A NOVEL APPROACH: TARGETED DRUG DELIVERY SYSTEM- A REVIEW

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ABSTRACT

Nowadays most of the dosage forms has a poor pharmacokinetic and biopharmaceutical properties. Hence, there is need to develop a drug molecule which will act only on the site of action, without affecting other tissues or organs basically targeted drug delivery is to assist the drug molecule to reach preferably to the desired site of action. The advantage of targeted drug delivery system is under high consideration of research and development in clinical and pharmaceutical field as backbone of therapeutic and diagnostic to various drug carries soluble polymer, micro particles made up of biodegradable natural and synthetic polymer neutrophils, lipoproteins, liposomes and micelles. The goal of targeted drug delivery system is to prolong localize target and have a protected drug interaction with the desired tissues. Targeted drug delivery system is a basic tool for achieving the therapeutic action without side effect within a low dose. This system prevent loss of drug within less time period.

KEYWORDS: Advanced drug delivery, Drug carrier system, Liposomes, Biopharmaceuticals, Targeted drug delivery system.

INTRODUCTION

Targeted drug delivery may be a quite smart drug delivery system which is miraculous in delivering the drug to a patient. This conventional drug delivery system is completed by the absorption of the drug across a biological membrane, whereas the targeted release system is that drug is released during a dosage form. Targeted drug delivery system is predicated on a

way that delivers a particular amount of a therapeutic agent for a protracted period of your time to a targeted diseased area within the body. This helps to maintain the required plasma and tissue drug levels in the body; therefore avoiding any damage to the healthy tissue via the drug. The drug delivery system is very integrated and requires various disciplines, like chemists, biologist and engineers, to hitch forces to optimize this technique. When implementing a targeted release system, the subsequent criterion for the system got to take into account: the drug properties, side effects of the drugs, the route taken for the delivery of the drug, the targeted site, and therefore the disease. Products supported such a delivery system are being prepared by considering the precise properties of target cells, nature of markers or transport carriers or vehicles which convey drug to specific receptors and ligands and physically modulated components. Ideally targeted drug delivery systems should be biochemically inert (non-toxic), should be non-immunogenic, should be physically and chemically stable in vivo and in vitro conditions, and will have restricted drug distribution to focus on cells or tissues or organs and will have uniform capillary distribution. It should have controllable and predictable rate of drug release and also drug release shouldn't affect the drug action. It should have therapeutic amount of drug release and will have minimal drug leakage during transit carriers used in TDDS must be biodegradable or it must be readily available and eliminated from the body. Targeted drug delivery system has more solubility, less drug instability, better absorption, increased half-life, require less volume of distribution, more specificity and high therapeutic index so it is preferred over conventional drug delivery system. The first being pharmaceutical reason. Conventional drugs have low solubility and more drug instability as compared to targeted drug delivery systems. Conventional drugs even have poor absorption, shorter half-life and need large volume of distribution. These constitute its pharmacokinetic properties. The third reason constitutes the pharmacodynamic properties of medicine. The conventional drugs have low therapeutic index as compared to targeted drug delivery system. Because of these reasons targeted drug delivery system is preferred over conventional drug delivery systems.[1,2,3,4,5]

BENEFITS AND IMPORTANCE OF TARGETED DRUG DELIVERY SYSTEM

- They provide improved or unique clinical benefits, such as:
- Improvement of patients' compliance
- Improved outcomes
- Reduction of adverse effects
- Improvement of patients' acceptance of the treatment

- Avoidance of costly interventions like laboratory services

- Allowing patients to receive medication as outpatients, and possibly

- A reduction in the overall use of medicinal resources

ADVANTAGES

- Target drug delivery system reduces the side effects and toxicity.

- The dose of the drug reduces by targeting organ.

- It avoids the degradation of drug (first pass metabolism).

- Drug bioavailability increases and fluctuation in concentration decreases.

- It also has positive effect on permeability of proteins and peptide.

- These all factors in combination cause in reduction in dosage frequency and hence reduce the cost of expensive drug from the body without any problem.

- The need of this system is to deliver the certain amount of drug to the targeted diseased area within the body.

- This will help to maintain the required plasma level and tissue drug level in the body therefore avoiding any damage to the healthy tissue via drug.

DISADVANTAGES

- With the targeted drug delivery it becomes difficult to target the tumour cells.

- Advanced techniques and skilled persons are required.

- Sometimes it may causes toxicity and it is very difficult to maintain stability of dosage forms.

TYPES OF TARGETED DRUG DELIVERY

Targeting drug to a selected area isn't only increases the therapeutic efficacy of medicine but also it's main aim is to decrease the toxicity related to drug to permit lower doses of the drug to be utilized in therapy. For the fulfilment of such conditions, two approaches are used extensively which also known as classification of drug is targeting.[6,7,8]

1. PASSIVE TARGETING

It refers to the buildup of drug or drug carrier system at a selected site like anti-cancerous drug whose explanation could also be attributed to physicochemical or pharmacological factors of the disease. Hence, in case of cancer treatment the size and surface properties of drug delivery nanoparticles must be controlled specifically to avoid uptake by the reticulo-

endothelial system (RES) to maximize circulation times and targeting ability. The bottom line is named passive targeting as misnomer which is straightforward drug delivery system via blood circulation. Drug release or drug actions are limited to selective sites within the body like a tumour but not the liver. Other examples include targeting of antimalarial drugs for treatment of leishmiansis, brucellosis, and candiadsis.[6]

2. ACTIVE TARGETING

Active targeting means a selected ligand-receptor type interaction for intracellular localization which occurs only after blood circulation and extravasations. This active targeting approach are often further classified into three different levels of targeting which are,

1) First order targeting refers to restricted distribution of the drug carrier systems to the animal tissue of a predetermined target site, organ or tissue e.g. compartmental targeting in lymphatics, greater peritoneal sac, plural cavity, cerebral ventricles and eyes, joints.

2) Second order targeting refers to selective delivery of medicine to specific cell types like tumour cells and to not the traditional cells e.g. selective drug delivery to kupffer cells within the liver.

3) Third order targeting refers to drug delivery specifically to the targeted cells at which their intracellular site. e.g. receptor based ligand mediated entry of a drug complex into a cell by endocytosis.[7]
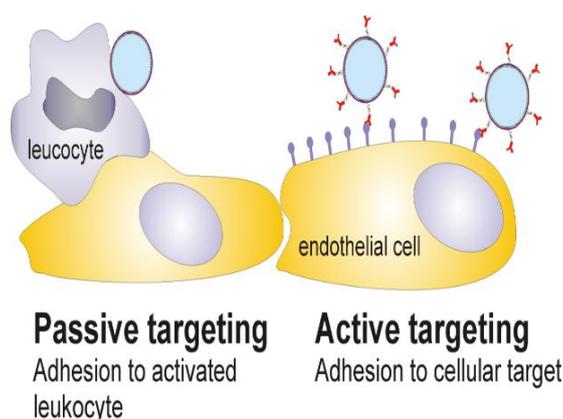
Fig. No. 1: Types of TDDS.

COMPONENTS OF TARGETED DRUG DELIVERY

A drug delivery system mainly consists a target and drug carriers or markers. Target means specific organ or a cell or group of cells, which in acute or chronic condition need treatment. Route of administration involves drug carrier as a important targeting moiety and after its

leakage from its carrier/markers to know the drug to the precise or targeted site via biological metabolism with its clearance also on not reach at non targeted site to form this delivery system more site specific with reduced side effects of medicine and its quantity too. Carrier is one among the special molecule or system essentially required for effective transportation of loaded drug up to the pre-selected sites. Carriers are engineered vectors which retain drug inside or onto them either via encapsulation and transport or deliver it through vicinity of target cell.[6,7,9]

DRUG DELIVERY VEHICLES

Drug delivery vehicles also are referred as drug vectors which are most vital entity required for successful transportation of the loaded drug. Drug vectors transports and retains the drug to be delivered it within or within the vicinity of target. They are made capable of performing such specific functions which can be attributed by slight structural modification.[3,4,11]

CHARACTERISTICS OF AN IDEAL DRUG VEHICLE

An ideal drug vehicle should be ready to cross blood brain barriers and just in case of tumour chemotherapy tumour vasculature. It must be recognized by the target cells selectively and specifically and also it should maintain the specificity of the surface ligands. The drug ligand complex should be stable in plasma as well as in interstitial and other bio-fluids. The drug vehicle used in TDDS must be non-toxic, nonimmunogenic and biodegradable. After recognition, the drug moiety inside the target organs released by carrier system, tissues or cells. Targeting Moieties includes antibodies, lectins and other proteins, lipoproteins, hormones, charged molecules, polysaccharides and low molecular- weight ligands.[3,9,11,12]

LIPOSOMES

Liposomes are small artificially designed vesicles composed of phospholipid bilayers surrounding with the dimensions starting from 20 to 10 000 nm. Many liposome formulations are rapidly haunted by macrophages and this could be exploited either for macrophage-specific delivery of drugs or for passive drug targeting which enable slow release of the drug over time from these cells into the overall circulation. Cationic liposomes and lipoplexes are extensively researched for his or her application in non-viral vector mediated gene therapy.[10,11]
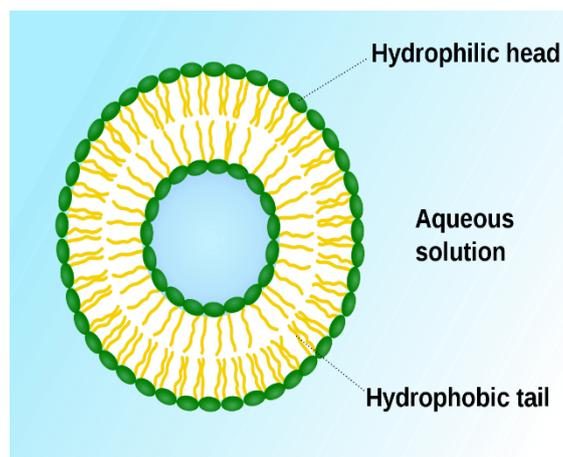
Fig. No. 2: Liposomes.

CONCLUSION

This article provides valuable information regarding the targeted drug delivery system and is more useful reference for the research scientist. Delivery of drug molecule to reach its specific site is itself a difficult task in the complex cellular network of an organism. Finally, targeted drug delivery is coming forward as one of the brightest advanced technique in the medical sciences in the diagnosis and treatment of couple of lethal diseases. It has crossed the infancy period and now touching height of growths in research and development in clinical and pharmaceutical fields.

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