

## Results of a Comparative Analysis of Clinical and Laboratory Symptoms of Pyelonephritis in Patients with an Anamnesis of COVID-19

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**Relevance:** The pathogenesis of kidney damage in SARS-COV-2 infection is multifactorial. SARS-COV-2 can have a direct cytopathic effect on the kidney. This is confirmed by the detection of coronavirus fragments by polymerase chain reaction in the urine of patients infected with COVID-19. In children with pyelonephritis against the background of COVID-19, all extrarenal signs were observed, as in children without COVID, with OP, the frequency of which was higher in patients with a background of COVID. Local signs of the disease: pain in the lumbar region (98/98/95%), Pasternatsky symptom (100/66/100%) were positive. According to the results of the investigation, all clinical-laboratory symptoms in patients with COVID-19 during the active period of pyelonephritis were more pronounced and more obvious compared to the 2 groups.

**Key words:** pyelonephritis, children, kidney function, SARS-COV-2.

**Relevance:** The pathogenesis of kidney damage in SARS-COV-2 infection is multifactorial. First, SARS-COV-2 may have a direct cytopathic effect on the kidney. This is confirmed by the detection of coronavirus fragments by polymerase chain reaction in the urine of patients infected with COVID-19 [5]. As previously mentioned, SARS-COV-2 uses ACE2 to enter the host cell [8]. Recent data from human tissue RNA sequencing have shown that ACE2 expression in the kidneys is almost 100-fold higher than in the respiratory organs (lungs).

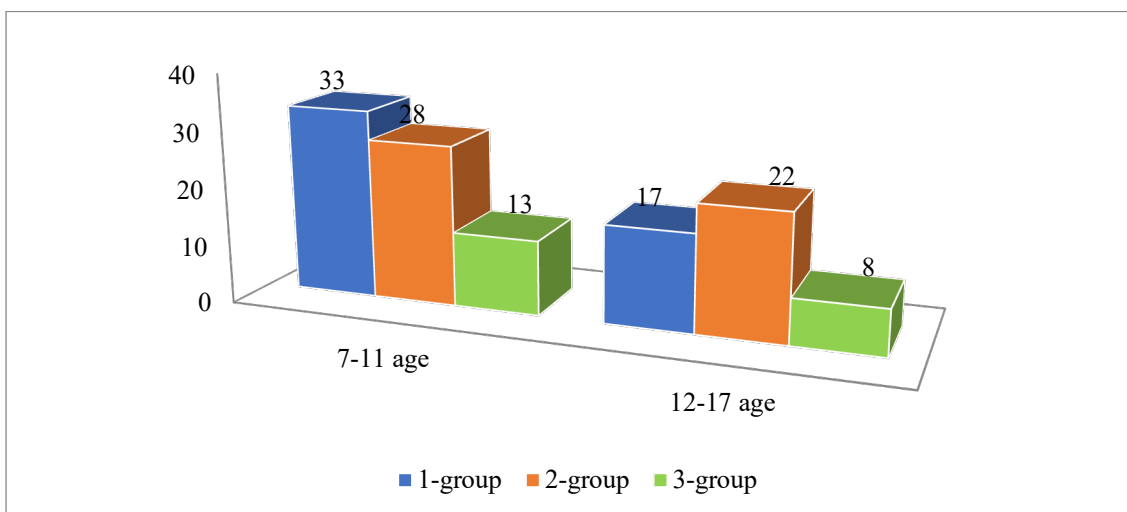
Further immunohistochemical analysis of micropreparations revealed another link in the pathogenesis of kidney damage by the SARS-COV-2 virus. In situ expression of viral nucleocapsid protein (NO) antigen, immune cell CD8, CD68, CD56 and complement C5b-9 markers proved that SARS-COV-2 NO antigen was accumulated in renal tubules [1-6]. Thus, infection with the COVID-19 virus induces massive cytokine release, promotes macrophage activation and lymphocyte infiltration of the renal parenchyma, and enhances C5b-9 complement deposition in nephron tubules [7-9]. During the exacerbation of inflammation and "cytokine storm" in patients with COVID-19, the filtration pressure and glomerular filtration rate decrease, the intensity of blood flow in the kidney decreases in parallel, which can lead to cardiorenal syndrome type 1 and the development of acute kidney failure [22]. Thus, viruses cause acute damage to nephrons, and then acute kidney failure and CBK develop.

**The aim of the work:** comparative analysis of pyelonephritis symptoms in patients with a history of COVID-19.

**Research object and subject:** 121 patients aged  $7 \leq 17$  years with pyelonephritis who had Covid-19. Group 1 was 50 patients with acute pyelonephritis+ COVID-19, group 2 was 50 patients with acute pyelonephritis, and group 3 was 21 patients with chronic pyelonephritis+ COVID-19.

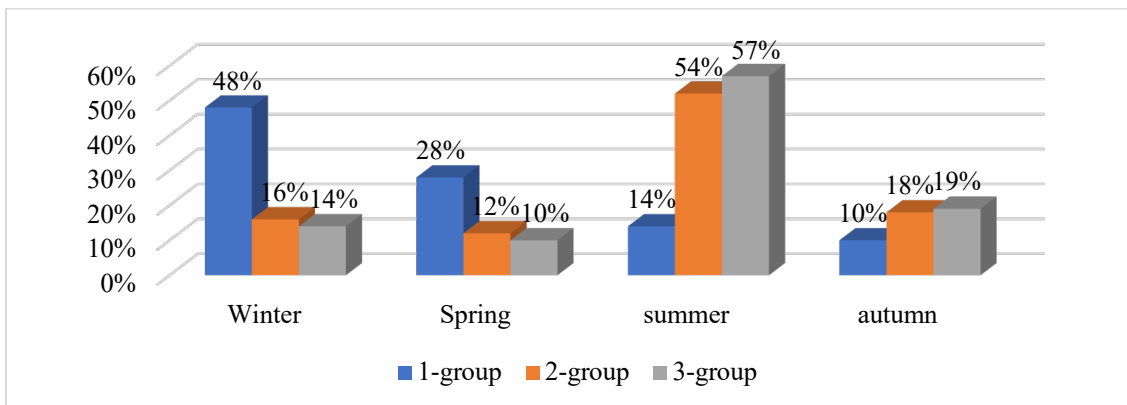
**Research methods:** blood analysis, general urinalysis indicators, UTT were conducted.

**Research results:** Sick children were divided according to age groups. The average age of the children was  $9 \pm 2.4$  years. The main contingent of our patients was 61.15% (74) children aged 7 to 11 years (Fig. 1).

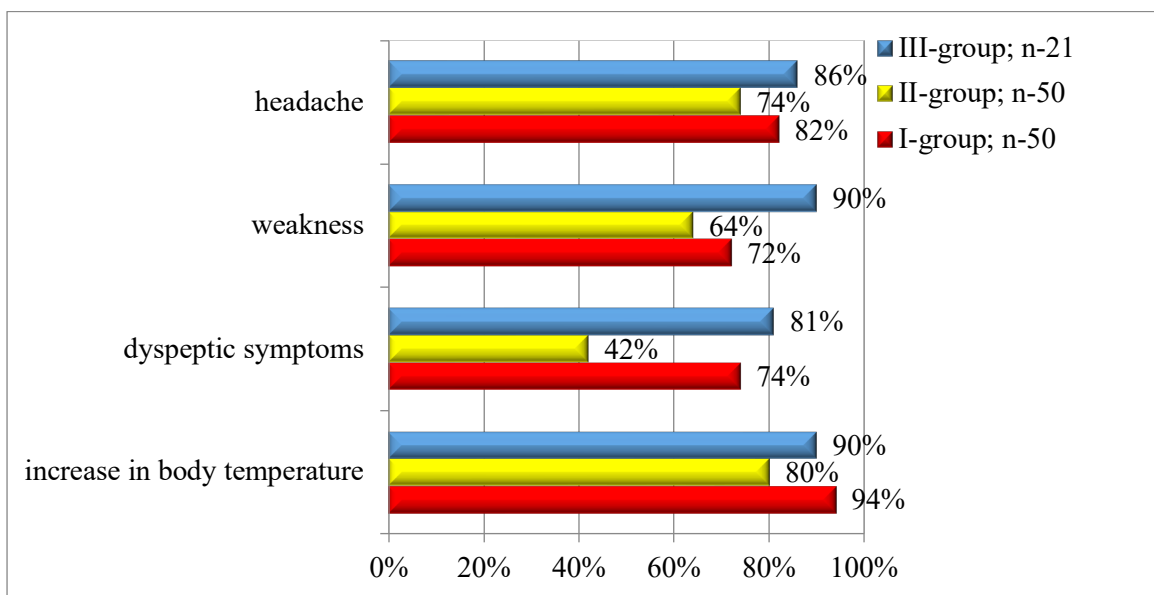


**Figure 1.** Distribution of sick children by age.

Patients with pyelonephritis who had passed COVID-19 came to us mainly in the summer season, which we attribute to the increase in the number of COVID-19 in the summer, while the hospitalization of patients with acute pyelonephritis occurred mainly in the late winter and early spring months (Fig. 2 ). The main reason for this is the increase in other types of acute respiratory diseases and ypovitaminosis in the body.

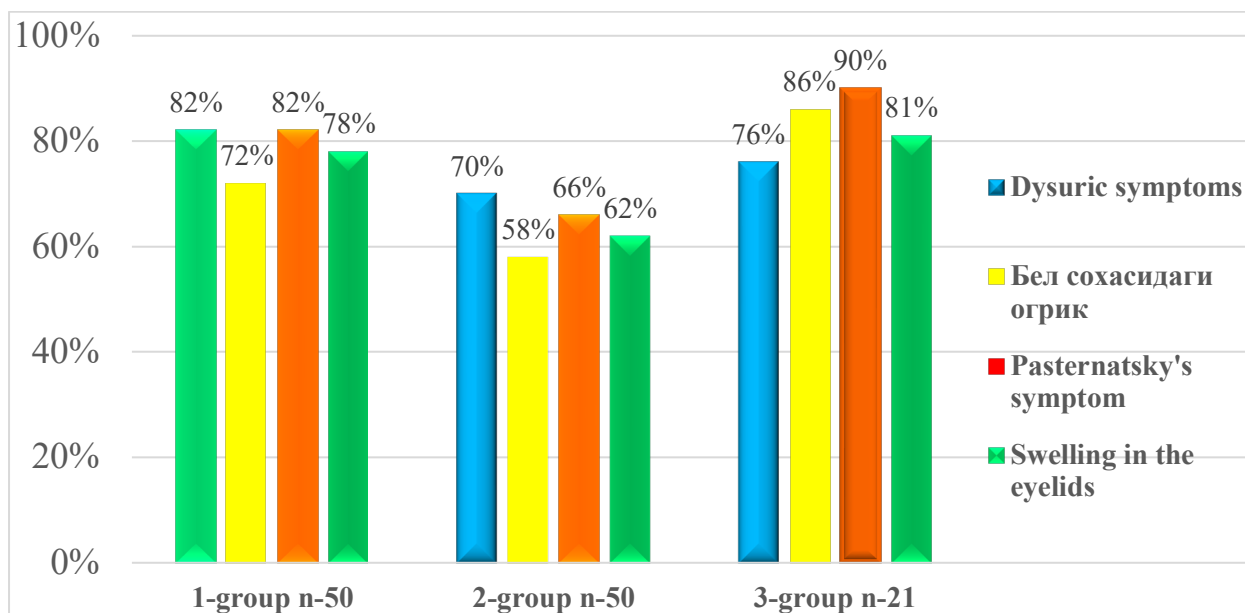


**Figure 2.** Distribution of sick children's appeals to the hospital by year and season



**Figure 3.** Common clinical symptoms of pyelonephritis in patients (%)

In children with pyelonephritis against the background of COVID-19, all extrarenal signs were observed, as in children without COVID, with OP, the frequency of which was higher in patients with a background of COVID. In particular, headache, weakness and fever were more and more prominent in patients with COVID-19 + pyelonephritis.



**Figure 4.** Renal symptoms of pyelonephritis in patients (%)

Local signs of the disease: pain in the lumbar region (98/98/95%), Pasternatsky symptom (100/66/100%) were positive. Dysuria was observed in patients in the form of frequent and painful urination (86/78/85%). In patients with Covid-19+pyelonephritis, pollakiuria was later replaced by scanty urination. We attributed this to the direct pathogenetic effect of viral toxins on the kidney.

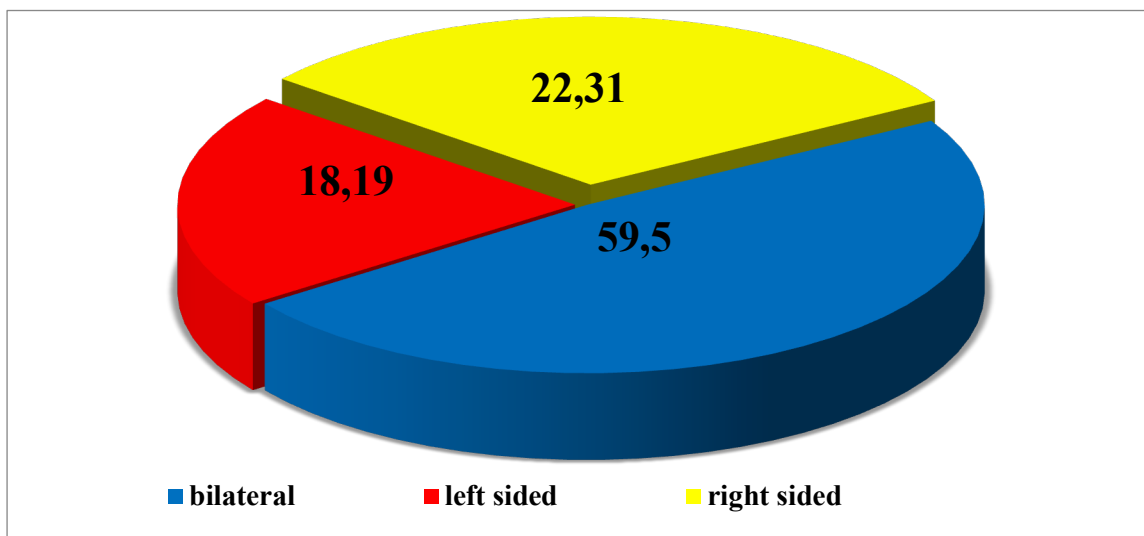


Figure 5. Ultrasound examination results (%).

According to the results of the examination, kidney damage was symmetrical in most of the patients, and bilateral pyelonephritis was noted. SARS-COV-2 directly affects the kidneys, as a result of which it leads to impaired kidney function and facilitates the spread of the virus in the body. , systemic effects include hypoxia, inadequate hemodynamics, and direct Inflammatory process was noted bilaterally more often in patients due to tubulo-globulin injuries.

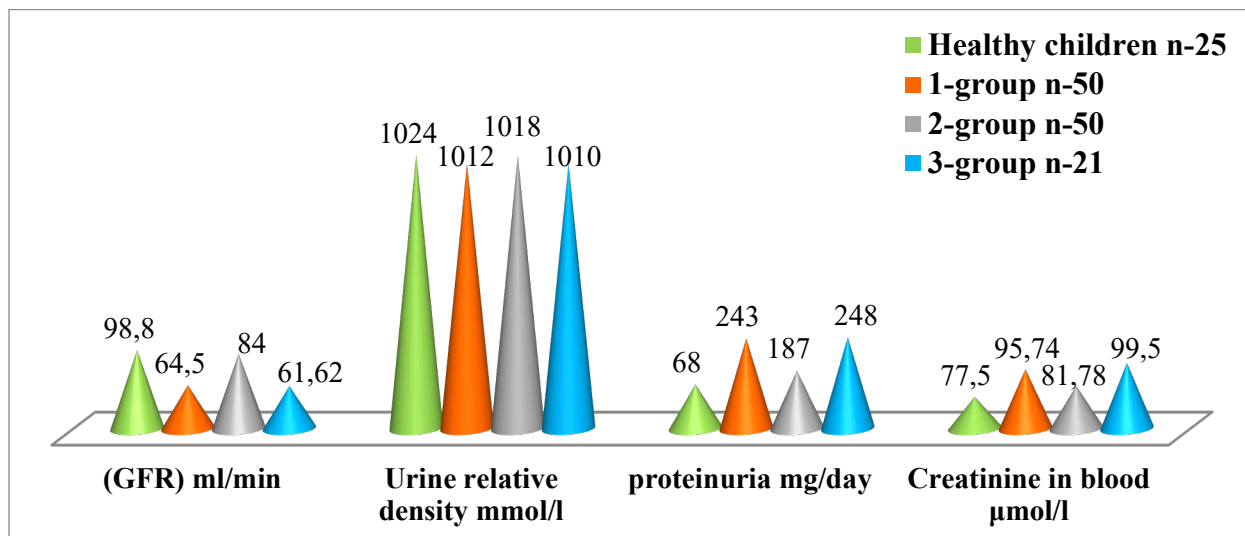


Figure 6. Indicators of partial kidney function in children with pyelonephritis.

In our patients with pyelonephritis against the background of COVID-19, the glomerular filtration rate was significantly decreased compared to our group 2, proteinuria increased in the proximal tubules, and the relative density of urine decreased in the distal tubules. Thus, we attribute this phenomenon to hemodynamic instability (ventilation problem). this significant volume replacement, positive fluid level and further complications of inflammation in the kidney tissues, together with the changes in the analysis of re-infection with bacterial agents, reflect the fact that against the background of the active inflammatory process in the kidneys, disorders of the concentration and absorption properties of the kidneys are much higher in patients of groups 1 and 3 than in patients of group 2 makes

**Conclusion:** According to the results of the investigation, all clinical-laboratory symptoms in the active period of pyelonephritis in patients with COVID-19 were more pronounced and more obvious

compared to the 2 groups, which we attributed to the direct toxic effect of SARS-COV-2 on the renal proximal tubules.

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