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Nasal irrigation using saline at room temperature or body temperature: which is more beneficial in chronic rhinosinusitis?

Subrat K. Behera, Sruthi Thattamparambil Radhakrishnan*, Smruti Swain

Department of ENT and HNS, SCB Medical College and Hospital, Cuttack, Odisha, India

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***Correspondence:**
Dr. Sruthi Thattamparambil Radhakrishnan,
E-mail: sruthitr23@gmail.com

ABSTRACT

Background: Mucociliary clearance in nasal mucosa shows changes with temperature. In cold climate, it is expected to decrease, thus contributing to exacerbation of rhinosinusitis symptoms. If we raise the temperature of saline used for nasal irrigation to the normal body temperature, can it overcome this problem in cold climate? This study aims to examine whether irrigation using saline that is heated to 37°C has any superiority compared to irrigation using saline at 18^0C in rhino sinusitis treatment.
Methods: Prospective double blind study done in a tertiary care centre from November 2017 to March 2018. 32 patients of chronic rhinosinusitis were divided into 2 groups. Group A received saline nasal irrigation using saline at 18^oc and Group B received irrigation with saline at 37^oc for 2 weeks. Saccharine transit time and sino nasal outcome test (SNOT-22) scores were calculated before and after treatment in both groups and the results compared.
Results: Saccharine transit time improved from mean pretreatment value of 12.4±5.52 minutes to 9.1±6.3 minutes in Group A and from 12.82±6.3 to 8.5±6.45 in Group B ($p=0.0212$). Mean SNOT-22 score decreased from 58.8±5.6 to 41.4±4.8 in Group A and from 57.5±4.2 to 37.9±5.1 in Group B after treatment ($p<0.05$).
Conclusions: Nasal irrigation using saline at 37^0C is more effective than saline at 18°C in increasing mucociliary clearance and improving symptoms in chronic rhinosinusitis patients.

Keywords: Nasal irrigation, Temperature, Chronic rhinosinusitis, Saccharine transit time

INTRODUCTION

Saline nasal irrigation is a well documented treatment modality of chronic rhinosinusitis.[1,2] It is known that cold exposure hampers ciliary motility and thus mucociliary clearance, which can lead to exacerbation of rhinosinusitis symptoms.[3] So, if we could increase the temperature to the body temperature locally in the nasal mucosa, it may lead to improved mucociliary clearance and thus improvement in symptoms. One method of achieving this is via the nasal irrigation solutions. The effect of temperature of the saline used for irrigation in rhinosinusitis is not very well studied and the literature on the same is also minimal. This study was undertaken to find if warming the saline to 37°C for nasal irrigation has any added advantage over saline at room temperature of 18°C.

METHODS

This is a prospective study done at department of ENT, SCB Medical College and Hospital, Cuttack, Odisha, from November 2017 to March 2018. The institutional ethical committee clearance was obtained. Patients of chronic rhinosinusitis, presenting to the ENT out patient department were taken up for the study. The inclusion criteria were the patients who fit into the diagnosis of chronic rhinosinusitis, according to the EPOS criteria

(European position paper on rhinosinusitis and nasal polyps) and those who were willing to take part in the study. We excluded patients who had other diseases like HIV infection, head and neck malignancy, any other nasal diseases, cases of cystic fibrosis, those who had upper respiratory tract infection at time of presentation, those with a history of nasal surgery. Patients who had undergone nasal irrigation in the last 2 months and those who were not willing to participate in the study were also excluded. Informed written consent was taken from all the participants. 32 patients who fulfilled these criteria were taken up for the study. They were asked to stop all topical medications like nasal sprays 1 month before the procedure along with all drugs for rhinosinusitis like antibiotics. Drugs for chronic conditions like hypertension and diabetes mellitus were continued.

The patients were divided into 2 groups using random number table. Group A, the 18°C group and Group B, the 37°C group, each having 16 patients each. Each participant filled up the SNOT-22 (sino nasal outcome test-22) questionnaire. The initial mucociliary clearanc was measured by saccharine transit time. 1/4th of a saccharine tablet was placed in the anterior most part of the inferior turbinate and the time taken by the patient to appreciate the sweet taste was noted as pretreatment saccharine transit time. The patient was told not to sniff or sneeze during the procedure. Then 100 ml of hypertonic saline was used for irrigation in each nostril twice daily using a squeeze bottle for 2 weeks. The irrigation was performed with the patient leaning forwards with the head slightly tilted to the opposite side. The nozzle of the squeeze bottle was inserted to one nostril and the bottle pressed so as to irrigate the nasal cavity. The same was repeated on the opposite side. Group A used hypertonic saline at 18^{0}C and Group B used hypertonic saline at 37^{0}C. The mucociliary clearance was measured for the 2nd time on the 15th day by the same person (who measured the saccharine transit time before treatment) using the same procedure. This person was blinded to which group each patient belonged to. The post treatment SNOT-22 questionnaire was filled by the patients. The values were tabulated and the improvement in saccharine transit time was calculated. The improvement in the SNOT-22 scores were also calculated for both the groups. The improvement was compared between the two groups using t test. The result was considered to be significant if p value was <0.05.

RESULTS

The mean age of the study population was 36±5 years. Group A had 7 males and 9 females and Group B had 8 males and 8 females. The difference between the 2 groups was not statistically significant. The pretreatment and post treatment saccharine tansit times of both groups are as shown in Table 1. The improvement in mucociliary clearance of Group A was statistically significant with a p value of 0.04 [t value=-1.78, degree of freedom (df)=30, 95% confidence interval (CI)]. The improvement in mucociliary clearance in Group B was also statistically significant with a p value of 0.01 (t value=-2.45, df=30, 95% CI). One tailed t-test was used to compare the improvement in mucociliary clearance between the 2 groups. t-value was found to be (-2.125) and p value was calculated as 0.0212 (95% CI, df=30), that was statistically significant.

The SNOT-22 scores are tabulated in Table 2. The difference in improvement between the 2 groups was statistically significant with p value <0.05. Adverse effects noted included nasal irritation and sneezing that decreased on the course of treatment.

Table 1: Effect of nasal irrigation on mucociliary clearance.

	Mean saccharine transit time (min)		Mean improvement	P value (comparing pre and post treatment)
	Pre treatment	Post treatment		
Group A (saline at 18^{0}C)	12.4±5.52	9.1±6.3	3.76±7.68	0.04
Group B (saline at 37^{0}C)	12.82±6.3	8.5±6.45	4.4±5.88	0.01
P value (comparing mean improvement in both groups): 0.0212				

Table 2: Effect of nasal irrigation on SNOT-22 score.

	SNOT–22 score		Mean improvement
	Pre treatment	Post treatment	
Group A (saline at 18^{0}C)	58.8±5.6	41.4±4.8	16.7±5.4
Group B (saline at 37^{0}C)	57.5±4.2	37.9±5.1	20.9±6.7

DISCUSSION

Respiratory epithelium is specialized with a mucociliary function. It contains cilia that continuously beat so as to propel the sheet of mucous overlying it. This helps in removing the dust and bacteria entrapped in it. The cilia functions mainly at 2 modes: low rate requiring only ATP and a high rate that makes use of second messengers.[4] Protein kinase C and calcium calmodulin dependent kinase II are involved in regulation of the ciliary beat frequency in response to temperature. Cilia function starts at 4°c in normal human nasal epithelium.[3]

Chronic rhinosinusitis is a major problem presenting to an otolaryngologist. Saline nasal irrigations have long been used as adjunctive treatments for patients with chronic rhinosinusitis. Nasal irrigations reduces nasal inflammation and causes decrease in the symptoms.[5] Different solutions like isotonic saline, hypertonic saline, buffered saline, ringer lactate, dead sea water have all been used.[6-9] Hauptman et al found that both buffered physiological and buffered hypertonic saline improved mucociliary clearance.[10] Studies by Ural et al states hypertonic saline to be more effective in chronic sinusitis compared to isotonic saline.[11] Metaanalysis in 2018 also reports the superiority of hypertonic saline and high volume nasal irrigation.[12] Here in this study we have used hypertonic saline at high volume.

In winters the incidence and exacerbation of rhinosinusitis increases. As room temperature falls during this time, so does the temperature of the saline used by patients for nasal irrigation. Does this decrease the efficacy of treatment? Well, the effect of saline irrigation at different temperatures on the ciliary beat frequency and mucociliary clearance are scarcely studied. In this study there was significant improvement in nasociliary clearance after nasal irrigation, in both the groups. This shows that saline nasal irrigation is effective in treating chronic rhinosinusitis. The improvement was much more in the group that used saline at 37^0C, with a p value of <0.05. Sauvalle et al in 2018 conducted a similar study in 78 healthy subjects and found a better improvement with saline at 37^0C than with saline at 20^0C.[13] Here they showed an improvement from 12.3±4.5 minutes to 8.4±4.9 minutes in the heated saline group and in the room temperature group it was from 12.8±5 minutes to 8.9±4.2 minutes. However another study by Nimsakul et al did not find any such statistically significant difference.[14] This difference may be due to the difference in the study population and the temperatures used.

The SNOT-22 is an easy, quick and effective method of assessing nasal symptoms. It is a 22 point questionnaire in which patients rate the severity of their symptoms from 0 to 5. In Rabago et al study which evaluated the efficacy of hypertonic saline nasal irrigation, SNOT-20 scores improved from 43.5±5.7 points to 28.4±4.8 points.[15] Isotonic saline irrigation also produced lowering of SNOT-20 scores in Pynnonen et al study.[16] In our study, Group A (saline at 18^0C) had a mean SNOT-22 score of 58.8±5.6 before treatment that decreased to a mean of 41.4±4.8 after treatment. Group B (saline at 37^0C) had decrease in score from 57.5±4.2 to 37.9±5.1. The difference between the 2 groups was statistically significant with p value <0.05, which reflected that saline at 37^0C produced better resolution of symptoms of rhinosinusitis.

The main drawback of this study was the inability to crosscheck that the patients were using saline at the prescribed temperatures. Others included small sample size, not taking into account the comorbidities or severity of rhinosinusitis in both groups. There are still no definite protocols on the saline nasal irrigation, in terms of concentration, amount, procedure pressure or temperature used. More larger multicentre studies are required to draw concrete conclusions.

CONCLUSION

To conclude, increasing the temperature of saline used for nasal irrigation to 37°C increases the mucociliary clearance rate in nasal epithelium as compared to saline at 18^0c in patients with chronic rhinosinusitis. The improvement in symptoms is also more as the temperature is increased. So ensuring that the saline used for irrigation is at body temperature can give better outcomes.

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