

Saline nasal irrigation

Its role as an adjunct treatment

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ABSTRACT

OBJECTIVE To review clinical evidence on the efficacy of saline nasal irrigation for treatment of sinonasal conditions and to explore its potential benefits.

QUALITY OF EVIDENCE Clinical trials, reviews, and treatment guidelines discussing nasal irrigation were obtained through a MEDLINE search from January 1980 to December 2001. Most trials were small, and some were not controlled; evidence, therefore, is level II, or fair.

MAIN MESSAGE Flushing the nasal cavity with saline solution promotes mucociliary clearance by moisturizing the nasal cavity and by removing encrusted material. The procedure has been used safely for both adults and children, and has no documented serious adverse effects. Patients treated with nasal irrigation rely less on other medications and make fewer visits to physicians. Treatment guidelines in both Canada and the United States now advocate use of nasal irrigation for all causes of rhinosinusitis and for postoperative cleaning of the nasal cavity.

CONCLUSION Nasal irrigation is a simple, inexpensive treatment that relieves the symptoms of a variety of sinus and nasal conditions, reduces use of medical resources, and could help minimize antibiotic resistance.

RÉSUMÉ

OBJECTIF Faire une revue des preuves cliniques de l'efficacité de l'irrigation saline du nez pour traiter différentes conditions sinonasales et explorer les avantages potentiels de ce traitement.

QUALITÉ DES PREUVES Les essais cliniques, recherches bibliographiques et directives thérapeutiques concernant l'irrigation nasale ont été recensés dans MEDLINE entre janvier 1980 et décembre 2001. La plupart des essais étaient de petite taille et certains n'avaient pas de groupe témoin; les preuves sont donc de niveau II ou de qualité passable.

PRINCIPAL MESSAGE L'irrigation de la cavité nasale avec une solution saline favorise le nettoyage mucociliaire en humidifiant la cavité nasale et en enlevant les croûtes. Cette méthode est utilisée de façon sécuritaire chez les adultes et les enfants, et aucun effet indésirable n'a été rapporté. Les patients ainsi traités prennent moins de médicaments et consultent moins souvent. Les directives thérapeutiques canadiennes et américaines préconisent l'irrigation nasale pour toutes les formes de sinusite et pour le nettoyage post-opératoire de la cavité nasale.

CONCLUSION L'irrigation saline du nez est une façon simple et peu coûteuse de soulager les symptômes de plusieurs conditions nasales et sinusales; elle diminue le recours aux ressources médicales et pourrait aider à minimiser la résistance aux antibiotiques.

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Cet article a fait l'objet d'une évaluation externe.

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Healthy people's respiratory tracts are protected from airborne contagion and debris by a mucociliary layer^{1,2} that lines the sinonasal cavity. This layer consists of columnar, ciliated epithelial cells and goblet cells bathed in mucus. Foreign particles are trapped in the sticky layer of mucus, and ciliary action propels the entire mucous layer out of the sinuses toward the nasopharynx. When this transport mechanism fails, rhinosinusitis occurs, usually in response to a virus, bacterium, irritant, or allergen.³

Nasal irrigation is a simple, inexpensive procedure that has been used to treat sinus and nasal conditions for many years.⁴ It is still recommended routinely by otolaryngologists.⁵ The procedure involves flushing the nasal cavity with saline solution, which promotes improved mucociliary clearance by moisturizing the nasal cavity and removing encrusted material.⁶ Evidence shows that pulsating saline lavage can remove bacteria also.^{3,7}

In the past, recommendations to use nasal lavage were based primarily on strong and long-standing anecdotal evidence.⁸ Treatment guidelines in both Canada and the United States advocate use of nasal irrigation.^{3,9} Multicentre clinical trials have just begun to demonstrate its efficacy for treating several diseases, including rhinosinusitis and allergic rhinitis, and for postoperative care.

Quality of evidence

References for this article were obtained from a MEDLINE search from January 1980 to December 2001. Key words used were nasal irrigation, nasal lavage, nasal saline, sinusitis, and rhinitis. Because there are as yet relatively few research papers on nasal irrigation, all relevant papers in English and French obtained from the search were reviewed. Most trials were small, however, involving fewer than 100 patients, and several trials were not placebo controlled (Table 1¹⁰⁻¹⁷). Consequently, the quality of evidence is only fair.

Rhinosinusitis

Rhinosinusitis, an inflammatory disease of the paranasal sinuses, is a substantial source of morbidity and is one of the most common reasons patients visit primary care physicians.⁹ In the United States, rhinosinusitis

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patients make 16 million visits to physicians each year; the direct medical cost of sinusitis is estimated to be about \$2.4 billion.¹⁸

Signs and symptoms of sinusitis, both acute and chronic, are well known.³ Acute sinusitis is usually accompanied by fever and facial pain near the bridge of the nose and the eyes. Chronic sinusitis is not typically accompanied by fever unless there is acute infection. Both acute and chronic sinusitis share several symptoms, including nasal stuffiness, congestion, postnasal drip, blunted sense of smell and taste, yellow-green nasal drainage, and nausea. Increased quantity or viscosity of sinus secretions can overwhelm the nose's clearing capacity, which can lead to pooled secretions and secondary bacterial infection.

Medical management of rhinosinusitis includes antibiotics, decongestants, corticosteroids, and mucolytics.¹⁹ Therapy is usually directed at alleviating or reducing symptoms, eradicating the underlying cause, or both. Use of irrigating solutions before patients take decongestants or corticosteroids improves these medications' penetration and, presumably, efficacy. Because bacterial infection of the sinuses can be serious, antibiotics are frequently prescribed. Saline nasal lavage has been advocated as adjunct therapy for rhinosinusitis because it promotes ciliary function and decreases edema, which would improve drainage through the sinus ostia.¹⁸ Also, there is evidence that pulsating saline lavage helps flush out bacteria.⁷

Nasal irrigation is well tolerated by rhinosinusitis patients. One open multicentre study of 209 rhinosinusitis patients who irrigated two to six times daily for 20 days with isotonic seawater reported only two adverse events (pain).¹² Other studies have also found adverse events infrequent.^{8,16}

Respiratory infections account for more than 75% of antibiotic prescriptions written annually in physicians' offices,²⁰ and rhinosinusitis is the fifth most common diagnosis for which antibiotics are prescribed.⁹ According to the United States Centers for Disease Control, more than 110 million courses of antibiotics are prescribed each year by office-based physicians in the United States.²¹ A typical course of antibiotic therapy for acute sinusitis lasts 10 days.⁹ In an open, prospective study, 44 adults diagnosed with acute bacterial sinusitis were treated for just 5 days with antibiotic therapy in combination with 12 days of daily nasal irrigation.²² After 5 days, patients' symptoms had abated, and by day 12, the recovery rate was 93%. The authors concluded that frequent nasal lavage can reduce the length of antibiotic therapy and,

Table 1. Clinical studies of saline nasal irrigation

STUDY	PATIENTS	DESIGN	COMPARATORS	FINDINGS
Georgitis 1994 ¹⁰	30 allergic rhinitis	Crossover	Nasal hyperthermia (molecular or large-particle water vapour) versus simple irrigation	Histamine levels fell with all treatments; greatest decline seen with irrigation ($P < .05$ and $< .01$) Leukotriene C ₄ levels significantly reduced by irrigation ($P < .05$) Prostaglandin D ₂ levels unaffected by treatment
Krayenbuhl and Seppey 1995 ¹¹	104 intranasal surgery	Retrospective	Saline stream versus passive saline instillation	Stream patients required significantly fewer postoperative recovery days ($P < .05$) and visits to physicians ($P < .05$)
Seppey et al 1995 ¹²	209: 151 rhinosinusitis; 58 endonasal surgery	Treatment at physicians' discretion	Medium saline stream versus strong stream	Significant decrease in signs and symptoms in all patients ($P < .0005$)
Seppey et al 1996 ¹³	28 endonasal surgery	Randomized	Saline stream versus passive saline instillation	Stream significantly more effective than drops at 9 days after surgery ($P < .01$) Stream significantly more tolerable at 9, 15, and 30 days after surgery ($P < .02$)
Adam et al 1998 ¹⁴	143 cold or sinus infection	Randomized placebo-controlled	Hypertonic saline versus normal saline versus observation	No differences in nasal symptom scores among the three groups
Pigret and Jankowski 1996 ¹⁵	20 ethmoidectomy	Randomized, single-blind	Pressurized seawater nasal lavage versus nasal irrigation with antiseptic or mucolytic	Irrigation methods equally effective
Shoseyov et al 1998 ¹⁶	30 chronic sinusitis	Randomized, double-blind	Hypertonic saline versus normal saline	Improved cough and radiologic scores for hypertonic saline group ($P \leq .05$) Improved nasal secretion scores for both groups ($P \leq .05$)
Heatley et al 2001 ¹⁷	150 chronic sinusitis	Crossover	Saline delivery via bulb syringe versus irrigation pot	Irrigation methods equally effective

as a consequence, increase patient compliance and lower costs of medication and other treatment.

Rhinosinusitis is common in children, particularly in those with allergies where impaired drainage increases the likelihood of infection. A randomized controlled, double-blind study of 30 children aged 3 to 16 years (median age 9.5 years) with chronic sinusitis compared use of hypertonic and isotonic saline nasal irrigation.¹⁶ Significant reductions in cough, nasal secretions, and postnasal drip were reported for those using hypertonic saline; those using isotonic saline had significant reductions in nasal secretions. Irrigation was also effective for cleaning the nose and removing intranasal crusts. The authors reported that saline irrigation was simple to use, well tolerated, and inexpensive.

Allergic rhinitis

Perennial allergic rhinitis is typically treated with antihistamines and, if symptoms are severe, corticosteroids. Nasal irrigation has been recommended as an adjunct therapy to flush out mucus and irritants and improve the flow of air through the nose.²³ A controlled clinical study of 30 subjects with perennial rhinitis compared nasal hyperthermia treatment with saline nasal irrigation. Patients given nasal irrigation through a modified Water Pik[®] device had lower concentrations of nasal histamine (compared with baseline) immediately following treatment ($P < .001$) and at 2, 4, and 6 hours after treatment ($P < .05$).

Nasal irrigation also substantially decreased the concentration of nasal leukotriene C₄ (an inflammatory mediator) at 2, 4, and 6 hours after treatment ($P < .05$).

In contrast, nasal hyperthermia treatment produced no demonstrable reduction in leukotriene C₄ concentrations, and the reduction in histamine concentration was not sustained to 6 hours after treatment. The investigators concluded that nasal irrigation had a long-term effect on mediator production and was, therefore, a useful therapy for allergic rhinitis.¹⁰

Postoperative irrigation

The aim of sinus surgery is to open narrow passages and allow more effective airflow and drainage. Performed under general anesthesia, sinus surgery is done through the nostrils using an endoscope with no incision or sutures.²⁴ Surgery is typically done on an outpatient basis, with regular follow-up office visits to monitor healing. Because the nasal cavity quickly becomes encrusted following surgery, frequent cleaning and saline nasal irrigation are needed for 4 to 8 weeks until the lining of the nose and sinuses has regenerated.^{15,24}

Clinical trials of patients undergoing sinus surgery have compared the efficacy of various types of nasal washes. One study of patients undergoing rhinoplasty, septoplasty, and ethmoidectomy compared seawater with an isotonic antiseptic preparation.¹³ Both patients ($P < .002$) and physicians ($P < .001$) expressed a statistically significant preference for seawater lavage based on a global opinion survey of efficacy and tolerability. Also, because seawater lavage was easier to use, patients were more compliant with the regimen and, consequently, less likely to require rescue medication. A randomized, single-blind study comparing pressurized seawater lavage with antiseptic and mucolytic saline irrigation following ethmoidectomy found no statistically significant difference in nasal crust weights or nasal secretions between patients in the two treatment groups.¹⁰

A retrospective study of 104 postoperative patients compared lavage with pressurized jets of fluid from

a squeezable plastic bottle to cleansing with a passive, slow infusion of saline drops.¹¹ The number of postoperative recovery days required for each patient was determined by nasal endoscopy. For turbinal resection patients, recovery was defined as a complete absence of encrustations in the nasal fossae. For sinus surgery patients, recovery was complete when risk of synechia had disappeared, when the middle concha healed, or when the meatotomy was permeable and free of encrustation. Results indicated significantly shorter postoperative recovery periods for patients who received pressurized saline compared with patients receiving drops (13.9 days versus 18.2 days for turbinal resection patients [$P = .05$]; 18.9 versus 36.7 days for patients undergoing paranasal procedures [$P = .0005$]). Also, patients receiving pressurized saline required fewer health care visits than those receiving drops (2.06 visits versus 2.84 visits [$P .008$] for turbinal resection; 2.44 visits versus 4.23 visits [$P .0005$] for paranasal procedures).

Rhinitis and common colds

Although patients suffering from rhinitis and common colds typically use an array of medications for relief of symptoms, none has ever been shown to alter the course of disease.¹⁴ The value of nasal irrigation for this indication is still under debate; as yet few studies have been conducted. One randomized study of 143 patients suffering from colds or sinus infections compared hypertonic saline nasal spray with isotonic saline nasal spray or observation only. The study reported no difference in symptom scores between the three groups of patients. Compared with isotonic saline users, however, hypertonic saline users were significantly more likely to report nasal irritation (32% versus 13%, $P = .05$).¹⁴

There are several other areas where saline nasal irrigation has been studied. Tomooka et al⁸ noted the utility of nasal irrigation for treatment of patients with

Table 2. Saline nasal products available in Canada

PRODUCT (MANUFACTURER)	VOLUME (ML)	COST (PER ML)	APPLICATOR	PRESSURIZED	PRESERVATIVE
Hydrasense® (Schering Plough)	135	\$14.85 (11¢)	Detachable, washable nozzle with one-way valve	Yes, stable flow	Sterile, no preservatives
Otrivin Saline® (Novartis)	30	\$6.00 (20¢)	Fixed nozzle	No	Polyethylene and propylene glycol
Rhinaris® (Pharma Science)	30	\$10.80 (36¢)	Metered dose pump	Yes, variable flow	Polyethylene and propylene glycol
Salinex® (Sabex)	30	\$4.50 (15¢)	Fixed nozzle	No	Polyethylene and propylene glycol
Salinol® (Sabex)	30	\$9.60 (32¢)	Metered dose pump	Yes, variable flow	Polyethylene and propylene glycol

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Saline nasal irrigation

age-related rhinitis, allergic rhinitis, septal perforations, and rhinosinusitis associated with HIV infection. Nuutinen et al²⁵ reported success in treating patients with atrophic rhinitis, rhinitis sicca, and nasal polyps. For patients with cystic fibrosis, irrigation with balanced salt solutions is routinely recommended for restoring the sinonasal mucosa to a normal state.²

Saline solutions

Saline solutions can be prepared at home using warm water and noniodized salt,⁸ and are typically delivered using bulb syringes or irrigation pots.¹⁸ A variety of sterile solutions are available commercially in Canada (Table 2). They use various delivery systems, including metered dose pumps (Rhinaris[®]; Salinol[®]), squeezable bottles with fixed nozzles that are inserted into the nose and produce a fine spray (Otrivin Saline[®]; Salinex[®]), and detachable nozzles that control release of a steady stream (Hydrasense[®]). Studies comparing the various delivery systems are listed in Table 1¹⁰⁻¹⁷. Stream delivery has been studied comparatively in two trials, and found to be superior to passive instillation of saline.^{11,13}

Several different saline tonicities and pH levels are available. Hypertonic saline has been shown to increase mucociliary transit times,²⁶ but is irritating for nasal membranes.^{10,14,16} Mucociliary clearance was similar after irrigation with a solution buffered to pH 8 or a nonbuffered solution.²⁷

Conclusion

The indications for nasal irrigation are varied and are growing based on an increasing number of large-scale clinical trials. Clinical evidence is mounting that nasal irrigation is an effective, inexpensive adjunct treatment for symptom relief of sinus discomfort and disease. The procedure has been used safely by both adults and children and has no documented serious adverse effects. Clinical trials indicate that patients treated with nasal irrigation are less reliant on other medications and that some postsurgical patients tend to require fewer visits to physicians. Both these effects are likely to have desirable economic consequences for patients and the health care system. ❁

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Competing interests

None declared

Editor's key points

- Saline nasal irrigation is cheap and simple to use, and it appears to be effective. Recommendations are based mainly on results of small trials (fair-quality evidence).
- Saline nasal lavage is recommended as an adjunct therapy for rhinosinusitis and allergic rhinitis, and postoperatively after nasal surgery. It moisturizes the mucous membrane, reduces crusts, and promotes healing.
- It appears to be safe and generally well tolerated, even for children, and it has been shown to reduce use of antibiotics.
- Pressurized jets of saline appear to be more effective than drops. Hypertonic saline increases mucociliary transit times, but is more irritating.

Points de repère du rédacteur

- L'irrigation saline du nez est une méthode simple, peu coûteuse et qui paraît efficace. Les présentes directives sont fondées principalement sur les résultats de petits essais (preuves de qualité passable).
- L'irrigation nasale est recommandée comme traitement d'appoint dans la sinusite et la rhinite allergique et après une chirurgie nasale. Elle humidifie la muqueuse, diminue les croûtes et favorise la guérison.
- Elle semble sécuritaire et généralement bien tolérée, même chez les enfants, et il est prouvé qu'elle réduit le recours aux antibiotiques.
- Les jets de salin sous pression semblent plus efficaces que les gouttes. Le salin hypertonique accélère les temps de transit mucociliaire, mais il est plus irritant.

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References

1. Knops J, McCaffrey T, Kern E. Physiology: clinical applications. *Otolaryngol Clin North Am* 1993;26(4):517-34.
2. Gysin C, Allothman GA, Papsin BC. Sinonasal disease in cystic fibrosis: clinical characteristics, diagnosis, and management. *Pediatr Pulmonol* 2000;30(6):481-9.
3. Osguthorpe J, Hadley J. Rhinosinusitis: current concepts in evaluation and management. *Med Clin North Am* 1999;83(1):27-41.
4. Traissac L, Ohayon-Courtes C, Dufour P, Bordenave L. Le lavage de nez avec Physiomer...10 ans après: 1988-1998. *Rev Laryngol Otol Rhinol (Bord)* 1999;120(2):133-5.
5. Parsons D. Chronic sinusitis: a medical or surgical disease? *Otolaryngol Clin North Am* 1996;29(1):1-9.
6. Benninger M, Anon J, Mabry R. The medical management of rhinosinusitis. *Otolaryngol Head Neck Surg* 1997;117(Suppl 2):S41-9.
7. Anglen J, Apostoles S, Christensen G, Gainor B. The efficacy of various irrigation solutions in removing slime-producing staphylococcus. *J Orthopaed Trauma* 1994;8(5):390-6.
8. Tomooka L, Murphy C, Davidson TM. Clinical study and literature review of nasal irrigation. *Laryngoscope* 2000;110(7):1189-93.

9. Low D, Desrosiers M, McSherry J, Garber G, Williams J, Remy H, et al. A practical guide for the diagnosis and treatment of acute sinusitis. *Can Med Assoc J* 1997;156(Suppl 6):S1-14.
10. Georgitis J. Nasal hyperthermia and simple irrigation for perennial rhinitis: changes in inflammatory mediators. *Chest* 1994;106(5):1487-92.
11. Krayenbuhl M, Seppely M. Efficacité de Rhinomer Force 3 dans les suites opératoires de la chirurgie endonasale. *Rev Med Suisse Romande* 1995;115(3):1-4.
12. Seppely M, Krayenbuhl M, Simmen D, Buvelot J-M, Pelloni R. Rhinomer pour la thérapie de la pathologie rhinosinusale. *ORL Highlights* 1995;2(2):20-4.
13. Seppely M, Schweri T, Hausler R. Comparative randomised clinical study of tolerability and efficacy of Rhinomer Force 3 versus a reference product in post-operative care of the nasal fossae after endonasal surgery. *ORL J Otorhinolaryngol Relat Spec* 1996;58(2):87-92.
14. Adam P, Stiffman M, Blake R. A clinical trial of hypertonic saline nasal spray in subjects with the common cold or rhinosinusitis. *Arch Fam Med* 1998;7(1):39-43.
15. Pigret D, Jankowski R. Management of post-ethmoidectomy crust formation: randomized single-blind trial comparing pressurized seawater versus antiseptic/mucolytic saline. *Rhinology* 1996;34(1):38-40.
16. Shoseyov D, Bibi H, Shai P, Shoseyov N, Shazberg G, Hurvitz H. Treatment with hypertonic saline versus normal saline nasal wash of pediatric chronic sinusitis. *J Allergy Clin Immunol* 1998;101(5):602-5.
17. Heatley DG, McConnell KE, Kille TL, Leverson GE. Nasal irrigation for the alleviation of sinonasal symptoms. *Otolaryngol Head Neck Surg* 2001;125(1):44-8.
18. Fagnan L. Acute sinusitis: a cost-effective approach to diagnosis and treatment. *Am Fam Physician* 1998;58(8):1795-802.
19. Mabry R. Therapeutic agents in the medical management of sinusitis. *Otolaryngol Clin North Am* 1993;26(4):561-70.
20. Schwartz B, Bell D, Hughes J. Preventing the emergence of antimicrobial resistance. A call for action by clinicians, public health officials, and patients. *JAMA* 1997;278(11):944-5.
21. Centres for Disease Control. Defining the public health impact of drug-resistant *Streptococcus pneumoniae*: report of a working group. *MMWR Morb Mortal Wkly Rep* 1996;45:1-14.
22. Seppely M, Krayenbuhl M. Traitement combiné de la sinusite aiguë avec Rhinomer et Zinat. *ORL Highlights* 1998;5(4):3-6.
23. Georgitis J. Local hyperthermia and nasal irrigation for perennial allergic rhinitis: effect on symptoms and nasal airflow. *Ann Allergy* 1993;71(4):385-9.
24. Rice D. Endoscopic sinus surgery. *Otolaryngol Clin North Am* 1993;26(4):613-8.
25. Nuutinen J, Holopainen E, Haahtela T, Ruoppi P, Silvasti M. Balanced physiological saline in the treatment of chronic rhinitis. *Rhinology* 1986;4:265-9.
26. Daviskas E, Anderson SD, Gonda I, Eberl S, Meikle S, Seale JP, et al. Inhalation of hypertonic saline aerosol enhances mucociliary clearance in asthmatic and healthy subjects. *Eur Respir J* 1996;9(4):725-32.
27. Homer J, England R, Wilde A, Harwood G, Stafford N. The effect of pH of douching solutions on mucociliary clearance. *Clin Otolaryngol* 1999;24(4):312-5.