

altenpflege.de Edition

Short Textbooks for Nursing Education - Focus on Elderly Care

Theo Ahrens

Basics of Pharmacology - Medications and Their Effects

presented by

YES
ARCH
ITEC
TURE.

Bibliographic Information

Theo Ahrens – Short Biography

Theo Ahrens, born in 1979 near Munich, is a teacher for nursing professions and a dedicated nursing educator. After a year of voluntary social service in a hospital, he completed training as a health and nursing professional and gained valuable work experience in the intensive care unit. Driven by his desire to share knowledge, he studied nursing education and began teaching at a vocational school in Munich in 2009. Theo is known for his practical and empathetic teaching, which prepares future nursing professionals for their demanding career. Privately, he lives with his wife and two children in Berlin and is involved in volunteering for better conditions in nursing education.

This concise textbook was formulated from the curriculum of his classes using A.I. The translation was carried out automatically.

Published by altenpflege.de

Price DE/AT: €3.90

CH: 5 Fr

Copyright 2024 altenpflege.de

Comments and suggestions for improvement to team@altenpflege.de.

1/1-2412181522

preview

Table of Contents

1 Introduction to Pharmacology	4
1.1 Definition of Pharmacology	4
1.2 Importance of Pharmacology in Elderly Care	4
1.3 Objectives of Pharmacological Therapy	5
1.4 Professional Responsibility of the Elderly Care Nurse in Handling Medications	5
2 Basic Concepts of Pharmacology	7
2.1 Medications vs. Drugs	7
2.2 Active Ingredients, Excipients, and Dosage Forms	7
2.3 Pharmacokinetics and Pharmacodynamics	8
2.4 Mechanisms of Action of Medications	9
2.5 Placebo and Nocebo Effects	10
3 Pharmacokinetics - The Path of Medication in the Body	12
3.1 Admission (Absorption)	12
3.2 Distribution	13
3.3 Biotransformation (Metabolism)	14
3.4 Excretion (Elimination)	14
3.5 Factors Influencing Pharmacokinetics	15
4 Pharmacodynamics - Effects of Medications on the Body	17
4.1 Target Structures	17
4.2 Mechanisms of Action (Agonists, Antagonists, Inhibitors)	17
4.3 Dose-Response Relationship	18
4.4 Side Effects and Adverse Drug Reactions (ADRs)	19
4.5 Interactions	20
5 Medication Groups and Their Effects	21
5.1 Analgesics (Painkillers)	21
5.2 Antihypertensives (Blood Pressure Medications)	22
5.3 Diuretics (water pills)	23
5.4 Psychotropic Drugs	24
5.5 Anticoagulants (Blood Thinners)	25
5.6 Antibiotics (Infection Control)	26
5.7 Antidiabetics (Blood Sugar Lowering Medications)	27
5.8 Laxatives (Cathartics)	29
5.9 Vitamins, Minerals, and Supplements	30
6 Medication Therapy Safety (MTS)	32
6.1 Avoiding Medication Errors	32
6.2 Guidelines and Legal Requirements	33
6.3 Storage and Organization of Medications	34
6.4 Documentation of Medication Administration	35
6.5 Measures in Case of Suspected Side Effects and Interactions	36
7 Practical Application of Medications in Elderly Care	37
7.1 Forms of Administration	37
7.2 Preparation of Medications	37
7.3 Observation of the Care Recipient After Administration	38
7.4 Specific Challenges in Elderly Care	39
8 Legal Foundations and Ethical Aspects	41
8.1 Legal Foundations of Medication Administration	41
8.2 Responsibility of Nursing Staff in Handling Medications	42
8.3 Patient Autonomy and Consent to Therapy	43
8.4 Handling Narcotics (BTM)	43
9 Practical Examples and Case Studies	45
9.1 Case Studies on Medication Administration in Elderly Care	45
9.2 Recognizing and Responding to Adverse Effects	46
9.3 Case Analysis of Medication Errors and Their Consequences	47
10 Appendix and Materials	48
10.1 Glossary of Key Technical Terms	48
10.2 Overview of Commonly Used Medication Groups in Elderly Care	49

1 Introduction to Pharmacology

1.1 Definition of Pharmacology

Pharmacology is the science of interactions between active substances and living organisms. It deals with the research and analysis of drugs, their sources, chemical structure and properties, biological effects, mechanisms, and therapeutic applications. Essential questions concern how medications work in the body (pharmacodynamics), the path they take (pharmacokinetics), and the effects they can induce.

A fundamental goal of pharmacology is to understand and optimize the safe and effective use of medications. It forms the basis for the development of new pharmaceutical substances and the improvement of existing therapies. Potential side effects and interactions with other medications are also addressed to minimize risks and maximize therapeutic efficiency.

1.2 Importance of Pharmacology in Elderly Care

Pharmacology in geriatric care is of central importance, as older adults frequently suffer from multiple chronic illnesses and therefore take various medications simultaneously, a practice known as polypharmacy. A deep understanding of pharmacology helps caregivers ensure the effectiveness and safety of drug therapy.

Older adults exhibit physiological changes that affect pharmacokinetics and pharmacodynamics. These include a slowed metabolism and reduced kidney function, which increase the risk of side and interactions. Caregivers must be able to identify these risks early and respond accordingly.

A comprehensive knowledge of pharmacology supports geriatric nurses in promoting individually appropriate medical therapy and assuming responsibility for medication administration. Proper assessment of the potential positive and negative effects of drugs is required to minimize side effects and improve quality of life.

Communication with doctors, pharmacists, and relatives is improved through deeper pharmacological knowledge. It enables geriatric nurses to make informed recommendations or raise concerns regarding medication plans. Additionally, it contributes to patient education about their medication, which enhances adherence and disease understanding.

Pharmacology in geriatric care ensures that medications are used safely, effectively, and responsibly. Caregivers must continually update their knowledge to meet the demands of an aging society. A solid pharmacological foundation supports the conscious and competent guidance of older adults in managing their drug therapy.

1.3 Objectives of Pharmacological Therapy

Pharmacological therapy aims to achieve specific goals to attain the best possible health outcomes for the patient. A primary goal is the cure of diseases by eliminating pathogens or reversing disease-causing processes in the body. For chronic or incurable diseases, the focus is instead on alleviating symptoms, which includes reducing pain and improving quality of life.

Another goal is to delay the progression of diseases. Here, physiological processes are to be stabilized or degenerative changes slowed with the help of medications. For patients with multiple ailments, the therapy often aims to balance the different demands of each condition.

The prevention of diseases and complications is also among the goals of pharmacological therapy. The use of prophylactic medications attempts to prevent the onset of certain diseases or the progression of existing ones. This can be accomplished through vaccinations, antihypertensive drugs, or lipid-lowering agents to reduce cardiovascular risks.

An important aspect is the optimization of adherence. Patients should carry out treatment as consistently and accurately as possible to ensure the therapy's efficiency. This often requires adjusting the therapy to the patient's circumstances and avoiding complex medication regimens.

Minimizing side effects and interactions is another goal. Careful selection and dosing of medications should limit negative effects on the organism. Regular review and adjustment of the therapy based on the current health status and medications play a crucial role here.

Finally, it is important to mention the intended increase in the patient's autonomy and quality of life. This is achieved by tailoring the therapy to individual needs and promoting independence in managing medications. The use of digital tools and therapeutic counseling can support fostering a self-determined approach to therapy.

1.4 Professional Responsibility of the Elderly Care Nurse in Handling Medications

Nurses in elderly care carry significant responsibility in handling medications. This responsibility encompasses the proper storage, preparation, and administration of medications, as well as the accurate documentation and monitoring of patients following medication administration.

First and foremost, it must be ensured that all medications are stored correctly. This involves adhering to temperature requirements, protecting against light and moisture, and checking expiration dates. Proper storage prevents loss of efficacy and safety risks.

Special care is required in the preparation and administration of medications. Nurses must ensure that they administer the correct medication to the right person at the specified time and in the correct dosage. This process requires concentration and precision, as errors can have serious health implications.

Another aspect of professional responsibility is the precise documentation of medication administration. Every step, from administration to monitoring for potential side effects, must be meticulously recorded. Thorough documentation not only aids traceability and transparency but also improves therapeutic control by the interprofessional team.

It is also essential to monitor the patient after medication administration. Side effects or adverse reactions must be quickly identified and reported to the responsible doctors. Having knowledge of possible side effects and interactions is crucial in this regard.

Ongoing communication and collaboration with doctors, pharmacists, and other healthcare professionals are indispensable. Regular training helps keep knowledge current and ensures the quality of medication management.

Nursing staff must also communicate empathetically and competently with the care-dependent and their relatives. Educating them about medications, their purpose, effects, and possible side effects is essential for promoting medication adherence and understanding the therapy.

Finally, it is the responsibility of nurses in elderly care to ensure compliance with ethical and legal standards in medication administration. This includes respecting the autonomy and dignity of patients and assisting them in managing their medications. Conscious and responsible action in pharmacotherapy significantly contributes to the quality of life and safety of the care-dependent.

2 Basic Concepts of Pharmacology

2.1 Medications vs. Drugs

In pharmacology, a distinction is made between the terms "drugs" and "medications," although they are often used synonymously in everyday language.

Drugs are generally substances or combinations of substances intended to cure, alleviate, prevent diseases, or restore physiological functions through a pharmacological, immunological, or metabolic effect. They encompass a broad spectrum, ranging from chemically defined compounds to biologically manufactured products and more complex therapeutic units, including vaccines, blood products, or biopharmaceuticals.

Medications, on the other hand, are specifically prepared forms of drugs that are ready for use in humans. They include not only the active ingredient but also excipients that help facilitate application, extend shelf life, or optimize the absorption of the active ingredient in the body. The form of administration—whether tablet, capsule, solution, or injection—also belongs to this category.

It is important to understand that all medications are drugs, but not all drugs are considered medications at every stage of their development. During development and testing, they are often referred to as potential drugs, and only with approval and marketing do they become medications.

Understanding this distinction in elder care is important as it influences classification and handling. Drugs can only be used as medications after extensive testing and regulatory approvals. Such tests ensure the safety and efficacy of the products to be administered, which are essential in daily care. Care professionals must always be aware that they are working with complex substances, the targeted use of which carries a high level of responsibility.

2.2 Active Ingredients, Excipients, and Dosage Forms

Active Ingredients

Active ingredients are the central components of a medication that achieve the desired therapeutic effect. The type of active ingredient determines which physiological functions in the body are affected. Active ingredients can be synthetic in nature or derived from plant parts, animals, or microorganisms. Their primary goal is to influence biological processes to alleviate symptoms or treat diseases. Identifying and developing active ingredients requires intensive research to ensure the desired effect and minimize potential side effects.

Excipients

Excipients are included in a medication to stabilize the active ingredient, support its function, or facilitate administration. They can improve the taste, consistency, or appearance of the product and often extend its shelf life. Excipients are inactive in terms of pharmacological effects but significantly influence the absorption, intake, and distribution of the active ingredient in the body. They play an essential role in the production of various dosage forms by controlling, for example, the solubility or release rate of the active ingredient.

Dosage Forms

Dosage forms refer to the form in which a medication is manufactured and administered. They are crucial for the way the active ingredient enters the body. The choice of dosage form is influenced by the active ingredient, the desired action speed, the route of administration, and the specific needs of the patient. Common dosage forms include tablets, capsules, solutions, ointments, suppositories, and injections. Each form has its specific advantages and disadvantages. For instance, capsules are favorable to the gastrointestinal tract and can offer delayed release, while injections are suitable for rapid effects directly into the bloodstream. When selecting the appropriate dosage form, the therapeutic goal of the medication is always considered.

2.3 Pharmacokinetics and Pharmacodynamics

Pharmacokinetics and pharmacodynamics are two essential concepts of pharmacology that significantly influence the management of medications in elderly care.

Pharmacokinetics

Pharmacokinetics describes the journey of a drug through the body. It encompasses four main processes: absorption, distribution, metabolism, and elimination. These processes determine how quickly and at what concentration a drug exerts its effect at the target site.

- **Absorption:** The entry of the drug into the bloodstream. Factors such as the drug formulation and the route of administration play a crucial role here. Oral medications, for instance, must pass through the gastrointestinal tract to reach the bloodstream.
- **Distribution:** The distribution of the drug within the body. This process influences how the active substance reaches its target structures. Factors such as blood flow, binding to plasma proteins, and cell membrane permeability have an impact here.
- **Metabolism:** The chemical conversion of the active substance, usually in the liver. Metabolism prepares the drug for excretion and can enhance effectiveness or reduce side effects.

- **Elimination:** The excretion of the drug, primarily through the kidneys and liver. Efficient elimination prevents the accumulation of drugs that could lead to toxic effects.

Pharmacodynamics

Pharmacodynamics deals with the effects of a drug on the body. This effect results from the interaction of the active substance with target structures like receptors, enzymes, or ion channels.

- **Receptor binding:** Drugs often work by activating or blocking specific receptors. Agonists activate receptors, while antagonists inhibit their effect.

- **Mechanisms of action:** Drugs achieve their effects through various mechanisms, for example, by influencing chemical messengers or inhibiting enzymes crucial for certain metabolic pathways.

- **Dose-response relationship:** Describes how the administered dose affects the strength of the effect. A larger dose does not always lead to a stronger effect, as receptors can become saturated.

Knowledge of pharmacokinetics and pharmacodynamics is crucial to maximize the effectiveness and safety of drug therapy. This is especially important in elderly care, as age-related physiological changes can affect drug effectiveness and the risk of side effects. Staff must understand how these processes interact to make individually tailored therapeutic decisions.

2.4 Mechanisms of Action of Medications

Medications influence biological systems through various mechanisms of action. These mechanisms are crucial for the specific effects of a medication and derive from the properties of the active substance and its interaction with the body.

Receptor Interaction

The most common way medications work is by binding to receptors. Receptors are specific proteins on or in cells that transmit certain signals. Medications can act as agonists or antagonists:

- **Agonists** activate receptors and mimic the effect of the natural ligand, often to enhance a physiological response.

- **Antagonists** block receptors by occupying the binding site for the natural ligand and thus interrupt signal transmission.

Enzyme Inhibition and Activation

Many medications target enzymes to modulate biochemical reactions.

- **Inhibitors** decrease enzyme activity and can thereby reduce the metabolism of a substrate or inhibit the formation of a product.

- **Activators**, on the other hand, increase enzyme activity and thereby promote specific metabolic pathways.

Ion Channel Modulation

Some medications affect ion channels in cell membranes that are responsible for the transport of ions such as sodium, potassium, or calcium.

- **Modulation** of these channels can lead to changes in membrane potential and thereby regulate the excitability of cells, especially in the heart and nervous system.

Transporter Blockade

Transport proteins responsible for the uptake or release of substances in cells can also be targets of medications.

- **Inhibitors** of such transporters can, for example, block the reuptake of neurotransmitters like serotonin in nerve endings, thereby increasing their concentration in the synaptic cleft.

Immune Modulation

Some medications interact directly with the immune system to alter its function.

- **Immunomodulators** can stimulate or suppress the immune system, depending on the therapeutic goal, as in autoimmune diseases or cancers.

Signal Cascade Influence

By influencing intracellular signaling cascades, medications can regulate secondary messengers.

- **Influencing** these cascades can alter the cellular response to external stimuli and thus achieve therapeutic effects, for example in cancer therapy. These mechanisms of action are fundamental to understanding how medications modulate body functions. Knowledge of them enables a targeted selection and application of medications and helps to better predict their effects and potential side effects

2.5 Placebo and Nocebo Effects

Placebo and Nocebo Effects arise from patients' psychological expectations and influence the therapeutic success of treatments.

Placebo Effect

A placebo effect occurs when patients experience improvement in their health condition despite receiving a medication without active ingredients. This effect is based on the positive expectation and belief that the treatment will be helpful. Comparisons show that physiological changes, such as pain reduction or mood improvement, can occur solely due to the expectation. The placebo effect demonstrates that the interaction between mind and body has significant impacts on well-being, which is particularly important in elderly care.

Nocebo Effect

In contrast, the nocebo effect is a negative reaction to a treatment without active ingredients, triggered by the expectation of adverse effects. For example, patients might develop headaches or nausea if they believe that a treatment could cause these side effects. This phenomenon explains how negative expectations can influence medical outcomes and highlights the importance of careful communication of information. It is crucial how care staff talk to patients about potential side effects to minimize the nocebo effect.

7 This is just a preview

The complete book is available at <https://www.altenpflege.de> for registered users. Registration and use are free of charge. Those who do not want to register can transfer the amount mentioned on page 2 via PayPal to buchhaltung@factsoft.de and include both the book title and email address. They will then receive the PDF via email.

In addition to free access to the short textbooks, registering on [altenpflege.de](https://www.altenpflege.de) enables you to apply directly for jobs and also post a free job advertisement yourself. Become part of the [altenpflege.de](https://www.altenpflege.de) community too.