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Understanding the Pharmacodynamics of Kriyakalpa

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Abstract

Pharmacodynamics is the study of a drug's molecular, biochemical, and physiologic effects. In short, it is all about how a drug affects an organism. There are some important factors that play an important role in the absorption of drugs in the body, like the route of drug administration, solubility and bioavailability, physical state of the drug and molecular weight, Time of absorption, and Vascularity of the absorbing surface. In Ayurveda, the local treatment procedures of Netra are explained in the name of Netra Kriya Kalpa (Su. U. 18/2). The word kriya means therapeutic action, and kalpana means specific formulations. Kriya Kalpa is a Bahirparimarjana Chikitsa and has several advantages over oral administration. They are noninvasive and cost-effective. No biodegradation of Drugs, Effective against blood aqueous and blood-retinal barriers, Comparatively, less dose is required, and it can be used as a preventive as well as a curative. Overall, we can say that Kriyakalp Procedures have several advantages as compared to oral administration.

Keywords: Netra kriyakalpa, Pharmacodynamics, Absorption of drug

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Introduction

Pharmacodynamics is the study of a drug's molecular, biochemical, and physiologic effects. It comes from the Greek words pharmacon, meaning "drugs" and dynamikos, meaning "power." In short, it is all about how a drug affects an organism. In Ayurveda, the local treatment procedures of Netra are explained under the name Netra Kriya Kalpa.[1] The word kriya means therapeutic action, and kalpana means specific formulations. Kriya kalpa is a bahirparimarjana Chikitsa and has several advantages over oral administration.

Absorption of Drugs in the Body

There are some important factors that play an important role in the absorption of drugs in the body, like the route of drug administration, solubility and bioavailability of the drug. Physical state of the drug and molecular weight, Time of absorption, Vascularity of absorbing surface, Patient and drug compliance, Absorbing surface and, Excretion of the drug.

Penetration of Drugs through Epithelium

The important factors are: Fat Solubility, Molecular weight below 500, Drug absorption, which is regulated by the duration of contact with the epithelium, The bioavailability of a drug is enhanced by the use of viscous vehicles such as hydroxypropyl methylcellulose, polyvinyl alcohol, polyvinylpyrrolidone, and hyaluronic acid.

Route of Administration

Topical: According to modern pharmacology, various drugs used in the form an eye drops, eye ointments, etc. enter the eyeball by passing through the cornea and Conjunctiva. This penetration depends upon the permeability of various layers of the cornea. The epithelium and endothelium of the cornea are highly permeable to lipid-content drugs, i.e., lipophilic, and the stroma is permeable to water-content drugs, i.e., hydrophilic. Thus, for complete penetration of drugs, it should be both lipophilic and hydrophilic. Medicated Ghruta, which is usually used for Tarpana, is saturated with decoctions of various drugs and has both lipophilic and hydrophilic natures. It gets absorbed by corneal layers and gives good results, as Prasadan Chikitsa.

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Solubility and Bioavailability of the Drug

In pharmacology, bioavailability is a subcategory of absorption and is the fraction of an administered drug that reaches the systemic circulation, one of the principle pharmacokinetic properties of drugs. For example, when a medication is administered intravenously, its bioavailability is 100%.

The Absorbing surface is determined largely by the route of drug administration. Drugs are absorbed more rapidly from large surface areas like the pulmonary epithelium, intestinal mucosa, or skin. When dealing with the eye, the absorbing surface area is very small, so for better results, we have to increase dosage and tissue contact time too. In Tarpana, tissue contact time is longer, the nature of the drug is lipophilic, and molecular size is also smaller, which ensures better absorption through the absorbing surface.

Patient and Drug Compliance

The peak serum level of a particular drug is required for a particular period of time to achieve the desired effect of that drug. The peak serum level of the drug is the criterion of its dosage schedule, which should be maintained by repeating that drug at that interval. This must be the reason that Sushrutacharya described clearly dharankaal and repetition of kriyakalpa as per vitiated Dosha.

Vascularity of the Absorbing Surface

- Increased blood flow brought about by massage or the local application of heat enhances the absorption of drugs. This is the reason, in many Ayurvedic procedures, massage and steam are indicated as premedication. Even before Tarpana, mild hot fomentation is done compulsorily to enhance drug absorption. Seka is done with lukewarm kashay.

Time of Absorption

In ophthalmology, the time of absorption depends on tissue contact time. Eye drops get washed out immediately through the nasolacrimal duct. In Aaschyotan, the matra described is 8, 10, and 12 drops. Here, prolongation of drug contact time with the external ocular surface can be achieved by keeping the head tilted to the opposite side.

Factors Affecting Intraocular Bioavailability

Inflow and outflow of lacrimal fluids, efficient nasolacrimal drainage, interaction of drugs with proteins in lacrimal fluid, dilution with tears, corneal barriers, and active ion transport at the cornea, this is the reason that Tarpan is contraindicated in Saam Dosha Avastha.

Advantages and Disadvantages of Kriyakalpa

Advantages

- Can be used as a preventive as well as curative
- They are non-invasive and cost-effective
- No biodegradation of Drugs
- Effective against blood aqueous and blood retinal barriers
- Comparatively, less dose is required.

Disadvantages

- The patient has to spare time for the procedure
- Patient compliance is not acquired every time
- Aseptic and antiseptic precautions need to be followed.

Kriyakalpa Procedures

Aaschyotan

Used in all Netra Vikaras, it is the first line of treatment.[2]

This Procedure is Easy to use and cost-effective. Dosages: 8,10, or 10 drops as per action (Lekhan, Snehan, and Ropan).[3] For better results, hold the medicated liquid at the inner canthus;, this will increase tissue contact time, the bioavailabity of medicine, and better absorption. Decoctions prepared properly helps in reducing the molecular weight of the medicated liquid, thus ensuring better penetration into the cornea. As it is aqueous in nature,the corneal epithelium will resist the penetration, so the procedure should be repeated.

Seka

More potent than Aaschyotan, If the symptoms of vititiated doshas are more severe, then Seka should be practiced.[4] It can be done at night too, depending on the severity of the disease. It ensures more tissue contact time than Aaschyotan, which means better bioavailability and absorption.

The Dharankaal depends on expected action –
Like for Lekhan-200 Matra
Snehan-400 Matra
Ropan-600 Matra

Bidalak

Bidalako bahirlepo.[5] Used mainly for conjunctival diseases. The absorption of the active principle is from the skin. Conventional corneal absorption is not actively involved. It is mainly indicated for *Tarun Netrarog,* who has symptoms of *daah, updeha, ashru, and shofa*.

Pindika

Pindi kawalika Prokta badhyate Vastrapattake. It works *like hot foementation.* The absorption is through the skin and mainly relieves *Netra Abhishyanda* and *Vran*.[6]

Tarpan

Tarpan Should be done in Nirama Avastha. It Must be done after Shodhan and Shirovirechan.[7] To ensure better results, Mrudu Swedan with koshna jal is indicated (aadiantyo). As the medicated Ghruta is lipid, the corneal epithelium allows its maximum absorption. As the tissue contact time and bioavailability are both higher in Tarpan, maximum efficacy is achieved. The medicated ghruta has a lesser molecular weight as compared to Aaccha Sneh, so always prefer to go for Tarpan with medicated ghruta.

Putapak

Topical application of extracts prepared out of plant drugs, animal flesh, mineral drugs, and fats, etc. heated in a closed chamber. The liquid extract is retained over the eyes, as in Tarpana.[8]

Compliance, disposal, and tissue contact time are the same as in Tarpana. To avoid the side effects of Tarpan, Putapak is usually used as a Paschatkarma for Tarpan. As it contains flesh and fats, the extract is absorbed through corneal epithelium as well as stroma to the maximum.

Kriykalpa Pharmacodynamics at a Glance

Kriyakalpa	*Drug delivery*	*Advantages*	*Disadvantages*
Aaschyotan	Direct diffusion	Better compliance	Less tissue contact time
Seka	Direct diffusion	Removes pathogens	Drug wastage more, less bioavailability
Pindi	Trans cutaneous	Trans cutaneous absorption	Transient effect
Bidalak	Trans cutaneous	Trans cutaneous absorption	Transient effect, so needs repetition
Tarpana	Corneal	More tissue contact time and Bioavailability	Follow up difficult, time consuming
Putapak	Corneal	More tissue contact time and Bioavailability	Follow up difficult, time consuming
Anjan	Corneal	More tissue contact time and Bioavailability	Less compliance

Conclusion

- An emulsion-based formulation approach like medicated Ghruta offers an advantage in improving both the absorption and bioavailability of drugs. There are two types of emulsions that are commercially exploited as vehicles for active pharmaceuticals: oil in water (o/w) and water in oil (w/o) emulsion systems. For ophthalmic drug delivery, o/w emulsion is common and widely preferred over w/o systems. The reasons include less irritation and better ocular tolerance of o/w emulsion.
- Bruhat trayee was very well aware of blood-aqueous and blood-retinal barriers, so they developed local procedures for ocular ailments. Putapak and Anjana are the procedures that have active nanoparticles, so their action is extended up to the posterior segment. In all kriyakalpa preparations, most of the drugs are of herbal origin. The preparation procedure ensures a lower molecular weight, ultimately ensuring better penetration through the cornea. Some of the best preparations are commonly used in kriyalkapa, like-Triphala, which is the best antioxidant and antimicrobial, Tonic solutions like Saindhavlavanjal, Viscous drugs like honey and ghruta, which provide better tissue contact time, etc.

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