



UTILIZATION OF POLYMER AND LIPID-BASED DRUG DELIVERY SYSTEMS IN TREATMENT OF NEUROLOGICAL DISORDERS- A MINI REVIEW

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Abstract:

In modern drug discovery techniques consistently increasing in the number of new pharmacologically active lipid compounds these compounds are poorly water-soluble. A great challenge of making this medication for oral administration with the desired bioavailability. Epilepsy is a severe neurological disorder that needs rapid treatment. To enhancement of its bioavailability, we need to make lipid-based drugs. On other hand, the surface tension reducing agents will give poor water-soluble formulation. Treatment of Neurological disorder is still a challenge for medical practitioners because of restricted moments and barriers. The solid lipid nanoparticles (SLN) and nanoemulsions are easily avoided the blood-brain barrier. Therefore, there is a maximum therapeutic efficacy achieved by using the lipid and polymer-based drug delivery system in the treatment of neurological disorders.

Keywords: Neurological disorder, Lipid, Polymer, Lipid Based Drug delivery systems, Epilepsy, Treatment.

Introduction:

Many neurological disorders are seeking treatments and in most of the neurologic diseases based on the hypersynchronous activity of the neurons in the cerebral cortex or neurochemical imbalance in the brain. Every year more than 500000 patients have reported this disorder in the world. In a neurological disorder, the tolerance of medication is high due to the molecular mechanism.^[1,2,3]

The drug which able to cross BBB that only able to treat neurological disorders. The small molecular weight lipophilic molecule can easily penetrate or cross BBB. In this review, we are focusing on the creative drug delivery system. These transporters play a very important role it is restricting access of molecules to the brain. Specifically, few transporters permit therapeutic drug molecules to the brain.^[4,5,6,7] The ATP binding cassette transporter (ABC-Transporter) & P-glycoprotein is one of the most studied BBB transporters of the ABC family. P-glycoprotein can eliminate NRx drug molecules, such as phenytoin, phenobarbital, and levetiracetam. There is another one transporter named as solute carrier (SLC) transporter which includes organic anion transporter present over neurons.^[8,-23] The neurochemical which get affected in neurologic disorder & their roles are Serotonin, dopamine, adrenaline, acetylcholine, GABA, glutamate.^[24]

Glutamate: It is an excitatory neurotransmitter if it is in higher in amount then the brain will hyperactive .^[24]

GABA: It is an inhibitory neurotransmitter that diminished the activity of neurons which leads to loss of attention mood swings & drowsiness.^[24]

Serotonin: The synonym of serotonin is 5-Hydroxytryptamine. It is the hormone of happiness that plays the important role in the mood and normal behavior of a person. It manages the autonomic responses of the brain such as body temperature vasoconstriction vasodilation sleep & hormonal regulations, the level of serotonin involved in depression. It is a psychoactive substance and has a lot of roles in certain mental disorders.^[24]

The present review highlights, the use and clinical implications of lipid or polymer-based drug delivery systems in the treatment of neurological disorders.

Challenges in lipid and polymer delivery systems

If we can manipulate these transporters it will significantly enhance the penetration of the drug into the brain. Lipid-based drug delivery system (LBBDS) has the potential to emerge as a novel treatment for various neurological disorders.^[25,26'27'28'29] These carriers will protect the drug from degradation & on the other hand reducing the neural toxicity. Lipid and polymer delivery systems leading from front because of its higher advantages & numerous biocompatibilities.^[30,31,32,33,34-40] To meet a wide range of product requirements these formulations can be modified in various ways per the disease condition, route of administration, and also cost product stability, toxicity, and efficacy. Lipid-based carriers are safe and efficient hence they have been proved to be attractive candidates for the formulation of pharmaceuticals, as well as vaccines, diagnostics, and nutraceuticals. Lipid and polymer delivery systems enhance the solubility and bioavailability of drugs.^[41]

In LBBDS oral route is more preferable because of its properties like noninvasiveness, inexpensive with fewer side effects.^[42,43,44,45,46,47] Easiest and most convenient route of administration for the chronic therapies of diseases. Solubility dispersion digestion we have to keep in our mind while formulating LBBDS.^[48,49,50,51,52-61] With LBBDS various molecules of the drug have been created that have a potential for therapeutic action. But the real problem is most of the novel discovered molecules possess a higher molecular weight and belong to biopharmaceutical classification system (BCS)-II, these molecules have poor aqueous solubility and high membrane permeability.^[62] These two characteristics are a challenging task for the bioavailability of orally-administered drugs. On the other hand, the drugs possess low solubility which leads to low dissolution and lack of good absorption properties. The poor solubility of the molecules not only gives low oral bioavailability but it leads to high inter and intracellular variability and lack of dose responses. Few drugs may enhance bioavailability when administered along with food.^[63,64] To formulate such drugs which is safe as well as efficacious, we have to maintain a balance between bioavailability, disposition within the body & toxicity.^[65,66] Their various techniques can be used e.g. micronization, complexation with cyclodextrins, dispersions of solid, surfactants, and permeation enhancers have been reported to solve the permeability & solubility issues.^[67,68]

Formulation of lipid and polymer delivery systems

Lipid and polymer delivery systems can be developed successfully by consideration of the following formulation objectives in which selection of excipients based on their melting point and fatty acid composition, HLB value, disposability, and digestibility; proper screening of required excipients for appropriate solubility, dispersion & dissolution properties, which must be compatible with API and able to enhance the stability of formulation design of proper animal models to evaluate in vivo performance of the chosen formulation and improve the formulation with the proper drug loading and dissolution profile.^[69,70,71,72]

Silica Based Materials for Solid Carriers

Silica-based materials have had a traditional role in lipid and polymer delivery systems silica is very important excipients which increases surface area and that enhance the absorbance of the drug. MCM-41 and SBA-15 are mesoporous materials. Researches have been a great interest in silica-based materials as delivery systems for numerous variety of hydrophilic and hydrophobic drug substances. It is suitable for poorly water-soluble drugs, the physicochemical properties of silica-based materials makes the effective in enhancing drug dissolution and oral absorption of drug multiple mechanisms, in which (i)

preservation of drug molecules in the molecularly dispersed (i.e. amorphous) form, (ii) maintain the drug contact with solid surface & control the balance between intermolecular interaction in aqueous media silica-based materials are hydrophilic, (iii) It allows the supersaturated drug solubilization which helps in a drug absorption.^[69,70,71,72]

Assessment of safety and Toxicity concerns of delivery systems in Neurological disorders

The use of novel materials for lipid and polymer delivery systems will bring various regulatory challenges, like proving biocompatibility and safety to human use. Whilst the oral route is considered as safer in comparison to other delivery routes of administration (e.g. parenteral), The importance given by the regulatory agencies on the safety of nanostructured materials has increased in recent times due to notable advances in the field of nanomedicine. In which the repurposing of known and biocompatible excipients like montmorillonite, starch & carbonate salts, for solidifying lipid and polymer delivery systems have negligible regulatory hurdles when seeking marketing approval. Lipid and polymer delivery systems are a cost-effective and biocompatible approach towards novel therapies for neurologic disorders.^[69,70,71,72]

Conclusion

Lipid and polymer delivery systems are bioavailability enhancing formulations for poorly water-soluble drugs, on the other hand, lipid and polymer delivery systems help in minimizing the cost. Lipid and polymer delivery systems are suitable for the hydrophilic as well as the hydrophobic nature of the drug. The solid carrier of lipid and polymer delivery systems like silica-based increase the area of absorption of drugs which leads to help in hassle-free absorption. If absorption of the drug is in the desired manner will give appropriate permeability and smooth transportation of the drug across the barriers. There are some regulatory authority hurdles but once it clears then will achieve the desired therapeutic action with less detrition and wastage of drug. Lipid and polymer delivery systems enhance the biopharmaceutical performance of the drug.

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