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Novel Drug Delivery System

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Commentary

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INTRODUCTION

Drug delivery is the process of administering the drug or pharmaceutical product, in order to achieve desired therapeutic effect. The method by which drug delivered is important, as it has significant effect on its efficacy. Novel drug delivery system involves various approaches like medical devices or drug-device combination products. Novel drug delivery system (NDDS) involves combining polymer science, pharmaceutics and molecular biology [1 - 3]. Novel drug delivery systems are designed based on physical and biochemical mechanisms. Physical mechanism or controlled drug delivery system includes dissolution, osmosis, erosion and diffusion. Biochemical mechanism includes gene therapy, liposomes, nanoparticles, monoclonal antibodies. NDDS drugs are designed to target the site specific region, in order to achieve desired therapeutic effect, thereby reducing the side or toxic effects.

Novel drug delivery system

Various drug delivery and drug targeted systems are developed, in order to minimize drug degradation, drug adverse effect, and in order to increase the drug bioavailability (amount of drug available at site targeted region). Site specific drug delivery may be either active or passive process.

Liposomes

Liposome serves are lipoidal vesicles (lipid bilayer), which serves as drug carriers for improving the delivery for pharmaceutical drug.

Mechanism: Liposomes are small lipodial vesicles enclosing aqueous solution inside a hydrophobic membrane, in order to deliver the molecules to targeted site, the lipid bilayer can fuse with other bilayers such as the cell membrane, thus liposomes act as drug carrier for drug delivery [4 - 7].

They are various clinical approved liposomal drugs like: liposomal daunorubicin, doxorubicin, Liposomal amphotericin B, Liposomal cytarabine.

Liposomes have following advantages

1. Liposomes are non-toxic, biocompatible, biodegradable, and nonimmunogenic for systemic and non-systemic administrations.

2. The efficacy and therapeutic index of drug Actinomycin can be increased , by formulating it as liposomes.
3. Liposomes has flexibility to bind with site-specific ligands , in order to achieve active targeting.
4. Site-specific targeting of Anti-cancer, Anti-inflammatory drugs.
5. Has high penetration into tissues (Corticosteroids, anesthetics, and insulin).

Nano particles

Nanoparticles are amorphous or crystalline compounds ranging from 10-200 nm, which are used for novel drug delivery system [8 - 15]. Nano particles adsorb or encapsulate the drug, thus protecting against chemical or enzymatic degradation [16 - 21].

Various Nano devices for drug delivery includes: Nano tubes, quantum dots, Nano robots, den dimers, Nano wires, Nano shells and Nano pores.

Mechanism: The release of the dug from the formulation is by controlled diffusion or erosion mechanism. Thus the release of the drug occurs from the core, across the polymer matrix or membrane. Thus the membrane acts as a barrier for drug release. Therefore solubility and diffusivity of drug in polymer membrane becomes the determining factor for drug release.

Advantages:

- Nanosomes offer uniform delivery of drug, with greater bioavailability.
- It can be administered through different routes.
- Smaller in size with high surface area.
- Low drug dose is required

Hydrogels

Hydrogels are three –dimensional cross linked water soluble polymers. Various combination of polymers are formulated as novel drug delivery system. Various drugs formulated as hydrogels include Riboflavin, Salicylic acid, Simvastatin [22 - 25].

Classification of hydrogels:

- Based on the methods of preparation- Homo-polymeric Hydrogel, Co-polymeric hydrogel, Inter Penetrating Network,
- Stimuli-sensitive hydrogels- Temperature-sensitive hydrogels, pH-sensitive hydrogels, Dual pH-thermal sensitive systems
- Based on mechanism of release-Diffusion controlled, swelling controlled.

Advantages of Hydrogels:

- Biocompatible, biodegradable and can be injected
- Hydrogels possess wide degree of flexibility similar to natural tissue.
- Have good transport properties and easy to modify.

Drug loaded erythrocytes

Drug loaded erythrocytes are novel drug delivery system, in which erythrocytes can be loaded with variety of biologically active substances. The mechanism of drug loading in erythrocytes involves various physical and chemical methods, in which cells are broken down, and the drug is entrapped into erythrocytes. Thus the entrapped drugs are resealed to form resealed erythrocytes. Resealed erythrocytes are used for targeting the drug delivery, and in treatment of parasitic diseases (antimalarial, antiamoebic drugs).

Advantages:

- Biodegradable, biocompatible and non-immunogenic.
- Wide variety of chemicals or drugs can be entrapped.
- Prevents degradation of drug from in activation by endogenous chemicals.

Fast dissolving tablets (FDT)

It is one of novel drug delivery system, in which the dosage form is administered, in absence of water or fluid intake. The administered dosage form dissolves or disintegrates in saliva within 60 seconds. Advantages of fast dissolving tablet include increased patient compliance with ease administration.

Iontophoresis

It is electrochemical process, which involves application of electric current or voltage, thus transport of solute molecules occurs through the skin, by creating potential gradient. Advantages of fast dissolving tablet include increased patient compliance with ease administration.

Phonophoresis

It involves transport of drug through the skin by ultra sound or ultra sonophoresis.

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