Annals of R.S.C.B., ISSN: 1583-6258, Vol. 25, Issue 1, 2021, Pages. 7002 - 7012
Received 15 December 2020; Accepted 05 January 2021.

Clinical and Laboratory Parameters in Children with Urolithiasis and the Quality of Laboratory Tests at the Stage of Stationary Treatment

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Annotation. 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 inpatient patients with a diagnosis of urolithiasis. These studies are relevant in view of the need for constant monitoring by laboratory tests in the management of these patients by clinicians. This will increase the level of competence of specialists in the field of laboratory services, as well as urologists, improve the rationality of prescribing laboratory tests for various nosologies, comparing them with the "Standards of diagnosis and Treatment".
Keywords: laboratory tests, urolithiasis, quality of laboratory tests, biochemical research, immunological research

Introduction: One of the most common pathologies among the population are diseases of the genitourinary sphere [1,2,3]. Among urological diseases, one of the most common is urolithiasis [4,5,6,7]. Due to the widespread prevalence, development and course of ICD remains one of the urgent problems of medicine, especially since over the past decades there has been a tendency to an increase in the frequency of this disease associated with the growing influence of a number of adverse environmental factors on the human body [8,22,23,24].
In addition to the high incidence of morbidity, the urgency of the problem lies in the fact that the disease has a long, often recurrent course. According to statistics, on average, each patient with urolithiasis undergoes inpatient treatment 2 times a year. It was revealed that in patients with ICD observed by urologists and receiving appropriate anti-relapse treatment, the frequency of disease relapses is 3 times lower than in patients who did not receive similar therapy.
Among the causes of disability due to urological diseases, urolithiasis ranks third after malignant neoplasms and pyelonephritis, which is associated with a progressive deterioration in the anatomical and functional state of the kidneys and urinary tract, ending in chronic renal failure.
The polyetiological nature of the disease, lack of knowledge of the role of numerous pathogenetic mechanisms of stone formation complicate both a reasonable choice of treatment tactics and measures of primary and secondary prevention for each patient. Therefore, the question of how best to treat patients with urolithiasis remains relevant.
Stones can form anywhere in the urinary system. Most often, stones are localized in the kidneys and ureters (92%), bladder (7%), urethra (1.4%). Urinarystones, depending on the type of metabolic disorders or the presence of infection, can be of different chemical composition: some of them have a mono-structure, but more often there are polymineral or mixed structure stones.

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Knowledge of the stone structure plays an important role in the choice of treatment and prevention methods [9,20,21].

However, experts agree on one thing: prevention of the disease based on regular clinical and biochemical studies of the patient's blood is quite effective [10,18,19]. In blood tests, with suspected ICD, its cellular composition, ESR, the concentration of total protein and its fractions, calcium, phosphorus, urea, uric acid, creatinine, parathyroid hormone and vitamin D, and alkaline phosphatase activity are determined. In urine tests, attention should be paid to signs of infection, bacteruria, proteinuria, excretion of calcium, phosphorus, magnesium, oxalates, citrates, cystine, urates, creatinine clearance. Biochemical studies in the absence of special indications are carried out upon admission, 1 month after the start of treatment, and then every 2 months until the condition stabilizes [11,16,17].

The success of KSD treatment largely depends on the identification of etiological factors and pathogenetic features of stone formation. Laboratory diagnostics in ICD is important for the correct therapy and monitoring of the objective condition of patients, in view of which it is necessary to correctly and timely prescribe laboratory tests for patients with ICD [12,13,15]

Materials and methods. The addressability of patients (primary and general indicators) with urolithiasis to the 2nd clinic of SamMI for 2019-2020, living in the Samarkand region, was studied. The analysis of the quality of laboratory care at the inpatient stage of patients with urolithiasis (Urolithiasis) was carried out. The material for the study was the information obtained by copying information from the register of the Department of Clinical Laboratory Diagnostics of the 2 clinic of SamMI.

The data of the register of laboratory studies of the patient's condition were analyzed. Materials were taken from the journals: socio-demographic (gender, age, etc.), the diagnosis of the sending institution and the clinical diagnosis, the results of laboratory tests.

All patients underwent examination: general clinical examination, including general urine analysis (OAM); biochemical (urea, creatinine, ALT, AST, calcium, total blood protein); hematological (complete blood count - OAC), leukocyte intoxication index (LII); determination of hemostasis indicators (PTT, PTI, APTT, plasma recalcification).

A laboratory and clinical algorithm for the examination of patients with ICD for early diagnosis and monitoring of inpatients to control treatment has been proposed. All complex examinations (biochemical, hematological, general clinical, coagulogram) were carried out in the department of clinical and laboratory diagnostics of the 2nd clinic of SamMI.

The analyzes were carried out on the following analyzers: general blood test "DIRUI BCC-3600", biochemical tests "Mindray BS-120", general urine analysis on the analyzer "Mindray UA -66", coagulogram on the analyzer "MINILAB 701". The study included 79 children from 1 month to 14 years old (Table 1).

As you can see from the table. 1, the disease is common in both boys and girls. The distribution of patients by age and sex showed that ICD is most common in boys under four years old - 25 (33%), in girls of the same age group - 13 (17%). This is due to the structural features of the genitals in young boys.

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Table 1 Distribution of patients with ICD 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 observation volume was 79 analyzes. Based on the information received, it was determined that the frequency and frequency of the provided laboratory services were consistent with the standard of medical care for patients with urolithiasis. Ciphering of diagnoses was carried out according to the full list and according to the four-digit ICD code of the tenth revision.

Research results

The indicator of treatment with urolithiasis in the 2nd clinic of SamMI in 2019 was 26, in 2020 it reached 53 (Fig. 1).

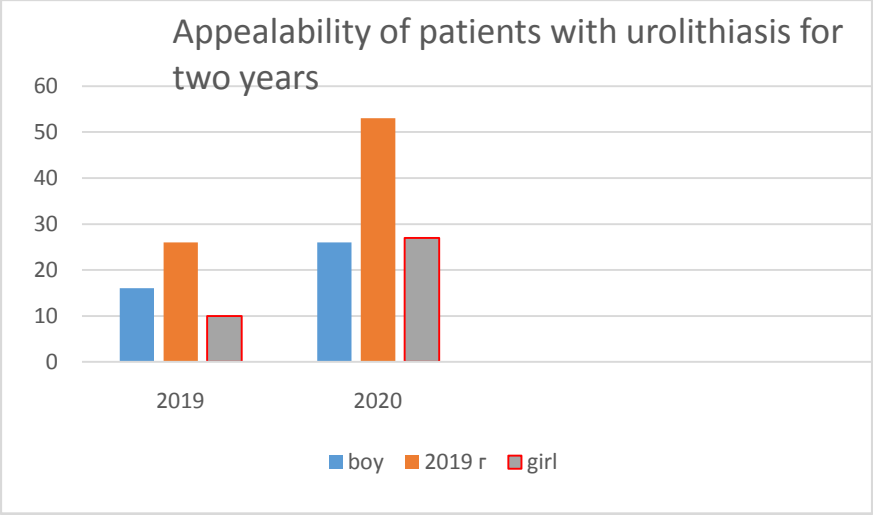

Figure: 1. The indicator of the treatment of patients with urolithiasis to the 2nd clinic of SamMI for 2019-2020.

The distribution of patients by age showed that 29.0% were in the age group from 1 to 3 years. This data indicates that children under one year of age and children in the next age group have a predisposition to ICD.

19.0% - in the group under 1 year old; 24% - in the group from 3 to 7 years old; 12% - in the group from 7 to 10 years old, 16% - in the group from 7 to 14 years old. Boys had more cases (55.0%) than girls (45.0%). This is due to the anatomical features of the male body.

Taking into account the type of change, all patients were divided into 3 groups, depending on the degree of growth of changes in laboratory parameters (Table 2). The first included 9 patients with different localization of the stone. With a complete clinical and laboratoryexamination, it turned out that the erythrocyte sedimentation rate(ESR)in all patients was increased in the KLA, while the number of leukocytes increased, the number of erythrocytes decreased, hemoglobin in the

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peripheral blood, the color index was below normal and LII was increased. In the study of the biochemical parameters of the serum of patients, it was found that creatinine, urea were sharply increased. Transaminase enzymes are elevated with a predominance of AST. Indicators of electrolyte balance: sodium exceeds the norm, potassium and chlorine are within the normal range, total protein and calcium are lowered (hypocalcemia is not associated with KSD).
Clinical (general) urine analysis determines the pH of urine, the presence of bacteria, blood, the number of leukocytes. The analysis shows in which direction the violation of water-salt metabolism occurred: acidic or alkaline, which means the doctor can suggest the type of stones. If bacteria, leukocytes are found, then there is a concomitant inflammatory process. If there is blood in the urine, most likely the stone began to move and damaged the mucous membranes of the urinary tract. Both morning urine and daily urine analysis may be required. The procedure involves the detection of salt crystals in the urine, which serve as the basis for the formation of kidney stones. In patients belonging to the 1st group, during the general analysis of urine, protein was found in the urine to high concentrations, with microscopy of urinary sediment, leukocytes (WBC) and erythrocytes (RBC) are completely in the field of view, in some patients bacteria from (+) to (++) and mucus from (++) to (+++) under microscopy. The above changes indicate that the patients in this group either had chronic renal failure or secondary infections.

In the study of clinical and biochemical parameters of the 2nd group, which included 55 patients, the results of laboratory tests were up to 3-5 times higher than the norm. In hematological parameters, thenumber of erythrocytes and hemoglobin in the peripheral blood is reduced, the color index is below normal, and LII is higher than the normal, ESR is within or above normal, leukocytes in the peripheral blood are moderately increased.

Table2 Clinical and biochemical indicators according to the patient groups

1st group		
Parameters	**Results**	**Normal value**
General blood analysis		
ESR	51 ± 0,5mm/hour	5–15
Hb	58 ± 0,5g/l	120-140 g/l
RBC	$2 \pm 0{,}39 \cdot 10^{12}$	$4{,}5\text{-}5{,}5 \cdot 10^{12}$
MCH	0,8 ± 0,05	0,85-1,05
Peripheral blood leukocytes	$23 \pm 0{,}0 \cdot 10^{9}$	$4{,}0\text{–}8{,}0 \cdot 10^{9}$
LII	4 ± 0,14	<1,3
Biochemical indicators		
Urea	24 ± 0,65mmol/l	3,0–8,0mmol/l
Kreatinine	282 ± 0,5μmol/l	53,3–100μmol/l

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Total protein	35 ± 0,375 g/l	65-85 g/l
AST	118 ± 0,0Ed	< 35 Ed
ALT	90 ± 0,5 Ed	< 40 Ed
Ca	1± 0,58 mmol/l	2,15–2,50mmol/l
K	3 ± 0,8 mmol/l	3,6–5,5mmol/l
Na	173 ± 0,5mmol/l	135–150mmol/l
P	1± 0,74 mmol/l	0,87–1,45mmol/l
Cl	99 ± 0,0 mmol/l	97–108mmol/l
General urine analysis		
Clinic urine tests (urine protein)	1 ± 0,56 g/l	Absent
WBCunder microscopy	Consummately in poise	2–3in poise
RBCunder microscopy	Consummately inpoise	0–1in poise
Mucus	(++) - (+++) in poise	Absent
Bacteria	(++) - (+++) in poise	Absent
2nd group		
General blood analysis		
ESR	12-26mm/hour	5–15mm/hour
WBC	$10,1–15·10^9$	$4,0–9,0·10$
RBC	$3,5- 3,99 ·10^{12}$	$4,5-5.5 ·10^{12}$
Hb	85-118 g/l	120-140 g/l
MCH	0,69- 0,79	0.85-1.05
LII	0,81–2,0	1,3
Biochemical indicators		
Urea	12 ± 0,76mmol/l	3,0–8,0mmol/l
Kreatinine	124± 0,5 µmol/l	53,3–100µmol/l

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Total protein	50 ±0,90 g/l	65-85 g/l
AST	72 ± 0,0 Ed	< 35 Ed
ALT	55 ± 0,5 Ed	< 40 Ed
Ca	1,89 ± 0,0 mmol/l	2,15–2,50
K	3,5 ± 0,0mmol/l	3,6–5,5
Na	146,5 mmol/l	135–150
P	1± 0,60 mmol/l	0,7–108
Cl	100 ± 0,0 mmol/l	10–55
General urine analysis		
Protein	1 ± 0,56g/l	65-85 g/l
WBC	20 ± 0,5 in poise	2–3in poise
RBC	1 ± 0,5 in poise	0–1in poise
Mucus	(+)in poise	Absent
Bacteria	(+)in poise	Absent
3rd group		
General blood analysis		
ESR	4 ±0,0 mm/hour	5–15mm/hour
WBC	$6\pm0,65\cdot10^{9}$	4,0–9,0·10
RBC	$4\pm 0,855\cdot10^{12}$	$4,5\text{-}5.5\cdot10^{12}$
Hb	85-118 g/l	120-140 g/l
MCH	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
Kreatinine	72 ± 0,5µmol/l	53,3–110µmol/l
Total protein	72 ± 0,0 g/l	65-85 g/l
AST	20 ± 0,5Ed	< 35 Ed
ALT	26± 0,5 Ed	< 40 Ed
Ca	2±0,33mmol/l	2,15–2,70mmol/l

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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
General urine analysis		
Protein	1,56g/l	65-85 g/l
WBC	10-15 - 28-30in poise	2–3in poise
RBC	1-0-1 in poise	0–1in poise

When studying the biochemical parameters of the serum of patients, it was found that creatinine and urea are higher than normal. The enzymes ALT and ASAT are slightly increased. Hypoproteinemia was found in the blood serum. Electrolyte balance: calcium and potassium - below or within normal limits; sodium - within or above the norm; phosphorus and chlorine are above normal.

OAM: the presence of protein in the urine remains, microscopy of urinary sediment has an increased number of leukocytes and erythrocytes (the bulk of erythrocytes due to unchanged forms), in some patients mucus was found.

3rd group (11 patients). Hematological parameters: ESR and leukocyte count within normal limits. Hemoglobin, erythrocytes, platelets are at the reference level, LII is closer to normal.

Biochemical blood parameters: urea, creatinine - within normal limits;

OAM: traces of protein; microscopy observed leukocytes from 5 to 10 in the field of view, erythrocytes were absent. Electrolyte balance: all investigated electrolytes are within normal limits. No changes were observed in the coagulogram in all patients.

The analysis showed that the volume of laboratory tests, guaranteed by the standards of medical care, patients with ICD were provided in most cases (> 95.0%) in full in accordance with the requirements of the EMS. General blood and urine tests were prescribed for all patients (100%), regardless of the form of the ICD, in almost the same volume. Urine analysis (Zimnitsky test) was performed in 72.5% of patients. The least number of patients was determined by the Addis-Kakovsky urine volume (14%) and the analysis of urinary stones was not performed at all (0%). The study of the level of total protein, creatinine, urea, blood glucose was carried out in all patients (100%). The level of sodium and potassium in the blood was investigated in 55.0% of patients with KSD. Biochemical analysis of urine (protein, bilirubin) was performed in 100% of the examined patients. The frequency and efficiency of providing laboratory tests to patients with ICD and compliance with the EMS were analyzed. All patients underwent general urine and blood tests on the first day after admission to the hospital.

The frequency of providing a general blood test varied from 1 time (on average 2.9), a general urine test from 1 time to 3, a biochemical blood test from 1 to 2.

The study showed that 90.0% of patients underwent laboratory tests included in the list of the standard of medical care. Some patients are assigned random tests. Of these, in most cases: the study of total bilirubin and its fractions (92%), the study of aminotransferases (92%), which was probably due to the nature of the complications of the underlying disease, concomitant diseases and some features of monitoring the therapy.

Findings:

1. All patients were divided into three groups depending on the degree of increase in changes in biochemical parameters in ICD with different types of localization of stones and the severity of the clinical picture.

2. Regardless of the groups of patients, all patients without exception have an increase in LII and leukocytosis, erythrocytopenia. For groups 1 and 2, another diagnostic indicator is an increase in transaminase in the blood (with a predominance of AST).

3. The increase in total protein in the urine is typical for all groups of patients. Erythrocytes were increased in urine by microscopy.

4. The analysis of the laboratory studies of inpatients showed that the volume, frequency, availability, timeliness of laboratory tests according to the standard of medical care for urolithiasis correspond to the recommended ones, which positively characterizes the work of clinicians and the laboratory department of the hospital of the 2nd clinic of SamMI.

5. Evaluation of the laboratory tests carried out for inpatients revealed the appointment of some laboratory tests in excess of the EMS, which is due to complications of the ICD and the nature of the course of the disease.

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