Original Article

Study of the Bacteria Associated with Acute Urinary Tract Infection in Human

Mytham J. Abdul Hussein[1]*, Riad A.H. Delool[2], Hala RA. Al-Fahham[3]

[1]Department of Medical Laboratory Techniques, College of Health and Medical Techniques, Al-Bayan University, Baghdad, Iraq.
Email: mytham.j@albayan.edu.iq
[2]Department of Medical Laboratory Techniques, College of Health and Medical Techniques, Al-Bayan University, Baghdad, Iraq.
Email: riad.delool@albayan.edu.iq
[3]Department of Clinical Laboratory Science, College of Pharmacy, University of Jabir Ibn Hayyan for Medical and Pharmaceutical Science, Al-Najaf, Iraq.
Email: hala.ridha@jmu.edu.iq

Abstract

Background: A urinary tract infection (UTI) is an infection that affects most organs of the urinary system, which includes the kidneys, ureters and bladder, especially the lower part of the urinary tract, especially the bladder and urethra. Females are usually more likely to be infected than males. Most often urinary tract infections are treated with antibiotics, but at the same time, some preventive measures can be taken to reduce urinary tract infections. **Methods:** One hundred urine samples were taken from patients of different ages (20-45 years) and were collected and tested for urinary tract infection according to World Health Organization protocol. Bacteria were cultured on Blood and MacConkey and CLED and EMB medium and stained by gram stain and antibiotic sensitivity test method. **Results:** One hundred urine samples were taken, 70% of specimens gave growth of bacteria while 30% gave no growth 40/70 (57.14%) of growth can from female patients, while 30/70 (42.86%) from male patients, 50/70(71.43%) of which were gram-negative bacillus bacteria and 20/70(28.57%) of the gram-positive cocci bacteria. The gram negative bacteria includes *E.coli* by about 25/50 (50%) and *Proteus mirabilis* about 13/50(26%) and *Pseudomonas aeruginosa* about 7/50(14%) and *Klebsiella pneumoniae* about 5/50(10%). **Conclusion:** The gram-positive bacteria contained about 10/20(50%) of them *Staphylococcus aureus* and *Staphylococcus saprophyticus* about 6/20(30%) and *Staphylococcus epiderimidis* about 4/20 (20%).

Keywords: Urinary Tract Infection, Pyelonephritis, Cystitis.

Introduction

Urinary tract infections are common infections that infect humans, and they may develop into the occurrence of clinical syndromes such as prostatitis, urethritis, cystitis as well as pyelonephritis. Infections of the lower urinary tract include prostatitis, epididymitis, cystitis and urethritis, while the upper part of the urinary tract includes pyelonephritis.[1] Half of urinary tract infections in hospitals occur by *Escherichia coli*, but at the same time, they are responsible for 85-90% of infections in the community. *Enterococci* comes in second place after *Escherichia coli* by causing urinary tract infections in hospitals. Catheterization, diabetes and spinal cord injury increase the severity of urinary tract infections.[2] *Klebsiella*, *Enterococci* as well as *Streptococci group B*, are the most common types of bacteria in the development of urinary tract infections in children and diabetes. Urinary tract infections often occur due to one bacterium, while the patients with stones or chronic renal abscesses or indwelling of urinary catheters it's caused by multiple organisms.[3] More than 7 million people have urinary tract infections in the United States. Adults are most commonly vulnerable to urinary tract infections but the infection is more serious in children and causes them to urinate in bed. Women are more likely to be infected than men because of the structural difference between them.[4] There are several possible ways for organisms to enter the urinary tract, including the lymphatic route, the blood-borne route and the ascending route. The infection in women begins with the colonization of the pathogen for the vagina, perineum and the area around the urethra to

Access this article online

Quick Response Code:

Website: www.jnsbm.org

DOI: https://doi.org/10.4103/jnsbm.JNSBM_15_2_3

Address for Correspondence: Department of Medical Laboratory Techniques, College of Health and Medical Techniques, Al-Bayan University, Baghdad, Iraq
Email: mytham.j@albayan.edu.iq

Submitted: 09th May, 2024 **Received:** 28th May, 2024
Accepted: 29th June, 2024 **Published:** 11th July, 2024

How to cite this article: Hussein M J A, Delool R A H, Al-Fahham H R A. Study of the Bacteria Associated with Acute Urinary Tract Infection in Human. J Nat Sc Biol Med 2024;15:189-191

reach the bladder. The widespread incidence of urinary tract infection in females is that their urethra is shorter than males as well as the presence of urethral meatus close to the anus. Bacteria may enter the female urinary bladder during sexual intercourse, and the risk is increased when using diaphragms and spermicides.[5] The main objective of this study is to identify the bacteria associated with acute urinary tract infections in human and find out the most important ways to reduce their spread and eliminate.

Material and Methods

Samples Collections

One hundred urine samples from adults of different ages (25-45 years), we collected them under sterile conditions.

Culture Media

All urine samples, were cultured on different types of culture media such as MacConkey agar then Blood agar and finally on CLED and EMB agar.

Blood agar is an enriched medium used for the growth of fastidious organisms, such as *Streptococcus* and *Staphylococcus* and that's by adding 5% sheep blood to encourage the growth of bacteria.[6] We isolated and differentiated the organisms of non-fastidious gram-negative rods on selective media such as MacConkey agar and EMB agar.[7] As for the bacteria that are present in the urine and that usually cause a urinary tract infection we cultured them on the differential media such as CLED agar to isolate and figure out enumerate them.[8] All bacteria were stained with gram stain and then it was performed antibiotic sensitivity test by the Kirby–Bauer test method.

Results

One hundred urine samples were taken, 70/100 (70%) of the specimens gave growth of bacteria compared with 30/100 (30%) gave no growth and 40/70 (57.14%) of growth from female patients, while 30/70 (42.86%) from male patients (Table 1).

Table 1: Distribution of Clinical Specimens with Ages and Infection of Patients.

Sex	Growth	No Growth
Total	70 (70%)	30(30%)
Female	40(57.14%)	20(66.67%)
Male	30(42.86%)	10(33.33%)
Age Category		
25-30 year	15(21.43%)	8 (26.7%)
30-35 year	22(31.43%)	7 (23.3%)
35-40 year	28 (40%)	6 (20%)
40-45 year	5 (7.14%)	9 (30%)
Chill and fever	20(28.57%)	10 (33.3%)
No chill and fever	50(71.42%)	20 (66.7%)
History of previous UTI	60(85.71%)	18 (60%)
No history of previous UTI	10(14.29%)	12 (40%)
No history of catheterization	50(71.43%)	16(53.33%)
History of catheterization	20(28.57%)	14(46.67%)

All growth species contained different bacterial strains, 50/70 (71.43%) of which were gram-negative bacillus bacteria and 20/70 (28.57%) of the gram-positive cocci bacteria. The gram negative bacteria includes *E.coli* by about 25/50 (50%) and *Proteus mirabilis* about 13/50 (26%) and *Pseudomonas aeruginosa* about 7/50(14%) and *Klebsiella pneumoniae* about 5/50(10%). The gram-positive bacteria contained about 10/20 (50%) of them *Staphylococcus aureus* and *Staphylococcus saprophyticus* about 6/20 (30%) and *Staphylococcus epiderimidis* about 4/20 (20%) (Table 2).

Table 2: Distribution of Bacterial Isolates Concerning Gender.

	Female	Male	Total
Gram Negative Bacterial Isolates			
E.coli	15/25(60%)	10/25(40%)	25
Proteus mirabilis	8/13(61.54%)	5/13(38.46%)	13
Pseudomonas aeruginosa	5/7(71.43%)	2/7(28.6%)	7
Klebsiella pneumoniae	3/5(60%)	2/5 (40%)	5
Gram Positive Cocci Isolates			
Staphylococcus aureus	6/10 (60%)	4/10(40%)	10
Staphylococcus saprophyticus	4/6(66.67%)	2/6(33.33%)	6
Staphylococcus epiderimidis	3/4(75%)	1/4(25%)	4

The gram-negative rods bacteria, which include most *E.coli* isolates are sensitive to trimethoprim and sulfamethoxazole, most of *Proteus mirabilis* are sensitive to tetracycline and nitrofurantoin, most of *Pseudomonas aeruginosa* sensitive to ciprofloxacin and levofloxacin, and also most of *Klebsiella pneumoniae* sensitive to aminoglycosides and cephalosporins while gram-positive cocci such as most of *Staphylococcus* species sensitive to levofloxacin meropenem and imipenem shows as in Table.3.

Table 3: Antibiotic Susceptibility of Bacterial Isolates.

Bacterial Isolates	Antibiotics	Resistant	Sensitive
E.coli	Trimethoprim and sulfamethoxazole	6/25(24%)	19/25(76%)
Proteus mirabilis	Tetracycline and Nitrofurantoin	7/25(28%)	18/25(72%)
Pseudomonas aeruginosa	Ciprofloxacin and Levofloxacin	2/7(28.57%)	5/7(71.43%)
Klebsiella pneumoniae	aminoglycosides and cephalosporins	1/5(20%)	4/5(80%)
Staphylococcus species	Levofloxacin, Meropenem, and imipenem	6/20(30%)	14/20(70%)

Discussion

Urinary tract infections either include the lower urinary tract, which is called a bladder infection, or an upper urinary tract called pyelonephritis. When urine contains large numbers of bacteria and without the appearance of symptoms is called asymptomatic bacteriuria.[9] The infection becomes complicated if there is an infection in the upper urinary tract of people with diabetes, immunodeficiency or pregnant women.[10] When a urinary tract infection coincides with fever in children, in this case, it is considered an upper urinary tract infection.[11]

The number of people with urinary tract infections is about 150 million people, women are more likely to be infected than men, which is mostly by bacterial infections, and most women become infected more than once in their lifetime.[12,13] Infections acquired in hospitals make up about 40% of urinary tract infections, and some cases are due to microorganisms and some come from the wet environment of hospitals. Urinary catheters may be contaminated with microorganisms and lead to the development of urinary tract infections at the dwelling. Microorganisms causing urinary tract infections in hospitals have more antibiotic resistance than uncomplicated pathogens.[14] In one study conducted on urinary tract infection, where 267 urine samples were collected, where formed a urinary tract infection acquired from hospitals constitutes a ratio of 32.2%. The most common bacterial pathogens are *Escherichia coli* at 41.9%, *Staphylococcus aureus* at 31.4%, *Klebsiella pneumoniae* at 11.6%, *Klebsiella oxytoca* at 7.0%, *Proteus mirabilis* by 3.5%, *Enterococcus faecalis* at 3.5%, and *Proteus vulgaris* 1.2%.[15]

Conclusion

In the results of our study, one hundred urine samples were taken, all containing different bacterial strains, 75% of which were gram-negative bacillus bacteria and 25% of the gram-positive cocci bacteria. The gram-negative bacteria include *E.coli* by about 50% *Proteus mirabilis* about 11% *Pseudomonas aeruginosa* about 9% and *Klebsiella pneumoniae* about 5%. The gram-positive bacteria contained about 50% of them *Staphylococcus aureus* and *Staphylococcus saprophyticus* about 25% and *Staphylococcus epiderimidis* about 15%.

Reference

1. Saleem K, Azim W. Patterns of Presentation in Gonococcal Urethritis and Assessment of Antibiotic Sensitivity in Gonorrhea. J AIDS Clin Res. 2016; 7(9): 1000613. doi: https://doi.org/10.4172/2155-6113.1000613.
2. Agboola A. Infertility and Subinfertility. In: Akin A, Ed. Textbook of Obstetrics and Gynaecology. Heinman Educational Books; 2004:174-76.
3. Centers for Disease Control Prevention. Pseudomonas Aeruginosa in Healthcare Settings. HAI/CDC. Updated August 27, 2018. Available from: https://www.cdc.gov/hai/organisms/pseudomonas.html.
4. Urrutia-Herrera D, Greiner F, Tejada-Tayabas LM, Monárrez-Espino J. Clinical Training of Primary Health Care Physicians to Reduce False Positive Diagnoses of Pediatric Urinary Tract Infections. J Community Med Health. 2016; 6(2): 1000412. doi: https://doi.org/10.4172/2161-0711.1000412.
5. Litster A, Moss SM, Honnery M, Rees B, Trott DJ. Prevalence of bacterial species in cats with clinical signs of lower urinary tract disease: recognition of Staphylococcus felis as a possible feline urinary tract pathogen. Vet Microbiol. 2007; 121(1-2): 182-8. doi: https://doi.org/10.1016/j.vetmic.2006.11.025.
6. Buxton R. Blood Agar Plates and Hemolysis Protocols. American Society for Microbiology. 2005: Available from: https://asm.org/protocols/blood-agar-plates-and-hemolysis-protocols.
7. Allen ME. MacConkey Agar Plates Protocols. American Society for Microbiology. 2005: Available from: https://asm.org/protocols/macconkey-agar-plates-protocols.
8. Khalid M. Comparison of Chromogenic (HiCrome Urinary Tract Infection Agar) Medium with Cysteine Lactose Electrolyte Deficient Agar in a Resource-Limited Setting. Int J Appl Basic Med Res. 2021; 11(1): 9-13. doi: https://doi.org/10.4103/ijabmr.ijabmr_306_19.
9. Lane DR, Takhar SS. Diagnosis and management of urinary tract infection and pyelonephritis. Emerg Med Clin North Am. 2011; 29(3): 539-52. doi: https://doi.org/10.1016/j.emc.2011.04.001.
10. Colgan R, Williams M. Diagnosis and Treatment of Acute Uncomplicated Cystitis. Am Fam Physician. 2011; 84(7): 771-6. Available from: https://www.aafp.org/pubs/afp/issues/2011/1001/p771.html.
11. Bhat RG, Katy TA, Place FC. Pediatric Urinary Tract Infections. Emerg Med Clin North Am. 2011; 29(3): 637-53. doi: https://doi.org/10.1016/j.emc.2011.04.004.
12. Salvatore S, Salvatore S, Cattoni E, Siesto G, Serati M, Sorice P, Torella M. Urinary Tract Infections in Women. Eur J Obstet Gynecol Reprod Biol. 2011; 156(2): 131-6. doi: https://doi.org/10.1016/j.ejogrb.2011.01.028.
13. Flores-Mireles AL, Walker JN, Caparon M, Hultgren SJ. Urinary tract infections: epidemiology, mechanisms of infection and treatment options. Nat Rev Microbiol. 2015; 13(5): 269-84. doi: https://doi.org/10.1038/nrmicro3432.
14. Deepthi B, Gopika KT, Samyuktha KR, Priyanka R, Sharmila SK. Nosocomial Urinary Tract Infections. Skin Dis Skin Care. 2017; 2(1): 14. Available from: https://skin-diseases-and-skin-care.imedpub.com/articles/nosocomial-urinary-tract-infections.pdf.
15. Odoki M, Almustapha Aliero A, Tibyangye J, et al. Prevalence of Bacterial Urinary Tract Infections and Associated Factors among Patients Attending Hospitals in Bushenyi District, Uganda. Int J Microbiol. 2019; 2019: 4246780. doi: https://doi.org/10.1155/2019/4246780.