AMERICAN ACADEMIC PUBLISHER

INTERNATIONAL JOURNAL OF MEDICAL SCIENCES

ISSN NUMBER: 2692 - 5206 Volume 5,September ,2025

CHARACTERISTICS OF HEMOGRAM AND BIOCHEMICAL BLOOD MARKERS IN PATIENTS WITH POST-COVID AND DERMATOLOGICAL SYNDROMES

Literature review

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Abstract: This article is dedicated to the study of hemogram characteristics and biochemical blood markers in patients with post-COVID and dermatological syndromes. Changes in blood composition are analyzed, such as leukocyte and platelet levels, as well as markers reflecting inflammatory processes, including C-reactive protein, fibrinogen, and cytokines. Special attention is given to identifying correlations between changes in these markers and manifestations of skin diseases observed in patients who have recovered from COVID-19. The results of this study may serve as a basis for the development of new diagnostic and monitoring methods for patients with dermatological and post-COVID manifestations, as well as optimizing therapy taking into account changes in biochemical blood markers.

Keywords: post-COVID dermatitis, military personnel, systemic inflammatory response syndrome (SIRS), alanine aminotransferase (ALT) and aspartate aminotransferase (AST) COVID-19, SARS-CoV-2, Post-COVID Syndrome (PCS)**.**

Changes in Hemogram Markers in Patients Who Have Recovered from COVID-19

Changes in hemogram markers in patients who have recovered from COVID-19 reflect the features of post-viral recovery and the development of complications, including dermatological ones [5,7]. Peripheral blood analysis provides insight into the intensity of the inflammatory process, the degree of immune imbalance, and the risk of autoimmune reactions.

Leukocytes: leukopenia or normocytosis is observed in most patients, with some with skin manifestations showing leukocytosis due to neutrophils [2,7]. Lymphocytes: lymphopenia is typical, especially a decrease in CD4+; in dermatitis, it may be associated with eosinophilia.

Neutrophils: neutrophilia is more common in patients with vasculitis-like skin lesions.

Eosinophils: eosinophilia is observed in some patients, reflecting an atopic nature of the lesions.

Platelets: thrombocytosis is possible (risk of microthrombosis and skin vascular lesions) or thrombocytopenia [4,12].

Erythrocytes and Hemoglobin: moderate anemia is frequently found, exacerbating trophic skin disorders.

ESR: generally elevated, reflecting chronic inflammation and autoimmune reactions.

Post-COVID Syndrome (PCS) Development

AMERICAN ACADEMIC PUBLISHER
INTERNATIONAL JOURNAL OF MEDICAL SCIENCES
ISSN NUMBER: 2692 - 5206 Volume 5,September ,2025

In patients who have recovered from COVID-19, especially among women who experienced severe fatigue for 10 weeks post-recovery and have a history of neuropsychiatric conditions, there is a tendency for post-COVID syndrome (PCS) to develop. Due to an increased immune response and hormonal changes, women are considered a potential risk group for PCS [5,10]. However, some studies have shown no gender differences in the development of PCS after acute SARS-CoV-2 infection. Risk factors for PCS include comorbidities, age, and the severity of the initial illness. Observational studies have identified ten symptoms in the acute phase of COVID-19 that increase the risk of PCS development 1–6 months after infection [7,9]. Moreover, patients with severe COVID-19 are at high risk for PCS. It's important to note that significant tissue damage caused by acute illness can lead to long-term neuropsychiatric disorders and physical weakness, manifesting as post-resuscitation syndrome. Data indicates a high risk of developing post-resuscitation syndrome in COVID-19 patients who were in intensive care [2,9].

Biomarkers and Long-term Effects of COVID-19

Moreover, biomarkers indicating the severity of COVID-19 correlate with PCS development. Elevated levels of D-dimer and urea in blood were observed as risk factors for PCS and lung dysfunction three months post-discharge. High levels of CRP, D-dimer, and IL-6 are also linked to lung dysfunction and PCS development. Other studies have noted correlations between systemic inflammatory markers, lymphopenia, and radiological damage to various organs in patients who recovered from COVID-19 within 3 months. Importantly, elevated troponin levels were associated with fatigue development, while lymphopenia increased the risk of tachycardia in patients with PCS [8,13].

Post-COVID Syndrome (PCS)

Post-COVID syndrome (PCS) includes various conditions and symptoms whose frequency varies depending on the severity, duration, and features of the acute infection. The most common symptom of PCS is fatigue, observed in 17–72% of patients who had a severe form of COVID-19. Respiratory symptoms, such as chest pain (22%), shortness of breath (10–40%), and exercise intolerance (10–40%), are commonly observed in patients with PCS. However, in patients who were in intensive care, shortness of breath can worsen to 65%. Endothelial dysfunction and heart damage can lead to arrhythmia, postural hypotension, and persistent hypertension.

Gastrointestinal symptoms, such as nausea, vomiting, diarrhea, changes in intestinal motility, and loss of appetite, can persist for more than two months in 30% of patients after discharge from the hospital. Neuropsychiatric disorders, such as disturbances in smell and taste, can persist in 9–11% of patients for 6–8 months after mild COVID-19. Furthermore, anxiety (26%) and depression (40%) are observed in patients for six months after the onset of COVID-19 or after recovery [5,9].

These data suggest that PCS can manifest as systemic symptoms ranging from mild to severe. However, according to research by Moreno-Pérez and colleagues, many symptoms associated with PCS resolve over time without consequences. The final outcomes of PCS remain unknown [7,12].

AMERICAN ACADEMIC PUBLISHER
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Systemic Inflammatory Response Syndrome (SIRS) in PCS Systemic Inflammatory Response Syndrome (SIRS) may be a potential cause of organ dysfunction and tissue damage in PCS. Excessive immune response and intense inflammatory processes in COVID-19 lead to the development of a balanced anti-inflammatory response to maintain immunological homeostasis, resulting in an immunodepressed state. Chronic immunosuppression may enhance the catabolic syndrome and promote the development of PCS. Studies show that after septic illnesses, patients may be susceptible to latent viral infections and secondary infections, increasing the risk of COVID-19 recurrence [3,11].

Russell et al. observed elevated levels of transforming growth factor β (TGF-β), an immunosuppressive, profibrotic, and anti-inflammatory cytokine, to suppress the inflammatory process during and after SARS-CoV-2 infection. TGF-β is linked to the development of interstitial lung fibrosis in COVID-19 patients. Thus, targeting TGF-β in COVID-19 patients may have therapeutic significance in reducing fibrotic changes in post-COVID syndrome (PCS).

Autoimmune Reactions in PCS

Several studies have shown that subclinical and/or symptomatic SARS-CoV-2 infections may persist up to 3 months after the acute phase. Some studies have found that SARS-CoV-2 remains in the lungs for up to 4 months and in the gastrointestinal tract for up to 2 months [5,13]. Persistent SARS-CoV-2 infection stimulates the development of PCS and prolonged immune system activation. The continued presence of SARS-CoV-2 activates autoreactive T-cells through antigen presentation by antigen-presenting cells, causing 'random' damage observed in MIS syndrome. Interestingly, MIS can develop 2–6 weeks after infection in both children and adults and is related to inflammatory cytokine levels, but not the severity of the initial SARS-CoV-2 infection. Late onset of MIS after SARS-CoV-2 infection may be associated with adaptive immune response dysfunction [2,7].

In PCS, autoimmune dysfunction of the thyroid gland develops as a result of T-cell immune activation. Moreover, 52% of patients with PCS exhibit B-cell activation and the production of antiphospholipid autoantibodies. Similarly, up to 50% of patients with COVID-19 and PCS have autoantibodies, which are linked to the development of autoimmune diseases, such as systemic lupus erythematosus (SLE) [4,5]. Prolonged lymphopenia in patients with PCS is associated with chronic immune activation and hyperinflammation. It should be noted that lymphopenia is linked to the duration of the SARS-CoV-2 infection, abnormal immune response, and symptoms of COVID-19 in PCS [1,6].

Conclusion

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INTERNATIONAL JOURNAL OF MEDICAL SCIENCES
ISSN NUMBER: 2692 - 5206 Volume 5,September ,2025

Post-COVID syndrome and dermatological manifestations that emerge after a COVID-19 infection have a significant impact on patient health. Our study shows that changes in hemogram and biochemical blood markers play a key role in diagnosing and monitoring these conditions. Increased levels of inflammatory markers, such as C-reactive protein and fibrinogen, as well as changes in the cellular composition of blood, may be associated with the development of skin diseases in patients who have recovered from COVID-19. The study results highlight the importance of a comprehensive approach to treating post-COVID syndrome and dermatological manifestations, as well as the need for further research to optimize diagnostic and therapeutic strategies. Timely correction of biochemical disturbances and monitoring blood markers can significantly improve the prognosis for patients and enhance the effectiveness of therapy.

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