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REVIEW ARTICLE

Chronic rhinitis and its impact on COPD: A literature review

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Abstract

Background: Chronic obstructive pulmonary disease (COPD) exerts a notable impact on the quality of life of individuals, precipitating substantial economic burdens. A probable association exists between chronic obstructive pulmonary disease (COPD) and chronic rhinitis (CR).

Objective: This study aims to explore the impact of CR in COPD.

Method: A scoping literature review framework was used for this study. Relevant publications published between January 2003 to December 2023, were captured from Embase, MEDLINE, and Scopus. The outcomes included prevalence, quality of life, exacerbation and hospitalization, lung function, COPD symptom score, and psychological impact.

Results: The scoping review included six eligible studies that focused on CR in COPD. The prevalence of chronic nasal symptoms was found in up to 88% of COPD with nasal discharge found to be the most common symptom in COPD. Chronic rhinitis impacted the QoL, causing a significant increase in the risk of exacerbation & hospitalization, associated with lower lung function and higher COPD symptom scores. CR was not found to impact mood disorder in terms of psychological aspects.

Conclusion: CR, including Allergic and Non-allergic rhinitis, may influences the outcomes of COPD. Assessing chronic nasal symptoms in COPD patients is suggested to understand their role in disease progression. A comprehensive approach targeting both upper and lower airway conditions could improve COPD treatment outcomes.

Key words: allergic rhinitis, chronic obstructive pulmonary disease, chronic rhinitis, non-allergic rhinitis, literature review

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Abbreviations:

AR	Allergic rhinitis
CAT	COPD Assessment Test
COPD	Chronic obstructive pulmonary disease
CR	Chronic rhinitis
FEV1	Forced expiratory volume in the first second
HADS	Hospital Anxiety and Depression Scale (HADS)
HR	Hazard ratio
ICS	Inhaled corticosteroids
INCS	Intranasal corticosteroids
mMRC	Modified Medical Research Council
NIR	Noninfectious rhinitis
OR	Odds ratio
QoL	Quality of life
SNOT-22	Sino-nasal Outcome Test
SGRQ	St. George's Respiratory Questionnaire

Introduction

Chronic obstructive pulmonary disease (COPD) is distinguished by the presence of airflow limitation, accompanied by several symptoms including chronic cough, dyspnea during physical exertion, expectoration, and wheezing.[1] The prevalence of COPD increases with age and is commonly found over 40 years of age.[2] COPD has been a significant issue in public health and will continue to be a challenging task for medical professionals in the years to come. Globally, COPD is receiving significant attention due to its worldwide occurrence, high rates of illness and death, and the resulting difficult obstacles it poses for healthcare systems.[3]

COPD frequently coexists with other medical conditions that can significantly affect its progression and affect patient quality of life.[4] These comorbidities include cardiovascular diseases, lung cancer, osteoporosis, depression/anxiety, and gastroesophageal reflux disease.[4] COPD exacerbations are diverse occurrences that are now believed to be the result of intricate interactions among the individual, respiratory viruses, airway bacteria, and environmental pollution, resulting in an escalation of the inflammatory load.[5] COPD exacerbations are linked to heightened inflammation in both the upper and lower airways, as well as throughout the body.[5] According to the Global Initiative for Chronic Obstructive Lung Disease (GOLD) guideline, the therapy for COPD should not be changed based on the existence of other health conditions and comorbidities should be treated according to the regular standards.[4]

The upper and lower airways are anatomically connected and functionally interrelated as a well-established one-united airway concept.[6] The association between rhinitis and asthmatic bronchial hyperresponsiveness is widely acknowledged in the academic literature.[7,8] However, there is a paucity of literature regarding upper airway involvement in individuals diagnosed with COPD.[9] Some studies identified correlations between nasal and respiratory symptoms, indicating a potential linkage between the upper and lower airway in individuals with COPD.[9] Chronic rhinitis (CR) is found to have a notable comorbidity that contributes to an increased likelihood of early readmission among individuals with asthma or COPD.[10]

CR has a prevalence rate of 40% among adults, leading to a notable influence on health-related quality of life and imposing considerable health-economic burdens on society.[11-13] The symptoms of CR are frequently seen by medical practitioners such as sneezing, nasal itching, rhinorrhea, and nasal congestion.[14] CR can be categorized into allergic rhinitis (AR) and non-allergic rhinitis (NAR), or potentially a combination of both diseases.[15] CR has been related to chronic respiratory conditions, including asthma, bronchiectasis, and chronic obstructive pulmonary disease (COPD).[11,16,17] The aforementioned associations have been attributed to commonly recognized triggers, such as allergens, pollutants, and cigarette smoke, or to commonly seen pathophysiological pathways that involve epithelial and/or inflammatory cells.[18] Nevertheless, there have been limited investigations conducted on the frequency and significance of CR involvement in pulmonary symptoms and quality of life (QoL) among patients with COPD.[9,18,19] A review has emphasized the necessity for further studies to evaluate the influence of nasal symptoms on the quality of life in individuals with COPD.[20]

Therefore, this review aims to perform a comprehensive summary of existing literature regarding the impact of CR on COPD. This review will help enhance the comprehension of healthcare providers about outpatient treatment strategies for respiratory tract airway disorders affecting both the upper and lower tracts, such as CR, including AR and NAR, in COPD.

Method

This scoping literature review was conducted and reported to identify articles assessing the impact of CR in COPD following the flow diagram (**Figure 1**). This review summarized the evidence of CR which impacts COPD outcomes in the previous publications. Searches were conducted to capture eligible publications from January 2003 to December 2023 using the electronic literature databases Excerpta Medica Database (Embase), via EMBASE, MEDLINE, and SCOPUS. Search terms were as follows; Embase: (COPD OR chronic) AND obstructive AND pulmonary AND disease AND chronic AND rhinitis, Scopus: (COPD AND rhinitis), PubMed: (COPD) AND (chronic rhinitis)) OR (rhinitis) OR (allergic rhinitis). Bibliographies of the identified literature review on the impact of CR in COPD were examined for any additional relevant publications and to validate the electronic searches.

In the initial round of evaluation, two researchers (YK, CY) conducted an independent screening of titles and abstracts, adhering to predetermined criteria for inclusion and exclusion. The variables examined in this study include a prevalence of CR, exacerbation and hospitalization, lung function, COPD symptom scores, and psychological impact on COPD. To be eligible for inclusion, the articles must meet the following criteria: they must be published in the English language between January 1, 2003, and December 2023. Furthermore, the articles should focus on adult patients diagnosed with Chronic Obstructive Pulmonary Disease (COPD). COPD is defined as having a post-bronchodilator forced expiratory volume in 1 second/forced vital capacity (FEV_1/FVC) ratio of less than 0.70, with a moderate severity level of 50% ≤ FEV_1 < 80% predicted, the severe severity level of 30% ≤ FEV_1 < 50% predicted, or very severe severity level with FEV_1 less than 30%.[4] Alternatively, the articles may examine patients with COPD following the Global Initiative for Chronic Obstructive Lung Disease (GOLD) guidelines, which also include CR. CR is presently characterized by the occurrence of at least two nasal symptoms (congestion,

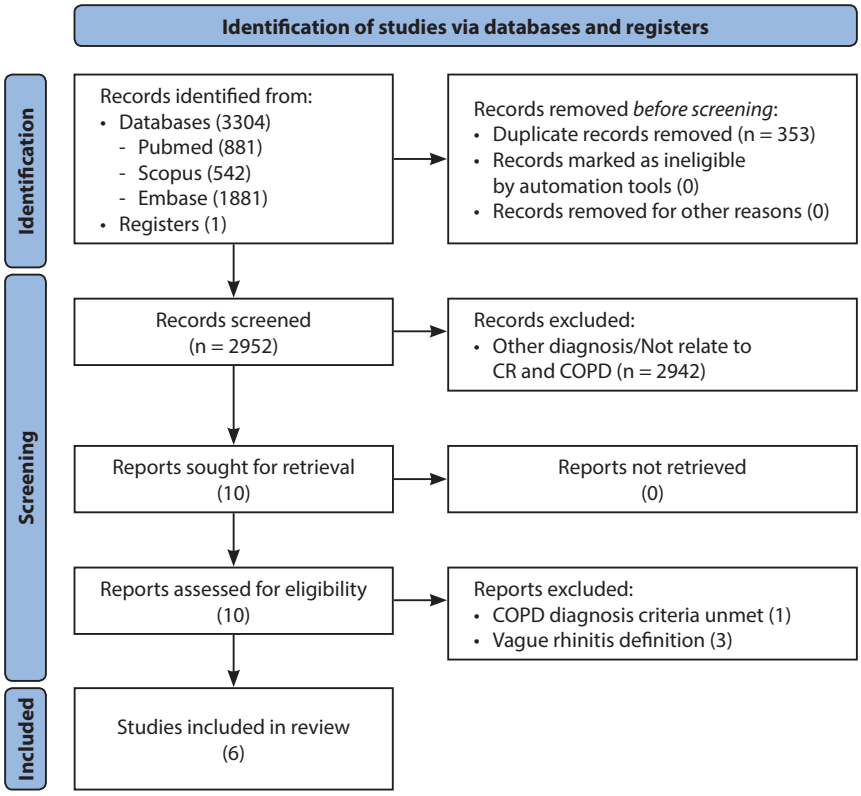

Figure 1. Flow diagram of included and excluded studies.

Abbreviations: COPD, Chronic obstructive pulmonary disease; CR, Chronic rhinitis

rhinorrhea, itching, and sneezing) for a minimum of one hour per day over a period exceeding 12 weeks per year. However, this definition lacks a robust evidence-based foundation.[21] A recent study proposed defining CR as the presence of at least one nasal symptom for a minimum duration of three weeks per year which still needs more future studies to validate the new definition.[21] Our study decided to use a new definition. The article that meets the criteria must address the following aspects: prevalence, quality of life, exacerbation and hospitalization, lung function, COPD symptom score, and psychological impact. In the study, non-English and those who had not received a diagnosis of COPD or CR were excluded.

We initially identified 2,952 articles from electrical databases after removing duplicates using the EndNote program (Version 21.2). For the study screening, two reviewers (YK, CY) independently assessed the titles and abstracts and retrieved full-text publications that appeared to meet the eligibility criteria. We independently evaluated the eligibility of the trials and documented the reasons for exclusion, which primarily included diagnosing diseases other than COPD and poorly defined CR. As part of a quality assurance process, all initially rejected studies underwent a subsequent review. Any discrepancies identified during both review rounds were resolved through discussions between the two reviewers or with the assistance of a third, more experienced researcher (TB, TS). From the 10 eligible studies identified in the screening phase, we excluded 4 articles due to unmet COPD diagnosis criteria and vague definitions of CR (**Figure 1**). Ultimately, six eligible publications, corresponding to the relevant abstracts identified in the initial review, were acquired and analyzed. Due to the inherent characteristics of the data, a quantitative analysis was deemed unsuitable. Nevertheless, the studies were categorized based on the specific results of interest including prevalence, quality of life, exacerbation and hospitalization, lung function, COPD symptom score, and psychological impact.

Results

Six articles of varying quality were included in the literature review. The characteristics and outcomes of the included studies are shown in **Table 1**.

Table 1. Characteristics and outcomes of the included studies.

Study	Type of Study (Follow up time)	Study Size (CR/COPD)	Disease phenotype	Country	Outcomes					
					Prevalence	QoL	Exacerbation & Hospitalization	Lung function	COPD symptom score	Psychological effect
Bergqvist, 2016[24]	Prospective cohort (5 years)	3,612 (67/620)	CR (NIR)	Sweden	10.8% increase in COPD, COPD is independently associated with newly onset NIR					
Caillaud, 2014[23]	Prospective cohort (4 years)	274 (115/274)	CR (> 6 wks)	France	42% nasal symptoms in COPD patients; Rhinorrhea 62%, nasal obstruction 43%, and anosmia 16%	SGRQ-Total score (OR 1.018)*, SGRQ-Activity score (OR 1.015)***	NS for number of Exacerbation	NS for Lung function	mMRC (OR 1.310)**	NS for HADS
Huerta, 2015[25]	Prospective cohort (8 years)	209	CR	UK			Nasal discharge was more likely in patients with frequent exacerbation. (OR 1.96)*		Higher CAT scores in patients with nasal discharge*	
Hurst, 2004[22]	Cross-sectional (Oct 2002 - April 2003)	65 (67/65)	CR	UK	88% have nasal symptoms; Rhinorrhea 52%, Nasal obstruction 50%, sneezing 50%, Postnasal drip 43%, and hyposmia 30%	SNOT-20*, No correlation between SNOT-20 and SGRQ				
Hurst, 2006[26]	Cross-Sectional Study (April 2004 - June 2005)	51	CR (> 6 wks)	UK				Correlation between Nasal patency and FEV_1*		
Singh, 2019[10]	Retrospective cohort (Median 553 days)	2176	CR (AR/NAR)	USA			HRs for 30-day COPD-related readmission rates = 2.4 in AR* and 2.6 in NAR*			

*$P < 0.05$, NS = No statistically significant, **$P < 0.05$ when SGRQ force out from the model, ***$P < 0.05$ when analysis only sub domain of SGRQ

Abbreviations: AR, Allergic rhinitis; CAT, COPD Assessment Test; COPD, Chronic obstructive pulmonary disease; CR, Chronic rhinitis; FEV_1, Forced expiratory volume in the first second; HADS, Hospital Anxiety and Depression Scale; HR, Hazard ratio; mMRC, Modified Medical Research Council; NAR, Non-allergic rhinitis; NIR, Non-infectious rhinitis; OR, Odds ratio; QoL, Quality of life; SGRQ, St. George's Respiratory Questionnaire; SNOT-20, Sino-nasal Outcome Test-20; USA, United States of America.

Prevalence

CR, which includes both AR and NAR, was discovered to be linked to COPD due to the concept of a united airway. Hurst et al. 2004 reported that 88% of COPD have nasal symptoms and the most common symptom is rhinorrhea (52%) followed by nasal obstruction 50%, sneezing 50%, postnasal drip 43%, and hyposmia 30%.[22] Caillaud et al. 2013 found that 42% of COPD patients experienced nasal symptoms, over half of the patients had nasal discharge (62%), whereas 43% had nasal blockage, and 16% suffered from anosmia.[23] Moreover, Bergqvist et al. (2016) reported a significant 10.8% increase in the occurrence of noninfectious rhinitis (NIR) within the COPD cohort over a five-year period.[24] COPD was found to be independently associated with newly onset NIR.[24]

Quality of life

Quality of life was a primary concern in COPD patients with concurrent CR. The review revealed that individuals with COPD who experienced chronic nasal symptoms exhibited elevated St. George's Respiratory Questionnaire (SGRQ) total score, indicating a lower quality of life (OR 1.018, 95%CI 1.004-1.031, P = 0.01).[23] An independent correlation was established with the activity score among the SGRQ subdomains (OR 1.015, 95%CI 1.005-1.026, P = 0.01).[23]

Hurst et al. 2004 demonstrated a positive correlation between the SNOT-20 score and the quantity of chronic nasal symptoms (r = 0.51, P = 0.01), indicating that higher daily nasal symptoms are associated with a more significant effect on health status.[22] There was no significant link between SNOT-20 and SGRQ (r = 0.21, P = 0.09), indicating that both upper and lower airway symptoms have a role in the overall quality of life impact.[22]

Exacerbation and Hospitalization

Exacerbation and Hospitalization are primary concerns in people with COPD. Caillaud et al. 2014 found that there was no significant difference in exacerbation between COPD with chronic nasal symptoms and those without chronic nasal symptoms.[23] In contrast, Huerta et al. 2015 showed a notable influence of nasal symptoms on the COPD Assessment Test (CAT) scores in COPD patients. In patients with frequent exacerbations, the likelihood of nasal discharge was higher with an odds ratio of 1.96 (95%CI, 1.17–3.28; P = 0.011).[25]

In relation to hospitalization, Singh et al. (2019) demonstrated that patients with AR or NAR had significantly higher 30-day readmission rates due to COPD.[10] The hazard ratios were 2.4 (95%CI: 1.7-3.2) for AR and 2.6 (95%CI: 1.8-3.7) for NAR, indicating a marked increase in readmission risk compared to COPD patients without rhinitis.[10]

Lung function

Hurst et al. 2006 found the correlation between nasal patency and pulmonary airflow limitation showed as the FEV_1 in COPD. The study reported a significant association between FEV_1 and the summed second nasal minimum cross-sectional area with r = 0.36 (p = 0.009).[26] Hence, nasal airway obstruction in COPD is directly related to the reduction in pulmonary airflow and is more severe when chronic nasal symptoms are present.[26] On the other hand, Caillaud 2013 found that there is no significant relation between lung function and CR in COPD.[23]

COPD symptom score

Caillaud et al. 2014 suggested that COPD with CR contributes significantly to dyspnea reflected as an mMRC score which was found independently associated with chronic nasal symptoms (OR 1.310, 95%CI 1.055-1.633, P = 0.02)[23] Huerta et al. 2015 found the connection of nasal discharge with the frequent exacerbation phenotype of the COPD cohort over 8 years (OR, 1.96, 95%CI 1.17–3.28; P = 0.011). CAT scores were significantly different between baseline and at exacerbation, CAT scores were higher by 1.06 units (95%CI, 0.32–1.80; P = 0.005) in stable COPD and higher by 1.30 units (95%CI, 0.05–2.57; P = 0.042) during exacerbations.[25]

Psychological impact

Caillaud et al. 2014 collected data on Mood disorders assessed using the Hospital Anxiety and Depression Scale (HADS) in COPD patients with chronic nasal symptoms. HADS was not statistically different between patients with and without chronic nasal symptoms.[23]

Discussion

This study is a scoping literature review that focuses on the impact of CR on COPD outcomes. Our review focuses on the impact of CR in COPD patients including prevalence, quality of life, exacerbation and hospitalization, lung function, COPD symptom score, and psychological effect.

Prevalence

Our review identified a relationship between CR and COPD, indicating a higher frequency of CR and chronic nasal symptoms in individuals with COPD. From the varying in prevalence of each study, we found upto 88% of COPD patients reported experiencing nasal symptoms which mainly included nasal discharge, nasal blockage, sneezing, and anosmia/hyposmia.[22] There were also some prevalence reported for AR and NAR in COPD which showed in similar range of our review. A high prevalence of NAR among COPD patients, with approximately 48.9% of COPD patients exhibiting non-allergic rhinitis symptoms, compared to 37.1% of non-COPD individuals.[27] While the prevalence of AR among individuals with COPD is approximately 24%.[28] The variation in the incidence might be due to the study design (prospective/cross-sectional), sample size of each study, and country prevalence. Further new standardized studies need to address this issue.

Possible link of CR and COPD

CR and COPD might associated with three common potential aspects 1) Risk factors include exposure to inhaled irritants such as cigarette smoke, gas, fumes, or dust, and individual vulnerability of airway mucosa 2) The spread of inflammatory mediators through the bloodstream to both the upper and lower airways is observed in rhinitis and asthma 3) Individual susceptibility in the airway lining to irritants in overall inflammatory reactions may be a reason why COPD and CR are frequently present in the same persons.[27]

NAR includes various distinct conditions, which may coexist with AR and differ in clinical presentation and treatment.[29] The pathogenesis of NAR remains unclear and likely involves multiple mechanisms.[29] NAR may be linked to COPD through shared inflammatory mechanisms, such as elevated cytokines like IL-6 and TNF-α,[30] contributing to airway inflammation in both conditions. Smoking is considered a common risk factor for both NAR and COPD which might be a possible link between NAR and COPD.[18-20,31] Patients with irritant rhinitis due to cigarette smoke exposure had significantly higher levels of neuropeptide Y, vasoactive intestinal peptide, and substance P.[32,33] Impaired mucociliary clearance and neurogenic inflammation[33] from smoking common to both NAR and COPD can further aggravate respiratory obstruction and airway hyperresponsiveness.[11,34]

There are potential associations between AR and COPD. While AR is more frequently observed as a concomitant comorbidity in asthma than in COPD, the mechanistic link between AR and asthma is more clearly established. The detection of atopy in COPD patients could encourage physicians to explore the possibility of AR, even if AR symptoms have not been previously considered or recorded in the patient's history. There was a reported genetic association between asthma-COPD overlap[35] which could be predisposed to type 2 inflammation which is linked to allergic diseases such as asthma and AR. To increase awareness of asthma-COPD overlap syndrome, recognizing co-existing asthma and COPD diagnoses is necessary for prevention. Moreover, some aeroallergen sensitization or AR might correlate with this group of patients.[36] The recent study addressed type 2 inflammation as the important driver of 20-40% of COPD patients, however, there was no robust data to identify the coexisting inflammation of AR and COPD.[37] Peripheral eosinophilia in patients with CR increases the risk of acute COPD exacerbations 2.56-fold.[10] Similar to Obling et al. 2021 reported that patients with high upper airway symptoms exhibited higher levels of eosinophils in both blood and sputum.[38] However, in this review, no studies investigated the correlation of bio-inflammatory markers such as blood eosinophils or FeNo with CR and the impact of COPD. Therefore, concomitant AR is one of the causes of blood eosinophilia in COPD patients, helping us recognize the AR association before jumping to the conclusion that it is COPD with blood eosinophilia itself. Several studies have demonstrated a well-established relationship between rhinitis and asthmatic bronchial hyperresponsiveness,[7,8] with up to 88% of asthma patients exhibiting rhinitis symptoms and approximately 50% of rhinitis patients experiencing bronchial hyperresponsiveness.[39,40] Evidence suggests that diseases of the upper respiratory tract can initiate or exacerbate chronic inflammation in the lower airways.[41] Given the significant prevalence of nasal symptoms in COPD and their impact on patients' quality of life,[28] It is suggested to further investigate the involvement of the upper airways in COPD, particularly in patients with atopy[22] and positive blood eosinophilia.[10]

Impact of CR on COPD

We found the impact of QoL on both CR and COPD. The absence of a correlation between the quality of life measures (SNOT-20 and SGRQ) for upper and lower respiratory diseases underscores the distinct impact that each disease has on the quality of life of COPD patients.[22] In terms of exacerbation having nasal discharge was found to be associated with frequent exacerbations of COPD individuals.[25] However, another study did not find an increase in the frequency of exacerbation in COPD with CR.[23] Therefore, more research needs to be conducted to conclude the impact of CR on the frequency of exacerbation.

Previous studies showed a significant risk of readmission within 30 days of COPD patients having both AR and NAR.[10] In terms of lung function, there is inconsistent data on whether CR has an impact on lung function or not. A study suggested that there was a correlation between nasal patency and FEV_1 in patients with CR and COPD.[26] However, another study found no significant impact of having CR on COPD lung function.[23] For the COPD symptoms score, mMRC was found to be associated with chronic nasal symptoms[23] as well as the CAT score was found significantly associated with COPD patients having co-existing CR.[25] Lastly, only one study revealed that there was no impact on mood disorder in patients with CR.[23] Further standardized studies are necessary to better understand the prevalence of CR in relation to COPD.

Previous studies have determined a high prevalence of asthma and COPD in patients with CR.[42-47] Other studies have also determined a significant correlation between high nasal symptom scores, representative of CR, and high sputum production[9] that is typically observed during acute exacerbations in COPD.[48] Upper airway symptoms increase over time in patients with COPD which are related to increased lower airway symptom and also the frequent exacerbation phenotype.[25,38] If not treated, nasal symptoms in COPD patients could result in frequent exacerbations. It is essential to carefully evaluate the presence of chronic nasal symptoms in COPD patients, as appropriate treatment of these symptoms may offer therapeutic benefits for individuals with COPD. The treatment of coexisting CR depends on the specific condition. For NAR, treatment varies based on the specific condition. For instance, INCS

and/or intranasal antihistamines are the primary therapies for vasomotor rhinitis, while INCS is recommended for non-allergic rhinitis with eosinophilia syndrome.[29] Moreover, INCSs are the mainstay treatment for AR.[49] Possible pathways for INCS treatment in CR coexist with COPD involve restoring the nose's air conditioning functions, alleviating upper/lower airway reflex, decreasing the aspiration of nasal secretions, and reuptake of inflammatory agents in rhinitis linked to COPD.[50]

Our study is the first study of a scoping review on CR in COPD patients. The limitation of this study is that only a few studies have shown a connection between CR in COPD and the possible correlation of biomarkers in these diseases. Therefore, further research is required to investigate the connection between CR and COPD and the shared inflammatory pathways of these two entities. Our investigation examined the correlation and consequences between the upper and lower airways, underscoring the established notion of "a united airway". This encompasses not only the connection between AR-Asthma but also the association between both AR and NAR with COPD. This linkage is highlighted through symptom-related factors and shared risk factors among these conditions. Nasal symptoms in COPD are frequently overlooked, despite their impact on the entire airway, extending from the nose to distant lungs. Long-term nasal and respiratory symptoms affect the QoL and lead to systemic inflammation during exacerbation. We suggest to raise the awareness of upper respiratory tract diseases such as CR and encourage to treat for both upper and lower airway diseases.

Conclusion

CR may affect several outcomes in COPD, including quality of life, exacerbation frequency, hospitalization rates, lung function, and the severity of COPD symptoms. The unified airway concept emphasizes the interconnectedness of upper airway symptoms, such as CR, with lower respiratory conditions. Evaluating chronic nasal symptoms in COPD patients is recommended to better understand their contribution to disease progression. A holistic treatment approach that addresses both upper and lower airway conditions has the potential to enhance COPD management outcomes.

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Conflict of interests

YK, KP, and TS did not receive any fee and have no conflicts of interest to declare. There are no other conflicts of interest to declare. CY and TB are employees of GSK.

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Author contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, and interpretation, or all these areas; took part in drafting, revising, or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agreed to be accountable for all aspects of the work.

Ethics approval

Ethics approval was considered exempt due to the nature of the literature review.

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