

## Investigation Of The Etiological Structure And Sensitivity Of Pathogens To Antibacterial Drugs In Patients With Various Forms Of Pyelonephritis

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### Abstract

**Introduction:** Pyelonephritis is an infectious inflammatory kidney disease. One of the main directions of treatment of this disease is antibiotic therapy. But recently, due to the excessive, unjustified and inadequate use of antibiotics, the problem of antibiotic resistance of pathogens has manifested itself. In this regard, measures are being developed for the rational and effective use of antibiotics in medicine. Therefore, monitoring of resistance and updating of epidemiological data deserves special attention.

**Objectives:** Goal: investigation of the etiological structure of pyelonephritis with the establishment of the sensitivity of pathogens to appropriate antibacterial drugs.

**Methods:** 68 medical records with a diagnosis of pyelonephritis were analyzed

**Results:** The most common pathogens of acute and chronic pyelonephritis were *E. coli*, which was isolated in 87.5±4.8% of the studied patients.

**Conclusions:** High sensitivity of *Escherichia coli* to carbapenems (imepenem/cilastatin), cephalosporins (ceftriaxone, cefotaxime, cefoperazone) was determined.

**Keywords:** Pyelonephritis, Antibacterial drugs, *Escherichia coli*, Antibiotic sensitivity, Antibiotic resistance.

### 1. Introduction

Pyelonephritis is a nonspecific infectious and inflammatory process, with a predominant lesion of the interstitial tissue of the kidney and with involvement in the pathological process of the calyx-pelvic system, tubules, blood and lymph vessels.[1]

Pyelonephritis ranks second in prevalence among urological diseases. There is a tendency for a further increase in the number of pyelonephritis diseases. Patients suffering from acute and chronic pyelonephritis account for about 2/3 of all urological patients. The disease can occur in an acute or chronic form, affecting one or both kidneys. The disease can occur at any age. pyelonephritis develops more often in children under the age of 7 years (the probability of pyelonephritis increases due to the peculiarities of anatomical development, in young women aged 18-30 years (the occurrence of pyelonephritis is associated with the onset of sexual activity, pregnancy and childbirth), in older men (with urinary tract obstruction due to the development of prostate adenoma).[2]

Any organic or functional causes that interfere with the normal outflow of urine increase the likelihood of developing pathology. Pyelonephritis often appears in patients with urolithiasis. The adverse factors contributing to the occurrence of pyelonephritis include diabetes mellitus, immune disorders, chronic inflammatory diseases and frequent hypothermia. In some cases (usually in women) pyelonephritis develops after acute cystitis. The acute form of the disease is manifested by fever, symptoms of intoxication and pain in the lumbar region. Chronic pyelonephritis may be asymptomatic or accompanied by weakness, impaired appetite, increased urination and non-intense lower back pain. An asymptomatic course is often the cause of delayed diagnosis of chronic pyelonephritis. Patients begin to receive treatment when kidney function is already impaired. Since pathology very often occurs in patients suffering from urolithiasis, such patients need special therapy even in the absence of symptoms of pyelonephritis. In the absence of timely therapy, pyelonephritis can lead to severe complications such as kidney failure, carbuncle or kidney abscess, sepsis and bacterial shock. [3]

Etiological therapy with antibiotics for inflammatory diseases caused by bacterial flora is beyond doubt. But their excessive, unjustified and inadequate use, both in self-treatment and on the recommendations of specialists, leads to an aggravation of the problem of pathogen resistance. This negative trend poses a serious threat to global health. In this

regard, measures are being developed for the rational and effective use of antibiotics in medicine. The objectives of such measures are to improve the prevention and treatment of infectious diseases, taking into account economic expediency, providing medical care taking into account the recommendations developed, monitoring the resistance of antibacterial drugs to relevant pathogens, feedback from healthcare professionals, compliance and adherence to recommendations from relevant specialists, monitoring compliance with the requirements of clinical recommendations.[4]

Recent studies have also shown a tendency to increase the resistance of most uropathogens to antibiotics, the emergence of new infectious agents characterized by the presence of polyresistance. For this reason, in order to prescribe effective antibacterial therapy, it is important to know the sensitivity of uropathogens to antibiotics in appropriate patients [5], [6]. To obtain such data, urine is seeded for microflora and antibiotic sensitivity before the appointment of antibacterial therapy, but since the results of this analysis come only on 4-5 days, and the appointment of etiological therapy is necessary from the first day of diagnosis, antibiotics are prescribed empirically. Information is used on the most common pathogens of this disease and their sensitivity to antimicrobial drugs. In this regard, monitoring of resistance and updating of epidemiological data deserves special attention [7], [8].

The most common uropathogens in pyelonephritis are Gr (-) flora: *E. coli* (about 80%), *proteus*, *klebsiella*, *enterobacteria*, *Citrobacteria*, *Pseudomonas aeruginosa*, as well as gram-positive cocci (*Staphylococcus aphytic*, *Staphylococcus epidermis*, *enterococcus fecal*), *mycoplasma*, *ureaplasma*, *fungi*. There may be an association of two or three types of bacteria (often in patients with urinary catheters installed). Therefore, it is important to start with broad-spectrum antibiotics [9], [10].

## 2. Objectives

Purpose: to study the etiological structure of pyelonephritis with the establishment of the sensitivity of pathogens to appropriate antibacterial drugs.

## 3. Methods

The study was conducted between April 2023 and October 2023 in the Department of Nephrology. During this time, 68 medical histories with a diagnosis of pyelonephritis were analyzed. Of these, 24 were men (average age  $54\pm 3.4$  years), 44 were women (average age  $43\pm 4.1$  years). Acute obstructive pyelonephritis was found in 20 subjects. 7 patients were diagnosed with acute non-obstructive pyelonephritis, 41 patients were diagnosed with chronic pyelonephritis. The study material was an average portion of morning urine obtained after hygienic toilet of the genitals, before the appointment of antibacterial therapy. The method of investigation is urine culture for microflora and sensitivity to antibacterial drugs. The determination of uropathogens was performed using a quantitative method of urine culture on nutrient media (5% blood agar, Endo medium, ZHSA, Saburo). The sensitivity and resistance of uropathogens to antibiotics was established by the disco diffusion method using standard methods. In our study, discs for the following antibacterial drugs were used: penicillin group (amoxicillin, amoxiclav), cephalosporins (ceftriaxone, cefotaxime, cefoperazone), aminoglycosides (gentamicin) and fluoroquinolones (ciprofloxacin).

Statistical processing of the received information was carried out using the MS Office Excel program, with the calculation of extended indicators, with a statistical significance of  $P < 0.05$ .

## 4. Results

The most common pathogens in acute pyelonephritis were *Escherichia coli*, *Proteus spp.*, *Klebsiella spp.* The etiological structure of chronic pyelonephritis consists of: *Escherichia coli*, *Proteus spp.*, *Klebsiella spp.*, *Enterobacter spp.*, *Citrobacter spp.*, *Klebsiella pneumoniae*, *Candida albicans*. The leading pathogen among them was *E. coli*. The degree of bacteriuria in 14 patients (52%) was 105 CFU/ml, in 10 patients (37%) - 104 CFU/ml, in 3 patients (11%) - 103 CFU/ml.

The sensitivity of *Escherichia coli* to amoxicillin was  $66.6\pm 7.83\%$ . The sensitivity to amoxicillin/clavulanic acid (Amoxiclav) was  $77.7\pm 6.49\%$ . The sensitivity to ceftriaxone was  $89.1\pm 3.8\%$ , cefotaxime  $86.2\pm 5.3\%$ , cefoperazone  $97.4\pm 0.8\%$ , ciprofloxacin  $83.5\pm 5.9\%$ , imepenem/cilastatin 100%, gentamicin  $58.7\pm 11.4\%$ .

The sensitivity of *Proteus spp.* to amoxicillin  $75.4\pm 8.7\%$ , to amoxicillin/clavulanic acid (Amoxiclav)  $81.2\pm 7.9\%$ , to ceftriaxone sensitivity was  $94.3\pm 2.4\%$ , cefotaxime  $91.8\pm 3.0\%$ , to cefoperazone 100%, ciprofloxacin  $89.5\pm 4.1\%$ , imepenem/cilastatin 100%, gentamicin  $49.2\pm 13.2\%$ .

*Klebsiella spp* sensitivity to amoxicillin  $37.9\pm 17.7\%$ , to amoxicillin/clavulanic acid (Amoxiclav)  $64.6\pm 8.8\%$ , to ceftriaxone sensitivity was  $81.9\pm 5.8\%$ , cefotaxime  $80.4\pm 6.1\%$ , to cefoperazone  $87.5\pm 5\%$ , ciprofloxacin  $56.7\pm 12.6\%$ , imepenem/cilastatin  $89.4\pm 4.8\%$ , Gentamicin  $70.2\pm 9.5\%$ .

The sensitivity of *Enterobacter* spp. The resistance to amoxicillin was 72.6±7.3%. The sensitivity to amoxicillin/clavulanic acid was 85.7±6.1%. The sensitivity to ceftriaxone was 93.4±3%, cefotaxime 89.7±4.3%, cefoperazone 100%, ciprofloxacin 86.3±5.5%, imipenem/cilastatin 100%, gentamicin 56.7±11.9%.

## 5. Discussion

Women are more susceptible to the incidence of pyelonephritis. The most common pathogens of acute and chronic pyelonephritis were *E. coli*, which was isolated in 87.5±4.8% of the studied patients. High sensitivity of *Escherichia coli* to carbapenems (imipenem/cilastatin), cephalosporins (ceftriaxone, cefotaxime, cefoperazone) was determined. These data allow us to confirm the clinical recommendations for the treatment of pyelonephritis. The resistance of *E. coli* to unprotected penicillin and gentamicin was also determined. Protected penicillins and fluoroquinolones are recommended for the treatment of uncomplicated outpatient pyelonephritis. Treatment should begin with broad-spectrum antibiotics. When choosing antibacterial agents, it is necessary to take into account the regional resistance of pathogens to antimicrobial drugs, the previous experience of using antibiotics in the patient, the clarification of pathogens in previous exacerbations to increase the effectiveness of treatment and the correct choice of therapy. Annual monitoring of the etiological structure, antibiotic sensitivity and resistance of pathogens is necessary to optimize empirical therapy.

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