Management of Rhinitis Medicamentosa: A Systematic Review

Shana M. Zucker1, Blair M. Barton, MD1, and Edward D. McCoul, MD, MPH1,2,3

Abstract

Objective. Rhinitis medicamentosa (RM) is a common condition resulting from overuse of topical nasal decongestants. Despite the prevalence in otolaryngologic practice, a clear treatment protocol has not been established. Our objective was to review the current published literature pertaining to the treatment of RM with the possibility of finding data that support one treatment over another.

Data Sources. PubMed, Embase, Cochrane, and Web of Science databases were examined for patients diagnosed with RM resulting from chronic use of topical nasal decongestants.

Review Methods. The PRISMA standard (Preferred Reporting Items for Systematic Reviews and Meta-analyses) was utilized to identify English-language studies reporting treatment of patients with the primary diagnosis of RM after chronic use of a topical decongestant. Outcome measures of interest included patient-reported symptom relief and objective parameters. MINORS criteria (methodological index for nonrandomized studies) were used to assess the quality of articles.

Results. A total of 350 articles were identified, 9 of which met final inclusion criteria for qualitative analysis. Outcomes defined in each publication were highly varied and relied on several unstandardized measures. The most commonly reported treatment option was topical nasal steroids, although overall there was limited evidence on which to base treatment recommendation.

Conclusions. There is not adequate evidence to develop a standardized treatment protocol for RM. The development of a uniform questionnaire, standard outcomes to be measured, and a method of assessing such outcomes is necessary. Prospective randomized controlled studies are warranted to determine the optimal treatment regimen following diagnosis of RM.

Keywords

rhinitis medicamentosa, chronic rhinitis, nonallergic rhinitis, nasal decongestants, systematic review, rhinomanometry, nasal congestion

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Rhinitis medicamentosa (RM), also referred to as rebound rhinitis, is a type of nonallergic mucosal inflammation resulting from the overuse of topical nasal decongestants. RM causes patients to experience nasal stuffiness, swelling, discomfort, and mucosal hyperreactivity.1-3 Topical nasal decongestants are indirect sympathomimetic drugs that exert action by promoting vesicular release of norepinephrine from neurons with subsequent stimulation of alpha-adrenergic receptors.4 Topical nasal decongestants, such as oxymetazoline and phenylephrine, which are available over the counter, result in vasoconstriction and hypertrophy of the nasal soft tissue.5-7 Despite a relatively high incidence of RM in up to 9% of patients visiting otolaryngology and allergy clinics, the pathophysiologic mechanism is not well understood.8 Consequently, management of RM has not been clearly defined, with most physicians advocating for the prompt discontinuation of topical decongestants and application of intranasal steroids and nasal saline.1-3,5,6

Patients who self-medicate with topical nasal decongestants pose a particular challenge to physicians, as these agents are easily accessible over the counter and characteristically provide rapid relief of nasal congestion. As a result, physical dependence can occur, which drives the vicious cycle of continued use of the product in an effort to maintain nasal patency. Other sinonasal disorders may underlie or coexist with RM, which indicates the importance of obtaining a thorough history to identify overlapping sources...
of nasal obstruction or inflammation.\textsuperscript{3,5,7-9} Patients with allergic rhinitis, septal deviation, or upper respiratory infections often elect to use over-the-counter topical nasal decongestants, putting themselves at higher risk for developing RM.\textsuperscript{4} Despite the recognition of RM as a clinical entity for several decades, an widely accepted protocol of treatment for rebound rhinitis, chronic rhinitis, or atrophic rhinitis as a result of nasal decongestant use among patients with RM.

A variety of medical and surgical treatments are potentially available to treat patients with RM. We aimed to summarize the available evidence in the literature about the treatment of RM, which might form the basis for a standardized protocol for treatment and a guide for future research. Outcomes of interest included improved breathing and reduced decongestant use among patients with RM.

**Methods**

A comprehensive review of the English-language literature was performed from the following electronic bibliographic databases: PubMed, EMBASE, the Cochrane Library, and Web of Science (science and social science citation index). Search criteria included all occurrences in the title or abstract of the following terms: (1) rhinitis medicamentosa, rebound rhinitis, chronic rhinitis, or atrophic rhinitis and (2) nasal decongestant and (3) nasal steroids or turbinate reduction. Inclusion criteria for the literature search were defined with the PICOS approach (population, intervention, control, outcome, study design). Search criteria included adults $>18$ years of age described as having RM, rebound rhinitis, chronic rhinitis, or atrophic rhinitis as a result of the chronic use of topical nasal decongestant medications. Interventions included, but were not limited to, nasal steroid treatment or turbinate reduction and were compared with a control. Outcomes measured in our search were improvement of breathing and related symptoms. Study designs included case-control, case series with chart review, prospective cohorts, and randomized controlled trials. A systematic search was performed and reported in accordance with the PRISMA standard (Preferred Reporting Items for Systematic Reviews and Meta-analyses; Figure 1).

Two reviewers (S.M.Z., B.M.B.) performed eligibility assessment of data in a standardized manner. In the initial screening, the abstract of every citation was reviewed for relevance to the treatment of RM in human patients. Irrelevant citations and case reports were excluded and duplicate records subsequently removed. The full text of the remaining citations was obtained and reviewed in full. Noneligible studies were excluded—specifically, those that did not provide data on treatments or outcomes and those that did not distinguish between patients with RM and those with other forms of rhinitis. One full-text article was excluded because the authors published 2 articles about the same patients in a prospective cohort: the original report\textsuperscript{10} and a 1-year follow-up.\textsuperscript{11} The 1-year follow-up study was selected for inclusion in the qualitative synthesis. The other remaining studies were included for qualitative analysis. Despite the use of the exclusion criterion of patients $>18$ years old, 3 of our qualifying studies each included 1 under-
positive across all studies: regardless of the intervention, patients experienced improvement in each study’s measured parameters. However, the patient age range, observation period, and number of patients in the intervention differed across publications. Furthermore, outcome measures and treatment protocols were inconsistent across the included publications. As such, quantitative pooling was unable to be performed in this review due to heterogeneity of outcome measures across interventions.

Discussion

RM is a pervasive and frustrating condition for patients and physicians alike, without a consensus on treatment type or treatment duration. The lack of standard regimen is directly linked to the uncertainty, as reflected in the literature, of the pathophysiologic mechanism underlying RM. One proposal holds that the chronic vasoconstriction causes hypoxemia and subsequent ischemia of the nasal mucosa, resulting in impaired function and congestion.7,9 Alternatively, fatigue of the overstimulated alpha- and beta-adrenergic vasoconstrictor mechanisms may occur, resulting in reactive hypervascularity and edema, as well as tachyphylaxis and decreased sensitivity to endogenous catecholamines, defined as a decreasing therapeutic response necessitating a higher dosage of medication to attain the same benefit.4,7,9 A third proposal is that increased parasympathetic activity intended to counter the sympathomimetic drugs may alter vasomotor tone, resulting in increased vascular permeability and edema.4 Histologic, pharmacokinetic, and pathophysiologic studies are necessary to better understand the mechanism of RM, which would lead investigators to more targeted treatments.

Of the interventions assessed, 1 eligible publication assessed oral ATP; 1 used a kinetic oscillator device; and 1 utilized a laser diode treatment. The most commonly used treatment among the included studies was intranasal steroids.12,13,16-22 Whereas the pathophysiology of the condition of RM is not fully understood, the mechanism of action is most well understood for nasal steroids. The conclusion of Vaidyanathan et al may be a good starting point in better understanding the pathophysiology of the condition, as their results showed statistical significance in reversal of tachyphylaxis in response to fluticasone.19 It has been established that the use of nasal steroids results in activation of beta-adrenergic receptors, resulting in a cascade that inhibits endothelial adherence of leukocytes and the subsequent
activation of prostaglandin synthesis, thereby promoting resolution of the edematous state of the nasal mucosa.\textsuperscript{1,23,24} It is believed that the edema, rather than vasodilation, is the component of RM that is responsible for the hallmark nasal obstruction.\textsuperscript{1,23} Treatment of RM fails because the symptom of chronic obstruction results in relapse to abuse of decongestants; therefore, subjects whose obstruction is relieved exhibit lower rates of returning to topical decongestant use.\textsuperscript{1,23} with nasal mucosa that reverts to normal.\textsuperscript{24-27}

Clinical trials in the mid-1970s developed the use of dexamethasone as an intranasal steroid treatment, with decreasing frequency over 2 to 4 weeks.\textsuperscript{3,12,28} Since then, administration of corticosteroids has been established as a first-line therapy for allergic rhinitis,\textsuperscript{29} but with a more concrete understanding of the pathophysiology of RM, a more appropriate and specific pharmacologic intervention could be developed.\textsuperscript{1,6,7,9,17} Contrary to previous studies, which pointed to immediate cessation of topical nasal decongestants,\textsuperscript{3,21} findings in this review point to the potential for an alternative management plan.

A further finding of this review, albeit understated, is the importance of patient education. Only 2 studies highlighted the importance of informing patients of the cause of their rhinitis, which is the overuse of topical nasal decongestants, and that limiting the frequency and duration of these medications is central to avoiding development of RM.\textsuperscript{11,16} Reviews describing RM highlighted the significance of properly informing patients of the risk of abusing topical decongestants, emphasizing that this crucial piece of communication could help prevent the development of RM altogether. These reviews further suggested that, given both patient-reported and objective measures of nasal pressure, administration of these medications should be limited to a controlled medical setting.\textsuperscript{7,16} Such discussion of patient education is hardly touched on in the included studies, and limiting the use of topical decongestants to a medical center was not suggested.

The selectivity of the inclusion and exclusion criteria greatly affects the ability to qualitatively assess the findings of these publications as a whole. The inclusion of patients with perennial allergic rhinitis in 1 study weakens the broader conclusions that can be drawn.\textsuperscript{17} Furthermore, inclusion criteria of daily overuse of topical nasal decongestants ranged from minimum 1 month,\textsuperscript{12} 3 months,\textsuperscript{18} 4 months,\textsuperscript{21} minimum 1 year,\textsuperscript{14} and minimum 15 months.\textsuperscript{20} One study included patients whose use of topical nasal decongestants ranged from 3 to 15 years, with dose per day ranging from daily use to 15 times a day.\textsuperscript{16} One study defined overuse as administration 5 times a day, and the duration of these doses ranged from 2 weeks to \( \geq 10 \) years.\textsuperscript{13} One study included exclusively healthy patients in whom RM was induced with oxymetazoline and treated by administering nasal steroids 3 times a day for 2 weeks and then 2 times a day for 3 more days.\textsuperscript{19} The exclusion criteria, however, were generally comparable.

The outcomes examined included patient reports of symptom relief, peak nasal inspiratory flow, nasal flow and

\begin{table}
\centering
\begin{tabular}{|l|c|c|c|c|c|c|c|c|c|c|c|c|}
\hline
Author (Year) & MINORS Score & Clearly Stated Aim & Inclusion of Consecutive Patients & Prospective Collection of Data & Adequate Baseline Equivalence of Groups & Contemporary Groups & Adequate Statistical Analysis & Appropriate Unbiased Assessment of Endpoint & Appropriate Follow-up Period & Loss to Follow-up < 5\% & Prospective Calculation of Sample Size & Adequate Control Group & Baseline Equivalence of Groups & Adequate Statistical Analyses & Dashes indicate nonrandomized study (ie, 16 maximum score vs 24 for comparative study) \\
\hline
Halle\’n (1997)\textsuperscript{16} & 18 & 2 & 2 & 2 & 0 & 2 & 2 & 2 & 2 & 0 & 2 & 2 & 0 & 2 & 0 \\
Ferguson (2001)\textsuperscript{17} & 20 & 2 & 2 & 2 & 2 & 2 & 2 & 2 & 2 & 0 & 2 & 2 & 0 & 2 & 0 \\
Juto (2014)\textsuperscript{18} & 19 & 2 & 2 & 2 & 2 & 2 & 2 & 2 & 2 & 0 & 2 & 2 & 0 & 2 & 0 \\
Vaidyanathan (2010)\textsuperscript{19} & 18 & 2 & 2 & 2 & 2 & 2 & 2 & 2 & 2 & 0 & 2 & 2 & 0 & 2 & 0 \\
Wang (1991)\textsuperscript{20} & 10 & 2 & 2 & 2 & 2 & 2 & 2 & 2 & 2 & 0 & 2 & 2 & 0 & 2 & 0 \\
Baflin (1997)\textsuperscript{11} & 12 & 2 & 2 & 2 & 2 & 2 & 2 & 2 & 2 & 0 & 2 & 2 & 0 & 2 & 0 \\
Bende (1996)\textsuperscript{21} & 9 & 2 & 2 & 2 & 2 & 2 & 2 & 2 & 2 & 0 & 2 & 2 & 0 & 2 & 0 \\
\hline
\end{tabular}
\caption{MINORS: Methodological Index of Nonrandomized Studies.\textsuperscript{2}}
\end{table}
resistance, peak inspiratory flow, minimal cross-sectional area, thickness of mucosa, histamine sensitivity, patient ability to discontinue use of topical nasal decongestants without relapse, and histological examination. The 2 most common measures were objective patient report of symptom relief and nasal flow and resistance. Given the complementary role for subjective and objective measures—specifically, objective measures that are accurate and replicable—we propose that the outcomes to be measured would ideally include (1) a standardized subjective patient symptom score, (2) nasal flow and resistance, and (3) histological changes. Simplifying or ensuring that future studies measure these 3 outcomes, with the same indices, would reduce variability and yield results that could provide standardized practice recommendations.

The heterogeneity of reporting patient symptom scores stands out as a key issue from this systematic review. Of the included studies, 6 incorporated patient reports of symptom relief as 1 of their primary outcomes, yet all 6 utilized different methods. In 1 study, patients reported their daily “nasal congestion” scores on a visual analog scale of 1 to 10 in both the morning and the evening over the course of the 6-week trial; another study used a visual analog scale of 1 to 100 to estimate “nasal stuffiness” before treatment and at 6 and 12 months after the treatment period. Other studies reported quotes of patients describing their “sinuses opening,” queried patient “need” for topical decongestants at 2 and 6 months after the treatment period, used a visual analog scale of 1 to 10 to report nasal airflow as well as patient satisfaction at pre- and posttherapeutic time points, and required patients to keep a diary symptom score based on summing scales of 0 to 4 in the categories of stuffiness, itching, and secretion. The heterogeneity in assessments of the hallmark symptom of RM highlights a deficiency in the current literature. The employment of common measures and a validated disease-specific tool would enhance validity and comparability.

A second useful outcome for studying RM is analysis of nasal flow and resistance. Current evidence suggests that rhinomanometry would be the most precise, accurate, and relevant objective test for RM, with high reliability. Furthermore, given that RM is a condition in which swelling and congestion are key physical findings, the ability of rhinomanometry to measure transnasal flow and pressure make it an appropriate functional examination. Additionally, acoustic rhinometry, which evaluates changes in airway dimensions and geometry, is highly correlated with rhinomanometry and was found to produce comparable results; as such, these measures could be used complementarily, which would facilitate standardization of objective outcomes.

Finally, further examination of histologic changes was one of the least common outcomes assessed, yet it has the potential to deepen the understanding of the pathophysiology of RM. Recent findings suggest that patients with RM have alterations including, but not limited to, reduced cilia cell counts, changes in cilia ultrastructure, and rupture of the basal layer, each of which predisposes a patient to interstitial edema. Additionally, ultrastructural changes to the endothelial cells of capillaries of the submucosal sinusoid venous plexuses suggestive of increased permeability is indicative of edema. Using these 3 ideal outcomes and common methods would allow for better comparison and potential pooling of results.

It is important to note that the strength of the conclusions drawn from this systematic review depends on the quality of the evidence of the studies, as reflected in the assessment with MINORS criteria. Notably, while the loss to follow-up was predominately reported and adequate, the majority of the studies had inadequate reporting of patient selection, and none of the included studies prospectively calculated a sample size. Further significant limitations include that 3 of the 4 randomized studies were subject to potential conflict of interest, as they were supported by pharmaceutical and pharmaceutical device companies. Additionally, 2 studies combined information in such a way that only vague inferences can be made about their findings. Specifically, 1 article included patients with either RM or perennial allergic rhinitis but did not distinguish their outcomes in the presentation of the data, whereas the second article administered 2 different treatments and likewise presented all patients as 1 group. Another publication experienced patient dropout but made assumptions about the data. This limits the

<table>
<thead>
<tr>
<th>Author (Year)</th>
<th>Direction of Inquiry</th>
<th>Randomization</th>
<th>Blinding</th>
<th>Handling of Lost Data</th>
<th>Basis for Treatment Allocation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hallén (1997)</td>
<td>Prospective</td>
<td>Yes</td>
<td>Yes</td>
<td>NA</td>
<td>Randomized</td>
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<tr>
<td>Ferguson (2001)</td>
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<td>Yes</td>
<td>NA</td>
<td>Excluded</td>
<td>Randomized</td>
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<td>Juto (2014)</td>
<td>Prospective</td>
<td>Yes</td>
<td>Yes</td>
<td>Excluded</td>
<td>Randomized</td>
</tr>
<tr>
<td>Vaidyanathan (2010)</td>
<td>Prospective</td>
<td>Yes</td>
<td>Yes</td>
<td>Excluded</td>
<td>Randomized</td>
</tr>
<tr>
<td>Wang (1991)</td>
<td>Prospective (case series)</td>
<td>No</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Caffier (2008)</td>
<td>Prospective (case series)</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>Standard protocol</td>
</tr>
<tr>
<td>Baldwin (1975)</td>
<td>Prospective (case series)</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>Standard protocol</td>
</tr>
<tr>
<td>Graf (1997)</td>
<td>Prospective (case series)</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>Standard protocol</td>
</tr>
<tr>
<td>Bende (1996)</td>
<td>Prospective (case series)</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>Standard protocol</td>
</tr>
</tbody>
</table>

Abbreviation: NA, not applicable.
<table>
<thead>
<tr>
<th>Author (Year)</th>
<th>Design</th>
<th>Age, Mean (Range), y</th>
<th>Control: Treatment, n</th>
<th>Treatment: Fluticasone, 200 μg BID for 3 d; placebo at days 1, 14, 17</th>
<th>Outcomes Reviewed</th>
<th>Methods of Outcome Analysis</th>
<th>Findings</th>
</tr>
</thead>
</table>
| Hallén (1997) 16 | RCT    | 33                   | 10:10                 | Placebo nasal spray qd for 14 d                | Patient reports of symptom relief, nasal volume, PNIF, MCA, thickness of nasal mucosa | Nasal mucosal swelling and MCA recorded with rhinostereometry, acoustic rhinometry, and peak inspiratory flow meter; nasal stuffiness (estimated on VAS twice daily) | • Mean reduction with rhinostereometry: –1.2 mm  
• Mean increase in MCA: 0.27 cm²  
• PNIF mean improvement: 121 L/min  
• Morning symptom scores: reduced by 45  
• Evening symptom scores: reduced by 37  
• Improvement statistically significant vs placebo after 1 and 2 wk |
| Ferguson (2001) 17 | RCT    | 37.2                 | 10:9                  | Placebo nasal spray                            | Patient reports of symptom relief, nasal volume, MCA | Subjective: patients recorded nasal congestion scores on 10-point VAS AM and PM (mean used for statistical analysis); objective: nasal volume and minimal cross-sectional area by acoustic rhinometry | • Significantly less congested and subjective symptom improvement vs placebo  
• Nasal airway objectively was improved vs placebo but not to statistical significance  
• MCA significantly decreased  
• Median RQSS stuffiness measure fell from 2 to 1 (on scale of 0 to 3) |
| Juto (2014) 18 | RCT    | 40                   | 35:36                 | Device maintained stable pressure without oscillation | Kinetic oscillation stimulation: mechanical vibrations at 50 Hz | Patient reports of symptom relief, PNIF | RQSS, diary symptom score, PNIF |
| Vaidyanathan (2010) 19 | RCT    | 33                   | 19:19                 | Fluticasone, 200 μg BID for 3 d; placebo at days 1, 14, 17 | Fluticasone, 200 μg BID for 3 d; oral prazosin, 1 mg, at days 1, 14, 17 | PNIF, NAR, oxymetazoline dose-response curve | • Significant decrease in PNIF after day 1  
• Significant increase in NAR after days 1, 14, 17 |

(continued)
Table 3. (continued)

<table>
<thead>
<tr>
<th>Author (Year)</th>
<th>Design</th>
<th>Age, Mean (Range), y</th>
<th>Control: Treatment, n</th>
<th>Control</th>
<th>Treatment</th>
<th>Outcomes Reviewed</th>
<th>Methods of Outcome Analysis</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wang (1991)¹³</td>
<td>Prospective clinical investigation</td>
<td>17-50</td>
<td>NA: 22 (1), 8 (2)</td>
<td>NA</td>
<td>(1) Topical dexamethasone or triamcinolone in normal saline for 1-2 wk, followed by normal saline as regular nasal drops; (2) oral ATP, 20 mg, 3 times daily</td>
<td>PNIF, NAR</td>
<td>Nasal mucus clearance time measurement, gross appearance of nasal mucous membrane, optical microscopy appearance of sample taken from junction of anterior and middle thirds of inferior turbinate, and rhinomanometry</td>
<td>- Nasal mucus clearance time shortened in varying degrees throughout cohort</td>
</tr>
<tr>
<td>Caffier (2008)¹⁴</td>
<td>Prospective clinical investigation</td>
<td>44 (15-72)</td>
<td>NA: 42</td>
<td>NA</td>
<td>Video-endoscopic inferior turbinate reduction with a diode laser</td>
<td>Patient reports of symptom relief, PNIF, NAR, ability to discontinue vasoconstrictors without relapse</td>
<td>Short term: NAR, patient satisfaction rating on VAS; long term: inferior turbinate photodocumentation, recurrent need for decongestants</td>
<td>- NAR: significant improvement</td>
</tr>
<tr>
<td>Baldwin (1975)¹²</td>
<td>Case series report</td>
<td>14-60</td>
<td>NA: 22</td>
<td>NA</td>
<td>Dexamethasone administered by Decadron Turbine apparatus: 0.084 mgm, with diminishing frequency over 4 wk</td>
<td>Patient reports of symptom relief, MCA, patient ability to discontinue vasoconstrictors without relapse</td>
<td>Complete cessation of topical vasoconstrictors in any form, relief of symptoms, return of appearance of nasal mucosa to “normal”</td>
<td>- All patients discontinued use of topical vasoconstrictors within 2 wk of treatment regimen without relapse at 6-mo follow-up</td>
</tr>
<tr>
<td>Author (Year)</td>
<td>Design</td>
<td>Age, Mean (Range), y</td>
<td>Control: Treatment, n</td>
<td>Control</td>
<td>Treatment</td>
<td>Outcomes Reviewed</td>
<td>Methods of Outcome Analysis</td>
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</table>
| Graf (1997)¹¹ | 1-y follow-up of prospective clinical investigation | 30.3 (18-42) | NA:10 NA | NA | Budesonide spray, 400 μg/d, for 6 wk during decongestant withdrawal | Patient reports of symptom relief, MCA | MCA, decongestive effect of oxymetazoline, histamine sensitivity measured with rhinostereometry; symptom score for nasal stuffiness | • Histamine sensitivity: still increased after 6 mo but not after 1 y  
• Decongestive effect of oxymetazoline: increased after 6 mo (indicative of reversible tolerance)  
• No relapse to long-term use during 1-y follow-up |
| Bende (1996)²⁰ | Case cohort | 30 | NA:11 NA | NA | BANS, 8000 μg/d, for 2 mo | Patient reports of symptom relief, NAR | NAR at rest and after exercise, before and after treatment; need for topical nasal decongestants 2 and 6 mo after treatment period | • Statistically significant difference in total NAR at rest before and after treatment (38.0 ± 4.3)  
• No statistically significant difference in total NAR after exercise before and after treatment |

Abbreviations: ATP, adenosine triphosphate; BANS, budesonide aqueous nasal spray; BID, twice per day; MCA, minimal cross-sectional area; NA, not applicable; NAR, nasal airway resistance; PNIF, peak nasal inspiratory flow; qd, daily; RCT, randomized controlled trial; RQSS, Rhinitis Questionnaire Symptom Score; VAS, visual analog scale.
conclusions that can be drawn about the effectiveness of the findings.

Although the results from these publications cannot be quantitatively pooled, the reported subjective patient experience, as well as objective examination of nasal function, suggests that further investigation of RM is needed. Doing so with consistently selected and evaluated outcomes and performing prospective randomized controlled trials would be a significant contribution to the understanding of the condition, as well as its diagnosis and optimal treatment. The findings of this study conclude that there is no consensus on the best medical therapy for the treatment of RM. Despite this finding, the most common medication used today to treat RM continues to be intranasal corticosteroids.

Conclusion
There is not adequate evidence to conclusively suggest a standardized treatment protocol for RM. Given the significant variability in study design and outcomes reported across the relevant publications, it is recommended that uniform objective and patient-centered outcome measures be adopted for future study. Additional high-level evidence is needed to determine the optimal management strategy for patients diagnosed with RM.

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Author Contributions
Shana M. Zucker, acquisition and analysis of data, drafting of manuscript, final approval, accountable for all aspects; Blair M. Barton, acquisition and analysis of data, drafting of manuscript, final approval, accountable for all aspects; Edward D. McCoul, conception and design, interpretation of results, revision of manuscript, final approval, accountable for all aspects.

Disclosures
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