

The Effect of Intranasal Steroid on Nasal Mucociliary Clearance in Allergic Rhinitis

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ABSTRACT

Intranasal glucocorticosteroids are the most effective treatment for allergic rhinitis and are recommended as first-line therapy for patients with moderate to severe Allergic Rhinitis, particularly when nasal congestion is the prominent symptom. The use of intranasal corticosteroids showed to affect the mucociliary action by decreasing the prolonged mucociliary clearance time and increasing the mucociliary clearance rate.

Keywords: AR- Allergic Rhinitis, INCS- Intranasal corticosteroid, NMC- Nasomucociliary clearance, MCT- Mucociliary Clearance Time, MCR- Mucociliary clearance rate, OAH- Oral antihistamine

INTRODUCTION

Allergic rhinitis is one of most common allergic diseases worldwide, affecting about 10-25% of population. In India 20-30% of the population suffers from allergic rhinitis and/or other allergic diseases, prevalence being increasing over past many years¹. It causes significant disability and is often poorly managed. There may be co-morbidities with other organs being involved, commonly the eyes causing allergic conjunctivitis and the lungs with allergic asthma.

The most widely used and effective medication to treat allergic rhinitis are oral or topical antihistamines and topical nasal steroids². Intranasal glucocorticosteroids are the most effective treatment for allergic

rhino conjunctivitis and are recommended in current guidelines as first-line therapy for patients with moderate to severe Allergic Rhinitis, particularly when nasal congestion is the prominent symptom. They allow high concentration of the active drug to be delivered to the nasal mucosa with minimal systemic absorption. INCS inhibit the onset of the inflammatory response and reduce nasal mucosa permeability, the number of inflammatory cells and the release of mediators. The drug reduce all symptoms of allergic rhinitis and ocular symptoms and are the first line treatment of choice in patients who complain of nasal block. Nasociliary clearance is a defense mechanism of the upper and lower respiratory tract. The removal of debris-laden mucus in the sinuses completely depends on MCC, whereas in the lower airways, MCC can be compensated for by other mechanisms like coughing. Nasal Mucociliary Clearance (NMC) is determined to obtain an in vivo measurement of the effectiveness of the interaction between the cilia and mucus. Any disturbance in the number and movement of cilia and mucus production leads to altered mucociliary clearance as occurs in allergic rhinitis.

The mean normal MCT in our population is 8.2 min in children and 9.5 min in adults with an average 5.6-13 min. and the MCR is 11.1 mm/min in normal children and 12.7 mm/min in normal adults³. The present study was undertaken to evaluate the effect

of allergic rhinitis on nasal mucociliary clearance using Andersen's method and to see the effect of Intranasal corticosteroids on Nasal Mucociliary Clearance in patients of Allergic Rhinitis.

The prevalence of AR is high in the population covered by our Hospital. Our study is a one year prospective study to find out the effect Fluticasone propionate intranasal steroid on the mucociliary clearance of the patients of AR in this region.

LITERATURE REVIEW

A Study done on Pre and Post Treatment Mucociliary Function in Allergic Rhinitis in Three Different Treatment Modalities by Lee and Gendeh⁴ (2003). Patients in group one on intranasal beclomethasone spray showed an improvement in the mucociliary function after treatment. The average saccharin transport time (SIT) was 688 seconds pre treatment and 579 seconds post treatment. In group two, the patients were treated with loratidine alone. The pre and post treatment SIT were 507 seconds and 502 seconds respectively. In group 3, the patients were treated with loratidine and intranasal beclomethasone spray. The pre and post SIT were 603 seconds and 617 seconds respectively. In both group 2 and 3 there were no significant changes in the mean SIT pre and post treatment.

Study on comparison of nasal clearance after treatment of perennial allergic rhinitis with budesonide and mometasone by Naclerio et al⁵(2003) , before and after 2 weeks of treatment, subjects completed a Rhinoconjunctivitis Quality of Life Questionnaire (RQLQ) and underwent a measurement of nasal clearance of a radioactive colloidal spray into the nose. After 2 weeks of treatment, both budesonide and mometasone demonstrated overall improvement in quality of life as assessed by the RQLQ.

A study done by Neffen and Wingertzahn⁶(2010), on Ciclosonide, a hypotonic intranasal corticosteroid Intranasal corticosteroids (INCSs)

established INCS's as the first-line treatment of moderate to severe allergic rhinitis (AR) in both adults and children. Compared with other nasal allergy medications, INCSs are the most effective at providing symptom relief and increasing quality of life.

Another study on Clinical efficacy of nasal steroids on nonallergic rhinitis and the associated inflammatory cell phenotypes done by Kirtsreesakul et al⁷ (2015), to compare the response to steroids in non-AR versus AR. At 28 days after nasal steroid treatment, all nasal symptom score, peak inspiratory flow indexes, and NMCCTs were significantly improved within each group; however, the non-AR group recorded significantly lower levels of improvement in blocked nose, rhinorrhea, sneezing, nasal itching, peak flows, and NMCCTs than the AR group.

Salahuddin et al⁸ in an effort to study the effect of steroids and antihistamines on nasal mucociliary clearance found that topical steroids positively modify the nasal mucosal environment in terms of mucociliary clearance. Their results showed statistically significant difference in group I and group III, treated with nasal corticosteroid and nasal corticosteroid plus oral H1 antihistaminies, but the results were not significant in group II , which were given oral H1 antihistamines only.

MATERIALS & METHODS

Our study is a one year prospective study. The Nasal Mucociliary Clearance were evaluated on basis of Anderson's method⁴ in which a saccharin particle of size 1.5mm diameter was placed on the floor of nasal cavity approximately 1.5 cm behind the anterior end of inferior turbinate. Patients were advised not to eat or drink for at least 30 min before the test. The subjects were instructed to blow their nose at the beginning of the test and rest while the test was performed. Patient were asked to swallow every 30 seconds and report when they felt the sweet taste of saccharin. Time taken from placement of particle to

appreciation of sweet taste by the patient was taken as MCT. The test was repeated on each side and the average of two was taken as the mean MCT. This was done to exclude the effect of nasal cycle on mucociliary clearance. After measuring mucociliary clearance time, measurement of the length of the nose from anterior nares to posterior pharyngeal wall just lateral to uvula was done with help of a thin soft rubber catheter. With the help of nasal MCT and the approximate length of the nose the mucociliary clearance rates in mm / minute was calculated. Study population included adult population (>=18 years) suffering from AR.

The patients were divided in two groups 1 and 2 -Patients taken in Group 1 were prescribed -Intranasal Corticosteroid-Fluticasone propionate and oral antihistaminic drug for a duration of one month.

The patients in Group 2 were prescribed Saline nasal drops and oral antihistaminic drug for a duration of one month.

RESULT

Nasal Mucociliary Clearance Time

Nasal mucociliary time was divided into 3 categories as discussed previously. There were 70% patients in group 1 and 42% patients in group 2 who had prolonged (> 13 minutes) mean mucociliary time. While 2% of the patients each in group 1 and group 2 had decreased (<5.6 minutes) mean mucociliary time. We also observed that the patients with prolonged mean mucociliary clearance time were significantly higher in group 1 in pre-treatment Anderson saccharin test.

We found that post-treatment, there were only 6% patients in group 1 who had prolonged mean mucociliary time. We observed that the patients with normalization of mean mucociliary clearance time was significantly higher in group 1 as compared to group 2.

Table 1. Distribution of patients on the basis of mean nasal MCT.

		Group 1 (n=50)	Group 2 (n=50)	P Value
Pre-treatment	Decreased (<5.6 min)	1 (2%)	1 (2%)	0.017
	Normal (5.6-13 min)	14 (28%)	28 (56%)	
	Prolonged (>13 min)	35 (70%)	21 (42%)	
Post-treatment	Decreased (<5.6 min)	6 (12%)	2 (4%)	0.002
	Normal (5.6-13 min)	41 (82%)	32 (63%)	
	Prolonged (>13 min)	3 (6%)	16 (32%)	
P Value		<0.0001	0.528	

Table 1 shows the number and percentage of patients with decreased, normal and prolonged MCT in both the groups, before and after treatment. The number of patients in Group 1 before treatment with normal and prolonged MCT was 14 and 35 respectively, which after treatment was found as 41 and 3 respectively. Whereas there was no significant change in the pre and post treatment MCT.

We also observed that the patients for whom mucociliary clearance time was decreased, were significantly higher in group 1 upon post-treatment in comparison to pre-treatment (P<0.0001). However, it was not statistically significant in group 2.

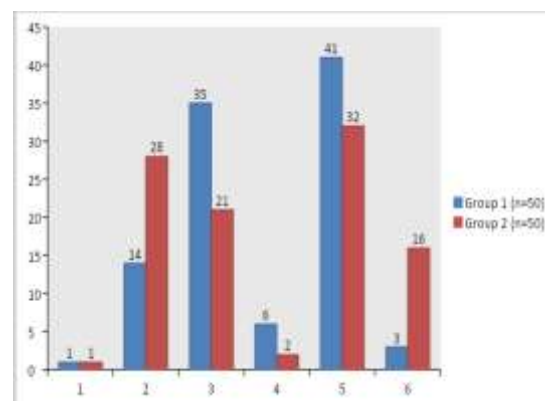


Fig 1. Distribution of patients on the basis of mean nasal MCT. Values shown in frequencies.

Our study also observed that mean mucociliary time (minutes) was significantly decreased post-treatment in comparison to pre-treatment mean

mucociliary clearance time in group 1. In group 2, there was no significant change in mean mucociliary time (minutes) post-treatment in comparison to pre-treatment mean MCT.

Table 2. Comparison of mean Mucociliary Clearance time

	Group 1 (n=50)	Group 2 (n=50)	P Value
Pre-treatment	14.08±3.81 min	12.33±3.29 min	0.016
Post-treatment	8.88±2.61 min	12.11±3.10 min	<0.0001
P Value	<0.0001	0.349	

Table 2 shows the pre treatment and post treatment MCT in Group 1 was 14.08 +- 3.81 min and 8.88 +- 2.6 min respectively, with a statistically significant difference (p<0.0001). While the pre and post treatment MCT was 12.33+- 3.29 min and 12.11+- 3.10 min respectively in Group 2.

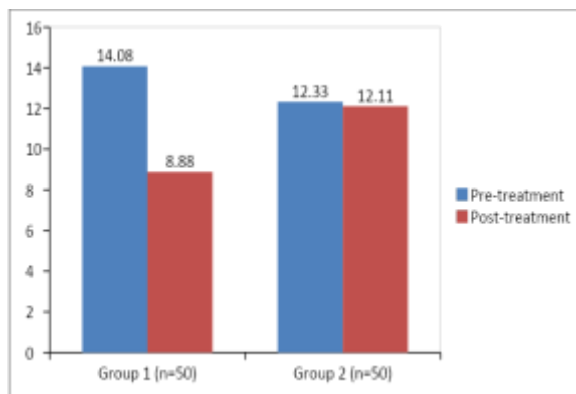


Fig 2. Comparison of pre and post treatment mean Mucociliary Clearance time of group 1 and group 2. Value shown as mean.

Mucociliary Clearance Rate

Our study observed that mean mucociliary rate in group 1 was significantly increased post-treatment in comparison to pre-treatment mean mucociliary clearance rate. Whereas, in group 2, there was no significant change in mean mucociliary clearance rate post-treatment in comparison to pre-treatment mean clearance rate.

Table 3. Comparison of mean mucociliary clearance rate

	Group 1 (n=50)	Group 2 (n=50)	P Value
Pre-treatment	5.69±3.10 mm/min	6.28±1.86 mm/min	0.254
Post-treatment	9.04±4.58 mm/min	6.58±2.75 mm/min	<0.0001
P Value	<0.0001	0.160	

Table 2 shows that the mean MCR in Group 1 increased from 5.69+- 3.10 mm/min to 9.04 +-4.58 mm/min, with a statistically significant difference. While in Group 2 the mean MCR before and after treatment did not show any significant difference.

DISCUSSION

MCT after treatment in Groups 1 and Group 2

Our study shows that patients in Group 1 who were treated with intranasal Fluticasone propionate + OAH with prolonged MCT decreased from 35(70%) to 3(6%) after treatment for a month, which is statistically significant (p<0.0001). While patients in Group 2 who were treated with OAH + intranasal saline nasal drops with prolonged MCT decreased from 21(42%) to 16(32%), showing no statistically significant difference (p=0.349).

A statistically significant difference was observed in the mean MCT in Group 1 which decreased from 14.08+-3.81 min to 8.88+-2.61 min (p<0.0001), while no statistically significant difference was observed in Group 2 where the MCT pre and post treatment were 12.33+-3.29 min and 12.11+-3.10 min respectively (p=0.349).

The Mucociliary rate were found reduced in the patients of AR. The pre and post treatment MCR in Group 1 were 5.9+- 3.10 mm/min and 9.04+-4.58 mm/min respectively. The pre and post treatment MCR in Group 2 were 6.28+-1.86 mm/min and 6.58+-2.78 mm/min respectively. The MCR in group 1 increased significantly, with a statistically significant difference after treatment (p<0.0001).

Several studies favour our results. Lee and Gendeh using Anderson saccharine transport time in group I on intranasal Beclomethasone spray showed improvement in mucociliary function with pre treatment STT AS 688 sec and post treatment STT 579 sec, while in patients on Loratidine, Loratidine plus Beclomethasone spray there was no significant change in the

mean pre and post treatment STT⁴. Neclerio et al demonstrated an overall improvement in RQLQ and nasal clearance with INCS¹⁵. Kirt Sreesakul et al observed significant improvement in TNSS, NMC in AR and non AR after treatment with nasal Triamcinolone acetonide⁷. Neffen and Wingertzhn concluded that INCS are the most effective at providing symptom relief and increasing quality of life⁶. Significant improvement in the ocular and nasal symptoms was seen by Giaviana et al after using intranasal Fluticasone furoate in AR⁹. Salahuddin et al statistically significant difference in group I and III treated with INCS and INCS plus OAH, but the results were not significant in group II where only OAH were given⁸.

Contrary to our results there are studies which have shown that INCS do not effect MCC in AR. Pata et al suggested that Mometasone furoate did not affect MCC in patients of AR¹⁰. Inanh et al found no significant difference between basal MC and 20th minute MC of Fluticasone propionate in acute bacterial rhinusinusitis¹¹.

CONCLUSION

Intranasal glucocorticosteroids are the most effective treatment for allergic rhinoconjunctivitis and are recommended in current guidelines as first-line therapy for patients with moderate to severe Allergic Rhinitis. INCS produce a statistically significant change in the Mucociliary clearance, depicted by the decrease in MCT and consequent increase in MCR in the intervention group. Early treatment with INCS should be helpful in alleviating the severity of the disease and reduce the suffering of patients of AR.

Declaration by Authors

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Conflict of Interest: The authors declare no conflict of interest.

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