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The clinical characteristics and outcomes of patients with positive and negative urine cultures who presented to Emergency Department, A Tertiary Care Center, Jeddah: A retrospective chart review study

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Research Article

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Abstract

Background

Urine cultures are widely used in emergency departments as a diagnostic tool for urinary tract infections. However, culture contaminations and unnecessary ordering increase costs, antibiotic misuse, and the development of resistance. The study is a retrospective chart review design that aims to compare contaminated and non-contaminated urine cultures and the effect on the outcomes among patients presenting to the Emergency Department at King Abdulaziz Medical City (KAMC) in Jeddah, between February 2023 and February 2024.

Methods

The study population included adult patients (≥ 18 years) who had the results of the urine cultures, and excluded patients with incomplete medical records, pediatric patients, and those who were discharged against medical advice. The data collection process was completed over a two-month duration. It was obtained using the BestCare information system and was assembled into a spreadsheet. The variables included demographic characteristics, such as age and gender. Other variables, like symptoms and comorbidities, are provided in the variables sheet. Comparisons between both groups were made using appropriate statistical tests, with a p-value < 0.05 considered statistically significant.

Results

A total of 353 adult patients participated in the study; the majority of them were female (77.6%), and most of the participants were aged between 19 and 64 years (54.5%). Among all urine cultures, 40.2% resulted in no significant bacterial growth, 49% were positive for pathogens, while only 10.8% were contaminated cultures. Furthermore, the most common associated microorganisms in positive cultures were E. coli (34.3%) and Klebsiella pneumoniae (11.3%). Moreover, around 40.8% of the urine culture indications were unnecessary, with 33.4% of them being asymptomatic patients. Regarding the disease characteristics, 88.1% of the cases were prescribed empiric antibiotics, most commonly Ciprofloxacin (18.7) and Augmentin (10.3%), with a 28.8% resistance rate. Approximately 90.1% of the cases were discharged directly.

Conclusions

Urine culture contamination and unnecessary ordering were frequent in the emergency department. This reflects the need for improved sample collection and strict diagnostic criteria in order to address antibiotic misuse, costs, and resistance.

Trial registration

Not applicable.

Background

An identification of bacteria or fungi in a urine sample can be done in a lab setting using a urine culture. It is a test that cultivates microorganisms from the urine to identify the precise kind of bacteria or fungus causing the infection, it aids in the diagnosis of urinary tract infections (UTIs). This test is crucial for directing the selection of the appropriate management to successfully treat the infection.[1] The use of urine culture is warranted in various scenarios such as in complicated UTIs, differentiating between complicated and uncomplicated UTIs, treatment failure, and inpatient UTI. These scenarios require urine culture not to only confirm the diagnosis, but to specify the causative organism.[2] The most common organisms that are found in urine culture are gram negative Escherichia coli, which is responsible for approximately 70–80% of community-acquired infections. In addition to E. coli, other commonly found organisms include Klebsiella pneumoniae, Proteus mirabilis, Enterococcus faecalis, Pseudomonas aeruginosa, Staphylococcus saprophyticus, Staphylococcus aureus and Streptococcus agalactiae.[3, 4]Based on multiple studies, a positive urine culture depends on the symptoms of the patient. In asymptomatic patients, the threshold for bacterial growth on a midstream voided urine that is indicative of bacteriuria without contamination is ≥ 10^5 colony forming units (CFU)/ mL. However, the threshold differs in symptomatic females with pyuria, lower midstream urine counts (le, ≥ 10^2 CFU/mL) have been associated with the presence of bladder bacteriuria. Therefore, in such cases, the findings of a colony count < 10^5 but ≥ 10^2 CFU/mL may still be representative of a UTI. In males, lower bacterial counts are still indicative of infection, in patients already on antimicrobials, and with organisms other than E. coli and Proteus species.[5] A urine culture that yields positive results can aid in diagnosing different types of UTIs such as complicated and uncomplicated UTIs, asymptomatic bacteriuria (ASB), catheter-associated UTIs (CA-UTIs), and catheter-associated asymptomatic bacteriuria (CA-ASB). These results can help identify the source of infection. Accurate diagnosis leads to proper antibiotic administration, decreasing morbidity and mortality.[2] Although urine culture can be useful in many cases, it shouldn’t be used in every case. There are a few factors which can overestimate or underestimate the number of urine culture orders. In terms of human factors, patient factors (13%), physician communication/availability (12%), reflex culture protocols (9%), the electronic health record (7%), urinary symptoms (6%), and ED throughput (5%) were the most common factors among ER nurses.[6] There are few researches who studied the outcome of urine cultures worldwide, but there isn't any studies done in Saudi Arabia. This study aims to assess the the clinical characteristics and outcomes of patients with positive and negative urine cultures who presented to Emergency Department, A Tertiary Care Center.

Methods

Study setting and participants

Study was conducted in King Abdulaziz medical city (KAMC), Jeddah, Saudi Arabia. The study was designed as a chart review retrospective study. Data were gathered from the electronic patient medical record system for each corresponding patient.

The inclusion criteria was any patient 18 years old and above with at least one urine culture result from February 2023 to February 2024 was eligible. On the contrary, patients younger than 18 years old, patients with incomplete data, and patients absconded from ER were excluded.

The study sample size was 353 patients sampled through consecutive sampling techniques. Data were obtained from available electronic patient files of adults with urine culture results in a tertiary center, NGHA, Jeddah, Kingdom of Saudi Arabia, from February 2023 to February 2024.

Data collection process

Best Care system will be used to retrieve the required data. Then, data will be assembled in a spreadsheet for further analysis. Qualitative variables will include age group, gender, etc.. Further classification of variables is in the attached variables sheet. Data collection duration will be for 2 months.

Variables

The data collection sheet provided the month the urine culture was performed, urine culture result (categorized as: positive (with organism), no significant growth, and contamination), Organism Identified (If the urine culture is positive).

Sociodemographic information included gender and age. Age was categorized to 3 groups (2–18 years old, 19–65 years old, and > 65 years old).

Furthermore, clinical information provided the indication for the urine culture, whether the urine culture was necessary or not, antibiotics use in the last 30 days, empiric antibiotic use in the ER, and any other antibiotics that the patient may have been taking.

It also provided the susceptibility of the organism to the antibiotic (susceptible, intermediate, and resistant), comorbidities, and patient's clinical presentation.

Lastly, patient outcomes classified as: Hospitalization/Admission, still admitted, discharged home from ER, transfer to another hospital, signed DAMA, or deceased, were provided.

This structured data collection approach will allow for a thorough analysis of urine culture practices, organisms identified, patterns of antimicrobial resistance, and patient outcomes.

Data analysis

Data will be extracted from the collection form and entered into a Microsoft Excel spreadsheet for aggregation of data. Eventually, data will be exported to JMP 15.2.0 (SAS institute) for data analysis.

Descriptive statistics such as frequency, mean, and standard deviation will be calculated for all applicable variables and demonstrated as mean ± standard deviation or percentage while the median will be calculated for variables with extreme outliers.

One-way analysis of variance (ANOVA) and independent t-test analysis will be utilized for quantitative-qualitative data analysis. Chi-square and its other variants i.e., fisher exact test will be used for qualitative- qualitative variables analysis.

The correlation of quantitative-quantitative data will be evaluated using Pearson's correlation coefficient. Regarding two-variable analysis, two-way ANOVA will be utilized. In relation to multivariable analysis, binary logistic regression test, multinomial logistic regression analysis, and linear logistic regression analysis will be utilized.

P-value < 0.05 will be considered significant.

Results

Basic characteristics of patients

The study included a total of 353 patients. The majority were female with 274 (77.6%) patients, while males accounted for 79 (22.3%) patients. Patients' ages were predominantly within the 19–64 years range with 192 (54.5%) patients, followed by 101 (28.7%) patients 65 years and above, and 40 (11.3%) patients aged 18 years. Among all cultures, 142 (40.2%) showed no significant bacterial growth, while 38 (10.8%) were considered contaminated samples. Among positive cultures, Escherichia coli was the most frequently isolated pathogen with 121 (34.3%) cultures, followed by Klebsiella pneumoniae with 40 (11.3%). Other organisms accounted for 3.4% of cases. The most common indications for urine culture included asymptomatic patients (118 cases; 33.4%), followed by complicated urinary tract infections (80 cases; 22.7%), upper respiratory tract infections (33 cases; 9.3%), complicated cystitis (30 cases; 8.5%), and pyelonephritis (30 cases; 8.5%). Other indications included cystitis (28 cases; 7.9%), pregnant states (14 cases; 3.9%), chemo (11 cases; 3.1%), and others (9 cases; 2.6%). Urine cultures were deemed necessary in 209 (59.2%) of cases, while 144 (40.8%) were considered unnecessary based on clinical presentation. Table (1)

Table 1
Basic characteristics of patients:

Variable	**N = 353**
Gender	
Female	274 (77.6)
Male	79 (22.3)
Age at presentation	
18 years	40 (11.3)
19–64 years	192 (54.5)
65 years and above	101 (28.7)
Organism	
Contamination	38 (10.8)
E. coli	121 (34.3)
Klebsiella pneumoniae	40 (11.3)
No significant growth	142 (40.2)
Other	12 (3.4)
Indication	
Chemo	11 (3.1)
Complicated cystitis	30 (8.5)
Complicated UTI	80 (22.7)
Cystitis	28 (7.9)
No UTI symptoms	118 (33.4)
Pregnant states	14 (3.9)
Pyelonephritis	30 (8.5)
URTI	33 (9.3)
Other	9 (2.6)
Culturing order	
Necessary	209 (59.2)
Unnecessary	144 (40.8)
AB Used in the last 30 days	

Variable	N = 353
Yes	69 (19.8)
No	280 (80.2)

Disease characteristics

A total of 311 patients received empiric therapy, 161 (51.8%) of them were not given AB in ED. The most frequently prescribed agents were ciprofloxacin with 58 (18.7%) prescriptions and Augmentin with 32 (10.3%). Other AB included nitrofurantoin (14 prescriptions; 4.5%), cefuroxime (10 prescriptions; 3.2%), tazocin (9 prescriptions; 2.9%), and ceftriaxone (7 prescriptions; 2.3%). Among 207 antibiotic susceptibility tests, 104 (71.2%) were susceptible, while 42 (28.8%) were resistant to the prescribed AB. Table (2)

Table 2
Disease characteristics:

Variable	N = 353
Empiric Antibiotic (n = 311)	
Augmentin	32 (10.3)
Ceftriaxone	7 (2.3)
Cefuroxime	10 (3.2)
Ciprofloxacin	58 (18.7)
Nitrofurantoin	14 (4.5)
No AB given in ED	161 (51.8)
Tazocin	9 (2.9)
Other	20 (6.4)
Susceptibility (n = 207)	
R	42 (28.8)
S	104 (71.2)
Charlson Index	2.53 ± 2.65

Outcomes

Among all patients, 318 (90.1%) were discharged from ED, while 19 (5.4%) patients required hospitalization. 16 (4.5%) patients were still admitted. No patients were transferred to other hospitals,

left against medical advice, or were deceased during the study period. Table (3)

Table 3
Outcomes:

Variable	**N = 353**
Hospitalization	
Yes	19 (5.4)
No	334 (94.6)
Still Admitted	
Yes	16 (4.5)
No	337 (94.5)
Discharge home from ER	
Yes	318 (90.1)
No	35 (9.9)
Transfer to other hospital	
Yes	0 (0)
No	353 (100)
Signed DAMA	
Yes	0 (0)
No	353 (100)
Deceased	
Yes	0 (0)
No	353 (100)

Discussion

In our study, urinary tract infections (UTIs) disproportionately affect women, where 77.6% of cases were female. Similarly, 84% of cases were primarily female in Hansen et al. (2022) study [7]. Moreover, Foxman (2002) supports these findings, reporting that nearly 50% of women experience at least one UTI in their lifetime [8]. This susceptibility is attributed to anatomical factors, hormonal influences, and behavioral patterns.

In addition, according to our study, Escherichia coli was the most prevalent uropathogen at 34.3%, while Klebsiella pneumoniae came in second at 11.3%. Similarly, Al-Tawfiq et al.'s (2020) reported that the

most common isolates were E. coli constituting 69.8% and Klebsiella pneumoniae constituting 17.2% of Gram-negative bacteria isolates [9]. Moreover, E. coli was found in 36% of the patients in a study conducted in Sri Lanka, though they reported much higher rates of K. pneumoniae at 26% [10]. This may be attributable to a rise in nosocomial infections because the study from Sri Lanka indicated that indwelling catheters and obstructive uropathy pose considerable risk [10].

Urine culture contamination is a major challenge in clinical diagnostics, leading to unnecessary treatments and increased healthcare costs. In our study, 10.8% of urine cultures were contaminated, while Hansen et al. (2022) study reported a significantly higher contamination rate of 54.9% in primary care settings [7]. This difference may be because our study was conducted in a controlled environment, where trained staff ensured proper collection techniques. In contrast, Hansen et al. (2022) study was conducted in primary care settings, where patients might not receive direct supervision during sample collection.

Urine cultures are essential for diagnosing urinary tract infections (UTIs) but are often ordered unnecessarily. In our study, 40.8% of cultures were deemed unnecessary, with 33.4% ordered for asymptomatic patients. This aligns with findings by Hartley et al., where 57.7% of hospitalized patients underwent urine cultures without guideline-based indications but out of them only 37.5% had no documented reason for ordering the culture [11].

The antimicrobial stewardship literature emphasizes that urine cultures should primarily be reserved for complicated UTIs, pyelonephritis, and cases requiring treatment adjustments [12]. Overuse of urine cultures leads to increased healthcare costs and contributes to antibiotic resistance.

Out of the total sample of 353 patients, 311 (88.1%) were found to have received empirical antibiotic therapy during treatment. The most frequently administered agents were ciprofloxacin 18.7% and Augmentin 10.3%, as demonstrated in our results document. Contrary to this, the international guidelines recommend nitrofurantoin, trimethoprim-sulfamethoxazole and fosfomycin as first line agents because of their lower resistance chances [13]. The concerns which emerged over the resistance to ciprofloxacin, which is increasing throughout the world, are further enhanced by the 28.8% resistance which was noted in our study. Similarly, in a study were 12,253,679 of urinary E. coli isolates were obtained, the resistance rate for ciprofloxasin against E. coli has increased from 3% in 2000 to 17.1% in 2010 [14].

When comparing the hospitalization outcomes in our study with the findings from Jaffe et al.'s 2021 scoping review on emergency department (ED) discharge risk stratification, several important observations emerge [15]. Our study demonstrated that a substantial majority of patients with suspected urinary tract infections-90.1%-were safely discharged from the ED, with only 5.4% requiring hospitalization and 4.5% remaining admitted at the time of data collection. Notably, there were no cases of transfer, patients leaving against medical advice, or in-hospital mortality.

These findings are consistent with the general trend in EDs, as highlighted by Jaffe et al., where most patients are managed on an outpatient basis [15]. However, the scoping review emphasizes that while

discharge is common, it remains a critical juncture for patient safety, with potential risks including adverse events, medication non-compliance, and inadequate follow-up-areas not captured in our current outcome data.

Moreover, Allaudeen et al. study identified notable gaps in documentation and variable rates of follow-up, with only 76% of discharged patients completing a follow-up appointment within 30 days [16]. In contrast, our study did not capture post-discharge follow-up or revisit rates, representing an important area for future research.

Limitations:

This study has potential limitations. First, the study was conducted at a single tertiary care centre in Jeddah, indicating that it was applied to a subgroup of the population, thus limiting the generalizability to other healthcare centers in Saudi Arabia. Second, the study focused on the outcomes of the patients who were presented to the emergency department. However, it did not include follow-ups after discharge for any complications, adverse effects, or possible recurrence. Finally, the study included a sample of only 353 patients, which may have missed rare clinical outcomes or detected less common organisms.

Recommendations:

Several recommendations can be made to enhance both clinical practice and patient outcomes. First, it is crucial to have clear guidelines that recommend first-line treatments such as nitrofurantoin for UTI and avoid the overuse of fluoroquinolones, which can increase resistance. In addition, following international guidelines prevents ordering unnecessary urine culture, especially in asymptomatic patients who do not require diagnostic testing.

Second, it is important to reduce contamination rates in specimens to avoid false results. This can be improved by implementing regular staff training and patient education.

Lastly, wider and larger studies are needed to be conducted across Saudi Arabia to provide a better understanding of the practice and outcomes.

Conclusions

The study highlights the urine culture practice at the Emergency Department in King Abdulaziz Medical City (KAMC) in Jeddah, indicating that urine culture contamination and excessive ordering are common among physicians. This causes overprescription of antibiotics and antimicrobial resistance. Furthermore, E. coli is the most common isolated pathogen found on cultures. Even though there were inappropriate requests for urine cultures and antibiotic prescriptions, most of the patients were safely discharged. These findings suggest the need to start improving diagnostic criteria, the sample collection process, and limit the overuse of antibiotics, aiming to address costs and enhance patient outcomes.

Declarations

Ethics approval and consent to participate

All procedures performed in this study involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. The study was approved by the IRB Committee at King Abdullah International Medical Research Center (KAIMRC). Study number NRJ23J/120/04. A waiver of informed consent by KAIMRC was considered for this study due to the retrospective study design.

Consent for publication

Not applicable.

Availability of data and materials

The datasets used and/or analyzed in the current study are available from the corresponding author upon reasonable request.

Competing interests

The authors declare no conflict of interest.

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Authors' contributions

MJ, ZR, FA, EA, FA, MA, KA, BA, and RA conducted the study. ZR, FA, EA, FA, MA, and KA collected data. MJ provided statistical advice and study design and analyzed the data. MJ, ZR, FA, EA, FA, MA, KA, BA, and RA drafted the manuscript. RA provided the abstract, limitations, recommendations, and conclusion. MJ took responsibility and supervised the study. All authors reviewed the study. All the authors have read and approved the final version of the manuscript and agree to be accountable for all aspects of the work.

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Authors' information

Not applicable.

References

1. Mayo Clinic. Urinalysis [Internet]. Mayo Clinic. 2023. Available from: https://www.mayoclinic.org/tests-procedures/urinalysis/about/pac-20384907
2. Sinawe H, Casadesus D. Urine Culture. In: StatPearls. StatPearls Publishing, Treasure Island (FL); 2023. PMID: 32491501.
3. Lee DS, Lee SJ, Choe HS. Community-Acquired Urinary Tract Infection by Escherichia coli in the Era of Antibiotic Resistance. BioMed Research International [Internet]. 2018;2018(2018):1–14.
4. Asadi Karam MR, Habibi M, Bouzari S. Urinary tract infection: Pathogenicity, antibiotic resistance and development of effective vaccines against Uropathogenic Escherichia coli. Mol Immunol. 2019;108:56–67.
5. Pernille H, Lars B, Marjukka M, Volkert S, Anne H. Sampling of urine for diagnosing urinary tract infection in general practice – First-void or mid-stream urine? Scand J Prim Health Care. 2019;37(1):113–9.
6. Redwood R, Knobloch MJ, Pellegrini DC, Ziegler MJ, Pulia M, Safdar N. Reducing unnecessary culturing: a systems approach to evaluating urine culture ordering and collection practices among nurses in two acute care settings. Antimicrob Resist Infect Control. 2018;7(1).
7. Hansen MA, Valentine-King M, Zoorob R, Schlueter M, Matas JL, Willis SE, et al. Prevalence and predictors of urine culture contamination in primary care: A cross-sectional study. Int J Nurs Stud. 2022;134:104325.
8. Foxman B. Epidemiology of urinary tract infections: incidence, morbidity, and economic costs. Am J Med [Internet]. 2002;113(1):5–13.
9. Al-Tawfiq JA, Rabaan AA, Saunar JV, Bazzi AM. Antimicrobial resistance of gram-negative bacteria: A six-year longitudinal study in a hospital in Saudi Arabia. J Infect Public Health. 2020;13(5):737–45.
10. Samarawickrama SS, Illangakoon HU, Uthuman A, Vinod, Saranga, Chaminda Janaka. The Clinical Profile of Patients With Culture-Positive Urinary Tract Infections Admitting to a Tertiary Hospital in Sri Lanka. Cureus [Internet]. 2024 Apr 20.
11. Hartley S, Valley S, Kuhn L, Washer LL, Gandhi T, Meddings J, et al. Inappropriate testing for urinary tract infection in hospitalized patients: an opportunity for improvement. Infect Control Hosp Epidemiol. 2013;34(11):1204–7. 10.1086/673449.
12. Abbo L, Hooton T. Antimicrobial Stewardship and Urinary Tract Infections. Antibiotics. 2014;3(2):174–92.
13. Gupta K, Hooton TM, Naber KG, Wullt B, Colgan R, Miller LG, et al. International Clinical Practice Guidelines for the Treatment of Acute Uncomplicated Cystitis and Pyelonephritis in Women: A 2010 Update by the Infectious Diseases Society of America and the European Society for Microbiology and Infectious Diseases. Clin Infect Dis. 2011;52(5):e103–20.
14. Sanchez GV, Master RN, Karlowsky JA, Bordon JM. VitroAntimicrobial Resistance of Urinary Escherichia coli Isolates among U.S. Outpatients from 2000 to 2010. Antimicrob Agents Chemother. 2012;56(4):2181–3.

15. Jaffe TA, Wang D, Loveless B, Lai D, Loesche M, White B, et al. A scoping review of emergency department discharge risk stratification. West J Emerg Med [Internet]. 2021;22(6):1218–26.
16. Allaudeen N, Breckenridge JS, Vashi AA. To admit or not to admit: Emergency department discharges after request for medicine admission. J Healthc Qual [Internet]. 2020;42(3):122–6.