Looking after local nasal and sinus mucosa in health, disease and after surgery

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Abstract The paper emphasises the need for looking after of nasal and sinus mucosa in health, disease and after nasal surgery. It is a systematic arrangement of steps required to restore nasal mucosa to healthy state. These steps have been arranged to co relate them to diseases and symptoms for symptomatic and curative treatment. It can rationalise the need for surgery in cases non responsive to maximum medical treatment. It can improve postoperative surgical results after functional endoscopic sinus surgery (FESS) and other endoscopic assisted procedures.

Keywords Nasal mucosa · Local medical management

Nasal mucosa plays a very important role as the guard of airway to lung. It has important function of ventilation, filtration and olfaction in addition it manufactures chemicals. The status of nasal mucosa can be affected by a number of nasal diseases – acute and chronic infections, environmental factors, stress and increasingly the iatrogenic, surgical interventions for surgery on nose, sinuses and as an approach to tumors of pituitary, anterior cranial fossa and clival area. Thus, the need to understand the steps that can improve the health of nasal mucosa and maintain it becomes very important. For purposes of presentation the function, complaints and management have be grouped separately. However, nose function as a whole (holistically).

Local medical management of nasal mucosa

The local management of nasal diseases is basically to restore nasal functions. The drugs so given are absorbed in smaller quantities than oral and injectable drugs and are less likely to affect systemically. Thus, effect of steroids for example on blood glucose, blood pressure and gastric acidity can be reduced. The effect of decongestants on blood pressure is significantly less when given nasally. The growth in children is not effected by steroids given nasally as much as those given orally. Postoperatively the local management after nasal surgery significantly reduces discomfort and improves healing. The detailed steps in diseases to restore specific nasal function are discussed in Tables 1 and 2.

Ventilatory function

It allows inhalation and normal environment for delicate nasal mucosa. The oxygen tension of sinuses is raised. The air from nose can enter ear through Eustachian tube.

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Table 1 Showing local medical treatment required

Action require									
Nasal status	One	Two	Three	Four	Five	Six	Seven	Eight	Nine
A. Healthy nose	✓	–	–	–	–	–	–	–	–
B. Common cold	✓	✓	–	–	–	–	–	–	–
C. Allergic rhinitis	✓	✓	✓	✓	✓	–	–	–	–
D. Rhinitis bacterial	✓	✓	–	✓	✓	–	–	–	–
E. Rhinitis fungal	✓	✓	–	✓	✓*	–	–	–	–
F. Atrophic rhinitis	✓	–	–	–	–	✓	–*	✓	–
G. Industrial rhinitis	✓	✓	–	–	–	✓	✓	–	–
H. Postoperation (Endoscopic)**	✓	✓	✓	✓	✓*	✓	–	✓	✓

1. Healthy life style – No smoking – Breathing exercises: Fruits and vegetables intake.

2. Symptomatic treatment – Antipyretic, decongestants.

3. Anti allergics – Steroids – Mast cell stabilisers – Anti-allergic

4. Anti bacterial – Local + Nasal wash/douche: Muciprocin wash etc.

5. Anti fungal amphoterecin B wash

6. Lubricating nose drops + Estrogen injection

7. Masks – wood workers, painters, chemical factories etc.

8. Local cleaning by forceps under LA

9. Mintomycin application to prevent synechae (rare)

* Mixed infections

**Surgery and systemic treatment may be needed concurrently are not discussed in present paper.

If the ventilatory function is affected patient comes with nasal obstruction in 99% cases. Excluding states like deviated nasal septum, tumors of nose etc. which may require surgery, there are a number of local medical steps which can be taken to improve nasal cavity. Most of reversible obstruction is caused by mucosal, sub mucosal oedema and dilatation of cavernous venous spaces of turbinates which can be controlled medically. Obstruction can also occur because of crusting in nose and iatrogenic causes like synechae which can be prevented by local management. The drug delivery locally can be given by drops, sprays or packs. Drops can be used with patient supine and pillow under shoulder and not under head (Fig. 1A).

Use of nasal drops in sitting position takes them to throat and causes bitter test. Most of these drops contain vasoconstrictors like ephedrine, xylometazolame etc. These act on the cavernous plexuses of nasal mucosa on turbinates. Their effect can occur in few minute but tends to wear off in few hours. These drugs can be habit forming and should be used for short period as prescribed.

Mucosal or submucosal interstitial allergies swelling can be reduced by steroids or mast cell stabilises or anti-allergic nasal drops. These take some time to be effective in some case from hours to days. We have to keep in mind that just as aspirin may reduce headache in cases of hypertension

but bloodpressure controlling drugs will be required to treat the patient. Vaso constrictors mostly give symptomatic relief but drugs like steroid and mast all stabilisers and anti-allergic treat the disease.

The nasal spray can deliver medicine to nasal cavities. It is recommended to use right hand for left nose and left hand for right nose to avoid damaging the nasal septal mucosa by direct impingement of nozzle and of the pressure of the sprays (Fig. 1B).

The sprays can reach niches in the nose, turbinates and spread widely on mucosa. Nasal packing with medical medicines gives prolonged contact with nasal mucosa. But it is difficult to pack all niches and corners. The neural patties (Soft cotton packs) are more malleable than firm cotton gauze packs. The patties can be pushed under turbinates to reach all hidden mucosal areas.

The packs are better when softing of crusts, and are required as by their prolonged presence and fluid retention of lubricants (paraffin) and nasal secretion they allows easy loosening and removal of crusts. They are, however, more unpleasant than drops and sprays and require a doctor to do it whereas drops, and sprays can be used by patient and parents in case of children. Thus obviating the medical manpower requirements. Use of creame like Vaseline petroleum jelly in nasal vestibule

Table 2 Showing chief nasal functions and complaints due to function derangement, main functional investigation and local management

Function	Abnormality	Etiology, pathology	Complaints	Functional tests	Management (local)
Ventilatory	Reduced	Inflammation	Obstruction	Rhinomanometry	Decongestants
	Increased	Atrophy or iatrogenic	Obstruction	Rhinomanometry	Lubricants/ humidification
Secretary	Excessive secretion	AR, infectious rhinitis	Discharge	Swab for esinophils, allergy test-IgE culture - bacteria/ fungi	Antimicrobial-S wash anti-allergic drugs
	Reduced secretion	Atrophic rhinitis empty nose syndrome	Bad smell, obstruction, crust, dry nose	Biopsy atrophic rhinitis for TB, leprosy	Humidification, estrogens etc.
Olfactory	Reduced	Viral idiopathic	Anosmia lack of taste	Olfactometry, gastrometry	Steroids/ Vitamins
	Hyper active	Anxiety	Hyperosmia	Olfactometry	Tranquilisors
	Bad smell	Collection of purulent material	Cacosmia self or relatives	Culture/sensitivity of nasal secretion	Humidification - antibacterial anti-allergic -estrogens etc.
Trigeminal and autonomic	Abnormality imbalance	AR, vasomotor rhinitis (VMR)	Sneezing + Obstruction	Nasal provocation test	Antiallergic
Filtration	Reduced	Crusting	Immotle cilia atrophic rhinitis	Histopathology Saccharine clearance	Long term symptomatic, antibacterials, lubricants
Temprature regulation	Reduced external environment	Excessive climate desert/snow	Obstruction burning nose obstruction	Rhinomanometry	Adequate clothes and mask etc.

* Radiological, CAT, MRI and endoscopic examination for structural status are not discussed in present paper

Fig. 1A Use of nasal drops, (pillow under shoulders, not head) **Fig. 1B** Use of nasal sprays (right hand for left nostril and left hand for right nostril)

to lubricate helps prevent epistaxis in summer, especially in children.

Carboxy methyl cellulose (CMC) nasal packing after FESS was compared with unpacked side. No difference was seen on two sides for packing with CMC and unpacked side CMC was detected in four cases out of 26 cases after 2 weeks. Authors recommended use of CMC for prolonged drug delivery [1]. No adverse affects were found in either side synechae formation, crusting, mucosal integrity and granulation tissue formation were equal on both sides.

After case of FESS with polypectomy use of high topical corticosteroid therapy was more effective than low topical therapy in preventing recurrent nasal polyposis [2]. Study of budesonide nasal spray was found to be clinically effective in decreasing the symptoms of chronic rhinosinusitis without affecting hypothalamic-pituitary-adrenal axis after 30 days treatment [3, 4].

Temperature regulation

We have far more cases of dry nose (Rhinitis sicca) in warm dry weather (summers), due to evaporation of water from nasal secretions. This evaporation helps in cooling down the

warm air and to humidify it, but when it becomes excessive it causes dry nose, crusting and bleeding from nose.

Excessive removal of nasal tissues i.e. turbinate and septum in surgery can result in feeling of nasal obstruction in spite of excessive patency, the so called “empty nose syndrome” where the absence of nerve ending to monitor air flow results in feeling of nasal obstruction.

Use of substances like estrogen products (placentrex) can be given in cases of atrophic rhinitis to promote the health of nasal mucosa and reduce excessive patency and increase the mucous secreting cells.

Filtration

When filtration function is affected the main complaint may be crusting and post nasal drip. This is often due to ciliary dysfunction and or due to excessive production of mucous or thick mucous secretion which makes it more viscous. Rarely it can be due to immotile cilia syndrome.

Washing of nose by nasal douches is advised in such condition. Douching can be done by rubber syringe, squeeze bottle, yoga copper can, enema can etc. We have found a soft enema can economical and good for this purpose. It can be hung on a nail 3 feet above the sink. Patient can stand in front of sink, bend head forward with open mouth and wash the nose with medicated solution (Fig. 1C).

It is said that life evolved in sea and in fishes gills are washed by seawater. Thus, use of saline water seems to be naturally the choice of douching material. Approximately 300 ml of water at body temperature can be used. Numerous authors have recommended, normal saline, isotonic saline, hyper tonic saline or water containing low concentration of hydrochlorous acid. Yoga also prescribes “Jal Neti” which is essentially a nasal douche with clean water.

Nasal saline irrigation can be viewed as good alternative treatment option for allergic rhinitis (AR). It permitted use of less topical steroids for controlled AR in children which will contribute to fewer side effects and less economic burden [5].

The comparison of buffered 2.3%, buffered 0.9% and non-buffered 0.9% saline irrigation of nasal mucosa after septoplasty showed that buffered hypertonic seawater improved nasal airway patency more than the buffered isotonic saline. Buffered hypertonic solutions used after endonasal surgery have been advantageous for both mucociliary clearance and post-operative congestion [6].

Sulphurous water inhalations in prophylaxis of recurrent upper respiratory tract infection tract infection was studied and it was found that in addition to their known effect, the sulphurous waters also have an immunomodulant activity that contributes to their therapeutic effect in children [7].

Low concentration hypochlorous acid nasal irrigation was studied for its effect on bacteria, fungi and virus. It was

Fig. 1C Nasal douche with enema can (mouth open for breathing, bend forwards)

an effective nasal irrigation solution. Ninety-nine percent bactericidal and fungicidal activity was noted except for candida albicans. In addition a 3.2 log 10 reduction was achieved in cells challenged with influenza A virus [8].

The douche serves the purpose of:

- (a) Washing out of crust and thick viscous secretion
- (b) Humidification of dry nasal mucosa
- (c) Dysruption of biofilm protecting bacteria
- (d) Washing out collected fungal and bacterial debris and reduces the load of infecting organism and antigens.

The removal opens up the orifices of sinus ostea and improves drainage in selected cases.

For frontal sinus irrigation vertex to floor position was found to be superior to bending over sink position for nasal wash by squeeze bottle containing 200 ml of solution after lothorp frontal sinus surgery. The nasal spray and squeeze bottle 50 ml and 100 ml solution were less effective when judged with straining of frontal sinus area by irrigation fluid [9, 6].

Nasal blowing by adults can remove secretion. It is assumed that nasal blowing is known to everyone but in India we have seen children adolescents and some adults who do not know how to blow nose. One side at a time is

recommended. They are advised not sniff in or close both nostrils and blow strongly causing secretions to go through Eustachian tube to ear and cause ear infection.

In infants nose can be cleaned by suction by rubber balloons or suction with soft catheters

Nasal filters are available to filter inspired air and to keep them free from antigens and large particles pollution. In our experience most patients using filters tend to find them inconvenient and complain of nasal obstruction.

Humidification of nose

The derangement of this function leads to increase in secretions (Nasal Discharge) or reduction in dry nose. Nasal obstruction and nasal discharge are the most common complaints in nasal diseases. Muciprocin application locally in nose was studied in preventing *Staphylococcus aureus* infection in nasal carriers [10]. It was found that there was significant reduction in *S. aureus* infections in patient using muciprocin. *S. Aureus* has been blamed for causing “super antigen” reaction and polyp formation.

Postoperative application of amphotericin B nasal spray in chronic rhinosinusitis with nasal polyp was studied. It was found that endoscopically nose appeared better but the symptom scores of patient did not improve. The amphotericin B solution acts as antifungal as well as “Biofilms” dysruptor [11].

In cases of rhinitis sicca and atrophic rhinitis use of humidifier, aerosols, steam inhalation and normal saline nasal drops helps in retaining the moisture in nose.

Olfaction

In some cases of anosmia or hyposmia the function can be restored by use of nasal drops, nasal sprays containing steroids and other antiallergic drugs. In cases of AR with hyposmia, these control the allergic reaction and act by opening up the nasal passages, reducing infection of olfactory nerve ending and reducing watery nasal overflow which prevents odorous particles by washing them away from reaching the olfactory sensitive nerves in olfactory cleft. The cacosmia is usually associated with collection of foul smelling bacterial discharge in nose or sinuses. Sneezing can occur after exposure to antigens or malodorous particles. It is nature's attempt to throw out the offending agent.

Chemical manufactures

The nasal mucosal gland manufacture secretions which have antibacterial property when exposed to bacteria. The nasal

mucosa on exposure manufactures antibodies to allergens and bacteria which improves the defence mechanism of nasal mucosa. It helps in manufacture of cytokines and organizes eosinophilic and mast cell responses i.e. humoral and cytological response.

The use of desensitization by intranasal antigens helps in desensitization of sensitive spots on nasal mucosa.

The sensitive spots can also be controlled by silver nitrate application and by “Dowlings nasal packs” containing silver compound with ephedrine. Local nasal immunotherapy (LNIT) has been reported to be effective in mite induced AR. However the compliance is poor due to persistent nasal reaction and difficulty of application. A dermatophagoides petronyssinus (Der-p)-coated strip for self application was compared to placebo. It was noted that both local and systemic immune responses were observed after LNIT. This therapeutic modality may serve as good alternative treatment for AR [12].

Zinc ionization has been used in past to reduce nasal mucosal sensitivity. Microemulsion was used to study the allergen-induced symptoms and signs of AR. It was found that microemulsion significantly attenuate exudation and symptoms as compared to placebo [13]. The effect of LNIT to AR using allergen of the allergen dermats phagodes prevony was found to reduce the need for nasal medications [11] and severity of AR histamine release and eosinophilic protein were reduced in nasal mucosa 4 months after treatment. There were no severe adverse effect this was found to be good alternative treatment for AR [12].

Nasal flora

The effect of probiotic in changing the nasal flora by spraying helpful-health giving bacteria (probiotic) can restore nasal mucosa to health. Probiotic were found to have a beneficial effect in AR by reducing symptom severity and medication use. The use of nasal spray of streptococcus sanignisis produced better resolution of middle ear effusion than placebo with no delitrous effect on nose or nasopharynx [14, 15].

The suggestion and topic discussed in this paper are not new and have been known for generation. But in view of new technology and glamour of nasal video endoscopy and functional endoscopic surgery, they often get neglected and are not given “free and fair” trial with decision being taken in favour of surgery. In such cases a very successful surgery may not result in a symptoms free patients until postoperative care is taken as described in this paper.

(Note: For the sake of brevity the references have been restricted to 2008–2009. Numerous cross references are available in quoted papers)

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