ejpmr, 2023,10(3), 302-305

SJIF Impact Factor 6.222

EUROPEAN JOURNAL OF PHARMACEUTICAL AND MEDICAL RESEARCH

www.ejpmr.com

Review Article

ISSN 2394-3211

EJPMR

A REVIEW ON TARGETED DRUG DELIVERY SYSTEM

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Article Received on 21/01/2023 **Article Revised on 10/02/2023** **Article Accepted on 01/03/2023**

ABSTRACT

New form of drug delivery system is drug targeting. The goal of the drug targeting is to deliver the drug to that targeted site of action without releasing the drug at non targeted site or without damaging other tissues/organs/cells. It has more advantages over conventional drug delivery system like low side effects, improvement of pharmaceutical activity and reduction of administered dose. The main reason of the targeted drug delivery system is to provide good pharmacological therapeutic agents for diseased organs without harming healthy tissues. Cancer treatment with chemotherapeutic agents have more side , targeted drug delivery system serve a purpose to reduce those side effects. various drug carrier which can be used in this advance delivery system are soluble polymers, biodegradable, microsphere polymers (synthetic and natural), neutrophils, nanoparticles, lipoproteins, liposomes, micells, niosomes, these carriers maintain and transport the loaded drug to the pre-selected organ. Drug targeting have a different mechanisms such as passive targeting, inverse targeting, active targeting, physical targeting, ligand-mediated targeting, dual targeting and double targeting. Targeted drug delivery system is useful for delivering the therapeutic agent to a particular site of action without causing any virulent effect to other organs.[2] GOAL OF TDDS To prolong, localize target and have a protected drug interaction with a diseased tissue.[3]

KEYWORDS: Therapeutically active drug, drug delivery, drug targeting, chemotherapeutic agents, therapeutic action.

INTRODUCTION

Conventional drug delivery system is the classical methods for the delivery of the drug into the body example tablets, capsules, syrups, ointments etc. These poses few limitations such as poor water solubility, limited targeting, Suffer from poor bioavailability, fluctuations in plasma drug delivery, unable to achieve sustained release. The technology of the targeted drug delivery system has become advanced and controls the drug absorption bioavailability and pharmacokinetic parameters and other limitations of conventional ones. The main principles of targeted drug delivery system requires:

1. The ability to load the drug to the target site.
2. Avoid the degradation by body fluid.
3. Reach the targeted site.
4. Release the drug at specific site at a pre determined time.

Targeted drug delivery is a type of smart drug delivery system which is miraculous in delivering the drug to a patient. This conventional drug delivery system is done by the absorption of the drug across a biological membrane, whereas the targeted release system is that drug is released in a dosage form. Targeted drug delivery is a special from of drug delivery system where the medicament is selectively targeted or delivered only to the site of action and not to the non-targeted organs or tissues or cells. The system has principal of that delivers a certain amount of a therapeutic agent for a prolonged period of time to a targeted diseased area within the body and improves the efficacy and reduces the side effect. This helps maintain the required plasma and tissue drug levels in the body, thereby preventing any damage to the healthy tissue via the drug. Carriers used should be biodegradable or readily eliminated from the body without any problem.

Targeted drug delivery mostly used for selective and effective localization of pharmacologically active moiety at pre-determined target in therapeutic concentration, while restricting it's access to non target normal cellular linings, thus minimizing therapeutic index.

Products based on such a delivery system are being prepared by considering the specific properties of target cells. Nature of markers or transport carriers or Vehicles, which convey drug to specific receptors and ligands and physically modulated components. Targeted drug delivery system should be biochemically inert and should be Non-immunogenic, physically- chemically stable in vivo and in vitro conditions. Carriers is specially

engineered molecules/system essential for effective transportation of the loaded drug towards pre- selected sites, such as polymers, monoclonal antibodies, liposomes, nanoparticles, niosomes, microspheres. Carriers used should be bio degradable are readily eliminated from the body without any problem.[2,3,4,5]

Definition

Drug delivery system is a system of specifying the drug moiety directly into its targeted body area (organ, cellular and subcellular level of specific tissue) to overcome the a specific toxic effect of conventional drug delivery, thereby reducing the amount of drug required for therapeutic efficacy.

1. Examples for drug carrier
2. Liposomes, niosomes, nanosphere, microsphere, etc.

Ideal Characteristics

- It should be non-toxic and Non-immunogenic.
- It should be physically and chemically stable in vivo and in vitro.
- They control the drug distribution to target cells or tissues or organs.
- Must have uniform capillary distribution.
- Convenient and predicate rate of drug release.
- Drug release does not influence the drug action.
- Curative amount of drug release.
- Minimal drug leakage during transfer.
- Carriers used must be bio-degradable or readily eliminated from the body without any problem and no carrier induced modulation of diseased state.
- The preparation of the delivery system should be easy or reasonably simple, reproductive and cost effective.[2,3]

Advantages

- Drugs deliver / releases over extended period of time.
- Intermittent dosing can be avoided.
- Improve patient compliance.
- Reduce inter and intra-patient variability.
- Drug can be administered in a smaller dose to produce the desired side effect.
- No peak and valley plasma concentration.
- Toxicity is reduced by delivering drug at the targeted site.
- Self administration is possible.
- Enhance absorption of drug.[2]

Disadvantages

- Requires a skill in manufacturing storage, administration.
- Diffusion and redistribution of drug release.
- Rapid clearance of targeted systems.
- Maintaining stability of dosage form is difficult.
- Highly sophisticated technology requires for formulation.
- Expensive.
- Yields comparatively very less.[2]

Applications

- Widely used in case of cancer therapy.
- Used in the treatment of ocular drug delivery system.
- Used in a DNA delivery.
- Used in case of Oligo nucleotide delivery.
- Enzyme immune assays.
- To cross BBB.
- In intracellular targeting.
- Used as a vaccine adjuvant.

Reasons

- Used in various treatment to prevent diseases.
- Reduction of drugs side effects and fluctuations in circulating drug levels.

METHODS

As discussed, targeting drug to a specific area is not only increases the therapeutic efficacy of drugs also it aims to decreases the toxicity association with drug to allow lower doses of the drug to be used in therapy. For the fulfilment of such conditions, few approaches are used extensively, which also know an classification of drug targeting:[2]

1. Active targeting
2. Passive targeting
3. Physical targeting
4. Chemical targeting
5. Prodrug targeting
6. Dual targeting
7. Inverse targeting
8. Combination targeting

1. Active targeting

- Active targeting means a specific ligand- receptor type interaction for intracellular localization which occurs only after blood circulation and extravasation. This active targeting approach can be further classified into three different levels of targeting which are:
- First order targeting refers to restricted distribution of the drug carrier system to the capillary bed of predetermined target site, organ or tissue e.g.: compartmental targeting in lymphatic, peritoneal cavity, plural cavity, cerebral ventricles.
- Second order targeting refers to selective delivery of drugs to specific cell types such as tumor cells and not to the normal cells e.g.: selective drug delivery to kupffer cells in the liver.
- Third order targeting refers to drug delivery specifically to the intracellular site of targeted cells e.g. receptor based ligand mediated entry of the drug complex into a cell by endocytosis.

2. Passive targeting

- It refers to the accumulation of drug/ drug carrier system at a specific site.
- The drugs are Targeted to systemic circulation
- Targeting is occurring because of body's natural response to physicochemical character of drug.

- E.g. include Targeting of antimalarial drugs for the treatment of leishmiansis, brucellosis and candidiasis.

3. Inverse targeting

This approach leads to a saturation of RES and suppression of defense mechanism by pre- injecting large amount of blank colloidal carriers . This is an effective approach for non- RES organs.

4. Dual targeting

The carrier molecules itself has their own therapeutic activity and therefore increases effect of drug.

5. Double targeting

In this type the temporal and spatial methodologies are combined to target a carrier system.

6. Combination targeting

Similar to double targeting, the combination targeting system for the site specific delivery of proteins and peptides are equipped with molecular specificity. The latter provides a direct access to target site.[2,6]

Carriers Applied For Drug Targeting

Drug targeting can be attained by using carrier system. Carriers are very much important and which required for the transportation of entrapped drug to target sites without releasing its in non targeting site.

Types of carriers which are applied for drug targeting:

1. Nanotubes

- Nanotubes are a type of drug carrier which is hallow cylindrical tube made of carbon that can be easily filled with required drug.[7,8]
- These are used for delivering the drug to the cancer cell.[9]

2. Nanowires

- It is wire with a very small diameters made of metal/ other organic compounds.
- It can be used for detecting the causes and treatment of brain disease like seizures, Parkinson's and similar diseases.[10]

3. Nanopores

- They have very tiny holes that allow the passage of DNA molecules, allow highly exact and effective DNA sequencing.[11,12]
- This potential in genetic engineering and biotechnology.[12,13,14]

4. Nanoparticles

The gold nanoparticles are used by scientists to develop a sensitive ultra-sensitive detection system for DNA and protein markers associated with the presence of different type of cancer.[15]

5. Liposomes

- These are microscopic bilayer structure vesicles prepared using natural phospholipid.[16]
- They can entrap both hydrophilic and lipophilic drugs in the aqueous space.[17,18]

6. Niosomes

- These are the non-ionic surfactant vesicles niosomes can entrap both hydrophilic and lipophilic drug. As like liposomes but the stability of niosomes is higher than the liposomes due to the phospholipid properties.
- The niosomes are effective for targeting anti-neoplastic drugs, anti-inflammatory, anti-bacterial, anti-fungal and anti-viral.[19]

CONCLUSION

Drug targeting system as the name suggestes is to facilitate the loaded drug to reach the desired site, the main advantages of this system has been the reduction in dose and side effects of drug. There are several carriers used in system such as nanotubes, nanowires, nanpores, nanoparticles, liposomes, niosomes.

ACKNOWLEDGEMENT

We are thankful to management, principal and all the staff members of the college for their guidance and support

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