

## NASAL DRUG DELIVERY SYSTEM

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### ABSTRACT

Nasal drug delivery is one of the most commonly employed route for the delivery of drugs which treats diseases like allergy, sinusitis, rhinitis and congestion etc. Nasal drug delivery is basically systematic delivery of drugs like Antihistamines, Vasoconstrictors, Anticholinergic and Anti congestion drugs through the highly vascularized Nasal mucosa. Nasal route is usually safe and effective for drug delivery as it delivers the drug to the systematic circulation without passing the hepatic first pass metabolism. Nasal drug delivery is best for lipophilic drugs and is also nonirritant in administration. In recent times nasal drug delivery is a very good option for the treatment of the cancer mainly Brain tumor as it is non-invasive in nature, less expensive and also doesn't require complicated surgeries. Other than drug delivery nasal drug delivery can also be used for the hormone delivery into the systematic circulation. Hence nasal drug delivery is best for both local as well as systematic drug delivery.

**Keywords:** Nasal route, Nasal mucosa, Systemic circulation and nasal drug delivery.

### INTRODUCTION

Nasal drug delivery is the delivery of the drug through the nasal mucosa. Drugs that treat conditions including allergies, sinusitis, rhinitis, and congestion are frequently delivered via the nasal route, which is one of the most popular routes. Nasal drug delivery is the methodical administration of medications such as antihistamines, vasoconstrictors, anticholinergic, and anticongestives through the highly vascularized nasal mucosa. The nasal route is often safe and efficient for medication administration since it bypasses the hepatic first pass metabolism and instead delivers the drug directly to the systemic circulation. Lipophilic medications are best delivered via the nasal route, which is also painless. Due to its non-invasive nature, lower cost, and lack of difficult operations, nasal medication administration has recently become a very good choice for the treatment of cancer, particularly brain tumours. Alzheimer and parkinson diseases are very well treated by the nasal drug administration. There are many factors which affects the administration of drug through the nasal route.[1] The main advantage of nasal administration of drug is that drug are easily delivered to brain as compared to the intravenous administration.[2] Brain tumor like Glioblastoma (GBM) are well treated by the nasal administration.[3] Alzheimer disease can be better treated by the nasal drug delivery.[4] Intranasal administration are mainly used for systemic as well as local effect but it can also be used for treatment of epileptic seizures also. [5] Nasal mucous grafting is recent technique for passing the blood brain barrier.[6] In the nasal drug delivery the unique as well as complex anatomical features of the nasal cavity as well as that of nasal mucosa acts as a principal factor for affecting the the drug absorption.[7]

### MECHANISM OF NASAL DRUG ABSORPTION:

Drug absorption in nasal mucosa mainly takes place by the following two mechanism which are Pericellular pathway and Transcellular pathway.

#### 01. PERICELLULAR PATHWAY:

Pericellular pathway is defined as the passing of drugs through the pores of the cells of the nasal mucosa. It is one of the most common mechanism for the nasal drug absorption. The drugs which are of low molecular weight (1000 Daltons) can be easily absorbed whereas the high molecular weight drugs can't be absorbed.[8]

## 02. TRANSCELLULAR PATHWAY:

Transcellular pathway is the movement of the drug across the cells of the nasal mucosa. This route is ideal for the lipophilic drugs they can easily pass it. The absorption of drugs having low lipophilicity is difficult through transcellular route.

## ROUTE OF NASAL DRUG DELIVERY:

Nasal drug delivery follows the following route:

Drug is administered to the Nasal vestibule → Nasal cavity → Respiratory tract  
Nasal mucosa → Systemic circulation.

## BARRIERS OF NASAL DRUG DELIVERY:

The most common barriers in nasal drug delivery are:

### 01. PRESENCE OF MUCOCILIARY CLEARANCE:

Presence of mucociliary clearance is the predominant barriers for the absorption of the nasal drugs as it causes the rapid dislocation of the administered nasal drug from the mucosa. The main function of the mucociliary is to remove dust and dirt from the nose however it removes the administered drug also.

### 02. LOW PERMEABILITY OF NASAL MEMBRANE:

Nasal membrane allows absorption of lipophilic and low molecular weight drugs only. It is less permeable to the polar, less lipophilic and high molecular weight drugs.

### 03. PRESENCE OF NASAL ENZYMES:

Presence of nasal enzymes possess great barrier for the nasal drug absorption as certain enzymes causes the degradation of the nasal drugs thus their absorption gets low.

## STRATEGIES TO INCREASE DRUG ABSORPTION:

There are many strategies which increases the nasal drug absorption which are as follows:

### 01. USE OF PRODRUGS:

Prodrugs are the therapeutically inactive drug which gets activated after the metabolism in the body. Use of prodrug is one of the best strategies as it protects the drug from the enzymatic degradation of the nasal enzymes and also increases the physico-chemical properties of drug which helps in its absorption.[9]

### 02. USE OF MUCOADHESIVES:

When the nasal drugs are administered they are rapidly gets removed from the nasal mucosa due to the presence of the mucociliary clearance which significantly reduces the drug absorption. With the use of the mucoadhesives like chitosan the clearance can be diminished and hence there is more absorption. Chitosan is predominantly produced by marine organism. [10] Chitosan can be used as a bioadhesive in nasal drug delivery due to the less sideeffects, low toxicity and it also doesn't allow the rapid clearance of the drug. [11]

### 03. USE OF NASAL ENZYMES INHIBITORS:

Many drugs get degraded in the nasal mucosa due to the presence of the enzyme. With the use of the nasal enzymes inhibitors, degradation of drugs can be stopped and thus their absorption gets low.

### 04. USE OF PERMEATION ENHANCERS:

Use of permeation enhancer is the best technique to increase the nasal drug absorption as they reduce mucociliary clearance, reduces mucus viscosity, reduces enzyme activity and also opens the tight junctions present between the cells.

## ADVANTAGES

- |                              |   |
|------------------------------|---|
| 01. Easy to administer.      | 04. Same bioavailability as that of Intravenous administration. |
| 02. More patient compliance. | 05. It is non irritant in nature.                               |
| 03. Noninvasive technique.   |   |

## **.DISADVANTAGES**

01. It is not suitable for high molecular weight drugs.
02. Not suitable for polar drugs.
03. Nasal drugs gets easily degraded due to the presence of the nasal enzymes.
04. Drugs gets removed by the mucocilliary clearance.
05. Large volume of drugs can't be administered through it.

## **APPLICATION OF NASAL DRUG DELIVERY:**

01. Nasal drug delivery can be used to deliver peptides
02. It can be used to deliver high molecular weight drugs.
03. Delivery of anti cancerous drugs to brain.
04. It can be used to deliver various types of vaccines.
05. It can be used to deliver hormones and corticosteroids into the systemic circulation.

## **CONCLUSION**

The nasal route though simple and easy but with complex anatomy involved is one of the best option for delivery of drug into the systemic circulation with less side effects and toxicity level. The bioavailability produce by the nasal drug delivery is very same and comparable to that of Intravenous one. Nasal drug delivery is also known as non invasive approach for drug delivery especially in case of targeted drug delivery in treating certain brain tumor. In common sense nasal drug delivery is all about delivery of drug through the nasal mucosa. The nasal mucosa lines the nasal cavity and predominantly affects the absorption of drugs. Nasal mucosa is less permeable to high molecular weight and less lipophilic drugs. Nasal mucosa is highly vascular in nature due to which drugs can be delivered to the systemic circulation by modification of drug structure or by using of prodrug. Nasal drug delivery is mainly thought to be for treatment of Sinutitis, Rhinitis and Congestion only, but in recent times nasal drug delivery is used for treatment for Alzheimer, Parkinson and also very complicated brain tumor. Because of its simplicity, less expensive and better bioavailability nasal drug delivery is becoming best option for drug delivery.

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