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IMPACT OF THE COVID-19 PANDEMIC ON THE COURSE OF ALLERGIC DISEASES

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ABSTRACT

Background: The COVID-19 pandemic affected millions worldwide, especially those with chronic diseases. Both direct effects of SARS-CoV-2 infection and indirect consequences, such as restrictions and changes in healthcare access, significantly challenged daily life and disease management. Allergic diseases like atopic dermatitis (AD) and asthma were particularly vulnerable, as their course is highly influenced by biological and environmental factors.
Aim: This study analyzes the impact of the COVID-19 pandemic on the course of AD and asthma, based on available scientific literature.
Material and methods: A narrative review of current literature was conducted, focusing on studies examining the relationship between SARS-CoV-2 infection, pandemic restrictions, and the clinical course of atopic dermatitis and asthma. The review emphasized disease exacerbations, healthcare access, psychological factors, and the impact of pharmacological treatments.
Results: Patients with AD experienced symptom exacerbations due to increased psychological stress, lifestyle changes, frequent use of detergents, and restricted access to care. For asthma, severe or poorly controlled disease increased the risk of adverse COVID-19 outcomes, while well-controlled asthma did not worsen prognosis. Inhaled corticosteroids (ICS) and biological therapies did not increase the risk of COVID-19 complications and may have offered protective effects.
Conclusions: The COVID-19 pandemic worsened allergic diseases by increasing stress, reducing healthcare access, and changing lifestyles. Severe asthma raised the risk of poor outcomes, but well-controlled asthma did not. Inhaled corticosteroids and biologics were safe and possibly protective. Ongoing treatment and attention to psychosocial factors remain essential for managing allergic diseases during such public health crises.

KEYWORDS

COVID-19, Allergic Diseases, Atopic Dermatitis, Asthma

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1. Introduction

The COVID-19 pandemic, which began in 2019, became a global health challenge of unprecedented scale. The SARS-CoV-2 virus, responsible for the disease, affected millions of people worldwide, leading to serious health, social, and economic consequences. In addition to its direct impact on the respiratory system, the pandemic triggered several indirect health effects that remain the subject of intensive research.

Among the patient groups potentially exposed to consequences of the pandemic are individuals suffering from chronic diseases, including allergic diseases. Atopic dermatitis (AD) and asthma, among the most common allergic conditions, are characterized by chronic inflammation and immune system hyperreactivity. AD is a chronic, relapsing dermatosis that often coexists with other allergic diseases such as asthma or allergic rhinitis (Arndt et al., 2008; Gans & Gavrilova, 2020). Asthma, in turn, is a respiratory disease characterized by chronic airway inflammation.

In the context of the COVID-19 pandemic, numerous questions have arisen regarding the potential impact of SARS-CoV-2 infection and pandemic-related restrictions (such as lockdowns, mask-wearing, and changes in access to healthcare) on the course and severity of allergic diseases. On the one hand, reduced exposure to certain allergens may have potentially alleviated symptoms; on the other hand, psychological stress, lifestyle changes, and limited access to treatment may have led to disease exacerbations.

The aim of this study is to analyze available scientific publications examining the relationship between the COVID-19 pandemic and the course of allergic diseases, with particular emphasis AD and asthma. This paper seeks to identify key factors that may have influenced the course of these diseases during the pandemic and to summarize current knowledge on the subject.

2. Research materials and methods

A narrative review of current scientific publications was conducted to synthesize available evidence on the interplay between SARS CoV 2 infection, pandemic related restrictions, and the clinical course of AD and asthma. A comprehensive search of the PubMed database and other relevant medical literature was performed, using key terms related to COVID 19, AD, asthma, disease exacerbations, psychosocial factors, healthcare access, and pharmacological treatment. Studies were selected based on their relevance to the impact of the pandemic on disease severity, access to routine care, and the effects of therapeutic strategies, including inhaled corticosteroids (ICS) and biologic therapies. Particular emphasis was placed on identifying how pandemic induced changes in healthcare utilization, hygiene practices, stress levels, and treatment continuity influenced disease outcomes. This approach allowed for an integrative analysis of direct effects of SARS CoV 2 infection as well as indirect consequences of public health measures on the management and clinical course of both AD and asthma.

AI was utilized for a specific purpose. Assistance in refining the academic English language of the manuscript, ensuring clarity, consistency, and adherence to scientific writing standards. AI were used for additional linguistic refinement of the research manuscript, ensuring proper English grammar, style, and clarity in the presentation of results. It is important to emphasize that all AI tools were used strictly as assistive instruments under human supervision. The final interpretation of results, classification of errors, and conclusions were determined by human experts in clinical medicine and formal logic. The AI tools served primarily to enhance efficiency in data processing, pattern recognition, and linguistic refinement, rather than replacing human judgment in the analytical process.

3. Research results

3.1. Atopic Dermatitis

Atopic dermatitis (AD) is a chronic, relapsing dermatosis characterized by typical skin lesions and intense pruritus. Lesions may appear as vesicles or pustules on an erythematous base, and in severe cases, skin thickening (lichenification) may occur. The distribution of skin lesions depends primarily on the patient's age. The most commonly affected areas include the flexural surfaces of the knees and elbows, as well as the distal parts of the limbs and the face.

AD predominantly occurs in childhood but may persist throughout life. IgE-dependent hypersensitivity reactions constitute an important element of its pathophysiology; therefore, approximately 30% of patients also suffer from asthma or allergic rhinnitis (Arndt et al., 2008). Both genetic and environmental factors play a role in disease onset and progression.

When assessing the impact of the COVID-19 pandemic on AD, it is necessary to consider not only the effect of SARS-CoV-2 infection itself but also pandemic-related difficulties. The introduction of numerous restrictions resulted in limited access to treatment, delays in receiving medications, and delays in diagnosis for many patients.

During the pandemic, patients were exposed to significant psychological stress, which is known to exacerbate AD. Psychological stress impairs skin barrier function. Studies have demonstrated that the pandemic may have increased skin inflammation through elevated levels of neuroendocrine factors, associated with increased stress, reduced physical activity, and decreased sunlight exposure (Hernández N et al., 2021).

Another factor contributing to the disruption of the hydrolipid barrier was frequent handwashing with strong detergents and disinfectants. Fear of infection led many patients to overuse alcohol-based products, significantly worsening the condition of the skin, particularly on the hands.

Pandemic-related restrictions also altered allergen exposure. While mask-wearing and reduced mobility may have decreased exposure to outdoor allergens, restrictions may have increased exposure to indoor allergens such as house dust mites and animal dander.

Additionally, unhealthy dietary habits and reduced physical activity during the pandemic contributed to increased obesity rates. Obesity promotes systemic inflammation through macrophage activation and increased production of proinflammatory cytokines such as IL-6 and IL-1β, potentially aggravating AD symptoms.

A significant impact on disease course has been attributed to difficulties in maintaining treatment continuity due to restricted access to healthcare providers. Patients enrolled in drug programs experienced the greatest challenges, as the administration of these therapies was substantially disrupted. These difficulties were related both to concerns about the risk of infection in medical facilities and to mobility restrictions implemented in many countries.

3.2. Asthma

Asthma is a chronic inflammatory disease of the airways. The World Health Organization recognizes asthma as one of the major noncommunicable diseases worldwide (Abbafati et al., 2020). In 2019, approximately 262 million people globally were affected, and asthma was responsible for 455,000 deaths (Abbafati et al., 2020). In Europe, asthma prevalence among adults ranges from 5.1% to 8.2% (Wecker et al., 2023).

Symptoms include wheezing, dyspnea, cough, and airflow limitation due to bronchial smooth muscle contraction, mucosal edema, and thick mucus secretion. Over time, airway remodeling and persistent obstruction may occur.

In the pathogenesis of asthma, a key role is played by the Th2 subpopulation of helper T lymphocytes, which produce cytokines such as IL-4, IL-5, and IL-13 that stimulate IgE production by B cells (Gans & Gavrilova, 2020). These processes lead to the proliferation and activation of eosinophils and mast cells, which release mediators including histamine, cysteinyl leukotrienes, and prostaglandin D_3, contributing to bronchial obstruction (Gans & Gavrilova, 2020).

Innate lymphoid cells type 2 (ILC2), located within the bronchial mucosal epithelium, also play an important pathophysiological role. When activated by environmental irritants, these cells secrete cytokines such as thymic stromal lymphopoietin (TSLP), which promotes eosinophil chemotaxis and activation. Consequently, the majority of asthma cases are characterized by eosinophilic inflammation, a fact that significantly guides therapeutic strategies (Gans & Gavrilova, 2020).

In asthma, various triggers play a significant role in inducing exacerbations and acute attacks. These include allergens, respiratory infections (predominantly viral) irritants, physical exertion, and strong emotional stress (Gans & Gavrilova, 2020). Other, less prominent risk factors include weather changes, certain foods, food additives, and medications (Gans & Gavrilova, 2020).

The assessment of biomarkers is an important component of asthma diagnostics (Gans & Gavrilova, 2020). Traditional biomarkers include eosinophils, neutrophils, IgE, periostin, leukotrienes, and fractional exhaled nitric oxide (FeNO). Additionally, other biomarkers such as cytokines, dipeptidyl peptidase-4 (DPP-4), and volatile organic compounds have also been investigated in asthma (Gans & Gavrilova, 2020).

At the beginning of the SARS-CoV-2 pandemic, it was suggested that asthma might increase the risk of infection and contribute to a more severe course of COVID-19. However, as the pandemic progressed and further observational data emerged, newer viral variants did not appear to significantly increase the risk of asthma exacerbations, particularly in patients with well-controlled disease (Adir et al., 2021). Nevertheless, individuals with severe asthma remained at higher risk of adverse COVID-19 outcomes, including increased mortality (Adir et al., 2021).

Viral respiratory infections are well-recognized triggers of asthma exacerbations, particularly in non-allergic asthma. Moreover, patients with asthma have been shown to exhibit defects in innate immune responses that may increase susceptibility to viral respiratory infections. These factors amplify the negative impact of viral infections on asthma control. Viral infections can impair interferon production and contribute to eosinophil dysfunction.

Despite these mechanisms, available evidence has not demonstrated as strong a detrimental effect of SARS-CoV-2 on asthma patients as observed with other respiratory viruses (Adir et al., 2021). This difference may be explained by distinct viral entry pathways. Common respiratory viruses enter cells via intercellular adhesion molecule 1 (ICAM-1), whereas SARS-CoV-2 utilizes angiotensin-converting enzyme 2 (ACE2) and transmembrane serine protease 2 (TMPRSS2) in conjunction with the viral spike (S) protein.

The immune response to SARS-CoV-2 in patients with asthma appears to vary depending on disease heterogeneity (Adir et al., 2021). In allergic asthma, a predominant Th2 response may downregulate Th1-mediated inflammation associated with COVID-19, potentially reducing the risk of cytokine storm (Adir et al., 2021). Interleukin-33 (IL-33), released from damaged epithelium, promotes activation of both Th1 and Th2 pathways (Adir et al., 2021). Furthermore, IL-13 has been shown to decrease ACE2 expression in epithelial cells, which may reduce susceptibility to SARS-CoV-2 infection (Adir et al., 2021).

3.3. Asthma Treatment and COVID-19

Inhaled corticosteroids (ICS) are widely used in asthma as anti-inflammatory therapy, often in combination with long-acting bronchodilators. They play a central role in controlling airway inflammation and reducing the frequency of exacerbations (Gans & Gavrilova, 2020).

Due to their immunomodulatory properties, concerns were initially raised that ICS might increase susceptibility to viral infections, including SARS-CoV-2 (Gans & Gavrilova, 2020). Some studies suggested that corticosteroids could attenuate antiviral immune responses and potentially delay viral clearance (Gans & Gavrilova, 2020). However, clinically significant immunosuppression is primarily associated with systemic corticosteroids administered at high doses. At low doses, corticosteroids predominantly exert anti-inflammatory rather than systemic immunosuppressive effects (Gans & Gavrilova, 2020). Consequently, inhaled corticosteroid therapy, characterized by minimal systemic activity, does not appear to confer the same level of risk (Gans & Gavrilova, 2020).

ICS reduce the production of proinflammatory cytokines (Gans & Gavrilova, 2020). Analyses have demonstrated that asthma patients treated with ICS had a lower risk of severe complications related to viral infections (Gans & Gavrilova, 2020). Moreover, reduced expression of ACE2 and TMPRSS2 receptors (key entry points for SARS-CoV-2) has been observed in patients receiving ICS therapy (Gans & Gavrilova, 2020).

Systemic corticosteroids (SCS), such as prednisone and dexamethasone, are used in the management of severe asthma exacerbations (Gans & Gavrilova, 2020). When administered in higher-than-low doses, they exert strong immunosuppressive effects (Gans & Gavrilova, 2020). Regular use of systemic corticosteroids in asthma patients has been associated with an increased risk of severe COVID-19 and higher mortality. The OpenSAFELY study demonstrated an elevated risk of COVID-19-related death among patients who had received high doses of systemic corticosteroids within the previous year (Gans & Gavrilova, 2020). Conversely, well-controlled asthma has been associated with significantly reduced mortality (Gans & Gavrilova, 2020).

Biological therapies targeting IL-5 or its receptor effectively suppress eosinophilic inflammation, resulting in substantial clinical improvement and improved disease control. These agents include mepolizumab, reslizumab, benralizumab, and tezepelumab (Gans & Gavrilova, 2020). Furthermore, position statements from the Polish Society of Allergology, the Polish Respiratory Society, and the European Academy of Allergy and Clinical Immunology (EAACI) indicate that suppression of airway inflammation does not increase the risk of SARS-CoV-2 infection and may, in fact, reduce it (Gans & Gavrilova, 2020).

4. Conclusions

In summary, the COVID-19 pandemic exerted a significant and multifaceted impact on the course of allergic diseases. In atopic dermatitis (AD), pandemic-related restrictions and consequent changes in daily life, including increased psychosocial stress, limited access to healthcare services, and intensified hygiene practices involving the frequent use of strong detergents contributed to symptom exacerbation in a substantial proportion of patients. Difficulties in maintaining treatment continuity resulted from both concerns about infection in medical settings and mobility restrictions. Moreover, psychological stress may have impaired skin barrier function through neuroendocrine mechanisms, further aggravating cutaneous inflammation. Lifestyle changes, including altered dietary habits and reduced physical activity leading to weight gain, may also have contributed to heightened systemic inflammation and worsening of AD.

In asthma, SARS-CoV-2 infection was associated with an increased risk of severe COVID-19 in specific subgroups, particularly among patients with severe disease course. Viral respiratory infections, including SARS-CoV-2, represent established triggers of asthma exacerbations, partly due to defects in innate antiviral immune responses observed in some patients. However, treatment with inhaled corticosteroids (ICS) was not associated with an increased risk of infectious complications and may exert protective effects. ICS reduce proinflammatory cytokine levels and may decrease the expression of ACE2 and TMPRSS2 receptors involved in viral entry. Additionally, biological therapies targeting interleukin-5 (IL-5), such as mepolizumab, reslizumab, benralizumab, and tezepelumab, may modulate susceptibility to SARS-CoV-2 infection through suppression of eosinophilic inflammation. Position statements from national and international scientific societies support the continuation of anti-inflammatory therapy during the pandemic. Notably, the immune response to SARS-CoV-2 in asthma appears to vary according to disease phenotype and heterogeneity.

Overall, the COVID-19 pandemic highlighted specific clinical and therapeutic challenges in patients with allergic diseases and underscored the need for continued research into the interactions between viral infections and chronic inflammatory disorders. Future studies should focus on the long-term consequences of the pandemic on the natural course of allergic diseases and on the development of evidence-based management

strategies for use during public health crises. Particular attention should also be given to the psychological well-being of patients and to patient education regarding appropriate disease management under changing epidemiological conditions.

Disclosures

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