

 Banu Karaca¹,  Mehmet Goktug Efgan²,
 Bahar Ormen¹,  Serkan Bilgin²,  Beyza Erol¹,
 Nurbanu Sezak¹

¹İzmir Katip Celebi University, Faculty of Medicine,
Department of Infectious Diseases, İzmir, Türkiye
²İzmir Katip Celebi University, Faculty of Medicine,
Department of Emergency Medicine, İzmir, Türkiye

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Corresponding Author: Banu Karaca, İzmir Katip Celebi University, Faculty of Medicine, Department of Infectious Diseases, İzmir, Türkiye
Email: banu.karaca@yahoo.com

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INTRODUCTION

Urinary tract infections are common in the community and affect all age groups. Bacteria are usually the causative agents (1). Urinary tract infection should be considered in cases presenting with dysuria, pollakiuria, and urgency complaints not accompanied by vaginal discharge, vaginitis, and cervicitis symptoms. These infections are divided into 2 groups: upper and lower urinary tract infections. The involvement of the bladder and urethra is called a lower urinary tract infection, while the involvement of the ureter, pelvis, and kidneys is called an upper urinary tract infection (2). The number of patients presenting to the emergency department with complaints of urinary system infection is high and there may be presentations with a wide spectrum of clinical pictures ranging from simple cystitis to

Retrospective analysis of urine culture results of patients admitted to the emergency department with urinary tract infection symptoms

Abstract

Aim: In this study, we aimed to examine the prognostic factors for infection and the approach and demographic data of patients admitted to the emergency department of a university training and research hospital with signs and symptoms of urinary tract infection.

Materials and Methods: In this retrospective observational study, using the hospital data management system, we analyzed the demographic data, presenting complaints, type of urinary tract infection, comorbid diseases, culture positivity, other laboratory results, imaging reports, and mortality rates of 115 patients admitted to the emergency department of a tertiary care university hospital with symptoms of urinary tract infection.

Results: Pyelonephritis and cystitis rates were 47.8% and 52.1%, respectively. Of all patients admitted with pyelonephritis and cystitis, 28.6% were hospitalized. We observed that 18% of the hospitalized cases were admitted to the intensive care unit. The urine culture positivity rate of all cases was 24.3%. The most common microorganisms grown in urine culture were *Escherichia coli* (*E. coli*) (50%), *Klebsiella pneumoniae* (*K. pneumoniae*) (17.8%), and *Enterococcus faecalis* (*E. faecalis*) (10.7%). In blood culture results, the blood culture positivity rate was 6% and the isolated microorganisms were *E. coli* (42.8%), and coagulase-negative staphylococci (28.5%). Extended-spectrum beta-lactamase was detected in 50% of *E. coli* and 40% of *K. pneumoniae*. The total mortality rate was calculated as 1.7% in the whole study group.

Conclusion: Urinary tract infections are common in the community and may be fatal when complicated or involving the upper urinary tract. These cases should be evaluated carefully and rapidly in the emergency department.

Keywords: Emergency department, pyelonephritis, cystitis

pyelonephritis, which may progress with bacteremia and lead to sepsis (3).

The diagnosis of urinary tract infection is made when pyuria is accompanied by the growth of 10⁵ CFU/ml microorganisms in urine culture (4). Studies have reported that there may not always be a positive correlation between growth in culture and pyuria, proteinuria, nitrite, and leukocyte esterase positivity detected by urinalysis (5-7). In addition, particularly pyelonephritis cases may be complicated with renal abscess, perirenal abscess, and emphysematous pyelonephritis due to delayed application for medical assistance or delayed treatment. The patient's age, upper urinary tract involvement, comorbid status, and the concurrence of the septic presentation are important in the hospitalization decision (8).

After rapid evaluation of clinical findings and physical examination, urinalysis, urine culture, and blood culture, when necessary, empirical antibiotherapy should be initiated considering local agents and susceptibility patterns. Treatment should be revised according to the susceptibility pattern of the microorganism grown in the culture. In addition, imaging methods such as ultrasound and computed tomography are necessary to determine the source of toxic cases, hemodynamic instability, suspicion of urolithiasis, suspicion of upper urinary infection or complicated urinary infection, treatment unresponsiveness, recurrent infections, and septic shock.

In this study, we aimed to evaluate the demographic data, comorbid factors, culture growth, hospitalization rate, and treatment of 115 patients with urinary tract infections who presented to the emergency department of a tertiary healthcare institution. At this point, our study will clarify the determination of urinary tract infection agents and their susceptibilities in our community and will ensure that appropriate antibiotics are administered as an empirical treatment. We planned this study due to the limited number of studies on this subject in the emergency department.

MATERIALS AND METHODS

In this study, we analyzed 115 patients admitted to the emergency department of a tertiary care institution with symptoms and signs of urinary tract infection, including dysuria, polyuria, pollakiuria, hematuria, flank pain, and suprapubic tenderness. The data was collected during a two-year period from 01.01.2021 to 31.12.2022. By reviewing their hospital records, we evaluated retrospectively and observationally the demographic data, the comorbid factors, the type of urinary infection (upper/lower), the growth rate in urine culture, the distribution of causative microorganisms, and the hospitalization rate.

The inclusion criteria for the patients were age over 18 years, presentation to the emergency department with symptoms of urinary tract infection, and presence of a urine culture examination. We excluded patients under 18 years of age presenting with the same symptoms, patients with other focal infections, and patients whose laboratory records were not available.

Pyelonephritis was diagnosed with fever, leucocytosis, flank pain, or having pyelonephritis findings in radiological imaging methods. Cystitis was diagnosed with dysuria, polyuria, and pollakiuria without leucocytosis, flank pain, or pyelonephritis findings in radiological imaging methods. Urine and blood cultures were collected according to primary diagnosis.

Statistical analysis Data were analyzed using IBM SPSS Statistics Standard Concurrent User V 26 (IBM Corp., Armonk, New York, USA) statistical package programs. Descriptive statistics were depicted as mean±standard deviation (Mean ± SD) and median (M). The Ethical Approval for the study was obtained from the non-interventional ethics committee of the hospital with the date 24.11.2022 and number 0551.

RESULTS

The mean age of the patients included in the study was 57.63±20.9 years. 62.6% of the patients were female. Cystitis was diagnosed in 60 (52.1%) and pyelonephritis in 55 (47.8%) patients. Three complicated cystitis patient were hospitalized. The risk factors for complicated cystitis were diabetes mellitus, hypertension, having urinary catheter and hospitalization history in the last 3 months in one patient, hypertension, hospitalization history in last 3 months in one patient also having cerebrovascular disorder, urinary catheter, hypertension, diabetes, hospitalization history in last 3 months in one patient. In order of frequency, dysuria was found in 46%, flank pain in 26%, decreased oral intake in 18.2%, hematuria in 17.3% and fever in 13% of the patients. In terms of comorbid diseases, diabetes mellitus was found in 26%, hypertension in 38%, chronic renal disease in 18%, benign prostatic hyperplasia in 17%, and urinary system stones in 14% of the patients. Patients with a Foley catheter and nephrostomy were 17.3% and 4.3%, respectively. The rate of positivity costovertebral angle tenderness was 20%. Suprapubic tenderness was positive in 11% of the patients. The rate of hospitalization in the last 3 months was 17% and the rate of urinary intervention history in the last 3 months was 8%. Septic shock rate at hospital admission was 2.6% in all cases and pyelonephritis was diagnosed in all of these cases. Clouding of consciousness symptoms were present in 8% of patients. While evaluating qSOFA values, the rate of patients with a score of 3 was 1.7%. The rate of nephrostomy in patients with pyelonephritis was 4.3%. We observed that 54.5% of pyelonephritis patients were hospitalized. In our study, the mean value of CRP was 88 mg/dL (0-398), and the white blood cell count was 11.000 /microliter (1.060-28.000).

Urine and 2 peripheral blood cultures were collected in pyelonephritis cases. Urine culture was positive in 34.5% of pyelonephritis cases, whereas blood culture was positive in only 12.7%. Microorganisms grown in urine culture in pyelonephritis cases are given in Table 1.

Table 1. Microorganisms grown in urine culture in pyelonephritis cases.

Microorganism	n (%)
<i>E. coli</i>	10 (52.6)
<i>K. pneumoniae</i>	4 (21)
<i>Pseudomonas aeruginosa</i>	2 (10.5)
<i>E. faecalis</i>	1 (5.2)
<i>Candida albicans</i>	1 (5.2)
<i>Enterococcus faecium</i>	1 (5.2)
Total	19 (100)

Extended-spectrum beta-lactamase (ESBL) was detected in 50% of the *E. coli* and 40% of *K. pneumoniae*. In these strains, the rates of resistance to trimethoprim cotrimoxazole and ciprofloxacin in *E. coli* were 71.4% and 85.7%, respectively. The rates of fosfomycin and gentamicin resistance in the ESBL-positive *E. coli* strains were 14.2% and 42.8%,

respectively. This group showed intermediate susceptibility to amikacin with a rate of 28.5%. All ESBL-positive strains were susceptible to carbapenems. Resistance rates to trimethoprim cotrimoxazole and ciprofloxacin in *K. pneumoniae* were 100% and 50%, respectively. In ESBL-positive *K. pneumoniae* strains, fosfomycin and gentamicin resistance rates were 100% and 50%, respectively. The most common agents detected in patients with pyelonephritis blood cultures were *E. coli* (42%) and *coagulase-negative staphylococcus* (28.5%).

While analyzing the causative agents of cystitis cases, the rate of positivity in urine culture was 13.3%, while no growth was detected in blood cultures (n:15) collected from febrile and complicated cases. The microorganisms grown in urine culture were *E. coli* in 50%, *E. faecalis* in 12.5%, *K. pneumoniae* in 12.5%, and *methicillin-sensitive Staphylococcus aureus* in 12.5%.

We observed that the predisposing conditions in the resistant *Pseudomonas aeruginosa* group were urinary calculi presence and urological intervention history in the last 3 months, in the resistant *K. pneumoniae* group were Foley catheter presence and benign prostatic hyperplasia, and in the resistant *E. coli* group were Foley catheter presence, hospitalization history in the last 3 months and urinary calculi presence.

Ultrasound was planned in two cases, computed tomography was performed in 22 cases, and findings compatible with pyelonephritis were observed. In addition, emphysematous pyelonephritis was observed in one of the 2 cases and perirenal abscess was observed in the other.

While evaluating the antibiotherapies used in hospitalized pyelonephritis and cystitis cases, we observed that ceftriaxone was used by 48.4%, piperacillin-tazobactam by 21.2%, and meropenem by 15.1% of the patients. The mortality rate was calculated as 1.7% in patients admitted to the emergency department with urinary tract infection findings. We had two mortal cases; one patient was 62 years old, had prosthetic hip infection, hepatic cirrhosis and acute renal failure concomitantly and the other patient was 77 years old, had hypertension, benign prostatic hypertrophy, pyelonephritis with leukocytosis also was in septic shock in admittance.

DISCUSSION

Urinary tract infections are common in the community and pyelonephritis is diagnosed in some patients admitted to hospital. Pyelonephritis cases progress with bacteremia and patients are systemically affected. Some patients presenting to the emergency department with signs and symptoms of urinary tract infection are diagnosed with urinary infection and a significant proportion of these cases have more easily managed infections classified as cystitis. According to the guidelines, empirical 3rd generation cephalosporin or quinolone treatment should be initiated following blood and urine culture collection, particularly in cases of pyelonephritis. Modifications of therapy should be planned

according to culture results (9,10).

In our study, 62.6% of the pyelonephritis cases admitted to the emergency department were females and the whole group's mean age was 57.63 years and this rate is compatible with the study of Bakırçivi et al. (11). Among the presenting symptoms of the patients, dysuria was the most common symptom in our study, followed by flank pain, decreased oral intake and hematuria. In the literature, while these symptoms were similar to our study, fever was detected more frequently while this rate was lower in our study at 13%. We think that this may be because of the patients taking antipyretics before admission to the hospital and the inadequacy of the immune system to develop a fever response due to advanced age. The most common presenting symptom was dysuria with a rate of 46%, which was consistent with the study of Karakeçili et al. While the costovertebral angle tenderness rate was 20% in our study, this rate was 42% in the literature and this difference was attributed to the fact that cystitis cases were more common than pyelonephritis in patients admitted to our emergency department. Whereas the suprapubic tenderness rate was 11.3% in our study, the rate in the literature was 41%, and this difference may be attributed to the inability of the patients to localize their complaints correctly or the limited time allocated for physical examination in the intensive conditions of the emergency department (12). While evaluating the comorbidities that create a predisposition for complications in the patients of our study group, the diabetes mellitus rate was calculated at 26%, hypertension at 38%, chronic renal failure at 18%, benign prostatic hyperplasia at 17.3%, urinary system calculi at 14.7%, and these rates were aligned with the study of Bakırçivi et al. and Karakeçili et al. (11,12). Patients' rate with a Foley catheter present was 17.3%, and patients' rate with nephrostomy was 4.3% and these rates were consistent with the literature (12).

In this study, the rate of hospitalization in the last 3 months was calculated as 17.3%, the rate of urinary intervention in the last 3 months was calculated as 7.8%, and these rates were compatible with the literature as 32.8% and 27%, respectively. While examining the laboratory data in our study, we observed that the mean value of C reactive protein (CRP) was 88 mg/dL, the white blood cell count was 11.000, and data similar to our results were reported in the literature (11).

At hospital admission, 2.6% of all cases were in septic shock and pyelonephritis was diagnosed in all of these cases. The mortality rate was calculated as 1.8% in patients admitted with septic shock. In the literature, the mortality rate in urinary system infections admitted to hospital with sepsis is similar to our study and is given as 2.4% (12).

Urine culture positivity was detected in 34.5% of pyelonephritis cases, while only 12.7% had positive blood cultures. While analyzing the microorganisms grown in urine cultures of pyelonephritis cases, we observed that *E. coli* was the most common agent, at a rate of 52.6%. In the literature, the *E. coli* rate was 62.6%, 77%, and 63% in the study by Karakeçili et al.,

Taşbakan Işıkgöz, and Doyuk Kartal, respectively, which were compatible with the rates of our study (12-14). In our study, the rate of ESBL-positive *E. coli* quinolone and trimethoprim-sulfamethoxazole resistance was high, and this was compatible with the literature data (15). While analyzing blood culture results, we observed that the rate of blood culture positivity in pyelonephritis cases was lower than in the literature; this rate was reported to be 30.7% in the literature and this rate was 12.7% in our study and the lower rate may be attributed to improper collection of samples, inappropriate cultivation in the laboratory or differences during transport of the samples (11).

While analyzing the causative agents of cystitis cases, we observed that the rate of positivity in urine culture was 13.3% and no growth was found in blood cultures collected from patients with fever or complicated cases. The microorganisms grown in urine culture were *E. coli* at a rate of 50%, *E. faecalis* at a rate of 12.5%, *K. pneumoniae* at a rate of 12.5%, and methicillin-sensitive *Staphylococcus aureus* at a rate of 12.5%. These agents were found compatible with the literature (16). An important point in our study in terms of its reflection on the clinic is that anti-pseudomonal activity should be taken into consideration when starting empirical treatment, especially in patients with urinary calculi and a history of urinary intervention in the last 3 months.

Ultrasound is recommended in the literature, particularly in cases of pyelonephritis, but tomography was more frequently preferred in our center. This may be attributed to the fact that our center is a tertiary care center and usually advanced and complicated cases are admitted to our emergency department. Urinary ultrasound is a cheap, easy, and radiation-safe diagnostic method for the diagnosis of urinary infections and should be used more frequently.

While evaluating the antibiotherapies used in hospitalized pyelonephritis and cystitis cases, we observed that ceftriaxone was used at a rate of 48.4%, piperacillin-tazobactam at a rate of 21.2%, and meropenem at a rate of 15.1%. In a study conducted in our country, it was observed that ceftriaxone treatment was given most frequently at a rate of 63%, similar to our results (12). In our study, the mortality rate in these patients was 1.7%, whereas this rate was reported as 4.7%-5% in different studies in the literature, aligned with our study (12,17). Urinary tract infections are common infections in the community and while lower urinary tract infections have a better prognosis, particularly complicated upper urinary tract infections may have a more morbid and mortal course. Patients presenting to the emergency department with symptoms of urinary tract infection should be evaluated very rapidly in this respect and empirical treatment for local expected agents should be initiated without delay after urine and blood cultures are collected.

Study Limitations

The limitation of our study is that it was conducted retrospectively in a single center. Multicentric and large case series studies

on upper or lower urinary tract involvement, agents and susceptibility patterns, length of hospitalization, and mortality in patients presenting to the emergency department with signs and symptoms of urinary tract infection will provide useful insights into the literature.

CONCLUSION

In light of the results obtained in this study, trimethoprim-sulfamethoxazole and quinolones should not be preferred in the empirical treatment of patients diagnosed with urinary tract infections in the emergency department. There is need for more extensive studies on the causative agents and susceptibility patterns of urinary tract infections in patients presenting to the emergency department.

Conflict of Interests

The authors declare that there is no conflict of interest in the study.

Financial Disclosure

The authors declare that they have received no financial support for the study.

Ethical Approval

The Ethical Approval for the study was obtained from the non-interventional ethics committee of the hospital with the date 24.11.2022 and number 0551.

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