Intranasal Delivery of Nano Neurotherapeutics: A Meta Opinion

Chandrakantsing V Pardeshi *, Abhijeet D Kulkarni1, Veena S Belgamwar2 and Sanjay J Surana3

1Department of Pharmaceutics, R. C. Patel Institute of Pharmaceutical Education and Research, India
2Department of Pharmaceutical Sciences, R.T.M. Nagpur University, India
3Department of Pharmacognosy, R. C. Patel Institute of Pharmaceutical Education and Research, India

Abstract

The most stringer barrier for the delivery of neurotherapeutics in-vivo is presented by the blood-brain barrier which limits the access of neurotherapeutics to the CNS effectively. Intranasal delivery of neurotherapeutics is one of the promising endeavors to surmount the blood-brain barrier, designated as direct nose to brain transport, by the passage of neurotherapeutics along the olfactory and trigeminal nerve pathways. The outstanding findings obtained from the nanomedicines in the preclinical studies for the treatment of CNS disorders via intranasal administration have harnessed the scientists from various research groups to walk around the nano neurotherapeutics for the effective management of CNS disorders. Currently, 33 nanotherapeutics and 67 commercialized nanodevices are on the market but none of them is a nano neurotherapeutic. This could be attributed to the fact that though the researchers have obtained outstanding preclinical findings but these were followed by the disappointing clinical results. To conclude in summary, the authors want to mention here that the development of targets-specific nano pharmaceuticals delivered via non-invasive intranasal route of administration might present some hope to the development of novel neurotherapeutics for major CNS disorders. According to our assessment, in order to come out with a newly designed neurotherapeutic with optimized physicochemical, pharmacological, and pharmacokinetic properties, it requires several parameters to be studied in silico, in-vitro, and in-vivo, keeping in mind the complex nature of the brain.

Keywords: Nanotechnology; Nanomedicine; Neurotherapeutics; Intranasal; Drug delivery; CNS disorders; Nose to brain

Introduction

Nanotechnology is a multidisciplinary field where Nano refers to the scale of objects measured in nanometers (nm) means one nanometer is one billionth, or 10^-9, of a meter. The dimensions of nanoparticles are similar to biomolecules, such as proteins (1-20 nm), DNA (~diameter 2 nm), virus (~20 nm), cell surface receptors (~10 nm), hemoglobin (~5 nm), cell membrane (~6-10 nm). Therefore scientists with diverse interests and backgrounds have clutched their attention to work with and understand properties of materials on a nano scale and apply them in medicine [1]. Nanomedicine comes along one of the most important disciplines of nanotechnology and according to National Institute of Health (NIH), the term nanomedicine refers to highly specific medical intervention at the molecular scale for diagnosis, prevention and treatment of various diseases [2,3]. National Nanotechnology Initiative defines nanotechnology as the production of materials in the scale between 1 and 100 billionths of a meter (1-100 nm) at least in one dimension [4].

The last 20 years have witnessed an outburst in research on the development of novel drug delivery systems. Among them, the multiparticulate drug delivery systems have broad prospects in the pharmaceutical field [5]. Researchers from various disciplines have been harnessed by the superior outcomes obtained from such nanocarrier systems viz. greater therapeutic efficacy and reduced dosing frequency [6]. At the University of North Carolina, a chemistry Professor Joseph De Simone once said about nanoparticles that you want to deliver it where you want it, when you want it, without wasting it [7]. A very first report was published on the designing a specified drug...
Our research group is investigating the potential of neurotherapeutics in the treatment of various CNS disorders developed and evaluated for the brain targeting ability of administration. The nanoparticulate formulations have been based on delivery of neurotherapeutics via intranasal route of extensive investigations published on the theme nanotechnology – Research at a Glance

Intranasal Delivery of Nano Neurotherapeutics: shelves for the well being of society. still needed so as to bring the nano neurotherapeutics to the via intranasal route of drug administration is the topic of great author’s opinion, the nanotechnology-mediated delivery of CNS days, is the design of nanocarriers for targeted drug therapy. In general, the trend for the effective brain targeting of neurotherapeutics follows the below-mentioned sequence: nano neurotherapeutics > intranasal drug delivery is one of the promising avenue to unlock the limitations posed by the other routes of drug administration or other formulation strategies. In general, the trend for the effective brain targeting of neurotherapeutics follows the below-mentioned sequence:

Nasal mucoadhesive nanoparticles > Nasal solution > Intravenous nanoparticles > Intravenous solution

Nano technological interventions could be able to improve the brain targeting ability of neurotherapeutics. Thereby, nano neurotherapeutics would be useful to reduce the gap between preclinical and clinical investigations, to increase the success rate of neurotherapeutics in clinical studies and further, their scale-up and commercialization aspects. The current findings indicate that the development of nano neurotherapeutics will certainly occupy the pharmaceutical market, the only query is when? To conclude in summary, the authors want to mention here that the development of target-specific nano pharmaceuticals delivered via intranasal route of administration might present some hope to the development of novel neurotherapeutics for major CNS disorders. In order to come out with a newly designed neurotherapeutic with optimized physicochemical, pharmacological, and pharmacokinetic properties, it requires several parameters to be studied in silico, In-vitro, and In-vivo,
keeping in mind the complex nature of the brain.

Declaration of Interest

The authors have no relevant affiliations or financial involvement with any organization or entity with a financial interest in or financial conflict with the subject matter or materials discussed in the manuscript. This includes employment, consultancies, honoraria, stock ownership or options, expert testimony, grants or patents received or pending, or royalties.

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