

Coronavirus Pandemic

The role of SARS-CoV-2 infection in patients with bronchial asthma and allergic rhinitis at tertiary St. George Hospital Plovdiv, Bulgaria

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Abstract

Introduction: The COVID-19 pandemic has generated uncertainty about epidemiology, clinical course, and the influence of comorbidities. Evidence is conflicting on whether bronchial asthma and allergic rhinitis alter susceptibility to SARS-CoV-2 or the severity of COVID-19. This study describes occurrence and clinical course of SARS-CoV-2 infection in a small cohort of patients with allergic respiratory comorbidities.

Methodology: Nineteen patients with PCR-confirmed COVID-19 were observed from 11 to 30 November 2020 at the Department of Occupational Diseases with Clinical Allergy Activity, University Hospital “St. George”, Plovdiv. Viral RNA was extracted from respiratory specimens using automated systems and amplified by real-time PCR; cycle threshold (Ct) values were recorded as an indirect viral load measure. The department was temporarily reorganized as a dedicated COVID-19 unit and care followed institutional protocols based on international evidence. Data were obtained retrospectively from official medical records; informed consent was included.

Results: Clinical histories, examinations, and laboratory data were reviewed for all 19 patients. Six had bronchial asthma and three had allergic rhinitis. Although the sample is small and not statistically representative, allergic respiratory diseases were observed to coexist with SARS-CoV-2 infection in this hospitalized series.

Conclusions: Given the lung’s central role in both allergic airway disease and COVID-19, clinicians should evaluate infection risk and clinical implications in patients with asthma and allergic rhinitis to inform prevention and management strategies.

Key words: SARS-CoV-2, bronchial asthma, allergic rhinitis, concomitant diseases.

J Infect Dev Ctries 2026; 20(2):148-152. doi:10.3855/jidc.22009

(Received 28 June 2025 – Accepted 04 August 2025)

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Introduction

The world is currently facing a global crisis caused by the emergence and rapid spread of the novel severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) virus, which has reached the scale of a global pandemic. As of 11 February 2021, cases of coronavirus disease 2019 (COVID-19) had been reported in nearly every country and territory across all continents. By that date, the total number of confirmed cases worldwide had approached 108 million [1].

The exponential increase in the number of COVID-19 cases worldwide, coupled with significant mortality rates, has made the pandemic one of the most severe public health challenges in decades. Early protection measures, timely identification and diagnosis, as well as prompt isolation, are critical for the prevention and control of COVID-19 infections [2]. A sharp increase in newly diagnosed cases was observed following the initial outbreak in Wuhan, China in December 2019

[3,4]. The risk of COVID-19 infection has become a matter of paramount concern for millions of individuals worldwide living with asthma and allergic rhinitis [5].

It is crucial for clinicians—pulmonologists, allergists, and otolaryngologists—to investigate the risk of COVID-19 infection in patients with asthma and allergic rhinitis, considering the central role of the pulmonary system as a primary target in both conditions. Moderate to severe SARS-CoV-2 infection often manifests as viral pneumonia associated with COVID-19. Additionally, the loss of the sense of smell, a hallmark symptom of COVID-19, further underscores the relevance of these specialties in managing affected patients [6–8]. Chronic allergic diseases are associated with tissue remodeling processes, and persistent inflammation may impair the immune system, potentially increasing susceptibility to infections [9]. The association between allergic diseases and severe clinical outcomes of COVID-19 remains inconclusive

and controversial, with studies reporting either no association [10] or a positive correlation [11]. It is well established that asthma, atopic dermatitis, and allergic rhinitis can exacerbate illnesses caused by common respiratory viruses [12].

Risk factors for severe COVID-19 include older age, ethnicity, gender, comorbidities, and living conditions. While individuals with asthma and allergies are generally more susceptible to severe outcomes from viral infections, asthma has not consistently been identified as a major comorbidity in COVID-19 cases. Conflicting reports exist regarding the impact of asthma on COVID-19 severity. These discrepancies may be partially explained by underlying immunological and molecular mechanisms [13].

Other reports support the opposing view—that allergic respiratory diseases such as asthma and rhinitis do not confer protection against SARS-CoV-2 infection [14].

SARS-CoV-2 infection, like other respiratory viral diseases, may exacerbate asthma symptoms, particularly in cases of severe or uncontrolled asthma. However, there is growing evidence suggesting that a Th2-skewed immune response might offer protection against severe COVID-19, due to cross-regulation between allergic and interferon-mediated immune pathways [15]. Researchers in South Korea have reported that asthma and allergic rhinitis are associated with an increased likelihood of SARS-CoV-2 test positivity and worse clinical outcomes in COVID-19 patients. Notably, patients with non-allergic asthma exhibited a higher risk of both SARS-CoV-2 infection and severe COVID-19 outcomes compared to those with allergic asthma. These findings enhance the understanding of the relationship between COVID-19 pathogenesis and respiratory allergic diseases and highlight the need for clinicians to recognize the increased susceptibility and severity risk associated with respiratory conditions—particularly non-allergic asthma—both during and beyond the pandemic [16].

Clarifying this issue will enable more effective prevention and management of these diseases during the ongoing SARS-CoV-2 pandemic.

The objective of this study was to investigate the incidence of bronchial asthma and allergic rhinitis among 19 hospitalized COVID-19 patients with comorbidities, and to evaluate whether these chronic conditions are associated with an increased risk of infection or may act as protective factors.

Methodology

A target cohort of 19 patients with confirmed

COVID-19 infection were examined during the period from 11 November 2020 to 30 November 2020. All cases were confirmed as SARS-CoV-2 positive via standard real-time PCR testing, performed in a certified microbiology laboratory. Viral RNA was extracted from respiratory specimens using automated systems, followed by amplification targeting specific SARS-CoV-2 genes. Cycle threshold (Ct) values were recorded as an indirect measure of viral load. The methodology adhered to internationally accepted diagnostic protocols, ensuring both accuracy and reproducibility.

The observation was conducted at the Department of Occupational Diseases with Clinical Allergy Activity at the University Multiprofile Hospital for Active Treatment (UMHAT) "St. George" – Plovdiv.

The department was temporarily reorganized, due to the rising number of cases, into a specialized clinical unit for the treatment of patients with confirmed COVID-19 infection. Patient treatment was conducted in accordance with protocols and algorithms officially approved within the framework of the "Programme for Work under COVID-19 Epidemic Conditions: Prevention of the Emergence and Spread of Nosocomial Infections and Ensuring Continuity of the Medical-Diagnostic Process" at the Medical University – Plovdiv. The program was based on recorded and summarized evidence from international databases covering all aspects of SARS-CoV-2 infection.

All data were sourced from the patients' official medical documentation, which included medical history, clinical and paraclinical diagnostics, therapeutic procedures, and discharge summaries. Informed consent was appended to the patient's medical records.

The study is documentary and retrospective in nature.

Results

Comorbidities were identified in 17 out of 19 patients (89.5%) who were hospitalized with confirmed COVID-19 during the study period. Of these 17 patients, 12 had more than 1 concomitant disease. The most frequently reported comorbidities were arterial hypertension (8 patients), bronchial asthma (6 patients), and ischemic heart disease (5 patients). Three patients were diagnosed with allergic rhinitis, 3 with renal diseases, and another 3 had diabetes mellitus.

In total, 9 patients had concomitant allergic respiratory diseases (bronchial asthma and allergic rhinitis), making this the second most common category of comorbid conditions after cardiovascular diseases.

Allergic respiratory diseases accounted for 52.9% of all registered comorbidities, while arterial hypertension and ischemic heart disease combined accounted for 76.5%.

The results are presented in Figures 1 and 2. The results in the two figures correlate with each other and are based on the total number of hospitalized patients during the period.

Discussion

As with any newly emerging and not yet fully understood disease, opinions on whether individuals with allergic conditions are afforded increased protection against COVID-19 have been polarized—some supporting the hypothesis, others opposing it.

Several authors suggest that patients with asthma may be protected from SARS-CoV-2 infection and disease progression, primarily attributing this to the role of the angiotensin-converting enzyme 2 (ACE2) receptor [13,15,17].

ACE2 serves as the entry point for SARS-CoV-2 into host cells and is typically upregulated in Th1-mediated immune responses. However, *ACE2* gene expression is generally reduced in patients with bronchial asthma. Recent studies have demonstrated a negative correlation between levels of Th2 cytokines including IL-4, IL-5, and IL-13; and ACE2 expression in airway epithelial cells; along with other type 2 biomarkers. The Th2 response in patients with allergic asthma can decrease Th1 activation in COVID-19, preventing the onset of a cytokine storm. This may partially explain the potentially protective role of

asthma in the context of COVID-19. [13,17,18]

The role of eosinophils—traditionally viewed as detrimental in asthma—is also under investigation in relation to COVID-19. While eosinophil counts are typically decreased in the peripheral blood of SARS-CoV-2-infected patients, it is hypothesized that elevated eosinophil levels in the airways of asthmatic individuals may offer protection against the exaggerated inflammatory responses seen in severe COVID-19 cases [15].

Observational data from over 70,000 patients in Europe show that individuals with both asthma and COVID-19 tend to be older and are at increased risk due to comorbidities. Nonetheless, inhaled corticosteroids (ICS) and biologic therapies appear to be generally safe and may even confer some protection against severe COVID-19 outcomes [19]. Mucus hypersecretion, a hallmark of asthma, may prevent SARS-CoV-2 from reaching the distal lung and protect from pathology [17]. Finally, as described worldwide for various diseases, a decrease in asthma cases was observed during the COVID-19 lockdown [18].

Numerous publications have explored the correlation between comorbidities and COVID-19 severity. Conditions such as hypertension, respiratory diseases, and cardiovascular disease have been identified as risk factors for more severe outcomes compared to patients without such comorbidities [20]. Additionally, IL-33 released by the damaged epithelium in the context of COVID-19 potentiates either Th1 or T2-high responses, a process that contributes to poor outcomes [18].

However, early data from the first study of critically

Figure 1. Frequency of concomitant diseases among the 19 patients with confirmed COVID-19, hospitalized in the Department of Occupational Diseases with Clinical Allergy Activity at UMHAT "St. George", Plovdiv, during the period 11–30 November 2020. The data show that arterial hypertension was the most common comorbidity, followed by bronchial asthma and ischemic heart disease.

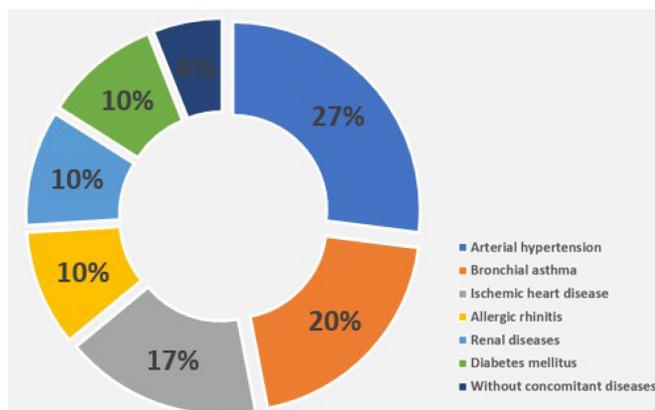
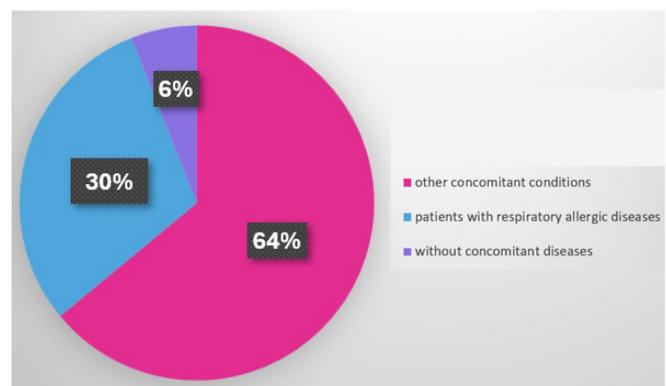


Figure 2. Relative proportion of patients with allergic respiratory diseases (bronchial asthma and allergic rhinitis) among the 19 patients hospitalized with confirmed COVID-19 infection in the Department of Occupational Diseases with Clinical Allergy Activity at UMHAT "St. George", Plovdiv, during the period 11–30 November 2020. The results illustrate the prevalence of these comorbidities within the sample.



ill COVID-19 patients in the United States found that 5 out of 24 patients admitted to intensive care units (ICUs) had asthma [21]. Similarly, a more recent report involving 393 patients in the US established an asthma prevalence of 12% within this population [22].

A recent Italian study reported that patients with Global Initiative for Asthma guidelines (GINA) 4/5 asthma, and those not adequately treated, should be considered at higher risk. A prevalence of males was detected (64 vs 29%, $p = 0.026$) within the worse outcome group. They suffered from more severe asthma (43 vs 14%, $p = 0.040$) and were more frequently current or former smokers (62 vs 25%, $p = 0.038$) [23].

The Open SAFELY study, with over 17 million patients, classified adults as ‘asthma’ or ‘severe asthma’, where severe was defined as a prescription of a course of oral corticosteroids in the year prior. They found, after adjusting for multiple confounders, that those meeting the severe asthma criteria had a slight increased risk of COVID-19 related mortality, whereas those that did not have the same risk as the general population [24].

The ISARIC study, with over 75,000 hospitalized patients, investigated medication use by patients in the fortnight before admission. It was found that higher doses of regular asthma medication (for example, inhaled corticosteroid, long-acting beta-agonist, and long-acting muscarinic antagonist) were associated with increased COVID-19 related mortality [25].

Data in the global literature continue to be contradictory, necessitating a strictly personalized approach to each patient to continue to be the guiding framework.

Conclusions

Even after the critical and challenging period of the pandemic, SARS-CoV-2 remains present and continues to cause serious respiratory, neurological, and cardiovascular diseases.

Although statistically unrepresentative, this observation may serve as a basis for a more in-depth and comprehensive study of the relationship between COVID-19 and concomitant allergic respiratory diseases. The results indicate that patients with asthma and allergic rhinitis do not appear to have protection against infection or the clinical manifestations of COVID-19.

Understanding the relationship between SARS-CoV-2, bronchial asthma, and allergic rhinitis requires a thorough investigation of the underlying pathophysiological mechanisms. Such insight could lead to both more effective preventive measures and

improved therapeutic management of comorbid conditions in these patients.

Acknowledgements

This study was supported by Project No. BG-RRP-2.004-0007-C01, titled "Strategic Research and Innovation Program for the Development of MU-PLOVDIV (SRIPD-MUP)." The project is part of the creation of a network of research-intensive higher education institutions under the National Plan for Recovery and Sustainability, funded by the European Union's Next Generation EU initiative and the National Program for Research "Young Scientists and Postdoctoral Students."

We would like to express our sincere gratitude to our reviewers and to our professional translator Mrs. Dora Yordanova for their invaluable assistance.

Informed consent statement

Informed consent was obtained from all subjects involved in this study.

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Conflict of interest

No conflict of interest is declared.

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