

# Development and Application of Lipid Nanotechnology on Infectious Diseases of CNS- Current Scenario

Swarupanjali Padhi<sup>1,\*</sup>, Rupa Mazumder<sup>1</sup>, Shradha Bisth<sup>2</sup>

<sup>1</sup>Pharmacy Institute, Noida Institute of Engineering and Technology, Greater Noida, Gautam Buddha Nagar, Uttar Pradesh, INDIA.

<sup>2</sup>Department of Pharmacy, Sardar Bhagwan Singh Post Graduate Institute of Biomedical Science and Research, Balawala, Dehradun, Uttarakhand, INDIA.

## ABSTRACT

**Background:** This is an era of inventive technology illuminating fundamental mechanisms of diseases and fabricating drug molecules according to prerequisite condition, but it is still a challenge to target infectious diseases specially in CNS due to various restrictions of drug delivery to the brain and drawbacks of various conventional antimicrobial agents. These are prone to development of multiple drug resistances as sufficient amount of drug cannot reach to the site of infection. **Materials and Methods:** This review summarizes the problems associated with the amount of drug delivered to CNS and the emergence of new tools like lipid nanoparticles to deal with the current challenges in treating infectious diseases of CNS. **Results:** This article discusses the anatomical and physiological barriers of CNS and development of various drug delivery system, specially the development of lipid nanoparticles including solid lipid nanoparticles, nanostructured lipid carriers, lipid drug conjugated nanoparticles to address the challenges. **Conclusion:** This article is an extensive review on current status of drug therapy of infectious diseases of CNS. Lipid nanoparticles like SLN and NLCs have proven to be effective tools for improved drug delivery to CNS and PNS.

**Key words:** Multiple drug resistance, Solid lipid nanoparticles, Nanostructured lipid carriers, Lipid drug conjugated nanoparticles, CNS, Blood-brain barrier.

## INTRODUCTION

The futile treatment of CNS disorders by most of the neurotherapeutics can be due to their ineffective drug delivery. Although brain has relatively high blood flow yet drug delivery to the brain is most challenging because of the two physiological barriers *i.e.*, Blood-Brain Barrier (BBB) and Blood-Cerebrospinal Fluid Barrier (BCFB). BBB and BCFB separates the brain from its blood supply controlling the transport of compounds and this is the reason why most of the brain or CNS associated diseases remain untreated by effective therapies. Contemporary approaches like ligand conjugation and nanotechnology are used to target the barriers of CNS by means of various transport pathways and various surface fabrication.<sup>1</sup>

Infectious diseases were the main cause of death at the juncture of 19<sup>th</sup> and 20<sup>th</sup> century.<sup>2</sup> The advent of antibiotics led to a

decrease in morbidity and mortality in the last century. However, of late microbe developing resistance to antibiotics is posing a serious problem in health administration.<sup>3,4</sup> The cause of brain infection are viruses, bacteria, fungi or occasionally, protozoa or parasites listed in Table 1.<sup>5-19</sup> Another group of brain disorders, called spongiform encephalopathies, are caused by abnormal substances called prions.<sup>5,6</sup>

### Challenges Associated with Infectious Disease of Brain

There can be possibly three main causes which makes the management of infectious disease difficult:

#### Delay in Clinical Diagnosis

In case of patients where the classic symptom may be minimal or absent.

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#### Correspondence:

**Mrs. Swarupanjali Padhi**,  
Assistant Professor, Institute of Pharmacy, Noida Institute of Engineering and Technology, Greater Noida, Gautam Buddha Nagar, Uttar Pradesh – 201306, INDIA.  
Phone: +91-7011164903  
E-mail: swppadhi@gmail.com



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