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ЕЖЕМЕСЯЧНЫЙ НАУЧНЫЙ ЖУРНАЛ

Медицинские новости Грузии

საქართველოს სამედიცინო სიახლენი

GEORGIAN MEDICAL NEWS

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GMN: Georgian Medical News is peer-reviewed, published monthly journal committed to promoting the science and art of medicine and the betterment of public health, published by the GMN Editorial Board since 1994. GMN carries original scientific articles on medicine, biology and pharmacy, which are of experimental, theoretical and practical character; publishes original research, reviews, commentaries, editorials, essays, medical news, and correspondence in English and Russian.

GMN is indexed in MEDLINE, SCOPUS, PubMed and VINITI Russian Academy of Sciences. The full text content is available through EBSCO databases.

GMN: Медицинские новости Грузии - ежемесячный рецензируемый научный журнал, издаётся Редакционной коллегией с 1994 года на русском и английском языках в целях поддержки медицинской науки и улучшения здравоохранения. В журнале публикуются оригинальные научные статьи в области медицины, биологии и фармации, статьи обзорного характера, научные сообщения, новости медицины и здравоохранения. Журнал индексируется в MEDLINE, отражён в базе данных SCOPUS, PubMed и ВИНИТИ РАН. Полнотекстовые статьи журнала доступны через БД EBSCO.

GMN: Georgian Medical News – საქართველოს სამედიცინო სიახლენი – არის ყოველთვიური სამეცნიერო სამედიცინო რეცენზირებადი ჟურნალი, გამოიცემა 1994 წლიდან, წარმოადგენს სარედაქციო კოლეგიისა და აშშ-ის მეცნიერების, განათლების, ინდუსტრიის, ხელოვნებისა და ბუნებისმეტყველების საერთაშორისო აკადემიის ერთობლივ გამოცემას. GMN-ში რუსულ და ინგლისურ ენებზე ქვეყნდება ექსპერიმენტული, თეორიული და პრაქტიკული ხასიათის ორიგინალური სამეცნიერო სტატიები მედიცინის, ბიოლოგიისა და ფარმაციის სფეროში, მიმოხილვითი ხასიათის სტატიები.

ჟურნალი ინდექსირებულია MEDLINE-ის საერთაშორისო სისტემაში, ასახულია SCOPUS-ის, PubMed-ის და ВИНИТИ РАН-ის მონაცემთა ბაზებში. სტატიების სრული ტექსტი ხელმისაწვდომია EBSCO-ს მონაცემთა ბაზებიდან.

WEBSITE

www.geomednews.com

К СВЕДЕНИЮ АВТОРОВ!

При направлении статьи в редакцию необходимо соблюдать следующие правила:

1. Статья должна быть представлена в двух экземплярах, на русском или английском языках, напечатанная через **полтора интервала на одной стороне стандартного листа с шириной левого поля в три сантиметра**. Используемый компьютерный шрифт для текста на русском и английском языках - **Times New Roman** (**Кириллица**), для текста на грузинском языке следует использовать **AcadNusx.** Размер шрифта - **12**. К рукописи, напечатанной на компьютере, должен быть приложен CD со статьей.

2. Размер статьи должен быть не менее десяти и не более двадцати страниц машинописи, включая указатель литературы и резюме на английском, русском и грузинском языках.

3. В статье должны быть освещены актуальность данного материала, методы и результаты исследования и их обсуждение.

При представлении в печать научных экспериментальных работ авторы должны указывать вид и количество экспериментальных животных, применявшиеся методы обезболивания и усыпления (в ходе острых опытов).

4. К статье должны быть приложены краткое (на полстраницы) резюме на английском, русском и грузинском языках (включающее следующие разделы: цель исследования, материал и методы, результаты и заключение) и список ключевых слов (key words).

5. Таблицы необходимо представлять в печатной форме. Фотокопии не принимаются. **Все цифровые, итоговые и процентные данные в таблицах должны соответствовать таковым в тексте статьи**. Таблицы и графики должны быть озаглавлены.

6. Фотографии должны быть контрастными, фотокопии с рентгенограмм - в позитивном изображении. Рисунки, чертежи и диаграммы следует озаглавить, пронумеровать и вставить в соответствующее место текста **в tiff формате**.

В подписях к микрофотографиям следует указывать степень увеличения через окуляр или объектив и метод окраски или импрегнации срезов.

7. Фамилии отечественных авторов приводятся в оригинальной транскрипции.

8. При оформлении и направлении статей в журнал МНГ просим авторов соблюдать правила, изложенные в «Единых требованиях к рукописям, представляемым в биомедицинские журналы», принятых Международным комитетом редакторов медицинских журналов - http://www.spinesurgery.ru/files/publish.pdf и http://www.nlm.nih.gov/bsd/uniform_requirements.html
В конце каждой оригинальной статьи приводится библиографический список. В список литературы включаются все материалы, на которые имеются ссылки в тексте. Список составляется в алфавитном порядке и нумеруется. Литературный источник приводится на языке оригинала. В списке литературы сначала приводятся работы, написанные знаками грузинского алфавита, затем кириллицей и латиницей. Ссылки на цитируемые работы в тексте статьи даются в квадратных скобках в виде номера, соответствующего номеру данной работы в списке литературы. Большинство цитированных источников должны быть за последние 5-7 лет.

9. Для получения права на публикацию статья должна иметь от руководителя работы или учреждения визу и сопроводительное отношение, написанные или напечатанные на бланке и заверенные подписью и печатью.

10. В конце статьи должны быть подписи всех авторов, полностью приведены их фамилии, имена и отчества, указаны служебный и домашний номера телефонов и адреса или иные координаты. Количество авторов (соавторов) не должно превышать пяти человек.

11. Редакция оставляет за собой право сокращать и исправлять статьи. Корректура авторам не высылается, вся работа и сверка проводится по авторскому оригиналу.

12. Недопустимо направление в редакцию работ, представленных к печати в иных издательствах или опубликованных в других изданиях.

При нарушении указанных правил статьи не рассматриваются.

REQUIREMENTS

Please note, materials submitted to the Editorial Office Staff are supposed to meet the following requirements:

1. Articles must be provided with a double copy, in English or Russian languages and typed or compu-ter-printed on a single side of standard typing paper, with the left margin of **3** centimeters width, and **1.5** spacing between the lines, typeface - **Times New Roman** (**Cyrillic**), print size - **12** (referring to Georgian and Russian materials). With computer-printed texts please enclose a CD carrying the same file titled with Latin symbols.

2. Size of the article, including index and resume in English, Russian and Georgian languages must be at least 10 pages and not exceed the limit of 20 pages of typed or computer-printed text.

3. Submitted material must include a coverage of a topical subject, research methods, results, and review.

Authors of the scientific-research works must indicate the number of experimental biological species drawn in, list the employed methods of anesthetization and soporific means used during acute tests.

4. Articles must have a short (half page) abstract in English, Russian and Georgian (including the following sections: aim of study, material and methods, results and conclusions) and a list of key words.

5. Tables must be presented in an original typed or computer-printed form, instead of a photocopied version. **Numbers, totals, percentile data on the tables must coincide with those in the texts of the articles.** Tables and graphs must be headed.

6. Photographs are required to be contrasted and must be submitted with doubles. Please number each photograph with a pencil on its back, indicate author's name, title of the article (short version), and mark out its top and bottom parts. Drawings must be accurate, drafts and diagrams drawn in Indian ink (or black ink). Photocopies of the X-ray photographs must be presented in a positive image in **tiff format**.

Accurately numbered subtitles for each illustration must be listed on a separate sheet of paper. In the subtitles for the microphotographs please indicate the ocular and objective lens magnification power, method of coloring or impregnation of the microscopic sections (preparations).

7. Please indicate last names, first and middle initials of the native authors, present names and initials of the foreign authors in the transcription of the original language, enclose in parenthesis corresponding number under which the author is listed in the reference materials.

8. Please follow guidance offered to authors by The International Committee of Medical Journal Editors guidance in its Uniform Requirements for Manuscripts Submitted to Biomedical Journals publication available online at: http://www.nlm.nih.gov/bsd/uniform_requirements.html
http://www.icmje.org/urm_full.pdf
In GMN style for each work cited in the text, a bibliographic reference is given, and this is located at the end of the article under the title "References". All references cited in the text must be listed. The list of references should be arranged alphabetically and then numbered. References are numbered in the text [numbers in square brackets] and in the reference list and numbers are repeated throughout the text as needed. The bibliographic description is given in the language of publication (citations in Georgian script are followed by Cyrillic and Latin).

9. To obtain the rights of publication articles must be accompanied by a visa from the project instructor or the establishment, where the work has been performed, and a reference letter, both written or typed on a special signed form, certified by a stamp or a seal.

10. Articles must be signed by all of the authors at the end, and they must be provided with a list of full names, office and home phone numbers and addresses or other non-office locations where the authors could be reached. The number of the authors (co-authors) must not exceed the limit of 5 people.

11. Editorial Staff reserves the rights to cut down in size and correct the articles. Proof-sheets are not sent out to the authors. The entire editorial and collation work is performed according to the author's original text.

12. Sending in the works that have already been assigned to the press by other Editorial Staffs or have been printed by other publishers is not permissible.

Articles that Fail to Meet the Aforementioned Requirements are not Assigned to be Reviewed.

ავტორთა საყურადღებოდ!

რედაქციაში სტატიის წარმოდგენისას საჭიროა დავიცვათ შემდეგი წესები:

1. სტატია უნდა წარმოადგინოთ 2 ცალად, რუსულ ან ინგლისურ ენებზე,დაბეჭდილი სტანდარტული ფურცლის 1 გვერდზე, 3 სმ სიგანის მარცხენა ველისა და სტრიქონებს შორის 1,5 ინტერვალის დაცვით. გამოყენებული კომპიუტერული შრიფტი რუსულ და ინგლისურენოვან ტექსტებში - **Times New Roman (Кириллица)**, ხოლო ქართულენოვან ტექსტში საჭიროა გამოვიყენოთ **AcadNusx.** შრიფტის ზომა – 12. სტატიას თან უნდა ახლდეს CD სტატიით.

2. სტატიის მოცულობა არ უნდა შეადგენდეს 10 გვერდზე ნაკლებს და 20 გვერდზე მეტს ლიტერატურის სიის და რეზიუმეების (ინგლისურ, რუსულ და ქართულ ენებზე) ჩათვლით.

3. სტატიაში საჭიროა გაშუქდეს: საკითხის აქტუალობა; კვლევის მიზანი; საკვლევი მასალა და გამოყენებული მეთოდები; მიღებული შედეგები და მათი განსჯა. ექსპერიმენტული ხასიათის სტატიების წარმოდგენისას ავტორებმა უნდა მიუთითონ საექსპერიმენტო ცხოველების სახეობა და რაოდენობა; გაუტკივარებისა და დაძინების მეთოდები (მწვავე ცდების პირობებში).

4. სტატიას თან უნდა ახლდეს რეზიუმე ინგლისურ, რუსულ და ქართულ ენებზე არანაკლებ ნახევარი გვერდის მოცულობისა (სათაურის, ავტორების, დაწესებულების მითითებით და უნდა შეიცავდეს შემდეგ განყოფილებებს: მიზანი, მასალა და მეთოდები, შედეგები და დასკვნები; ტექსტუალური ნაწილი არ უნდა იყოს 15 სტრიქონზე ნაკლები) და საკვანძო სიტყვების ჩამონათვალი (key words).

5. ცხრილები საჭიროა წარმოადგინოთ ნაბეჭდი სახით. ყველა ციფრული, შემაჯამებელი და პროცენტული მონაცემები უნდა შეესაბამებოდეს ტექსტში მოყვანილს.

6. ფოტოსურათები უნდა იყოს კონტრასტული; სურათები, ნახაზები, დიაგრამები - დასათაურებული, დანომრილი და სათანადო ადგილას ჩასმული. რენტგენოგრამების ფოტოასლები წარმოადგინეთ პოზიტიური გამოსახულებით **tiff** ფორმატში. მიკროფოტოსურათების წარწერებში საჭიროა მიუთითოთ ოკულარის ან ობიექტივის საშუალებით გადიდების ხარისხი, ანათალების შეღებვის ან იმპრეგნაციის მეთოდი და აღნიშნოთ სურათის ზედა და ქვედა ნაწილები.

7. სამამულო ავტორების გვარები სტატიაში აღინიშნება ინიციალების თანდართვით, უცხოურისა – უცხოური ტრანსკრიპციით.

8. სტატიას თან უნდა ახლდეს ავტორის მიერ გამოყენებული სამამულო და უცხოური შრომების ბიბლიოგრაფიული სია (ბოლო 5-8 წლის სიღრმით). ანბანური წყობით წარმოდგენილ ბიბლიოგრაფიულ სიაში მიუთითეთ ჯერ სამამულო, შემდეგ უცხოელი ავტორები (გვარი, ინიციალები, სტატიის სათაური, ჟურნალის დასახელება, გამოცემის ადგილი, წელი, ჟურნალის №, პირველი და ბოლო გვერდები). მონოგრაფიის შემთხვევაში მიუთითეთ გამოცემის წელი, ადგილი და გვერდების საერთო რაოდენობა. ტექსტში კვადრატულ ფჩხილებში უნდა მიუთითოთ ავტორის შესაბამისი N ლიტერატურის სიის მიხედვით. მიზანშეწონილია, რომ ციტირებული წყაროების უმეტესი ნაწილი იყოს 5-6 წლის სიღრმის.

9. სტატიას თან უნდა ახლდეს: ა) დაწესებულების ან სამეცნიერო ხელმძღვანელის წარდგინება, დამოწმებული ხელმოწერითა და ბეჭდით; ბ) დარგის სპეციალისტის დამოწმებული რეცენზია, რომელშიც მითითებული იქნება საკითხის აქტუალობა, მასალის საკმაობა, მეთოდის სანდოობა, შედეგების სამეცნიერო-პრაქტიკული მნიშვნელობა.

10. სტატიის ბოლოს საჭიროა ყველა ავტორის ხელმოწერა, რომელთა რაოდენობა არ უნდა აღემატებოდეს 5-ს.

11. რედაქცია იტოვებს უფლებას შეასწოროს სტატია. ტექსტზე მუშაობა და შეჯერება ხდება საავტორო ორიგინალის მიხედვით.

12. დაუშვებელია რედაქციაში ისეთი სტატიის წარდგენა, რომელიც დასაბეჭდად წარდგენილი იყო სხვა რედაქციაში ან გამოქვეყნებული იყო სხვა გამოცემებში.

აღნიშნული წესების დარღვევის შემთხვევაში სტატიები არ განიხილება.

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REPRESENTATION OF KIDNEY DAMAGE AT THE MOLECULAR LEVEL IN PATIENTS WITH UROLITHIASIS BASED ON THE STUDY OF ENZYMATIC TEST INDICATORS

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Abstract.

Aim: The aim of the work is to improve the results of early diagnosis of acute infectious kidney diseases at the molecular level in urolithiasis (urinary stone disease) through the study of enzymatic test indicators.

Materials and methods: Enzymatic tests (NGAL, IL-1β, β2-microglobulin) were investigated at the molecular level using the IFA method in the urine of patients with urolithiasis. Comparative and prognostic significance of the conducted treatment was established between the groups of patients, and an algorithm was developed based on the results of kidney damage predictors.

Results: It was found that the indicators of general laboratory analysis in patients with urolithiasis within the first 24-48 hours do not reliably indicate the absence of an infectious-inflammatory process in the kidneys and the development of renal failure. It was determined that an increase in the inflammation predictor indicators in more than 50% of patients indicates the development of infectious-inflammatory complications within the first 12-24 hours before the occurrence of general laboratory and clinical changes. The assessment of the effectiveness of conservative therapy in groups IA and II revealed that complications of the inflammatory process in the kidneys were observed five times more frequently in group II (comparison) than in group IA.

Conclusions: The use of enzymatic tests as markers for early kidney damage allows for the classification of two main groups of patients: those requiring conservative treatment and those requiring urgent surgical intervention. This significantly reduces the frequency of inflammatory, purulent-septic complications and improves the treatment outcomes for patients with upper urinary tract obstruction in urolithiasis.

Key words. Urolithiasis, pyelonephritis, kidney damage markers, NGAL, IL-1β, β2-microglobulin, CRP-1.

Introduction.

Despite the progress in the study of urolithiasis (urinary stone disease), the problem of its occurrence remains one of the most challenging and unresolved [1-5]. The course of the disease is accompanied by infectious-inflammatory processes and frequent recurrences in more than 50% of cases, which can lead to complications such as renal failure, disability, and even death [6-9]. In 60-70% of urolithiasis patients, the presence of infection not only exacerbates the disease but also significantly worsens its further prognosis [8,10-14]. The combination of upper urinary tract dysfunctions with infectious-inflammatory processes leads to a vicious cycle. Infections and inflammatory processes, along with sclerotic changes in the kidneys, result in urinary flow disturbances. According to scientific studies found in the literature, chronic pyelonephritis contributes to recurrences and complicates urolithiasis in 85% of patients [1,9,11,15].

Early diagnosis, timely establishment of the diagnosis, and determination of treatment tactics play a crucial role in the final outcomes of the disease and significantly reduce complications related to the kidneys [1,8,11,16-18]. Despite significant progress in diagnosing and treating acute pyelonephritis, there remains a high frequency of complications, such as urosepsis, bacteriotoxic shock, acute and chronic renal failure, leading to high mortality rates among these patients [6,13,19]. According to some literature, there is not always a direct correlation between the severity of the disease and the changes observed in the complete blood count (CBC) and complete urine analysis (CUA). In cases of severe infection and patient debilitation, leukocytosis may be absent, and sometimes leukopenia is observed. This phenomenon is associated with the suppression of the immune system in the body [2,16,18,20]. In cases of urinary tract obstruction from the kidneys, purulent forms of acute obstructive pyelonephritis may develop at the end of the first day of the disease.

By the end of the second day, the inflammatory process begins to spread and affect the parenchyma of the affected kidney, leading to significant disturbances in enzymatic processes, indicating the development of renal failure. An important characteristic of its course in the case of nephrolithiasis is the difficulty in determining the moment of sepsis and multiple organ failure [1,2,6,9,14].

Currently, proteinuria, elevated serum creatinine levels, and reduced glomerular filtration rate are considered markers of kidney damage. However, these markers are detected only in the late stage of chronic kidney disease when conservative therapy may not be effective, and the damage process becomes irreversible. Therefore, there is significant attention being given to the search for biomarkers of acute and chronic kidney injury that can be detected in urine, as well as studying the role of cytokines in the inflammatory response. This allows for the detection of pathological changes in the kidneys at early stages, assessment of the degree of damage, and evaluation of the intensity of inflammation and fibrogenesis [1,21-24]. To assess the functional status of renal parenchyma, investigations of the

activity of tissue enzymes in urine and blood are conducted. However, the activity of enzymes in blood remains almost unchanged in kidney diseases and does not reflect the severity of kidney damage [1,11,16,18,23]. Enzymatic tests provide a better reflection of metabolic processes at the molecular level, even when clinical and laboratory indicators have minimal expression [9,16,21,20,23].

The purpose of this study was to improve the results of early diagnosis of acute infectious kidney diseases at the molecular level in urolithiasis (urinary stone disease) through the study of enzymatic test indicators.

Materials and Methods.

The research was conducted at the urology department of the Emergency and Ambulance Hospital in Zaporizhzhia, which serves as the clinical base for the Department of Urology at Zaporizhzhia State Medical University.

The inclusion criteria for the study were individuals of both genders aged 18 years and older with ureteral or urinary stone(s) of various localizations. The exclusion criteria were active concomitant pathologies and the presence of oncological diseases requiring specific therapy.

To achieve the set goal, the results of examination and treatment of 142 patients during the period from 2018 to 2019 were analyzed. Among them, 70 patients were analyzed using the enzyme-linked immunosorbent assay (ELISA) of urine. For the determination of reference values, 30 individuals who were considered clinically healthy were examined. To evaluate the course of pyelonephritis and long-term complications after conservative treatment, a retrospective analysis of the medical histories of 42 patients with urolithiasis was conducted, excluding the results of enzymatic tests.

In this study, patients and healthy individuals were divided into three clinical groups, as described below:

Group I: This group consisted of patients with urolithiasis (urinary stone disease) who underwent enzymatic urine tests. A total of 70 patients were included in this group.

Subgroup IA: This subgroup included patients from Group I whose inflammatory markers were within normal range or showed elevated levels of only one of the three early kidney damage markers. These patients received conservative therapy. The number of patients in this subgroup was 48.

Subgroup IB: In this subgroup, patients from Group I were identified with elevated levels of two or more inflammation markers. These patients received surgical treatment. The number of patients in this subgroup was 22.

Group II: This group consisted of patients for whom a retrospective analysis of their medical histories was conducted, specifically comparing the treatment outcomes of pyelonephritis and long – term complications. There were 42 patients in this group.

Group III: This group comprised 30 individuals who were considered conditionally clinically healthy and served as the control group.

All groups were homogeneous in terms of gender and age ($p \geq 0,05$).

All patients included in the study underwent a collection of anamnestic data and comprehensive clinical and laboratory examinations. The main criterion for the clinical – diagnostic effectiveness of using inflammation predictors was the defection of early signs of infectious – inflammatory complications in patients with urinary tract dysfunction in groups IA and IB

Table 1. *Surgical Treatment of Patients in Group IB, (n/%).*

Surgical methods for patients in group IB, (n=22)	**Number, (n/%)**
Contact Ureterolithotripsy (CUL)	9 (40,9%)
Ureterolithoextraction	8 (36,4%)
Extracorporeal Shock Wave Lithotripsy (ESWL)	4 (18,2%)
Percutaneous Nephrostomy + ESWL	1 (4,5%)

The obtained results were entered into a Microsoft Excel 2010 database and underwent statistical processing using a licensed Statistical 13.0 software package (license number JPZ804I382130ARCN10-J).

Conservative therapy (n=48) was based on providing immediate urgent care for renal colic according to the current protocols of medical care.

For patients who showed signs of infectious – inflammatory processes along with urinary tract obstruction and persistent pain syndrome, urgent surgical intervention was performed (n=22). The choice of the surgical method depended on the results of the IFAs of early kidney damage markers, the overall condition of the patient, as well as the results of general laboratory and instrumental examinations. All patients in Group IB, diagnosed with infectious – inflammatory processes, underwent lithotripsy or stone extraction, kidney drainage, and received antibacterial, anti – inflammatory, and infusion therapy (Table 1).

Results.

According to the findings of the conducted study in patients with urolithiasis who were hospitalized within the first hours, the detection of early preclinical signs of infectious – inflammatory complications was most effective using the Immunoassay (IFA) test for NGAL, IL - 1β, and β2 – microglobulin in urine. The research revealed that MSR – 1 did not provide a high informative value compared to other predictors, and therefore further analysis of this marker was not carried out.

For β2 – microglobulin, the following results were obtained: the cut – off point value was 0,13µg/ml sensitivity was 95,5%, specificity was 66,7%, and accuracy was 75,5%. The area under the ROC – curve (AUC) is 0,707. More detailed data can be found in Table 2 and Figure 1 of the study.

The parameters for IL - 1β were as follows: the cut - off point value was 6 pg/ml, sensitivity was 86,4%, specificity was 85,4%, and accuracy was 85,7%. The area under the ROC – curve (AUC) is 0,689 (see Figure 2 and Table 3).

The ROC – analysis with the constructed logistic regression model for NGAL yielded the following results: the cut - off point value was 11 ng/ml, sensitivity was 72,7%, specificity was 100%, and accuracy was 91,4%. The area under the ROC – curve (AUC) is 0,678 (see Figure 3 and Table 4).

During the examination of results of Group IA, which included 48 patients, it was found that the indicators of leukocytes, neutrophils, erythrocyte sedimentation rate (ESR), and creatinine were within normal limits at the time of hospitalization. This indicated the absence of significant signs

Table 2. *Results of assessment of β2 - microglobulin in groups IA and IB.*

Group	Value β2 - microglobulin	
	<0,13µg/ml	**≥ 0,13µg/ml**
Conservative treatment (IA), (n=48)	32	16
Operative treatment (IB), (n=22)	1	21
In total	33	37

Table 3. *Results of assessment of IL – 1β in groups IA and IB.*

Group	Value IL – 1β	
	<6 pg/ml	**≥ 6 pg/ml**
Conservative treatment (IA), (n=48)	41	7
Operative treatment (IB), (n=22)	3	19
In total	44	26

Table 4. *Results of assessment of NGAL в групах IA та IB.*

Group	Value NGAL	
	<11 ng/ml	**≥ 11 ng/ml**
Conservative treatment (IA), (n=48)	48	–
Operative treatment (IB), (n=22)	6	16
In total	54	16

Table 5. *Methods of removing stones of the upper urinary tract, (n=70).*

Conservative treatment, (IA) n=48	**n/%**	**Operative treatment, (IB) n=22+3**	**n/%**
Independent removal of calculi	34(70,8%)	Percutaneous nephrostomy + remote lithotripsy	3(12,0%)
Transferred to group IB	3 (6,3%)	Contact ureterolithotripsy	10(40,0%)
Planned surgical treatment:	11(22,9%)	Ureterolithoextraction	8(32,0%)
– remote lithotripsy;	8(72,7%)	Remote lithotripsy	4(16,0%)
– contact ureterolithotripsy	3(27,3%)		

Table 6. *Indicators of kidney dopplerography in patients of group I (n=70) on the 10th day after the treatment, M±m.*

Indexes	**Conservative treatment (IA), (n=48)**	**Operative treatment (IB), (n=22)**
V_{max}, m/s	0,68±0,09	0,66±0,09
V_{min},m/s	0,19±0,02	0,17±0,02
RI	0,65±0,04	0,78±0,04
PI	0,96±0,06	1,02±0,02
S/D	0,31±0,03	0,35±0,03

of an infectious – inflammatory process and the development of renal insufficiency. Detailed data can be found in Figure 4 of the study.

In Group IB (n=22), leukocytosis with a shift to the left was observed in 19 patients (86,4%) at the time of hospitalization. Elevated creatinine levels were found in 11 individuals (50,0%) (see Figure 5).

The study revealed that the absence of pronounced leukocytosis, left shift in the leukocyte count, elevated ESR (erythrocyte sedimentation rate), and creatinine levels within the first 24-48 hours after hospitalization cannot fully confirm the absence of an infectious-inflammatory process in the kidneys and the development of renal insufficiency. This means that only CBC (complete blood count) and biochemical analysis of blood are not sufficient for early diagnosis of infectious-inflammatory processes in the kidneys in patients with urinary tract dysfunction.

In the further analysis of the group of patients with IA, after 7 days of therapy, spontaneous passage of the kidney stone was observed in 34 patients (70.8%). In 11 patients (27.9%), there was no spontaneous passage of the stone, and these patients underwent planned surgical intervention. Additionally, in 3 patients (6.3%), exacerbation of obstructive symptoms occurred on the 5th day of conservative treatment, and they were transferred to group IB for urgent surgical management. After performing the urgent surgical intervention in group IB, normalization of leukocyte and creatinine levels was observed on the 10th day post-surgery. Detailed results of these observations can be found in Tables 5 and Figure 4 of the study.

The restoration of kidney microcirculation, as assessed by color Doppler mapping (CDM), was diagnosed in groups IA and IB on the 10th day after the treatment was administered (see Table 6).

In the conducted retrospective analysis of 42 medical case histories, a comparative assessment of the effectiveness of conservative treatment was carried out in patients who did not undergo instrumental functional analysis (IFA) of urine with the determination of predictor levels. Based on the obtained data, patients in groups IA and IB, who underwent IFA of urine, showed a consistently positive trend in laboratory indicators on the 10th day of treatment and on the 30th day after therapy. However, in group II, which was used for comparison, a significant negative trend in the administered treatment was observed, leading to the development of purulent-septic complications and, consequently, necessitating urgent surgical intervention. The proposed information is presented in tabular format in Table 7.

Discussion.

During the analysis of the nearest complications that occurred within the first 10-14 days of treatment, it was found that the frequency of complications in group II was 5 times higher compared to group IA. In the comparative assessment of complications one month after conservative treatment, it was revealed that the frequency of complications in group II was 3 times higher than in group IA. This information is presented in tabular format in Table 8.

An algorithm has been developed for the examination and selection of treatment methods in patients with urodynamic disorders, which includes the following steps. During hospitalization, data on complaints and a detailed history of past and concomitant somatic diseases are collected. The next step in early diagnosis is the performance of instrumental functional analysis (IFA) of urine with the determination of various markers such as NGAL, IL-1β, β2-microglobulin. This helps to detect signs of infectious-inflammatory processes and the development of renal insufficiency. Subsequently, a study of general laboratory indicators is conducted as an additional guide to determine the presence of an inflammatory process and

Table 7. *Dynamics of indicators of the nitrogen excreting function of the kidneys (average indicators) in patients of all experimental groups (n=142), M±m.*

Indexes	IA group, n=48			IB group, n=22			II group (comparison) n=42			III group (contr.) n=30
	I day	10 day	30 day	I day	10 day	30 day	I day	10 day	30 day	
Creatinine, µmol/L	92,3 ±6,8*	89,0 ±6,4*	74,0 ±4,2*	138,0 ±16,1*	108,2 ±12,4*	103,0 ±14,3*	105,0 ±16,3*	123,0 ±14,5*	110,3 ±14,2*	95,0 ±6,8*
leukocytosis, 10^9/L	8,6 ±0,54*	8,5 ±0,7*	7,9 ±0,44*	11,7 ±0,68*	9,7 ±0,42*	8,0 ±0,52*	9,08 ±0,75*	12,01 ±0,68*	0,6 ±1,2*	6,5 ±0,42*
ESR, mm/hour	9,4 ±1,9*	10,3 ±3,20*	7,3 ±3,4*	19,6 ±3,6*	18,1 ±2,1*	15,3 ±3,2*	16,4 ±3,4*	26,4 ±1,03*	19,1 ±6,9*	8,4 ±2,3*
Rod nuclear, %	6,0 ±1,2*	6,75 ±1,13*	6,01 ±0,84*	9,45 ±1,4*	8,2 ±1,2*	6,05 ±0,72*	9,0 ±1,4*	11,45 ±1,47*	9,01 ±2,3*	5,01 ±0,74*
Note:* - the difference in indicators regarding treatment is likely, P≤0,05.										

Table 8. *Frequency of complications during conservative treatment of patients with ureteral stones, n=90.*

Complication	IA group (conservative treatment), n=48				II (comparison) group, n=42			
	10-14 days		1 month		10-14 days		1 month	
	Abs.	%	Abs.	%	Abs.	%	Abs.	%
Exacerbation of hr. pyelonephritis	3	6,25%	1	2,1%	14	33,3%	8	19,0%
Acute pyelonephritis	3	6,25%	–	–	10	23,8%	5	11,9%
Kidney carbuncle	–	–	–	–	2	4,8%	–	–
Persistent leukocyturia	6	12,5%	4	8,3%	28	66,7%	22	52,4%
Increasing the level of azotemia	2	4,2%	–	–	31	73,8%	19	45,2%
In total	14		5		85		54	

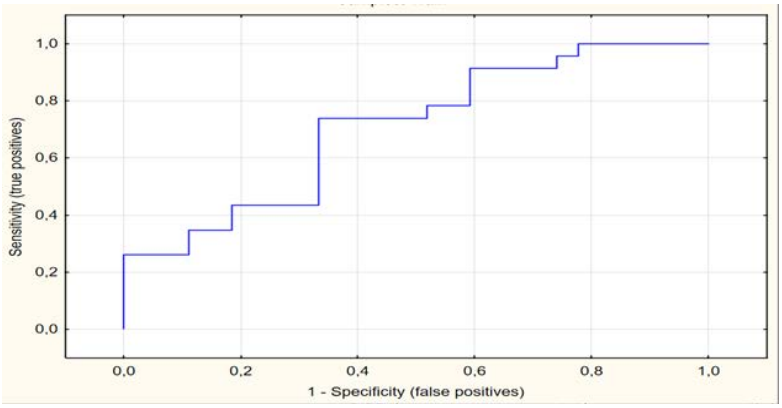


Figure 1. *ROC- curve for β2-microglobulin.*

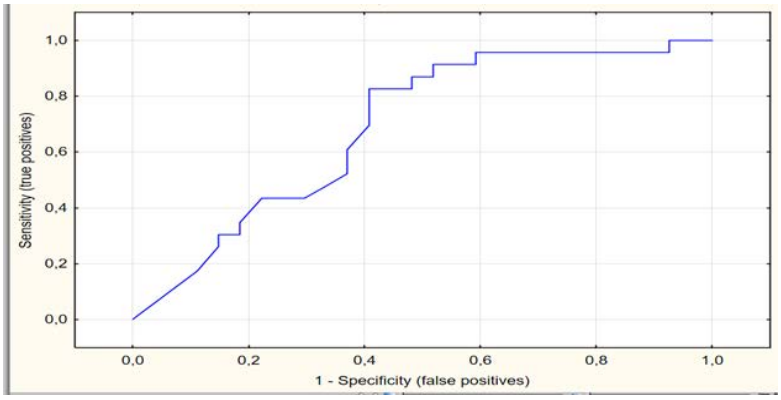


Figure 2. *ROC- curve for IL – 1β.*

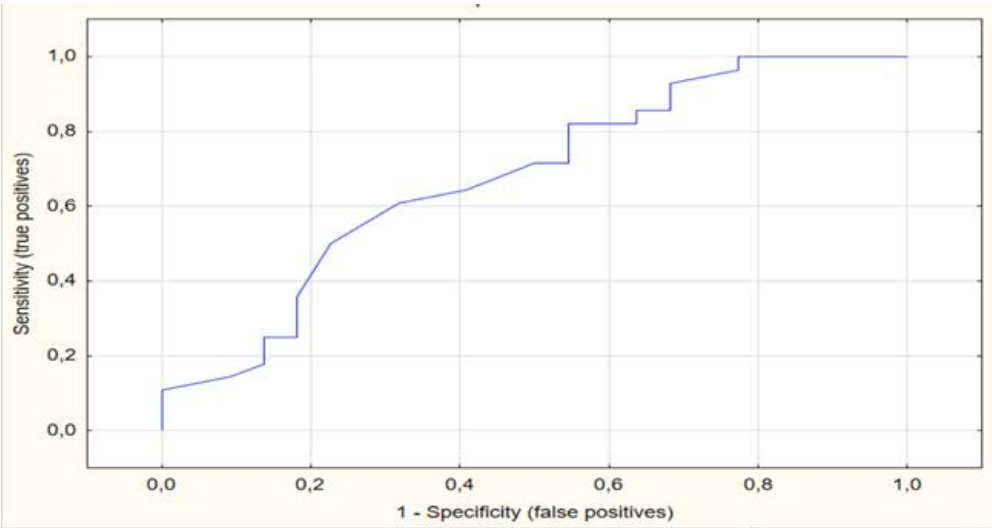


Figure 3. *ROC- curve for NGAL.*

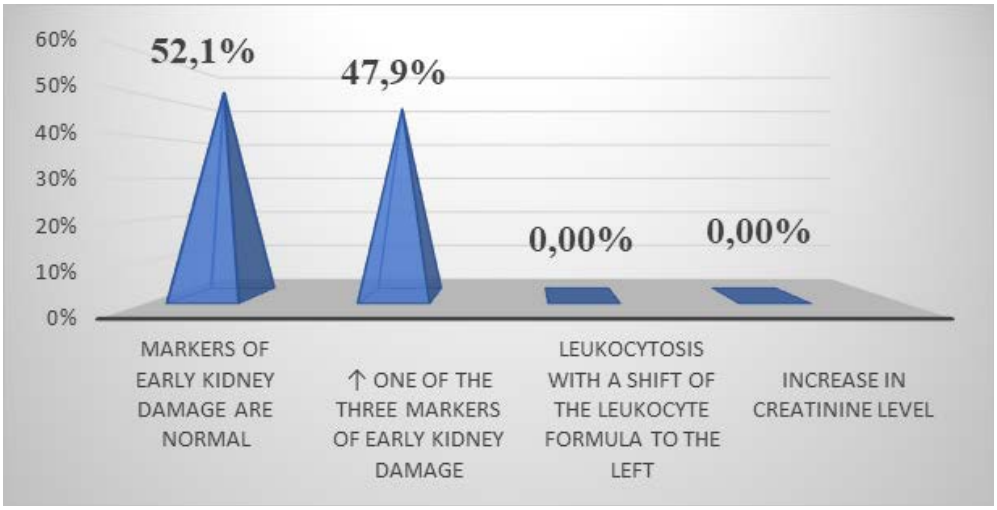


Figure 4. *Results of ELISA and general laboratory studies of patients included in the IA group.*

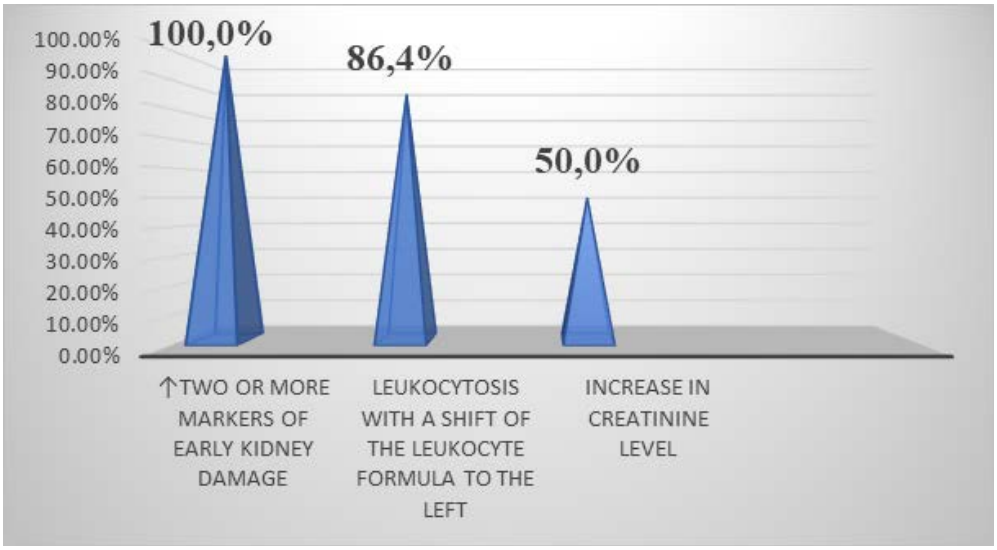
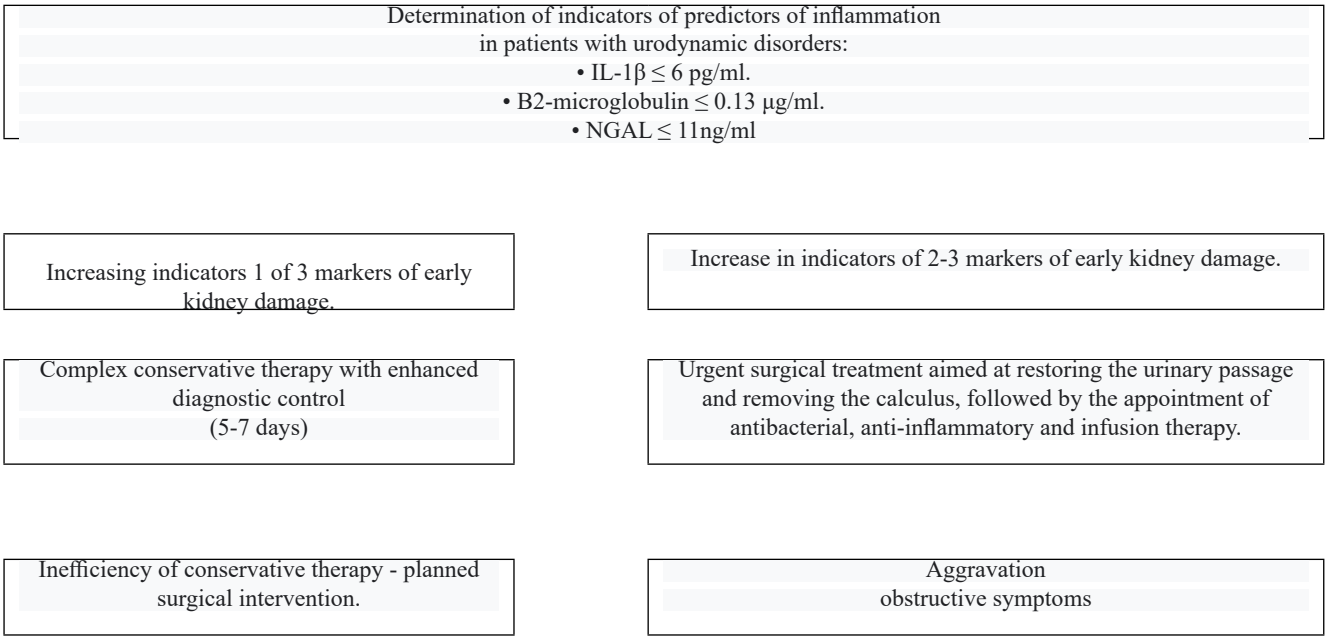


Figure 5. *Results of ELISA and general laboratory studies of patients included in the IB group.*



the functional status of the kidneys. This process is illustrated in Figure 6.

Based on the conducted research and obtained results, risk factors have been identified, and criteria for selecting further treatment tactics have been developed. The main recommendations are as follows:

- Upon hospitalization of the patient and detection of an elevation in the level of one of the three early kidney injury markers, it is recommended to initiate comprehensive conservative therapy with intensified diagnostic monitoring over a period of 5-7 days. If the kidney stone does not pass on its own, scheduled surgical intervention is recommended. In cases of exacerbation of obstructive symptoms, urgent surgical treatment is necessary. These guidelines aim to address the risk factors and tailor the treatment approach to each patient's specific condition for better outcomes.
- In cases where the levels of two or more inflammatory markers are elevated upon hospitalization, regardless of the results of general laboratory indicators indicating the presence or absence of an infectious – inflammatory process and renal insufficiency, immediate surgical intervention is recommended. This intervention should involve draining the affected kidney and removing the kidney stone, as well as administering antibiotic, anti – inflammatory, and infusion therapy.

These recommendations help establish criteria for selecting the optimal treatment approach based on the results of diagnostic studies and the risks of kidney damage and complication development. By promptly addressing multiple elevated inflammatory markers, healthcare providers can effectively manage and treat the condition to minimize potential adverse outcomes.

Conclusion.

1. General laboratory analysis indicators in patients with upper urinary tract calculi (Urinary stone disease) within the first 24-48 hours cannot definitively indicate the absence of an infectious-inflammatory process in the kidneys or the development of renal insufficiency.

2. The elevation of inflammatory predictor markers in more than 50% of cases indicates the development of infectious-inflammatory complications 12-24 hours before clinical and general laboratory changes occur.

3. The comparative analysis of the effectiveness of conservative treatment in groups IA and II showed that complications of the inflammatory process in the kidneys occurred 5 times more frequently in group II (comparison group) compared to group IA.

4. The use of enzymatic tests for early kidney injury markers allows distinguishing two main treatment directions - conservative and urgent surgical, significantly reducing the frequency of inflammatory, purulent-septic complications, and improving the treatment outcomes of patients with upper urinary tract obstruction in urinary stone disease.

Conflict of interest: None.

These conclusions highlight the importance of using early diagnostic markers for kidney injury and implementing appropriate treatment strategies to manage complications effectively in patients with upper urinary tract calculi. The absence of conflicts of interest ensures the impartiality of the research and recommendations provided.

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