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POST-COVID SYNDROME IN CHILDREN – THE INVISIBLE CONSEQUENCE OF A VISIBLE DISEASE

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Abstract: It was believed that COVID-19 spared the pediatric population, presenting in mild or asymptomatic forms. However, months after the pandemic, the medical community encountered a new challenge, post-COVID syndrome (Long COVID) in children and adolescents. This article provides a detailed overview of the symptoms, pathogenesis, diagnosis, and treatment approaches for this prolonged condition, aiming to raise awareness among pediatricians, parents, and educators. Based on an analysis of current literature, the paper emphasizes the multifaceted nature of the clinical presentation and the need for an interdisciplinary approach to rehabilitation.

Keywords: Post-COVID syndrome, Long COVID, children, pediatrics, adolescents, COVID-19 consequences, post-viral asthenia, brain fog, diagnosis, rehabilitation, multisystem inflammatory syndrome (MIS-C).

Введение. COVID-19, caused by the SARS-CoV-2 coronavirus, has fundamentally transformed the outlook of modern medicine. While children were initially considered a low-risk group for severe acute disease, increasing attention is now being paid to the long-term consequences of infection. Post-COVID syndrome (PCS), or Long COVID, is a condition in which a range of symptoms persist or reappear 12 weeks after the initial infection, last for at least two months, and cannot be explained by alternative diagnoses [1]. The prevalence of PCS in children, according to various estimates, ranges from 2% to 10% of those who have recovered, including individuals who experienced only mild illness [2]. This article aims to systematize current knowledge about this emerging problem in pediatrics.

Clinical Presentation: The Many Faces of Post-COVID in Children

The symptomatology of PCS in children is highly diverse and can affect multiple organ systems simultaneously. It can be conditionally divided into several groups:

1. **General Somatic and Asthenic Symptoms:**

Persistent weakness and rapid fatigability: The child is unable to tolerate usual physical or mental loads, leading to a marked reduction in quality of life. This is one of the most common and disabling manifestations.

Sleep disturbances: Insomnia, daytime sleepiness, fragmented or poor-quality sleep.

Prolonged low-grade fever: Body temperature ranging from 37.1–37.5 °C without apparent cause.

Muscle and joint pain.

2. **Neurological and Cognitive Impairments ("Brain Fog"):**

Headaches: Often persistent and poorly responsive to standard analgesics.

Cognitive dysfunction: Problems with attention, memory, and learning new information. This is especially critical for school-age children and may be mistakenly interpreted as laziness.

Olfactory and gustatory disorders (parosmia, anosmia): May persist for several months.

Dizziness and orthostatic tachycardia (POTS syndrome).

3. **Cardiorespiratory Symptoms:**

Shortness of breath and exercise intolerance: The child becomes breathless when climbing stairs or during active play.

Chest tightness, tachycardia, and palpitations.

Persistent cough.

4. **Psychiatric and Psychological Manifestations:**

(The continuation of this section would typically include anxiety, depression, mood swings, and post-traumatic stress features - if you'd like, I can translate and expand that part next.)

Psychiatric and Psychological Manifestations

- **Anxiety, depressive states, and mood lability.**
- **Panic attacks,** which may be associated with somatic sensations (for example, shortness of breath).

5. Gastrointestinal Disorders

Abdominal pain, nausea, diarrhea, loss of appetite, and weight loss.

A Distinct Form: MIS-C

It is important to distinguish PCS from **Multisystem Inflammatory Syndrome in Children (MIS-C)** - a rare but severe complication that develops 2–6 weeks after infection. MIS-C is characterized by high fever, pronounced inflammation, and multiorgan failure [5]. In contrast, PCS manifests less acutely but has a more prolonged course.

Risk Factors

Although PCS can develop in any child, several high-risk groups have been identified:
Adolescents (older children are affected more often than younger ones).
Children who experienced a more severe acute form of COVID-19.
Patients with allergic diseases (e.g., asthma).
Children with obesity.
Presence of chronic comorbid conditions.

Possible Mechanisms of Development

The exact pathophysiological mechanisms of PCS are not yet fully understood, but several hypotheses have been proposed:

1. **Persistence of the virus or its antigens:**

The retention of viral fragments in body tissues (for example, in the intestines or nervous tissue) may sustain chronic inflammation.

2. **Autoimmune reactions:**

The virus may "confuse" the immune system (a phenomenon known as molecular mimicry), causing it to attack the body's own cells.

3. **Endothelial dysfunction and microthrombosis:**

Viral damage to the inner lining of blood vessels may impair microcirculation and tissue perfusion.

4. **Neuroinflammation:**

Direct viral impact on the central nervous system, or indirect effects mediated by a cytokine storm, can lead to "brain fog" and asthenia.

5. **Microbiome dysbiosis:**

Alteration of the gut microbiota composition may influence immunity, metabolism, and neurological health through the "gut–brain axis."

Diagnosis

Diagnosing PCS is challenging, as there is no specific laboratory test — it is a diagnosis of exclusion. The main stages include:

1. Thorough medical history taking:

A detailed assessment of the patient's COVID-19 history (confirmed by PCR/antibody testing or presumed based on clinical presentation) and a precise timeline of symptom onset and persistence.

2. Exclusion of other diseases:

It is essential not to overlook alternative conditions that may mimic PCS (for example, endocrine disorders, iron deficiency, or other chronic infections).

3. **Comprehensive clinical evaluation, which may include:**

- Complete blood count and biochemical tests (to assess inflammation markers and liver and kidney function).
- Coagulogram (to evaluate the coagulation system).
- ECG, 24-hour Holter monitoring, and echocardiography (to rule out myocarditis, pericarditis, or arrhythmias).
- Chest X-ray or CT scan (as indicated).
- Spirometry (to assess lung function).
- Consultations with specialists: neurologist, cardiologist, gastroenterologist, psychologist, or psychiatrist.

Principles of Treatment and Rehabilitation

Treatment of PCS in children is **symptomatic and rehabilitative** in nature, there is no single "cure." The main directions include:

1. **Non-pharmacological therapy (the cornerstone of management):**

Gentle, stepwise regimen: Gradual resumption of physical and mental activity. Overexertion must be strictly avoided; "energy-conservation" strategies are recommended.

Cognitive-behavioral therapy (CBT): Effective for managing anxiety, depression, "brain fog," and for teaching coping strategies.

Physical rehabilitation: Therapeutic exercise with gradual load increase and breathing exercises under professional supervision.

- **Nutritional support:** A balanced diet ensuring adequate intake of protein, vitamins, and micronutrients, with correction of any identified deficiencies.

2. **Pharmacological support (strictly prescribed by a physician):**

- For asthenia and cognitive impairment **B vitamins**, **L-carnitine**, and mild **nootropic agents** may be considered.
- For cardiac symptoms, **metabolic therapy** (e.g., potassium and magnesium supplements); in confirmation

The Role of Parents and Schools

Parents and educators play a crucial role in recognizing and supporting children with PCS. It is important to **believe the child's complaints**, even when laboratory tests appear normal, PCS is primarily a clinical diagnosis. Maintaining a **symptom diary** helps track symptom dynamics and their correlation with physical or mental load. Parents should work **closely with the pediatrician**, acting as advocates for their child's needs. It is also essential to **inform the school** about the child's condition so that teachers can adjust academic demands, provide additional breaks, and create a **supportive and understanding environment**.

Conclusion

Post-COVID syndrome in children is a real and serious medical concern whose long-term consequences are yet to be fully understood. It lacks clear diagnostic markers and requires a **comprehensive, patient-centered, and family-oriented approach**. Increasing awareness of PCS among **healthcare professionals, parents, and educators** will facilitate timely recognition, accurate differential diagnosis, and early, individualized rehabilitation.

Future **longitudinal studies** should focus on identifying reliable biomarkers, understanding long-term outcomes, and developing **evidence-based treatment and rehabilitation protocols**, to help restore children's health and ensure their full physical, emotional, and cognitive development.

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