



REVIEW ARTICLE

Recent Advances in Inhaled Nanoformulations of Vaccines and Therapeutics Targeting Respiratory Viral Infections

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Abstract

With the rapid outbreak of respiratory viral infections, various biological (e.g. vaccines, peptides, recombinant proteins, antibodies and genes) and antiviral agents (e.g. ribavirin, palivizumab and valaciclovir) have been successfully developed for the treatment of respiratory virus infections such as influenza, respiratory syncytial virus and SARS-CoV-2 infections. These therapeutics are conventionally delivered via oral, intramuscular or injection route and are associated with several adverse events due to systemic toxicity. The inherent *in vivo* instability of biological therapeutics may hinder them from being administered without proper formulations. Therefore, we have witnessed a boom in nanotechnology coupled with a needle-free administration approach such as the inhalation route for the delivery of complex therapeutics to treat respiratory infections. This review discussed the recent advances in the inhalation strategies of nanoformulations that target virus respiratory infections.

Key Words inhaled vaccines and therapies · nanoformulation · respiratory viral infections

Abbreviations

ACE2	Angiotensin-converting enzyme 2
BOS	Bronchiolitis obliterans syndrome
BAL	Bronchoalveolar lavage
CD	Cluster of differentiation
CpG	Cytosine-guanine rich oligonucleotide motifs
DPI	Dry powder inhalation
FPD	Fine particle dose
FPF	Fine particle fraction
FliC	Flagellin
AuNPs	Gold nanoparticles
HA	Haemagglutinin
Th2	Helper type 2
HSCT	Hematopoietic stem cell transplant

HCNP	Hesperidin/chitosan nanoparticles
HCoV	Human coronaviruses
HSA	Human serum albumin
HCQ	Hydroxychloroquine
HPMC	Hydroxy Propyl Methyl Cellulose
IgG1	Immunoglobulin subclass 1
IgG2a	Immunoglobulin subclass 2a
M2e	Influenza matrix protein 2 ectodomain
IFN-γ	Interferon gamma
IL	Interleukin
IM	Intramuscular
IV	Intravenous
kg	Kilogram
LNP	Lipid nanoparticles
LRTI	Lower respiratory tract infection
ML	Maleic anhydride
MMAD	Mass median aerodynamic diameter
mRNA	Messenger RNA
hMPV	Metapneumovirus
μL	Microlitre
mg	Miligram
nm	Nanometer
NA	Neuraminidase
PIV	Parainfluenza virus
PIV2	Parainfluenza virus type 2
PIV3	Parainfluenza virus type 3

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