

Evaluation of the Knowledge and Awareness Level of the Pediatric Residents About the Diagnosis, Treatment and Follow-up of Urinary Tract Infection in Children

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ABSTRACT

Objective: In this study, we sought to assess pediatric residents' level of knowledge about the diagnosis, treatment, and follow-up of urinary tract infection in children.

Methods: This survey was a descriptive study applied to pediatric residents. In the study, a questionnaire form prepared by researchers consisting of questions about socio-demographic features, about the diagnosis, treatment, and follow-up of urinary tract infection in children was used.

Results: Eighty-eight physicians participated in this research. The percentage of participants who correctly indicated urine culture based on the results of routine urinalysis in the diagnosis of urinary tract infection ranged from 95.5% to 96.6. 54.5% of participants (n=48) correctly identified the indication for ultrasonography in children with acute urinary tract infection. 67.0% (n=59) of the participants answered that Mercaptuacetyltryglycin was not appropriate for initial evaluation of recurrent urinary tract infection under the age of one year, while 33.0% (n=29) answered the question incorrectly. In clinical scenarios, 48.9% (n=43.0) participants made the proper decision for treatment of extended spectrum beta-lactamase-positive *E. coli* treatment.

Conclusion: In conclusion, pediatric residents had appropriate training and experience in the diagnosis of urinary tract infection in children. However, over half of the residents lacked sufficient training in the management of resistant bacteria and additional radiological imaging techniques. Considering this, we believe it will be good to keep the knowledge updated concerning the treatment and follow-up of children with urinary tract infection through in-service training and post-graduate education.

Keywords: Pediatric residents, urinary tract infection, diagnosis, treatment, follow-up, radiological imaging

INTRODUCTION

Urinary tract infection (UTI) is a common bacterial infection during early childhood.¹ In the first eight years of life, 2% of boys and 7-8% of girls experience a UTI.² Prepubescent girls and boys are

diagnosed with UTI at rates of 3% and 1%, respectively.³ Moreover, approximately 7.8% of children aged between 2 and 19 years who have fever and/or urinary tract symptoms have UTI.³ After the first few months of life, UTIs occur more frequently in girls than in boys, because of the shorter length of the female urethra.⁴

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Clinically, UTIs can range from asymptomatic bacteriuria to acute pyelonephritis, which can cause children to develop sepsis.⁵ Lower UTIs are more prevalent, although infections at a young age frequently take the form of pyelonephritis. Childhood upper UTIs pose a significant risk of eventual kidney injury, hypertension, or kidney failure.⁶ The infection can return frequently and result in morbidities such as development retardation, kidney scarring, and high blood pressure in children, despite advances in medicine and the therapy of UTI. Therefore, it is crucial to identify UTI and treat it appropriately.⁷

In this study, we sought to assess pediatric residents' level of knowledge about the diagnosis, treatment, and follow-up of UTI in children and to identify their knowledge gaps.

MATERIALS AND METHODS

This descriptive study was conducted in 2022. A questionnaire was used to help gather the data. The researcher developed the questionnaire by reviewing the literature, and the data regarding the detection and treatment of UTIs was made by considering the most recent National Institute for Health and Clinical Excellence (NICE) guideline in England.⁸ Pediatric residents were asked to fill out surveys while researchers watched. The practitioners were informed about the study before administering the surveys, and their verbal and written consent was obtained. The participants who took part in the survey received a questionnaire with 13 items on it, which they were requested to complete anonymously. The questions were written in the style of closed-ended, multiple-choice questions (Table 1). There is a brief piece in the questionnaire that asks about the physicians' socio-demographic traits and how long they have worked as assistants. The questions are divided into three primary categories: diagnosis, therapy, and patient follow-up.

Statistical Evaluation

Statistical analysis was performed using SPSS Statistical Software (version 25; SPSS, Chicago, IL, USA), and mean, standard deviation, number and percentage were used to define the data. Pearson's chi-square test and Fisher's chi-square test were used to compare discrete (discontinuous/uncountable) variables between groups. Statistical significance was set as $p < 0.05$. This study was approved by the institutional board.

Ethics approval for this study was obtained from the Clinical Research Ethics Committee of the University of Health Sciences Türkiye, Dr. Behçet Uz Child Disease and Pediatric Surgery Training and Research Hospital with the approval number of 736 and the date with 15.09.2022.

RESULTS

Eighty-eight pediatric residents participated in the research. The gender split among the participating physicians was 76.1% female ($n=67$) and 23.9% male ($n=21$). The average age was 24 to 30 years in 79 (89.8%) residents and 30 to 35 years in 9 (10.2%) residents. Participants in the survey were clinicians who were between the first and fourth years of their residency training, and 18 (20.5%) individuals were found to be in their first year of pediatric education, while 15.9% ($n=14$) were in their final year. Throughout their pediatric residency training, 71 (80.7%) of the residents had previously studied in the nephrology clinic (Table 2). Generally, the percentages of responses to the questions ranged from 98.8 to 94.3%. The percentage of respondents who said, "I have no idea," was computed to range from the lowest 1.1% ($n=1$) to the highest 5.7% ($n=5$).

Of the participants, 2.3% and 5.7% stated that they had no opinion on UTI identification and epidemiology, respectively.

Table 1. Major elements of the questions in the questionnaire

1. Choose the incorrect statement regarding the epidemiology of pediatric urinary tract infections.
2. Which of the following is not included in the definition of atypical urinary tract infection?
3. Which of the following is the most common causative agent for pediatric urinary tract infection?
4. Which of the following is not defined as a recurrent urinary tract infection?
5. Which of the following is true about the time it takes for the urine sample to be delivered to the laboratory after collection?
6. Which of the following routine urine examination findings would not consider taking a urine culture?
7. Which of the following is not an indication for urine culture?
8. Which of the following is false regarding imaging of urinary tract infection?
9. A boy younger than 1 year has a recurrent urinary tract infection. Which of the following examinations would you not want the patient to prioritize?
10. Which of the following patients with urinary tract infection does not have an indication for hospitalization?
11. In which patient group below would you not consider urinary tract infection prophylaxis as a priority?
12. Which of the following scenarios for urinary tract infection does not require treatment?
13. A 4-year-old girl, who was followed up by the otolaryngology department due to hearing loss, was diagnosed with leukocyte +3 and bacteria 1,037 in her urine, and a midstream urine culture was taken when she applied for fever and vomiting. The patient was started on prophylactic ceftriaxone. On the 3 rd day of the hospitalized patient's treatment, while the fever continues, ESBL+ <i>E. coli</i> was detected in his culture, which of the following changes would you make first in his treatment?

Table 2. Socio-demographic characteristics of the residents	
Variables	N (%)
Gender	
Female	67 (76.1)
Male	21 (23.9)
Age range (years)	
24-30 age range	79 (89.8)
30-35 age range	9 (10.2)
Years of education in pediatric residency training	
0-1	18 (20.5)
1-2	20 (22.7)
2-3	21 (23.9)
3-4	15 (17.0)
4-5	14 (15.9)
Previously worked in the nephrology clinic during pediatric residency training	
Yes	71(80.7)
No	17(19.3)

Most participants (n=86, 97.7%) knew that *Escherichia coli* (*E. coli*) is the major cause of UTIs. The percentage of participants who properly answered the questions about the definition of recurrent UTI ranged from 54.5% (n=48) to 84.1% (n=74), whereas the percentage of participants who correctly answered the question about the diagnosis of atypical UTI remained at 52.3% (n=46).

The percentage of participants who correctly indicated urine culture based on the results of routine urinalysis in the diagnosis of UTI ranged from 95.5% to 96.6% (n=84 to n=85). 54.5% of participants (n=48) correctly identified the indication for ultrasonography (USG) in children with acute UTI. 60.2% (n=53) participants correctly responded to the question about when the laboratory should collect the urinary tract sample.

In the ninth question, was asked that "A boy younger than 1 year who had a recurrent UTI. Which of the following examinations would you not want the patient to prioritize?" Fifty-nine (67.0%) of the participants answered that Mercaptuacetyltriglycine (MAG3) was not appropriate for initial evaluation of recurrent UTI under the age of one year, while 29 (33.0%) answered the question incorrectly. Hospitalization indications in children with UTIs were accurately identified in 81 (92.0%) participants. In clinical scenarios that didn't require for treatment, it was shown that 96.6% (n=85) of the participants selected the right response, "Bacteriuria diagnosed in asymptomatic adolescent females." 48.9% (n=43.0) participants made the proper decision for extended spectrum beta-lactamase-positive *E. coli* treatment. It was noted that 96.6% (n=85) respondents correctly identified the question about the appropriate prophylactic indication. The rate of correct answers was 74.0% (683/923) in the residents who had pediatric nephrology rotation and 72.4% (160/221) in the residents who had no pediatric nephrology rotation (p>0.05).

DISCUSSION

One of the most significant childhood infections is UTI. It can cause hypertension, proteinuria, and end-stage renal disease if it is not identified and treated in a timely manner. Early detection and prompt treatment of UTIs in children are crucial for this reason. Due to this, this study aimed to evaluate pediatric residents' approaches to the diagnosis, follow-up, and treatment of UTIs using questions created in accordance with new developments in the literature. While the diagnosis of UTI had the highest rate of correct responses in the study, it was noted that the rate of correct responses was around 60.0%, particularly in the indications for requesting USG in the case of UTI and in the choice of advanced imaging method to be requested later.

In our study, we assessed how pediatric residents deal with UTI. Bunting-Early et al.⁹ revealed that delays in urinalysis/culture, particularly in the diagnosis of UTI, resulted in difficulties in their survey research of physicians practicing in the United States. In our study, 95% of participants were aware of the urine culture indication for the diagnosis of UTI. It is crucial to remember that early detection is important, especially because an untreated UTI can lead to sepsis in the early stages and renal scarring or failure in the later stages.¹⁰⁻¹²

Kennedy et al.¹³ revealed variations in UTI follow-up and thorough examination tests in a study that compared NICE recommendations and accepted practices. Particularly in the first approach, general practitioners, according to the provided scenarios, half of the participants reported having divergent views on whether to refer patients with UTI to an advanced center and the appropriate imaging techniques.¹³ In accordance with NICE recommendations, USG should be used to look for structural anomalies in all febrile children with atypical infections who do not respond clinically after 3 days despite receiving the proper antibiotic treatment.⁸ Half of the participants in our survey incorrectly identified the ultrasound indication. All children under the age of two should have USG at the first sign of UTI, according to American and Canadian standards.^{14,15} NICE recommendations advocate USG for children under the age of six months, for atypical causative microorganisms, and for unresponsive UTIs.⁸ In terms of cost-effectiveness, asking for USG imaging in the appropriate patient is crucial. This is also a tactic that will reduce the workload of radiologists.

A renal plasma flow agent called MAG3 is nearly entirely secreted in the proximal tubules and discharged there.¹⁶ MAG-3 is used as an advanced step test in the assessment of UTIs, but when we take the patient's urinary tract blockages into consideration.^{16,17} In our study 67% of the participants correctly identified MAG3 as not being among the first-line examinations when asked about other tests, which were not given priority while examining the 1-year-old infant kid with recurrent UTI.

Antibiotic resistance in UTI, as well as other infections, has been emerging globally and as a consequence increases the mortality and hospital costs.¹⁸⁻²⁰ A study in Turkey reported an increased

antimicrobial resistance at UTI, resulting in clinicians facing difficult to treat UTI in children.²¹ In the treatment section of the survey, nearly half of the residents could not treat the UTI-associated extended spectrum beta-lactamase-positive *E. coli* in an appropriate way, which was critical for eradication of the bacteria.²²

Study Limitations

This study contains limitations because of its design. It can't be stated that the number of participants represents all physicians working in this sector and limited in our institution because a sufficient sampling selection technique was not applied. The study provides additional information for designing strategies, although the approach and level of knowledge of pediatric residents on UTI have not been reviewed in the literature in Turkey.

CONCLUSION

In conclusion, pediatric residents had appropriate training and experience in the diagnosing of UTI in children. However, over half of the residents lacked sufficient training in the management of resistant bacteria and additional radiological imaging techniques. Considering this, we believe it will be good to keep the knowledge updated concerning the treatment and follow-up of children with UTI through in-service training and post-graduate education.

Ethics

Ethics Committee Approval: Ethics approval for this study was obtained from the Clinical Research Ethics Committee of the University of Health Sciences Türkiye, Dr. Behçet Uz Child Disease and Pediatric Surgery Training and Research Hospital with the approval number of 736 and the date with 15.09.2022.

Informed Consent: The practitioners were informed about the study before administering the surveys, and their verbal and written consent was obtained.

Peer-reviewed: Externally peer-reviewed.

Authorship Contributions

Surgical and Medical Practices: F.D., Concept: N.D., Design: F.D., N.D., Data Collection or Processing: F.D., D.B., B.P.Z., Ö.D., E.Y., Analysis or Interpretation: E.Y., Literature Search: F.D., Ö.D., E.Y., Writing: F.D.

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