International Journal of Medical Science and Clinical Research Studies

ISSN(print): 2767-8326, ISSN(online): 2767-8342

Volume 02 Issue 09 September 2022

Page No: 941-951

DOI: https://doi.org/10.47191/ijmscrs/v2-i9-07, Impact Factor: 5.365

Prevalence of Uropathogen and Antibiotic Susceptibility Pattern in Urinary Tract Infection: A Reterospective Observational Cohort Study

Roshini R[1], Janet Jomon[2], Muhsin Muhammed A[3], Lijo Joseph Thomas[4]

[1,2,3]Pharm D, K V M College Of Pharmacy, Kokkothamangalam P O, Cherthala, Alappuzha, Kerala. Pin: 688527

[4]Assistant professor, KVM college of pharmacy,kokkothamangalam po Alappuzha,cherthala,kerala.pin 688527

ABSTRACT

Aim: The aim of the study is to evaluate prevalence of uropathogen and antibiotic susceptibility pattern in urinary tract infection in a tertiary care hospital.

Method: This is a retrospective cohort study conducted over a period of 6 months in general medicine department of tertiary care hospital, Kerala. A total of 170 patients satisfying the inclusion criteria were analyzed. Case records were retrospectively reviewed for demographic data, clinical presentations, investigations, management and outcome. Data analysis were conducted using SPSS and Microsoft Excel 2010.

Results: The majority of the patients causing urinary infection were females (61.2%) when compared with men (38.8%). Out of 170 patients, the age group >70 years were more prone to urinary tract infection. Of the total study group, Gram negative bacteria (97.1%) was the most prevalent organism causing urinary tract infection, among which *E. coli* (64.7%) predominates. *E coli* shows high sensitivity to amikacin. The most common antibiotic prescribed was found to be cefaperazone/sulbactam (30.6%).

Conclusion: According to the study, urinary tract infections are highly prevalent in female patients >70 years of age. Regular surveillance and monitoring are extremely important to give practitioners the most recent information on the most efficient empirical treatment for urinary tract infections because antibiotic resistance among bacterial pathogens is evolving over time and space. Based on knowledge of the pattern of antibiotic susceptibility, empirical antibiotic selection should be made in the treatment of urinary tract infections**.**

KEYWORDS: Empirical treatment, Susceptibility pattern, Urinary tract infection, Uropathogen.

ARTICLE DETAILS

Published On:
12 September 2022

Available on:
https://ijmscr.org/

INTRODUCTION

The term Urinary tract infection usually refers to the presence of organisms in the urinary tract together with symptoms and sometimes signs of inflammation. Several factors such as gender, age, race, presence of disease, urinary catheter, genitourinary tract abnormalities, pregnancy, and hospitalization status bear significant risk for recurrent UTIs.[1,2]Urinary tract infection is known to cause short-term morbidity like fever, dysuria, and lower abdominal pain (LAP), may result in permanent damage of the kidney.[3] UTIs may be asymptomatic, acute, chronic, and complicated or uncomplicated, the clinical complications depend on the portion of urinary tract involved, the uropathogen, and severity of the infection.[4] Urinary tract infection is global and in India more than 150 million cases are reported every year and economic burden is more than 6 billion. About 40% women and 12% men suffers with UTI at least one time in their life time.[5] Among UTI patients, antibiotics are the most often given medications. The most likely uropathogen should be considered when choosing the antimicrobial medicines, but so should be its susceptibility pattern. Because of the invariably increased development of resistant organisms, the UTI are often treated with broad spectrum antibiotics even when one with narrow spectrum activity may be appropriate. Overusing antimicrobials can raise hospital costs, morbidity, and death as well as the emergence of antibiotic resistance.[6] Hence an attempt is made

in this study to assess the prevalence of various uropathogen and to evaluate the antibiotic susceptibility pattern in UTI.

MATERIALS AND METHODS

Study Site: General Medicine Department
Study Design: Retrospective observational study
Study Duration: 6 Months
Sample Size Required: 170

METHOD

The data was collected retrospectively for a period of 6 months from general medicine department. Case records was retrospectively reviewed from MRD, demographic and medical details were documented in the self-designed patient profile form, which includes age, sex, duration of hospital days, culture and sensitivity test, urine routine examination, past medical history, antibiotic management and study of antibiotic which was commonly prescribed.

STATISTICAL ANALYSIS

In this study, Categorical and quantitative variables were expressed as frequency (percentage) and mean ± SD respectively. Statistical analyses were performed by using a statistical software package SPSS, version 20.0 and Microsoft excel 2010.

RESULTS

The study represents overall distribution of UTI in different age groups of both genders. About 38.8% of the population affected by UTI with age group >70 years were females when compared to males (34.8%). (**Table no:1**).

The study shows the Gram-negative bacteria contribute to 97.1% of the total bacterial isolates while Gram positive bacteria constituted 2.9%. **(Table:2).** *Escherichia coli* (64.7 %) is the predominant organism causing UTI followed by *Klebsiella pneumonia* (9.4%), *Pseudomonas aeruginosa* (5.9%) **(Table:3)**

The most commonly used antibiotics for UTI were Cefoperazone+sulbactam (30.6%) followed by Piperacillin+tazobactam (22.4%), Meropenem (20.0%), Amikacin (19.4%) **(Table:4)**

The most common antibiotics prescribed for UTI caused by *E.coli* and *Klebsiella pneumoniae* were Cefoperazone+sulbactam 32.7% and 31.3% respectively. **(Table:5,6)**. The most common antibiotic prescribed for UTI caused by *Pseudomonas aeruginosa* was Amikacin (40%) (**Table:7).** In this study, the causative organism of UTI such as E coli, Klebsiella pneumonia and Pseudomonas aeruginosa shows highest sensitivity to amikacin. **(Table: 8,9,10)**

In our study we observed that majority of the antibiotic prescribed for UTI were from the Watch group followed by Access group and Reserve group. Out of 22 antibiotics prescribed 3 were from Access group, 17 from Watch group and 2 from Reserve group. High consumption of watch group antibiotics were observed in the study **(Table:11).**

Table 1: Percentage Distribution Of Uti According To Age And Gender

AGE	MALE (N=66)		FEMALE (N=104)		TOTAL (N=170)	
	CASES	PERCENTAGE	CASES	PERCENTAGE	CASES	PERCENTAGE
<=50 years	26	39.4	39	37.5	65	38.2
51 – 70 years	17	25.8	22	21.2	39	22.9
>70 years	23	34.8	43	41.3	66	38.8

Table 2: Percentage Distribution Of Uti According To Type Of Organism

ORGANISM	SAMPLE SIZE (N=170)	PERCENTAGE (%)
Gram negative	165	97.1
Gram positive	5	2.9

Table 3: Prevalence Of Causative Micro Organisms In Uti

ORGANISMS	SAMPLE SIZE (N=170)	PERCENTAGE (%)
E.coli	110	64.7
Klebsiella pneumoniae	16	9.4
Pseudomonas aeruginosa	10	5.9
Multi drug resistant Klebsiella pneumoniae	8	4.7
Methicillin resistant Staphylococcus haemolyticus	4	2.4
Enterococcus faecium	3	1.8
Acinetobacter baumanii	3	1.8
Klebsiella sps	2	1.2
Serratia liquefaciens	2	1.2
Proteus mirabilis	2	1.2
Citrobacter koseri	2	1.2
Enterobacter aerogenes	2	1.2
Staphylococcus haemolyticus	1	0.6
Enterococci sps	1	0.6
Multi drug resistant Pseudomonas aeruginosa	1	0.6
Multi drug resistant Acinetobacter baumanii	1	0.6
Morganella morganii	1	0.6
Acinetobacter junii	1	0.6
Streptococcus agalactiae	1	0.6

Table 4: Antibiotic Prescribed For Uti

ANTIBIOTIC	FREQUENCY (N= 291)	PERCENTAGE (%)
Cefoperazone+sulbactam	52	30.6
Piperacillin+tazobactam	38	22.4
Meropenem	34	20.0
Amikacin	33	19.4
Nitrofurantoin	26	15.3
Ofloxacin	16	9.4
Cefixime	17	10
Norfloxacin	12	7.1
Levofloxacin	10	5.9
Amoxicillin+clavulanic acid	9	5.3
Cefotaxime	8	4.7
Ceftriaxone	7	4.1
Cefuroxime	6	3.5
Faropenem	3	1.8
Cefoperazone	3	1.8
Cephalexin	3	1.8
Ciprofloxacin	2	1.2

Netilmycin	2	1.2
Imipenem	2	1.2
Cefpodoxime proxetil	2	1.2
Cefoperazone+tazobactam	2	1.2
Cefpodoxime	1	0.6
Linezolid	1	0.6
Cefotaxime+sulbactam	1	0.6
Tigecycline	1	0.6

Table 5: Antibiotics Prescribed For The Organism *E.Coli*

ANTIBIOTICS	FREQUENCY (N=185)	PERCENTAGE (%)
Cefoperazone+sulbactam	36	32.7
Piperacillin+tazobactam	23	20.9
Amikacin	22	20.0
Meropenem	21	19.1
Nitrofurantoin	17	15.5
Cefixime	14	12.7
Ofloxacin	10	9.1
Amoxycillin+clavulanic acid	8	7.3
Cefotaxime	6	5.5
Norfloxacin	6	5.5
Ceftriaxone	5	4.5
Faropenem	3	2.7
Levofloxacin	3	2.7
Cefoperazone	3	2.7
Cefuroxime	2	1.8
Cefpodoxime proxetil	1	0.9
Imipenem	1	0.9
Cefpodoxime	1	0.9
Netilmycin	1	0.9
Cefotaxime+sulbactam	1	0.9

Table 6: Antibiotics Prescribed For The Organism *Klebsiella Pneumoniae*

ANTIBIOTICS	FREQUENCY (N=31)	PERCENTAGE (%)
Cefoperazone+sulbactam	5	31.3
Piperacillin+tazobactam	4	25.0
Amikacin	4	25.0
Ofloxacin	4	25.0
Meropenem	3	18.8
Nitrofurantoin	3	18.8
Imipenem	1	6.3
Amoxycillin+clavulanic acid	1	6.3
Cefotaxime	1	6.3

Cefixime	1	6.3
Cefuroxime	1	6.3
Norfloxacin	1	6.3
Levofloxacin	1	6.3
Cefoperazone+tazobactam	1	6.3

Table 7: Antibiotics Prescribed For The Organism *Pseudomonas Aeruginosa*

ANTIBIOTICS	FREQUENCY (N=19)	PERCENTAGE (%)
Amikacin	4	40
Piperacillin+tazobactam	3	30
Cefoperazone+sulbactam	3	30
Meropenem	3	30
Nitrofurantoin	2	20
Norfloxacin	2	20
Cefpodoxime proxetil	1	10
Levofloxacin	1	10

Table 8: Antibiotic Susceptibility Pattern For The Organism *E.Coli* (N=110)

ANTIBIOTICS	SENSITIVE	%	RESISTANT	%
Amikacin	102	94.4	6	5.6
Meropenem	100	93.5	6	6.5
Netilmycin	90	92.8	6	7.2
Imipenem	97	92.4	7	7.6
Vancomycin	12	92.3	1	7.7
Cefoperazone+sulbactam	92	91.1	8	8.9
Tigecycline	60	89.6	7	10.4
Gentamycin	91	88.3	12	11.7
Benzyl penicillin	13	86.7	2	13.3
Ertapenem	72	86.7	11	13.3
Tetracycline	13	86.7	2	13.3
Nitrofurantoin	80	82.5	17	17.5
Piperacillin+tazobactam	80	80.8	19	19.2
Ticarcillin+clavulanic acid	8	80.0	2	20
Chloramphenicol	12	80.0	3	20
Colistin	19	79.2	5	20.8
Doripenem	19	79.2	5	20.8
Oxacillin	24	77.4	7	22.6

Tobramycin	68	77.3	20	22.7
Teicoplanin	13	76.5	4	23.5
Clindamycin	10	71.4	4	28.6
Linezolid	5	71.4	2	28.6
Cefazolin	25	67.6	12	32.4
Cefixime	33	67.3	16	32.7
Cefotaxime	28	66.7	14	33.3
Rifampicin	2	66.7	1	33.3
Cefoxitin	16	64.0	9	36
Levofloxacin	61	60.4	40	39.6
Cefpodoxime	21	60.0	14	40
Gatifloxacin	6	60.0	4	40
Amoxicillin+clavulanic acid	61	59.2	42	40.8
Daptomycin	4	57.1	3	42.9
Cefipime	57	56.4	44	43.6
Ceftazidime	55	53.4	48	46.6
Cotrimoxazole	52	51.0	50	49
Ofloxacin	43	45.7	51	54.3
Sparfloxacin	4	44.4	5	55.6
Norfloxacin	46	43.0	61	57
Erythromycin	3	42.9	4	57.1
Ciprofloxacin	39	39.4	60	60.6
Nalidixic acid	34	38.6	54	61.4
Cefuroxime axetil	25	28.4	63	71.6
Ceftriaxone	30	28.3	75	71.7
Cephalexin	27	27.0	73	73
Cefuroxime	27	25.0	81	75
Ampicillin	24	22.4	83	77.6

Table 9: Antibiotic Susceptibility Pattern For The Organism *Klebsiella Pneumoniae* (N=16)

ANTIBIOTICS	SENSITIVE	%	RESISTANT	%
Amikacin	16	100.0	0	0
Colistin	1	100.0	0	0

Doripenem	3	100.0	0	0
Tigecycline	8	100.0	0	0
Teicoplanin	1	100.0	0	0
Tetracycline	2	100.0	0	0
Vancomycin	2	100.0	0	0
Benzyl penicillin	1	100.0	0	0
Cefoxitin	1	100.0	0	0
Clindamycin	1	100.0	0	0
Oxacillin	1	100.0	0	0
Sparfloxacin	1	100.0	0	0
Gentamycin	14	93.3	1	6.7
Tobramycin	11	91.7	1	8.3
Ertapenem	9	90.0	1	10
Netilmycin	11	84.6	2	15.4
Meropenem	12	80.0	3	20
Cefoperazone+sulbactam	12	75.0	4	25
Cefixime	3	75.0	1	25
Imipenem	10	71.4	4	28.6
Cotrimoxazole	10	66.7	5	33.3
Nalidixic acid	8	57.1	6	42.9
Piperacillin+tazobactam	6	50.0	6	50
Erythromycin	1	50.0	1	50
Cefpodoxime	1	50.0	1	50
Cefotaxime	2	50.0	1	50
Ciprofloxacin	7	46.7	8	53.3
Levofloxacin	6	42.9	8	57.1
Chloramphenicol	2	40.0	3	60
Norfloxacin	5	38.5	8	61.5
Nitrofurantoin	6	37.5	10	62.5
Ofloxacin	5	35.7	9	64.3
Gatifloxacin	1	33.3	2	66.7
Cefazolin	1	33.3	2	66.7
Cefipime	4	28.6	10	71.4
Ceftazidime	3	21.4	11	78.6
Amoxicillin+clavulanic acid	3	20.0	12	80

Cephalexin	2	15.4	11	84.6
Ampicillin	2	14.3	12	85.7
Ceftriaxone	2	13.3	12	86.7
Cefuroxime	2	13.3	12	86.7
Cefuroxime axetil	1	9.1	10	90.9

Table 10: Antibiotic Susceptibility Pattern For The Organism *Pseudomonas Aeruginosa* (N=10)

ANTIBIOTICS	**SENSITIVE**	**%**	**RESISTANT**	**%**
Amikacin	10	100	0	0
Colistin	4	100	0	0
Doripenem	5	100	0	0
Gentamycin	10	100	0	0
Ertapenem	3	100	0	0
Nalidixic acid	2	100	0	0
Teicoplanin	1	100	0	0
Tetracycline	1	100	0	0
Vancomycin	1	100	0	0
Benzyl penicillin	1	100	0	0
Cefazolin	1	100	0	0
Cefoxitin	1	100	0	0
Cefpodoxime	1	100	0	0
Cefotaxime	1	100	0	0
Cefixime	2	100	0	0
Chloramphenicol	1	100	0	0
Cefaperazone+sulbactam	9	90.0	1	10.0
Cefipime	9	90.0	1	10.0
Ceftazidime	9	90.0	1	10.0
Imipenem	9	90.0	1	10.0
Meropenem	9	90.0	1	10.0
Piperacillin+tazobactam	8	88.9	1	11.1
Netilmycin	8	88.9	1	11.1
Tobramycin	6	85.7	1	14.3
Ciprofloxacin	8	80.0	2	20.0
Levofloxacin	8	80.0	2	20.0
Norfloxacin	6	75.0	2	25.0
Ticarcillin+clavulanic acid	3	75.0	1	25.0
Ofloxacin	2	66.7	1	33.3
Amoxicillin+clavulanic acid	2	66.7	1	33.3

Ampicillin	2	66.7	1	33.3
Ceftriaxone	2	66.7	1	33.3
Oxacillin	1	50.0	1	50.0
Cefalexin	1	50.0	1	50.0
Cefuroxime	1	33.3	2	66.7
Cefuroxime axetil	1	33.3	2	66.7
Cotrimoxazole	1	25.0	3	75.0
Tigecycline	2	25.0	6	75.0
Nitrofurantoin	1	16.7	5	83.3

Table 11: Aware Classification Of Prescribed Antibiotics

ACCESS	**WATCH**	**RESERVE**	**TOTAL**
Amikacin (N=33; 19.4%)	Cefoperazone+Sulbactam(N =52;30.6%)	Linezolid (N=1; 0.6%)	
Nitrofurantoin (N=26; 15.3%)	Ofloxacin (N=16; 9.4%)	Tigecycline (N=1; 0.6%)	
Amoxycillin+Clavulanic Acid (N=9; 5.3%)	Piperacillin+ Tazobactam (N=38;22.4%)		
	Meropenem (N=34;20.0%)		
	Levofloxacin (N=10; 5.9%)		
	Ceftriaxone (N=7; 4.1%)		
	Imipenem (N=2; 1.2%)		
	Netilmycin (N=2; 1.2%)		
	Norfloxacin (N=12; 7.1%)		
	Cefuroxime (N=6; 3.5%)		
	Cefotaxime(N=8; 4.7%)		
	Cefixime (N=17;10.0%)		
	Faropenem (N= 3; 1.8%)		
	Cefoperazone (N=3; 1.8%)		
	Cefalexin (N= 3; 1.8%)		
	CefpodoximeProxetil (N=2;1.2%)		
	Cefpodoxime (N=1; 0.6%)		
3	17	2	22

DISCUSSION

The study represents overall distribution of UTI in different age groups of both gender. About 39.4% of the population were males whereas 38.2% were females in the age group <=50 years. About 25.8% of the populations were males whereas 22.9% were females in the age group 51-70 years. About 38.8% of the population affected by UTI with age group >70 years were females when compared to males (34.8%). This study correlates with the study conducted by Pardeshi P in 2016.[7] In his study, 66.78% were female and 33.22% were males.

According to the study conducted by Gebissa A D et al in 2018,[8] the prevalence of gram negative bacteria (59.2%) was predominant than gram positive bacteria (38%), which is in agreement with the result obtained from our study. In our study, *E.coli* was found to be the most commongram negative bacteria causing UTI. This result correlates with the study conducted by Pardeshi P in 2016. In his study *E.coli* (53.77%) was the common isolate causing UTI. The second most prevalent isolate was *Klebsiella pneumoniae* (27.40%) followed by *Pseudomonas aeruginosa* (8.56%), *Proteus spp*. (4.79%), *Enterobacter spp*. (1.71%), *Staphylococcus aureus* (1.54%).

The most commonly used antibiotics for UTI were Cefoperazone+sulbactam (30.6%) followed by Piperacillin+tazobactam (22.4%), Meropenem (20.0%), Amikacin (19.4%), Nitrofurantoin (15.3%), Ofloxacin (9.4%), Cefixime (10%), Norfloxacin (7.1%), Levofloxacin (5.9%), Amoxicillin+clavulanic acid (5.3%), Cefotaxime (4.7%), Ceftriaxone (4.1%) Cefuroxime (3.5%), Faropenem (1.8%), Cefoperazone (1.8%), Cephalexin (1.8%), Ciprofloxacin (1.2%),

Netilmycin (1.2%), Imipenem (1.2%), Cefpodoxime proxetil (1.2%), Cefoperazone+tazobactam (1.2%), Cefpodoxime (0.6%), Linezolid (0.6%), Cefotaxime+sulbactam (0.6%), Tigecycline (0.6%), Cefpodoxime proxetil+clavulanic acid (0.6%). Our study also correlates with the study conducted by Chandrasekhar et al in 2018,[9] in their study the most commonly used antibiotic was cefoperazone+sulbactam (n = 28).

Cefoperazone+sulbactam is the most commonly prescribed antibiotic for UTI caused by *E coli* and *Klebsiella pneumoniae*,32.7% and 31.2% respectively. This study correlates with the study conducted by Chandrasekhar et al in 2018. According to their study the most commonly used antibiotic among UTI caused by *E.coli* and *Klebsiella pneumoniae* was Cefoperazone+sulbactam. The most common antibiotics prescribed for UTI caused by *Pseudomonas aeruginosa* were Amikacin (40%) followed by Piperacillin+tazobactam (30%), Cefoperazone+sulbactam (30%), Meropenem (30%), which correlate with the study conducted by Roy B M et al in 2018. According to their study, the patients with UTI caused by *Pseudomonas aeruginosa* were treated with Levofloxacin and Cefoperazone+sulbactam.

In our study the first line agents used for the treatment of UTI were found to be Cephalosporins, Fluroquinolones, Meropenem, Penicillin, Nitrofurantoin and Sulphonamides.

In this study, E coli shows highest sensitivity to Amikacin (94.4%), similar with the study conducted by Daoud N et al.[10] According to their study *E.coli* was more sensitive to Meropenem (100%), Imipenem (100%). Our study also correlates with the study conducted by Dimitrov T S et al. in 2003. *Klebsiella pneumonia* shows highest sensitivity to Amikacin (100%),Our study correlates with the study conducted by Dimitrov T S et al in 2003.[11] In their study, *Klebsiella pneumonia* showed higher sensitivity to Amikacin (100%). In contrast, *Klebsiella pneumonia* showed higher sensitivity to Nitrofurantoin, Cotrimoxazole, Tetracycline. *Pseudomonas aeruginosa* is highly sensitive to Amikacin (100%) in our study.

We observed that majority of the antibiotic prescribed were in the Watch followed by Access and Reserve. Out of 22 antibiotics prescribed 3 were from Access, 17 from Watch and 2 from Reserve. High consumption of Watch group antibiotics were observed in the study. Similar observation was reported in the study conducted by Nguyen N V et al in 2020.[12]

CONCLUSION

According to the study, there was a high prevalence of UTI in female patients with age >70 years. Regular surveillance and monitoring are absolutely necessary to give medical practitioners the most recent information on the most efficient empirical treatment for UTIs because medication resistance among bacterial pathogens might change over time and place. Knowing the pattern of antibiotic susceptibility should inform the empirical antibiotic choice in the treatment of UTI.

One of the most frequent ailments seen in general practice is UTI, which is responsible for one-third of infections picked up in hospitals. The risk of a significant increase in the economic cost of these illnesses is posed by high rates of recurrence and rising antibiotic resistance among uropathogens. The results of sensitivity testing may enable a clinician to switch from empirical therapy, in which an antibiotic is chosen based on the clinician's suspicion of the infection and the most likely causative bacteria, to directed therapy, in which the antibiotic is chosen based on the organism and its sensitivities. Antibiotic susceptibility testing aims to identify potential treatment

resistance in common infections and confirm susceptibility to the preferred medications for a specific infection.

REFERENCES

I. Convay H, Cnaan A, Zaoutis T et al. recurrent Urinary Tract Infection in Children Risk factors and Association with prophylactic antimicrobials. The Journal Of The American Association. 2007;298(2):179-186

II. Adukauskiene D, Cicinskaite I, Macas A et al. Hospital Aquired Urinary Tract infections. Uro PubMed centeral. 2016;42(12):957-964.

III. Odoki M, Aliero AA, Tibyangye J etal. Prevalance Of Bacterial Urinary Tract Infections And Associated Factors Among Patients Attending Hospitals in Bushenyi District, Uganda. International Journal Of Microbiology. 2019:1-8.

IV. Olowe OA, Makanjuola OB, Mabayoje VO et al. Detection of Bacteriuria Among Human Immuno Deficiency Virus Seropositive Individuals in Osogbo south western Nigeria. European Journal Of Microbiology and Immunology. 2015;5(1):126-130.

V. Foxman B. The Epidemiology Of Urinary Tract Infection: Economic considerations. Nature Reviews urology. 2010; 7:653-660.

VI. John AS, Mvoto CI and Agbo B. A review On The Prevalance And Predisposing factors responsible for Urinary Tract Infection among Adults. European Journal Of Experimental Biology. 2016;6(4): 7-11.

VII. Pardeshi P. Prevalence of Urinary Tract Infections and Current Scenario of Antibiotic Susceptibility Pattern of Bacteria Causing UTI. Indian Journal of Microbiology Research. 2018;5(3): 334 – 338.

VIII. Seifu W D, and Gebissa A D. Prevalence and Antibiotic Susceptibility of Uropathogens from Cases of Urinary Tract Infections in Shashemene Referral Hospital, Ethiopia. BMC Infectious Diseases.2018; 18: 30.

IX. Chandrasekhar D, Dollychan A, Roy B M, Cholamughath S, and Parambil J C. Prevalence and antibiotic utilization pattern of uropathogens causing community-acquired urinary tract infectionin Kerala, India. Journal of Basic Clinical Physiology and Pharmacology. 2018; 29(6): 671–677.

X. Dimitrov T S, Udo E E, Emara M, Awni F and Passadilla R. Etiology and Antibiotic Susceptibility Patterns of Community- Acquired Urinary Tract Infections in a Kuwait Hospital. Medical Principles and Practice.2004; 13: 334 – 339.

XI. Daoud N, Hamdoun M, Hannachi H *et al*. Antimicrobial Susceptibility Patterns of *Escherichia coli* among Tunisian Outpatients with Community-Acquired UTI. Current Urology. 2020; 14:200 – 205.

XII. Nguyen N V, Thuydo N T, Nguyen K T C et al. Community level consumption of antibiotics According to AWaRe classification in rural Vietnam. JAC-Antimicrobial Resistance.2020;3(2):1-8.

XIII. Alldredge B K, Corelli R L, Ernst M E, Guglielmo B J, Jacobson P A et al. Urinary tract infections. Koda - Kimble Young's Applied Therapeutics: The clinical use of drugs, 10th edition.1594 – 1618.

XIV. Zeind C S and Carvalho M G. Urinary tract infections. Applied Therapeutics: The clinical use drugs, 11th edition. 2018; 3838 – 3894.

XV. Kabew G, Abebe T and Miheret A. A Retrospective study on prevalence and antimicrobial susceptibility patterns of bacterial isolates from UTI in Tikur Anbessa Specialized Teaching hospital Addis Ababa, Ethiopia. The Ethiopian Journal of Health Development. 2013; 27(2): 111-117.

XVI. Folliero V, Caputo P, Rocca M T D, Chianese A, Galdiero M *et al*. Prevalence Antimicrobial, Susceptibility Patterns of Bacterial Pathogens in Urinary Tract Infections in University Hospital of Campania . Antibiotics 2020, 9, 215: 1-9.

XVII. Whittlesea C and Hodson K. Urinary tract infections. Clinical Pharmacy and Therapeutics, 6th edition. 2019; 623 – 634.

XVIII. Tomy A, Hareendran A, David E *et al*. Antimicrobial Susceptibility of Uropathogens and Prescribing Patterns in Hospital and Community-Acquired Urinary Tract Infections in a Tertiary Care Hospital. Journal of Applied Pharmaceutical Science. 2020; 10 (11): 50 – 58.

XIX. Prakash D and Saxena R S. Prevalence and Antimicrobial Susceptibility Pattern of *Escherichia coli* in Hospital Acquired and Community Acquired Patients Related to Urinary Tract Infection in India. Journal of Applied Pharmaceutical Science.2013; 3(8): 124 – 132.