

Clinical and laboratory indicators in children with urolithiasis and the quality of laboratory diagnostics at the stage of inpatient treatment

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Abstract. The study of changes in biochemical parameters in urolithiasis with different types of stone localization and clinical picture was carried out. All patients in the hospital were examined: general clinical, including a general analysis of urine; biochemical; hematological. The article presents the results of studies of inpatients with a diagnosis of urolithiasis. These studies are relevant in view of the need for constant monitoring of the prescribed laboratory tests by clinicians in the management of these patients. This allows you to increase the level of competence of specialists in the field of laboratory services and for urologists, improves the rationality of prescribing laboratory tests for various nosologies and work with the “Standards of diagnosis and treatment”.

1 Introduction

One of the most common pathologies among the population is urolithiasis, a disease of the urogenital tract [1-3]. The prevalence of urinary stone disease remains one of the most pressing problems of medicine, especially in recent decades, the rapid growth of this disease is associated with an increase in the impact of a number of adverse environmental factors on the human body [4-8].

In addition to the high incidence of the disease, the urgency of the problem is that the disease is a long-lasting, often recurrent pathology. According to statistics, on average, every patient with urolithiasis is treated in a stationary conditions 2 times a year. Patients with urinary stone disease are monitored by urologists and appropriate treatment measures are recommended. Typically, anti-relapse treatment reduces the frequency of recurrence of the disease by 3 times.

Urolithiasis is the third leading cause of disability in urological diseases, after malignant tumors and pyelonephritis. The disease is characterized by deterioration of the anatomical and functional state of the urinary tract and, consequently, leading to chronic renal failure.

The polyetiological nature of the disease and the presence of many pathogenetic mechanisms of stone formation complicate the choice of therapeutic tactics and the

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concentration of primary and secondary prophylactic measures for each patient. Therefore, there are questions about the tactics of treatment of patients with urolithiasis. Urinary stones, depending on the presence of metabolic disease - urolithiasis and infection, can have different chemical composition: some of them have a mono-structural structure, but most often there are polymineral or mixed stones. Knowledge of the structure of the stone plays an important role in the choice of treatment and prevention methods. Stones can appear anywhere in the urinary system. Most often, the stones are located in the kidneys, urinary tract (92%), bladder (7%), urethra (1.4%).

However, experts believe that prevention of the disease on the basis of regular clinical and biochemical examinations of the patient is more effective [9-10]. If urinary stone disease is suspected, cellular, chemical composition of urine, increased ECHT in blood tests, increased activity of total protein and its fractions, calcium, phosphorus, urea, uric acid, creatinine, parateroid hormone and vitamin D and alkaline phosphatase are detected. In the analysis of urine should pay attention to the signs of infection, bactericidal, proteinuria, excretion of calcium, phosphorus, magnesium, oxalates, citrates, cysts, urates, creatinine clearance. In the absence of special instructions, biochemical examinations are performed 1 month after the start of treatment, and then every 2 months until the patient's condition stabilizes [11].

The success of treatment of urinary stone disease depends in many respects on the identification of etiological factors and pathogenetic features of stone formation. Laboratory diagnosis in urinary stone disease is important for proper treatment and objective monitoring of patients, so it is important to schedule laboratory tests correctly and in a timely manner for patients with urinary stone disease [12,13].

2 Materials and methods

The application of children with urolithiasis in the Samarkand region in 2019-2020 to the 2nd clinic of SamMI was studied (general indicators were calculated). At the clinic No. 2 in SamMI, an analysis of the quality of laboratory care in the inpatient phase of patients with urolithiasis was performed. The results of lab examinations conducted at the department of clinical-laboratory diagnostics of the clinic were copied and analyzed. Data from journals (social status, sex, age) were used as the main source. The following laboratory tests were performed on all patients: clinical blood analysis, clinical urine analysis; biochemical (urea, creatinine, ALT, AST, calcium, total blood protein); hematologic leukocyte intoxication index (LII); coagulogram analysis (PTT, PTI, APTT). Inpatient treatment of patients with urinary stones was carried out according to the standard "Laboratory diagnosis and treatment" developed by the Department of Health of Uzbekistan. All laboratory tests (biochemical, hematological, general clinical, coagulogram) were performed in the department of clinical laboratory diagnostics of the 2nd clinic of SamMI.

Laboratory analyzes were performed on the following analyzers: DIRUI BCC-3600, clinical blood analysis, biochemical tests on Mindray BS-120, general analysis of urine on Mindray UA-66 analyzer, coagulogram on MINILAB 701 analyzer.

The study involved 79 children aged 1 month to 14 years (Table 1).

The distribution of patients by age and sex showed that the disease was more common in both boys and girls, with the highest incidence of urinary stone disease in children under four years of age: (33% in boys and 17% in girls). That is, the predisposition to this disease in young boys is associated with the specific anatomical and physiological features of the urinary tract.

Table 1. Distribution of patients with urinary stone disease by age and sex

	Age				
	0-1	1-3	3-7	7-10	10-14
Boys(n=47)	11	14	13	4	5
Girls(n=32)	4	9	6	5	8
Total	15	23	19	9	13

The data of 79 patients were analyzed during the study. Based on the data obtained, it was found that the frequency of medical care and laboratory tests in patients with urolithiasis was carried out in accordance with the standards.

3 Results

In 2019, the number of patients treated with urolithiasis at the 2nd SamMI Clinic was 79 (Fig 1).

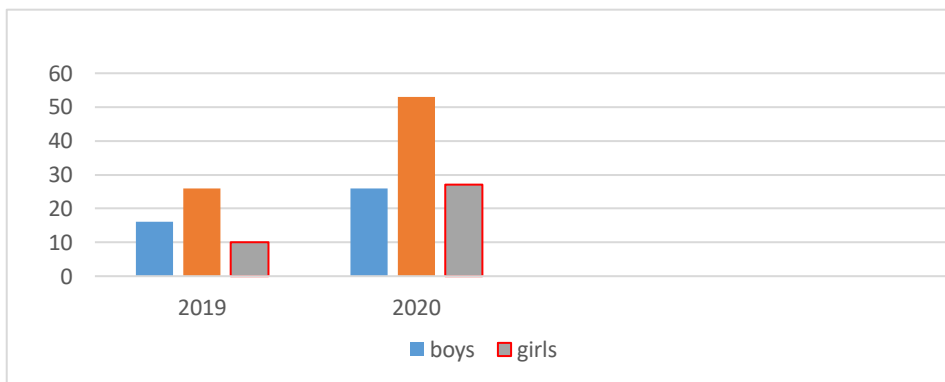


Fig. 1. Applications with urolithiasis at the 2nd clinic of SamMI in 2019-2020

In 2019, the number of appeals increased from 26 to 53 in 2020 (Figure 1). Age distribution of patients: 29.0% of patients are in the age group 1-3 years, and these data show a high susceptibility to urinary stone disease in young children. 19.0% - up to 1 year; 24% - 3-7 years; 12% were reported at 7-10 years of age and 16% at 7-14 years of age. The distribution of patients by sex was as follows: Boys (55.0%) girls (45.0%). Boys made up the majority. All patients were divided into 3 groups, taking into account the degree of laboratory changes. (Table 2).

Table 2. Clinical and biochemical parameters of patients in groups

Indicators	First group	
	Results	Norm
Clinical blood analysis		
EChT	$51 \pm 0,5$ mm/ch	5-15
Hb	$58 \pm 0,5$ g/l	120-140 g/l
Erythrocyte	$2 \pm 0,39 \cdot 10^{12}$ /l	$4,5-5,5 \cdot 10^{12}$ /l
Color indicator	$0,8 \pm 0,05$	0,85-1,05
Leukocytes	$23 \pm 0,0 \cdot 10^9$ /l	$4,0-8,0 \cdot 10^9$ /l
LII	$4 \pm 0,14$	<1,3
Biochemical indicators		

Urea	$24 \pm 0,65$ mmol/l	3,0-8,0mmol/l
Creatinine	$282 \pm 0,5$ mkmol/l	53,3-100mkmol/l
Total protein	$35 \pm 0,375$ g/l	65-85 g/l
AsAT	$118 \pm 0,0$ Ed	< 35 Ed
AlAT	$90 \pm 0,5$ Ed	< 40 Ed
Ca	$1 \pm 0,58$ mmol/l	2,15-2,50mmol/l
K	$3 \pm 0,8$ mmol/l	3,6-5,5mmol/l
Na	$173 \pm 0,5$ mmol/l	135-150mmol/l
P	$1 \pm 0,74$ mmol/l	0,87-1,45mmol/l
Cl	$99 \pm 0,0$ mmol/l	97-108mmol/l
Clinical urine analysis		
Clinical urine analysis (protein in urine)	$1 \pm 0,56$ g/l	Absent
WBC	Much in k/m	2-3k/m
RBC	Much in k/m	0-1 k/m
Mucus	(++) - (+++) k/m	Absent
Bacterium	(++) - (+++) k/m	Absent
2 nd group		
Clinical blood analysis		
ECHT	12-26mm/s	5-15mm/ch
Leukocytes	$10,1-15 \cdot 10^9$ /l	$4,0-9,0 \cdot 10^9$ /l
Erythrocyte	$3,5-3,99 \cdot 10^{12}$ /l	$4,5-5,5 \cdot 10^{12}$ /l
Hb	85-118 g/l	120-140 g/l
Color indicator	0,69- 0,79	0.85-1.05
LII	0,81-2,0	1,3
Biochemical indicators		
Urea	$12 \pm 0,76$ mmol/l	3,0-8,0mmol/l
Creatinine	$124 \pm 0,5$ mkmol/l	53,3-100mkmol/l
Total protein	$50 \pm 0,90$ g/l	65-85 g/l
AsAT	$72 \pm 0,0$ Ed	< 35 Ed
AlAT	$55 \pm 0,5$ Ed	< 40 Ed
Ca	$1,89 \pm 0,0$ mmol/l	2,15-2,50
K	$3,5 \pm 0,0$ mmol/l	3,6-5,5
Na	146,5 mmol/l	135-150
P	$1 \pm 0,60$ mmol/l	0,7-108

Cl	100 ± 0,0 ммол/л	10–55
Clinical urine analysis		
Protein	1 ± 0,56g/l	65-85 g/l
WBC	20 ± 0,5 k/m	2-3k/m
RBC	1 ± 0,5k/m	0-1k/m
Mucus	(+) k/m	Absent
Bacterium	(+) k/m	Absent
3 rd group		
Clinical blood analysis		
ECHT	4 ± 0,0 mm/s	5-15mm/ch
Leukocytes	6 ± 0,65 · 10 ⁹ /l	4,0-9,0 · 10 ⁹ /l
Erythrocyte	4 ± 0,855 · 10 ¹² /l	4,5-5,5 · 10 ¹² /l
Hb	85-118 g/l	120-140 g/l
Color indicator	0,96 ± 0,5	0.85-1.05
LII	0,46 ± 0,5	1,3
Biochemical indicators		
Urea	5 ± 0,95mmol/l	4,0-8,0mmol/l
Creatinine	72 ± 0,5mkmol/l	53,3-110mkmol/l
Total protein	72 ± 0,0 g/l	65-85 g/l
AsAT	20 ± 0,5Ed	< 35 Ed
AlAT	26 ± 0,5 Ed	< 40 Ed
Ca	2 ± 0,33mmol/l	2,15-2,70mmol/l
K	4 ± 0,25 mmol/l	3,6-5,5mmol/l
Na	145 ± 0,5 mmol/l	135-150mmol/l
P	1 ± 0,17 mmol/l	0,87-1,45mmol/l
Cl	101 ± 0,0 mmol/l	97-108mmol/l
clinical urine analysis		
Protein	1,56g/l	65-85 g/l
WBC	10-15 - 28-30k/mda	2-3k/mda
RBC	1-0-1 k/mda	0-1k/mda

4 Discussion

The first group included 9 patients with different localization of the stone. In this group of patients, laboratory parameters were found to be 5-10 times higher than the reference level. The analysis showed that in all patients with urolithiasis we can see the increased erythrocyte sedimentation rate (ECHT), increased leukocyte count, decreased red blood cell count, peripheral blood hemoglobin, abnormal color and increased LII. A study of patients' blood biochemical parameters found a sharp increase in creatinine and urea, and transaminase enzymes were elevated with a predominance of AST. Electrolyte balance indicators: sodium exceeded normal, potassium and chlorine are normal, total protein and calcium decreased. Clinical urine analysis reveals the presence of bacteria in the urine, blood, leukocytes. Bacteria and leukocytes in the urine test indicate the presence and severity of inflammation. If there is blood in the urine, it is likely that the stone has started to move and is damaging the mucous membranes of the urinary tract. In the general analysis of urine in patients of group 1, a large amount of protein was detected in the urine. Leukocytes (WBC) and

erythrocytes (RBCs) were detected in the urine in the visual field. In some patients, bacteria (+) to (++) and mucus (++) to (+++) were detected by microscopy. The above changes indicate a complication of urolithiasis in patients in this group, ie chronic renal failure or secondary infection.

Group 2 included 55 patients. In these patients, the result of clinical and biochemical indicators is 3-5 times higher than normal. Hematological parameters revealed a decrease in the amount of erythrocytes in the peripheral blood, hemoglobin, color was below normal and LII was elevated, ECHT was above normal, leukocytosis. In the study of biochemical parameters of serum of patients revealed elevations of creatinine and urea, a slight increase in enzymes ALAT and AsAT, hypoproteinemia. Electrolyte balance: calcium and potassium below normal or normal; sodium - normal or slightly increased; phosphorus and chlorine were observed to be above normal. Clinical urine analysis: the presence of protein in the urine was preserved, leukocytes and mucus were found in some patients during urinary sediment microscopy.

Group 3 included 11 patients. Hematological parameters: ECHT and leukocytes, hemoglobin, erythrocytes, platelet count were in the normal range. LII - within the norm. Biochemical parameters of the blood: urea, creatinine - normal. Clinical urine analysis: protein traces and 5 to 10 leukocytes were observed in the field of view under a microscope, no erythrocytes were determined. Electrolyte balance: all tested electrolytes were within normal limits.

No changes were observed in the coagulogram analysis in all groups of patients.

The analyzes showed that the volume of medical care and laboratory tests was guaranteed according to the standards, and patients with urinary stone disease were fully provided in accordance with the requirements in the main cases (> 95.0%). Clinical blood and urine analyzes were performed in all patients (100%). A urine test (Zimnitsky test) was performed in 72.5% of patients. In a small number of patients, Addis-Kokovsky urine test was performed (40%) and urinary stone content was not performed at all (0%). Studies of total protein, creatinine, urea, and blood glucose were performed in all patients (100%). Sodium and potassium levels in the blood were examined in 55.0% of patients with urolithiasis. Biochemical analysis of urine (protein, bilirubin) was performed in patients (100%). The frequency and effectiveness of laboratory tests in patients with urinary stone disease were found to meet the standard. All patients underwent clinical urine and blood analyzes, biochemical blood tests on the first day after hospitalization. The frequency of the general blood analysis was 1-3 times, the total urine test was 1 to 3 times, and the biochemical blood test was 1 to 2 times. The study showed that 90.0% of patients underwent laboratory tests included in the list of medical care standards, which are selective analyzes: of which, in most cases: study of total bilirubin and its fractions (92%), study of aminotransferases (92%), which is associated with the observation of complications of the underlying disease, diagnosis and treatment of comorbidities.

5 Conclusion

1. All patients are divided into three groups depending on the variety of localization of stones and the severity of the clinical course, the degree of change in biochemical parameters in urinary stone disease.
2. An increase in LII, leukocytosis, erythrocytopenia was observed in all patients, without exception, regardless of the group of patients. Groups 1 and 2 showed elevated transaminases (predominance of AST), increased urea, creatinine, and decreased total protein.
3. The range of changes in the presence of total protein, erythrocytes, leukocytes in the urine in all groups varied depending on the course of the disease.
4. Analysis of laboratory tests in inpatients shows that the volume, frequency, timeliness of laboratory tests for urolithiasis meet the standards of medical care.
5. Evaluation of laboratory tests for inpatients revealed that some laboratory tests were applied more

than the standard. This is due to the presence of complications of urinary stone diseases and concomitant diseases.

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