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Original Research Article

Comparison of Clinical Outcomes of Short-Course vs Long-Course Antibiotic Treatment in Children With Pyelonephritis

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Abstract: *To evaluate the comparative effectiveness of short-course vs long-course antibiotic treatment for clinical outcomes of children with pyelonephritis.* ***Methodology:*** *A retrospective observational study was conducted in the Pediatrics Department of PIMS Hospital, Islamabad, between May 2024 and May 2025. A total of 200 children aged from 6 months to 18 years presenting in the outpatient department with urine culture showing the presence of Escherichia coli, Klebsiella species, or Proteus mirabilis were selected for the study. Children were divided into two treatment groups by physicians; Group A included 100 patients who were administered the short-course antibiotic treatment for 6-9 days, and Group B included 100 patients treated for 10 or more days. The primary endpoint was treatment failure, shown by the occurrence of one or more composite outcomes in 1 month following treatment.* ***Results:*** *The odds ratio of achieving the composite outcomes at follow-up between both groups was 1.19 (95% CI: 0.81-2.02). There was no significant difference between outcomes concerning age between both groups however between the age groups, children aged 4-13 years had a significantly higher frequency of treatment failure (14.7%) as compared to other age groups (9 vs 8.2%) irrespective of treatment (OR: 1.68, 95% CI: 1.12-2.81, p<0.01). 40% patients in Group A and 65% in Group B had a recurrence with an increasingly resistant organism at follow-up (OR: 0.40, 95% CI: 0.11-1.48).* ***Conclusion:*** *The effect of short-course and long-course antibiotic treatment is similar in children with pyelonephritis. However, short-course therapy is superior for reducing the risks of drug-resistant infection recurrence.*

Keywords: Antibiotics, Bacteria, Pediatrics, Pyelonephritis

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Introduction

Pyelonephritis is a common bacterial infection affecting one or both kidneys can lead to temporary or permanent morbid conditions, including chronic hypertension, sepsis, kidney scarring, and acute kidney injury (1). The long-term effects of the infection can be limited in the early phase by an antibiotic course of 1-2 weeks (2).

The majority of the literature favors the superiority of short-course (5-7 days) in terms of better outcomes in adults as compared to long-duration antibiotic treatment (≥10 days). (3, 4). However, there is scarce data about the treatment of pyelonephritis in children, especially with urological dysfunction (5). Short-course had been shown to improve patients' quality of life and comfort, less the risk of side effects, and antibiotic resistance.

Although children are treated with short-course antibiotics as a standard but there is still variability in prescriptions for pediatric subjects with pyelonephritis. Therefore, the impact of antibiotic treatment must be assessed on outcomes. This study was conducted to evaluate the comparative effectiveness of short-course vs long-course antibiotic treatment for clinical outcomes of children with pyelonephritis.

Methodology

A retrospective observational study was conducted in the Pediatrics Department of PIMS Hospital, Islamabad, between May 2024 and May 2025. A total of 200 children aged from 6 months to 18 years presenting in the outpatient department with urine culture showing the presence of Escherichia coli, Klebsiella species, or Proteus mirabilis were selected for the study. Patients met the laboratory and microbiological criteria for pyelonephritis and had at least one of the clinical signs: fever, emesis, rigors, persistent tachycardia, hypotension, irritability, and flank pain. Patients with a renal abscess or those who received nitrofurantoin or Fosfomycin were excluded. Informed consent was obtained from guardians. The ethical review board approved the study.

The patient's personal and medical data, grade of infection, laboratory, and microbiological information were recorded. Children were divided into two treatment groups by physicians; Group A included 100 patients who were administered the short-course antibiotic treatment for 6-9 days, and Group B included 100 patients treated for 10 or more days. The duration included both inpatient and outpatient antibiotic treatment.

The primary endpoint was treatment failure, shown by the occurrence of one or more of these outcomes in 1 month following treatment: symptoms of urinary tract infection prompting an ED visit, severity of UTI symptoms leading to hospital admittance, need for prolonged treatment, or death. The secondary outcome was a 2-fold increase in the presence of antibiotic-resistant organisms in the urine sample at follow-up.

All data were analyzed by Stata Software version 15. Wilcoxon Rank test and x2 test were used to compare continuous and categorical data, respectively. The data was adjusted for confounding factors (age, immunocompromise, female gender, history of urological disorders, and bacterial source of infection, hospital & ICU stay) by propensity score weighting to balance differences and accurately study the effect of treatment in both groups. A two-tailed p-value of less than 0.05 indicated statistical significance.

Results

The mean of the study population was 8.9 ± 6.0, with 85% female children. In unadjusted data, most of the baseline patients' characteristics were similar between both groups; however, there were significant age differences (Table I). Patients younger than 3 years (18%) were treated with short-term treatment as compared to 34% treated with long-term treatment (p<0.001); on the other hand majority of teenagers were given short-term treatment (40% vs 28%, p=0.28). This difference did not remain significant after adjusting data in propensity score weighting (p=0.89 vs 0.91). The mean duration of short-term therapy was 7 days, and of long-term therapy was 12 days. After adjustment of factors and 170 (85%) were females. A total of 87.5% had E. coli in urine samples, and most patients received ceftriaxone (30%), followed by 21% receiving cephalexin and 20% administered TMP-SMX in the first 24 hours. 163 (81.5%) were administered oral antibiotics after a mean duration of 2 days.

A total of 20 patients reached the primary endpoint, among which 5 patients (1%) required hospital admission due to UTI symptoms, 7 patients (7%) visited the ED with similar complaints, and 8 patients (8%) required prolonged antibiotic treatment. None of the patients died during treatment. Treatment failed in 11% of children in the short-course group and 10% in long-course therapy (p=0.39). The odds ratio of achieving the composite outcomes at follow-up between both groups was 1.19 (95% CI: 0.81-2.02). There was no significant difference between outcomes concerning age between both groups however between the age groups, children aged 4-13 years had a significantly higher frequency of treatment failure (14.7%) as compared to other age groups (9 vs 8.2%) irrespective of treatment (OR: 1.68, 95% CI: 1.12-2.81, p<0.01). The difference in outcomes between children with and without a history of urological disorder was also insignificant (OR: 1.13, 95% CI: 0.61-2.08) (Table II). 40% patients in Group A and 65% in Group B had a recurrence with an increasingly resistant organism at follow-up (OR: 0.40, 95% CI: 0.11-1.48).

Table 1: Adjusted Baseline Patients' Data

	Group A (n=100)	Group B (n=100)	P-value
Age			
6-36 months	28 (28%)	28 (28%)	0.89
4-13 years	41 (41%)	41 (41%)	0.95
14-18 years	31 (31%)	31 (31%)	0.91
Female gender	85 (85%)	85 (85%)	0.88
Immunocompromised	3 (3%)	3 (3%)	0.89
Previous urological disorders	25 (25%)	25 (25%)	0.89
Pregnancy	2 (2%)	2 (2%)	0.90
Pathogens			
E.coli	88 (88%)	87 (87%)	0.77
Klebsiella	10 (10%)	10 (10%)	0.72
P. mirabilis	2 (2%)	3 (3%)	0.88
Bacteremia with the same pathogen	1 (1%)	1 (1%)	0.71
Hospital admission	22 (22%)	22 (22%)	0.87
ICU admission	1 (1%)	1 (1%)	0.86
Treatment			
1st gen cephalosporin	43 (43%)	18 (18%)	<0.001
3rd gen cephalosporin	16 (16%)	43 (43%)	<0.001
Trimethoprim-sulfamethoxazole	19 (19%)	24 (24%)	0.30
Fluoroquinolone	8 (8%)	7 (7%)	0.38

Table 2: Frequency of Treatment Failure in Study Group

	Overall n(%)	Group A	Group B	OR (95% CI)	P-Value
Age					
6-36 months n=56)	5 (9%)	1/28 (3.6%)	4/28 (14.3%)	0.49 (0.16-1.88)	0.28
4-13 years (n=82)	12 (14.7%)	8/41 (19.6%)	4 (9.7%)	1.47 (0.68-2.67)	0.27
14-18 years (n=62)	5 (8.2%)	3/31 (9.7%)	2 (3.2%)	1.69 (0.72-4.39)	0.25
Previous urological disorders					
Yes (n=50)	10 (20%)	6/25 (24%)	4 (16%)	1.51 (0.71-3.27)	0.26
No (n=150)	12 (8%)	6 (8%)	6 (8%)	1.12 (0.62-2.07)	0.79

Discussion

Our study results showed that there was no difference in outcomes of children receiving short-term or long-term antibiotic treatment for pyelonephritis. Although this finding was insignificant, patients administered short-course therapy had a lower risk of developing recurrent infections during follow-up with a more antibiotic-resistant organism (40% vs 65%). This is similar to previous studies that suggested that short-course treatment is more effective than traditional long-term treatments for bacterial infections. (6-8).

The present study is the only study in Pakistan to evaluate the comparative efficacy of antibiotic durations for pyelonephritis in the pediatric population. Our findings may be useful to standardize the treatment for children locally, as previous internal studies have also supported shorter courses in adults with infections. In addition, our inclusion criteria from different from most studies as we included immunocompromised patients, those with urological disorders and history of UTIs, which most comparative studies exclude, which increased the applicability of our results to highly susceptible children (9, 10).

Patients aged 4-13 years had a higher incidence of treatment failure than other age groups, indicating a high risk of future infection (11). This is because this age group poses more risk factors for bacterial infections than infants or young adults. Secondly, the infection rate in children aged less than 4 years can be accounted for by an evolving immune system, and this is the stage at which children are trained for toilet and hygiene practices (12). Children older than 14 had the lowest infection rate, and the UTIs

can be caused by sexual activity during early marriages, but are unlikely without any neurological dysfunction, urinary tract abnormalities, or control issues. The history of urological dysfunction is an independent risk factor of treatment failure in both short and long-course treatment.

We also analyzed the correlation between the type of antibiotic and treatment duration. Previous studies conducted on adult patients reported that TMP-SMX or fluoroquinolones yielded better outcomes in comparison to treatment with β-lactam agents (13, 14). Additionally, the β-lactam treatment is given for long durations (10-14 days) as compared to shorter treatments of other drugs (5-7 days). The high treatment failure by B-lactam is justified by the risk of development of recurrent vaginal colonization after its use. However, in the current study, the treatment outcomes were similar between treatment regimens, which can further be investigated in children.

This study is limited in several aspects. We did not report long-term outcomes after discharge, which may or may not have affected the current findings. Secondly, we did not evaluate the compliance of patients with antibiotic treatment and duration.

Conclusion

The effect of short-course and long-course antibiotic treatment is similar in children with pyelonephritis. However, short-course is superior for reducing the risk of drug-resistant infection recurrence.

Declarations

Data Availability statement

All data generated or analysed during the study are included in the manuscript.

Ethics approval and consent to participate

Approved by the department concerned. (IRBEC-M-24)

Consent for publication

Approved

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Not applicable

Conflict of interest

The authors declared the absence of a conflict of interest.

Author Contribution

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AZ (Paediatrician)
Conception of Study, Development of Research Methodology Design,
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All authors reviewed the results and approved the final version of the manuscript. They are also accountable for the integrity of the study.

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