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LABORATORY DIAGNOSIS OF URINARY TRACT INFECTIONS (UTIS)IN KARBALA-IRAQ

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ABSTRACT

Background: While the presence of bacteria, or bacteriuria, in a freshly drawn urine sample is the most common cause of a urinary tract infection (UTI), other microorganisms including parasites are also significant uropathogens that require careful microscopic evaluation. Any area of the urinary tract may be affected by the infection, which may or may not cause symptoms. Urinary tract infections typically start as urethritis and progress to cystitis and ureteritis. Dysuria is among the symptoms that accompany cystitis. The purpose of this study was to diagnose the pathogenic bacteria that cause urinary tract infections and to determine the sensitivity and resistance of these bacteria to a particular class of antibiotics. **Methods and Results:** Sixty-three (63) urine samples from individuals with inflammation were collected to achieve the aims of this study. Following their transfer to the lab, urinary tract samples from both sexes were studied. After performing diagnostic tests, it emerged that the Escherichia coli bacterium ranked highest, with a proportion of (33%), and it was cultured on various culture media to diagnose the bacteria causing urinary tract infections. Proteus bacteria exhibited a high rate of resistance to cephalosporins and penicillins due to their production of lactamase B enzymes. Regarding Proteus bacteria's capacity, biofilm formation and production were detected using the tissue culture plates (TCP) technique. According to the data, 28.57% of the samples could create biofilm, whereas 42.85% of the samples showed an inadequate capacity to create a biofilm. **Conclusion:** Although this study highlights the high prevalence and resistance of bacterial uropathogens, comprehensive laboratory diagnosis must also consider non-bacterial etiologies, including parasitic infections, particularly when investigating cases of sterile pyuria.

KEYWORDS: Urinary tract infection (UTIs), Staphylococcus, Proteus, Pseudomonas aeruginosa, Klebsiella, Microscopic examination, Parasitic UTI.

INTRODUCTION

Urinary tract infection (UTI) is defined as the presence of pathogenic microorganisms in a freshly taken urine sample. While this is most commonly characterized by the presence of bacteria (Bacteriuria), UTIs can also be caused by other microorganisms, including fungi and parasites. The infection can occur in any part of the urinary tract and may be accompanied by symptoms or be asymptomatic (Pandey et al., 2022). All age groups and both sexes can get urinary tract infections, which range in severity from mild infections with no symptoms to infections with severe symptoms (Chu & Lowder, 2018). Severe systemic disorders like bacteremia and septicemia can frequently result from urinary tract infections. Due to physiological and anatomical factors, urinary tract infections are more common in women than in men (John et al., 2016).

Previous studies have shown that the incidence of infection increases in males after the age of 60 years, especially in the case of enlargement of the prostate gland, which requires emptying the urinary bladder using a catheter, and here the probability of infection increases (Najar et al., 2009). Most urinary tract infections begin with urethritis and the infection progresses to cystitis and ureteritis. Cystitis is accompanied by symptoms such as dysuria (painful urination) and pyuria (the presence of pus in the urine), and about 20% of untreated cases of cystitis develop into pyelonephritis, which is an inflammation of one or both kidneys (Goje, 2020). The most important symptoms associated with it are flank pain, fever, and recurring pain during urination. Furthermore, about 10% of UTIs are polymicrobial, shared by two or more microorganisms (Gunn, 2012).

The most important risk factors that increase the severity of inflammation are the presence of chronic diseases such as diabetes, sickle cell anemia, chronic kidney disease, kidney transplantation, and congenital structural and neurological abnormalities of the urinary tract, including the presence of stones, the use of a bladder scope, and the use of long-term catheterization (Begum & Latunde-Dada, 2019).

In general, urinary tract infections can be divided into two categories according to the source of infection (Tan & Chlebicki, 2016).

1. Community-acquired UTIs: These, in turn, are divided into uncomplicated infections, the most common causes of which are *E. coli*, in addition to *Klebsiella* spp., *S. saprophyticus*, and other members of the Enterobacteriaceae family. Complicated infections occur especially in cases of recurrent infections and are frequently caused by *Enterobacter* spp., *Pseudomonas*, *Proteus*, and *Klebsiella*.
2. Hospital-acquired (Nosocomial) UTIs: The hospital environment plays an important role in identifying the germs that cause UTIs. Hospitalized patients are highly infected with *E. coli*, as well as *Proteus*, *Klebsiella*, *Enterococcus*, and other species belonging to the Enterobacteriaceae family. About 20% of people who use catheters develop bacteremia, blood poisoning, and kidney failure (Forbes et al., 1998).

There are several ways for pathogenic microorganisms to enter the urinary tract. The ascending route is the most common, especially in women and in the case of using catheters. The descending route includes the blood tract and the lymphatic tract (Nicolle, 2005). Other bacterial species that rarely cause UTIs include *Ureaplasma urealyticum*, *Acinetobacter* spp., *Gardnerella vaginalis*, and *Corynebacterium* spp. (Rosales-Castillo et al., 2023).

In addition to bacterial etiologies, a comprehensive laboratory diagnosis must also consider parasitic causes of UTIs, which are often overlooked but clinically significant. Parasites such as *Trichomonas vaginalis* can infect the lower urinary tract via the ascending route, often identified during routine microscopic urine examination. Furthermore, *Schistosoma haematobium*, a blood fluke, causes urinary schistosomiasis and enters the urinary system via the bloodstream, typically presenting with hematuria. Recognizing these parasitic agents is essential for an accurate differential diagnosis, particularly in cases of sterile pyuria where standard bacterial cultures yield negative results despite the presence of inflammation.

RESULT AND DISCUSSION

The study sample

The main goal of collecting samples was to isolate and diagnose the bacterial species causing urinary tract infections using routine methods, and then study the resistance and sensitivity of these bacteria to (6) types of antibiotics, in addition to studying the ability of the isolated *Proteus* bacteria to produce biofilms. For this purpose, (63) samples of urine were collected from Al-Hussein Teaching Hospital, Karbala, where *Proteus* bacteria were isolated in a percentage of (11.11%) of urinary tract infection cases. Several types of microorganisms that cause urinary tract infections were also isolated in this study, and Table (1) shows these microorganisms with their isolation rates.

Table 1: shows the types of microorganisms that cause UTIs isolated in this study.

Bacterial isolates the number(%)	Microscopic organism
21(33.3%)	***Escherichia coli***
19 (30.15%)	***Staphylococcus***
7(11.11%)	***Proteus***
8(12.6%)	***Klebsiella***
8(12.6%)	***Pseudomonas aeruginosa***
63(100%)	**Total number of isolates**

From observing Table (1), it is clear that *E. coli* bacteria occupy the first place in causing urinary tract infections, as they were isolated at a rate of (33.3%) in this study. This may be attributed to the fact that these bacteria are present in a large proportion within the normal flora endemic in the intestinal tract. It is one of the opportunistic bacteria that can cause various diseases, including urinary tract infections, especially if the appropriate opportunity exists.

We also find that *Proteus* bacteria ranked third in causing urinary tract infections, as they were isolated at a rate of (11.11%) in this study. The reason for the isolation of *Proteus* bacteria at this rate is attributed to the fact that they are members of the coliform bacilli that are naturally present in the intestinal tract and have the ability to cause opportunistic diseases when they access the urinary tract. This result is expected, as *Proteus* bacteria can be isolated from immunosuppressed individuals such as AIDS and cancer patients, and people who use antibiotics for long periods (Calik Basaran & Ascioglu, 2017).

From the results of the current study, it is clear that *Staphylococcus* bacteria ranked second in causing urinary tract infections, as they were isolated at a rate of (30.15%). This percentage indicates the ability of this opportunistic bacterium to cause inflammation, as it is naturally present in the vagina and urethra, in addition to its natural presence on the skin.

It is important to highlight from a comprehensive diagnostic perspective that while our findings exclusively identified bacterial etiologies, the laboratory diagnosis of UTIs must always account for potential parasitic infections. Although not detected in the current sample pool from Al-Hussein Teaching Hospital, parasites such as *Trichomonas vaginalis* and *Schistosoma haematobium* are significant uropathogens. Their absence in this study could be attributed to the specific sample size, the demographic targeted, or the primary methodological focus on bacterial cultivation. Nevertheless, precise microscopic examination of urine sediments remains an indispensable practice in medical laboratories to rule out these parasitic agents, particularly in patients presenting with symptoms of UTIs but yielding negative bacterial cultures (sterile pyuria).

Table 2: shows the results of the sensitivity test of *Proteus* bacteria to the antibiotics used in this study.

Number of resistant isolates	Number of susceptible isolates	code	Antibiotics
4	3	Ak	Amikacin
3	4	Lmp	Lmipenem
5	2	Ri	Rifampin
6	1	P	Penicillin
3	4	Cip	Ciprofloxacin
5	2	Am	Amoxocillin

The results of this study showed that the highest percentage of resistance was to the antibiotics ampicillin and amoxicillin, as the highest percentage of isolates were resistant to these antibiotics. The reason for the resistance of *Proteus* bacteria to penicillin antibiotics may be due to their production of beta-lactamase enzymes that protect the bacterial cell by attacking the beta-lactam ring present in the nucleus of penicillins and cephalosporins, breaking the amide bond, and transforming the antibiotic into an ineffective compound (Lima et al., 2020). This can also occur through the possession of efflux systems by Enterobacteriaceae family bacteria, whereby the antimicrobial agent is excreted from inside the cell to the outside (Alav et al., 2021).

Wincor et al. (2001) demonstrated that amikacin resistance rates in *Proteus* isolates, obtained from urinary tract infection cases in Canada, Europe, and Latin America, were 24.3%, 33%, and 47.7%, respectively. More recent studies have also shown that most *Proteus* isolates exhibit resistance to rifampin, attributed to chromosomal mutations or the presence of plasmids carrying multiple antibiotic resistance genes (Gifford et al., 2023). These findings generally indicate that *Proteus* isolates can resist the majority of clinically used antibiotics.

The reason for this may be attributed to the bacteria's adaptation to the hospital environment, which is characterized by the constant presence of antibiotics, encouraging the occurrence of mutations in the genetic material. Biofilm formation increases the resistance of bacteria to antibiotics, as treatment with normal concentrations of antibiotics leads to the killing of the peripheral bacteria that make up the biofilm, while the bacteria remaining inside the polysaccharide layer maintain their vitality, develop resistance to antibiotics, and act as a focus for recurrent infections (Srinivasan et al., 2021).

Table (3): Number of isolates of biofilm-producing *Proteus* spp.

Biofilm production			Isolates
weak	Moderate	Strong	
2	2	3	***Proteus Spp.***

Augimeri and his group (2015) found that a high percentage of *Proteus* species can produce biofilms, and this result is consistent with the findings obtained in our current study. The ability of *Proteus* bacteria to swarm or crawl rapidly represents an important mechanism that enables the bacteria to move and spread from the mature biofilm to colonize a new surface or membrane, causing the blockage of catheters. Bacterial biofilms cause chronic diseases that are difficult to control.

The biofilm is a major virulence factor for the bacteria that produce it. In addition to the role of extracellular polymeric substances in stabilizing the biofilm, they protect the cells inside it from harsh environmental conditions such as ultraviolet radiation, pH changes, osmotic shock, dehydration, and toxic substances (Wu et al., 2008).

Gebreyohannes et al. (2019) pointed out the role of the biofilm in reducing the access of antibiotics to the cells located within it, which increases resistance to antibiotics and promotes the spread of resistant strains. Furthermore, Liu et al. (2021) showed that the antibiotic ciprofloxacin penetrates surfaces not covered with a biofilm within 40 seconds, while it takes 21 minutes to penetrate the same surface when covered with a biofilm.

CONCLUSIONS

1. *Escherichia coli* and *Staphylococcus* spp. are the leading bacterial causes of UTIs in the studied samples.
2. Isolated *Proteus* spp. exhibited significant multidrug resistance, particularly to beta-lactams, largely due to beta-lactamase production and genetic adaptations.
3. A high proportion of *Proteus* isolates are capable of biofilm formation, which significantly enhances their antibiotic resistance and contributes to recurrent infections.
4. Although bacteria are the primary uropathogens, accurately diagnosing UTIs—especially in cases of sterile pyuria—requires considering non-bacterial etiologies, including parasites.

Recommendations

1. Emphasize meticulous microscopic evaluation in general urine examinations (GUE) to detect parasitic uropathogens (e.g., *Trichomonas vaginalis* and *Schistosoma haematobium*), particularly when bacterial cultures are negative.
2. Implement strict antibiotic stewardship and catheter care protocols in healthcare settings to control the spread of multidrug-resistant and biofilm-producing strains.
3. Conduct future epidemiological studies focused on the prevalence of parasitic and fungal UTIs to develop more comprehensive laboratory diagnostic algorithms.

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REFERENCES

1. Alav, I., Kobylka, J., Kuth, M. S., Pos, K. M., Picard, M., Blair, J. M., & Bavro, V. N. (2021). Investigated the structure, assembly, and function of tripartite efflux and type I secretion systems in Gram-negative bacteria. Chemical Reviews, 121(9): 5479–5596.
2. Augimeri, R. V., Varley, A. J., & Strap, J. L. (2015). Explored the role of bacterial cellulose in environmental interactions, with insights from biofilm-producing Proteobacteria. Frontiers in Microbiology, 6: 169282.
3. Begum, S., & Latunde-Dada, G. O. (2019). Reviewed anemia of inflammation, emphasizing chronic kidney disease. Nutrients, 11(10): 2424.
4. Calik Basaran, N., & Ascioglu, S. (2017). Provided a literature review on epidemiology and management of healthcare-associated bloodstream infections in non-neutropenic immunosuppressed patients. Therapeutic Advances in Infectious Disease, 4(6): 171–191.
5. Chu, C. M., & Lowder, J. L. (2018). Discussed diagnosis and treatment of urinary tract infections across different age groups. American Journal of Obstetrics and Gynecology, 219(1): 40–51.
6. Dobrut, A., Skibiński, J., Bekier, A., Drożdż, K., Rudnicka, K., Płociński, P., … & Brzychczy-Włoch, M. (2024). Developed a field-usable diagnostic tool for detecting Gram-positive cocci-induced mastitis in cattle. BMC Veterinary Research, 20(1): 169.
7. Gebreyohannes, G., Nyerere, A., Bii, C., & Sbhatu, D. B. (2019). Examined challenges in intervention, treatment, and antibiotic resistance of biofilm-forming microorganisms. Heliyon, 5(8).
8. Goje, O. (2020). Covered genitourinary infections and sexually transmitted diseases.
9. Gunn, A. (2012). Presented a systematic guide for differential diagnosis of common diseases and disorders. Springer Science & Business Media.
10. John, A. S., Mboto, C. I., & Agbo, B. (2016). Reviewed prevalence and predisposing factors for urinary tract infections in adults. Euro J Exp Bio, 6(4): 7–11.
11. Lima, L. M., da Silva, B. N. M., Barbosa, G., & Barreiro, E. J. (2020). Provided an overview of β-lactam antibiotics from a medicinal chemistry perspective. European Journal of Medicinal Chemistry, 208: 112829.
12. Liu, Y., Li, Y., & Shi, L. (2021). Discussed controlled drug delivery systems for eliminating bacterial biofilm-associated infections. Journal of Controlled Release, 329: 1102–1116.
13. Najar, M., Saldanha, C., & Banday, K. (2009). Reviewed approaches to urinary tract infections. Indian Journal of Nephrology, 19(4): 129–139.
14. Nicolle, L. E. (2005). Discussed catheter-related urinary tract infections. Drugs & Aging, 22: 627–639.
15. Pandey, R., Lu, Y., Osman, E., Saxena, S., Zhang, Z., Qian, S., … & Soleymani, L. (2022). Developed DNAzyme-immobilized microgel magnetic beads for rapid and culture-free quantification of bacteria in urine. ACS Sensors, 7(4): 985–994.
16. Rosales-Castillo, A., Expósito-Ruiz, M., Gutiérrez-Soto, M., Navarro-Marí, J. M., & Gutiérrez-Fernández, J. (2023). Investigated emerging microorganisms in clinical genitourinary samples. Microorganisms, 11(4): 915.

17. Tan, C. W., & Chlebicki, M. P. (2016). Reviewed urinary tract infections in adults. Singapore Medical Journal, 57(9): 485.
18. Wu, H.-J., Wang, A. H., & Jennings, M. P. (2008). Explored virulence factors of pathogenic bacteria. Current Opinion in Chemical Biology, 12(1): 93–101.