



NASOPULMONARY DRUG DELIVERY SYSTEM : A SYSTEMIC REVIEW

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Abstract: The goal of this thorough to investigate the application of Nasopulmonary drug delivery system for administration of drug in future. This system has many advantages like quick absorption, avoid first pass metabolism And systemic effect.Nasopulmonary drug delivery system is received a great deal of attention as convenient, reliable and promising method for the systemic administration of drug. It also describes the advantages, disadvantages and applications of nasopulmonary drug delivery system. Study about novel Approaches of Nasopulmonary drug delivery system. After the analysis of literature ,we can conclude that Nasopulmonary drug delivery system is provides potential for several drugs. This route has bright future ahead of it. And the years to come ,major advancement in this subject should be expected.

keywords: Nasopulmonary drug delivery system, nasal route, nasla spray,

Introduction:

Nasopulmonary drug delivery system is received a great deal of attention as convenient, reliable and promising method for the systemic administration of drug.In ancient times the Indian Ayurvedic system of medicine used nasal route or administration of drug that process is called as Nasya. Nasal route of drug delivery has been considered as a potential administration route to achieve faster and higher level of drug absorption because it is permeable to more compounds than the gastrointestinal tract due to lack of pancreatic and gastric enzymatic activity, neutral pH of the nasal mucus and less dilution by gastrointestinal contents.It is a useful delivery method for drugs that are active in low doses and show no minimal oral bioavailability such as proteins and peptides. One of the reasons for the low degree of absorption of peptides and proteins via the nasal route is rapid movement away from the absorption site in the nasal cavity due to the muco-ciliary clearance mechanism. For many years, drugs have been administered nasally for both topical and systemic action. Topical administration includes the treatment of congestion, rhinitis, sinusitis and related allergic or chronic conditions. Prominent therapeutic classes of drugs delivered are decongestants for cold nasal symptoms and antihistamines and corticosteroids for allergic rhinitis.The intranasal administration of drugs is an effective way for the systemic availability of drugs as compared to oral and intravascular routes of administration.¹

Anatomy of nose :

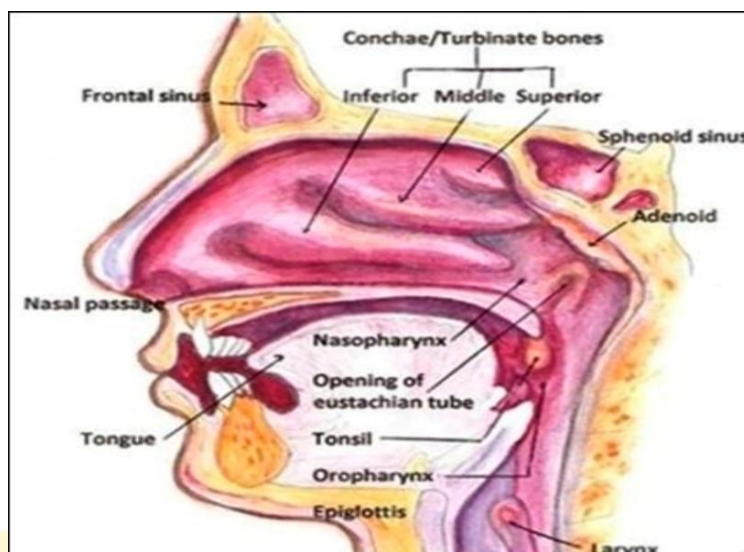


Fig No.1 : Anatomy of nose

<http://dreamstime.com/>

- The nasal cavity consists three main regions:

- 1) Nasal vestibule
- 2) Respiratory region

Major drug absorption.

15-20% of the respiratory cells covered by layer of long cilia size 2-4 μm .

- 3) Olfactory region

Small area in the roof of the nasal cavity of about 10 cm² drug is exposed to neurons thus facilitate it across the cerebro- spinal fluid.

- Normal pH of the nasal secretions in adult \rightarrow 5.5-6.5.
- Infants and young children \rightarrow 5.0-6.7.
- Nasal cavity is covered with a mucous membrane. Mucus secretion is composed of 95%- water, 2%-mucin, 1%-salts
- her proteins such as albumin, lysozyme and lactoferrin and 1%-lipids.

Mechanism of drug absorption:

Intercellular : Slow and passive absorption of peptides and proteins associated with intercellular spaces and tight junctions.

Transcellular: Transport of lipophilic drugs passive diffusion/active transport.

Transcytotic: Particle is taken into a vesicle and transferred to the cell.²

Mechanism of mucoadhesive drug delivery system :

Two mechanisms have been considered predominantly out of several mechanisms that have been proposed.

The first involves an aqueous route of transport, which is also known as the paracellular route. Key feature of this mechanism involves. This route is slow and passive . There is an inverse log correlation between intranasal absorption and the molecular weight of water-soluble compounds. Poor bioavailability was observed for a drug with a molecular weight greater than 1000 Daltons.

The second involves transport through a lipoidal route is also known as the transcellular process and is responsible for the transport of lipophilic drugs that show a rate dependency on their lipophilicity. For examples, chitosan, a natural biopolymer from shellfish, opens tight junctions between epithelial cells to facilitate drug transport³

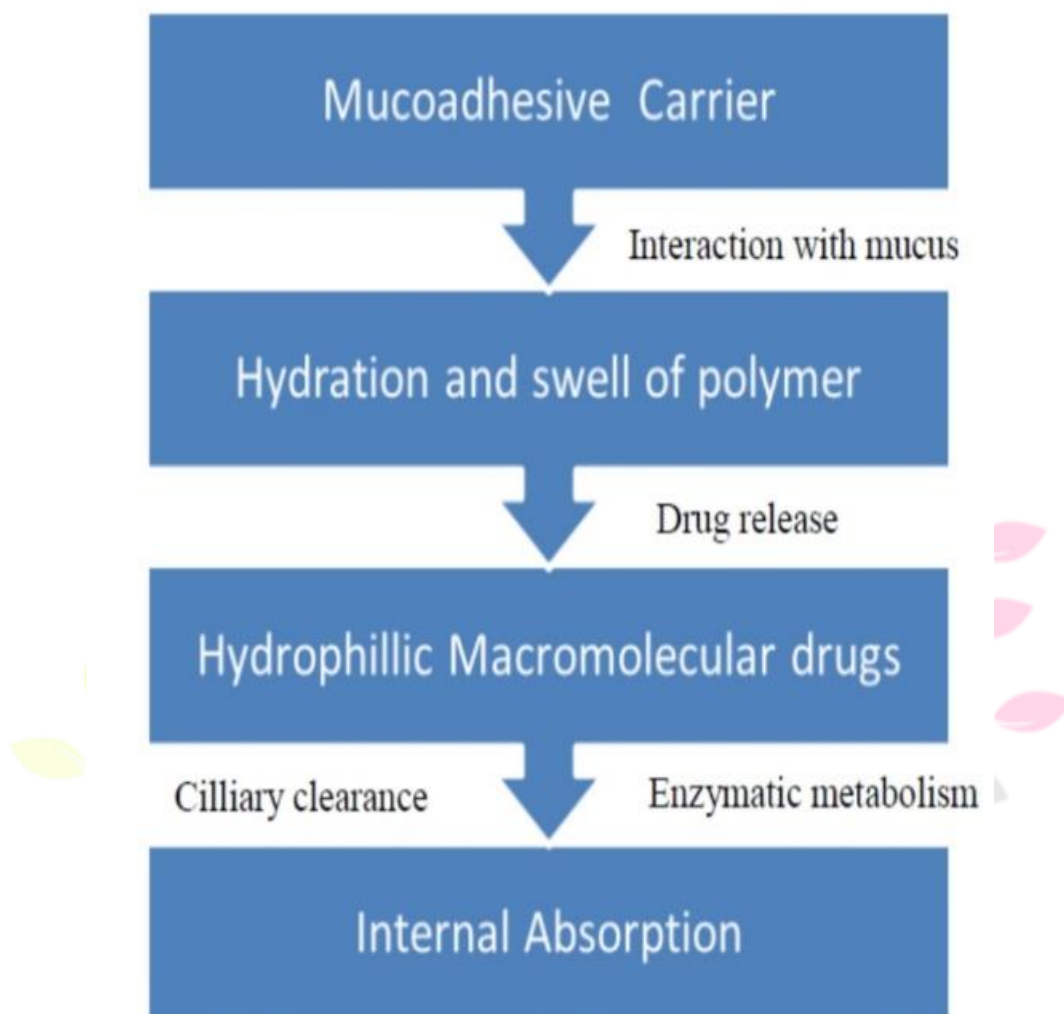


Fig No.2 : Mechanism of Mucoadhesive Absorption

<https://images.app.goo.gl/e4pqc6pYMD8khkep8>

Merits:

- 1) Drug degradation that is observed in the gastrointestinal tract is absent.
- 2) Hepatic first pass metabolism is avoided.
- 3) The bioavailability of larger drug molecules can be improved by means of absorption enhancer or other approach.
- 4) The nasal bioavailability for smaller drug molecules is good.
- 5) Rapid drug absorption and quick onset of action can be achieved.
- 6) Drugs that are orally not absorbed can be delivered to the systemic circulation by nasal drug delivery.
- 7) Studies so far carried out indicate that the nasal route is an alternate to parenteral route. Especially, for protein and peptide drugs.
- 8) Convenient for the patients, especially for those on long term therapy, when compared with parenteral medication.
- 9) Drugs possessing poor stability in gut, fluids are given by nasal route.
- 10) Polar compounds exhibiting poor oral absorption may be particularly suited for this route of delivery.⁴

Demerits (Limitations) :

- 1) The histological toxicity of absorption enhancers used in nasal drug delivery system is not yet clearly established.
- 2) Relatively inconvenient to patients when compared to oral delivery systems since there is a possibility of nasal irritation.
- 3) Nasal cavity provides smaller absorption surface area when compared to GIT.
- 4) There is a risk of local side effects and irreversible damage of the cilia on the nasal mucosa, both from the substance and from constituents added to the dosage form.
- 5) Certain surfactants used as chemical enhancers may disrupt and even dissolve membrane in high concentration.
- 6) There could be a mechanical loss of the dosage form into the other parts of the respiratory tract like lungs because of the improper technique of administration.⁵

Characteristics

- 1) The drug's particle size should range from 5 to 10 micrometers. Particles smaller than 5 m are immediately inhaled into the lungs, while those larger than 10 m are deposited in the nasal cavity.
- 2) The drug's molecular weight should be less than 1000 Da.
- 3) Drug molecules with cyclic shapes are more absorbable than those with linear shapes.
- 4) The medication shouldn't irritate the nasal mucosa and shouldn't smell or taste bad.
- 5) The drug's dosage shouldn't exceed 25 mg per dose.
- 6) It shouldn't cause any hazardous nasal metabolites and should have adequate stability qualities.
- 7) The clinical justification for the nasal dosage form should be appropriate.⁶

Factors Affecting on Nasopulmonary drug delivery :

- Physiochemical properties of drug
 1. Molecular size.
 2. Lipophilic-hydrophilic balance.
 3. Enzymatic degradation in nasal cavity.
 4. Stability
 5. Solubility
 6. Physical state of drug
 7. Chemical state of drug
- Nasal Effect
 1. Membrane permeability.
 2. Environmental pH
 3. Muco-ciliary clearance
 4. Cold, rhinitis.
 5. Blood flow
- Effect of drug formulation
 1. Formulation (Concentration, pH, osmolarity)
 2. Delivery effects
 3. Drugs distribution and deposition.
 4. Viscosity
 5. Pharmaceutical excipients⁷

Recent formulations of pulmonary drug delivery:

1. Insulin by aerosol
2. Nicotine aerosol for Smoking cessation
3. Alpha 1 Antitrypsin
4. Aerosols for Angina
5. Gene therapy via aerosol
6. In cancer chromatography
7. Pentamicine aerosol
8. Gentamycin aerosol
9. Ribavirin aerosol
10. Pulmonary delivery of lower molecular weight heparin
11. Controlled delivery of drugs to lungs.⁸

Novel Approaches of Formulation :

- Nasal gels
- Nasal drops
- Nasal Spray
- Nasal Powder
- Liposome
- Microspheres⁹

Future Scope :

With several possible uses, Nasopulmonary drug delivery system that shows promises. Nasopulmonary drug delivery system has a bright future ahead of it, and in the years to come, major advancements in this subject should be expected. The intranasal route is an accessible alternative route for drug administration. This route provides future potential for several drugs through the development of safe and efficacious formulations for simple, painless and long term therapy.

Conclusion:

After the analysis of literature ,we can conclude that Nasopulmonary drug delivery system is provides potential for several drugs. This route has bright future ahead of it. And the years to come ,major advancement in this subject should be expected. Many advantages are associate ed with this route. This system avoids first pass metabolism.Nasopulmonary drug delivery system is the most useful an effective route for treatment of diseases.

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