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Pharmacokinetics of Drugs in the Gastro Intestinal Tract (GIT)

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Review Article

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ABSTRACT

The application of the pharmacokinetic models is embracing in the drug development and regulation of the parameters in the pharmacological society. Pharmacological parameters provide the vast range of comparison parameters for the drug development and increase the drug efficacy. Drugs are classified accordingly with respect to kinetics and dynamics of drug pharmacology. Different drugs undergo different pathways in the metabolism and excretion. The pharmacokinetic parameters explain the usage, administration and routes of administration of the various drugs available. Before formulation the drugs are analysed with respect the kinetic factors.

INTRODUCTION

Pharmacology is the branch of medicine that deals with the action of drugs that enter the human body. Pharmacology is the pharmaceutical branch of which describes the drug physiology and ailments. Pharmacology describes the drug depending upon the two important parameters i.e., Pharmacokinetics and Pharmacodynamics.

Pharmacokinetics is usually described as “what a drug does to the body” while Pharmacodynamic explains “what a body does to the drug”.

Pharmacokinetic and Pharmacodynamics are the two important parameters of the physiology of drug in the organ body. These parameters help in the therapeutic and toxic plasma drug concentrations. Pharmacokinetics defines the physiology of the drug by the following:

a) Absorption
b) Bioavailability
c) Distribution
d) Metabolism
e) Excretion

Pharmacodynamics refers to the relationship between the drug concentrations at the site of action which includes the time and adverse effects of the therapeutic effects of the drug. The effect of the drug is determined by the drugs binding with receptor [1-20].

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PHARMACOKINETICS OF DRUG

Pharmacokinetic is the study of the time between the drug absorption, distribution, metabolism and excretion. Clinical Pharmacokinetics enhances the efficacy of the drug and decreases the toxicity of the drug. A drug effect is related to the concentration at the site of action while the drug receptors are distributed in the body.

Drug Administration

Drug administration is the onset of site where the drug activates its nature. There are many routes for drug administration like Enteral, Parenteral and Other.

Enteral Administration is administrating a drug by mouth; either it is swallowed or oral delivery or Sublingual. Enteral administration is the simplest drug administration for all ages.

Parenteral administration is the route where the drug directly enters the systemic circulation. This method is generally used for the drugs which are poorly soluble in the GIT. For example, Insulin is given intravenously as it is poorly soluble in GIT. Parenteral administration is also performed either by intravenous, intramuscular or subcutaneous.

Other routes of administration include Inhalation, Intranasal, Topical, Transdermal and Rectal. The drugs are administered depending on the solubility [20-30].

Tablets are of different types based upon the API. The different types are:

- Uncoated Tablets
- Effervescent tablets
- Coated tablets
- Gastro Resistant Tablet
- Modified Release Tablet
- Dispersible Tablet
- Enteric Coated tablet
- Soluble Tablet
- Controlled release tablets
- Sustained release tablets

The quality control tests of these tablets depend on the nature of the tablet. The quality control tests remove the damaged or broken tablets or which are unbinded to the ingredient [30-50].

Absorption of Drugs

Absorption of drug refers to the transfer of the drug into the blood or fluid in the body from the site of administration. The absorption depends on the route of administration. IV delivery route the drug absorption is complete as the total drug constituents reach the blood stream.

The drug is transported from the administration site to the action of site through passive diffusion, active transport, Endocytosis and Exocytosis [51-60].

The drugs absorption is affected by many parameters which are pH and other Physical factors.

- pH: Most drugs are weak acids or weak base. Depending upon the ion exchange of cations and anions the factor affects the absorption.

For acids: $pH = pKa + \log [A^-]/[HA]$ For
bases: $pH = pKa + \log [B]/[BH^+]$.

The physical factors influencing the absorption of drugs are:

- Total surface area
- Blood flow
- Contact Time

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Bioavailability

Bioavailability is the comparison of the plasma levels of the drug after its administration. The drug levels are estimated by the levels of plasma at the site of action. It is clearly determined by plotting the plasma concentration of the drug against the time. This graph plot determines the amount of drug is absorbed in blood [60-80].
The factors which influence the bioavailability:

- First pass hepatic metabolism
- Solubility of the drug
- Chemical instability
- Nature of the drug formulation

Bioequivalence

When two drugs show similar bioavailability at peak blood concentrations it is considered to be Bioequivalent. Similarly, if two drugs are therapeutically equal in the bioavailability then it is considered to be therapeutically bioequivalent [81-90].

Drug Distribution

Drug distribution is when the drug leaves the bloodstream and enters into the fluid. Drug distribution depends on the blood flow, Capillary permeability, the degree of binding of Drug to plasma, tissue and proteins and hydrophobicity of the drug and volume of distribution [91-100].

Drug Metabolism

Mostly the drugs are eliminated by excretion in urine or through bile. This process transforms lipophilic drugs to excreatable products.
Drug metabolism depends upon:

- Kinetics of the drug
- Reactions of drug metabolism

Most of the drugs depend on the above parameters to metabolize the drug constituents into the fluid. Drug Elimination

Drug elimination is the removal of the drug from the body through the kidney into urine. While, the other routes include bile, intestine and lung.
Drug elimination parameters:

- Renal Elimination of a drug
- Quantitative aspects of renal drug elimination
- Total body clearance
- Clinical situations resulting in changes in drug half-life

Pharmacokinetics of drugs also depends upon the patient related factors and drug chemical properties. These affect include all above parameters which are described under Pharmacokinetic.

DISCUSSION

Pharmacokinetics plays a very important role in the drug metabolism as well in the therapeutic efficacy of the drugs. Pharmacokinetics determines the responses of the drug towards the systemic circulation. They initiate the drug to get solubilized and overcome the therapeutic nature of drug from the site of action and target action site. All the factors are responsible for the drug to get metabolize.

CONCLUSION

A drug has to get dissolved into simpler constituents to get accumulated into the body fluids. After the molecular breakdown the therapic effects is shown only after it passes the kinetic and dynamics properties. Pharmacokinetics are the important processes for the simulation of the drug through GIT.

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