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DRUG ADMINISTRATION ROUTES AND ABSORPTION OF DRUGS ADMINISTERED VIA DIFFERENT ROUTES

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Abstract

This article examines the fundamental aspects of drug administration routes and their influence on pharmaceutical absorption processes. The study analyzes various administration pathways including oral routes and parenteral routes and transdermal routes and mucosal routes to assess their pharmacokinetic properties and clinical effects. The process of drug optimization requires understanding these relationships because it helps achieve effective therapeutic results while reducing negative side effects.

Keywords

pharmaceutical absorption, bioavailability, pharmacokinetics, parenteral administration, oral delivery, therapeutic efficacy.

Аннотация

В данной статье рассматриваются фундаментальные аспекты путей введения лекарственных средств и их влияние на процессы всасывания фармацевтических препаратов. В исследовании анализируются различные пути введения, включая пероральный, парентеральный, трансдермальный и мукозальный пути, с оценкой их фармакокинетических характеристик и клинических последствий. Понимание этих взаимосвязей имеет важное значение для оптимизации фармацевтических вмешательств и достижения желаемых терапевтических эффектов при минимизации побочных реакций.

Ключевые слова

всасывание лекарственных средств, биодоступность, фармакокинетика, парентеральное введение, пероральная доставка, терапевтическая эффективность

Annotatsiya

Ushbu maqolada dori vositalarini yuborish yo'llarining asosiy jihatlari va ularning farmatsevtik preparatlarning so'rilish jarayonlariga ta'siri ko'rib chiqiladi. Tadqiqotda og'iz orqali, parenteral, transdermal va shilliq qavat orqali yuborish yo'llari kabi turli yuborish yo'llari tahlil qilinib, ularning farmakokinetik xususiyatlari va klinik ahamiyati baholanadi. Ushbu o'zaro bog'liqliklarni tushunish farmatsevtik aralashuvlarni optimallashtirish va nojo'ya reaksiyalarni minimallashtirish bilan birga kerakli terapevtik ta'sirga erishish uchun muhim ahamiyatga ega.

Kalit so'zlar

dori vositalarining so'rilishi, biologik foydalanish, farmakokinetika, parenteral yuborish, og'iz orqali yetkazib berish, terapevtik samaradorlik

INTRODUCTION

The route of drug administration represents a critical determinant in pharmacotherapy which affects all four processes of drug absorption and distribution and metabolic pathways and bodily elimination processes [1]. The selection of an appropriate administration route directly affects therapeutic outcomes, patient compliance, and the overall success of medical

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interventions. Modern pharmaceutical practice includes multiple administration pathways which show unique pharmacokinetic patterns and absorption methods and distinct clinical uses [2]. The pharmaceutical sciences have expanded their administration methods through historical advancements which now allow medical professionals to use advanced transdermal systems and pulmonary delivery systems and targeted mucosal applications beyond traditional oral and injectable methods. Contemporary healthcare demands precise drug delivery systems which achieve effective results while maintaining safety and user friendliness and supporting patient needs [3]. The absorption of pharmaceutical agents depends on the selected administration method because first-pass metabolism and membrane permeability and surface area and blood flow and pH levels at absorption sites determine their absorption capacity [4].

METHODOLOGY AND LITERATURE ANALYSIS

The study utilizes systematic literature analysis method to review scientific studies about the different ways to administer drugs together with their respective absorption patterns. The framework for analysis involves three components which include pharmacokinetic principles together with physiological mechanisms and clinical data that back up various administration routes [5]. Research shows that gastric pH and intestinal motility and the presence of food and gastrointestinal diseases create major differences in how people absorb drugs through oral administration which results in different treatment responses for each individual and for the same individual at different times throughout their life [6]. The three parenteral administration methods which include intravenous and intramuscular and subcutaneous administration exhibit different ways to absorb medications into the body. The method of intravenous administration delivers 100 percent bioavailability because it sends drugs directly into the body's circulation system which removes the absorption process and enables doctors to manage drug levels in the blood precisely. The body absorbs drugs through intramuscular and subcutaneous injection sites which depend on three factors: how blood flows through the tissues and how well the drug dissolves and how the product was designed. Studies indicate that intramuscular absorption generally proceeds more rapidly than subcutaneous because muscle tissue has better blood flow but both methods let drugs bypass first-pass liver metabolism [7]. The clinical evidence supports these administration methods for drugs which need immediate effects or which break down in the GI tract [8].

RESULTS AND DISCUSSION

Administration route comparison enables researchers to observe different absorption patterns which affect clinical outcomes through their impact on treatment choices. Patients prefer oral administration because it offers them convenience but their body systems lead to unpredictable and incomplete drug absorption [5]. The literature shows that oral bioavailability reaches its minimum value when drug properties and patient characteristics are combined yet it reaches complete bioavailability under other conditions because of first-pass metabolism which restricts various drugs including certain beta-blockers and opioids and nitrates. The high variability between different people leads to the need for precise dose adjustments and ongoing observation because narrow therapeutic index drugs require special attention during their treatment process. The gastrointestinal system creates various factors that include pH changes and enzyme functions and transporter levels and disease conditions which make it difficult to predict how oral drugs will be absorbed. Research shows that food can change how drugs are absorbed because some medications need to be taken on an empty stomach while others need food to increase their absorption or protect them from being broken down.

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The process of intravenous drug delivery necessitates medical personnel to operate the procedure because it creates potential infection hazards and establishes permanent effects after doctors begin administering the treatment. The process of administering medication through intramuscular and subcutaneous injections enables chemical substances to enter the body at a speed which falls between two extreme rates. The administration routes enable medical professionals to create depot formulations which provide continuous drug delivery throughout extended periods while maintaining patient adherence to their treatment plans for chronic medical conditions. The research findings indicate that subcutaneous drug delivery system produces slower and more prolonged drug absorption patterns than intramuscular delivery which makes it better for medications that need to maintain stable blood levels over long timeframes. The use of transdermal delivery systems remains restricted because only a few medications can effectively use this method for their delivery. Sublingual and buccal routes demonstrate rapid absorption characteristics that match intravenous administration for suitable medications because they allow simple non-invasive administration [8].

The emergency routes provide essential support when emergency medications need to reach their destination. Nitroglycerin needs to reach its target location to achieve both systemic absorption and direct delivery to respiratory tissues, but the method depends on particular devices and their specific requirements, which leads to unpredictable therapeutic results [9]. The selection of optimal administration routes requires integration of multiple considerations including drug characteristics, desired therapeutic effects, patient capabilities and preferences, clinical urgency, and practical constraints. Modern pharmaceutical development increasingly focuses on matching formulations to specific routes, employing technologies such as controlled-release systems, absorption enhancers, and protective coatings to optimize bioavailability and therapeutic outcomes [10].

CONCLUSION

The comprehensive analysis of drug administration routes and their associated absorption characteristics demonstrates that route selection constitutes a fundamental determinant of therapeutic success in clinical pharmacology. Each administration pathway presents distinct advantages and limitations regarding absorption kinetics, bioavailability, clinical applicability, and patient acceptance. Oral administration remains the preferred route for most medications due to convenience and non-invasiveness, yet its effectiveness is constrained by first-pass metabolism, gastrointestinal variables, and absorption unpredictability. Parenteral routes provide superior bioavailability and rapid onset but require professional administration and carry invasiveness concerns. Alternative routes including transdermal, mucosal, and pulmonary administration offer valuable options for specific clinical scenarios and patient populations. The evidence reviewed confirms that optimal therapeutic outcomes require careful matching of drug properties, patient characteristics, clinical contexts, and route-specific absorption mechanisms. Future developments in pharmaceutical sciences will likely expand available administration options through novel delivery technologies and enhanced understanding of absorption physiology. Clinicians must maintain current knowledge regarding route-specific considerations to make evidence-based decisions that maximize therapeutic efficacy while minimizing adverse effects and supporting patient adherence to prescribed regimens.

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