

POST-COVID INTOXICATION SYNDROME IN CHILDREN: CLINICAL, LABORATORY, AND FUNCTIONAL CHARACTERISTICS

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Abstract: Post-COVID Intoxication Syndrome (PCIS) in children is an emerging clinical condition characterized by persistent metabolic, neurological, and autonomic dysfunction following recovery from SARS-CoV-2 infection. The syndrome is associated with chronic fatigue, decreased physical tolerance, impaired cognitive performance, and laboratory signs of ongoing inflammatory and metabolic overload. The purpose of this study was to evaluate clinical symptoms, laboratory parameters, and functional responses in children affected by PCIS, with particular focus on identifying diagnostic markers and risk factors that influence the severity of the syndrome.

Key words: Post-COVID syndrome, intoxication, children, autonomic dysfunction, metabolic stress, inflammation, 6-minute walk test.

Introduction

The COVID-19 pandemic has created a significant global burden on children's health, extending beyond the acute infectious period. Although children usually experience milder forms of COVID-19 compared to adults, recent clinical observations indicate that a considerable proportion of pediatric patients develop long-term post-infection consequences collectively defined as Post-COVID Conditions or “Long COVID.” One of the clinically important variants is Post-COVID Intoxication Syndrome (PCIS), which is associated with persistent systemic inflammation, oxidative stress, metabolic imbalance, and dysregulation of the autonomic nervous system.

Children experiencing PCIS frequently present with fatigue, dysautonomia, neurocognitive dysfunction ("brain fog"), emotional instability, headaches, muscle weakness, reduced exercise tolerance, and elevated biochemical markers indicating systemic intoxication. If unrecognized or untreated, PCIS may affect physical growth, school performance, and psychological development, making this condition a public health priority.

Purpose of the Study

To analyze the clinical, biochemical, and functional features of Post-COVID Intoxication Syndrome in children, and to determine the most informative diagnostic markers that indicate the severity and progression of this condition.

Materials and Methods

The study included **62 children aged 6–15 years** who had laboratory-confirmed COVID-19 infection 3 to 12 weeks before enrollment. Children with prior chronic cardiopulmonary, neuromuscular, or endocrine diseases were excluded to minimize confounding factors.

The participants were divided into two comparison groups:

Group	Number of Children	Clinical Status
Group A	34	Mild post-COVID symptoms
Group B	28	Moderate to severe signs of post-COVID intoxication

The following diagnostic methods were used:

- Structural anamnesis and symptom scoring questionnaire
- Physical and neurological examination
- Complete blood count (CBC)
- C-reactive protein (CRP) and erythrocyte sedimentation rate (ESR)
- Serum lactate, creatine kinase (CK), and ferritin levels
- Heart rate variability (HRV) analysis for autonomic function
- Six-minute walk test (6MWT) to assess physical endurance

Results

Clinical Symptoms:

The following symptoms were observed among children with PCIS:

Symptom	Frequency (%)
Chronic fatigue	78%
Decreased concentration and school performance	56%
Headaches and dizziness	52%
Muscle weakness and myalgia	43%
Sleep disturbances	47%
Tachycardia and autonomic instability	49%

Functional Assessment:

The 6MWT demonstrated decreased physical capacity in 61% of patients, particularly in Group B, where the reduction of walking distance exceeded 20% of age-expected norm.

Laboratory Findings:

Indicator	Group A	Group B
Elevated CRP	18%	57%
Elevated ESR	22%	68%
Increased serum lactate	12%	63%
Elevated CK	9%	41%
Hyperferritinemia	14%	52%

Children in **Group B** displayed signs of persistent systemic inflammation and impaired aerobic metabolism, indicating that metabolic intoxication remains active long after the acute infection phase.

Autonomic Nervous System Dysfunction:

HRV testing demonstrated **sympathicotonia** in 71% of Group B and 29% of Group A. This suggests that autonomic dysregulation plays a core role in PCIS, resulting in cardiovascular instability, sleep regulation disorders, and difficulties adapting to physical exertion.

Discussion

The findings confirm that PCIS is a multi-factorial syndrome with complex pathophysiological mechanisms, including:

- Chronic low-grade inflammation
- Dysregulation of mitochondrial energy metabolism
- Persistent autonomic nervous system imbalance
- Emotional and stress-related neuroendocrine reactions

Children are particularly vulnerable due to their developing nervous and immune systems. In many cases, symptoms were underestimated by families and primary care physicians, delaying targeted rehabilitation interventions.

Conclusion

Post-COVID Intoxication Syndrome is a clinically significant and underrecognized condition in pediatric patients. The syndrome is marked by persistent fatigue, autonomic dysfunction, metabolic disturbances, and decreased physical tolerance. Early diagnostic screening using CRP, lactate, HRV testing, and functional load assessment (6MWT) is essential. Effective management requires structured rehabilitation programs including graded physical activity, metabolic correction therapy, psychological support, and monitoring over several months.

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