

Volgograd State Medical University
Department of Clinical Pharmacology and Intensive Care

THE STUDENT GUIDEBOOK
OF
THE MODULE OF CLINICAL PHARMACOLOGY

Volgograd 2021

1. INTRODUCTION

Welcome to the Module of Clinical Pharmacology.

Clinical Pharmacology is an essential medical subject that bridges the basic pharmacology knowledge with real clinical practice.

Clinical pharmacology encompasses all aspects of the relationship between drugs and humans focusing on the safe, effective and economic use of medicines.

This comprehensive package is designed to guide year 6 General Medicine students in acquiring knowledge and introductory clinical experience in the field of clinical pharmacology.

This module would aid students in understanding the integration of basic sciences and their clinical applications. During this module the students will get to learn principles of pharmacokinetics and pharmacodynamics, drug safety and adverse drug reactions, as well as drug safety of the main groups of the pharmacotherapeutic agents. The students will also discuss the rational of the drug management of the most common clinical pathologies.

The teaching-learning methods include tutorials/small group sessions and self-directed learning sessions.

The Department of Clinical Pharmacology and Intensive Care is always wellcome and wishing you an enjoyable and beneficial learning experience!

2. GENERAL LEARNING OUTCOMES

By the end of the Module of Clinical Pharmacology module, the students should be able to understand and determine the pharmacological basis of drugs used for the treatment of the common diseases.

3. SPECIFIC LEARNING OBJECTIVES

Knowledge:

From this Module, the students should be able to understand / and:

1. describe the mechanisms of action and the pharmacological effects of the main drug classes.
2. describe the clinically relevant pharmacokinetics of the main drug classes.
3. discuss the clinical applications of the main drug classes.
4. discuss the most important adverse drug reactions and drug-drug interactions of the main drug classes.

Skills:

From this Module, the students should be able to understand/ and:

1. Identify the rational group of drugs and particular drug for the treatment of the common diseases.
2. Identify the route of administration, dose regime, timing etc. for the drugs and the main drug classes for the treatment of the common diseases.
3. Identify indications and contraindications for rational drug prescribing
4. Identify possible ADRs.

Attitude:

From this Module, the students should be able to understand/ and:

1. work as an effective team member and communicate appropriately with patients and colleagues.
2. exhibit the attitude of care, respect, and reverence.

4. TEACHING LEARNING METHODS

The coverage of this module is mainly via lectures, small group discussions and tutorials and SDL (self-directed learning) time to explore the learning needs of the topics identified. The SDL time is for your own study either individually or in groups. Use this time wisely, by reading up the relevant texts to attain the specific objectives of each teaching and learning session.

You are advised to read materials relevant to each topic given. A list of references is attached for your guidance. The learning objectives given in this Module Guide will help you to ensure that you will cover relevant materials for the particular topic. If you have any difficulty in understanding any topic, your lecturers are always available for consultation.

1. SUMMARY OF TEACHING-LEARNING

The total number of hours for teaching-learning activities are as follows:

Tutorial	Topic	Face to Face Hours	SDL Hours
1	Topic 1: Clinical Pharmacology and Pharmacokinetics	4	6
2	Topic 2: Pharmacodynamics	4	6
3	Topic 3: Drug toxicity, safety and drug-drug interactions.	3	6
	Topic 4: Factors that affect pharmacokinetics and pharmacodynamics	1	
4	Topic 5: Substance of abuse	2	3

	Topic 6: Clinical Pharmacology of the drugs used for the treatment of gastrointestinal diseases.	2	3
5	Topic 7: Principles of rational antimicrobial therapy	2	4
	Topic 8: Clinical Pharmacology of antibacterial drugs	2	4
6	Topic 8: Clinical Pharmacology of antibacterial drugs	2	4
	Topic 9: Clinical Pharmacology of antifungal and antiviral drugs	2	4
7	Topic 10: Clinical Pharmacology of the drugs used for the treatment of hypertension.	4	6
8	Topic 11: Clinical Pharmacology of the drugs used for the treatment of chronic ischemic drug disease and chronic heart failure.	4	6
9	Topic 12: Clinical Pharmacology of analgesics and anti-inflammatory drugs	4	6
10	Topic 13: Clinical Pharmacology of the drugs used for the treatment of respiratory diseases.	2	3
	Topic 14: Clinical Pharmacology of diuretics	2	3
11	Topic 15: Clinical Pharmacology of the drugs used for the treatment of diabetes mellitus type 1 and type 2	4	6
12	End of Module Test	4	-
Total hours		48	66

6. ATTENDANCE

Hundred percent attendance of the tutorials is a prerequisite for sitting the following examinations. Students who fail to meet the requirement will be barred from sitting the examinations and will be considered as failed in the respective examination.

7. STUDENT ASSESSMENT

The assessment will consist of continuous assessment (progress tests), end of the module final test and the viva voce end semester examination. To proceed to examination, students are required to attend all the classes and have to pass all progress tests and end of module test.

The end of module test will be conducted on the last day of the module and the marks from this test will contribute towards the Final mark.

Viva voice examination will be conducted during semester 11 exam session. A failure in the end semester exam will require the student to sit for the remedial examination. The level of questions and the criteria for passing remedial examination would be the same as end semester exam.

The Final mark will be calculated as the average from marks from the viva voice exam and end of module test.

8. TEXTBOOKS AND REFERENCES

PRESCRIBED TEXTBOOKS

1. Brunton, Laurence L.; Hilal-Dandan, Randa; Knollmann, Björn C., eds. (2017). Goodman & Gilman's: The Pharmacological Basis of Therapeutics, 13th Edition. Mc Graw Hill: New York. 1440 pp.
2. Bertram G. Katzung, Todd W. Vanderah (2020). Basic and Clinical Pharmacology, 15th Edition. Mc Graw Hill Medical: New York. 1328 pp.
3. Morris J. Brown, Pankaj Sharma, Fraz A. Mir, Peter N. Bennett (2018). Clinical Pharmacology, 12th Edition. Elsevier. 720 pp.

RECOMMENDED TEXTBOOKS

1. Derek Waller, Anthony Sampson (2017). Medical Pharmacology & Therapeutics, (5th Edition). Elsevier. 744 pp.
2. Joseph T. DiPiro, Gary C. Yee, L. Michael Posey, Stuart T. Haines, Thomas D. Nolin, Vicki Ellingrod (2020). Pharmacotherapy: A Pathophysiologic Approach (11th Edition). Mc Graw Hill: New York. 2672 pp.
3. Evan J Begg (2008). Instant Clinical Pharmacology. John Wiley and Sons Ltd. 112 pp.

USEFULL WEBSITES

1. Interactive Clinical Pharmacology. <https://www.icp.org.nz/>
2. DrugBank. <https://go.drugbank.com/>
3. Drugs.com. <https://www.drugs.com/>
4. PharmaKB (Pharmacogenetics). <https://www.pharmgkb.org/>
5. ToxTutor. <http://www.toxmsdt.com/0-toxtutor-home.html>
6. The Drug Development Process. <https://www.fda.gov/patients/learn-about-drug-and-device-approvals/drug-development-process>
7. Merck Manual for the Professional <https://www.merckmanuals.com/professional>

8. MedScape. <https://reference.medscape.com/>
9. MedScape: Clinical Practice Guidelines. <https://reference.medscape.com/features/guidelines>
10. Clinical Practice Guidelines. <https://www.nccih.nih.gov/health/providers/clinicalpractice>
11. Speed Pharmacology. <https://www.youtube.com/channel/UC-i2EBYXH6-GAglvuDlaufQ>
12. AMBOSS: Medical Knowledge Distilled <https://www.youtube.com/channel/UC8xEQrU6VhJU6pDZd-GkJWg>

9. SPECIFIC TOPICS: LEARNING OUTCOMES AND CONTENT

Topic 1: Clinical Pharmacology and Pharmacokinetics

Specific learning outcomes

From this tutorial students should be able to understand/ and:

Knowledge

1. Define Clinical Pharmacology
2. Describe and discuss different routes of drug administration
3. Discuss drug disposition processes: Absorption, distribution, plasma protein binding, metabolism, and excretion.
4. Discuss drug absorption process; mechanism of drug permeation, drug bioavailability, factors affecting bioavailability, bioequivalence.
5. Discuss first-pass metabolism and its clinical relevance.
6. Discuss drug distribution and redistribution; rate of protein binding, apparent volume of distribution (Vd), factors affecting protein binding and Vd.
7. Discuss drug metabolism; hepatic drug metabolism (phase I and II reactions), role of cytochrome in drug metabolism, factors affecting drug metabolism.
8. Discuss drug excretion process; renal excretion, enterohepatic circulation.
9. Describe and discuss the main pharmacokinetic parameters; bioavailability, volume of distribution (Vd), clearance (Cl), plasma half-life ($t_{1/2}$).
10. Discuss the concept of steady state, correlation between $t_{1/2}$ and time to reach steady state and the
11. Discuss first and zero order kinetics.
12. Describe the concept of loading and maintenance dose (DL and DM), methods to calculate DL and DM.
13. Define Pharmacogenetics and discuss the concept of individualised medicine.

Topic 2: Pharmacodynamics

Specific learning outcomes

From this tutorial students should be able to understand/ and:

Knowledge:

1. Describe main targets of drug action: Receptors, carriers, ion channels, enzymes and others with examples of the drugs.
2. Describe the four main types of receptors: Receptors coupled to G-proteins (GPCR: guanine nucleotide-binding proteins); receptors linked to ion channels; receptors that affect gene transcription and receptors linked to enzymes. Provide examples of the drugs binding to different types of the receptors.
3. Describe the drug binding to the receptor and explain the terms: ligand, affinity, selectivity, agonist, antagonist, partial agonist.
4. Define agonist and antagonist and describe the different types of agonist and antagonists: Competitive and non-competitive antagonists, full and partial agonists
5. Discuss pharmacological effects and drug efficacy.
6. Discuss therapeutic index.
7. Describe the following dose-response curves: a) graded; b) quantal

Topic 3: Drug toxicity, drug safety and drug-drug interactions

Specific learning outcomes

From this tutorial students should be able to understand/ and:

Knowledge:

1. Define and explain the concepts of Pharmacotherapeutics.
2. Define drug toxicity and list the factors influencing drug toxicity.
3. Define LD₅₀ (median lethal dose), TD₅₀ (median toxic dose), ED₅₀ (median effective dose).
4. Define, discuss and state examples of the types of adverse drug reactions (ADR).
5. Describe pregnancy risk categories of drugs.
6. Discuss pharmacovigilance.
7. Discuss the concept and classify the types of drug-drug interactions: Pharmaceutical, pharmacokinetic, and pharmacodynamic drug-drug interactions.
8. Provide the examples and discuss pharmacokinetic and pharmacodynamic drug-drug interactions.
9. Provide the examples and discuss drug-food and drug-herb interactions.

Topic 4: Factors that affect pharmacokinetics and pharmacodynamics

Specific learning outcomes

From this tutorial students should be able to understand/ and:

Knowledge:

1. Describe the factors affecting pharmacokinetics and pharmacodynamics.
2. Discuss pharmacokinetics and pharmacodynamics in children.
3. Discuss pharmacokinetics and pharmacodynamics in pregnancy.
4. Discuss pharmacokinetics and pharmacodynamics in older patients.

Topic 5: Substance of abuse**Specific learning outcomes**

From this tutorial students should be able to understand/ and:

Knowledge:

1. Describe the concept of substance /drug abuse, withdrawal syndrome, physical and psychological dependence.
2. Classify the main groups of substances of abuse and provide the examples.
3. Describe prevalence in population, mechanisms of action, clinically relevant pharmacokinetics, effects of short and long-term use, withdrawal effects, overdose and treatment of acute overdose of:
 - Opioid drug abuse (morphine, heroine)
 - Psychostimulants (cocaine, amphetamine, ecstasy)
 - Cannabinoids (marijuana)
 - Hallucinogens (LSD, mescaline, psilocybin)
 - Alcohol
 - Nicotine

Topic 6: Clinical Pharmacology of the drugs used for the treatment of gastrointestinal diseases**Specific learning outcomes**

From this tutorial students should be able to understand/ and:

Knowledge:

1. Classify drugs that are used in the treatment of peptic ulcer disease: a) gastric acid neutralizing agents b). antisecretory agents c) mucoprotective agents.
2. Describe mechanisms of action, pharmacological effects, clinically relevant pharmacokinetics, clinical applications, adverse drug reactions, and drug-drug interactions of the drugs used for the treatment of peptic ulcer.

3. Discuss the combined regimens used in the eradication of *H. pylori* – triple therapy (triple and quadruple *H. pylori* eradication therapy).

Topic 7: Rational antimicrobial therapy and Clinical Pharmacology of antimicrobial drugs.

Specific learning outcomes

From this tutorial students should be able to understand/ and:

Knowledge:

1. Outline the principles of antimicrobial chemotherapy
2. Discuss the type of antimicrobial therapy: Prophylactic, pre-emptive, empirical, and definitive.
3. Discuss the factors that influence the choice of antimicrobial agents.
4. Discuss the criteria of the effective antimicrobial therapy and criteria of the discontinuation of antimicrobial therapy.
5. Discuss the principles of combine antimicrobial therapy.
6. Discuss the antibiotic chemoprophylaxis.
7. Discuss the mods of bacterial antibiotic drug resistance.

Topic 8: Clinical Pharmacology of antibacterial drugs.

Specific learning outcomes

From this tutorial students should be able to understand/ and:

Knowledge:

1. Classify the antibacterial agents based on their targets of action.
2. Clinical pharmacology of inhibitors of bacterial wall synthesis (beta lactams and glycopeptides), inhibitors of bacterial protein synthesis (macrolides, tetracyclines, aminoglycosides), and DNA replication (fluoroquinolones): mechanisms of action, main pharmacological effects, clinically relevant pharmacokinetics, clinical applications, adverse drug reactions and drug-drug interactions.
3. Discuss the rational of antibiotic treatment of common respiratory, urinary, and abdominal infections.

Topic 9: Clinical Pharmacology of antifungal and antiviral drugs.

Specific learning outcomes

From this tutorial students should be able to understand/ and:

Knowledge:

1. Classify antiviral drugs based on the targeted virus and the targets of their action.
2. Discuss antiretroviral, anti-herpes virus, anti-influenza virus agents, and agents used for the treatment of viral hepatitis: mechanisms of actions, clinically relevant pharmacokinetics, clinical applications, adverse drug reactions and drug-drug interactions.
3. Classify antifungal drugs based on their targets of action.
4. Discuss antifungal drugs: mechanisms of actions, clinically relevant pharmacokinetics, clinical applications, adverse drug reactions and drug-drug interactions.

Topic 10: Clinical pharmacology of the drugs used for the treatment of hypertension.

Specific learning outcomes

From this tutorial students should be able to understand/ and:

Knowledge:

1. Clinical pharmacology of beta-blockers, inhibitors of renin angiotensin system, calcium channel blockers, and thiazide diuretics: Mechanism of action, main pharmacological effects, clinically relevant pharmacokinetics, clinical applications, adverse drug reactions, and drug-drug interactions.
2. Discuss the rational of the treatment of hypertension

Topic 11: Clinical pharmacology of the drugs used for the treatment of chronic ischemic heart disease and chronic heart failure.

Specific learning outcomes

From this tutorial students should be able to understand/ and:

Knowledge:

1. Clinical pharmacology of antiplatelet, anticoagulant, lipid lowering, antianginal, antiarrhythmic, and cardiotonic drugs: Mechanism of action, main pharmacological effects, clinically relevant pharmacokinetics, clinical applications, adverse drug reactions, and drug-drug interactions.

2. Discuss the rational of the treatment of chronic ischemic drug disease.
3. Discuss the rational of the treatment of chronic heart failure.

Topic 12: Clinical Pharmacology of analgesics and anti-inflammatory drugs.

Specific learning outcomes

From this tutorial students should be able to understand/ and:

Knowledge:

1. Classify anti-inflammatory drugs.
2. Describe the mechanism of action, clinically relevant pharmacokinetics, pharmacodynamic effects, clinical applications, adverse drug reactions, and drug-drug interactions of COX inhibitors.
3. Discuss the mechanisms of aspirin and paracetamol overdose and their management.
4. Classify glucocorticoids and mineralocorticoids based on their duration of action, relative potency and glucocorticoid, mineralocorticoid and anti-inflammatory efficacy
5. Describe clinical pharmacology of glucocorticoids and mineralocorticoids: Cellular mechanisms of action, pharmacological effect, clinically relevant pharmacokinetics.
6. Specify the mechanisms of anti-inflammatory and immunosuppressive action of glucocorticoids
7. Discuss the basis for the adverse drug reactions associated with glucocorticoids.

Topic 13: Clinical Pharmacology of the drugs used for the treatment of respiratory diseases.

Specific learning outcomes

From this tutorial students should be able to understand/ and:

Knowledge:

1. Describe clinical pharmacology of bronchodilators (beta2-adrenoceptor agonists, antimuscarinic drugs, and methylxanthines: Mechanisms of action, clinically relevant pharmacokinetics, pharmacodynamic effects, clinical applications, adverse drug reactions, and drug-drug interactions.
2. Describe clinical pharmacology of anti-inflammatory agents used for the treatment of bronchial asthma (inhaled corticosteroids, antileukotrienes and mast cell stabilizers: Mechanism of action,

- clinically relevant pharmacokinetics, clinical applications, adverse drug reactions and drug-drug interaction.
3. Discuss the rational of the treatment of bronchial asthma and chronic obstructive pulmonary diseases (COPD).

Topic 14: Clinical Pharmacology of diuretics.

Specific learning outcomes

From this tutorial students should be able to understand/ and:

Knowledge:

1. Classify diuretic agents according to their action and sites of action in the kidney tubules: a) loop diuretics; b) thiazide diuretics; c) osmotic diuretics; d) carbonic anhydrase inhibitors; e) potassium-sparing diuretics.
2. Describe clinical pharmacology of diuretics: Mechanisms of action, clinically relevant pharmacokinetics, clinical applications, adverse drug reactions and drug-drug interactions.
3. Discuss the principles of combined diuretic treatment.

Topic 15: Clinical Pharmacology of the drugs used for the treatment of diabetes myelitis type 1 and type 2.

Specific learning outcomes

From this tutorial students should be able to understand/ and:

Knowledge:

1. Describe the cellular mechanism of action of insulin and the main effects of insulin on target organs: liver, muscle and adipose tissue.
2. Classify insulin preparations according to their sources (animal, human, insulin analogues) and onset of action (rapid, short, intermediate and long acting). Explain the concepts of basal and bolus insulins and their clinical applications and discuss clinically relevant pharmacokinetic features
3. Describe insulin delivery systems
4. Discuss the clinical applications, adverse drug reactions and complications of insulin therapy
5. Classify antidiabetic drugs used for the treatment of diabetes myelitis type 2: biguanides, sulfonylureas, meglitinides, alpha-glucosidase inhibitors, thiazolidinediones, DPP-4 Inhibitors, amylin analogues, incretin mimetics, sodium-glucose transporter-2 inhibitors.

6. Describe clinical pharmacology of oral antidiabetic drugs: Mechanism of action, clinically relevant pharmacokinetics, main pharmacological effects, clinical applications, adverse drug reactions, and drug-drug interactions.
7. Rational of drug treatment of diabetes mellitus type 1 and type 2.