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A REVIEW ON TARGETED DRUG DELIVERY SYSTEM

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Abstract

Good drug delivery, also known as targeted drug administration, is a therapeutic approach that involves administering more medication to one or a few body parts than to others. Two tactics are Cancers Active and passive targeting is commonly employed to focus drugs to a certain organ or tissue. Delivery of drugs Cars provide the medication either continuously or only in the desired area. A perfect medicine delivery vehicle should be able to pass across barriers like the blood-brain barrier. Because nanotechnology is being used in medicine, nanomedicine has recently gained popularity. Nano drug delivery can help distribute medications with limited water solubility and can help prevent the first pass because nanoparticles are incredibly small. Liver metabolism. Medication delivery based on nanotechnology. These also include the approaches in which the therapeutic drugs are combined with "targeting ligands"—antigens linked to tumors—that have this potential.

Introduction

Targeted drug delivery (TDD) could be a reasonably sensible drug delivery system that is miraculous in delivering the drug to a patient. This typical drug delivery system is completed by the absorption of the drug across a biological membrane, whereas the targeted unharness system is that drug is discharged in an indefinite quantity Form (1). The drug delivery system is extremely integrated and needs various disciplines, like chemists, Scientist and engineers, to join forces to optimize this technique. Once implementing a targeted unleash system, The subsequent standard for the system got to take into account: the drug properties, side effects of the Medicine, the route taken for the delivery of the drug, the targeted website, and also the unwellness. (2,3) Targeted Drug delivery system is preferred over conventional drug delivery systems due to following three main reasons. The first being pharmaceutical reason. Conventional drugs have low solubility with more drug instability in Comparison 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 reasonConstitutes the pharmacodynamic properties of drugs (4).

Tumors are characterized by highly defective vessel architecture and poor lymphatic drainage, in Physical, Chemical,andBiologicalTargeting.

Physical targeting describes systems that localize agents to target areas because of theirsize, composition, or other characteristics that are not specifically designed toward a biological receptor. Chemical targeting involves the localization of agents to targeted areas through the use of site-specific prodrugs. Agents can also be directed to areas through the use of enzymatic or chemical reactions that lead to the targeting of a vehicle or the controlled release or action of the agent.

TDD with specific location-based strategies is a targeted delivery to specific cells, organs, and organelles. Intracellular targeting, gastrointestinal tract (GIT) targeting, brain targeting, and targeting the respiratory tract are some examples of location-based targeting. Intracellular delivery of pharmaceutical agents like proteins, Abs, and drug-loaded Nano carriers ensures that the therapeutic action is specifically introduced to the nucleus or specific organelles [5].

Floating DD is a model for this type of targeting in which antiviral, antifungal, and antibiotic agents are absorbed

from very specific regions of the GIT.

Ideal characteristics of Targeted drug delivery system are

- 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.

Advantages.

- Drugs deliver / releases over extended period of time.
- Improve patient compliance.
- Reduce inter and intra-patient variability.

Disadvantages

- Internalization of the plasma membrane,
- Concomitant with engulfment of extracellular material.

Preparation

Nanoparticles can be prepared from a variety of materials such as polysaccharides, proteins And Synthetic polymers. Selection of matrix materials depends on many factors including:

(a) Size of nanoparticles required; (b) inherent properties of the drug, e.g., stability; (c) surface cu area to Characteristics such as charge and permeability; (d) degree of biodegradability, Biocompatibility and toxicity; € Drug release profile desired; and (f) Antigenicity of the Final product. Different techniques like polymerization, preformed polymers or ionic gelation etch are use [6].

- Emulsification/solvent diffusion
  a) Micro Emulsion
  b) Interfacial Polymerization
  c) Controlled/Living Radical Polymerization

Liposomes:

Liposomes were first described by Bingham in 1965, while studying the Nature of cell membranes. The name liposome is derived from two Greek words: 'Lips' Meaning fat and 'Soma' meaning body [7,8].

- Mechanisms by which Liposome's act are as follows:

Liposome attaches to cellular membrane and appears to fuse with them, releasing their Content into the cell.

1. They are taken up by the cell and their phospholipids are incorporated into the cell Membrane by which the drug trapped inside is released.
2. In case of phagocyte cell, the Liposomes are taken up, the phospholipid walls are acted Upon by organelles called lysosomes and the active pharmaceutical ingredient are release [9].

- Advantages:

Biodegradable, biocompatible, flexible, Nonionic can carry both water soluble drugs.

1. Increased efficacy.
2. Increased stability via encapsulation.
3. Reduces toxicity of the encapsulated agent.

- Disadvantages:
  1. Production cost is high.
  2. Leakage and fusion of encapsulated drug/molecules
- Characterization of liposomes:

Broadly classified into three categories:

Physical characterization: evaluates parameters including size, Shape, surface features, Lamellarity, phase behavior and drug release profile [10].

chemical characterization includes those studies which establish the purity, potency of Various lipophilic constituents.

Biological characterization establishes the safety and suitability of formulation for

- Microspheres

Microspheres as carriers of drug become an approach of controlled release dosage form in Novel drug delivery system. Microspheres are sometimes referred to as microparticles. Microspheres can be prepared from various natural and synthetic materials.

Polymer Microspheres, Glass microspheres and ceramic microspheres are commercially available. Polyethylene and polystyrene microspheres are two most common types of polymer Microspheres [11].

Advantages

- Microspheres provide constant and sustained therapeutic effect.
- Improved drug utilization through bioavailability and reduce the incidence or intensity of Adverse effects.
- Microsphere morphology provides a controllable variability in deprivation and drug Release.
- Dosing frequency is reduced and improves patient compliance [12].
- Due to its spherical shape and smaller size, they can be injected and smaller size.

Limitations.

The modified release from the formulations. The release rate of the controlled release dosage form may vary from a variety

offactors Like food and the rate of transit though gut.

- Differences in the release rate from one dose to another.
- Controlled release formulations generally contain a higher drug load and thus any loss of Integrity of the release characteristics of the dosage form may lead to potential toxicity.

Types of Microspheres

Bio adhesive microspheres: Adhesion of drug delivery device to the mucosal membrane Such as, ocular, buccal, nasal, rectal etc., can be defined as bio adhesion. Microspheres Exhibit a prolonged residence time at the site of application and causes intimate contact with the absorption site and produces better therapeutic action [13].

- microspheres: This kind of delivery system is very much important which Localizes the drug to the disease site. In this larger amount of freely circulating drug can Be replaced by smaller amount of magnetically targeted drug. Magnetic carriers receive Magnetic responses to a magnetic field from incorporated materials such as chitosan, Dextran etc.
- Floating microspheres: In floating types the bulk density is less than the gastric fluid and so remains buoyant in stomach without affecting gastric emptying rate. The drug Is Released slowly at the desired rate. It also reduces chances of striking and dose. dumping. It produces prolonged therapeutic effect and therefore reduces dosing frequencies [14].
- Radioactive microspheres: radioactive microspheres deliver high radiation dose to the Targeted areas without damaging the normal surrounding tissues. It differs from drug Delivery system, as radio activity is not released from microspheres but actsfrom within a Radioisotope typical distance and the different kinds of radioactive microspheres are α Emitters, β emitters, γ emitters.
- Polymeric microspheres: The different types of polymeric microspheres can be classified as follows and they are biodegradable polymeric microspheres and Synthetic polymeric Microspheres [15].
- Biodegradable polymeric microspheres: Biodegradable polymers prolongs the residence Time when contact with mucous membrane due to its high degree of swelling property with aqueous medium, results gel formation. The rate and extent of drug release is Controlled by concentration of polymer and the release pattern in asustained manner.
- Synthetic polymeric microspheres: The interest of synthetic polymeric microspheres is Widely used in clinical application, moreover that also used as fillers, bulking agent, drug Delivery vehicles, embolic particles etc. and proved to be safe and biocompatible [16].

Brain Drug delivery system:

The brain is the most versatile and sophisticated organ in the body and is

Some of the formulations using targeted therapy for cancer are already available within the market, for instance, Moyet (liposomal doxorubicin) Adenotome (liposomal daunorubicin). Doxia (liposomal doxorubicin), Deposit (liposomal cytarabine), and Abraxane (album inbound paclitaxel particles). Some of the samples of antibodies directed toward cancer therapy include Rituxan (rituximab), Herceptin (trastuzumab), and Sampath (alemtuzumabIn case of treating fatal CNS disease, such as brain tumors, HIV encephalopathy, epilepsy, Cerebrovascular disease and neurodegenerative disorders is particularly challenging because a variety of difficult obstacles often delay drug delivery to brain and spinal cord. So, drug targeting to Brain is essential to increase treatment efficacy and it also reduces toxicity due to localizing drug at the desired site of action [17].

Barriers to CNS Drug Delivery

Blood-Cerebrospinal Fluid Barrier (BCSFB)

The epithelial cells have an arrangement in such a manner that it prevents the entry of molecules. The CSF freely exchange molecules with the extracellular fluid of brain, parenchyma, delivering Drugs into the CSF could theoretically result in therapeutic CNS drug concentrations. Factors affecting drug transport across the BBB.

Approaches to CNS drug delivery

- Intra cerebra ventricular (ICV) infusion
- Convection-enhanced delivery (CED)
- Intra-cerebral injection or implants

Disruption of the BBB. Non-invasive

A. Chemical techniques
B. Prodrug
C. Drug conjugate
D. Colloidal Techniques

Monoclonal antibody

Monoclonal antibody production by somatic cell fusion or hybridoma technology was Introduced by Kohler and Milstein in 1975. The technique involves fusing a normal antibody Producing B cell with a myeloma cell to produce a hybrid cell or hybridoma [18].

- Monoclonal antibodies characteristics: binding, their Homogeneity.

Application of targeted drug delivery systems.

- Targeted drug delivery is utilized to treat many diseases, such cardiovascular diseases and Diabetes. Regenerative technique is developed to cure various diseases. The development of A number of regenerative techniques in recent year for curing heart diseases.
- Targeted drug delivery is also used in the stem cell therapy. This therapy helps to Regenerate myocardium tissue and return the contractile function of heart by creating a Microenvironment before myocardial infarction.

Conclusion

A drug's destination, or site of action, is a very difficult place for it to arrive in the intricate cellular network of an organism. One of the newest and brightest areas of the medical sciences is targeted drug delivery with nanotechnology. Future research on the delivery of genes and medications via liposomes is expected to provide more positive results. One of the more exciting new frontiers in science and technology is the delivery of drugs, and nanoparticles offer promise for both targeting and managing drug delivery. Nanoparticles are employed in sustained release formulations for nuclear medicine, parenteral, oral, ophthalmic, and transdermal uses, as well as in hair and cosmetic technologies and as carriers of radioactive nucleotides.

Author contributions

All authors are contributed equally.

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Declaration of Competing Interest

The authors have no conflicts of interest to declare.

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