PYELONEPHRITIS: ETIOLOGY, CLINICAL COURSE, AND TREATMENT METHODS

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Abstract: *Pyelonephritis is an infectious-inflammatory disease affecting the renal calyceal-pelvic system and parenchyma, and it is one of the most common pathologies among urinary tract diseases. The disease often develops as a result of bacterial infection and occurs in acute and chronic forms. In the pathogenesis of pyelonephritis, urinary flow disruption, kidney stone disease, and anatomical and functional factors play an important role. This article extensively covers the etiology, pathogenesis, clinical signs, diagnostic criteria, differential diagnosis, as well as modern treatment and prevention methods of pyelonephritis. Based on a literature review, it is shown that early detection of the disease and rational antibiotic therapy are crucial factors in preventing severe complications such as renal failure.*

Keywords: *pyelonephritis, kidney diseases, urinary tract infection, pathogenesis, diagnosis, antibiotic therapy, prevention*

Introduction

Pyelonephritis remains a pressing issue in the fields of internal medicine, nephrology, and urology today. According to the World Health Organization, urinary tract infections rank second among infectious diseases occurring in the human body [1, 41]. A large proportion of these infections are specifically related to pyelonephritis. The disease occurs 3–4 times more frequently in women than in men, which is explained by the shorter length of the female urethra and the rapid ascent of infection in women [2, 118]. Pyelonephritis is especially severe during pregnancy, diabetes mellitus, kidney stone disease, and immunocompromised states [3, 95] The main danger of the disease is that it often progresses silently and, if untreated in time, becomes chronic, leading to gradual damage to the renal parenchyma. As a result, chronic renal failure, arterial hypertension, and sepsis may develop [4, 73]. Therefore, it is important to thoroughly study the causes, clinical course, and treatment issues of pyelonephritis.

Methods

This scientific work is based on a systematic literature review, studying local and foreign authors' scientific sources related to nephrology, urology, and internal diseases. During the research, textbooks, monographs, clinical guidelines, and international clinical recommendations were analyzed [5, 66]. Data were processed using analytical, comparative, and summarizing methods, comparing the etiology, pathogenesis, clinical signs, and treatment approaches of pyelonephritis. The obtained results were systematized based on scientific logic.

Results

According to the literature review, the main causative agents of pyelonephritis are gram-negative microorganisms, with Escherichia coli identified in 70–85% of cases [6, 52]. Additionally, bacteria such as Proteus mirabilis, Klebsiella pneumoniae, Enterococcus faecalis, and Staphylococcus aureus also play an important role.

The following factors contribute to disease development:

- disruption of urinary flow;
- kidney stone disease;
- vesicoureteral reflux;
- pregnancy;
- diabetes mellitus;
- decreased immunity [1, 84].

Pathogenesis

In the pathogenesis of pyelonephritis, infection often reaches the kidney by ascending from the lower urinary tract. Urinary stasis creates favorable conditions for bacterial proliferation and triggers an inflammatory process in the kidney tissues [2, 141]. Prolonged inflammation leads to fibrosis of the renal parenchyma, resulting in a reduction in the number of functional nephrons [3, 109].

Clinical Signs

In acute pyelonephritis, the disease begins suddenly and manifests with the following symptoms:

- body temperature rising up to 39–40°C;
- severe pain in the lumbar region;
- chills;
- nausea and vomiting;
- dysuric conditions [4, 88].In chronic pyelonephritis, clinical signs are less pronounced, with symptoms such as fatigue, headache, arterial hypertension, and changes in urine observed [5, 152].

Diagnosis

In laboratory diagnostics, general urine analysis reveals leukocyturia, bacteriuria, and proteinuria. Blood tests show leukocytosis and increased ESR, indicating an inflammatory process [6, 97]. Instrumental examinations such as ultrasound, computed tomography, and excretory urography are used to detect changes in kidney structure [7, 128].

Differential Diagnosis

It is important to differentiate pyelonephritis from other diseases when diagnosing. In cases presenting with acute back pain, the following pathologies should be considered [1, 105]:

- kidney stone disease;
- appendicitis;
- hepatitis;
- glomerulonephritis;

• endometriosis (in women).

Differential diagnosis is clarified using laboratory tests, ultrasound, and computed tomography. By evaluating clinical symptoms along with urine and blood tests, acute and chronic pyelonephritis can be distinguished from other diseases [2, 123].

Prevention

Measures to prevent pyelonephritis include the following [3, 142; 5, 210]:

1. Increasing fluid intake – drinking at least 2–2.5 liters of water per day;
2. Observing hygiene rules – reduces urinary tract infections;
3. Eliminating urinary tract obstructions – timely treatment of kidney stones;
4. Regular medical monitoring – for patients with chronic pyelonephritis and diabetes;
5. Healthy nutrition and strengthening immunity.

Applying preventive measures is especially important for pregnant women, patients with diabetes, and those suffering from chronic urinary tract diseases.

Modern Treatment Approaches

Antibiotic Therapy: When choosing empirical antibiotics, the following criteria are considered: bacterial spectrum, patient age, pregnancy, chronic diseases, and previous antibiotic use history [6, 112].

In acute pyelonephritis, prompt antibiotic therapy is essential, usually using the following groups:

• beta-lactams (amoxicillin-clavulanate, ceftriaxone);
• quinolones (ciprofloxacin);
• aminoglycosides (gentamicin) [7, 130].

In chronic pyelonephritis, long-term prophylactic antibiotics at low doses are used, along with eliminating the causes of infection.

Additional Therapy

• Symptomatic treatment to reduce pain and fever;
• Increasing water intake to normalize urine flow;
• Use of probiotics and immunomodulators to reduce bacterial biofilm and infection risk [8, 196].

Discussion

Numerous scientific studies indicate that the main focus in treating pyelonephritis should be on eliminating the infectious agent. The effectiveness of treatment significantly improves when empirical antibiotic therapy is adjusted based on microbiological test results [8, 214]. Additionally, treating comorbidities and restoring urine flow reduce the risk of pyelonephritis recurrence. Strengthening the patient's immunity, maintaining hygiene, and adhering to preventive measures improve long-term treatment outcomes [3, 155].

Conclusion

Pyelonephritis is a widespread and serious infectious disease of the kidney, where early diagnosis and proper treatment are crucial. Complex therapy considering etiological factors helps preserve kidney function and prevents severe complications. Differential

diagnosis, prevention, and modern antibiotic approaches are key components of effective pyelonephritis management.

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