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Original article

Occurrence of autoimmune diseases following Covid-19: a cross-sectional study in a municipality in northern Minas Gerais

Ocorrência de doenças autoimunes pós-Covid-19: estudo transversal em município do Norte de Minas Gerais

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Abstract

Objective: to identify the occurrence of autoimmune diseases that emerged following Covid-19 in the municipality of Montes Claros, Minas Gerais, Brazil. **Materials and Methods**: this is a descriptive, cross-sectional study. The population consisted of patients at clinical laboratories, individuals approached in public places within the municipality, and social media users. To collect responses, printed questionnaires, the digital platform *Google Forms*, and *Software* were used for data collection, analysis, and interpretation. The project was approved by the Research Ethics Committee under Opinion No. 7,397,994. **Results**: of the 43 participants infected with Covid-19, the majority were women, had the disease for a short duration, and did not develop chronic sequelae (n=39; 90.7%). Those who had a pre-existing disease experienced a worsening of symptoms (n=4; 9.3%). **Conclusion**: the intensification of inflammatory responses and symptoms in those infected with the virus indicates the need for further studies to investigate the symptomatology and interaction of the SARS-CoV-2 virus with the human organism and how it interferes with other pre-existing health conditions.

Keywords: Autoimmune diseases. Covid-19. Post-Acute Covid-19 syndrome. Long Covid.

Resumo

Objetivo: identificar a ocorrência de doenças autoimunes que surgiram pós-Covid-19 no município de Montes Claros, Minas Gerais, Brasil. **Materiais e Métodos:** trata-se de um estudo descritivo e transversal. A população foi composta por pacientes em laboratórios de análises clínicas, pessoas abordadas em locais públicos no município e usuários de redes sociais. Para obter as respostas, foram utilizados questionários impressos, a plataforma digital *Google Forms* e *Software* para a coleta, análise e interpretação dos dados. O projeto foi aprovado pelo Comité de Ética em Pesquisa com o Parecer 7.397.994. **Resultados:** dos 43 participantes infectados por Covid-19, a maioria eram mulheres, apresentaram a doença por um curto tempo e a infecção não gerou sequelas crônicas (n=39; 90,7%). Já aqueles que tinham uma doença prévia apresentaram piora nos sintomas da doença (n=4; 9,3%). **Conclusão:** a intensificação de respostas inflamatórias e sintomas naqueles infectados pelo vírus indicam a necessidade de estudos posteriores para investigar a sintomatologia e a interação do vírus Sars-Cov-2 com o organismo humano e como ele interfere em outras condições prévias de saúde.

Palavras-chave: Doenças autoimunes. Covid-19. Síndrome de Pós-COVID-19 Aguda. Covid longa.

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Introduction

The 2019 coronavirus (Covid-19) causes a viral disease that has had a global impact recently, and individuals who have been exposed to it for an extended period have experienced a wide rangeof symptoms. The main one is severe acute respiratory syndrome (SARS), which induces an inflammatory response; consequently, individuals are exposed to an excessive and continuous release of cytokines, presenting a greater predisposition to developing autoimmune diseases, such as hemolytic anemia, systemic lupus erythematosus, rheumatic diseases, Guillain-Barré syndrome, among others[1].

Adaptive immunity is a highly specific and memory-based defense system resulting from the production of antibodies by B lymphocytes when they differentiate into plasma cells. This immune response of the body during Covid-19 and the long-term viral infection has led, in some individuals, to the formation of autoantibodies—antibodies that end up recognizing the individual's own blood cells and proteins as foreign bodies and thus fight against the body itself during this excessive cytokine production[2].

An exaggerated inflammatory response in an individual leads to dysfunction that initially manifests as respiratory symptoms and changes primarily in lung tissue and subsequently affects other organs due to the patient's overall systemic failure. In severe cases, due to delayed treatment and the immune system's inability to effectively combat the virus, this can lead to death[3].

Therefore, it is important to study the onset of autoimmune diseases and the worsening of pre-existing conditions following Covid-19[4]. It can be observed that the pathophysiology of the disease and its severity depend on the patient's immune response and their pre-infection status, such as endocrinological and metabolic factors and pre-existing conditions that make them more susceptible to inflammation, sepsis, and organ dysfunction[5].

The secondary conditions that led to hospitalization and complications in the symptomatology of SARS-CoV-2 infection were: hypertension (15.8%), cardiovascular and cerebrovascular diseases (11.7%), and diabetes (9.4%). Among the less prevalent comorbidities were coinfection with Human Immunodeficiency Virus and hepatitis B (1.5%), malignant tumors (1.5%), respiratory diseases (1.4%), kidney diseases (0.8%), and immunodeficiencies (0.01)[6].

When analyzing the immunological implications of SARS-CoV-2 infection, the virus infects the individual via the respiratory tract and by binding the viral protein to the angiotensin-converting enzyme 2 (ACE2), which is expressed on the surface of various organs, such as the heart, lungs, liver, kidneys, and other tissues[3]. This systemic inflammatory effect associated with the dysregulated immune response can lead to autoimmune hemolytic anemia due to the lymphopenia characteristic of the condition. In this case, the viral SPIKE protein mimics the ANK protein present on the surfaces

of erythrocytes during the acute phase of Covid-19 infection[7].

Thrombocytopenia is also a common finding in severe Covid-19, resulting from direct viral invasion of the bone marrow, thrombocytes destruction, or even lung injury caused by oxygen toxicity in patients requiring mechanical ventilation[8].

When the virus reaches the intracellular medium, it replicates and associates with pro-inflammatory cells, increasing the plasma amount of these cells in the body in the innate immune response and causing apoptosis of some cells. After that, the adaptive immune system is activated by the activation of plasma cells and cells that neutralize the virus through IgM and IgG[9] antibodies. In the adaptive immune response, dendritic cells activate T and B lymphocytes, in which TCD4+ and TCD8+ cells act by promoting the production of specific antibodies against the virus and destroying cells infected by SARS-CoV-2, respectively[10].

The World Health Organization (WHO) defines Post-Covid Syndrome, or Long Covid, as the persistence of symptoms for more than 3 months that cannot be explained by a pre-existing condition or disability before infection with the virus[11]. Post-Covid Syndrome (PCS) is present in 80% of hospitalized patients infected with the virus who exhibit systemic symptoms[12]. Therefore, all symptoms following Covid-19 infection should be treated to prevent further complications.

PCS, also known as Long Covid (LC), is more common in patients with inflammatory and autoimmune diseases, such as fibromyalgia, due to the use of glucocorticoids and other immunosuppressive medications[13]. The destruction of cells by autoantibodies can occur through various pathways in the body and immune-mediated responses; thus, it can trigger various autoimmune diseases, such as lupus, hemolytic anemia, diabetes mellitus, Guillain-Barré syndrome, and rheumatic diseases, among others[14].

The objective of this study was to conduct a survey on the emergence of autoimmune diseases in patients after Covid-19 infection in Montes Claros – MG.

Materials and Methods

This is a descriptive, quantitative, cross-sectional study conducted in the municipality of Montes Claros, Minas Gerais, Brazil. Data collection took place between March and May 2025 using a printed and digital questionnaire (*Google Forms*) containing 12 multiple-choice questions covering the following variables: location where the questionnaire was accessed, city of residence, whether the respondent had Covid-19, sex, age group, duration of infection, whether hospitalization occurred, duration of hospitalization, and whether ventilatory support was required, presence of autoimmune disease before or after infection, as well as an analysis of the autoimmune disease status after infection.

The first participants recruited for the study were patients in the waiting room of a clinical laboratory located in the municipality. They were invited to participate in the study and could choose between accessing the link via a *QR code* or completing the printed questionnaire. Those who chose to answer the printed questionnaire first received the Free and Informed Consent Form (FICF) and, after signing it, received the physical questionnaire. Participants who decided the *QR code* had access to the FICF attached to the form and, after accepting it, accessed the questions. Subsequently and concurrently, the questionnaire was distributed to other patients at a private hospital in the city—a leading facility for emergency care, outpatient services, and highly complex medical care—as well as to passersby on public streets and through the authors' social media networks. The completed printed forms, 15 in total, were added to the digital platform for data analysis.

After applying the exclusion criteria (non-residents of the city of Montes Claros, those who did not sign the consent form in the online or in-person questionnaire, and those who had not been infected with Covid-19), and after identifying those who reported infection, the analysis was conducted using 43 responses.

The data were processed in a spreadsheet and analyzed descriptively, with absolute and percentage values reported, to examine the health effects and sequelae in the population following the pandemic period.

The research project was approved by the Centro Universitário do Norte de Minas (Research Ethics Committee of the Northern Minas University Center) under Approval No. 7,397,994 on February 20, 2025.

Results

A total of 43 individuals participated in the study. Most were women (n = 34; 79.1%) and were aged 18–30 years (n = 28; 65.1%) (Table 1).

Table 1. Sex and age group of participants infected with COVID-19. Montes Claros, MG, Brazil. (n=43).

Variables	n	%
Gender		
Women	34	79.1
Male	8	18.6
I prefer not to inform	1	2.3
Age group		
18 to 30	28	65.1
31 to 45	8	18.6
46 to 50	7	16.3

Most participants had a SARS-CoV-2 infection lasting less than 30 days (n=40; 93%); none presented with severe symptoms. Regarding the presence of autoimmune diseases before infection, most reported having no pre-existing conditions (n=39; 90.7%). However, 9.3% reported having an autoimmune disease before Covid-19 exposure, including rheumatoid arthritis, multiple sclerosis, psoriasis, and vitiligo. Those who had an autoimmune disease before Covid-19 reported worsening of disease symptoms following Covid-19 (n=4; 11.9%). Regarding the development of autoimmune diseases following SARS-CoV-2 infection, the majority did not develop any (n=32; 74.4%) (Table 2).

Table 2. Characteristics related to COVID-19 infection. Montes Claros, Minas Gerais, Brazil. (n=43).

Variables	n	%
How long your infection lasted		
Less than 1 month	40	93
1 to 3 months	3	7
Did you need to be hospitalized?		
Yes	1	2.3
No	42	97.7
How long were you hospitalized?		
Less than 1 month	1	2.3
Not applicable	42	97.7
Did you require ventilatory support?		
Yes	1	2.3
No	2	4.7
Not applicable	40	93.0
Did you have any autoimmune disease previously?		
Yes	4	9.3
No	39	90.7
Which autoimmune disease did you have previously?		
Rheumatoid arthritis	1	2.3
Multiple sclerosis	1	2.3
Psoriasis	1	2.3
Vitiligo	1	2.3
Not applicable	39	90.7
Did you notice a worsening of your autoimmune disease symptoms?		
Yes	4	9.3
Not applicable	39	90.7
Did you develop any autoimmune disease after Covid-19?		
Yes	4	9.3
No	32	74.4
I do not know how to answer	7	16.3

Discussion

It should be noted that the study aimed to raise public awareness and interest in the long-term impacts of the Covid-19 pandemic on the health of the population of Montes Claros, Minas Gerais,

even after the pandemic period.

Most participants had SARS-CoV-2 infection lasting less than one month, and only one participant required hospitalization. These findings should be interpreted considering the characteristics of the sample and the descriptive nature of the study. This may be associated with lower exposure to inflammatory cytokines, consequently reducing the likelihood of developing autoantibodies[1]. In 2021, a study conducted in the United States with the same objective of understanding the changes caused by the virus and the production of associated autoantibodies demonstrated a higher likelihood that infected individuals would present autoantibodies as a prolonged immune response due to high exposure to cytokines, highlighting the correlation between duration of infection and the probability of triggering autoimmune diseases[15].

Participants who had Covid-19 were predominantly female. In contrast, another study points to a higher risk of hospitalization and death in males compared to females, associated with biological and behavioral factors[15].

A study conducted in 2023 concluded that patients with Covid-19 may develop autoimmune diseases following infection. This is due to the presence of autoantibodies that existed before the disease and that are factors that can lead to severe Covid-19. The study points to the pandemic as a trigger for the onset of autoimmune diseases, noting that they occur due to immune system dysfunction caused by various factors, leading to increased susceptibility to infections. This finding is consistent with the results of the present analysis, in which it was observed that some participants, who had no prior autoimmune disease, developed such conditions after infection with the SARS-CoV-2 virus[17].

Participants who had autoimmune diseases before Covid-19 infection, such as rheumatoid arthritis, multiple sclerosis, psoriasis, and vitiligo, noted a worsening of their disease symptoms following infection with the virus. Thus, a correlation was observed between a higher susceptibility of individuals with rheumatoid arthritis and comorbidities to contracting Covid-19 and the fact that they already had an autoimmune condition. Furthermore, they also face the risk of prolonged complications from the viral infection, as other secondary diseases tend to exacerbate symptoms[18].

With this in mind, the inflammation induced by the Covid-19 virus may accelerate the mechanisms involved in the development of multiple sclerosis through the excessive activation of immune cells. Consequently, this process causes neurodegenerative inflammation, which may be exacerbated in people with multiple sclerosis, leading to aggravating factors that facilitate direct invasion by the coronavirus[19].

This study has some limitations in the analysis of the results, as it was conducted with residents of the city of Montes Claros, Minas Gerais, which introduces a sociodemographic limitation. It is also

worth noting the difficulty of reaching individuals infected with Covid-19 in this region via the questionnaire, as the majority of the results were from individuals without SARS-CoV-2 infection.

Conclusion

Most participants did not develop autoimmune diseases following Covid-19 infection. However, a minority exhibited an intensified immune response, which may lead to the onset of such diseases and the worsening of preexisting autoimmune conditions. Further studies and a larger sample size are needed to ensure more accurate research results and to better understand the effects of Covid-19 infection.

Author contributions

The authors' contributions are presented according to the Contributor Roles Taxonomy (CRediT), as described below:

Conceptualization and study design, data analysis and interpretation, manuscript writing, resource administration, critical revision of the manuscript for important intellectual content, and final approval: Lafetá MO, Corrêa DC, Vieira RSL, Maia JTLS. All authors approved the final version of the manuscript and agreed to be accountable for all aspects of the work, including ensuring its accuracy and integrity.

Conflict of interests

None.

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