

Nasalance measures outcome in vasomotor rhinitis patients after treatment with intranasal corticosteroids versus hypertonic saline irrigation

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Objective

The objective of this study was to evaluate the effect of intranasal corticosteroid versus hypertonic saline irrigation on the nasalance scores in patients with vasomotor rhinitis (VMR).

Patients and methods

The study was conducted on 71 patients recruited from the Otolaryngology Department, Kasr El-Aini Hospital, Cairo University, with a history of nasal obstruction for at least 6 months, clinical and endoscopic evidence of VMR, and negative skin prick test. The patients were subjected to nasometric evaluation to obtain their nasalance scores before treatment. The patients were then randomly classified into two groups: group A, which included 33 patients who were instructed to apply mometasone furoate nasal spray two puffs in each nostril once per day for 3 months, and group B, which included 38 patients who were instructed to apply hypertonic saline nasal spray three times per day for 3 months. Patients of the two groups were re-evaluated by means of nasometry to assess the change in their nasalance scores after each treatment plan.

Results

The mean pretreatment nasometry score for group A was 34.55 ± 7.71 , the minimum score was 18.7, and the maximum score was 48. The post-treatment nasometry score for the same group showed a mean of 46.44 ± 7.76 and ranged from a minimum of 29.9 to a maximum of 58.2. The difference between the two scores was found to be statistically significant ($P = 0.014$). As regards group B, the mean pretreatment nasometry score was 36.04 ± 7.36 , the minimum score was 17.4, and the maximum score was 47.3. The post-treatment nasometry score for the same group showed a mean of 45.57 ± 7.4 and ranged from a minimum of 29.3 to a maximum of 55. The difference between the two scores was found to be statistically highly significant ($P = 0.001$).

Conclusion

It appears that intranasal hypertonic saline is highly effective in the treatment of VMR and approaches the effect of intranasal corticosteroids.

Keywords:

hypertonic saline nasal irrigation, intranasal corticosteroids, nasalance, vasomotor rhinitis

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Introduction

Rhinitis is inflammation of the nasal lining characterized by nasal congestion, rhinorrhea, sneezing, and/or nasal itching [1]. Rhinitis is classified into allergic, nonallergic, occupational, hormonal (pregnancy and hypothyroidism), drug-induced, and food-related subtypes [2]. Vasomotor rhinitis (VMR) is the most common form of chronic nonallergic rhinitis (NAR). Recent articles have noted that VMR may sometimes be a 'wastebasket diagnosis'. This is because VMR is an idiopathic condition diagnosed in the absence of infection, allergy, eosinophilia, hormonal changes (such as pregnancy and hypothyroidism), and exposure to drugs (oral contraceptives, estrogens, angiotensin-converting enzyme inhibitors, receptor blockers, antihypertensives, aspirin, chlorpromazine, NSAIDs, and topical nasal decongestants) [3,4]. Several hypotheses have been proposed for the pathophysiology of VMR, such as autonomic dysfunction and trauma [5].

It is not possible to distinguish between perennial allergic rhinitis and NAR on the basis of symptoms alone. VMR is more commonly associated with nasal obstruction and postnasal drip. Allergic rhinitis is more commonly associated with itching, redness, clear rhinorrhea, and watery eyes. NAR affects a disproportionate percentage of female population, which may be the result of endocrinologic influences [6].

Intranasal steroids are usually prescribed for the management of VMR. Although the efficacy and safety of intranasal corticosteroids (INCs) are well established for the management of allergic rhinitis, rhinosinusitis, and nasal polyps, concerns remain among some patients, caregivers, and healthcare providers

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that these agents may reach the systemic circulation in sufficient concentrations to produce adverse effects [7]. These side effects include growth inhibition induced by hypothalamus–pituitary–adrenal axis suppression, decreased bone mineral density, myopathy, cataract, glaucoma, hypertension, hyperglycemia, and thin or easily bruised skin [8]. Nasal irrigations may be used for a variety of conditions [9]. Their use is included in the management of acute and chronic rhinosinusitis [10], allergic and NAR, nonspecific nasal symptoms (including postnasal drip), septal perforations, and the postoperative care of surgical patients. The use of prescribed nasal medications can be decreased as a result of nasal irrigations in some circumstances due to the effect of nasal irrigations on alleviating nasal symptoms [11]. Nasal irrigations have been shown to be safe and side effects encountered are minimal, such as local irritation, itching, burning, otalgia, and pooling in sinuses with subsequent drainage [12]. This pooling, with delayed discharge in some head positions, is most commonly seen in patients who have undergone previous sinus surgery [11]. Various reports suggest that hypertonic nasal irrigations are superior to isotonic nasal irrigations [13].

Nasometry is a technique to measure the oral and nasal components of nasalance. Nasalance is an objective measure of the nasal component of speech that is determined by the ratio of acoustic pressures emitted from the nasal and oral cavities. The nasometer provides a nasalance score based on the ratio of nasal acoustic energy to total acoustic energy (oral and nasal). Acceptable levels of agreement between the measure provided by the nasometer (nasalance score) and the auditory-perceptual measure of hypernasality has been demonstrated through numerous studies resulting in the acceptance of nasometry for both use in the clinic and laboratory [14,15].

According to Wetmore [16], the nasal cavity can provide as much as 50% of the total resistance to nasal airflow. Nasal airway obstruction/resistance can be increased in a variety of nasal conditions, including allergic rhinitis, NAR, and rhinosinusitis. This is attributed to swelling of nasal mucosa and hypertrophy of inferior turbinates. In these conditions, the acoustic energy emitted from the nose during speech evaluation by means of nasometry is reduced, resulting in hyponasality. Decreasing this nasal resistance (by medical or surgical means) leads to an increase in the nasal component of speech, which is reflected during nasometric study as improvement in the nasalance scores.

The current prospective study aimed to evaluate the effect of intranasal corticosteroid versus hypertonic saline irrigation on the nasalance scores in patients with VMR.

Patients and methods

The current prospective study was conducted on 71 patients recruited from the Otolaryngology Department, Kasr El-Aini Hospital, Cairo University, during the period from June 2014 to April 2016. The study protocol was approved by the Local Ethical Committees of Kasr El-Aini Hospital, and all study participants signed a written fully informed consent form. The main complaint of all patients was nasal obstruction. Other complaints included rhinorrhea, sneezing, nasal itching, and smell disorder.

Every patient was subjected to detailed history taking, complete general and otolaryngologic examination, diagnostic nasal endoscopy, and skin prick test. The main characteristic finding of the examination of these patients was inferior turbinate hypertrophy (of varying degrees). Other findings included swelling of the nasal mucosa, wetting of the nasal cavity, and in some cases prominent vessels along the nasal cavity floor. Patients older than 18 years with a history of nasal obstruction for at least 6 months, clinical and endoscopic evidence of VMR, and negative skin prick test were included in our study. The exclusion criteria were as follows: (a) active upper respiratory tract infection throughout the duration of the study; (b) history of nasal surgery; (c) history of asthma; (d) nasal polypi masses or tumors; (e) associated nasal septal deviation; (f) history of topical or systemic antiallergic treatment for at least 2 months before enrollment in the study; and (g) pregnancy, lactation, or use of contraceptive pills.

The patients were subjected to nasometric evaluation to obtain their nasalance scores before treatment using the model 6200-2 nasometer (Kay Elemetrics, New Jersey, United States). Calibration, data recording, and calculation of nasalance scores were carried out according to the procedures described in the nasometer's instructional manual. The nasometer is a computer-based device that analyzes acoustic energy that is emitted from the oral and the nasal cavity during speech. It consists of two microphones that are separated by a plate. The upper microphone measures nasally emitted acoustic energy, and the lower microphone measures the acoustic energy emitted from the oral cavity. The participant is then asked to read standard passages. While the participant is reading, the microphone captures sound pressure levels, which are emitted from the nasal and the oral cavity. These data were analyzed using the attached computer and presented graphically providing a nasalance score.

The patients were then randomly classified into two groups: group A, which included 33 patients who were instructed to apply mometasone furoate nasal spray two puffs in each nostril once per day for 3 months,

and group B, which included 38 patients who were instructed to apply hypertonic saline nasal spray three times per day for 3 months. Patients of the two groups were re-evaluated by means of nasometry to assess the change in their nasalance scores after each treatment plan. Post-treatment nasal scores were categorized as follows: (a) normalized, if the score was 48.8 or above; (b) partially improved, if the score increased but did not reach normal value (48.8); and (c) resistant, if the score was the same or decreased.

Statistical analysis

Microsoft Excel 2010 was used for data entry, and the statistical package for the social sciences (SPSS version 21 Chicago, USA, IBM Corporation) was used for data analysis. Simple descriptive statistics (arithmetic mean and SD) was used for summary of quantitative data and frequencies were used for qualitative data. Fisher’s exact test was used for categorical variables. For metric variables, the unpaired *t*-test was used for variables that satisfied the normality assumption; the Mann–Whitney test was used for those that did not.

Results

The study included 71 patients with symptoms of nasal obstruction, with a mean age of 36 years, (range 18–53 years) with a male-to-female ratio of 1.4:1.

The mean pretreatment nasometry score for group A was 34.55 ± 7.71, the minimum score was 18.7, and the maximum score was 48. The post-treatment nasometry score for the same group showed a mean of 46.44 ± 7.76 and ranged from a minimum of 29.9 to a maximum of 58.2. The difference between the two scores was found to be statistically significant (*P* = 0.014). As regards group B, the mean pretreatment nasometry score was 36.04 ± 7.36, the minimum score was 17.4, and the maximum was 47.3. The post-treatment nasometry score for the same group showed a mean of 45.57 ± 7.4 and ranged from a minimum of 29.3 to a maximum of 55. The difference between the two scores was found to be statistically highly significant (*P* = 0.001).

Among the 33 patients who were treated with mometasone furoate, 19 (57.6%) were normalized and 13 (39.4%) showed partial improvement, whereas only one (3%) was resistant to treatment. For the 38 patients who received hypertonic saline, 20 (52.6%) were normalized, 14 (36.8%) showed partial improvement, and four (10.5%) remained resistant to treatment. On correlation of the differences in the post-treatment nasometric results between the two groups, it was not statistically significant (*P* = 0.56).

Considering those patients who showed partial improvement in group A, three of 13 (23.1%) showed at least 50% improvement and the remaining 10 (76.9%) improved by less than 50%. Considering those patients who showed partial improvement in group B, two of 14 (14.3%) showed at least 50% improvement and the remaining 12 (85.7%) improved by less than 50%. The difference in the results of partial improvement was not statistically significant (*P* = 0.64) (Table 1 and Figs. 1–3).

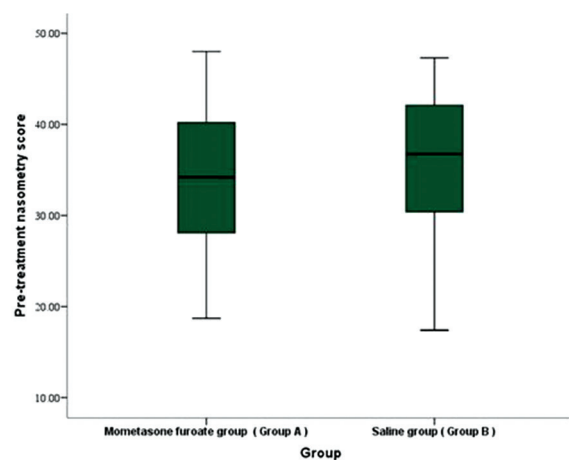
Discussion

On analyzing the previous results and according to the difference between the pretreatment and post-treatment nasometry scores between the two groups, 57.6 and

Table 1 The mean pretreatment and post treatment nasometry scores as well as the therapy results of both groups

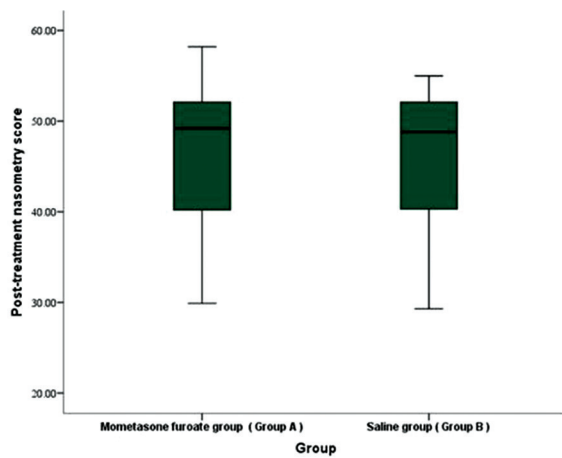
	Group A	Group B	<i>P</i>
Pretreatment nasometry score			
Mean	34.5	36	
Minimum	18.7	17.4	
Maximum	48	47.3	
Post-treatment nasometry score			
Mean	46.4	45.6	
Minimum	29.9	29.3	
Maximum	58.2	55	
<i>P</i>	0.014 (significant)	0.001 (highly significant)	
Therapy results (<i>n</i> (%))			
Normalized	19 (57.6)	20 (52.6)	
Partial improvement (<i>n</i> (%))			0.56
>50%	3 (9.1)	2 (5.3)	
<50%	10 (30.3)	12 (31.6)	
Resistant (<i>n</i> (%))	1 (3)	4 (10.5)	

Figure 1



Box plot showing the pretreatment nasometry score for both groups.

Figure 2



Box plot showing the post treatment nasometry score for both groups.

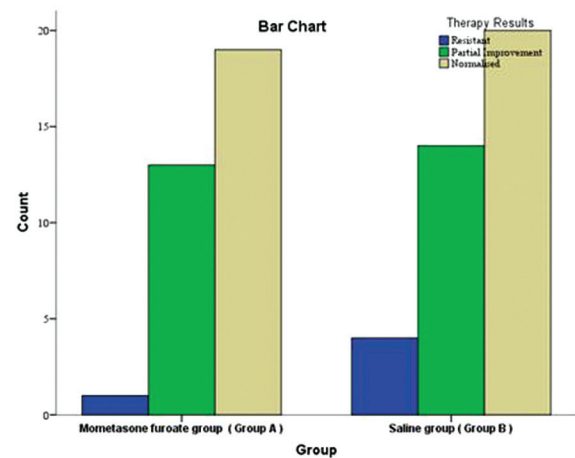
52.6% returned to normal nasometric score for those treated with mometasone furoate and hypertonic saline, respectively, in addition to those who showed partial improvement but did not reach normal nasometric values. This would high lighten the efficacy of future treatment using either intranasal steroids or hypertonic saline with nearly similar effect as shown by the non significant difference of the therapy results between both groups. Moreover, the improvement in the nasometry score of both groups was statistically significant ($P = 0.014$ and 0.001 for groups A and B, respectively).

Supporting our results, Cordray *et al.* [13] reported clinical and statistical improvements in mean scores of quality of life standard questionnaire among patients treated with either intranasal corticosteroids or hypertonic dead sea saline with difference between the two groups.

The use of normal saline was shown to have some benefit in the treatment of allergic rhinitis when it is delivered with significant irrigating agent, and the improvement of symptoms was related to mechanical removal of allergens from the nasal mucosa [17]. Moreover, Cordray *et al.* [13] supported this finding and they claimed that normal saline provides a clinical benefit in some patients with allergic rhinitis.

Cordray *et al.* [13] reported the global anti-inflammatory effect of hypertonic saline in addition to the mechanical irrigation of the nasal mucosa with positive effects on the nasal mucosa and mucociliary clearance similar to normal saline, and they concluded that intranasal hypertonic saline is superior to plain saline solution in the treatment of allergic rhinitis. According to our results, we support this idea as the post-treatment nasometry scores greatly improved to reach a mean of 45.6 in the group treated with hypertonic saline with

Figure 3



Therapy results for both groups.

a statistically significant difference compared with the pretreatment scores ($P = 0.14$).

As regards INCs treatment of VMR, it is clearly proved with a large body of evidence that INCs are highly effective in the treatment of VMR [17–20]. This is in agreement with our results as previously mentioned. The mechanism of action of INCs in VMR is by reducing the number of lymphocytes by programmed cell death or apoptosis [21], inhibiting T-lymphocyte activation, preventing an increase in interleukin-4, 5 and local IgE [22,23], and inhibiting eosinophil activation and interleukin-2 production and generation [24,25].

Conclusion

It appears that intranasal hypertonic saline is highly effective in the treatment of VMR and approaches the effect of INCs. Therefore, we recommend that the dual use of hypertonic saline in addition to INCs may have a superior effect to the sole use of either agent in the treatment of VMR, particularly among patients who are resistant to treatment with a single agent.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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