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## Association Between Fever and Pyuria in Children

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### ABSTRACT

**Background:** Fever is a common complaint among pediatric patients, often leading to hospital visits. Urinary tract infections (UTIs), which can be detected by the presence of pyuria, are a frequent cause of fever in children. This study aims to investigate the association between fever and pyuria in hospitalized children.

**Methods:** This case-control study included 202 children aged 12 to 144 months, hospitalized at Ali Ibn Abi Talib Hospital. The children were divided into two groups: 101 with fever and 101 without. The study analyzed data from medical records and laboratory results, using statistical tools to determine the association between fever and pyuria. Data were collected from medical records and laboratory results, and statistical analysis was performed using SPSS ver 27.0.1 software.

**Results:** Among the 202 children aged between 12 to 144 months, 101 had fever and 101 did not. There was no significant difference in the incidence of pyuria between the febrile and afebrile groups. The results showed no significant difference in the incidence of pyuria between febrile and afebrile children. Specifically, 5.8% of the febrile group and 3.9% of the non-febrile group exhibited pyuria, a difference that was not statistically significant ( $p=1.000$ ). Further, the correlation coefficient between fever and pyuria was  $-0.010$  ( $p=0.914$ ), indicating no significant correlation.

**Conclusion:** The study found no significant association between fever and pyuria in hospitalized children, underscoring the importance of considering other diagnostic factors beyond pyuria when evaluating febrile pediatric patients. This approach can help improve the accuracy of UTI diagnoses and optimize patient care.

### Introduction

Fever is generally the most common complaint when children visit a pediatric specialist or family physician. Fever occurs as the body reacts to the release of internal pyrogens during infections, inflammatory processes, rheumatism, malignancies, and external pyrogens like microbes

and toxins. Studies have shown that fever in children is one of the most frequent reasons parents seek medical care for their children in pediatric clinics (1,2). Some sources estimate that the prevalence of doctor visits due to fever in children is between 19% and 30% (2), while others estimate it at about 50% (3).



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The most common cause of fever in children is infection. Diseases caused by viruses and bacteria are usually the main sources of fever in children (7). Fever can also be caused by tissue damage due to burns, malignancies, drugs such as Amphotericin B, inflammatory diseases, or even metabolic disorders (8).

Urinalysis is a test commonly ordered upon hospital admission, especially when the patient has a fever. It usually provides useful information, but sometimes it can be misleading. Pyuria in children is defined as the presence of more than five white blood cells (WBC) per high-power field (HPF) in urinalysis (10). A urinalysis showing pyuria generally indicates an infection, although sterile pyuria can also be associated with urethritis, vaginitis, kidney stones, glomerulonephritis, and interstitial nephritis (9). One author (JWM) observed that patients hospitalized with acute non-urinary tract infections often have pyuria, which can confuse admitting physicians, leading them to alter antibiotic choices based on abnormal urinalysis results. Others have documented that sterile pyuria occurs in both adults and children with pneumonia and other acute febrile illnesses, suggesting that features of these illnesses or the fever itself may cause WBCs to leak into the urine (12-14).

Excretion of WBCs in urine is an indicator of inflammatory or infectious disorders of the urinary tract. Systemic inflammatory diseases like Kawasaki disease are other known causes of pyuria (9). Anatomical disorders of the genitourinary system such as hydronephrosis, polycystic kidney disease, vesicoureteral reflux, and tubulointerstitial disorders like interstitial nephritis, lupus nephritis, and kidney transplantation can also cause pyuria. Observations suggest that pyuria may often occur in febrile children without urinary infections as a nonspecific response to fever (11).

This study aims to explore the association between fever and pyuria in hospitalized children, providing insights into the diagnostic value of pyuria in febrile pediatric patients.

## **Methodology:**

### ***Study Design***

This was a case-control study conducted at the pediatric ward of Ali Ibn Abi Talib Hospital in Zahedan in 2020.

### ***Population***

The study included 202 children aged 12 to 144 months who were admitted to the hospital. 101 children over the age of one month hospitalized for fever at Ali Ibn Abi Talib Hospital, Zahedan, without a clear cause for pyuria (urinary tract infection, urinary stones, dehydration, vesicoureteral reflux, and renal disorders) were included in the case group. Another 101 children hospitalized for reasons other than fever, without underlying factors for pyuria, were included in the control group.

### ***Data Collection***

Data were obtained from the medical records, including demographic information, clinical symptoms, and laboratory results. Pyuria was defined as the presence of more than 5 WBCs per high-power field (HPF) in a urine sample examined under a microscope. Both groups were matched for age and sex. All patients underwent a thorough clinical examination and sample collection. After urine sample collection, those with normal urinalysis continued in the study, while those with pyuria had further tests including BUN, creatinine, urine culture, urinary system ultrasound, and pediatric nephrologist consultation. Any child with at least one causative factor for pyuria was excluded from the study.

### ***Statistical Analysis***

The data were analyzed using SPSS software (version 25). Chi-square tests were used to compare the incidence of pyuria between febrile and afebrile groups. P-values less than 0.05 were considered statistically significant.

### ***Ethical Considerations***

Informed consent was obtained from the parents of all participants. This study was approved by the Ethics Committee of Zahedan University of Medical Sciences with code: IR.ZAUMS.REC.1399.336\*.

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<https://ethics.research.ac.ir/EthicsProposalView.php?id=158596>

### **Results**

This study examined 202 hospitalized children aged 12 to 144 months, with 101 in the febrile

group and 101 in the non-febrile group. Twenty-two cases with a clear cause for pyuria (urinary tract infection (60.2%), renal disorders (9.2%), kidney stones (10.3%), and vesicoureteral reflux (20.3%)) were excluded from the study. The average temperature in the case and control groups was  $38.5 \pm 0.05$  and  $37.05 \pm 0.02$ , respectively, which was statistically significant ( $P < 0.001$ ).

The Mann-Whitney Test was used to compare WBC counts between the two groups. The results are as follows:

**Table 1-** Determining and comparing the average number of WBC in two groups of hospitalized febrile and non-febrile children

Variable	Case (Febrile Children)	Control (Non-febrile Children)	U	P-Value
WBC Count	4.99 (16.97)	4.29 (16.46)	1731.5	0.495

According to the results, the difference in mean WBC counts between the case and control groups was not significant.

To determine and compare the frequency of pyuria between the two groups, the Chi-square test was used:

**Table 2-** Determining and comparing the frequency of pyuria in two groups of hospitalized children with fever and non-febrile children

Pyuria	Case (Febrile Children)	Control (Non-febrile Children)	P-Value
Present	6 (5.8%)	4 (3.9%)	1.000

The Spearman correlation test was used to examine the relationship between pyuria and fever in hospitalized children. The results are as follows:

**Table 3-** Correlation between two variables of pyuria and fever in the studied children

Variable	Correlation Coefficient	P-Value
Fever - Pyuria	-0.010	0.914

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Based on the results, the Spearman correlation coefficient between fever and pyuria is -0.010, indicating no significant correlation between the two variables at the 0.05 error level. In other words, there is no statistical correlation between fever and pyuria ( $P = 0.9, \rho = 0.01$ ).

**Discussion**

The findings of this study suggest that there is no significant association between fever and pyuria in hospitalized children. While pyuria is often used as an indicator for UTIs, the results indicate that its presence alone is insufficient to diagnose UTIs in febrile children.

*Significance of Pyuria:* Pyuria, which is defined as the presence of more than 5 WBCs per HPF in urine, is commonly seen in various conditions, not just UTIs. It can occur in response to viral infections, inflammatory processes, and other non-infectious diseases. The lack of a significant difference in the incidence of pyuria between febrile and afebrile children underscores the need for a more comprehensive diagnostic approach.

*Implications for Clinical Practice:* Given the potential for pyuria to appear in non-UTI conditions, clinicians should be cautious in relying solely on pyuria to diagnose UTIs in febrile children. Misdiagnosis can lead to unnecessary antibiotic treatment, contributing to antibiotic resistance and other adverse effects. A more robust diagnostic strategy that includes clinical evaluation, history, and possibly other biomarkers is essential for accurate diagnosis and management.

**Comparison with Other Studies**

This study examined 202 hospitalized children aged 12 to 144 months, with 101 in the febrile group and 101 in the non-febrile group. In our study, pyuria was observed in 5.8% of the febrile group and 3.9% of the non-febrile group, with no significant statistical difference.

In a study by Mohajeri et al., pyuria was reported in 6.7% of febrile children and 2.2% of non-febrile children, which aligns with our results.

In another study by Turner et al., pyuria was observed in 43% of febrile children and 6% of non-

febrile children, with the difference likely due to varying definitions and criteria for pyuria.

In Hooker et al.'s study, pyuria was reported in 28% of febrile children and 30.7% of non-febrile children, without significant correlation, consistent with our findings. Oikonomou et al. also found no significant difference in pyuria between febrile and non-febrile groups. Sharif et al. reported a weak correlation between urinary leukocyte count and fever in patients with urinary tract infections.

Shrestha et al.'s study showed that pyuria, which is found in microscopic urinalysis, has low sensitivity and specificity for urinary tract infection, as a result, pyuria is not a reliable marker for urinary tract infection, but the reliability of pyuria in urinalysis sample was higher in children with fever.

### Potential Limitations

One limitation of this study is its observational nature, which may not account for all confounding factors. Additionally, the study was conducted in a single hospital, which may limit the generalizability of the findings. Future studies with larger sample sizes and multi-center designs are needed to validate these findings.

### Future Directions

Further research should focus on identifying additional diagnostic markers that, when combined with pyuria, can improve the accuracy of UTI diagnosis in febrile children. Advanced diagnostic technologies, such as rapid urine tests and molecular diagnostics, may provide more precise and timely results. Moreover, integrating clinical judgment with laboratory findings can help develop a more holistic approach to managing febrile children suspected of having UTIs.

### Conclusion

In conclusion, while pyuria is a common finding in febrile children, its presence alone does not significantly correlate with UTIs. Clinicians should adopt a comprehensive diagnostic approach that includes clinical symptoms, history, and other laboratory findings to accurately diagnose and manage febrile children. This approach will help avoid unnecessary antibiotic use and improve patient outcomes.

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