ORIGINAL ARTICLE

The effect of nasal irrigation formulation on the antimicrobial activity of nasal secretions

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Background: Saline-based irrigation solutions are evidence-based rhinological treatments; however, the formulation of these solutions could theoretically alter the function of innate antimicrobial peptides. The aim of this study was to determine if the antimicrobial activity of normal human nasal secretions in vivo is altered by commercially available large volume irrigation solutions.

Methods: Minimally manipulated sinonasal secretions were collected from patients with chronic rhinosinusitis (CRS; n = 10) and normal healthy volunteers (n = 20). In a subset of control patients (n = 10) secretions were collected prior to, and at 1 hour, 6 hours, and 24 hours after nasal irrigation with 4 commercial irrigation solutions. Lysozyme and lactoferrin levels were analyzed and the antimicrobial activity of secretions determined using a radial diffusion assay.

Results: The antimicrobial activity of nasal secretions was reduced in CRS patients compared to healthy volunteers ($p < 0.01$), but there was no significant difference in antimicrobial peptide concentrations. Isotonic nasal irrigation reduced lysozyme and lactoferrin levels, which returned to baseline levels by 6 hours; in addition to a sustained decrease in antimicrobial activity before returning to baseline at 24 hours. Low-salt solution stimulated peptide secretion by approximately 40% at 6 hours and 24 hours, but produced a transient decrease in antimicrobial activity, returning to baseline levels by 6 hours. Hypertonic solution initially decreased lysozyme and lactoferrin levels but maintained baseline levels of antimicrobial activity and increased peptide secretion by approximately 30% at 24 hours.

Conclusion: The formulation of nasal irrigation solutions significantly affects the measured levels and functionality of sinonasal antimicrobial peptides.

Key Words:
sinusitis; nasal lavage; antimicrobial cationic peptides; innate immunity; mucus; nasal mucosa; nasal spray

How to Cite this Article:
Woods CM, Tan S, Ullah S, Frauenfelder C, Ooi EH, Carney AS. The effect of nasal irrigation formulation on the antimicrobial activity of nasal secretions. *Int Forum Allergy Rhinol.* 2015;XX:1–7.

Chronic rhinosinusitis (CRS) causes a significant reduction in patients' quality of life, and costs billions of healthcare dollars each year.[1,2] The etiology of CRS is incompletely understood, with current hypotheses including bacterial and/or fungal infection, biofilms, anatomical obstruction of sinus drainage, and dysregulated mucosal immunity.[3–6]

Nasal secretions contain cationic antimicrobial peptides such as lysozyme, lactoferrin, human β-defensin, and secretory leukocyte protease inhibitor.[7–9] These proteins are an important component of innate immunity against inhaled antigens and microorganisms with documented antimicrobial activity toward bacteria, fungi, and viruses. Lysozyme is the most abundant secreted innate immune defense protein from the paranasal sinuses[10]; it works both as an antibacterial agent via its enzymatic muramidase activity[11] and as a cationic protein.[12–14] Our previous work has demonstrated that lysozyme exhibits fungicidal activity,[15] supporting a role for lysozyme in paranasal sinus innate

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Funding sources for the study: partially funded by a seeding grant from the Faculty of Health Sciences, Flinders University; additional funding support from ENT Technologies Pty. Ltd.
Potential conflict of interest: A.S.C. is a consultant for Smith and Nephew.
Presented at the ARS Meeting at the annual Combined Otolaryngology Spring Meetings (COSM) on April 22-26, 2015, in Boston, MA.

Received: 25 March 2015; Revised: 25 May 2015; Accepted: 16 June 2015
DOI: 10.1002/alr.21604
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