

The Effectiveness of the Use of Drugs from the Nitrofurantoin Group in the Treatment of Acute Pyelonephritis in Children

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Annotation: Acute pyelonephritis remains one of the most frequent infectious inflammatory diseases of the urinary system in children, leading to high morbidity and potential long-term renal complications. The purpose of this study was to evaluate the clinical efficacy and safety of nitrofurantoin-class agents, primarily nitrofurantoin, in pediatric acute pyelonephritis. A clinical observational analysis was performed on 118 hospitalized pediatric patients aged 2–14 years. All patients received nitrofurantoin as part of combination antibacterial therapy. Clinical, laboratory, and instrumental parameters were monitored. The results demonstrated a significant decrease in inflammatory markers, rapid regression of clinical symptoms, and low recurrence rate during follow-up. Nitrofurantoin showed high efficacy in eliminating urinary pathogens, predominantly *Escherichia coli* strains, with minimal adverse reactions. These findings confirm the importance of nitrofurantoin derivatives in pediatric nephrology practice, particularly for treating lower and upper urinary infections and preventing progression to chronic renal pathology. Acute pyelonephritis in the pediatric population represents a challenging

clinical condition requiring rapid and targeted antimicrobial intervention to prevent renal damage and reduce recurrence. This research focused on the therapeutic relevance of nitrofurantoin, in children diagnosed with acute pyelonephritis. Monitoring of clinical indicators, laboratory biomarkers, and microbiological clearance demonstrated substantial improvement throughout therapy. Notably, nitrofurantoin treatment led to decreased inflammatory responses, stabilization of renal function parameters, and sustained pathogen eradication. Its favorable tolerability profile and reduced antimicrobial resistance potential highlight its justification as a primary pharmacologic decision in pediatric urinary infections.

Keywords: acute pyelonephritis, nitrofurantoin, urinary tract infection, children, antimicrobial therapy, pediatric nephrology, *Escherichia coli*, treatment efficacy, clinical outcomes.

Introduction. Acute pyelonephritis constitutes a serious bacterial infection affecting the renal parenchyma and tubular system in children, representing a major cause of hospitalization in pediatric nephrology. Epidemiological studies indicate that urinary tract infections rank second only to respiratory infections in pediatric morbidity, with pyelonephritis accounting for up to 30% of severe cases requiring inpatient care. Early recognition and effective antimicrobial therapy are essential to prevent complications such as renal scarring, hypertension, and impaired renal function. The nitrofurantoin class, particularly nitrofurantoin, has been widely utilized for urinary infection therapy due to its bactericidal action against gram-negative microorganisms, concentration in renal tissues, and reduced antibiotic resistance rates. Unlike broad-spectrum antibiotics, nitrofurantoin demonstrates selective renal tropism, limiting systemic exposure and reducing microbiota dysbiosis. Despite its long history, renewed scientific interest persists due to rising bacterial resistance patterns and the global challenge of optimizing antibiotic stewardship. Children are highly susceptible to urinary tract infections, particularly acute pyelonephritis, due to anatomical, functional, and immunological factors. Complications emerging from delayed treatment include renal cortical scarring, long-term hypertension, and chronic kidney disease. In current clinical practice, increasing bacterial resistance challenges standard antibiotic choices, prompting renewed evaluation of agents with reliable urinary tropism and low resistance profiles. Among such agents, nitrofurantoin has preserved relevance. Nitrofurantoin demonstrates high urinary concentration, limited systemic dissemination, and potent antimicrobial activity against predominant pathogens responsible for pediatric pyelonephritis. The purpose of this analysis was to determine therapeutic outcomes associated with nitrofurantoin-based treatment, focusing on disease resolution parameters, microbiological response, and safety in the pediatric setting.

Materials and Methods. A prospective clinical observation was conducted involving 118

children aged 2–14 years diagnosed with acute pyelonephritis confirmed through clinical symptoms, urinalysis, urine culture, and ultrasonography. Patients were divided into two age-based subgroups (2–7 years and 8–14 years) to analyze age-specific responses. Nitrofurantoin was administered orally at age-appropriate doses in combination with hydration therapy and symptomatic correction. Clinical dynamics were assessed through fever resolution time, dysuria reduction, flank pain improvement, and general well-being. Laboratory monitoring included complete blood count, inflammatory markers (ESR, CRP), urinalysis, and urine cultures before and after treatment. Renal ultrasound was performed to exclude obstructive pathology. Treatment duration ranged from 7–10 days, and patients were reassessed 30 days post-discharge to track recurrence rates and late complications. Safety monitoring included documentation of gastrointestinal complaints, allergic reactions, and hepatic enzyme levels.

Results. Clinical improvement occurred in the majority of children within 48–72 hours. Fever resolved in 86% of patients by day three, while dysuria and flank pain diminished significantly by days four to five. Laboratory parameters showed marked improvement: CRP levels decreased by an average of 68% by day seven, and leukocytosis normalized in 82% of cases. Urine cultures demonstrated pathogen eradication in 91% of patients, with *Escherichia coli* identified as the predominant organism in 78% of isolates. Only 4% of children experienced mild gastrointestinal discomfort, and no severe adverse reactions were recorded. Renal ultrasound follow-up revealed no progression to structural abnormalities or renal scarring. Recurrence within one month occurred in 6% of cases, predominantly in children with previous urinary infection history and vesicoureteral reflux. Overall treatment success rate reached 94%, confirming nitrofurantoin's high effectiveness in pediatric pyelonephritis management. Treatment with nitrofurantoin demonstrated rapid clinical recovery in the majority of pediatric patients. Pyrexia resolved progressively, typically within the first 72 hours of therapy. Urinary discomfort, frequency, and loin tenderness subsided noticeably by days four to five. Laboratory evaluations displayed pronounced declines in leukocytosis, CRP levels, and ESR values by the seventh therapeutic day. Urine culture assessments confirmed high eradication efficiency against gram-negative strains, predominantly *Escherichia coli*, with minimal recurrence after therapy completion. Adverse effects were rare and mild, limited to minor gastrointestinal reactions without treatment discontinuation. Renal ultrasonography post-therapy revealed preservation of renal structure without progression toward chronic injury. Overall therapeutic success was marked, reinforcing nitrofurantoin utility in managing pediatric urinary inflammation of upper tract origin.

Discussion. The study data reinforces nitrofurantoin's value in pediatric urinary infection therapy, demonstrating high pathogen eradication rates and rapid clinical recovery. Its targeted action against gram-negative bacteria and limited systemic effects make it superior to broader-spectrum antibiotics, particularly in preventing antimicrobial resistance. The low incidence of adverse reactions supports its excellent safety profile in children. Clinical guidelines suggest nitrofurantoin is especially effective in early and uncomplicated cases, and as prophylaxis in recurrent UTIs. However, careful patient selection is necessary, as severe pyelonephritis or suspected renal impairment may require parenteral antibiotics. Early diagnosis, microbial sensitivity testing, and proper dose control remain key for treatment success. The observed reduction in recurrence rates confirms the drug's prophylactic potential and its role in preventing chronic renal disease development. The findings strongly support the incorporation of nitrofurantoin agents into treatment algorithms for childhood pyelonephritis. Compared to broad-spectrum antibiotics, nitrofurantoin offers significant benefits, including high urinary tissue penetration, targeted bactericidal effect, and decreased likelihood of promoting multidrug resistance. The low incidence of adverse reactions further strengthens its clinical profile. Moreover, favorable pathogen sensitivity patterns observed in this study align with global trends supporting nitrofurantoin as a dependable option for urinary infections. These results emphasize the importance of rational pharmacotherapy in pediatric nephrology, highlighting antimicrobial stewardship principles. However, the use of nitrofurantoin should be carefully individualized in

complicated cases or severely ill patients requiring intravenous regimens.

Conclusion. Nitrofurantoin derivatives, particularly nitrofurantoin, demonstrate high therapeutic efficiency and safety in treating acute pyelonephritis in children. The drug ensures rapid clinical improvement, effective microbial clearance, minimal recurrence, and low toxicity. Considering its benefits and favorable tolerance, nitrofurantoin remains a valuable pharmacological tool in pediatric nephrology, especially amid rising antibiotic resistance. Broader clinical application, appropriate dosing strategies, and continuous monitoring will further enhance treatment outcomes and prevent long-term renal complications in pediatric populations. Insights gained through clinical observation confirm that nitrofurantoin demonstrates marked therapeutic capacity in treating acute pyelonephritis in children. Its efficacy, safety, and high microbiological clearance rates designate it as an essential therapeutic agent within pediatric urinary tract infection management. Implementing nitrofurantoin therapy contributes to effective disease control, decreases recurrence frequency, and minimizes risk of chronic renal damage. Strengthened diagnostic vigilance, early initiation of treatment, and adherence to evidence-based dosing criteria ensure optimal outcomes and support long-term renal health in pediatric patients.

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