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A New Frontier in Neurological Treatments Nasal Drug Delivery to the Brain

Vaishnavi V. Khairnar[1], Yogesh S. Wankhede[2], Vasundhara D. Ahire[3], Amol R. Patil[4], Dr. M. R. N. Shaikh[5]

[1]Department of Pharmaceutical Chemistry, Srujan Foundations, G. D. Burkule Institute of Research and Education in Pharmaceutical Sciences, Cidco Nashik Maharashtra, India.
[3,4]Department of Pharmaceutics, Srujan Foundations, G. D. Burkule Institute of Research and Education in Pharmaceutical Sciences, Cidco Nashik Maharashtra, India.
[2]Department of Pharmaceutical Chemistry, METs Institute of D Pharmacy, Adgaon Nashik Maharashtra, India.
[5]Department of Pharmacognosy, METs Institute of D Pharmacy, Adgaon Nashik Maharashtra, India.

Email Id: serviceheb@gmail.com

ABSTRACT

A viable approach for treating neurological illnesses is the developing field of nose-to-brain medication administration, which circumvents the blood-brain barrier (BBB). This delivery strategy takes advantage of the nasal cavity's unique structure, which allows medications to reach the brain directly via the olfactory and trigeminal nerve pathways, bypassing systemic circulation and lowering side effects. Intranasal administration is a non-invasive, needle-free way of delivering therapeutic drugs to the central nervous system (CNS) that outperforms older approaches, which sometimes suffer from low BBB permeability. Various therapeutic formulations, including nanoparticles, nano emulsions, and chitosan-based carriers, have been shown in studies to enhance CNS targeting by improving drug stability, bioavailability, and retention time in the nasal cavity. These formulations have the potential to be used in a variety of treatments, including small-molecule medicines, peptides, and gene therapies, allowing them to address CNS illnesses such as Alzheimer's, Parkinson's, depression, migraines, and seizures. Human experiments employing intranasal delivery of insulin, oxytocin, and other CNS-active drugs have demonstrated positive results, underlining the clinical promise of this approach. Despite these advances, issues like as formulation stability, nasal enzymatic degradation, and mucociliary clearance continue to impede consistent drug delivery efficacy. To overcome these difficulties, precision-targeted devices are being developed that lengthen medication retention duration and improve delivery to the olfactory region. With its ability to provide effective, targeted treatment with less systemic exposure, nose-to-brain administration has the potential to completely transform neurotherapeutics. It is anticipated that further research and technology

advancements will result in improved formulations and sophisticated delivery systems, opening the door for a broad range of intranasal treatments designed to address neurological and mental disorders.

Keywords: Intranasal Drug Delivery, Nano formulations, Chitosan, Nose-to-Brain, Blood Brain Barrier, CNS, Respiration.

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