Fisioter Bras. 2024;25(5):1648-1655
doi: 10.62827/fb.v25i5.1028

ARTIGO ORIGINAL

Adapted retrograde rhinopharyngeal clearance versus high-volume nasal lavage and the impact on sleep in children and adolescents with allergic rhinitis

Desobstrução rinofaríngea retrógrada adaptada versus lavagem nasal de alto volume e o impacto no sono em crianças e adolescentes com rinite alérgica

Cláudia de Oliveira Lopes[1], Ricardo Reis Dinardi[2], Camila Raquel Pontelo de Souza[1], Mônica Versiani Nunes Pinheiro de Queiroz[1], Ricardo Neves Godinho[2], Cássio da Cunha Ibiapina[1]

[1]*Federal University of Minas Gerais (UFMG), Belo Horizonte, MG, Brasil*

[2]*Pontifical Catholic University (PUC), Belo Horizonte, MG, Brasil*

Received: november 11, 2024; Accepted: november 12, 2024.

Correspondence: Ricardo Reis Dinardi, dinardi06@hotmail.com

Como citar
Lopes CO, Dinardi RR, Souza CRP, Queiroz MVNP, Godinho RN, Ibiapina CC. Adapted retrograde rhinopharyngeal clearance versus high-volume nasal lavage and the impact on sleep in children and adolescents with allergic rhinitis. Fisioter. Bras. 2024;25(5):1648-1655. doi:10.62827/fb.v25i5.1028

Abstract

Introduction: Allergic rhinitis (AR) is characterized by nasal symptoms such as nasal congestion, rhinorrhea, nasal itching and sneezing caused by inflammation and/or dysfunction of the nasal mucosa. Such symptoms affect the quality of life, impacting sleep, school performance and the emotional state of children and adolescents. Despite being an extremely relevant disease due to its negative impact on the lives of children and adolescents, an appropriate approach that can be carried out both preventively and curatively is essential. *Objective:* to compare the retrograde rhinopharyngeal clearance technique adapted with saline instillation and perinasal massage (RRC+I) in relation to high-volume nasal lavage in reducing nasal obstruction in 36 children and adolescents with allergic rhinitis (AR). *Methods:* an experimental, controlled and randomized study was carried out. Group 1: RRC+I and group 2: high-volume nasal lavage. The Nasal Obstruction Syndrome Evaluation (NOSE) questionnaire was used to grade nasal obstruction before and the morning after the intervention. *Results:* there was a significant difference between pre and post-treatment in relation to the RRC+I group ($Z=3.559$; $p<0.001$) and

high-volume nasal lavage (Z=3.833; p<0.001). In both groups, the distribution of NOSE scale scores in the post-treatment phase was significantly lower. *Conclusion:* both nasal washing techniques were effective in terms of nasal clearance in children and adolescents with AR.
Keywords: Rhinitis; nasal obstruction; child; adolescents.

Resumo

Introdução: A rinite alérgica (RA) caracteriza-se por sintomas nasais como congestão nasal, rinorreia, prurido nasal e espirros causados por inflamação e/ou disfunção da mucosa do nariz. Tais sintomas afetam a qualidade de vida, impactam no sono, no rendimento escolar e no emocional das crianças e dos adolescentes. Apesar de ser uma doença de impacto negativo na vida das crianças e adolescentes, torna-se essencial uma abordagem adequada e que possa ser realizada de forma tanto preventiva quanto curativa. *Objetivo:* comparar a técnica de desobstrução rinofaríngea retrógrada adaptada com instilação de soro fisiológico e massagem perinasal (DRR+I) em relação à lavagem nasal de alto volume na redução da obstrução nasal em 36 crianças e adolescentes com rinite alérgica (RA). *Métodos:* foi realizado estudo experimental, controlado e randomizado de forma aleatória. Grupo 1: DRR+I e grupo 2: lavagem nasal de alto volume. Foi utilizado questionário *Nasal Obstruction Syndrome Evaluation* (NOSE) para graduar a obstrução nasal antes e na manhã seguinte à intervenção. *Resultados:* houve diferença significativa entre pré e pós-tratamento em relação ao grupo DRR+I (Z=3,559; p<0,001) e lavagem nasal de alto volume (Z=3,833; p<0,001). Em ambos os grupos a distribuição das pontuações da escala NOSE na fase pós-tratamento foi significativamente menor. *Conclusão:* ambas as técnicas de lavagem nasal foram efetivas quanto à desobstrução nasal em crianças e adolescentes com RA.
Palavras-chave: Rinite alérgica; obstrução nasal; crianças; adolescentes.

Introduction

Allergic rhinitis (AR) is characterized by nasal symptoms such as nasal congestion, rhinorrhea, nasal itching and sneezing caused by inflammation and/or dysfunction of the nasal mucosa [1]. Such symptoms affect the quality of life, impacting sleep, school performance and the emotional state of children and adolescents [2]. Despite being an extremely relevant disease due to its negative impact on the lives of children and adolescents, an appropriate approach that can be carried out both preventively and curatively is essential.

A child's nose, as it is narrower than an adult's, is more prone to nasal obstruction due to pollution, colds, allergic and infectious processes. It is known that uncontrolled AR results in chronic nasal obstruction and consequent mouth breathing, which predisposes to compensations that are harmful to the child's health, such as postural and growth changes, facial asymmetry, dark circles under the eyes, orthodontic problems and sleep-related breathing disorders [3]. Therefore, nasal washing is necessary as an adjuvant treatment for RA and can be performed with different devices, such as sprays, syringes, nebulizers, neti pots and squeeze bottles [4].

Head et al. in 2018, carried out a systematic review where they analyzed the effects of nasal

irrigation with saline solution on AR. The study stratified the volumes of 0.9% saline used into: "very low" (less than 5 ml in each nostril), "low" (from 5 to 59 ml of saline in each nostril using a syringe) and "volume high" (more than 60 ml in each nostril). It was concluded that nasal washing with saline can reduce the severity of AR in children and adults, without adverse effects [5].

The effects of nasal lavage with saline in patients with AR are constantly analyzed and have already been presented in recent publications. However, more studies are still needed, as there are several ways to train and correctly prescribe nasal washing, besides, nasal hygiene is often not performed adequately, in the necessary volume, much less with the frequency and constancy necessary to obtain the desired results of respiratory crises reduction. Saline solution is a low-cost, safe and acceptable adjuvant treatment and its prescription should be encouraged, because it is capable to unblock the nasal cavity through its mechanical discharge, as well as to improve mucociliary function [6,7]. The present study aimed to compare the effectiveness of the adapted retrograde rhinopharyngeal clearance technique with instillation of saline solution and perinasal massage (RRC+I) in relation to high-volume nasal lavage with a squeeze bottle in reducing nasal obstruction in children and adolescents with AR; as well as to evaluate the impact of these techniques on the sleep quality in this population.

Methods

An experimental, controlled and randomized study was carried out with 36 children and adolescents aged 2 to 16 years, of both sexes, with a clinical diagnosis of AR and nasal obstruction, from November 2021 to March 2022.

The study protocol and the Free and Informed Consent Form (ICF) were approved by the Ethics and Research Committee of the Federal University of Minas Gerais (UFMG) (CAAE: 41556620.6.0000.5149) and all patients over 13 years of age signed the ICF together with their guardians. And for participants under 13 years old, their guardians signed the ICF.

Children were excluded if they presented significant anatomical changes in the upper airways, such as septum deviation, nasal polyp, moderate or severe adenoid hypertrophy (grades II and III) [8] found in the videonasolaryngoscopy examination; diagnosed with asthma according to the ISACC [9] standard questionnaire and other chronic respiratory diseases; using antibiotics; who presented signs and/or symptoms of upper respiratory tract infection in the last four weeks; and those that were using systemic corticosteroids in the last month.

Data collection consisted of in-person anamnesis, intervention and interview in which standardized questionnaires were used for reassessment the day after the intervention.

The anamnesis applied and filled out in person and carried out by the researcher, followed by the application of the Children's Sleep Habits Questionnaire (CSHQ-PT) [10] and the Nasal Obstruction Syndrome Evaluation (NOSE) scale [11].

The intervention was carried out by another researcher, to ensure that the study was blind, chosen randomly and distributed into two groups. In group 1, RRC+I was performed and in group 2, nasal lavage was performed with 200 ml of 0.9% saline solution, using a high-volume device with a compressible bottle.

On the day of the interview and intervention, a visual analogue scale was given to the children and adolescents to facilitate the choice of answers to the NOSE questionnaire. The researcher explained to those responsible and to the children and adolescents that the research would only be completed after the telephone interview on the following morning. The call time was scheduled in advance to avoid mismatches. During the telephone call, it was ensured that the child/adolescent had the visual analogue scale in hand.

Statistical analysis

Non-parametric Mann-Whitney tests were used according to the nature of the variables evaluated. Comparison between patient ages was performed using Student's t-test, and Pearson's chi-square test was used to assess gender.

Results

36 children and adolescents participated, of which 17 were treated with RRC+I and 19 with high-volume nasal lavage using a Nasoar@ bottle. The comparative analysis between the two groups in relation to the total score on the NOSE scale showed that there was no statistically significant difference between the groups treated with "DRR+I" and "compressible bottle" both in the pre-treatment and post-treatment phases. However, a statistically significant difference was found between the pre- and post- treatment phases in relation to the "RRC+I" (Z=3.559; p<0.001) and squeeze bottle (Z=3.833; p<0.001) groups, in which, for both study groups, the distribution of NOSE scale scores in patients in the post-treatment phase was significantly lower than in the pre-treatment phase.

Table 1 - *Descriptive and comparative analyzes between the groups and phases of the study regarding the classification of severity of nasal obstruction according to the NOSE scale*

		PHASE				
		Pre-treatment		Post-treatment		
Group	**Classification**	**n**	**%**	**n**	**%**	**p***
RRC+I	*Mild*	0	0,0	13	76,5	**0,001** (Z=3,448)
	Moderate	11	64,7	3	17,6	*r =0,57*
	Severe	6	35,3	1	5,9	
	Total	**17**	**100,0**	**17**	**100,0**	
High-volume nasal wash	*Mild*	6	31,6	13	68,4	**0,001** (Z=3,317)
	Moderate	8	42,1	5	26,3	*r = 0,55*
	Severe	5	26,3	1	5,3	
	Total	**19**	**100,0**	**19**	**100,0**	
p		0,097 (U = 114,0)		0,627 (U=149,5)		
		r = 0,28		*r = 0,08*		

Both groups showed an improvement in sleep quality after intervention, as shown in table 2

Table 2 - *Descriptive and comparative analyzes between the groups and the study phases regarding sleep habits according to the CSHQ-PT questionnaire*

	PHASE		
Group	**Pre-treatment**	**Post-treatment**	**p***
RRC +I	55,0 (50,0 – 62,5)	42,0 (38,0 – 48,5)	**< 0,001** (Z=3,507)
	55,8 ± 7,8	42,7 ± 6,0	*r =0,58*
Squeeze bottle	55,0 (42,0 – 61,0)	41,0 (39,0 – 49,0)	**< 0,001** (Z=3,828)
	54,3 ± 11,8	43,7 ± 7,7	*r = 0,64*
p	0,446 (U = 137,5)	0,861 (U = 156,0)	
	r = 0,13	*r = 0,03*	

Discussion

In the present study, was compared the effectiveness of the adapted RRC+I technique with high-volume nasal lavage with a Nasoar@ bottle and it showed a statistically significant difference in the results of the NOSE scale before and after treatment in relation to the "RRC+ I" (Z=3.559; p<0.001) and "High volume nasal wash" (Z=3.833; p<0.001) groups.

It is important to highlight that the results show statistical significance in both groups before (Z=3.448; p=0.001) and after (Z=3.317; p=0.001) the intervention also in relation to the severity classification of nasal obstruction according to the NOSE scale score (mild, moderate or severe).

It is known that nasal lavage is widely used as an adjuvant treatment for RA and there is a variety of studies on different devices for nasal lavage [12,14]. However, it is essential to train and correctly prescribe nasal washing techniques, respecting the child's peculiarities.

No controlled clinical trials were found that compared the RRC+I technique with high-volume nasal lavage with a squeeze bottle in patients with nasal obstruction and AR that assessed its impact on the sleep quality in this population. In the present study, was possible to evaluate and perceive, both in the statistical results and in the parents' reports, the improvement in children's sleep after the two interventions, mainly in the reduction of nocturnal respiratory symptoms (items 18,19 and 20) of the CSHQ-PT that refer to symptoms: snoring loudly, having difficulty breathing during sleep and apparently stop breathing during sleep.

Complementarily, other authors presented positive results on the effectiveness of the RRC+I technique in reducing nasal obstruction in hypersecretive patients. All emphasize the effects of the technique in reaching posterior regions of the nasal cavity such as the cavum and consequent reduction of nasal symptoms, reduction of mucociliary transport time, as well as demonstrating greater effectiveness of the pulmonary defense system [6,7]. However, none of them correlated the RRC+I technique with another form of nasal lavage. The study conducted by Brant in 2014 [15] evaluated

the effects of RRC+I alone and associated with the instillation of saline solution on nasal symptoms in motorcyclists exposed to pollution and revealed no difference between the techniques in mucociliary transport (MCT).

In the present study, 5 ml of saline solution was used in each nostril, totaling 30 ml of saline solution in the session in which is considered low-volume nasal washing. Therefore, the results found suggest that voluntary sniffing, as it occurs in the same direction as the nasal MCT (unidirectional movement downwards to the oropharynx), favors nasal clearance similar to high-volume nasal lavage.

The present study used the adaptation of the RRC+I technique with perinasal and sinus massage, however, it was not possible to measure or associate the effect of this massage in reducing nasal obstruction, despite clinically patients reporting respiratory relief with massage, it is necessary to study this technique separately.

In addition, the scenario of Covid-19 was a limitation in conducting this study that made it impossible for children and adolescents to go to the office, as well as respiratory exacerbations and the consequent use of antibiotics and/or systemic corticosteroids days before the appointment, prevented children from participating of the study. Another limitation that led to the reduction of the sample was not being able to contact by phone the day after the intervention.

On the other hand, a relevant aspect was comparing the groups of patients and phases of the study regarding the child's sleep habit questionnaire, which was in line with literature findings: improving nasal obstruction improves sleep quality, as it has been proven that AR contributes to increased resistance of the nasal airways, especially nasal congestion, which can lead to snoring and a high number of awakenings during sleep [15-17].

The present study reported that the two treated groups showed improvement in sleep quality after intervention and it was inferred that there was no statistically significant difference ($p \geq 0.05$) between the treatment groups: RRC+I ($p=0.446$ and high-volume nasal lavage ($p=0.861$) pre- and post-treatment, with regard to the CSHQ-PT score. However, a statistically significant difference was found between the pre- and post-treatment phases in relation to the "RRC+I" ($Z=3.507$; $p<0.001$) and high-volume nasal lavage ($Z=3.3828$; $p<0.001$) groups.

A significant association was also observed between nasal obstruction caused by AR and sleep-breathing disorder, in line with the literature, which recognizes the lack of regular treatment for AR as one of the possible causes of the disease's association with sleep disorders [14]. Higher scores on the NOSE scale were associated with higher scores on the CSHQ-PT sleep questionnaire, when considering the CSHQ-PT alone to identify the existence of a sleep disorder, according to the 47-point score. Using this cutoff point, it was found that 100% of the children and adolescents in the present study had sleep disorders before treatment with the RRC+I group (55.8±7.8) and the high-volume nasal lavage group (54.3±11.8). Both groups after treatment reduced scores to normal sleep levels (RRC+I: 42.7±6.0 and high-volume nasal lavage 43.7±7.7) particularly in relation to nocturnal breathing disorders, drowsiness daytime and parasomnias.

This result is similar to the findings of Loekmanwidjaja et al. [16], who compared 112 children with AR and 55 children without AR, with a mean age of 7.3 years and concluded that children with AR, even undergoing regular treatment, exhibited a higher frequency of sleep brain disorders, as the CSHQ-PT questionnaire score was significantly higher in the group of children with RA [48 points

(44-54)] compared to the control group [43 (38-49)]. According to these authors, although the CSHQ-PT questionnaire is widely used, it still has flaws in diagnosing sleep disorders. Furthermore, there are few studies that correlate the CSHQ-PT with polysomnography in children.

Therefore, the use of the CSHQ-PT in the present investigation was a screening tool that did not conclusively establish the presence or absence of a sleep disorder, but significantly demonstrated that nasal lavage improves sleep quality in children with RA and nasal obstruction.

Conclusion

The results of the present study suggest that both nasal hygiene techniques, adapted RRC+I and high-volume nasal lavage with squeeze bottle, are accessible, low-cost and effective in reducing nasal obstruction and consequently improving sleep quality in children and adolescents with allergic rhinitis.

Conflicts of interest

We declare no conflicts of interest.

Funding sources

No funding sources was received.

Authors contribution

Conception and design of the research: Lopes CO, Souza CRP, Dinardi RR, Ibiapina CC; Data collection: Lopes CO, Souza CRP; Data analysis and interpretation: Lopes CO, Souza CRP, Dinardi RR, Ibiapina CC; Statistical analysis: Dinardi RR, Ibiapina CC; Manuscript writing: Lopes CO, Souza CRP, Ibiapina CC; Writing - Review and editing: Lopes CO, Souza CRP, Dinardi RR, Queiroz MVNP, Godinho RN, Ibiapina CC; Critical revision of the manuscript for important intellectual content: Dinardi RR, Queiroz MVNP, Godinho RN, Ibiapina CC.

References

1. Papadopoulos NG, Bernstein JA, Demoly P, Dykewicz M, Fokkens W, Hellings PW, et al. Phenotypes and endotypes of rhinitis and their impact on management: a PRACTALL report. Allergy. 2015;70:474-494.
2. Pereira AM. As várias faces da rinite. Rev Port Imunoalergologia. 2021;29(2): 81-83.
3. Ibiapina CC, Andrade CR, Camargos PAM, Alvim CG, Cruz AA. Reference values for peak nasal inspiratory flow in children and adolescents in Brazil. Rhinology. 2011;49(3):304-308.
4. Chong Neto HJC, Rosario CS, Rosario BA, Chong FH, Grasselli EA, et al. Allergic rhinitis in preschool children from southern Brazil. Allergy. 2014;69:545-547.
5. Head K, Snidvongs K, Glew S, Scadding G, Schilder AGM, Philpott C, et al. Saline irrigation for alleric rhinitis. Cochrane Database Syst Rev. 2018;22;6(6):012597.
6. Alexandrino AS, Santos R, Melo C, Tomé D, Bastos JM, Postiaux G. Immediate effects of a rhino-pharyngeal clearance protocol in nasal obstruction and middle ear condition of children under 3 years of age with upper respiratory infecctions: A randomized controlled trial. Acta Otorrinolaringol Esp. 2018;70(4):192-99.
7. Piromchai P, Puvatanond C, Kirtsreesakul V, Chaiyasate S, Thanaviratananich S. Effectiveness of nasal irrigation devices: a Thai multicentre survey. PeerJ. 2019;7:e7000.

8. Pereira L, Monyror J. Almeida FT, Almeida FR, Guerra E, Flores C, et al. Prevalence of adenoid hypertrophy: A systematic review and meta-analysis. Sleep Med Rev. 2018;38:101-112.

9. International Study of Asthma and Allergies in Childhood Steering Committee. ISAAC–The International Study of Asthma and Allergies in Childhood: background and methods. Eur Respir J.1996;9:410s.

10. Silva FG, Silva C, Braga L, Serrão Neto A. Questionário de hábitos de sono das crianças em português: validação e comparação transcultural. J Pediatr. 2014;90(1):78−84.

11. Stewart MG, Witsell DL, Smith TL, Weaver EM, Yueh B, Hannley MT. Development and validation of the Nasal Obstruction Symptom Evaluation (NOSE) Scale. Otolaringol Head Neck Surg. 2004;130(2):157–163.

12. Piromchai P, Kasemsiri P, Reechaipichitkul W. Squeeze bottle versus syringe nasal saline irrigation for persistent allergic rhimitis: a randomized controled trial. Rinology. 2020;58(5):460–464.

13. Satdhabudha A, Utispan K, Monthanapisut P, Poachannukoon O. A randomized controlled study comparing the efficacy of nasal saline irrigation devices in children with acute rhinosinusites. Asian Pac J Allergy Immunol. 2017;35:102-107.

14. Shrestha K, Salati H, Fletcher D, Singh N, Inthavong K. Effects of head tilt on squeeze-bottle nasal irrigation - A computational fluid dynamics study. J Biomech. 2021;123:110490.

15. Brant TC. Efeitos da desobstrução rinofaríngea retrógada isolada e associada à instilação de soro fisiológico (0,9% NACL), sobre as propriedades do muco nasal, a celularidade e as citocinas em lavado nasal e sintomas nasais de motociclistas profissionais expostos à poluição da cidade de Belo Horizonte. Tese (Doutorado em Ciências) - Faculdade de Medicina da Universidade de São Paulo (USP). 2014, 1-189.

16. Loekmanwidjaja J, Carneiro AC, Nishinaka ML, Munhoes DA, Benezoli G, Wandalsen GF, et al. Sleep disorders in children with moderate to severe persistent allergic rhinitis. Braz J Otorhinolaryngol. 2018;84:178-84.

17. Urrutia-Pereira M, Soé D, Chong Neto HJ, Acosta V, Cepeda AM, Álvarez-Castelló M, et al. Sleep disorders in Latin-American children with asthma and/or allergic rhinitis and normal controls. Allergol Immunopathol. 2017;45(2):145-151.