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Mucociliary Clearance in Patients with Allergic Rhinitis Before and After Medical Management

Lingaiah Jadi, Ramesh Kumar Saidugari*, Vamshi Krishna Rao Koppula, Manoj Gunde
[1] MS, Professor, [2] MS, DLO, Professor, [3] MS, Assistant professor, [4] MBBS, Post Graduate student, Department of ENT and head & neck Surgery, Chalmeda anand rao Institute of medical sciences, Bommakal, Karimnagar

Corresponding Author
Ramesh Kumar Saidugari. MS, DLO, Professor
Department of ENT and head & neck Surgery,
Chalmeda anand rao Institute of medical sciences, Bommakal, Karimnagar.

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ABSTRACT

Back ground: Allergic rhinitis is a common disease in India. Nasal mucociliary clearance has an important part in maintaining the proper rheological properties which is hampered in patients with allergic rhinitis.

Aims and Objectives: This study is to assess the impact of medical management on the nasal mucociliary clearance mechanism in patients with allergic rhinitis.

Materials and Methods: A total of 60 patients were part of this study where controls were 30 and study group were 30. Mucociliary function of the nasal mucosa of patients was measured by the Saccharin test. Test was done by placing saccharin granule 1 cm behind the anterior end of the inferior turbinate. The time required for the test subject to experience a sweet taste was measured in minutes. Patient was followed up for 45 days and the test times were compared. Data was analyzed by using CHI SQUARE test for qualitative data with the help of statistical software SPSS v.25, MS EXCEL.

Results: The mean nasal mucociliary time of the control group is 14.52 minutes and that of study group before medical management is 25.58 minutes and after treatment was 15.59 minutes.

Conclusion: Significant improvement in nasal mucociliary clearance was observed in all the patients of allergic rhinitis after medical management.

Keywords: Mucociliary clearance, Saccharin, Allergic rhinitis, Anderson method.

INTRODUCTION

Allergic rhinitis is a common worldwide disease affecting at least 10 to 20% of populations.[1] it significantly affects the quality of life. It is caused by interaction of immune system with particles in the air like pollens, cosmetics, mites, dust, fungi, detergents, tobacco, smoke, vehicular fumes, domestic spray, bleach, food additives and preservatives, clothes, household and industrial pollution products in the air.[2] It is usually associated with nasal obstruction due to inflammation of nasal cavity which leads to oedema of nasal lining and in turn interrupts normal mucociliary clearance and leads to retention of secretions within sinus cavities.

Nasal mucociliary clearance is a defence mechanism of upper and lower respiratory tract. The vital part of this mechanism is to transport adequate quantity of mucus with appropriate rheological qualities and adequately functioning cilia, which beat in metachronous fashion towards nasopharynx.[3] any disturbance in number and movement of cilia and mucus production leads to an altered nasal mucociliary clearance as occurs in allergic rhinitis.

Several studies were done with respect to mucociliary clearance mechanism to different pathologies. Allergic Rhinitis is the most common condition and studies were also done with its regard on effect on nasal mucosa. Rupender K Ranga et al stated the impairment of nasal mucociliary clearance in children who were affected with allergic rhinitis. Measurment of mucociliary function in health and diseases such as

Deviated nasal septum, Rhinitis, sinusitis, recent nasal packing, adenoid hypertropy by pandiya et al documented prolonged mucociliary function. Some authors documented the effect of mucociliary clearance before and after different nasal surgeries and found significant improvement in function.

AIMS AND OBJECTIVES

The present study was undertaken to evaluate the effect of medical management on nasal mucociliary clearance in adults affected by allergic rhinitis.

MATERIALS AND METHODS

Present study is a prospective study carried out for a period of 6 months on patients attending to ENT OPD in CAIMS, Karimnagar for symptoms suggestive of allergic rhinitis. A detailed history was taken with special reference to sneezing, itching, nasal discharge, nasal obstruction and loss of smell, which are generally the chief symptoms of allergic rhinitis. A thorough clinical examination of ear, nose and throat was carried out. Presence of pale blue nasal mucosa and hypertrophied boggy turbinate confirmed our diagnosis. Study consists of series of 60 patients divided in to 2 groups, 30 study and 30 controls. The nasal mucociliary clearance was evaluated with Andersen's method[4] as this method is very simple, reliable, reproducible and economical, in which a saccharin granule was carefully placed on the floor of nasal cavity approximately 1 cm behind the anterior end of inferior turbinate. The subject should not take anything orally at least 30 minutes before the test, to decrease the disturbance of taste perception. The subjects were asked not to sniff, sneeze, eat or drink during the test. They were asked to swallow every thirty seconds and to report any change in taste nasopharynx. The time taken by the subjects from placement of particle to perception of taste was taken as mucociliary clearance time in minutes. Ethical committee of Chalmeda Anand Rao Institute of Medical Science approval was taken to conduct the study and a written consent was taken from all patients to be included in the study.

Inclusion criteria: 60 patients irrespective of sex with age >18 years and <60 years presenting with nasal obstruction and history suggestive of allergic rhinitis.

Exclusion criteria: Age <18 years and >60 years, Patients with prior use of steroids, smokers, alcoholics, Patients who have undergone previous surgeries like submucosal diathermy, vidian neurectomy, electrocautery, septoplasty, FESS, partial and complete turbinecomy etc .

RESULTS

In our study there were 36 males and 24 females. The mean age in control group was 35.3 years (range 18-60) and in study group (B) it was 39.29 years (range 18-60). In control group, there were 17 (57%) males, 13 (43%) females, whereas in study group there were 19 (63%) males and 11(37%) females (Table 1).

The mean value of nasal mucociliary clearance time in control group was 14.52 minutes where as in allergic rhinitis patients before treatment it was 25.58 minutes the treatment included and after treatment it was 15.59 minutes which included steroid sprays, decongestants, leukotriene receptor antagonists, saline irrigation and oral anti histamines (Table 2). The data was analyzed by using CHI SQUARE test for qualitative data with the help of statistical software SPSS v.25, MS EXCEL. The difference in mean values of two samples was statistically significant ($p < 0.01$) (Table 3). The p value, <0.05 considered as statistically significant.

Table 1: Age and sex distribution of controls and patients

Group	Age in years		Sex	
	Mean	Range	Male	female
Controls	35.3	18-60	17	13
Patients	39.29	18-60	19	11

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Table 2: Nasal mucociliary clearance in controls and patients

Group	N	Mean NMC time value	
		BEFORE	AFTER
Controls	30	14.52	
Patients	30	25.58	15.59

Table 3: Statistical data

	Before Treatment	After Treatment	t-value	p-value
Mean	25.58	15.59	15.49	<0.001
SD	2.4	1.8		

DISCUSSION

The nasal mucosa can be affected by number of pathologies like rhinitis, deviated nasal septum, inferior turbinate hypertrophy, nasal polyposis, smoking etc.[5,6] These conditions will lead to very limited space between the middle turbinate and lateral wall of nose. Minimal mucosal swelling can impair the mucociliary activity and prolong the mucociliary time. This leads to a vicious cycle leading to recurrent infections ultimately leading to rhinosinusitis.[7]

Mucociliary clearance is an important defence mechanism of the nose and paranasal sinuses. Any disturbance in this mechanism will lead to stagnation of secretions which leads to secondary infection and prolongation of the clearance time. Upper respiratory tract infections hamper nasal mucociliary clearance by directly damaging the cilia and by changing the rheological properties of the nasal secretions.[8]

Numerous factors like smoking, infections, poor ventilation also have an effect on the mucociliary clearance. Tobacco smoke has a hampering effect on cilia and changes the property of viscoelasticity of mucous.[9] The aim of the medical management is to restore normal drainage and mucociliary clearance. Medical management includes steroid sprays, decongestants, leukotriene receptor antagonists, nasal irrigation and oral anti histaminics[10]. Steroid sprays improve nasal congestion more effectively and are more cost-effective, its advantage is that high concentrations of the drug, with rapid onset of action, can be delivered directly into the target organ, so that systemic effects are minimized. They exert their anti-inflammatory effect through the inhibition of the production of different cytokines, chemokines, enzymes, and cell adhesion molecules, after their interaction with intracellular glucocorticoid receptors [11]. Patients are advised to shake the Steroid spray bottle very well prior to its use and advised to implement cross hand technique, where left nostril is sprayed with right hand and vice versa. Oral antihistaminics are used along with Steroid sprays in exacerbations of rhinitis. Nasal irrigation is an intervention which is directed to clean the nasal mucosa, it consists of one tablespoon of sodium bicarbonate and two tablespoons of sodium chloride and two tablespoons of sodium biborate in 280 ml of water, by doing this the mucus lining of the nasal cavity is softened and dislodged. Moreover, inflammatory mediators such as prostaglandins, leukotrienes and antigens responsible for allergic reactions can be removed thereby leading to reduction of allergen load on the mucosal lining of nasal mucosa thereby leading to

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resolution of symptoms of Allergic rhinitis. [12]

In the present study, the mean value of normal nasal mucociliary clearance time in the control group was 14.52 minutes. In the present study group the mean nasal mucociliary clearance time has been reported to be 25.58 minutes in patients with allergic rhinitis before medical management. This finding of increased value of nasal mucociliary clearance time in allergic rhinitis is comparable with earlier reports.[13] When this was compared with control group there is a significant improvement of nasal mucociliary clearance time to 15.59 minutes after using steroid sprays, decongestants, leukotriene receptor antagonists, nasal irrigation and oral anti histamines . This difference from 25.58 to 15.59 minutes is statistically significant ($p < 0.01$).

It is based on the hypothesis that nasal secretions tend to become more alkaline in nature in allergic rhinitis and allergic inflammatory events involving mucus membrane. The nasal secretions pH in vivo is lower, but some workers mentioned that the average pH value of 7, whereas others opinion that the nasal pH is towards acidic side and fluctuates from 5.5 to 6.5 in healthy individual.[14] Another reason is obstructive effect exerted by congestion of nasal passage as a result of local vasodilation and consequent mucosal edema.[15]

Mucociliary clearance may be disturbed by factors including increased mucus production, abnormal mucus quality and quantity and abnormal ciliary activity, which causes stagnation of secretions in the sinuses.[16] The mucus layer which is present over the ciliated cells, has two properties viscosity and elasticity. Outer layer is thick, viscoelastic, semi solid mucus layer where the cilia do not strike directly, is found over a lower layer of watery serous fluid. Low viscosity layer of watery serous fluid or sol layer facilitates the movement of cilia which moves the sol layer affecting the movement of upper thick layer. If the movement of the mucus is slowed, bacteria can multiply as the mucus layer thicken and secretions stagnate which play major role in sinus and pulmonary diseases.[17]

CONCLUSION

We found that the mucociliary clearance is hampered in patients affected with allergic rhinitis. There is restoration of almost normal nasal mucociliary clearance after treatment of allergic rhinitis, which is of great importance for the restoration of normal physiology of the nose. The standard Saccharin test is simple, easy to perform, consistent, cheap and readily available in the market for measuring the nasal mucociliary clearance.

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