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CLINICAL AND LABORATORY ASPECTS OF ACUTE PYELONEPHRITIS AGAINST COVID-19 IN CHILDREN

Izomiddinova M. K.
Ochilov S. K.
Abdullaev S. N.
Kurbonova N. S.
Berdierov E. V.
Sultonov Zh.
Salimov A. S.
Abdalimov A. A.
Berdyeva N.
Samarkand State Medical University, Samarkand, Uzbekistan

Abstract
Renal pathology was more common in young children and in individuals with concomitant diseases.
The aim of the study was to determine and evaluate the features of clinical and laboratory criteria for acute pyelonephritis (AP) in children that developed against the background of COVID-19 and without it.
Methods. An observational cohort retrospective clinical study of 65 children with acute pyelonephritis was conducted.
Results and discussion. The following main clinical symptoms were identified in children with AP: febrile fever in 90% (27) and in 100% (35) of children against the background of intoxication symptoms. These signs were combined with dysuric disorders (imperative urges, pollakiuria, rare urination) in 33.3% (10) and 48.5% (17) of children, painful urination was noted in 33.3% (9) and 25.7% (10) of cases; in 46.6% (14) and 71% (25) of patients, respectively, intestinal disorders (constipation or diarrhea) were observed.
Conclusion. We found that clinical signs of the disease were more pronounced in patients with a history of Covid-19, which is associated with the presence of more significant intoxication in acute renal pathology arising from kidney inflammation, increased vascular permeability, fluid loss, intra-abdominal hypertension, hypovolemia and subsequent shock.

Keywords: COVID-19, acute pyelonephritis, urine bacteriological profile.

Introduction

While the data regarding the epidemiology, pathophysiology, risk factors, and prognosis of adults with renal histopathology after acute COVID-19 infection are now well established, there remains a significant gap in the study of endogenous renal pathological manifestations in children after acute COVID-19 infection [1, 3].

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Data from several European countries showed similar incidences in men and women, but men had more severe disease [2, 4].

Results from a study by Dong Y, Mo X, Hu Y, Qi X, Jiang F, Jiang Z in 287 patients showed that those admitted to Hankou Hospital, Wuhan, China, had a higher incidence of AKI (19.6%) in COVID-19 patients and a significantly increased mortality risk compared with COVID-19 patients without AKI [5, 6]. It also showed a significant correlation between survival and renal function [7, 8]. The aim of the study is to determine and evaluate the features of clinical and laboratory criteria for acute pyelonephritis (AP) in children, developed against the background of COVID-19 and without it. Material and methods of the study. An observational cohort retrospective clinical study of 65 children with acute pyelonephritis was conducted. Also, 20 healthy children were examined as a control group. Patients were observed at the State Budgetary Healthcare Institution "Samarkand Regional Children's Multidisciplinary Medical Center" of the Ministry of Health of the Republic of Uzbekistan, in the nephrology department.

The laboratory stage of the study was carried out on the basis of the clinical diagnostic laboratory of the State Budgetary Healthcare Institution"Samarkand Regional Children's Multidisciplinary Medical Center" of the Ministry of Health of the Republic of Uzbekistan, laboratories of the "Innova" clinic and the Central Research Laboratory of the Institute of Immunology and Human Genomics and the laboratory of the "Gunchamed" clinic in Tashkent of the Ministry of Health of the Republic of Uzbekistan. The study period: from January 2020 to December 2023. Participants were selected for different comparison groups before the start of treatment for renal complications based on the presence or absence of COVID-19 in the anamnesis. Three groups were formed: group 1 included 30 children with AP without a history of COVID-19, group 2 included 35 patients with AP against the background of COVID-19, and group 3 (control group) included 20 healthy children. General clinical urine analysis was performed (proteinuria (mg / day), leukocyturia (cells in p.z.), bacteriuria (CFU \ ml)); cumulative tests according to Nechiporenko (cells/ml); urine culture for microflora (>100,000 CFU/ml).

The obtained laboratory test data were processed using statistical methods. Calculations were performed using Excel (Microsoft Office, 2016, USA) and StatPlus version 7 (AnalystSoft Inc., USA).

Results and Discussion

The selection of subjects included the establishment of the diagnosis of "acute pyelonephritis" based on clinical and laboratory diagnostics in accordance with clinical guidelines. The diagnostic criteria for distributing children into groups were the results of the study of the anamnesis, objective examination of the patient, clinical and laboratory data (including general urine analysis, Nechiporenko test, bacterial culture of urine of patients with detection of the pathogen, determination of leukocytes in urine). The clinical basis of AP in children in the studied groups was febrile fever (in

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combination with symptoms of intoxication). These manifestations were combined with a violation of the rhythm of urination (imperative urges, pallakiuria, rare urination), equivalents of painful urination. The determination of Covid-19 in the anamnesis of the studied children with AP was carried out using ELISA diagnostics of blood serum, where an increased level of IgG (g / l) was detected, which confirmed the presence of this pathology in the anamnesis and the formation of the remission stage of Covid-19. We observed 65 children with acute pyelonephritis (AP) who received treatment in the nephrology department of the Samarkand Regional Children's Multidisciplinary Medical Center (SRCMMC) for the period 2020-2023. The patients were divided into two groups.

The first group included 30 children with acute pyelonephritis (n=65) who had no history of Covid-19, and the second group consisted of 35 patients with acute pyelonephritis with Covid-19. The duration of Covid-19 in the history from the date of admission ranged from 3 weeks to 2 months.

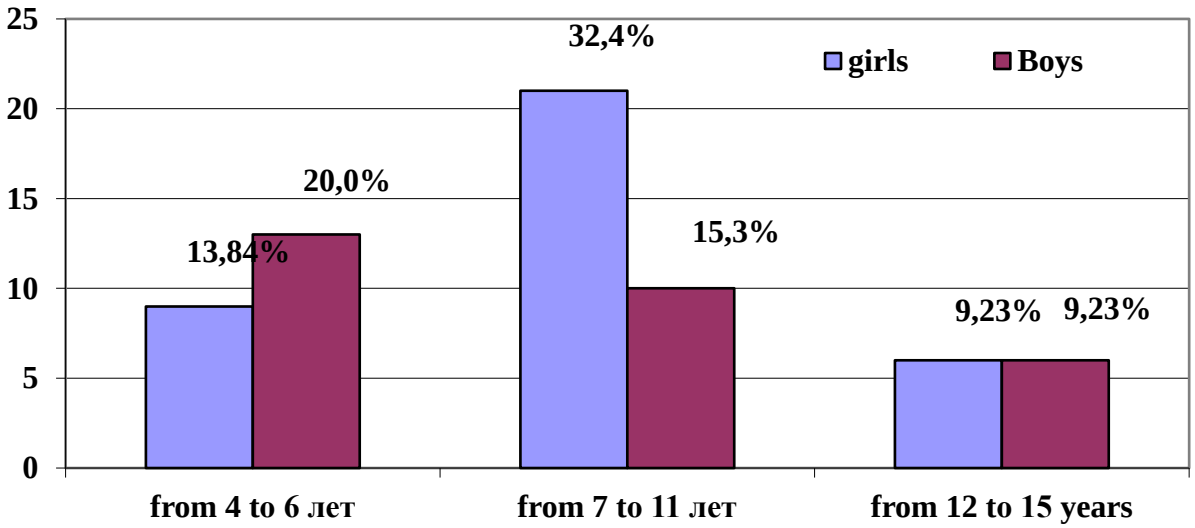

Fig. 1. Distribution of examined children of the OP depending on age and gender

The diagnosis of OP was established in accordance with the classification of the nosology (Korovina N.A. 2002).

The results of our studies showed that among our patients with OP, there were 29 boys (44.6%) and 36 girls (55.4%), and it should be noted that the number of boys 13 (20%) OP aged 4 to 6 years prevailed over the number of girls 9 (13.84%). Whereas, sick boys 6 (9.23%) and girls 6 (9.23%) aged 12 to 18 years were encountered with the same frequency (Fig. 1).

The main contingent of our patients consisted of 43 (32.5%) children aged 7 to 11 years (Fig. 1), where the majority of patients were female 21 (32.4%), and boys accounted for 10 (15.3%). Age groups were formed according to the classification of childhood periods recommended by A.F. Tur. The ratio of girls to boys was 1.24: 1.

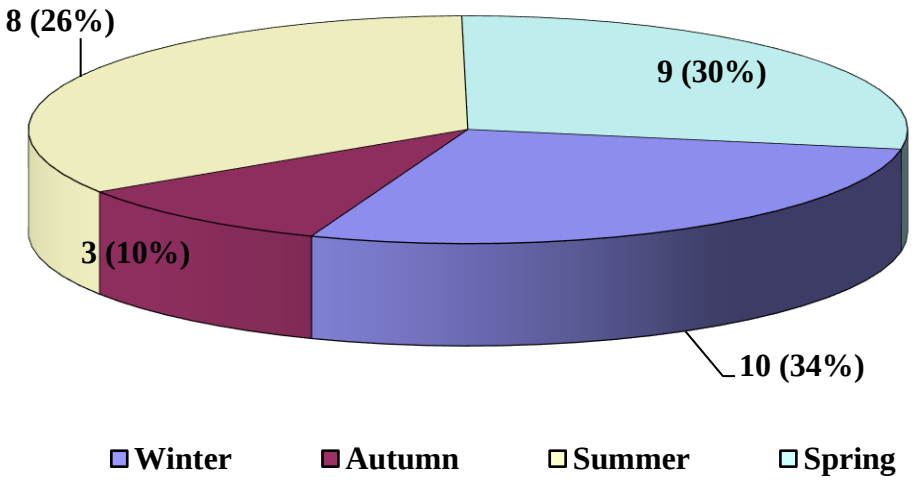

Fig. 2. Distribution of patients with AP by seasons of the year

We found that the peak of hospital admissions of patients with an active stage of acute pancreatitis without a history of Covid-19, depending on the season, was observed in the winter-spring period, which we associated with the spread of acute respiratory viral infections, hypovitaminosis of the child's body, which is typical at this time of year, while a greater number of patients with a history of Covid-19 were admitted to hospital in the summer season, which may be associated with the peak incidence of Covid-19 during this period (Fig. 2; 3).

According to the analysis of the results of clinical, laboratory and functional research methods, the most frequent occurrence of the secondary form of pyelonephritis was determined against the background of dysmetabolic nephropathy (n = 42 (64.6%)). The reasons contributing to its development were not identified only in 7.7% (5) of patients with an acute course of the disease, while the remaining 27.7% (18) patients had a primary form of AP. The degree of activity of the inflammatory process was established based on the severity of clinical symptoms, such as increased body temperature, general intoxication, dyspeptic phenomena, dysuric disorders, pain syndrome. The first degree of activity of the inflammatory process was not detected among our patients. We did not admit patients with acute pancreatitis who did not have a history of COVID 19 with stage 1 process activity to the hospital, they were treated on an outpatient basis, therefore they were not included in the general sample, since children with a history of COVID 19 had only stage 2 and 3 activity.

The second stage of activity was detected in 18.5% (12) of patients, and the third stage of activity was determined in 81.5% (53) of children. Stage 2 of the inflammatory process activity was characterized by a moderate manifestation of clinical symptoms of the disease, leukocytosis (>12x10/l), neutrophilia with a band shift, an increase in ESR (>20 mm/h), C-reactive protein ++, severe "urinary syndrome", and shifts in renal functional state indicators were detected in the blood. The 3rd degree of activity of the pathological

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process was characterized by pronounced clinical signs of the disease, persistent changes in the blood (leukocytosis (>18x10/l), neutrophilia with a band shift, increased ESR (>30 mm/h), C-reactive protein up to ++++, and in the urine significant leukocyturia, proteinuria, microhematuria, bacteriuria, oxaluria, stable disorders of the functional state of the kidneys.

The prevalence of a burdened perinatal history (specific and chronic non-specific diseases of the genitals) was noted in 27.7% (18) of mothers of sick children, as a risk factor for the development of AP. A burdened obstetric history was manifested by a threat of termination of pregnancy (TP) in 13.8% (9), early gestosis in 27.7% (18) of children. In the anamnesis, 26.6% (8) of patients with AP without Covid-19 and 34.2% of children (12) with AP against the background of Covid-19 received artificial feeding, in 50% (15) and 71.4% (25) of patients, frequent recurrent respiratory viral infections were noted, in 33.3% (10) and in 82.8% (29) children, respectively, there was a history of dysbacteriosis and acute intestinal infections; in 66.6% (20) and 40% (14) children, respectively, there were foci of chronic infection.

The following main clinical symptoms were identified in children with AP: febrile fever in 90% (27) and in 100% (35) of children against the background of intoxication symptoms. These symptoms were combined with dysuric disorders (imperative urges, pollakiuria, rare urination) in 33.3% (10) and 48.5% (17) of children, painful urination was noted in 33.3% (9) and 25.7% (10) of cases; intestinal disorders (constipation or diarrhea) were observed in 46.6% (14) and 71% (25) of patients, respectively; abdominal pain was noted in 50% (15) and 54% (19) of patients, respectively, which we associate with intoxication of the child's body (Table 1).

Table 1 Clinical symptoms of AP depending on the etiologic factor

Complaints	1st group: children of the OP (n=30)	Group 2: Children with OP against the background of Covid-19 (n=35)
Extrarenal		
Headaches	16 (53%)	23 (65,7%)
Weakness, fatigue	20 (66,6%)	24 (68,5%)
Dyspeptic phenomena*	14 (46,6%)	25 (71%)
Febrile fever	27 (90%)	35 (100%)
Poor appetite	22 (73,3%)	27 (77%)
Abdominal pain	15 (50%)	19 (54%)
Renal		
Swollen eyelids in the morning	22 (73%)	28 (80%)
Tendency to hypertension*	10 (33%)	28 (80%)
Pain in the kidney area*	17 (56,6%)	23 (65,7%)
Urination disorders:	10 (33,3%)	17 (48,5 %)
Imperative urges	10 (33,3%)	17 (48,5 %)
Rare micturitions	10 (33,3%)	17 (48,5%)
Painful urination	9 (33,3%)	10 (25,7%)

Note: * – p<0.05, group 2 – children with AP against the background of Covid-19.

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We determined that the clinical signs of the disease were more pronounced in patients with a history of Covid-19, which is associated with the presence of more significant intoxication in acute renal pathology arising from kidney inflammation, increased vascular permeability, fluid loss, intra-abdominal hypertension, hypovolemia and subsequent shock.

In order to determine Covid-19 in the history of the studied children with AP, ELISA diagnostics of blood serum was carried out, which revealed an increased level of IgG, which confirms the presence of this pathology in the history and the formation of the remission stage of Covid-19 (Table 2).

Table 2 Results of ELISA diagnostics of children with acute pyelonephritis

Indicators	In case of OP against the background of Covid-19 (n=35)	
	boys	Girls
Serum immunoglobulin G level, g/l	53,5±13,2 p≤0,001	50,8±15,6 p≤0,001
In healthy people	17,65±3,97	12,26±4,88

Note: p - reliability of differences between the studied indicator in the active stage of OP and the indicator in healthy people.

CONCLUSION

1. We determined that the clinical signs of the disease were more pronounced in patients with a history of Covid-19, which is associated with the presence of more significant intoxication in acute renal pathology arising from kidney inflammation, increased vascular permeability, fluid loss, intra-abdominal hypertension, hypovolemia and subsequent shock.
2. In 100% of patients with AP against the background of Covid-19 and in 40% of children with AP without a history of Covid-19, the third degree of activity of the inflammatory process was noted.
3. The peak of hospital admissions of patients with an active stage of acute pancreatitis without a history of Covid-19, depending on the season, was observed in the winter-spring period, which we associated with the spread of acute respiratory viral infections, hypovitaminosis of the child's body, which is typical at this time of year, while a greater number of patients with a history of Covid-19 were admitted to hospital in the summer season, which may be associated with the peak incidence of Covid-19 during this period of the year.

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