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Drug Delivery System Including Liposomal and Beaded

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Abstract

Drug delivery is the method or process of administering pharmaceutical compounds to produce a therapeutic effect in humans or animals. Nasal and pulmonary routes of drug administration are becoming increasingly important for the treatment of human disease. These routes represent promising alternatives for parenteral drug delivery, especially for peptide and protein therapeutics. To this end, several drug delivery systems have been formulated and investigated for nasal and pulmonary delivery. These include, but are not limited to liposomes, proliposomes, microspheres, gels, prod rugs, cyclodextrins. Nanoparticles composed of biodegradable polymers have demonstrated the safety of delivering drugs in a prescribed manner and degrading within an acceptable timeframe, meeting the stringent requirements placed on these delivery systems.

Keywords: Brain targeting; Infectious diseases; Liposomal; Lung diseases

Introduction

Developing new drug molecules is expensive and time-consuming. Various methods have been tried to improve the safety-efficacy ratio of the 'old' drugs [1]. B. Therapeutic medication monitoring; dose titration; and customized drug therapy. Controlled-rate drug delivery; low-speed and targeted delivery are other very attractive methods and have been vigorously pursued. Interestingly; considerable research and many publications from the US and Europe have been written by Indian researchers. Numerous studies in animals and humans have provided a better understanding of the pharmacokinetic and pharmacodynamics principles that govern the action and properties of potent opioid analgesics; inhaled anesthetics; sedatives/hypnotics; and muscle relaxants [2]. Now these studies suggest that the skin; oral and nasal mucosa can be used as alternative routes of administration for analgesics and anesthetics. Similar developments in other compounds have spawned a number of new devices; concepts and techniques collectively termed controlled release technology (CRT). Examples of CRTs include controlled-release transdermal and trans mucosal delivery systems; ml6 nasal and oral aerosol sprays; drug-impregnated lozenges; encapsulated cells; oral soft gels; iontophoretic devices for transdermal drug delivery; and various programmable There are many implantable drug delivery devices. There are many factors driving interest in developing these new devices; concepts; and technologies. Although conventional drug delivery methods are widely used; there are many problems that these methods can potentially overcome [3]. Equally important; these advances may appear attractive relative to the cost of developing new drugs. Rising R&D costs; alternative investment opportunities for pharmaceutical companies; fewer companies conducting pharmaceutical research; and erosion of effective patent terms have reduced the introduction of new chemicals since the late 1950s. It is now estimated that drug discovery; clinical trials; development and regulatory approval will take him 10 years and cost well over $120 million.

Beaded Delivery Systems

Although not used with oxybutynin; bead delivery formulations are another method used to achieve long-acting drug levels coupled with the convenience of once-daily dosing [4]. This system has been successfully coupled with tolterodine tartrate and is available as Detrol LA (Pharmacia; Pea pack; NJ). A bead system basically consists of several small beads made of an inert material (such as polystyrene). An active drug is coated onto the beads and enclosed in a delivery capsule [5]. Drug delivery from this system is acid sensitive; as drug levels depend on the release of gastric acid. This process produces a pharmacokinetic pattern that roughly resembles a zero-order pattern; with Cmax reaching approximately 4-6 hours after dosing and sustained levels observed over 24 hours after the first dose. In terms of both efficacy (improved incontinence rates) and tolerability; Detrol LA has comparable advantages to immediate release tolterodine [6]. In a double-blind; placebo-controlled; randomized study of 1;529 patients; the LA formulation was associated with 18% fewer episodes of incontinence than immediate-release tolterodine; and both formulations were associated with decreased urinary frequency and urine volume. Was statistically superior to placebo in increasing overall dry mouth was 23% lower with tolterodine LA than with immediate release tolterodine [7]. Payout rates were similar for all weapons. Van Kerrebroeck came to the conclusion that the rapid release version of tolterodine was inferior to the LA formulation.

Liposomal and Targeted Drug Delivery System

Drug delivery systems can; in principle; improve the efficacy and/or reduce the toxicity of anticancer drugs. Long-circulating macromolecular carriers; such as liposomes; can exploit the effect of “enhanced permeability and retention” for preferential extravasation from tumor vessels [8]. Liposomal anthracycline have achieved very efficient drug encapsulation; resulting in significant anticancer activity with reduced cardio toxicity and very long-lasting effects such as liposomal daunorubicin and paginated liposomal doxorubicin. Contains circular versions of Paginated liposomal doxorubicin has demonstrated significant efficacy in the treatment of breast cancer as immunotherapy and in combination with other chemotherapeutic agents. Additional liposomal constructs have been developed for the delivery of other drugs [9]. Next-generation delivery systems will

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include true molecular targeting. Immunoliposomes and other ligand-directed constructs represent the integration of biological components capable of tumor targeting using delivery technologies. Although not used with oxybutynin; bead delivery formulations are another method used to achieve long-acting drug levels coupled with the convenience of once-daily dosing. This system has been successfully coupled with tolterodine tartrate and is available as Detrol LA (Pharmacia; Pea pack; NJ). A bead system basically consists of several small beads made of an inert material (such as polystyrene). An active drug is coated onto the beads and enclosed in a delivery capsule. Drug delivery from this system is acid sensitive; as drug levels depend on the release of gastric acid [10]. This process produces a pharmacokinetic pattern that roughly resembles a zero-order pattern; with Cmax reaching approximately 4-6 hours after dosing and sustained levels observed over 24 hours after the first dose. In terms of both efficacy (improved incontinence rates) and tolerability; Detrol LA has comparable advantages to immediate release tolterodine. In a double-blind; placebo-controlled; randomized study of 1;529 patients; the LA formulation was associated with 18% fewer episodes of incontinence than immediate-release tolterodine; and both formulations were associated with decreased urinary frequency and urine volume. Was statistically superior to placebo in increasing Overall dry mouth was 23% lower with tolterodine LA than with immediate release tolterodine [11]. Payout rates were similar for all weapons. Van Kerrebroeck came to the conclusion that tolterodine's LA formulation was superior to its quick release variant. Drug delivery systems can; in principle; improve the efficacy and/or reduce the toxicity of anticancer drugs. Long-circulating macromolecular carriers; such as liposomes; can exploit the effect of "enhanced permeability and retention" for preferential extravasation from tumor vessels [12]. Liposomal anthracycline have achieved very efficient drug encapsulation; resulting in significant anticancer activity with reduced cardio toxicity and very long-lasting effects such as liposomal daunorubicin and paginated liposomal doxorubicin. Contains circular versions of Paginated liposomal doxorubicin has demonstrated significant efficacy in the treatment of breast cancer as immunotherapy and in combination with other chemotherapeutic agents. Additional liposomal constructs have been developed for the delivery of other drugs [13]. Next-generation delivery systems will include true molecular targeting. Immunoliposomes and other ligand-directed constructs represent the integration of biological components capable of tumor targeting using delivery technologies.

As mentioned above; currently approved liposomal drug delivery systems offer stable formulations; improved pharmacokinetics and some degree of 'passive' or 'physiological' targeting to tumor tissue. However; these carriers do not directly target tumor cells [14]. Design modifications that protect liposomes from undesired interactions with plasma proteins and cell membranes; versus reactive carriers such as cationic liposomes; also prevent interactions with tumor cells. Instead; after extravasation into tumor tissue; liposomes remain as drug-containing depots in the tumor stroma [15]. Liposomes are ultimately enzymatically degraded and/or attacked by phagocytic cells; releasing the drug for subsequent diffusion into tumor cells. Next-generation drug carriers in development offer direct molecular targeting of cancer cells via antibody-mediated or other ligand-mediated interactions.

Immunoliposomes, in which mAb fragments are attached to liposomes, represent a strategy for molecular targeting of drug delivery. Anti-HER2 Immunoliposomes have been developed using Fab' or scFv fragments linked to long-circulating liposomes. Rice field in preclinical studies; anti-HER2 Immunoliposomes efficiently bound and internalized HER2-overexpressing cells; resulting in efficient intracellular delivery of the encapsulated drug [16]. Anti-HER2 Immunoliposomes loaded with doxorubicin showed potent and selective anticancer activity against HER2-overexpressing tumors. This included efficacy significantly superior to all other therapies tested (free doxorubicin; liposomal doxorubicin; free mAb [trastuzumab]; and combinations of trastuzumab and doxorubicin or liposomal doxorubicin) increase [17]. Anti-HER2 Immunoliposomes are now being scaled up for clinical trials.

The Immunoliposomes approach offers many theoretical advantages compared to other antibody-based strategies. Anti-HER2 Immunoliposomes administration of doxorubicin can avoid the prohibitive cardio toxicity associated with combined trastuzumab and doxorubicin treatment [18]. Anti-HER2 Immunoliposomes; unlike trastuzumab; have no anti-proliferative activity; no antibody-dependent cytotoxicity; and can be constructed using scFvs that require threshold levels of HER2 expression for delivery. In contrast to drug-immunoconjugates which consist of small number of drugs (typically less than 10 drugs per mAb) conjugated directly to selected residues on the mAb via linker; Immunoliposomes Take advantage of the exponentially larger capacity of loaded liposomes (up to 104 drugs) Per liposome. Immunoliposomes are also non-immunogenic and appear to be able to prolong circulation with repeated administration [19]. Antibody-based targeting has also been developed in combination with polymer systems. Similarly; ligand-based targeting is being pursued using growth factors; hormones; vitamins (such as folic acid); peptides; or other specific ligands in combination with both liposomes and polymers. Liposomes are concentric bilayer structures of amphipathic phospholipids; and depending on the number of bilayers; liposomes are classified as multi lamellar (MLV); small uni lamellar (SUV); or large uni lamellar (LUV). Their size ranges from 0.025 to 10 microns in diameter. Liposome size and morphology are regulated by the manufacturing process and composition. Liposomes are used to deliver drugs; vaccines; and genes for various diseases.

Conclusion

Drug development of drug delivery systems is being pursued with enthusiasm in many laboratories in India. They have been studied in vitro for release patterns and possibly in vivo in animals for pharmacokinetics; but rarely for efficacy. There are few data regarding the benefits of DDS in clinical trials and patients. Pharmacologists should be involved in DDS pharmacokinetic and pharmacodynamic studies once the product has reached meaningful results (clinical use).

Conflict of Interest

None

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