DOI: 10.7860/JCDR/2023/62386.17635

Original Article

Microbiology Section

Microbiological Profile of Urinary Tract Infections in Males: A Cross-sectional Study

V HARITHA[1], SANJEEV D RAO[2], SYED SHAFEEQUR RAHMAN[3]

BY-NC-ND

ABSTRACT

Introduction: Urinary Tract Infections (UTIs) are uncommon among men. It is because the male urethra is longer and is away from the anal opening. Moreover, the perianal area is dry, and the prostatic secretion prevents from occurring of any infection. Hence, if men suffer from UTI, it is considered as a complicated infection. Complicated UTIs are difficult to treat and are more prone to treatment failures. Microorganisms causing these infections have a wide spectrum ranging from a variety of both Gram-negative and Gram-positive organisms. Early diagnosis and treatment of UTIs, plays a major role in preventing the spread of infection to the upper urinary tract.

Aim: To determine the microbiological profile and antibiotic sensitivity pattern from urine samples of male patients.

Materials and Methods: The present cross-sectional study was done for a period of two years (1/3/2019 to 31/4/2021) in the Department of Microbiology, Malla Reddy Institute of Medical Sciences and Research, Jeedimetla, Hyderabad, Telangana, India. Urine samples from male inpatients and outpatients suffering from various clinical conditions received in the microbiology laboratory were processed and analysed. These samples were cultured by conventional semiquantitative methods and the organisms were identified using standard biochemical reactions. Antibiotic sensitivity testing was done on Mueller Hinton agar by Kirby-Bauer's disk diffusion technique. Clinical history, associated conditions and co-morbidities were noted from the case sheets of all the culture positive patients to identify the risk factors which made them prone to UTIs. The data was descriptive and percentages were calculated for all the numerical data obtained.

Results: Total 304 urine samples received, 104 (34%) were found to be positive for bacterial and fungal isolates. *E. coli* (44%) was the predominant organism, followed by *Klebsiella* spp. (15%) among the Gram-negative bacteria isolated. Coagulase-negative *Staphylococcus* (5%) was the predominant organism among the Gram-positive bacteria followed by *Staphylococcus aureus* (4%) and *Enterococcus* spp. (4%). A 84.8% of *E. coli* and 68% of *Klebsiella* spp. were Extended-spectrum beta-Lactamase (ESBL) enzymes producing organisms. An analysis of the health conditions of the patients who were culture positive showed that 28% of patients had signs and symptoms suggestive of UTI. Diabetes (25%), hypertension (20%), and Benign Prostatic Hyperplasia (BPH) (5%) were observed commonly in patients above 60 years.

Conclusion: The UTI in male patients are quite uncommon as in female patients. The microbiological profile and drug sensitivity pattern of these organisms causing the infection is similar to that in female patients suffering from UTI. But, as UTI in males is considered a complicated infection thorough investigation of these patients for various health conditions like diabetes mellitus, hypertension and BPH has to be done, particularly in elderly males. This helps in initiating prompt treatment to prevent recurrent UTIs and drug resistance.

Keywords: Antibiotic sensitivity testing, Associated factors, Bacteria, Co-morbidities, Fungi, Urinary tract infections

INTRODUCTION

The Urinary Tract Infections (UTIs) are quite common among women. Various anatomical and physiological factors make them more prone to UTIs. The incidence of UTI is much higher in females during adolescence and childbearing years [1]. The incidence of UTI in men approaches that of women only in men older than 60 years. Young men rarely develop UTIs, and the prevalence of bacteriuria is 0.1% or less. There is an early peak incidence during the first three months of life; in neonates, UTIs occur more frequently in boys than in girls (with a male-to-female ratio of 1.5:1). The incidence of UTI in adult males younger than 50 years is low (approximately five to eight per year per 10,000). In men older than 50 years, the incidence of UTI rises dramatically (range, 20-50% prevalence), because of enlargement of the prostate, debilitation and subsequent instrumentation of the urinary tract [2].

The UTIs can be simple and complicated. Uncomplicated UTIs can be managed on an outpatient basis with a good prognosis. Whereas, complicated UTIs are associated with recurrent infections, treatment failures and Multidrug Resistance (MDR) [2]. All UTIs in immunocompromised patients, males and those associated with fevers, stones, sepsis, urinary obstruction, catheters, or involving the kidneys are considered complicated infections. In other words, infections occur despite the presence of anatomical protective measures (UTIs in males are by definition considered complicated UTIs). Treatment failure and longer duration of antibiotic therapy are needed in these patients when compared to female patients [3,4].

If left untreated, they may give rise to various complications like ascending infections, bacteraemia and organ damage. Hence, it is very important to diagnose and detect UTI at an early stage in this category of patients. Methods such as urinalysis, gram staining and urine culture used for the diagnosis of UTI. The presence of 2-5 or more White Blood Cells (WBCs) or 15 bacteria per High-power Field (HPF) in a centrifuged urine sediment gives a possible clue to the diagnosis of UTI. The presence of leukocyte esterase on a dipstick test is a rapid screening for pyuria; it is 57-96% sensitive and 94-98% specific for identifying pyuria. Urine culture remains the gold standard for the diagnosis of UTI. Collected urine should be immediately sent for culture; if not, it should be refrigerated at 4°C. The exact number of bacteria in a urine culture that is needed to define UTI in males is much lower than the threshold for females and positive results are seen, if there are more than 1000 Colony Forming Units (CFU)/mL of urine. However, a value of more than 10,000 CFU/mL is considered significant. Proteinuria is commonly observed in UTIs, but the proteinuria is

usually low-grade. In addition to these methods, imaging is also useful in certain cases of UTI, especially in males. Patients in the older age group, who are toxic, diabetic, or immunocompromised may be at risk for emphysematous pyelonephritis; hence, radiographic studies {e.g., Kidney, Ureters, Bladder (KUB)} may be necessary to exclude this possibility [2]. Present study focuses on UTIs in males, the uropathogenic organisms causing them, their sensitivity profile, and the various risk factors and associated conditions that make male patients more prone to UTIs.

MATERIALS AND METHODS

The present descriptive cross-sectional study was done for a period of two years from March 2019 to April 2021 in the Department of Microbiology, Malla Reddy Institute of Medical Sciences and Research, Jeedimetla, Hyderabad, Telangana, India. All patient details and samples were collected following the Institute's Ethical Approval (IEC/MRIMS/HYD/2018-19/32).

A total of 304 samples were received in given time period and further analysed.

Inclusion criteria: All the urine samples of male patients received in the microbiology laboratory during the study period.

Exclusion criteria:

- A CFU/mL of less than 10^5 isolated in culture.
- Polymicrobial growth (mixed growth) of more than two organisms in culture media.

Study Procedure

Urine samples of male inpatients and outpatients suffering from various clinical conditions received in the microbiology laboratory were analysed and processed. Semiquantitative culture of urine specimen was done on HiChrome UTI agar and MacConkey agar. Plates were incubated for 24 hours at 37°C and any growth in the culture media were noted. Identification of the organisms was done using standard conventional biochemical reactions and antibiotic sensitivity testing was done by the Kirby-Bauer disc diffusion method. All the methods were followed as per the standard textbook of microbiology [5]. Antibiotic sensitivity testing for ESBL producing enzyme detection was done by disc diffusion methods on Muller-Hinton agar as per Clinical and Laboratory Standards Institute (CLSI) guidelines [6]. Antifungal susceptibility testing for fungal isolates was not done.

Clinical history of patients, whose urine sample showed growth, was collected from the case sheets for any signs and symptoms, pertaining to UTI and to note any other associated health conditions or comorbidities that made them prone to UTIs.

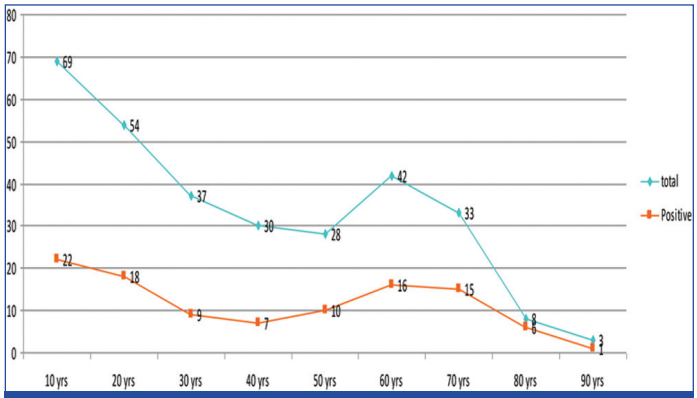
STATISTICAL ANALYSIS

The data was descriptive and percentages were calculated for all the numerical data obtained.

RESULTS

A total of 304 urine samples of male patients suffering from various clinical conditions were analysed and processed in the microbiology laboratory. Out of 304 urine samples received, 104 (34%) were found to be positive for bacterial and fungal isolates. In 200 (66%) patients, no bacterial growth was obtained.

The youngest patient in the present study was two-year-old and the oldest patient was 89-year-old. Culture positive rate was more in patients belonging to the age group of 10-15 years and in 60-70 years. The [Table/Fig-1] shows the distribution of patients according to the age group (green line) and the age-wise distribution of patients whose urine samples were culture positive (redline). *E. coli* 46 (44%) was the predominant organism isolated in culture followed by *Klebsiella* spp. 16 (15%), *Pseudomonas* 7 (7%), *Acinetobacter* 4 (4%), *Proteus* spp. 3 (3%), *Enterobacter* 2 (2%), *Citrobacter* 2 (2%) and *Alcaligenes* 1 (1%). Coagulase-negative Staphylococci (CoNS) 5 (5%) was the predominant organism among the Gram-positive bacteria followed by *Staphylococcus aureus* 4 (4%) and *Enterococcus* spp. 4 (4%). Total 10 (10%) species of *Candida* were isolated. The [Table/Fig-2] shows the various organisms isolated in culture.



[Table/Fig-1]: Distribution of patients according to the age group (Green line); Distribution of patients whose urine samples were culture positive (Redline).

Organism isolated	Number of isolates (n)	Percentage (%)
Escherichia coli	46	44
Klebsiella spp.	16	15
Pseudomonas spp.	7	7
Acinetobacter spp.	4	4
Proteus spp.	3	3
Enterobacter spp.	2	2
Citrobacter spp.	2	2
Alcaligenes spp.	1	1
Staphylococcus aureus	4	4
Coagulase-negative staphylococcus	5	5
Enterococcus spp.	4	4
Candida albicans	8	8
Non-albicans *Candida*	2	2

[Table/Fig-2]: Organisms isolated in culture.

The results of antibiotic sensitivity tests were as follows:

Gram-negative organism: *E. coli* was the predominant isolate. Among the 46 isolates of *E. coli,* 39 (84.8%) were ESBL enzymes producing organisms. Total 16 species of *Klebsiella* were isolated among them 11 (68.75%) were ESBL's. All isolates of *E. coli* and *Klebsiella* were sensitive to carbapenems. The [Table/Fig-3,4] depicts the sensitivity and resistance patterns of Gram-negative organisms where highest sensitivity found in *E. coli* (96%).

Antibiotic discs used	*E. coli* (n=46)		*K. pneumoniae* (n=16)	
	Sensitive n (%)	Resistant n (%)	Sensitive n (%)	Resistant n (%)
Ampicillin	2 (4)	44 (96)	-	16 (100)
Amoxicillin/clavulanic acid	4 (9)	42 (91)	12 (75)	12 (75)
Ampicillin/sulbactam	12 (26)	34 (74)	5 (31)	11 (69)
Piperacillin/tazobactam	23 (50)	23 (50)	9 (56)	7 (44)
Cefazolin	31 (67)	15 (33)	2 (13)	14 (87)
Cefepime	2 (4)	44 (96)	2 (13)	14 (87)
Cefotaxime	1 (2)	45 (98)	2 (13)	14 (87)
Ceftriaxone	6 (13)	40 (87)	4 (25)	12 (75)
Aztreonam	6 (13)	40 (87)	4 (25)	12 (75)
Amikacin	4 (9)	42 (91)	12 (75)	12 (75)
Gentamycin	35 (76)	11 (24)	11 (69)	5 (31)
Ciprofloxacin	35 (76)	11 (24)	6 (38)	10 (62)

Levofloxacin	17 (37)	29 (63)	5 (31)	11 (69)
Imipenem	18 (39)	28 (61)	16 (100)	0 (0)
Meropenem	44 (96)	2 (4)	16 (100)	0 (0)
Doripenem	44 (96)	2 (4)	16 (100)	0 (0)
Cotrimoxazole	44 (96)	2 (4)	10 (63)	6 (37)
Nitrofurantoin	20 (43)	26 (57)	10 (63)	6 (37)

[Table/Fig-3]: Antibiotic sensitivity pattern of *E. coli* and *Klebsiella* spp.

Antibiotic discs used	*P. aeruginosa* (n=7)		*Acinetobacter* spp. (n=4)	
	Sensitive n (%)	Resistant n (%)	Sensitive n (%)	Resistant n (%)
Piperacillin	3 (43)	4 (57)	4 (100)	0 (0)
Piperacillin/tazobactam	5 (71)	2 (29)	4 (100)	0 (0)
Ticarcillin/clavulanic acid	4 (57)	3 (43)	4 (100)	0 (0)
Ceftazidime	4 (57)	3 (43)	2 (50)	2 (50)
Cefepime	4 (57)	3 (43)	2 (50)	2 (50)
Imipenem	5 (71)	2 (29)	4 (100)	0 (0)
Meropenem	5 (71)	2 (29)	4 (100)	0 (0)
Doripenam	5 (71)	2 (29)	4 (100)	0 (0)
Amikacin	5 (71)	2 (29)	4 (100)	0 (0)
Tobramycin	5 (71)	2 (29)	4 (100)	0 (0)
Gentamycin	4 (57)	3 (43)	4 (100)	0 (0)
Ciprofloxacin	5 (71)	2 (29)	3 (75)	1 (25)
Levofloxacin	5 (71)	2 (29)	3 (75)	1 (25)

[Table/Fig-4]: Antibiotic sensitivity pattern of *Pseudomonas* and *Acinetobacter* spp.

Gram-positive organism: Nine isolates of *Staphylococcus* and four isolates of *Enterococcus* were the Gram-positive organisms obtained in this study. Amongst the nine isolates of *Staphylococcus*, four were *Staphylococcus aureus* and five were CoNS. Three isolates were Methicillin-resistant *Staphylococcus aureus* (MRSA), and all five isolates of CoNS were Methicillin-resistant (MRCoNS).

The [Table/Fig-5] shows the sensitivity pattern of *Staphylococcus aureus,* CoNS, and *Enterococcus,* respectively.

Antibiotic discs used	*Staphylococcus aureus* (n=4)		CoNS (n=5)		*Enterococcus* (n=4)	
	Sensitive n (%)	Resistant n (%)	Sensitive n (%)	Resistant n (%)	Sensitive n (%)	Resistant n (%)
Penicillin	1 (25)	3 (75)	0 (0)	5 (100)	1 (25)	3 (75)
Ampicillin	not tested		not tested		1 (25)	3 (75)
Oxacillin	1 (25)	3 (75)	0 (0)	5 (100)	not tested	
HLG (high-level aminoglycoside)	not tested		not tested		3 (75)	1 (25)
Vancomycin	4 (100)	0 (0)	5 (100)	0 (0)	4 (100)	0 (0)
Gentamycin	4 (100)	0 (0)	1 (20)	4 (80)	not tested	
Amikacin	4 (100)	0 (0)	1 (20)	4 (80)	not tested	
Tetracycline	2 (50)	2 (50)	2 (40)	3 (60)	2 (50)	2 (50)
Ciprofloxacin	2 (50)	2 (50)	2 (40)	3 (60)	1 (25)	3 (75)
Levofloxacin	1 (25)	3 (75)	1 (20)	4 (80)	1 (25)	3 (75)
Nitrofurantoin	3 (75)	1 (25)	3 (60)	2 (40)	3 (75)	1 (25)
Cotrimoxazole	2 (50)	2 (50)	2 (40)	3 (60)	not tested	

[Table/Fig-5]: Antibiotic sensitivity pattern of *Staphylococcus aureus*, Coagulase-negative Staphylococcus (CoNS), and Enterococci spp.

Eight *Candida albicans* and two non albicans *Candida* were isolated in the study. However, antifungal sensitivity testing of these isolates was not done.

Symptomatology: An analysis of various health conditions noted from the case sheets of the patients who were culture positive showed that 28% of patients had signs and symptoms suggestive of UTI. They were fever, dysuria, frequency, burning micturition and low back pain.

Nephritic syndrome (3%), renal calculi (3%), epididymo-orchitis (4%), undescended testis (1%), marfan syndrome (1%), Lesch-Nyhan syndrome (1%), phimosis (1%), fournier's (1%), hydrocoele (1%), congenital acyanotic heart disease (1%) and obstructive inguinal hernia (1%) were commonly associated factors in children. Chronic renal disease (2%), diabetes (25%), hypertension (20%), and BPH (5%), were observed commonly in patients above 45 years. A 17% of patients had pyrexia of unknown origin. A 14% of patients who were culture positive had no signs and symptoms suggestive of UTI (asymptomatic bacteriuria). A 12 (13%) patients had an indwelling catheter for more than five days. They were considered catheter-associated UTIs. The [Table/Fig-6] shows the associated clinical conditions found in urine culture positive patients with the age-wise distribution.

Age group	1-30 years (n=160)	31-60 years (n=100)	61-80 years (n=44)	Total n (%)
Nephritic syndrome	3	0	0	3 (3%)
Renal calculi	1	2	0	3 (3%)
Epididymo-orchitis	1	1	2	4 (4%)
Undescended testis	1	0	0	1 (1%)
Marfan syndrome	1	0	0	1 (1%)
Lesch-Nyhan syndrome	1	0	0	1 (1%)
Phimosis	0	1	0	1 (1%)
Fournier's	0	1	0	1 (1%)
Hydrocoele	0	1	0	1 (1%)
Congenital acyanotic heart disease	1	0	0	1 (1%)
Obstructive inguinal hernia	0	1	0	1 (1%)
Chronic renal disease	0	1	1	2 (2%)
Diabetes	0	18	7	25 (25%)
Hypertensive	0	16	4	20 (20%)
Benign prostatic hyperplasia	0	0	5	5 (5%)

[Table/Fig-6]: Associated clinical conditions found in urine culture positive patients age-wise.

DISCUSSION

Though, a lot of literature and data is available about UTIs in women, studies showing the microbiological profile and resistance pattern, exclusively in male patients are few in number. The present study was conducted to know about the organisms causing UTI in men, and also the associated clinical conditions. As UTI in males is considered complicated, coexisting clinical conditions have to be investigated and treated with appropriate antibiotic therapy to prevent a recurrence.

In the present study, culture positive rate obtained was 34%. Linhares I et al., in their 10-year surveillance study on community-acquired UTI, obtained a bacterial isolation rate of 21.5% [7]. Similarly, a study done by Magliano E et al., for a period of around two years in North Italy found the culture positive rate to be 22.6% [8]. These findings show that, although the majority of UTIs are seen in women, men are also affected at a significant rate. A urine culture should always be obtained when a male patient presents with a suspected UTI because UTIs in men are considered complicated by definition and warrant at least seven days of antibiotic therapy. Hence, diagnosing UTIs and treating them promptly is important.

Socio-demographic characters: As the literature suggests that UTI in males is common in the extremes of life, this study shows a high rate of culture positivity in urine samples was seen in the two extreme age groups of patients i.e., 0-20 years (33%) and patients >50 years (44%). This correlates with the study done by Linhares I et al., who reported an isolation rate of 11.3% in elderly males [7]. In another study done by Vigila CR et al., in South India showed that elderly men are affected by UTI to an extent of 40.53% (age group 61-90 years) [9]. Various health conditions like diabetes, decreasing

immunity due to age, and enlarged prostate, resulting in the retention of urine are some of the reasons for this. A study by Raval R et al., in patients belonging to the age group of 10-29 years, showed a 10% (8 out of 80) risk for the development of UTI. The age group of 30-49 years, showed a greater risk of developing UTI 19 (23.7%) and a dramatic increase in the incidence of UTI was seen in 50-69 years with 33 (41.25%) out of 80. Beyond the age of 70 years, the incidence of UTI declined to 22.5% [10].

Organisms isolated: *E. coli* and *Klebsiella* spp. were the predominant organisms amongst the Gram-negative isolates in the present study. The [Table/Fig-7] shows a comparison between the percentages of various isolates obtained in the present study and other studies [8,10-17]. *E. coli* was the predominant isolate in the present study and various other studies are shown in the table above. No change in the predominant isolate was observed. *E. coli* remains the most common cause of UTI in both males and females.

Gram-negative bacteria: Among the Gram-negative isolates of *E. coli and Klebsiella*, 84.8% and 68.75%, respectively were ESBL enzymes producing organisms in present study. Gebremariam G et al., demonstrated ESBL enzyme producers in 27.8% of the *E. coli* and 33.3% of *K. pneumonia* isolates in their study [12]. In another study by Bhargava K et al., in the Northeast part of India, it was found that 40.4% of *E. coli* and none of the *K. pneumoniae* were ESBL producing organisms [18]. Aggarwal R et al., reported 40% of *E. coli* and 54.54% of *Klebsiella* spp. to be ESBL producers [19]. Sood S and Gupta R, reported an ESBL production rate of 23.83% in *E.coli* strains and 8.69% in *Klebsiella* strains [20]. The high incidence of ESBL producing organisms in the present study was probably because the study was done in a tertiary care center.

When tested for third generation cephalosporins, *E. coli* showed a resistance rate of 96%, 98%, and 89% to cefepime, cefotaxime, and ceftriaxone, respectively, whereas, *Klebsiella* spp. showed a resistance rate of 87%, 87%, and 75% to cefepime, cefotaxime, and ceftriaxone. However, the organisms were found to be sensitive to carbapenems in this study. Fenta A et al., also found a similar pattern in their study done on children. They reported that 97.7% of the Gram-negative isolates were susceptible to meropenem [21].

Biswas R et al., demonstrated a high percentage of sensitivity (90%) to carbapenems in their study when tested against Gram-negative isolates [22]. Muzammil M et al., in their study done in a tertiary care center also found a similar sensitivity pattern. A total of 21 (100%) of the *E. coli* isolates, were sensitive to polymyxin B, colistin and ertapenem, 15 (71.4%) were sensitive to imipenem, and 13 (61.9%) isolates were sensitive to meropenem [23]. Inappropriate treatment of patients by not choosing the correct antibiotic and right dosage can cause recurrent UTI infections associated with MDR. The propensity of some uropathogenic *E. coli* to form biofilms is also another factor that favors the spread of drug resistance in these organisms.

Gram-positive bacteria: Amongst the nine isolates of *Staphylococcus*, four isolates were *S. aureus* and five were CoNS. Of these 8 (89%) of the isolates were MRSA. Muzammil M et al., in their study detected MRSA in three (5.7%) patients [23]. Fenta A et al., in their study done on children observed an MDR rate of about 33.33% in *S. aureus* [21]. Mishra PP et al., in their study found resistance against oxacillin was 61.6% and to vancomycin, it was 15.4% [24]. However, in the present study, all the isolates were found to be 100% sensitive to vancomycin.

Risk Factors

Unlike women, men suffering from UTIs need to be thoroughly investigated to find out the underlying aetiology to prevent them from suffering from complications. Hence, present study also tried to evaluate the associated factors and conditions which made these male patients prone to UTI.

Age group of 1-30 years: Infants and children present with atypical symptoms and most of the time fever is the only complaint in these patients. Prompt diagnosis and initiation of treatment must be done to prevent permanent renal scarring and damage.

Epididymo-orchitis (4%), nephritic syndrome (3%), renal calculi (3%), undescended testis (1%), marfan syndrome (1%), Lesch-Nyhan syndrome (1%) and congenital acyanotic heart disease (1%), were commonly associated factors in children and young adults in our study. Lesch-Nyhan syndrome is a rare inborn error of purine metabolism characterised by the absence or deficiency of the activity of the enzyme hypoxanthine-guanine phosphoribosyl transferase [25]. Uric acid levels are abnormally high in these patients and sodium urate crystals may accumulate in the joints and kidneys. This condition most often affects males. In present study, we had a two-year-old child with this syndrome who presented with recurrent UTIs.

The presence of renal calculi can obstruct the urinary flow which leads to UTIs, pyelonephritis and renal scarring. In the present study, three patients in the younger and middle age groups who were suffering from renal calculi. A study by Raval R et al., in rural India found renal stones as a risk factor for UTI in 6 (6.8%) and congenital anomalies in 3 (3.2%) of the patients [10].

Related studies	Year and place of study	Percentage of isolates obtained (%)						
		E. coli	*Klebsiella*	*Pseudomonas*	*Proteus*	*Acinetobacter*	CoNS *and S. aureus*	*Candida*
Present study	2019, Hyderabad	44	15	7	3	4	5 4	10
Gamit SC et al., [14]	2021, Gujarat	46.52	20.93	16.28	-	-	-	-
Kumar V et al., [15]	2020, Rishikesh	70.3	15.6	7	1.6	1.6	1 1.6	3.1
Malik N et al., [16]	2018, Punjab	81	7	5.66	1.3	-	- 2.33	2
Gebremariam G et al., [12]	2017, Ethiopia	48.6	8.1	-	-	-	23 13.5	-
Mbwambo HJ et al., [17]	2016, Tanzania	39.3	20	9.3	3.7	-	- 3.7	-
Raval R et al., [10]	2015 Ahmedabad	38	10	10	6	-	7.5 -	10
Kirtilaxmi B et al., [13]	2013, Karnataka	52.9	7.6	2.2	4.9	-	9.8 0.8	1.8
Magliano E et al., [8]	2012, Italy	67.6	8.8	2.5	5.2	-	-	-
Kavitha J et al., [11]	2011, Tamil Nadu	45.8	23.8	-	9.8	-	10.1 1.9	-

[Table/Fig-7]: Comparison between the percentage of isolates obtained in the present study with other studies [8,10-17].

A study by Gulati S et al., UTI in children with nephrotic syndrome found UTI to be a common infection (40.26%) in children [26]. In present study, nephrotic syndrome was found as an associated risk factor in 3% of patients who belonged to the 1-30 years age group. A 14% of patients who were culture positive in the present study had no signs and symptoms suggestive of UTI (asymptomatic bacteriuria). Akhtar A et al., reported an incidence of asymptomatic bacteriuria in 31.9% [27].

Age group of 31-60 years: In this study, diabetes and hypertension were the commonly associated factors in the middle age group of patients. Diabetes was seen in 18% of the patients and hypertension was a risk factor in 16% of the patients. A similar pattern was seen in a study done by Raval R et al., in rural India who found that in the 30-49 years age group, diabetes mellitus was the most dominating risk factor, and its incidence was 19 (23.5%) [10]. Another study done by Akhtar A et al., found diabetes mellitus in 43.1% and hypertension in 33.9% of the patients [27].

Patients with long-term diabetes with improper metabolic control have autonomous neuropathy which leads to inadequate bladder drainage which contributes to UTIs. Moreover, drug-resistant pathogens are commonly seen in these patients. Literature suggests that men with hypertension are more likely to have increased prostatic volume. Their International Prostate Symptom Score (IPSS) also increases with age. Hence, men with hypertension have a significant risk of acquiring UTI.

Age group of 61-90 years: In the present study, the incidence of hypertension and diabetes in this age group of patients was found to be 7% and 4%, respectively. A significant reduction in the incidence rate of diabetes and hypertension was seen in these patients when compared to those in the 31-60 years age group. Raval R et al., observed a similar pattern of decrease in the incidence of diabetes mellitus from 41.6-7.5% in the 70-89 years age group [10].

Chronic renal disease (1%) and BPH (5%) were the other conditions seen in these patients. BPH was observed to be the dominating factor in this category of patients. Various epidemiological studies show that bacteriuria is commonly observed in men with BPH, with a prevalence range of 4.4-44.7% [28]. A study done by Akhtar A et al., found prostatitis as a risk factor in 6.4% of geriatric patients [27]. BPH and bladder outlet obstruction are commonly seen in patients above 65 years. This leads to urine retention and as a result, they are more prone to UTIs, calculi formation, haematuria and damage to bladder walls and kidneys. Hence, it is always ideal to rule out any UTI in this age group of patients before subjecting them to any urological manipulations like Transurethral Resection of the Prostate (TURP). Asymptomatic bacteriuria is also common in these patients hence routine screening is advised.

Limitation(s)

In the present study, antifungal sensitivity testing was not done due to limited resources. This would have given information about the antifungal resistance prevalent in the community. Another limitation was, we focussed only on the symptomatology of the patients who were culture positive. Hence, a comparison between the symptoms of those who were culture negative yet showed signs and symptoms of UTIs could not be made.

CONCLUSION(S)

The UTI in male patients is complicated and must be evaluated thoroughly and always an attempt must be made to investigate the underlying and associated health conditions in these patients. The bacteriological profile and drug resistance patterns in these patients did not differ from the female patients suffering from UTI. However, certain risk factors like the association of renal calculi with UTI are common in males. The age of the patient also should be the criteria because certain conditions like diabetes, hypertension and BPH are seen with increasing age. Timely treatment of these patients based on the antibiotic susceptibility report will prevent complications like ascending UTIs, sepsis, multiorgan involvement and treatment failure with drug-resistant organisms.

REFERENCES

[1] Minardi D, D'Angelo G, Cantoro D, Conti A, Muzzonigro G. Urinary tract infections in women: Etiology and treatment options. Int J Gen Med. 2011;4:333-43. Doi: 10.2147/IJGM.S11767. Epub 2011 Apr 19. PMID: 21674026; PMCID: PMC3108201.

[2] Brusch JL. Urinary Tract Infection (UTI) in Males- Clinical Presentation. Infectious Diseases Society of America. Jan 02, 2020. https://emedicine.medscape.com/article/231574-overview.

[3] Sabih A, Leslie SW. Complicated Urinary Tract Infections. 2022 Nov 28. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2022 Jan. PMID: 28613784.

[4] Seminario JL, Aggarwal G, Sweetser S. 26-year-old man with recurrent urinary tract infections. Mayo Clin Proc. 2011;86(6):557-60. Doi: 10.4065/mcp.2010.0600. PMID: 21628619; PMCID: PMC3104916.

[5] Mackie & McCartney Practical Medical Microbiology by Collee, 14th edition page no. 84-90.

[6] Clinical and Laboratory Standards Institute (CLSI). Performance Standards for Antimicrobial Susceptibility Testing. 26th ed. CLSI supplement M100S (ISBN 1-56238-923-8 [Print]; ISBN 1-56238- 924-6 [Electronic]).

[7] Linhares I, Raposo T, Rodrigues A, Almeida A. Frequency and antimicrobial resistance patterns of bacteria implicated in community urinary tract infections: A ten-year surveillance study (2000-2009). BMC Infect Dis. 2013;13:19. https://doi.org/10.1186/1471-2334-13-19.

[8] Magliano E, Grazioli V, Deflorio L, Leuci AI, Mattina R, Romano P, et al. Gender and age-dependent etiology of community-acquired urinary tract infections. Scientific World Journal. 2012;2012:349597. Doi: 10.1100/2012/349597. Epub 2012 Apr 26. PMID: 22629135; PMCID: PMC3351074.

[9] Vigila CR, Athinarayanan G, Mariselvam R, Dhasarathan P, Ranjitsingh AJA. Epidemiology of urinary tract infection in South India. World Journal of Biology Pharmacy and Health Sciences. 2020;1(1):25-32.

[10] Raval R, Verma R, Kareliya H. Clino-pathological features of urinary tract infection in rural India. Advances in Infectious Diseases. 2015;5:132-39. Doi: 10.4236/aid.2015.54016.

[11] Kavitha J, Aravind MA, Jayachandran G, Priya S. Risk factors for urinary tract infection in pediatric patients. Int J Contemp Pediatr. 2018;5:184-89.

[12] Gebremariam G, Legese H, Woldu Y, Araya T, Hagos K, GebreyesusWasihun A. Bacteriological profile, risk factors and antimicrobial susceptibility patterns of symptomatic urinary tract infection among students of Mekelle University, northern Ethiopia. BMC Infect Dis. 2019;19(1):950. Doi: 10.1186/s12879-019-4610-2. PMID: 31703645; PMCID: PMC6842233.

[13] Kirtilaxmi B, Padmavathy M, Malini J, Navaneeth BV. Microbiological profile and antibiogram of uropathogens in pediatric age group. Int J Health Allied Sci [serial online] 2015. https://www.ijhas.in/text.asp?2015/4/1/61/149280.

[14] Gamit SC, Singel HV, Jadeja MI, Jain AA, Jain JN, Jain KP, et al. Bacteriological profile and antibiotics sensitivity pattern of patients with urinary tract infectionin tertiary care center, Pipariya, Vadodara, Gujarat. J Pure Appl Microbiol. 2022;16(4):2576-79. Doi: 10.22207/JPAM.16.4.24.

[15] Kumar V, Singh RKN, Verma PK, Bhat NK, Shrivastava Y, Yhoshu E, et al. Clinico-microbiological profile and clinical predictor of urinary tract infection in children: A single-center study from Himalayan foothills. Cureus. 2023;15(1):e33289. Doi: 10.7759/cureus.33289.

[16] Malik N, Faisal A, Munir S, Riaz S. Clinical and microbiological profile of urinary tract infection in male diabetic patients. J Microbiol Exp. 2020;8(1):30-34. Doi: 10.15406/jmen.2020.08.00282.

[17] Mbwambo HJ, Mbwambo OJ, Bright FB, Charles AC. Microbiological profile and antimicrobial susceptibility pattern among patients with urinary tract infection in northern Tanzania. Doi: 10.30574/gscbps.2021.16.2.0226.

[18] Bhargava K, Nath G, Bhargava A, Kumari R, Aseri GK, Jain N. Bacterial profile and antibiotic susceptibility pattern of uropathogens causing urinary tract infection in the eastern part of Northern India. Front Microbiol. 2022;13:965053. Doi: 10.3389/fmicb.2022.965053. PMID: 36016776; PMCID: PMC9396120.

[19] Aggarwal R, Chaudhary U, Sikka R. Detection of extended spectrum β-lactamase production among uropathogens. J Lab Physicians. 2009;1(1):07-10. Doi: 10.4103/0974-2727.44423. PMID: 21938241; PMCID: PMC3167965.

[20] Sood S, Gupta R. Antibiotic resistance pattern of community-acquired uropathogens at a tertiary care hospital in Jaipur, Rajasthan. Indian J Community Med. 2012;37(1):39-44. Doi: 10.4103/0970-0218.94023. PMID: 22529539; PMCID: PMC3326806.

[21] Fenta A, Dagnew M, Eshetie S, Belachew T. Bacterial profile, antibiotic susceptibility pattern and associated risk factors of urinary tract infection among clinically suspected children attending at Felege-Hiwot comprehensive and specialized hospital, Northwest Ethiopia. A prospective study. BMC Infect Dis. 2020;20(1):673. Doi: 10.1186/s12879-020-05402-y. PMID: 32938424; PMCID: PMC7493977.

[22] Biswas R, Rabbani R, Ahmed HS, Sarker MAS, Zafrin N, Rahman MM. Antibiotic sensitivity pattern of urinary tract infection at a tertiary care hospital. Bangladesh Crit Care J [Internet]. 2014[cited 2022 Dec. 18];2(1):21-24. Available from: https://www.banglajol.info/index.php/BCCJ/article/view/19952.

[23] Muzammil M, Adnan M, Sikandar SM, Waheed MU, Javed N, Ur Rehman MF. Study of culture and sensitivity patterns of urinary tract infections in patients presenting with urinary symptoms in a tertiary care hospital. Cureus. 2020;12(2):e7013. Doi: 10.7759/cureus.7013. PMID: 32211249; PMCID: PMC7081730.

[24] Mishra PP, Prakash V, Singh K, Mog H, Agarwal S. Bacteriological profile of isolates from urine samples in patients of benign prostatic hyperplasia and or prostatitis showing lower urinary tract symptoms. J Clin Diagn Res. 2016;10(10):DC16-DC18. Doi: 10.7860/JCDR/2016/21973.8734. Epub 2016 Oct 1. PMID: 27891339; PMCID: PMC5121677.
[25] Nanagiri A, Shabbir N. Lesch Nyhan Syndrome. [Updated 2022 May 8]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2022 Jan.
[26] Gulati S, Kher V, Arora P, Gupta S, Kale S. Urinary tract infection in nephrotic syndrome. Pediatr Infect Dis J. 1996;15(3):237-40. Doi: 10.1097/00006454-199603000-00012. PMID: 8852912.
[27] Akhtar A, Ahmad Hassali MA, Zainal H, Ali I, Khan AH. A cross-sectional assessment of urinary tract infections among geriatric patients: Prevalence, medication regimen complexity, and factors associated with treatment outcomes. Front Public Health. 2021;9:657199. Doi: 10.3389/fpubh.2021.657199. PMID: 34733812; PMCID: PMC8558341.
[28] Choi JB, Min SK. Complicated urinary tract infection in patients with benign prostatic hyperplasia, Journal of Infection and Chemotherapy. https://doi.org/10.1016/j.jiac.2021.06.006. (https://www.sciencedirect.com/science/article/pii/S1341321X21001677).

PARTICULARS OF CONTRIBUTORS:
1. Associate Professor, Department of Microbiology, Telangana Institute of Medical Science and Research, Hyderabad, Telangana, India.
2. Professor and Head, Department of Microbiology, Malla Reddy Institute of Medical Sciences, Hyderabad, Telangana, India.
3. Professor, Department of Microbiology, Malla Reddy Institute of Medical Sciences, Hyderabad, Telangana, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
V Haritha,
HIG 67, Ushodaya Enclave, Madinaguda, Hyderabad, Telangana, India.
E-mail: harithagunturu@gmail.com

PLAGIARISM CHECKING METHODS: [Jain H et al.]
- Plagiarism X-checker:Dec 21, 2022
- Manual Googling: Jan 28, 2023
- iThenticate Software: Feb 06, 2023 (20%)

ETYMOLOGY: Author Origin

AUTHOR DECLARATION:
- Financial or Other Competing Interests: None
- Was Ethics Committee Approval obtained for this study? Yes
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. No

Date of Submission: **Dec 20, 2022**
Date of Peer Review: **Jan 11, 2023**
Date of Acceptance: **Feb 08, 2023**
Date of Publishing: **Mar 01, 2023**