Prevelance and Age Wise Distribution of Bacterial Pathogens in Patients with Urinary Tract Infection

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ABSTRACT

Background & Objectives: One of the most common bacterial diseases are urinary tract infections (UTIs), in which the urinary system becomes inflamed due to an abnormal bacterial growth. Annually, there are over 150 million cases of UTIs recorded. Escherichia coli accounts for 80-90 % of infections and the rest are caused by Klebsiella Pneumoniae, Pseudomonas aeruginosa, Proteus mirabilis and Streptococcus.

Methods: Frequency of uropathogens was determined in Ayub Teaching Hospital from December 2021 to March 2022. The midstream urine specimens were collected and inoculated on Cysteine Lactose Electrolyte Deficient agar and blood agar and incubated aerobically at 37 °C for 18-24 hrs.

Results: Out of 1088 samples 441 (40 %) showed growth on culture medium. A higher frequency of Urinary tract infection was observed in females found as 369 (83 %) as compared to males as 72 (16 %). Frequency of Escherichia coli in Urinary tract infection was 355 (80 %) found to be highest as 82 % in females and 17 % in males. Klebsiella found to be the second most frequent bacteria in Urinary tract infection and its frequency was 9 % in females and 1.8 % in males followed by Staphylococcus found as 4 % in females and

0.9 % in males. Pseudomonas aeruginosa & Morganella morganii appeared only in females & frequency was 0.9% and 2 %) respectively.

Conclusion: Maximum frequency of Urinary tract infection observed in age group of 21 to 40 years in both male and females.

Key words: Escherichia coli, Klebsiella Pneumoniae, Pseudomonas aeruginosa, Proteus mirabilis, Streptococcus, Morganella morganii, Cysteine Lactose Electrolyte Deficient agar.

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INTRODUCTION

One of the most common bacterial diseases are urinary tract infections (UTIs), in which the urinary system becomes inflamed due to an abnormal bacterial growth. Annually, there are over 150 million cases of UTIs recorded. In contrast to men, women are more prone to UTI [1]. With up to 35% of nosocomial infections and being the second leading cause of bacteremia in hospitalized patients, these diseases have also emerged as the most prevalent hospital-acquired infections. Patients with this condition range in age and sex, with females making up 87.5% of instances compared to males 71.3%. This is related to women's short urethral tubes and the anus's near closeness to the urethral opening, which make it easier for bacteria to enter the urethra. It is predicted that during adulthood, half of all women will experience recurrent bouts of acute cystitis [2].

Inaccurate UTI treatment can result in serious problems such uremia, renal failure, high blood pressure, and abortion. E. coli, Citrobacter, Enterobacter, Enterococcus, Morganella spp., Proteus vulgaris, Proteus mirabilis, Pseudomonas aeruginosa, Staph. saprophyticus, and Staph. aureus are only a few of the pathogenic bacteria that can cause UTIs. But among both men and women of all ages, E. coli is the most common cause of urinary tract infections[3]. A particular uropathogenic subset of E. coli has the capacity to exhibit increased virulence. Fimbriae, flagella, many adhesions, siderophores, poisons, and other characteristics that enable it to escape or circumvent host defences, trigger a cascade of immune reactions, and assault the host cells and tissues are some examples of these virulence adaptations[4].

UTIs are frequently brought on by bacterial infections that spread to even a small section of the urinary system. These include increased urination frequency, discomfort, and cloudiness in the urine[5]. Other symptoms comprise dysuria, cramps in the lower abdominal region, back pain, chills, fever, and general weakness accompanied by nausea and vomiting[6]. Asymptomatic bacteriuria, if left untreated, may result in acute cystitis and pyelonephritis, which may ultimately have detrimental effects like prematurity, poor birth weight, and an increase in the foetal mortality risk[7].

Female sexual orientation, pregnancy, diabetes, and advanced age are some risk factors for UTI[8]. Several risk factors for septic shock in UTI patients have been identified in the past, including liver cirrhosis, infections contracted while receiving medical care, and the use of an indwelling urinary catheter[9]. More than two symptomatic episodes within six months or more than three symptomatic episodes within a year are considered recurrent UTIs[10]. Understanding the risk factors for recurrent UTI can help doctors develop preventative measures that effectively lower the likelihood of recurrence[11].

Early UTI therapy reduced the rate of morbidity. The medications' effectiveness has decreased as a result of drug resistance. Previously, they were effective in treating individuals with urinary tract infections. Even Nevertheless, there are still places in the globe where these medications are still useful[12]. The development of sepsis into septic shock might theoretically be stopped with the use of early, effective antibiotics. Patients with sepsis who receive ineffective empiric antibiotic therapy have a greater mortality rate, which could rise with each hour that adequate antibiotic administration is put off[13].

Aims and Objective of study

1. To evaluate prevalence of different bacterial pathogens in patient with Urinary tract infections in Ayub Teaching Hospital Abbottabad.
2. To determine age wise distribution of bacterial pathogens in both genders involved in UTI infection in Ayub Teaching Hospital Abbottabad.

MATERIALS AND METHODS

Study area and duration

This study was designed at Medical Laboratory Technology and carried out at Ayub teaching hospital Abbottabad from December 2021 to March 2022.

Study population

All patients with symptomatic UTIs, ages ranging 20-90 years and belonged to District Abbottabad of Pakistan were fulfill the inclusion criteria

Sampling and Isolation

A total of 1000 urine samples were collected from both genders using standard method “clean catch” from all the patients with suspected urinary tract infection. Urine samples were inoculated in different culture media (blood agar, MacConkey agar and Cystine lactose electrolyte deficient agar) using standard streak plate method. The plates of Blood Agar were incubated in 5-10 % CO_2 atmosphere. After incubation, plates were examined macroscopically and microscopically for bacterial growth and the urine cultures were classified as negative, positive and contaminated.

Identification of bacterial isolates

Isolates were identified on the basis of colony morphology, Gram staining and biochemical tests including Catalase, Oxidase, Sulfide, Indole, Motility, Citrate, Urea, Pyocinin production and Lactose by using kit method. These tests were performed based on the morphology of the isolated bacteria and on the results of the microscopic examination of the Gram-stained smear. E. coli produce opaque yellow colonies with a lactose fermenting colonies slightly deeper yellow center on CLED agar, K. pneumoniae produce yellow to whitish-blue colonies, extremely mucoid. P. aeruginosa produce green colonies with typical matted surface and rough periphery. S. aureus produce deep yellow colonies, uniform in color. Biochemical tests was selected based on the morphology of the isolated bacteria and on the results of the microscopic examination of the Gram-stained smear which show motility and gram-negative rods under microscope.

RESULTS

The current research was conducted in Microbiology Department of Ayub Teaching Hospital (ATH) Abbottabad District KPK Pakistan during December 2021 to March 2022.

In this study 1088 specimens were examined for bacterial growth. Out of these 441 (40.4%) have growth and 647 (59.5%) have no growth (Table 3.1) and (figure 3.1). Out of 441 positive male cases 72 (16.4%) show growth and female cases 369 (83.4%) show growth (Table 3.2) and (figure 3.2).

When the data were classified into different age and gender groups, it appeared that the cases of UTI were more in females than males. Among the bacterial pathogens E. coli was the most frequent in both sexes with 17 % and 82.9 % frequencies in male and female respectively. S. aureus caused 4.5 % UTI in females than the males 0.9 %. Klebsiella were isolated 1.8% in males and 9% in females. The P. aeruginosa 0.9 % appeared only in female. UTI cases caused by Morganella morganii appeared 2.7 % only in females (Table 3.3) and (figure 3.3). For the age group between 21-40 years showed more percentage of UTI cases then other age groups (table 3.4), (figure3.4) and (table 3.5), (figure 3.5).

Table 3.1: Total urine sample collected.

Total Examined	Culture	Percentage
Positive	441	40.4%
Negative	647	59.5%
Total	1088	100%

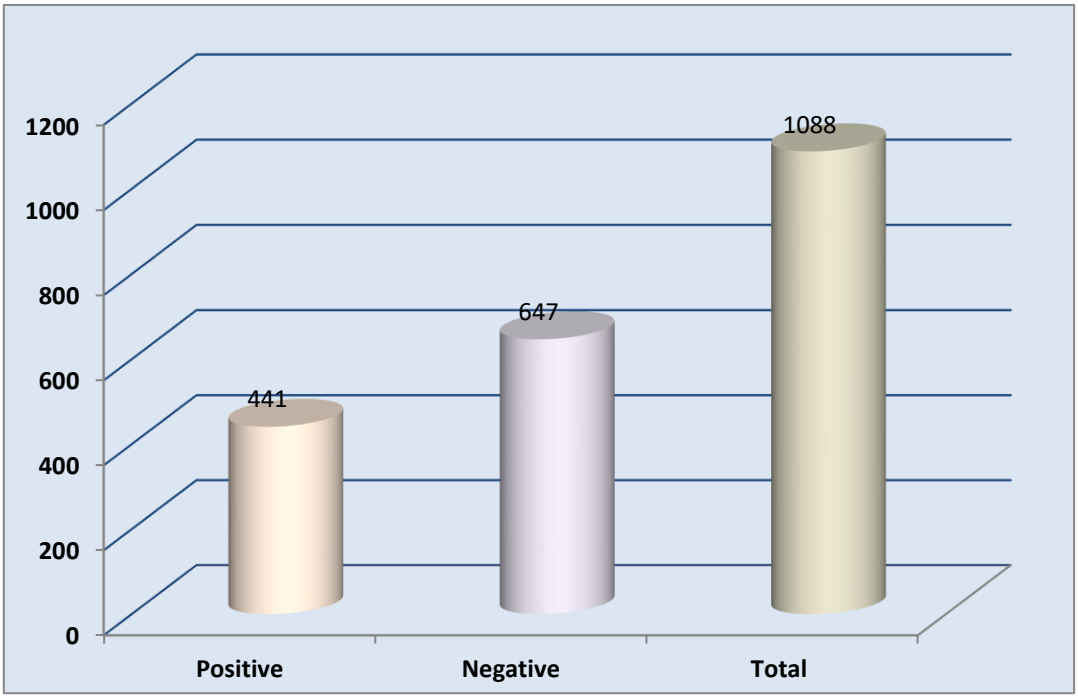

Figure 3.1: Total urine sample collected.

Table 3.2: Frequency of UTI in both genders.

Gender	Culture Positive	Percentage
Male	72	16.4 %
Female	369	83.6 %
Total	441	100 %

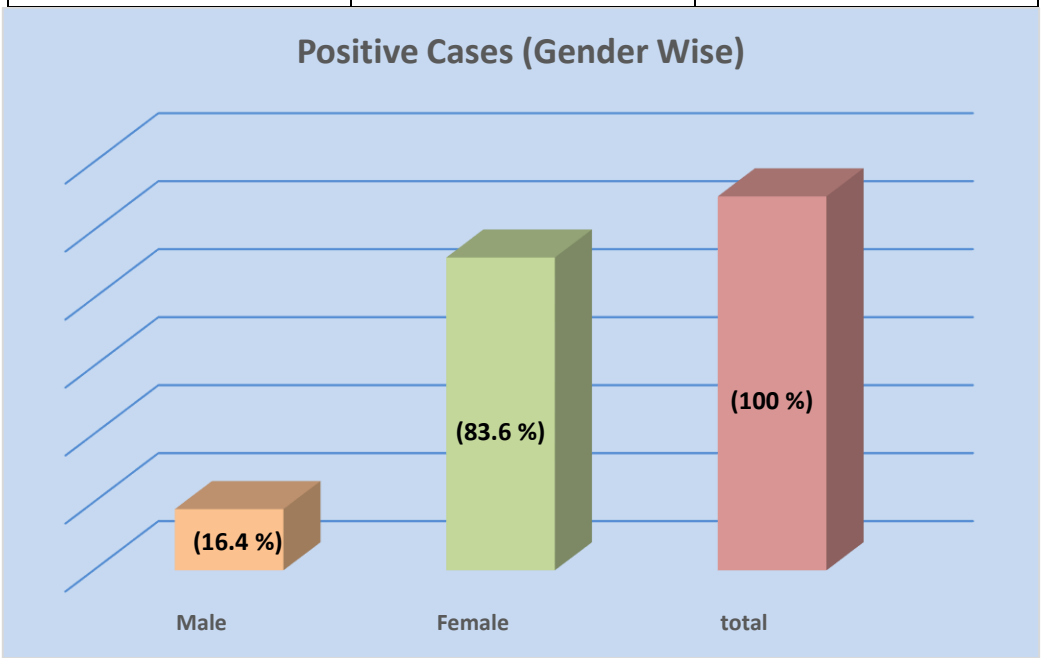

Figure 3.2: Frequency of UTI in both genders.

Table 3.3: Frequency of different bacterial pathogens in relation to sex of patients.

Organisms	Isolates from males	Isolates from females	Total cases
Escherichia coli	61	294	355 (80 %)
Staphylococcus aureus	2	20	22 (5 %)
Klebsiella pneumonia	9	39	48 (10.9 %)
Pseudomonas aeruginosa	0	4	4 (0.9 %)
Morganella morganii	0	12	12 (2.7 %)

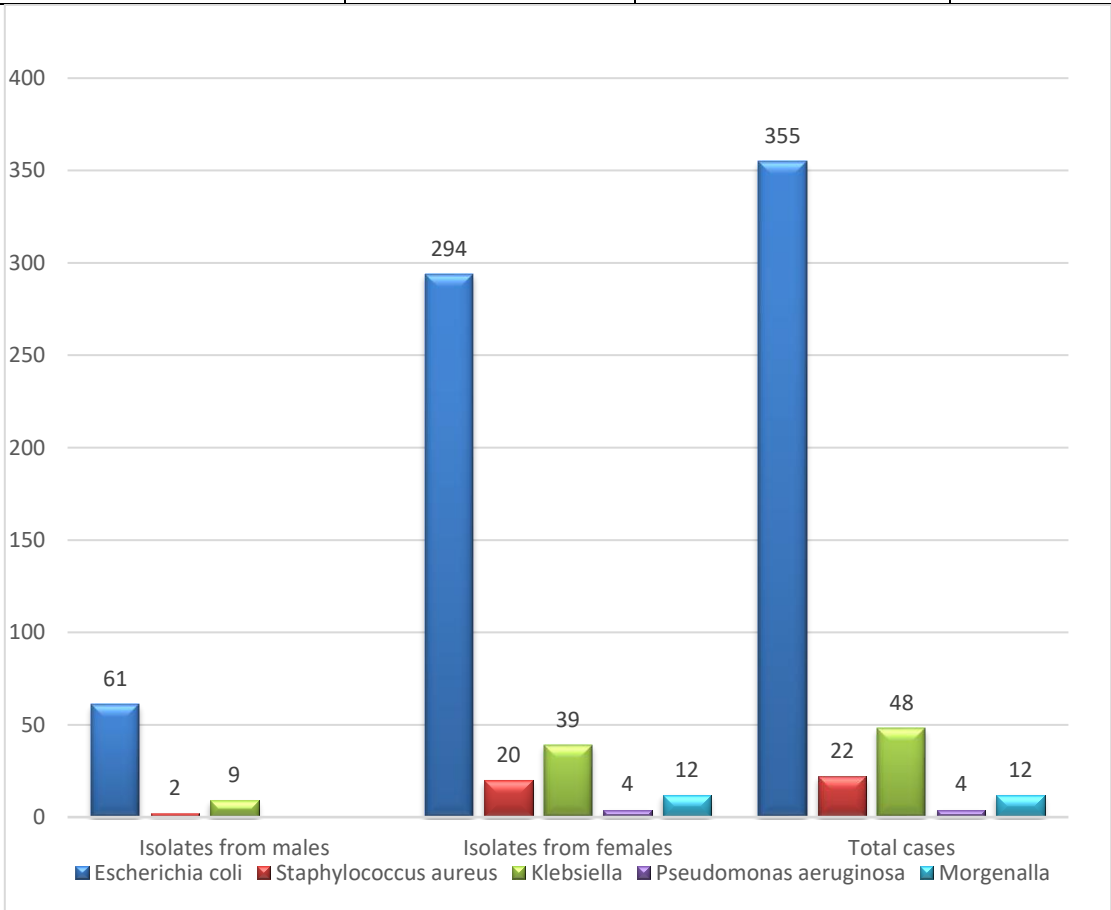

Figure 3.3: Frequency of different bacterial pathogens in relation to sex of patients.

Table 3.4: Frequency of Different bacterial pathogens in UTI of different age groups in Males.

Parameters	1-20	21-40	41-60	Above 60	Total case
E. coli	4	40	12	5	61 (17 %)
Staph. Aureus	0	2	0	0	2 (0.9 %)

Klebsiella pneumoniae	0	5	3	1	9 (1.8 %)
Pseudomonas aeruginosa	0	0	0	0	0 (00 %)
Morganella morganii	0	0	0	0	0 (00 %)

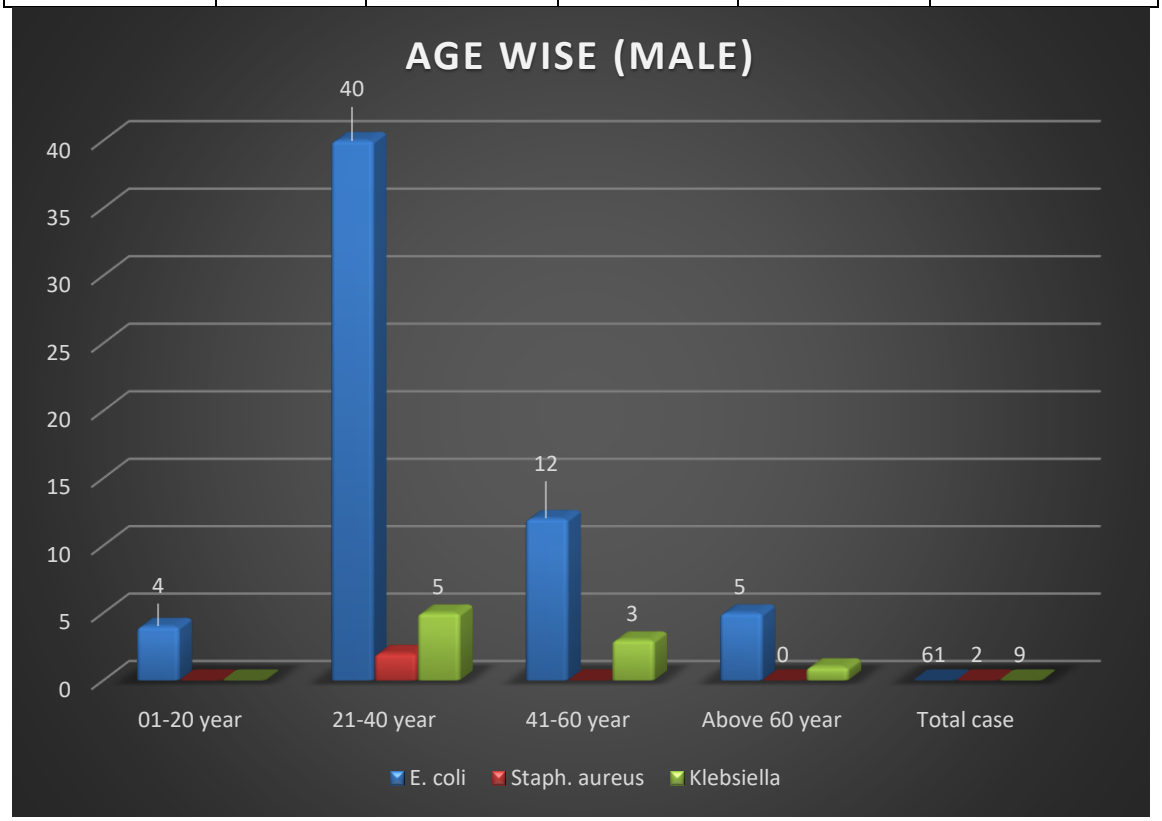

Figure 3.4: Frequency of different bacterial pathogens in UTI of different age groups in Males

Table 3.5: Frequency of different bacterial pathogens in UTI of different age groups in females.

Parameters	1-20	21-40	41-60	Above 60	Total case
E. coli	11	265	18	0	294 (82.9 %)
Staph. aureus	0	20	0	0	20 (4.6 %)
Klebsiella pneumonia	1	31	7	0	39 (9 %)
Pseudomonas aeruginosa	0	4	0	0	4 (0.9 %)
Morganella morganii	0	10	2	0	12 (2.7 %)

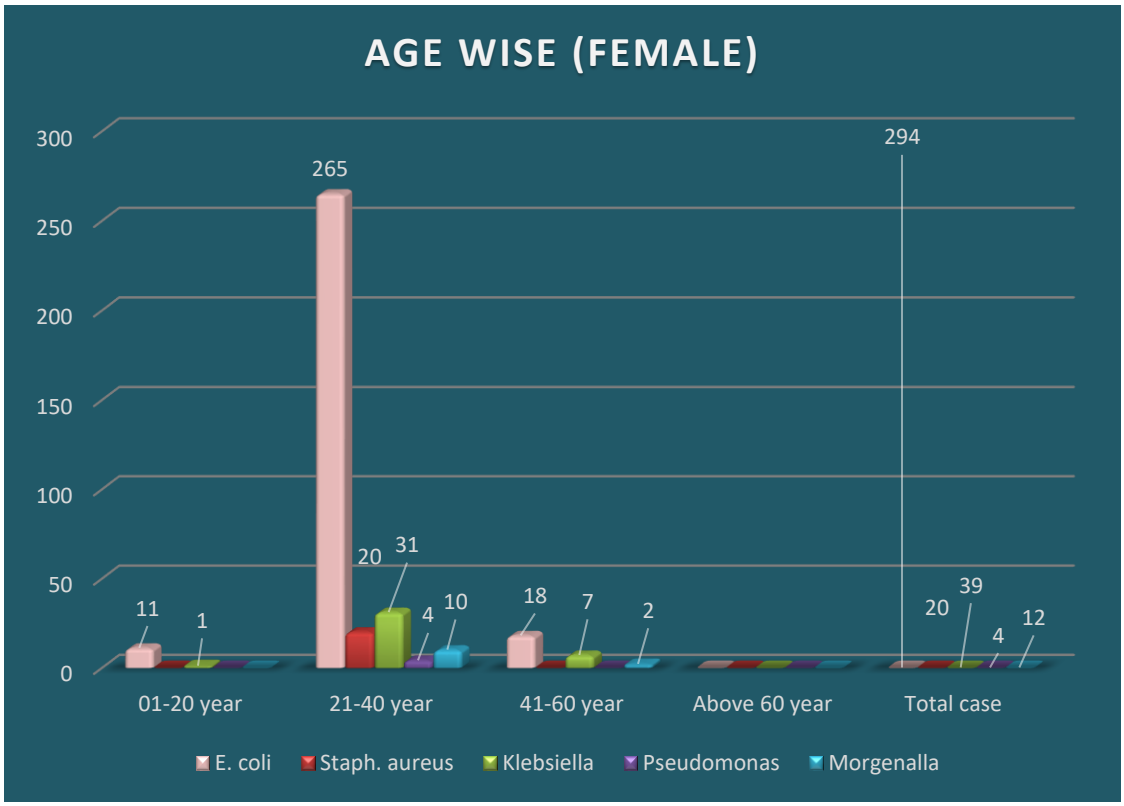

Figure 3.5: Frequency of Different bacterial pathogens in UTI of different age groups in females.

DISCUSSION

According to the National Healthcare Safety Network (NHSN), UTIs are the most typical form of healthcare-associated infections (HAI). In hospitals, about 75% of acquired UTIs are associated with an indwelling urinary catheter[14]. There are several limitations to this study, apart from its retrospective nature. Due to limited available information, not all cases included into the study provided full data from the medical charts, hence percentages displayed in the text are represented as "valid percentages." Also, no comorbidity data were examined. In the demographic variable with earlier studies our finding were the consistent with the previous findings such as frequency of UTI in male to female as compared to the age groups. In this recent study in Ayub Teaching Hospital Abbottabad, among the uropathogens E.coli was the most frequent in both sexes with 17 % and 82.9 % frequencies in male and female respectively. K. Pneumoniae were isolated as 1.8 % in males and 9 % in females while S. aureus accounts for 4.5 % UTI in females and 0.9% in males in the present study.

These results are in accordance with the study conducted by Russian federation, the uropathogens that were isolated, 64.2% were Gram negative bacteria. Among these, Escherichia coli (E. coli) was the most common (49.1%) followed by Klebsiella pneumoniae (9.5%), Proteus mirabilis (2.9%), Pseudomonas aeruginosa(1.7%), and Enterobacter spp. (1.0%)[15]. As compared to this study, another study in India showed that females (65%) were more prone to UTI than

males (35%)[16]. In the present study maximum frequency of UTI observed in age group of 21 to 40 years and consistent with our study another study in India showed females of a particular age group (33–42y) were found to be more susceptible to this disease as compared to all other groups. This may be due to a greater involvement of this age group in sexual activity[1]. The main reasons behind this increasing incidence of UTI with advancing age is due to prostate enlargement in male and neurogenic bladder in female[17].

Similarly another study on UTI in Nishtar Hospital of Multan Escherichia coli and Klebsiella pneumonia were the most persistent (47 % and 19 % individually) among the Gram-negative pathogens followed by S. aureus (14 %), Enterobacter spp. (11 %) and Candida (9 %) respectively[18]. Another study in Lahore General Hospital the most common isolate pathogen was the E. coli being the 72 percent, followed by the Klebsiella (11%), Enterobacter (7%) and Enterococcus (4%)[19]. Another study conducted in Sindh Institute of Urology and Transplantation Karachi reported most frequent isolated microorganism was E-coli (82.1%) followed by Klebsiella spp (14%), Pesudomonas Aeroginosa (1%),Proteus Mirabilis (1%), Morganella (1%) and Staph Aureus (0.8%)[20].

Consistent with our study, another study in Tertiary Care Hospital, Peshawar in which prevalence of UTI was highest for age group of 21 to 40 years 54.98%[21]. These variations attributed to different life style, poor healthcare system, lack of education, and inadequate availability of water, and also may be due to geographical variations.

CONCLUSION AND REOMENDATIONS

Microorganisms cause UTI anywhere in the urinary tract system including kidneys, ureters, bladder and urethra. Urine culturing and biochemical tests such as indole test, coagulase test and catalase test are commonly used for identification of bacterial species in urine. A higher prevalence of UTI was observed in the female population than male. E. coli were the predominant isolates causing UTI followed by Klebsiella, S. aureus, Morganella morganii and P. aeruginosa in Ayub Teaching hospital Abbottabad. For the age group between 21-40 years showed more UTI cases and least percentages were found in age group above 60 years. Different factors, including the duration of catheterization, were found to predict CA-UTI.

Therefore, we advise early surgical intervention to correct the indications leading to prolonged catheterization, in order to decrease CA-UTI among patients living at home with indwelling catheters. We also advise educating patients and carers on how to manage their catheters, maintain hygiene, and perform self-care.

REFFERENCES

1. Malik, S., J.S. Rana, and K. Nehra, Prevalence and antibiotic susceptibility pattern of uropathogenic Escherichia coli strains in sonipat region of Haryana in India. Biomedical and Biotechnology Research Journal (BBRJ), 2021. **5**(1): p. 80.
2. Odongo, I., R. Ssemambo, and J.M. Kungu, Prevalence of Escherichia Coli and its antimicrobial susceptibility profiles among patients with UTI at Mulago Hospital, Kampala, Uganda. Interdisciplinary Perspectives on Infectious Diseases, 2020. **2020**.
3. Rasool, M.S., et al., Prevalence and antibiotic resistance profiles of Gram negative bacilli associated with urinary tract infections (UTIs) in Karachi, Pakistan. Pakistan Journal of Pharmaceutical Sciences, 2019. **32**(6).
4. Stapleton, A.E., Urinary tract infection pathogenesis: host factors. Infectious Disease Clinics, 2014. **28**(1): p. 149-159.
5. Rajivgandhi, G., et al., Isolation and identification of biofilm forming uropathogens from urinary tract infection and its antimicrobial susceptibility pattern. Int. J. Adv. Lif. Sci, 2014. **7**(2): p. 352-363.
6. Nicolle, L.E., Uncomplicated urinary tract infection in adults including uncomplicated pyelonephritis. Urologic Clinics of North America, 2008. **35**(1): p. 1-12.
7. Asmat, U., M.Z. Mumtaz, and A. Malik, Rising prevalence of multidrug-resistant uropathogenic bacteria from urinary tract infections in pregnant women. Journal of Taibah University Medical Sciences, 2021. **16**(1): p. 102-111.
8. Linhares, I., et al., Frequency and antimicrobial resistance patterns of bacteria implicated in community urinary tract infections: a ten-year surveillance study (2000–2009). BMC infectious diseases, 2013. **13**(1): p. 1-14.
9. Shigemura, K., et al., Clinical factors associated with shock in bacteremic UTI. International urology and nephrology, 2013. **45**(3): p. 653-657.
10. Ahmed, H., et al., Long-term antibiotics for prevention of recurrent urinary tract infection in older adults: systematic review and meta-analysis of randomised trials. BMJ open, 2017. **7**(5): p. e015233.
11. Johansen, T.E.B., et al., Critical review of current definitions of urinary tract infections and proposal of an EAU/ESIU classification system. International journal of antimicrobial agents, 2011. **38**: p. 64-70.
12. Nozarian, Z. and A. Abdollahi, Microbial etiology and antimicrobial susceptibility of bactria implicated in urinary tract infection in Tehran, Iran. Iranian Journal of Pathology, 2015. **10**(1): p. 54.
13. Flaherty, S.K., et al., Septic shock and adequacy of early empiric antibiotics in the emergency department. The Journal of emergency medicine, 2014. **47**(5): p. 601-607.
14. Subudhi, M., et al., Incidence and variation of microbiological profile of catheter-associated urinary tract infection in precise comorbidities associated with tribal sickle cell anemic patients of medical intensive care unit in a tribal tertiary care center. Journal of Applied Hematology, 2021. **12**(3): p. 140.

15. Rafalskiy, V., et al., Distribution and antibiotic resistance profile of key Gram-negative bacteria that cause community-onset urinary tract infections in the Russian Federation: RESOURCE multicentre surveillance 2017 study. Journal of global antimicrobial resistance, 2020. **21**: p. 188-194.
16. KUMAR, H., et al., ISOLATION OF UROPATHOGENS AND THEIR ANTIBIOTIC SUSCEPTIBILITY PATTERN AT A TERTIARY CARE HOSPITAL IN NORTHERN INDIA. Asian J Pharm Clin Res, 2019. **12**(12): p. 84-86.
17. Abedin, M.Z., et al., Prevalence and Antimicrobial Susceptibility pattern of pathogens Isolated from different age groups with Urinary Tract Infection in Bangladesh. 2022.
18. Khan, H.R., et al., Prevalence and Multidrug Resistance Pattern of E. Coli among Urinary Tract Infection Patients in Tertiary Care Hospital of Multan. Journal of Bioresource Management, 2021. **8**(4): p. 8.
19. MAS, K., Prevalence of Urinary Tract Infection and Drug Resistance among Infants and Children in Pakistan.
20. Mubashir, F., et al., Spectrum and Antibiotic Resistance Pattern of Uropathogens Causing Urinary Tract Infection Among Inpatients and Outpatients: An Experience of a Tertiary Care Hospital in Karachi, Pakistan. Proteus, 2021. **1**: p. 20.
21. Tara, T., et al., FREQUENCY AND SUSCEPTIBILITY PROFILE OF PATHOGEN CAUSING URINARY TRACT INFECTION AT TERTIARY CARE HOSPITAL, PESHAWAR PAKISTAN. Annals of Allied Health Sciences, 2022. **8**(1): p. 23-27.