WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 8.084
Volume 10, Issue 12, 521-531. Review Article ISSN 2277–7105

A REVIEW: TARGETED DRUG DELIVERY SYSTEM

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Article Received on
03 Aug. 2021,

Revised on 24 Aug. 2021,
Accepted on 13 Sept. 2021

DOI: 10.20959/wjpr202112-21720

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ABSTRACT

Drug targeting is a new drug delivery strategy that tries to deliver the drug to the target location of action or absorption without releasing it elsewhere. The delivery method is meant to keep the drug in its original state until it reaches and releases at the target spot. Targeted drug delivery systems provide various advantages over traditional drug administration systems, including increased pharmacological action, less adverse effects, and a lower administered dose. The basic goal of a targeted drug delivery system is to direct the therapeutic agent's pharmacological effect only to sick organs while leaving healthy organs alone, which is especially important when treating cancer with chemotherapeutic drugs. Medication targeting can be accomplished utilising a variety of carriers that keep the drug intact while transporting it to a predetermined organ or tissue. Nanotubes and nanowires, nanoshells, quantum dots, nanopores, gold nanoparticles, dendrimers, noisomes, ufasomes, virosomes, cubosomes, nanobots, and transferosomes are some of the carriers that can be utilised for drug targeting.

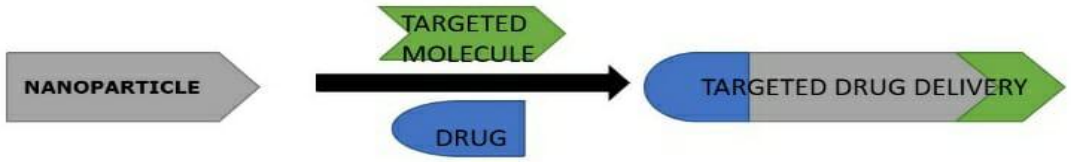
KEYWORDS: Drug targeting, Drug delivery system, strategies for drug targeting.

INTRODUCTION

Targeted drug delivery is a type of smart drug delivery device that delivers a drug to a patient miraculously. The medication is absorbed through a biological membrane in the conventional drug delivery system, whereas the drug is released in a dose form in the targeted release system.

Because of three key reasons, targeted drug delivery systems are chosen over conventional drug delivery systems. The first is for medicinal reasons. In comparison to tailored drug delivery methods, conventional drugs have a lower solubility and increased drug instability. Conventional medications are also poorly absorbed, have a short half-life, and require a high distribution volume. These are the pharmacokinetic features of the drug.

The pharmacodynamic effects of drugs are the third explanation. When compared to a focused medication delivery system, conventional pharmaceuticals have a limited specificity and therapeutic index. Targeted drug delivery systems are chosen over traditional drug delivery systems for these reasons.



The requirement for targeted drug delivery

A targeted drug delivery system refers to a system that treats a specific organ, cell, or group of cells that is suffering from a chronic or acute illness. One of the particular molecules necessary for effective delivery of a loaded medicine to a pre-selected spot is the drug carrier. The drug carrier should be biodegradable or easily removed from the body without difficulty. This system's purpose is to deliver a certain amount of drug to a desired location within the body. This will aid in maintaining the required plasma and tissue drug levels in the body, preventing drug-induced harm to healthy tissue.

The characteristics of a targeted medicine delivery system that are ideal

The targeted drug delivery system must have the following characteristics:

1. It must be stable, non-toxic, biodegradable, and compatible with bodily fluids.
2. Only deliver the medicine to the desired location.
3. Maintain a predetermined rate of medication release.
4. The pharmacological action is unaffected by the rate of drug release.
5. Drug leakage is kept to a minimum during transit to the target site.
6. Using a carrier that is inert, biodegradable, or easily removed.
7. The drug delivery system's preparation process should be simple, straightforward, and inexpensive.

Advantages of Targeted drug delivery system

- Drugs deliver / release information over a long period of time.
- It is possible to avoid intermittent dosage.
- Improve patient adherence.
- Reduce the diversity between and between patients.
- To get the desired side effect, the drug can be given in a lesser dose.
- There are no peaks or valleys in plasma concentration.
- Toxicity is decreased by delivering the drug to the desired location.
- Self-administration is an option.
- Increase drug absorption.

Disadvantages of targeted drug delivery system

- Requires manufacturing, storage, and administrative skills.
- Drug release diffusion and redistribution
- Targeted systems are cleared quickly.
- It's tough to keep the dosage form stable.
- Formulation necessitates highly complex technology.
- It's a bit of a splurge.
- Yields are low in comparison.

Carries are used to target drugs

a. Drug targeting can be accomplished through the use of carrier systems.

b. The carriers are the systems that convey the entrapped drug to the target areas.

c. The carriers entrap the drug moiety and deliver it to the target site while avoiding nontarget sites.

Various types of carriers have been used to target drugs.
the targeted medication delivery system uses a variety of carriers, including.
Drug targeting carriers of various sorts.

Nanotubes

Nanotubes are a sort of drug delivery system that consists of a hollow carbon cylindrical tube that can be readily filled and sealed with the appropriate medicament.
They are commonly employed to deliver drugs to cancer cells.
In mice, Liu et al. used carbon nanotubes to target the tumour.
Mc Devitt et al. also used antibody-functionalized, radiolabeled carbon nanotubes to target tumours.

Nanowires

It's a thin wire made of metal or organic compounds with a very small diameter. Because it has a high surface area, the nanowire's surface can be modified to allow it to bind with specific biological molecules once it's placed into the body. It can be used to diagnose and treat brain illnesses such as seizures, parkinsonism, and other comparable conditions. This technique can be used to treat Parkinson's disease and other disorders. It can also be utilised for tumour cell detection and localization.

Nanoshells

Nanoshells are innovative nanoparticle methods that consist of a hollow dielectric core of silica surrounded by a gold shell. It has the potential to be used for both diagnostic and therapeutic purposes. Nanoshells can have antibodies attached to their surfaces, allowing them to interact with specific locations like cancer cells. This method is quite good in locating the anticancer medication.

Quantum Dots

Quantum dots are nanocrystalline semiconductor particles with unique optical properties that allow them to be employed in tumour imaging.
This carrier is effective in delivering cancer-fighting medicines.
For cancer targeting and drug delivery, Pardo et al. employed quantum dots and nanotubes.

Nanopores

They have very small holes in them that allow one strand of DNA to flow through at a time. As a result, allow for extremely precise and efficient DNA sequencing. In genetic engineering and biotechnology, this strategy could be useful.

Nanoparticles of gold

Scientists are using gold nanoparticles to develop an ultrasensitive detection system for DNA and protein indicators linked to the presence of certain cancers, such as breast and prostate cancer. Lung cancer was diagnosed using gold nanoparticles.

Dendrimers

Dendrimers are nanoparticles with a specified diameter that are synthesised. They are made up of a control core surrounding by polymer layers. The medicine could be linked to one of numerous places on the surface of the dendrimers. They're employed in medical imaging and gene transfection.

Liposomes

Liposomes are vesicles with a tiny bilayer structure made from natural phospholipid. In the aqueous space or phospholipid bilayers, they can entrap both hydrophilic and lipophilic medicines. The physical and chemical properties of the medication, as well as the makeup of the lipids, influence the proportion of entrapped drug.

Niosomes

Non-ionic surfactant vesicles called niosomes can entrap both hydrophilic and lipophilic drugs. Because to the natural characteristics of phospholipid, niosomes have a higher stability than liposomes. Niosomes have been discovered to be effective at targeting antineoplastic medications, as well as anti-inflammatory, anti-bacterial, anti-fungal, and antiviral agents.

Ufasomes

In the presence of cholesterol, ufasomes are a dispersion of unsaturated fatty acid vesicles made from fatty acids and an ionic surfactant (soap). Ufasomes are an useful carrier for drugs that need to be applied topically. The stratum corneum, the skin's outermost layer, is thought to be the principal barrier to drug penetration. Because ufasomes contain a lipid membrane that has the potential to attach to the skin, this problem can be solved by employing them as DDS.

Pharmacosomes

Pharmacosomes are a neutral molecule having both positive and negative charges, hydrophilic and lipophilic properties, and an optimal polyphenol to phospholipid ratio in the form of a complex. By electrostatic force or by creating a hydrogen bond, the drug is conjugated to the lipoidal complex.

The phrase pharmacosome comes from the Greek words pharmakon, which means drug, and soma, which means carrier. Micelles or hexagonal aggregates may be used to conjugate the drug to the lipoidal complex.

Aceclofenac pharmacosomes were produced and tested.

Transferosomes

Transferosomes are a type of vesicular drug delivery mechanism that is relatively new. Transformers are self-optimizing, self-regulating, hyper deformable, and "ultra-flexible" in a unique way. Due to the presence of "edge activators" within a vesicular membrane, the surfactant has been utilised as edge activators. It contains an inner aqueous core surrounding by a complex lipid bilayer with unique features. As a result, it may efficiently permeate the epidermis by squeezing through pores that are 5 to 10 times smaller than their diameter.

Strategies for drug targeting

There are several strategies for drug targeting as shown by Figure 2 which include.

Active targeting

Active targeting refers to a unique ligand–receptor interaction that happens only after blood circulation and extravasation for intracellular localisation.

1) First order targeting refers to confined distribution of drug carrier systems to the capillary bed of a specific target site, organ, or tissue, e.g. **compartmental** targeting in lymphatics, peritoneal cavity, multiple cavity, cerebral ventricles and eyes, joints.
2) Second-order targeting refers to the delivery of drugs to specific cell types, such as tumour cells, rather than to normal cells, as in the case of kupffer cells in the liver.
3) Third-order targeting refers to drug delivery to a targeted cell's intracellular location, such as receptor-based ligand-mediated endocytosis entrance of a drug complex into a cell.

Passive Targeting

Passive delivery systems are defined as drug delivery techniques that are aimed at systemic circulation. The body's natural response to physicochemical features of the drug or drug carrier system causes drug targeting in this technique. Some colloid's capacity to be taken up by Reticulo Endothelial Systems (RES), particularly in the liver and spleen, making them a suitable substrate for passive hepatic drug targeting.

Reverse Targeting

The RES is saturated, and the defensive mechanism is suppressed, as a result of this technique. This method of targeting drug(s) to non-RES organs is highly successful.

Dual Targeting

The carrier molecule in this targeting strategy has therapeutic action, which increases the therapeutic efficacy of the drug. For example, an antiviral drug can be loaded onto a carrier molecule that has its own antiviral action, resulting in a net synergistic impact of the drug combination.

Double Targeting

Targeting is referred to as double targeting when temporal and spatial approaches are coupled to target a carrier system. Targeting medications to specific organs, tissues, cells, or even subcellular compartments is referred to as spatial placement. Controlling the rate of drug delivery to the target place is referred to as temporal delivery.

Combination Targeting

These targeting systems are equipped with molecularly specialised cariers, polymers, and homing devices that could allow a direct route to the target spot.

CONCLUSION

Drug targeting is a novel method of delivering drug molecules to a specific location or organ within the body. As a result of this delivery system, the dose of the pharmaceuticals was reduced, and therefore the side effects of the drugs were reduced. Liposomes, transferosomes, gold nanoparticles, niosomes, and nanotubes are some of the delivery mechanisms employed in drug targeting. In the treatment of cancers such as brain cancer, breast cancer, prostate cancer, and colon cancer, the targeted medication delivery mechanism is critical. Now, work

is being made in the field of drug targeting to address the issues with traditional drug delivery systems.

ACKNOWLEDGEMENT

The authors are grateful to the management of Loknete Shri Dadasaheb Pharate Patil College of Pharmacy, Mandavgoan Pharata, for providing the facilities and access to online resources needed to conduct the literature review. The author is also grateful toDr. Hemant Kamble and Dr.Amol Lokhande for his valuable guidance.

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