effects
 - c. Clinical uses
 - d. Adverse effects
- 12. Cholinergic receptor antagonists (parasympatholytics)
 - a. Muscarinic-blocking drugs
 - i. representatives
 - ii. organ system effects
 - iii. clinical uses
 - iv. adverse effects
 - 1. central nervous system disorders
 - 2. respiratory system disorders
 - 3. cardiovascular system disorders
 - b. Ganglionic blocking drugs
 - i. representatives
 - ii. cardiovascular system effects
 - iii. clinical uses
- 13. Adrenergic receptor-blocking drugs (sympatholytics)
 - a. Representatives
 - b. Alpha-antagonists
 - i. pharmacologic effects
 - ii. clinical uses
 - 1. cardiovascular system
 - 2. respiratory system

- c. Beta-agonists (blockers)
 - i. pharmacokinetics differences
 - ii. pharmacologic effects
 - iii. clinical applications
 - 1. hypertension
 - 2. cardiac arrhythmias
 - 3. neurologic diseases
- 14. Sympathomimetic bronchodilators
 - a. Action of bronchodilators
 - i. pharmacologic effects
 - ii. bronchodilation drugs
 - b. Structure-activity relationship (catecholamine)
 - c. Desirable characteristics in a bronchodilator
 - i. half-life
 - ii. specificity
 - d. Routes of administration
 - i. aerosol
 - 1. advantages
 - 2. disadvantages
 - ii. oral
 - 1. drugs which are ineffective orally
 - 2. disadvantages of the oral route of administration
 - iii. parenterally
 - 1. uses
 - 2. disadvantages
 - 3. drugs given parenterally
 - e. Tolerance
 - i. tachyphylaxis
 - f. Metered dose inhaler delivery problems
 - i. determination of dose by patient
 - g. Current sympathomimetic bronchodilators
 - i. strength
 - ii. dose aerosol
 - iii. pharmacologic effects
 - iv. onset of action
 - v. duration
 - vi. peak effect
 - vii. side effects
 - viii. precautions
 - ix. storage considerations
- 15. Parasympatholytic and xanthine bronchodilators
 - a. Parasympathetic and sympathetic stimulation on bronchial smooth muscle
 - i. physiology
 - ii. key factors
 - b. Parasympathetic role in bronchoconstriction
 - i. non-asthmatic lungs
 - ii. asthmatic lungs
 - c. Mechanism of action of parasympathetic overstimulation
 - i. afferent pathway
 - ii. efferent pathway
 - d. Aerosolized parasympatholytics
 - i. naturally occurring parasympatholytic agents
 - ii. pharmacological effects
 - 1. bronchioles
 - 2. secretions
 - 3. heart rate
 - 4. pupil
 - iii. side effects of parasympatholytics
 - iv. common parasympatholytic drugs

1. aerosol dosages
2. peak effects
3. duration of effects
4. pharmacologic action
5. side effects
6. xanthine agents
- v. common agents
- vi. pharmacologic effects
 1. central nervous system (CNS)
 2. skeletal muscle
 3. bronchioles
 4. pulmonary vasculature
 5. smooth muscle
 6. coronary arteries
 7. heart rate
 8. urine output
- vii. therapeutic serum concentration
- viii. individualized loading dosages
- e. Sustained-release products
 - i. advantages
 - ii. disadvantages
- f. Combination products
 - i. advantages of combination products
 - ii. disadvantages of combination products
16. Management of bronchial secretions
 - a. Mucociliary system
 - i. function
 - ii. alterations in certain diseases
 - b. Mucus production
 - i. mucus
 - ii. sol
 - iii. gel
 - iv. mucin
 - v. sputum
 - c. Factors which slow mucociliary transport rate
 - i. health status of the patient
 - ii. mechanical alterations of tracheo-bronchial tree
 - iii. drugs
 - iv. pollutants
 - d. Factors which increase mucociliary transport
 - i. drugs
 - ii. physiologic factors
 - e. Mucolysis
 - i. hydration
 1. systemic hydration
 2. topical hydration
 3. increased topical ph
 4. rupture of disulfide bonding
 5. proteolytic enzymes
 6. stimulation of additional secretions
 - f. Physical properties of mucus
 - i. cohesion
 - ii. adhesion
 - iii. rheology
 - iv. viscosity
 - v. elasticity
 - g. Improving mucus transport
 - i. changes in viscosity
 - ii. changes in elasticity

- h. Common mucolytic agents
 - i. strengths
 - ii. dose (for inhalation)
 - iii. mechanism of action
 - iv. side effects
 - v. physical incompatibilities
 - vi. storage precautions
- i. surface-active agents
 - i. surface tension
 - ii. mechanism of action
 - iii. clinical application
 - iv. common agents
- 17. Corticosteroids in respiratory care
 - a. Major pharmacologic effects
 - b. Physiology of corticosteroid secretion
 - c. Pharmacology of glucocorticoids
 - i. anti-inflammatory effects
 - 1. causes of inflammatory response
 - 2. mechanism of inflammatory changes
 - 3. mechanism of action of glucocorticoids in preventing inflammatory changes
 - ii. pharmacologic effects of glucocorticoids
 - 1. changed in tissue histamine
 - 2. enhanced bronchodilation
 - 3. immunosuppression
 - 4. blood sugar
 - 5. fluid balance
 - 6. blood pressure
 - 7. gastrointestinal tract
 - 8. bone structure
 - 9. cushingoid effect
 - 10. adrenal suppression
 - iii. danger of excessive exogenous steroids
 - d. Aerosol vs. systemic therapy
 - i. advantages
 - ii. disadvantages
 - iii. limitations
 - e. Common aerosol drugs
 - i. dosage
 - ii. duration of action
 - iii. side effects
 - iv. clinical uses
- 18. Allergic asthma
 - a. chemical mediators of inflammation
 - b. systemic affects of released chemical mediators
 - i. increased vascular permeability
 - ii. contraction of smooth muscle
 - iii. increased mucus secretion
 - iv. vasodilation with edema
 - c. affects of chemical mediator release in the lung
 - i. bronchospasm
 - ii. mucus plugging
 - iii. mucosal exema
 - d. control of mast cell discharge
 - i. cAMP
 - ii. cGMP
 - e. Antileukotriene Agents and Monoclonal Antibodies
 - i. mechanism of action
 - ii. precautions
 - iii. clinical applications

- iv. dosage forms
 - v. dose
 - vi. adverse effects
19. CNS depressants and respiratory stimulants
- a. The central nervous system (CNS)
 - i. basic anatomy
 - ii. reticular formation
 - 1. reticular activating system
 - 2. limbic system
 - iii. extrapyramidal system
 - 1. response to drugs
 - 2. dose-related
 - 3. descending manner
 - b. Sedatives and hypnotics
 - i. barbiturates
 - 1. structure-activity relationship
 - 2. duration of action
 - 3. metabolism
 - 4. tolerance mechanism of action
 - 5. adverse reactions
 - 6. clinical uses
 - 7. barbiturate intoxication
 - 8. drugs
 - ii. minor tranquilizers
 - 1. mechanism of action
 - 2. adverse reactions
 - 3. agents
 - c. Nonbarbiturate hypnotics
 - i. mechanism of action
 - ii. adverse reactions
 - d. Antipsychotic drugs
 - i. neuroleptics
 - 1. uses
 - 2. adverse drug reactions
 - 3. common agents
 - ii. antidepressants
 - 1. uses
 - 2. adverse reactions
 - 3. agents
 - e. Analgesics
 - i. pain
 - 1. types
 - 2. mechanism of pain
 - 3. mechanism of action for analgesics
 - ii. narcotic analgesics
 - 1. uses
 - 2. mechanism of action
 - 3. adverse reactions/side effects
 - 4. overdose
 - 5. narcotic antagonists
 - 6. agents
 - iii. non-narcotic analgesics
 - 1. uses
 - 2. mechanism of action
 - 3. adverse reactions
 - 4. agents
 - f. Respiratory stimulants
 - i. agents
 - ii. clinical uses

20. Neuromuscular blocking agents
 - a. Physiology of the neuromuscular junction
 - b. Mechanism(s) of action
 - i. nondepolarizing neuromuscular blocker
 - ii. depolarizing neuromuscular blocker
 - c. Nondepolarizing neuromuscular blockers
 - i. agents
 - ii. mechanism of action
 - iii. pharmacodynamics
 - d. Depolarizing neuromuscular blockers
 - i. agents
 - ii. mechanism of action
 1. phase 1
 2. phase 2
 - iii. pharmacodynamics
 - iv. sensitivity to succinylcholine
 - v. desensitization (dual) block
 - e. Clinical pharmacology
 - i. skeletal muscle paralysis
 - ii. cardiovascular system
 - iii. drug interactions
 - f. Uses of neuromuscular blockers
 - i. elective intubation
 - ii. continuous paralysis (control of ventilation)
 - iii. treatment of convulsions
 - g. Specific agents
21. Anti-infective agents
 - a. Definitions
 - i. bactericidal
 - ii. bacteriostatic
 - b. Mode of action for anti-infective agents
 - i. inhibition of cell wall synthesis
 - ii. inhibition of cell membrane function
 - iii. inhibition of protein synthesis
 - iv. inhibition of nucleic acid synthesis
 - v. competitive antagonism of some metabolite
 - c. Clinical aspects
 - i. broad-spectrum vs. narrow-spectrum
 - ii. bactericidal vs. bacteriostatic
 - iii. gram-positive organism vs. gram-negative organism vs. anaerobic organism
 - iv. sensitivity testing
 - v. development of resistance
 - d. Major categories used in respiratory infections
 - i. penicillins
 1. indications
 2. adverse reactions
 3. resistance
 4. penicillin allergy
 - ii. cephalosporins
 1. common agents
 2. indications
 3. adverse reactions
 - iii. aminoglycosides
 1. agents
 2. indications
 - iv. tetracyclines
 1. common agents
 2. indications
 3. adverse reactions

- v. sulfonamides
 - 1. common agents
 - 2. indications
 - 3. adverse reactions
- vi. miscellaneous agents
 - 1. indications
 - 2. adverse reactions
- e. Antifungal agents
 - i. common agents
 - ii. indications
 - iii. adverse reactions
- f. Antituberculosis drugs
 - i. primary agents
 - ii. indications
 - iii. adverse reactions
- g. Antiviral agents
 - i. indications
 - ii. mechanism of action
- h. Aerosolized antibiotics
 - i. systemic vs. local effects
 - ii. treatment of gram-negative pulmonary infections
 - iii. treatment of fungal infections
 - iv. hazards of aerosolized antibiotics
- 22. Cardiovascular agents
 - a. Categories of major drug groups
 - i. heart
 - 1. cardiac glycosides
 - 2. antiarrhythmic agents
 - 3. cardiac stimulants
 - ii. circulatory vessels
 - 1. antihypertensive agents
 - 2. coronary vasodilators
 - 3. pulmonary vasodilators
 - 4. vasoconstricting agents
 - iii. blood (anticoagulants)
 - b. Factors that influence mean arterial pressure
 - i. cardiac output
 - ii. contractile force
 - iii. blood volume
 - iv. venous return
 - c. Electrophysiology of the heart
 - i. normal electrical pathways
 - ii. rapid depolarization
 - 1. sodium movement
 - 2. calcium movement
 - iii. action potential
 - iv. absolute refractory period
 - v. electromechanical dissociation
 - d. Effects-of cardiac agents
 - i. terms
 - 1. inotropic
 - 2. chronotropic
 - 3. preload
 - 4. afterload
 - ii. filling pressures
 - 1. right heart
 - 2. left heart
 - e. Cardiac glycosides

- i. agents
 - ii. mechanism of action
 - iii. effects on the heart
 - iv. uses
 - v. adverse reactions
 - f. Antiarrhythmic drugs
 - i. mechanism of action
 - ii. adverse reactions
 - iii. indications
 - g. Antihypertensives
 - i. mechanisms of action
 - ii. step-care approach to treating hypertension
 - iii. common agents
 - h. Coronary vasodilators
 - i. indications
 - ii. agents
 - iii. agents and doses
 - i. Vasoconstricting agents/cardiac stimulants
 - i. indications
 - ii. agents
 - j. Drugs used in emergency resuscitation attempts
23. Antithrombotic Agents
- a. Clotting process
 - b. Agents
 - i. Anticoagulants
 - ii. Antiplatelets
 - iii. Thrombolytics
 - c. Adverse effects
24. Diuretics
- a. common agents
 - b. mechanism of action
 - c. pharmacokinetics
 - d. uses
 - e. adverse reactions
- .
- .
- .
- .

Resources

Colbert BJ, Gonzalez III LS, Kennedy BJ. (2019) *Integrated Cardiopulmonary Pharmacology*, BVT Publishers.

Des Jardins T. (2020) *Clinical Manifestations and Assessment of Respiratory Disease*, St. Louis, MO: Mosby.

Gardeniere DS. (2019) *Rau's Respiratory Care Pharmacology*, St. Louis, MO: Elsevier Mosby.

Gardeniere DS. (2012) *Rau's Respiratory Care Pharmacology Workbook*, St. Louis, MO: Elsevier Mosby.

Cairo JM. (2017) *Mosby's Respiratory Care Equipment*, St. Louis, MO: Elsevier Mosby.

Robert M. Kacmarek, James K. Stoller, Albert Heuer. (2020) *Egan's Fundamentals of Respiratory Care*, St. Louis: Elsevier.
