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Review on Targeted Drug Delivery System

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Abstract: *Targeted drug delivery is an advanced method of delivering drugs to the patients in such a targeted sequences that increases the concentration of delivered drug to the targeted body part of interest only (organs/tissues/ cells) which in turn improves efficacy of treatment by reducing side effects of drug administration. Basically, targeted drug delivery is to assist the drug molecule to reach preferably to the desired site. Targeted drug delivery seeks to concentrate the medication in the tissues of interest while reducing the relative concentration of the medication in the remaining tissues. This improves efficacy of the while reducing side effects. It is very difficult for a drug molecule to reach its destination in the complex cellular network of an organism*

Keywords: drug delivery

I. INTRODUCTION

Targeted drug delivery system is based on a method that delivers a certain amount of a therapeutic agent for a prolonged period of time to a targeted diseased area within the body[1] Targeted drug delivery is a method of delivering medication to a patient in a manner that increases the concentration of the medication in some parts of the body relative to others. Targeted drug delivery seeks to concentrate the medication in the tissues of interest while reducing the relative concentration of the medication in the remaining tissues.[2] The very slow progress in the treatment of severe diseases has led to the adoption of a multidisciplinary approach to the targeted delivery and release of drugs, underpinned by nano science and nano technology.[3] This helps 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 highly integrated and requires various disciplines, such as chemists, biologist and engineers, to join forces to optimize this system. When implementing a targeted release system, the following design criteria for the system need 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 the disease.[4] 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.[5] 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 should have restricted drug distribution to target cells or tissues or organs and shouldhave uniform capillary distribution.[6] The concept of designing targeted delivery system has been originated from the Paul Ehrlich, who was a microbiologist, proposed the idea of drug delivery in the form of magic bullet.[7] Targeted drug delivery means accumulation of pharmacologically active moiety at desired target in therapeutic concentration at the same restricting its access to normal cellular lining, thus minimizing therapeutic index. The drug can be targeted to intracellular sites, virus cells, bacteria cell and parasites using different scientific strategies have proven highly effective.[8] The drug can be targeted to intracellular sites, virus cells, bacteria cell and parasites using different scientific strategies have proven highly effective.[8] The minimum distribution of the parent drug to the non-target cells with higher and effective concentration at the targeted site certainly maximize the benefits of targeted drug delivery.[9] The design and development of potential carriers for cell-specific delivery of therapeutics should be based on recognition sites on the surface of target cells as well as on insight into the internalization and further cellular disposition of such macromolecules.[10] The choice of carrier system to be used in drug targeting strategies depends on which target cells should be reached and what drug needs to be delivered. Carriers can be divided into soluble, cellular carriers, particle type. Particle type carriers comprise liposomes, lipid particles (low and high density lipoproteins, LDL and HDL respectively), polymeric micelles, nanoparticles, microspheres. Soluble carriers consist of monoclonal antibodies and fragments thereof,

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modified plasma proteins, peptides, and biodegradable carriers consisting of polymers of various chemical composition.[11] Drug targeting is the delivery of drugs to receptors or organs or any other specific part of the body to which one wishes to deliver the drugs exclusively.[12] The desired differential distribution of drug its targeted delivery would spare the rest of the body and thus significantly reduce the overall toxicity while maintaining its therapeutic benefits The targeted or site- specific delivery of drugs is indeed a very attractive goal because this provides one of the most potential ways to improve the therapeutic index of the drugs.[13]

II. STRATEGIES OF DRUG TARGETING

Targeting: Drug delivery systems which are targeted to systemic circulation are characterized as Passive delivery systems. The ability of some colloid to be taken up by the Reticulo Endothelial Systems (RES) especially in liver and spleen made them ideal substrate for passive hepatic targeting of drugs

Inverse Targeting: In this type of targeting attempts are made to avoid passive uptake of colloidal carrier by RES and hence the process is referred to as inverse targeting. To achieve inverse targeting, RES normal function is suppressed by pre injecting large amount of blank colloidal carriers or macromolecules like dextran sulphate. This approach leads to saturation of RES and suppression of defense mechanism. This type of targeting is a effective approach to target drug(s) to non-RES organs

Active targeting: In this approach carrier system bearing drug reaches to specific site on the basis of modification made on its surface rather than natural uptake by RES. Surface modification technique include coating of surface with either a bioadhesive, nonionic surfactant or specific cell or tissue antibodies (i.e. monoclonal antibodies) or by albumin protein

Dual Targeting: In this targeting approach carrier molecule itself have their own therapeutic activity and thus increase the therapeutic effect of drug. For example, a carrier molecule having its own antiviral activity can be loaded with antiviral drug and the net synergistic effect of drug conjugate was observed.

Double Targeting: When temporal and spatial methodologies are combined to target a carrier system, then targeting may be called double targeting. Spatial placement relates to targeting drugs to specific organs tissues, cells or even subs cellular compartment. Whereas temporal delivery refers to controlling the rate of drug delivery to target site.

Advantage

- Drug administration protocols may be simplified.
- Toxicity is reduced by delivering a drug to its targed site ,there by reducing harmful systemic effects.
- Drug can be administered in a smaller dose to produce the desire effect.
- Avoidance of hepatic first pass metabolism.
- Enhancement of the absorption of target molecules such as peptides and particulates
- Dose is less compared to conventional drug delivery system.
- No peak and valley plasma concentration.

Disadvantages

- Rapid clearance of targeted systems.
- Immune reactions against intravenous administered carrier system.
- Insufficient localization of targeted system into tumour cells.
- Diffusion and redistribution of released drugs.
- Requires highly sophisticated technology for the formulation.
- Requires skill for manufacturing storage, administration.
- Drug deposition at the target site may produce toxicity sysmptoms.
- Difficult to maintain stability of dosage form. E.g : Resealed erythrocytes have to be stored at 4c Drug loading is usually law Eg: as in micelles. Therefore it is difficult to predict/fix the dosage regimen.

Application:-

- Assay - Coated microspheres provide measuring tool in biology and drug research

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- Buoyancy - Hollow microspheres are used to decrease material density in plastics (Glass and polymer)
- Spacers - Used in LCD screens to provide a precision spacing between glass panels (Glass)
- Standards – mono disperse microspheres are used to calibrate particle sieves, and particle counting apparatus.
- Retro reflective - added on top of paint used on roads and signs to increase night visibility of road stripes and signs (glass)
- Thickening Agent - Added to paints and epoxies to modify viscosity and buoyanc

III. CONCLUSION

It is very difficult for a drug molecule to reach its destination (site of action) in the complex cellular network of an organism. Nanotech targeted delivery of drug is becoming one of the brightest stars in the medical sciences. The inherent advantage of this technique has been reduction in the dose and the side effect of drug. The biological approach is more specific but it also has some limitations which may be overcome soon, keeping in mind the giant leaps taken by research scientists in the recent past. Nanotechnology in medicine is definitely here to stay. Liposomes have been realised as extremely useful carrier systems for targeted drug delivery. The use of lipososmes in the delivery of drugs and genes are promising and is sure to undergo further developments in future. Nanoparticles are one of the promising drug delivery systems, which can be of potential use in controlling and targeting drug delivery it is a frontier area of future scientific and technological development. Nanoparticles are used for parenteral, oral, ocular, and transdermal applications as well as in cosmetics and hair technologies, sustained release formulations and as carrier for radio nucleotides in nuclear medicine. new nanoparticles production techniques and equipment will aid in further discovery of pharmaceutical drugs microspheres are better choice of drug delivery system than many other types of drug delivery system because it is having the advantage of target specificity and better patient compliance. Its applications are enormous as they are not only used for delivering drugs but also for imaging tumours, detecting bio molecular interaction etc. So in future microspheres will have an important role to play in the advancement of medicinal field. Monoclonal antibodies for drug targeting are progressing steadily toward increased clinical use.

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