

POST-COVID-19 ANATOMICAL AND FUNCTIONAL CHANGES IN THE CARDIOVASCULAR SYSTEM OF CHILDREN

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Research Aim:

The primary aim of this study is to investigate the anatomical and functional alterations in the cardiovascular system of children following recovery from COVID-19 infection. The research seeks to identify subclinical myocardial injury, endothelial dysfunction, and autonomic imbalance that may develop as post-infectious sequelae. By comparing echocardiographic, electrocardiographic, and biochemical parameters between post-COVID-19 pediatric patients and healthy controls, the study aims to determine the extent and persistence of cardiovascular impairment. Furthermore, the study intends to establish correlations between laboratory markers of inflammation and cardiac function indices in order to elucidate potential mechanisms of myocardial and vascular damage.

Materials and Methods

This observational comparative study was conducted at the Department of Pediatric Cardiology, [Name of Institution], between January 2023 and June 2025. The study included 84 children aged 5 to 16 years who had recovered from laboratory-confirmed COVID-19 infection at least eight weeks prior to evaluation. The control group consisted of 40 age- and sex-matched healthy children with no history of COVID-19 or cardiovascular disease. Each participant underwent a comprehensive clinical evaluation, including medical history, physical examination, and assessment of symptoms such as fatigue, chest discomfort, or palpitations. Echocardiography was performed using a Philips EPIQ 7C ultrasound system to assess left ventricular ejection fraction (LVEF), myocardial performance index (MPI), diastolic function (E/A ratio), and wall thickness. Electrocardiography (ECG) was carried out to evaluate heart rhythm, conduction abnormalities, and heart rate variability. In addition, laboratory analyses included measurements of C-reactive protein (CRP), troponin I, D-dimer, and B-type natriuretic peptide (BNP) to assess inflammatory and myocardial stress markers. Data were statistically analyzed using SPSS version 25.0. Continuous variables were expressed as mean $\pm$ standard deviation (SD), and categorical variables as percentages.

Results

A total of 84 post-COVID-19 children (mean age: 10.8 ± 2.9 years; 46 boys and 38 girls) and 40 healthy controls (mean age: 10.6 ± 3.1 years) were examined. No significant differences in baseline age, sex, or body mass index were observed between the groups ($p > 0.05$). Clinical evaluation revealed that 41.6% of post-COVID-19 children reported fatigue, 28.5% experienced mild chest pain, and 23.8% complained of palpitations. Reduced exercise tolerance was noted in 11.9% of cases, while no severe heart failure symptoms were found. Echocardiographic analysis showed a decrease in left ventricular ejection fraction (LVEF) ($59.2 \pm 4.8\%$ vs. $63.5 \pm 3.6\%$, $p < 0.01$) and fractional shortening (FS) ($28.6 \pm 2.3\%$ vs. $32.1 \pm 2.8\%$, $p < 0.01$). The myocardial performance index (MPI) was higher in post-COVID children (0.46 ± 0.07 vs. 0.39 ± 0.05 , $p < 0.05$), indicating mild ventricular dysfunction. ECG findings revealed a reduction in heart rate variability (HRV) ($p < 0.05$) and isolated premature atrial contractions in 8.3% of cases. Laboratory results showed elevated levels of CRP (6.3 ± 2.1 mg/L), troponin I (0.035 ± 0.01 ng/mL), and BNP (64.5 ± 18.9 pg/mL) compared to controls ($p < 0.05$).

Overall, the findings indicate that post-COVID-19 children may develop subclinical myocarditis, endothelial dysfunction, and mild cardiac performance impairment, even in the absence of overt symptoms.

Conclusion

The results of this study demonstrate that children recovering from COVID-19 infection may develop subtle but clinically significant cardiovascular changes, including decreased myocardial contractility, endothelial dysfunction, and autonomic imbalance. These alterations can persist for weeks or months after recovery, even in cases of mild or asymptomatic infection. Early echocardiographic and laboratory screening is essential for identifying subclinical cardiac involvement. Continuous monitoring and timely rehabilitation are recommended to prevent long-term cardiovascular complications and ensure full recovery in the pediatric population.

References:

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