Review Pharm Dev Technol. 2023 Nov 17:1-16. doi: 10.1080/10837450.2023.2285506.
Online ahead of print.

Nose-to-brain drug delivery for the treatment of glioblastoma multiforme: nanotechnological interventions

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PMID: 37975846 DOI: 10.1080/10837450.2023.2285506

Abstract

Glioblastoma multiforme (GBM) is the most aggressive malignant brain tumor with a short survival rate. Extensive research is underway for the last two decades to find an effective treatment for GBM but the tortuous pathophysiology, development of chemoresistance, and presence of BBB are the major challenges, prompting scientists to look for alternative targets and delivery strategies. Therefore, the nose to brain delivery emerged as an unorthodox and non-invasive route, which delivers the drug directly to the brain *via* the olfactory and trigeminal pathways and also bypasses the BBB and hepatic metabolism of the drug. However, mucociliary clearance, low administration volume, and less permeability of nasal mucosa are the obstacles retrenching the brain drug concentration. Thus, nanocarrier delivery through this route may conquer these limitations because of their unique surface characteristics and smaller size. In this review, we have emphasized the advantages and limitations of nanocarrier technologies such as polymeric, lipidic, inorganic, and miscellaneous nanoparticles used for nose-to-brain drug delivery against GBM in the past 10 years. Furthermore, recent advances, patents, and clinical trials are highlighted. However, most of these studies are in the early stages, so translating their outcomes into a marketed formulation would be a milestone in the better progression and survival of glioma patients.

Keywords: Glioblastoma multiforme; blood-brain barrier; lipidic nanoparticles; nanocarriers; nose to brain drug delivery; polymeric nanoparticles.