

Prevalence of Different Uro-Pathogenes along with Antimicrobial Susceptibility Pattern in Tertiary Care Hospital of Saurashtra Region, GujaratNidhi Patel¹, Divya Fultariya², Miral Adroja³, Gaurav Chotaliya⁴¹Senior Resident, Department of Microbiology, GMERS Medical College, Morbi²Resident Doctor, Department of Obstetrics and Gynaecology, General Hospital, Vyara, Surat³Senior Resident, Department of Obstetrics and Gynaecology, GMERS Medical College, Morbi⁴Third year Resident, Department of Microbiology, Shri M.P. Shah Government Medical College, Jamnagar

Received: 25-08-2024 / Revised: 23-09-2024 / Accepted: 26-10-2024

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Conflict of interest: Nil

Abstract:

Aim: Urinary tract infections (UTI) are the infection or inflammation of urogenital tract involving urethra, bladder, ureter and kidney caused by microorganism like bacteria, fungal and parasite. UTI is Common healthcare burden affecting male and female but incidence in female was higher because of various reason-like anatomy of female urinary tract. UTI can be community acquired or hospital acquired, in hospital acquired UTIs chances of multi drug resistance isolate is higher. Therefore, this study aims to detect the prevalence and the antibiotic susceptibility pattern of UTIs patients in tertiary care hospital of Saurashtra region of Gujarat.

Material and Methodology: Retrospective study conducted over a period of 1 year. Clean catch mid-stream urine samples of patients received at present laboratory who were tentatively diagnosed as case of UTI. Total 900 samples tested according to standard bacteriological methods. Urine samples were cultured on blood agar and MacConkey agar and bacteria identified standard biochemical tests, catalase, oxidase, gram stain and motility, and for antibiotic susceptibility pattern we used Kirby-Bauer disk diffusion method.

Result: Total 900 samples of urine received from various wards and ICUs of our hospital. Among 900 samples 243 samples was culture positive and prevalence of UTIs was 27%. Majority of urine samples (65.02%) was of female of reproductive age and maximum samples received from medicine ward followed by surgical wards. In our study, gram negative bacteria most commonly isolated then gram positive bacteria. E. coli was the most common organism isolated which is followed by klebsiella and other bacteria. It was seen that E. coli was highly sensitive to Ceftazidime-avibactam (95.63%) followed by Fosfomycin (94.27%) and meropenem (91.36%). Among gram positive organism, enterococcus was isolated in more number (8.64%) then S. aureus (0.82%). Fortunately, both the organisms were fully susceptible to vancomycin and linezolid. For UTIs most sensitive drug was nitrofurantoin. High level Gentamicin resistance was 41.36% for enterococcus spp.

Conclusion: the UTIs in female is quite common and it is necessary to identify microorganism causing UTIs and study their antibiotic sensitivity pattern. Timely management of UTIs with antibiotic can prevent progression of complicated UTIs. Therefore, physicians must follow antibiotic steward ship and change their treatment based on performing antibiotics susceptibility testing.

Keywords: UTI, Uropathogens, E.coli, Antimicrobial susceptibility, Fosfomycin, Nitrofurantoin, Enterococcus.

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Introduction

Urinary tract infections (UTI) are the infection or inflammation of urogenital tract involving urethra, bladder, ureter and kidney caused by microorganism like bacteria, fungal and parasite [1,2]. Patients with UTI presents with different symptoms like fever, burning micturition, lower-abdominal pain, frequency, urgency. UTI is more commonly associated with females than males as because of Anatomical position of female urethra close to Anogenital openings. [2,3] Females harboring UTI mostly during Adolescence and child-bearing years

[4,5]. UTI rarely seen in adult males. However, in older males due to enlargement of prostate, diabetes, co-morbidities and instrumentation lead to increasing risk of UTI [4,6]. UTI can be community acquired or hospital acquired (HA-UTI). HA-UTI defined as symptoms of UTI after 48 hour of hospitalization and are not incubating at the time of admission or within 3 days of discharge [2,7]. Approximately burden of UTI is 150 million cases per year with 6 billion dollars of health care costs worldwide [2,8]. Uncomplicated UTI are mostly

diagnosed and treated as Outpatient bases were as those UTI associated with fever, Sepsis, indwelling catheters, comorbid conditions and anatomical and structural abnormalities of urinary tract consider as complicated UTI, offend requiring hospitalization. Common bacteria associated with UTI are E. coli, klebsiella, proteus, pseudomonas aeruginosa, Acinetobacter, enterococcus and staphylococcus. Roll of clinical microbiology laboratory is to identify each isolate to species level and determine susceptibility pattern and guide clinician regarding choice of appropriate antimicrobial agents in order to prevent accruing of multidrug resistance bacteria.

Material and Methodology

Retrospective study conducted over a period of 1 year from December -2023 to November-2024. Clean catch mid-stream urine samples of patients received at present laboratory who were tentatively diagnosed as case of UTI. Total 900 samples tested according to standard bacteriological methods. Urine samples were cultured on blood agar and MacConkey agar and bacteria identified by standard biochemical tests, catalase, oxidase, gram stain and motility. For bacterial colony count measured amount of urine was inoculated on nutrient agar by

using calibrated loop method. Significant bacteriuria assed on the bases of > 10⁵ CFU/ml (colony forming unit). < 10² CFU/ml was interpreted as negative UTI. Further proceeding of each organism done on muller Hinton agar to determine antimicrobial susceptibility by Kirby-Bauer disk diffusion method.

Inclusion criteria

Urine samples from different wards, OPD, ICU belong to both gender and all age group patients who were provisionally diagnosed as case of UTI.

Exclusion criteria

- Sample that are not transported in proper manner, grossly leak and contaminated are excluded.
- Mixed microbial growth in culture and colony count non-significant are excluded.

Result

Total 900 samples received and proceeded at present laboratory over a period of one year. out of 900 samples, 657 were sterile (73%) and 243 were culture positive (27% culture positivity rate). [Figure-1]

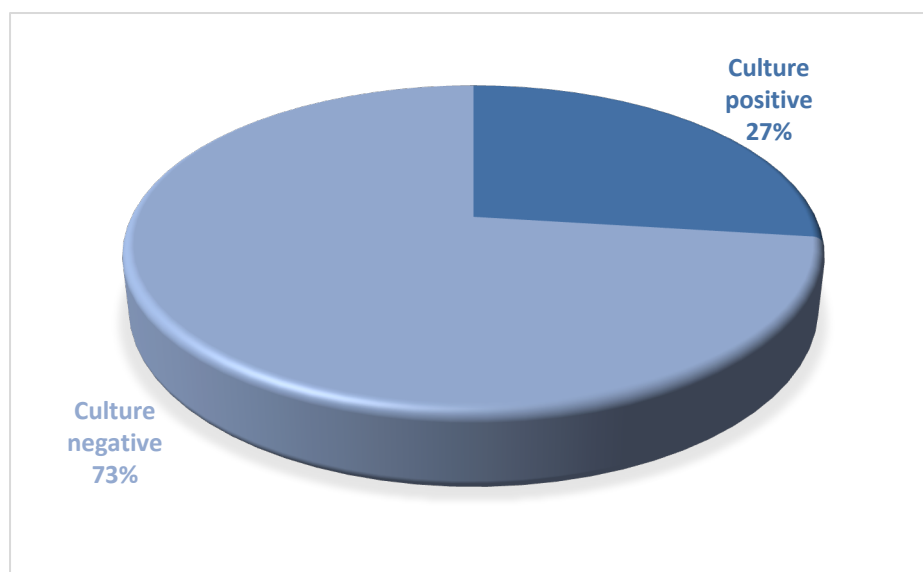


Figure 1:

Among 243 culture positive UTI, 85 belonged to male patient (34.97%) and 158 belonged to female patient (65.02%). Highest number of isolates came from 21-40 years age group which is predominantly reproductive age group; followed by 41-60 years. Least number of isolates noted from 81-100 years. [Table-1]

Table 1: Age Group Distribution among UTI Isolates

Age Group Distribution Among UTI Isolates	
0-20 Years	12(4.93 %)
21-40 Years	105(43.20 %)
41-60 Years	86(35.39%)
61-80 Years	32(13.16%)
81-100 Years	08(3.29%)

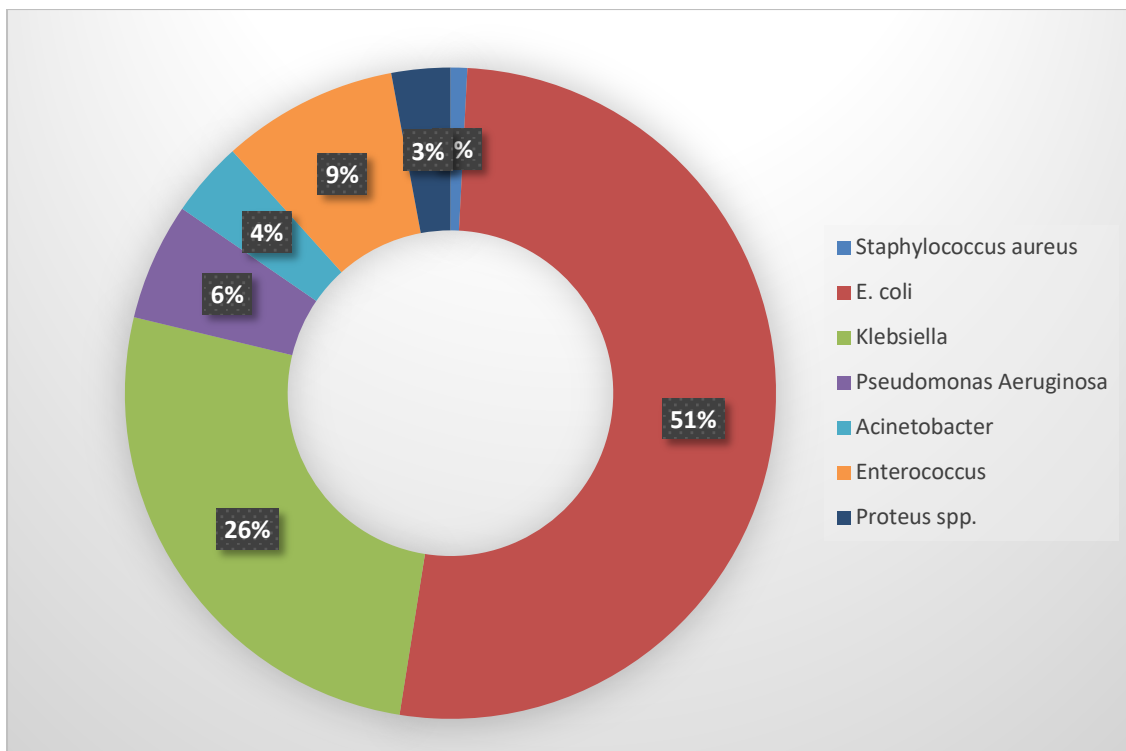


Figure 2: Micro-organisms isolated from UTI

As described in figure-2, E. coli was the predominant organism causing UTI (51.02%). Second most common organism was Klebsiella spp. (25.92%) followed by Proteus spp. (2.88%) & Acinetobacter spp. (3.70%), Pseudomonas (5.76%). Among gram positive organism, most common was Enterococcus spp. (8.64%) followed by Staphylococcus spp.

(0.82%). Distribution of UTI among different wards was also assessed and maximum number of isolates from Medicine units (43.20%).

Next common was surgical ward (24.56%). 14.23% isolates from different ICUs, Obstetric and Gynae (16.81%) & least from paediatric wards (1.20%).

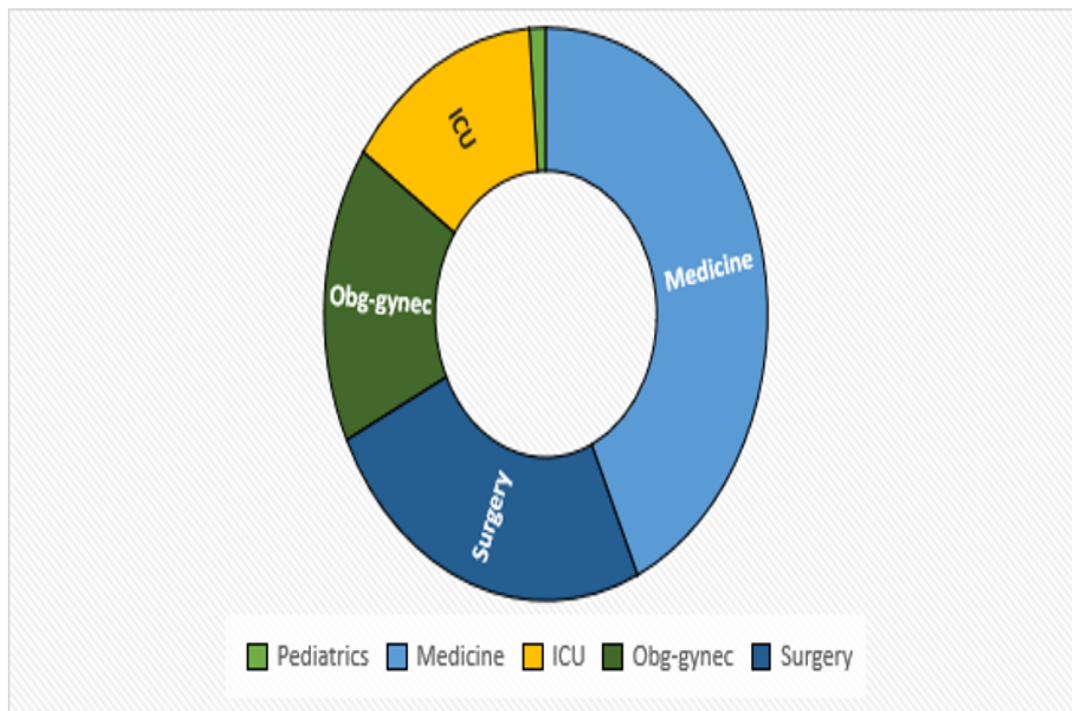


Figure 3: Distribution of UTI among different wards

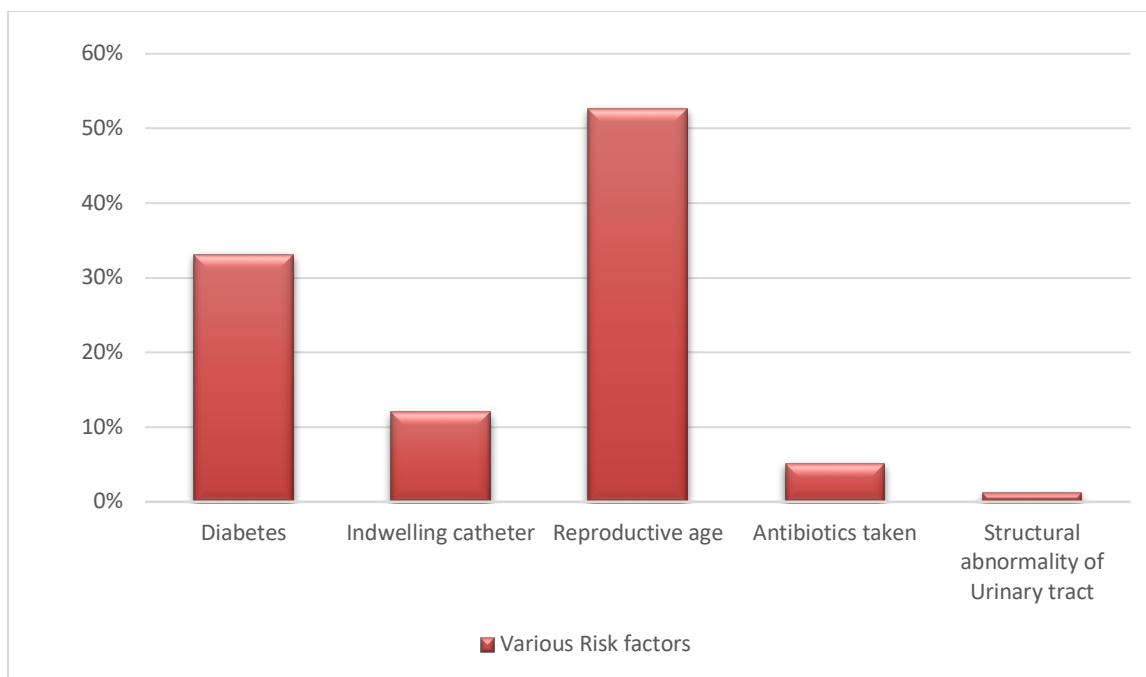


Figure 4: Underlying risk factors predisposing to UTI in culture positive isolates

In the present study, Reproductive age group was the most common factor for harboring UTI found. (52.60%) Other risk factors predisposing to UTI in culture positive isolates are Diabetes (33%), catheterization (12%), broad-spectrum antibiotics given (5.10%) & abnormalities of Urinary tract (1.20%). [Figure-4]

Table 2: Percentage of antibiotic sensitivity pattern of isolated gram-negative organism

Isolates	E. coli (%)	Klebsiella sp. (%)	Pseudomonas sp. (%)	Proteus sp. (%)	Acinetobacter sp. (%)
Drugs					
Ampicillin	9.09%	**	**	8.20%	**
Ceftriaxone	52.03%	45.56%	**	30.55%	52.14%
Cefotaxime	51.45%	47.85 %	**	30.55%	49.52%
Amoxicillin-clavulanate	25.63%	23.36%	**	**	**
Ampicillin-sulbactam	65.23%	47.89%	**	38.24%	58.34%
Piperacillin-tazobactam	52.29%	55.23%	51.82%	63.12%	78.22%
Gentamicin	67.51%	62.23%	**	45.16%	45.65%
Levofloxacin	10.11%	12.23%	41.25%	58.46%	61.75%
Co-trimoxazole	45.25%	56.28%	**	54.23%	59.66%
Nitrofurantoin	86.96%	84.99%	**	**	**
Cefepime	58.69%	47.55%	70.53%	61.23%	63.54%
Imipenem	91.36%	82.36%	84.56%	73.20%	82.56%
Meropenem	91.36%	82.36%	84.56%	73.20%	82.56%
Amikacin	66.39%	61.35%	65.39%	58.10%	47.58%
Ceftazidime-avibactam	95.63%	91.66%	94.36%	94.20%	**
Fosfomycin	94.27%	**	**	**	**
Aztreonam	64.78%	48.35%	61.02%	**	**
Ceftazidime	51.42%	41.23%	65.35%	58.70%	61.23%
Tetracycline	72.54%	65.20%	**	**	56.38%

**=not tested

According to our study (Table-2) gram negative isolated pathogen is higher than gram positive pathogen. It was seen that E. coli was highly sensitive to Ceftazidime-avibactam (95.63%) followed

by Fosfomycin (94.27%) and meropenem (91.36%). In all gram-negative bacilli, it was found out that ampicillin, levofloxacin are the list sensitive antimicrobial agents found in our study.

Table 3: Percentage of antibiotic sensitivity pattern of isolated gram-positive organism

Isolates	Staphylococcus spp. (%)	Enterococcus sp. (%)
Drugs		
Cefoxitin	60.53%	**
Tetracycline	42.60%	48.46%
Co-trimoxazole	68.30%	**
Vancomycin	100 %	100%
Nitrofurantoin	77.51%	82.34%
Linezolid	100%	100%
Levofloxacin	41.50%	56.28%
Gentamicin	62.81%	58.64% (High level gentamicin)
Fosfomycin	**	80%

Among gram positive organism, enterococcus was isolated in more number (8.64%) then *S. aureus* (0.82%). Fortunately, both the organisms were fully susceptible to vancomycin and linezolid. For UTIs most sensitive drug was nitrofurantoin. High level Gentamicin resistance was 41.36% for enterococcus spp. (Table-3)

Discussion

Table 4: Comparison of different parameters among various study

Study	Prevalence of UTI	Sex commonly affected	Commonest risk factor	Most common organism isolated
Present	27%	Female	Reproductive age group	<i>E. coli</i>
Eman Elsayed et al [9]	86%	Female	Urinary stone	<i>E. coli</i>
Bhargava et al [2]	77.98%	Female	Reproductive age group	<i>E. coli</i>
V Haritha et al [4] (study exclusively in male)	34%	Male	Diabetes	<i>E. coli</i>
Galate LB et al [10]	42.88%	Female	-	<i>E. coli</i>

UTIs are caring significant burden among all infections in the community as well as hospital side. In the present study we found out culture positivity rate of 27%. The range of culture positivity rate was ranging from 34% to 86% in different studies [2,4,9,10]. Female most affected than males in this study and several other studies (Table-4), this correlated with the fact of females having shorter urethra, close proximity of meatus to anus and improper hygiene maintained. In the study of V Haritha et al [4] which is done only in males, the commonest risk factor found was diabetes in 31 to 60 years age groups, were as it was the second most common risk factor in present study and the major one was reproductive age group (18-40 years) also seen with the studies of Bhargava et al [2]. In the present study highest number of culture positive isolates came from 21-40 years denoting the fact of association of urinary tract infection with child bearing age and sexual activity.

Highest number of isolates came from medicine ward as diagnosis of UTI commonly done by physician. However, surgical and gynecological units also having significant number of isolates because of instrumentation, surgery perform in bladder and perinium area and pregnant female.

Indwelling urinary catheters are important factors for causing UTIs if proper catheter care is not

maintained. It promotes hospital acquired infection and causes spread of multi drug resistance organism like ESBL *E. coli* and VRE (vancomycin resistant enterococcus) by biofilm formation and genetic mutation. This altimetry leads to increasing healthcare cost, longer duration of hospital stays and high-level antibiotics burden. Structural abnormality of urinary tract and urinary stones are other risk factor found.

Gram negative organism

E. coli was most resistance towards ampicillin (90.91%) and fluroquinolones – levofloxacin (89.89%). Ampicillin alone currently being most resistance with rate up 96% in study of V Haritha et al [4] and 1.1% in study of Bhargava et al [2]. Though fluroquinolones are commonly being used as broad-spectrum therapy of UTIs, these invitro study found 89% resistance and corelated with the other studies of Eman Elsayed et al [9] (82.65%) and 67% in Galate LB et al [10]. 3rd generation cephalosporins becoming ineffective rapidly with resistance rate of 52.03%. In fact, it is showing more resistance in *E. coli* and klebsiella spp. in other studies (75% to 98%) [4,2]. For treating urinary tract infection with MDR (multidrug resistant) organism imipenem, Ceftazidime-avibactam are available options. Nitrofurantoin and Fosfomycin are least resistance drugs and that should be includ-

ed in treatment regimen according to sensitivity report and used cautiously.

Isolation of Non fermenter bacteria like pseudomonas and Acinetobacter spp drawing attention towards possibility of HAIs. Carbapenem like imipenem and meropenem showed highest sensitivity against these gram-negative bacteria and also seen Patel H B et al [11].

Gram positive organism

Here, vancomycin and linezolid 100% sensitive but the clinical laboratory should be vigilant for detailed screening of isolate coming resistance or intermediate. High level gentamicin was sensitive 58.64% and showing synergy with ampicillin. Nitrofurantoin revealed promising effectiveness for gram positive organism also.

The steps should be kept in mind while treating UTIs are as follows

1. Be aware about locally prevalent organism and their antibiogram and start empirical therapy according to this.
2. Avoid using over the counter antibiotic as they increasing multi drug resistance
3. Care bundle approach for Catheter should be followed

Conclusion

Though UTIs are consider as easy to treat infections, by studding this it is concluded that increasing trend of prevalence is quit alarming and MDR organisms are more getting isolated. The use of culture and sensitivity report will definitely guide clinician for antimicrobial agents and also prevent promotion of complicated UTIs. Female with reproductive age group is at risk that's why community approach should be followed and includes education for improvement of personal hygiene. Hand washing and safe catheterization implemented in hospital to prevent HA-UTIs. Two most promising drugs- Nitrofurantoin and Fosfomycin increase the good outcome for UTIs but should be used according to the report.

Reference

1. M. Komala. Urinary Tract Infection: Causes, Symptoms, Diagnosis And It's Management. 1Karpagam University, Coimbatore 2 Department of Pharmaceutics, Coimbatore medical college, Coimbatore-114, Tamil Nadu, India, editor. Journal of Chemical and Pharmaceutical Sciences. 2015; 6(1):22–8.

2. 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. *Frontiers in Microbiology*. 2022 Aug 9; 13.
3. Fazly Bazzaz, B. S., Fork, S. D., Ahmadi, R., and Khameneh, B. (2021). Deep
4. Insights into urinary tract infections and effective natural remedies. *Afr. J. Urol.*27, 1–13.
5. V Haritha, Rao SD, Syed Shafeequr Rahman. Microbiological Profile of Urinary Tract Infections in Males: A Cross-sectional Study. 2023 Jan 1;
6. Minardi D, D'Angelo G, Cantoro D, Conti A, Muzzonigro G. Urinary tract infections [1]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.
7. Bruschi JL. Urinary Tract Infection (UTI) in Males- Clinical Presentation. *Infectious [2] Diseases Society of America*. Jan 02, 2020. <https://emedicine.medscape.com/article/231574-overview>.
8. Iacovelli, V., Gaziev, G., Topazio, L., Bove, P., Vespasiani, G., and Finazzi Agrò, E. (2014). Nosocomial urinary tract infections: A review. *Urologia* 81, 222–227. doi: 10.5301/uro.5000092
9. Kucheria, R., Dasgupta, P., Sacks, S. H., Khan, M. S., and Sheerin, N. S. (2005). nUrinary tract infections: New insights into a common problem. *Postgrad. Med. J.* 81, 83–86. doi: 10.1136/pgmj.2004.023036
10. Eman Elsayed Hegazy, Rasha Abd El-Hamid Alam El-Din, Ahmed Mostafa Amin, Fawkia Mohamed Mahgoub and Samir Abd El-Hakeem El-Gamal. 2018. Microbiological Profile of Urinary Tract Infections with special Reference to Antibiotic Susceptibility Pattern of Escherichia coli Isolates. . 7(02): 911-920.
11. Lata B.Galate, Sonal Bangde. Urinary Tract Infection: Study of Microbiological Profile and its Antibiotic Susceptibility Pattern. <http://www.ijcmas.com>. 2015.
12. Patel, H. B., Soni, S. T., Bhagyaxmi, A., and Patel, N. M. (2019). Causative agents of urinary tract infections and their antimicrobial susceptibility patterns at a referral center in Western India: An audit to help clinicians prevent antibiotic misuse. *J. Fam. Med. Prim. Care* 8, 154–159. doi: 10.4103/jfmpc.jfmpc_20_18.