

Original Article

Normal Saline Versus Hypertonic 3% Saline: It's Efficacy in Non-Acute Rhinosinusitis

*Nezamoddin Berjis¹, Seyyed Mehdi Sonbolastan², Seyyed Hanif Okhovat³, Ali Asghar Narimani⁴, Jaleh Razmjui⁵

Abstract

Introduction:

Sinusitis is one of the most common diseases in general and in otolaryngology practice, but the optimal therapeutic options have not yet been fully developed. This manuscript will try to compare normal saline nasal douching with hypertonic saline in reducing symptoms and improving its signs.

Materials and Methods:

One hundred and fourteen patients suffering from non acute rhinosinusitis, documented by history, physical examination and radiologic studies were divided into normal saline and hypertonic saline groups, each consisting of 57 patients. data were obtained by physical examination and a questionnaire..

Results:

Type of treatment had no significant effect on headache, morning dryness of mouth and pharynx and fatigue. Nonetheless, nasal congestion, purulent discharge and postnasal discharge were reported to have improved in the group treated with hypertonic saline versus the normal saline group. Patient satisfaction also showed better scores in the hypertonic saline group.

Conclusion:

Hypertonic saline (3%) is more effective for nasal irrigation than normal saline in chronic rhinosinusitis.

Keywords:

Chronic rhinosinusitis, Hypertonic saline, Postnasal discharge

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¹ Department of otorhinolaryngology, Isfahan University of Medical Sciences, Isfahan, Iran

² Department of otorhinolaryngology, Isfahan University of Medical Sciences, Isfahan, Iran

³ Department of otorhinolaryngology, Isfahan University of Medical Sciences, Isfahan, Iran

⁴ Department of otorhinolaryngology, Isfahan University of Medical Sciences, Isfahan, Iran

⁵ General physician, Isfahan University of Medical Sciences, Isfahan, Iran

*Corresponding author:

Alzahra Hospital, Isfahan University of Medical Sciences, Isfahan, Iran

Email: berjis@med.mui.ac.ir

Introduction

Sinusitis is one of the most common diseases associated with significant morbidity. It was the fifth most common disease requiring antibiotic therapy between 1985 and 1992 (1). It significantly affects quality of life so in some studies its effect has been comparable to congestive heart failure, COPD and low back pain (2). Normal function of the paranasal sinuses are dependent on : 1. Patency of the ostium, 2. Normal mucocilliary function and 3. Quality of the mucosal secretions. Alterations in one or more of the mentioned factors can lead to incomplete drainage and retention of secretions in the sinuses, leading to sinusitis.

Treatment of sinusitis consists of antimicrobial therapy, promotion of the drainage function (hydration, mucolytics and decongestants) and topical steroids (3,4,5). Subjective and objective improvement following nasal irrigation has been documented in the treatment of diseases of the paranasal sinuses (2). Its benefits seem to originate from removal of pathogens, decongestant effects and return of normal or near-normal mucocilliary function. Furthermore, nasal normal saline irrigation is one of the most universally accepted treatments modality following nasal and sinuses surgical procedures (e.g functional endoscopic sinus surgery).

Effects of hypertonic saline irrigation on cure rate of rhinosinusitis is unknown. Hypertonic saline has traditionally been administered as sea water in many chronic disorders and also in Yoga as a prerequisite for sanity. Some studies have shown its positive effects on nasal physiology and mucocilliary clearance (6,7,8). Other studies have failed to demonstrate any positive effects and even declare negative effects on nasal physiology (9,10,11). Its potential effects on mucosa are thinning of mucosa (3,4) and possibly antiinflammatory consequences (12).

Nevertheless, now a day no large study has compared effect of hypertonic saline with normal saline in the treatment of rhinosinusitis yet. Furthermore, in different studies, different concentration of saline has been administered as hypertonic saline (e.g 3%, 6% and 7%).

So this study was conducted to compare : 1) the effects of hypertonic 3% saline with normal saline in resolution of symptom and sign of rhinosinusitis and 2) the effects of hypertonic 3% saline with normal saline on satisfaction rate in non-acute rhinosinusitis patients.

Materials and Methods

This clinical trial was financially supported by Isfahan University of Medical Sciences. All patients suffering from non-acute rhinosinusitis enrolled the study. It was performed from September 2007 through May 2008.

The study population was selected by a simple convenient method among the patients with non-acute rhinosinusitis referred to ENT clinics affiliated to Isfahan University of Medical Sciences. Inclusion criteria were patients suffering from clinical features of post nasal drainage, purulent discharge and oral or oropharyngeal dryness in the mornings and also radiologic evidence of sinusitis. Exclusion criteria were as follows: polyposis, a recent episode of acute rhinosinusitis, osteomeatal complex mass obstruction, severe septal deviation on examination and asthma.

Data were gathered through history and physical examination, and were recorded in a questionnaire .

First patients informed verbally about the study and then written informed consents were obtained.

Patients were randomly assigned to one of the two study groups. Route of the drug administration was explained to them (according to their group), 4-5 drops daily

for one month. Loratadin (10 mg/day) as an antihistamine was prescribed in both groups. None of the patients received antibiotics. The patients were followed up one month, and then they reassessed by history and physical examination.

Data were analyzed by using the SPSS software, version 15. Data analysis was performed using the Chi-square test, fisher's exact test (comparing qualitative data), T student test (comparing quantitative independent data) and Paired t-test (comparing quantitative before-after data).

Results

Mean age of the studied cases was 26.5 years (SD=14.5 yrs). Mean age of hypertonic saline group was 24.6 ± 15.6 years, whereas the mean age of the normal saline group was 28.5 ± 13.1 years, age differences were not statistically significant between the two groups ($P=0.15$).

Signs and Symptoms:

1. Headache:

In the hypertonic saline group 10 patients (17.5%) and in the normal saline group 11(19.3%) patients reported complete improvement of headache. This difference was not statistically significant (Chi-square test, $P=0.98$). Detailed data is demonstrated in (Fig 1).

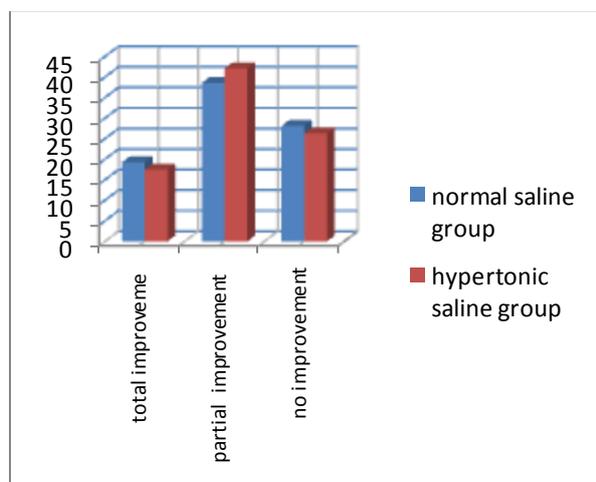


Fig 1: Frequency distribution of headache in the two groups

2. Nasal congestion:

In this study, total improvement, partial improvement and no improvement of nasal stuffiness in hypertonic saline and normal saline groups respectively were as follows: 24.6% vs 14%, 40.4% vs 33.3% and 26.1% vs 29.8%.

Chi-square test showed that improvement of nasal congestion in the hypertonic saline group was significantly more than the normal saline group ($P=0.03$).

3. Post Nasal Discharge (PND):

Our study revealed that 20 cases showed total improvement of PND (35.1%) in the hypertonic saline group, whereas 7 patients (12.3%) demonstrated the same result in the normal saline group. Partial improvement of PND was reported in 15 cases (26.3%) of the hypertonic saline group and in 24 cases (42.1%) of the normal saline group. This difference was statistically significant (χ^2 , $P=0.033$).

4. Dryness of mouth and pharynx in the morning:

Our results showed *total improvement* of oral dryness in 12 cases of the hypertonic saline group (21.1%) and 5 cases in the normal saline group (8.8%). *Partial improvement* of this symptom was reported in 24.6% of hypertonic saline group and 40.4% of normal saline treated patients. The difference was not significant (χ^2 , $P=0.13$).

5. Anterior Purulent discharge:

Findings revealed that 19 cases (33.3%) in the hypertonic saline group and 10 patients (17.5%) in the normal saline group showed total improvement of anterior purulent discharge. Partial improvement of anterior purulent discharge was reported in 23 (40.4%) and 33 (57.9%) cases of hypertonic saline and normal saline groups, respectively. The difference was statistically significant (χ^2 , $P=0.04$).

6. Fatigue:

Pre intervention 41(71.9%) patients in hypertonic saline group and 31(54.4%) in

normal saline groups had fatigue. After intervention Only 25 (%21.9) cases reported a partial improvement of fatigue, among which 11 (19.3%) cases were in hypertonic saline group and 14 (24.6%) in the normal saline group.

There was no statistically significant difference between the two groups ($\chi^2 P=0.1$).

7. Patient satisfaction:

Minimum satisfaction score was 0 and the maximum score was 10. In hypertonic saline group mean satisfaction score was 6.3 +-3.6 whereas in the normal saline it was 4.9+-2.2 for the. The difference was significant (T student test $P=0.01$). Results are depicted in (Fig 2).

28 cases (49.1%) in the hypertonic saline group and 5 cases (8.8%) in the normal saline group were ‘completely satisfied’ (scored 8-10). 13 cases (22.8%) in hypertonic saline group and 31 cases (54.4%) in normal saline group were ‘some what satisfied’ (scored 5-7). ‘Not satisfaction’ was reported in 28.1% of hypertonic saline group and 36.8% of normal saline group. The difference between the two groups was statistically significant ($\chi^2.P<0.001$).

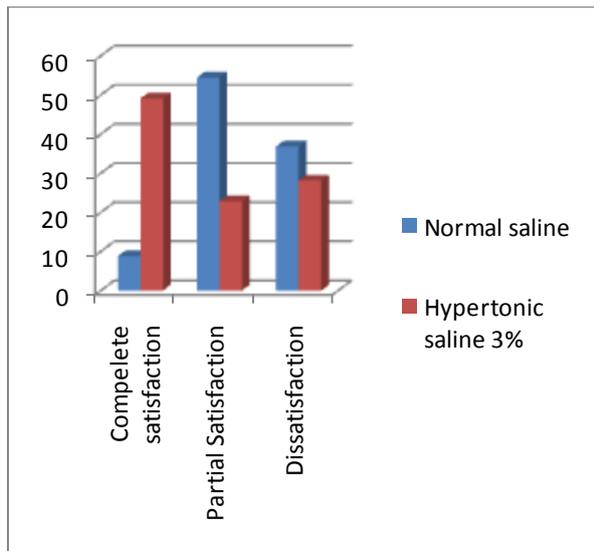


Fig 2: Percentage distribution of patient satisfaction in the studied groups.

Discussion

Effects of normal saline and hypertonic solutions on mucocilliary clearance in healthy individuals has been studied by Talbot et al (12). They demonstrated that hypertonic solutions have a positive effect on mucocilliary clearance whereas normal saline lacked such effects. They also showed that hypertonic saline may have a stronger effect on improvement of nasal congestion. These effects were studied again by Keojampa et al on healthy participants (13). They concluded that mucocilliary clearance improves by both normal and hypertonic saline, and that hypertonic saline solution is more potent in improving such clearance. In that study, acoustic rhinometry was unable to detect any changes in the nasal airway dimentions following administration of either solutions and so raised questions about the comparative benefits of hypertonic saline.

The goal of the current study was to introduce more data regarding diverse effects of hypertonic saline compared to normal saline in the management of chronic sinusitis. Various concentrations of hypertonic saline were used in different studies (7%, 6%, 3.5% and 3%). Based our study it seemed that hypertonic solution is better tolerated by than the normal saline.

Our results showed that improvement of headache, morning dryness of mouth and throat and fatigue do not remarkably differ in between hypertonic or normal saline solutions. But other signs or symptoms such as nasal congestion and stuffiness, post nasal discharge and anterior nasal discharge in the hypertonic saline group improved more than the normal saline group. Also, patient satisfaction with the medication was significantly higher in the hypertonic saline group.

In a study by Shoseyov et al which was conducted on children suffering from chronic sinusitis, a meaningful improvement was demonstrated in cough, PND, anterior nasal discharge and

radiologic scores; whereas in the normal saline group significant resolution was only reported in PND scores (6).

Hauptman et al demonstrated that both normal and hypertonic saline can improve sacharin clearance in the nasal mucosa. They also showed that resolution of nasal congestion was better with the hypertonic saline (14).

In another study by Cordray et al, Dead sea hypertonic saline nasal spray was compared with triamcinolon nasal spray. Interestingly, no significant difference was reported in rates of symptom resolution between the two groups (15). This study concluded that Dead sea hypertonic saline can be a suitable substitute in cases of mild to moderate allergic rhinitis.

The physiologic effects of hypertonic saline on respiratory mucosa are not totally understood. In chronic rhinosinusitis morphologic changes of the mucosa are seen; ciliated cells are reduced in comparison to non-ciliated cells and metaplasia and extrusion of epithelial cells are observed (16). Hyperosmolar solutions

have been shown to facilitate the release of ca^{2+} reserves into intracellular fluids and thus stimulate increased ciliary beat on the cell surface (17, 18).

Conclusion

In this study which was conducted on chronic rhinosinusitis patients, both normal saline solution and 3% hypertonic saline were effective in reducing signs and improving symptoms. In regard to certain complaints such as headache, morning dryness of mouth and pharynx and fatigue, the two solutions did not show statistically significant differences in reducing the symptoms. Nonetheless, nasal congestion, purulent discharge in anterior rhinoscopy and postnasal discharge were reported to have improved in those treated with hypertonic saline versus the normal saline group. Patient satisfaction also showed better scores in the hypertonic saline group. Hypertonic 3% saline solution was proven to be a better choice for nasal irrigation in patients with chronic rhinosinusitis.

References

1. McCaig LF, Hughes JM. Trends in antimicrobial drug prescribing among office based physicians in the united states. *JAMA* 1995; 273: 214-9.
2. Glicklich RE, Metson R. The health impact of chronic sinusitis in patients seeking otolaryngologic care. *Otolaryngol Head Neck Surg* 1995; 113: 104-9.
3. Robinson M, Hemming AL, Regnis JA. Effect of increasing doses of hypertonic saline on mucociliary clearance in patients with cystic fibrosis. *Thorax* 1997; 52: 900-3.
4. Homer JJ, Dowley AC, Condon L, El-Jassar P, Sood S. The effect of hypertonicity on nasal mucociliary clearance. *Clin Otolaryngol* 2000; 25: 558-60.
5. Homer JJ, England RJ, Wilde AD, Harwood GRJ, Stafford ND. The effect of pH of douching solution on mucociliary clearance. *Clin Otolaryngol* 1999; 24: 312-3.
6. Shoseyov D, Bibi H, Shai P. Treatment with hypertonic saline versus normal saline nasal wash of pediatric chronic sinusitis. *J Allergy Clin Immunol* 1998; 101: 602-5.
7. Heatley DG, McConnell KE, Kille TL, Leverson GE. Nasal irrigation for alleviation of sinonasal symptoms. *Otolaryngol Head Neck Surg* 2001; 125: 44-8.
8. Rabago D, Zgierska A, Mundt M. Efficacy of daily hypertonic saline nasal irrigation among patients with sinusitis: a randomized controlled trial. *J Fam Pract* 2002; 51: 1049-55.
9. Min YG, Lee KS, Yun JB. Hypertonic saline decreases ciliary movement in human nasal epithelium in vitro. *Otolaryngol Head Neck Surg* 2001; 124: 313-6.
10. Boek WM, Keles N, Graamans K, Huizing EH. Physiologic and hypertonic saline solutions impair ciliary activity in vitro. *Laryngoscope* 1999; 109: 396-9.
11. Adam P, Stiffman M, Blake RL. A clinical trial of hypertonic saline nasal spray in subjects with common cold or rhinosinusitis. *Arch Fam Med* 1998; 7: 39-43.
12. Talbot AR, Herr TM, Parsons DS. Mucociliary clearance and buffered hypertonic saline solution. *Laryngoscope* 1997; 107: 500-3.
13. Keojampa BK, Nguyen MH, Ryan MW. Effects of buffered saline solution on nasal mucociliary clearance and nasal airway patency. *Otolaryngol Head Neck Surg* 2004; 131: 679-82.
14. Hauptman G, Ryan MW. The effect of saline solutions on nasal patency and mucociliary clearance in rhinosinusitis patients. *J Otol HNS* 2007; 137: 815-21
15. Cordray S, Harjo JB, Miner L. Comparison of intranasal hypertonic Dead Sea saline spray and intranasal aqueous triamcinolone spray in seasonal allergic rhinitis. *Ear Nose Throat* 2005; 84(7): 426-30.
16. Toskala E, Nuutinen J, Rautiainen M. Scanning electron microscopy findings of human respiratory cilia in chronic sinusitis and in recurrent respiratory infections. *J Laryngol Otol* 1995; 109: 509-14.
17. Eveloff JL, Warnock DG. Activation of ion transport systems during volume regulation. *Am J Physiol* 1987; 252: 1-10.
18. Lansley AB, Sanderson MJ, Dirksen EP. Control of the beat cycle of respiratory tract by Ca²⁺ and cAMP. *Am J Physiol* 1992; 263: 232-42.