Short Communication
Volume 8:5, 2022

Epilepsy Journal

ISSN: 2472-0895 Open Access

Advance Technique of Drug Delivery System

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Abstract

Over the last few decades, nose-to-brain medication administration has piqued attention as a potential treatment for a variety of CNS illnesses and psychiatric disorders. Several nasal formulations have been created to bypass the blood-brain barrier and deliver medications directly to the CNS via the olfactory and trigeminal pathways. However, medication absorption by the nasal mucosa is poor, and the volume of the nasal cavity is small, making nose-to-brain drug transport difficult.

Keywords: Drugs • Medication • Nose and brain

Introduction

Nose-to-brain pharmaceutical administration has attracted interest as a potential cure for a number of CNS diseases and psychiatric disorders during the past few decades. To get across the blood-brain barrier and deliver drugs directly to the CNS via the olfactory and trigeminal pathways, a number of nasal formulations have been developed. However, due to poor nasal mucosal drug absorption and a tiny nasal cavity, drug delivery from the nose to the brain is challenging. Formulations based on nanostructured lipid carriers (NLCs) or solid lipid nanoparticles (SLNs) are effective nose-to-brain drug delivery strategies that boost drug solubility and penetration, prolong therapeutic action, and decrease enzymatic degradation. Numerous research teams have examined the in vivo pharmacokinetics and pharmacodynamics of SLNs and NLCs nose-to-brain administration techniques. This review was done to give an overview of these studies and to highlight research on formulations based on SLN and NLC for the treatment of CNS conditions such epilepsy, schizophrenia, and neurodegenerative diseases. We evaluate the efficacies and brain targeting effectiveness of these formulations based on assessments of their pharmacokinetic characteristics and toxicities, identify some information gaps, and suggest future development goals.

Description

Due to pharmacological side effects, the complexity of the brain, and, most importantly, the lack of efficient methods for transporting medicines across the blood-brain barrier (BBB), drug development for CNS diseases and psychiatric disorders is challenging [1,2]. The BBB shields the CNS from blood solutes and pathogens because it is composed of tightly knit endothelial capillary cells [3]. The BBB can be penetrated by solute molecules in a variety of ways. Several lipid-soluble substances can enter the brain by passive diffusion. The chemical's lipophilicity controls how quickly and deeply it enters the brain in this method. However, a lot of these substances are frequently forced back into the circulatory system via efflux pumps located in the BBB.

Small polar molecules such amino acids, glucose, nucleosides, and organic anions and cations are transported through carrier-mediated transport.

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Received: 24 September, 2022; Manuscript No: elj-23-86677; **Editor assigned:** 27 September, 2022, PreQC No: P-86677; **Reviewed:** 07 October, 2022, QC No: Q-86677; **Revised:** 12 October, 2022, Manuscript No: R-86677; **Published:** 18 October, 2022, DOI: 10.37421/2472-0895.2022.8.175

Another method for transferring large molecules, including as iron, insulin, and leptin, is receptor-mediated transcytosis [4]. Similar to Lipinski's rule of five [5], a molecule's ability to cross the BBB depends on its molecular weight, lipophilicity, H bond donors and acceptors, charge, and polar surface area. Because of this, it is difficult to develop drugs that specifically target the brain because only a few number of hydrophobic and low molecular weight chemicals can pass across the BBB, while others are hampered by the BBB's barrier qualities.

Conclusion

They enhance drug solubility and permeability, decrease mucociliary clearance, minimise drug enzymatic degradation, and enhance nasomucosal biocompatibility. Formulations based on SLN and NLC have been created and tested for nose-to-brain delivery in numerous investigations. A increasing corpus of research indicates that SLNs and NLCs are efficient drug delivery devices that can carry drugs directly to the brain. Although promising SLN and NLC-based formulations in the preclinical stage may fail in the clinical stage for a variety of reasons, there are still a number of challenges to be solved. To begin with, the anatomy of the nasal canals in humans and animals varies. By species, the nasal cavity's length, surface area, volume, histology, and geometry affect medication retention and absorption. Rats and mice were used in the majority of the research included in this evaluation for PK and PD studies due to their accessibility and low cost. On the other hand, they have nasal cavities that are very dissimilar from those of humans and other animals like rabbits, sheep, monkeys, and dogs. Intranasal administration is difficult in rats and mice because of their small nasal orifices, but it is simple in rabbits, lambs, primates, and dogs because theirs are considerably larger. The olfactory area only takes up 10% of the nasal cavity in humans, monkeys, rabbits, and lambs, but it can take up to 50% of the nasal canal in mice, rats, and dogs. Second, the amounts of IN administered vary according on the species. For example, the amounts range from 10 L for mice to 40-50 L for rats and higher levels for other larger animals. Additionally used for administration are micropipettes, syringes, nasal atomizers, sprays, and cannulas, which could affect therapeutic outcomes and overall drug absorption. Third, several strategies have been used to assess the effectiveness of formulations in targeting the brain, and different experimental approaches for PK studies on nose-to-brain transfer by IN injection are used by different research teams. Therefore, PK investigations on formulations created for nose-to-brain distribution ought to be somewhat standardised.

Conflict of Interest

None.

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How to cite this article: Tani, Alpah. "Advance Technique of Drug Delivery System." Epilepsy J 8 (2022): 175.