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Perspective

Mechanism of Targeted Therapeutics and Disease Outcomes using Novel Drug Delivery Systems

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DESCRIPTION

Drug delivery is the method or process of administering pharmaceutical compounds to produce a therapeutic effect in humans or animals. A new drug, also known as a new molecular entity or new chemical compound, is an entity distinct from drugs previously approved by the U.S. Food and Drug Administration (FDA). Novel drug delivery systems are new approaches to drug delivery that address the limitations of conventional drug delivery systems. New drug delivery systems can generally be divided into three categories according to their application, Rapid-acting drug delivery systems, long-acting drug delivery systems, and high-potency drug delivery systems. These drugs are innovative products that offer new ways to treat certain medical conditions. In the field of nanomedicine, Novel Drug Delivery Systems (NDDS) are being used to overcome the limitations of conventional dosage forms. Conventional formulations are associated with poor drug solubility, toxic side effects, lack of site selectivity, uncontrolled release profiles, and poor bioavailability. Recently, NDDS has received a lot of attention, especially in cancer therapy and immunodeficiency diseases, due to its high potency and stability. New substances include non-opioids such as synthetic cannabinoids, cathinone, and novel benzodiazepines.

Over the past decades, different types of NDDS have been developed. Specifically, they are microparticles, nanoparticles, osmomodulated drug delivery systems, Transdermal Therapeutic Systems (TTS), aquasomes, dendrimers, multiemulsions, microemulsions, liposomes, niosomes, pharmacophores, self-regulating drug delivery system, and brain-targeted delivery system. NDDS includes solubility, bioavailability, protection against toxicity, enhanced pharmacological activity and stability, enhanced tissue distribution of macrophages, and protection against chemical degradation. These novel formulations have advantages over traditional formulations. NDDS has played a more important role in establishing nanomedicine than traditional dosage forms. Treatment of several end-stage diseases, such as cancer and immunodeficiency diseases, requires controlled and targeted therapy with minimal side effects. Pharmaceutical companies are focusing on developing new drug delivery systems to overcome the limitations of using conventional dosage forms. For this reason, new drug delivery systems could become one of the fastest-growing segments in the pharmaceutical industry.

Conventional dosage forms and delivery systems pose multiple challenges to disease treatment, including low bioavailability, high doses, frequent dosing, and systemic side effects. Also, the increasing prevalence of chronic diseases, high demand for non-invasive drug delivery, and targeted delivery of drugs with high bioavailability and low side effects have paved the way for innovation in drug delivery systems. Conventional dosage forms provide immediate drug release and fluctuates drug levels in the blood depending on the dosage form. New drug delivery is often through chemical formulations of drugs, but may also include medical devices and drug combination products. Drug delivery is a concept highly integrated into dosage forms and routes of administration.

NDDS reduces the frequency of administration and slows the rate of rise of drug concentration in the blood. A drug that is administered can have a significant impact on its effectiveness. Some drugs have an optimal concentration range for maximum benefit, and concentrations above or below this range may be toxic or have no therapeutic effect. On the other hand, the very slow progress in therapeutic efficacy for major diseases suggests a growing need for multidisciplinary approaches to deliver therapeutics to tissue targets. This has given rise to new ideas for controlling pharmacokinetics, pharmacodynamics, nonspecific toxicity, immunogenicity, biorecognition, and drug efficacy. These new strategies, often called Drug Delivery Systems (DDS), are based on an interdisciplinary approach that combines polymer science, pharmacology, bioconjugate chemistry, and molecular biology.

Many pharmaceuticals, such as peptides and proteins, antibodies, vaccines, and gene-based drugs, may be susceptible to enzymatic degradation or may not be efficiently absorbed into the systemic circulation due to their molecular size and charge. Administration through these routes is generally prohibited. The overarching goal in developing new drug delivery technologies is to increase the efficiency and safety of drugs in the drug delivery process and bring greater convenience to patients. Advancement of existing drug molecules from conventional forms to novel delivery systems can greatly improve their performance in terms of patient compliance, safety, and efficacy.

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