



Study of Clinical profile and Antibiotic susceptibility of Urinary Tract Infection in a Tertiary Care Hospital

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Abstract

Introduction: Urinary tract infection (UTI) is one of the most common infectious disease for which Treatment is often started empirically. The etiology and the antimicrobial susceptibility for UTI have been changing over the years.

Objective: To know about the clinical and microbiological profile of urinary tract infection among patients admitted in Sri Manakula Vinayagar Medical College and Hospital.

Methodology: We conducted a cross sectional study among patients who were diagnosed as UTI based on urine culture. The commonest organism and their antibiotic susceptibility was studied. Ultrasonography (USG) abdomen and pelvis was done to find out any structural abnormalities and complications.

Results: Out of the 40 patients studied, fever(85%) was the most common presenting symptom and Escherichia coli(57.50%) was the most common organism isolated followed by Klebsiella (15%). The most sensitive antibiotic was meropenem (75%) and the most resistant antibiotic was cefazolin(87.50%). These results were found to be statistically significant.

Conclusion: A higher percentage of resistant organisms against the commonly used antibiotics alarm about the indiscriminate use of antibiotics. Hence empirical antibiotic selection should be based on the knowledge of local prevalence of bacterial organisms and their antibiotic sensitivity to avoid the development of resistance.

Keywords: Urinary tract infection (UTI), organisms, antibiotic sensitivity and resistance.

Introduction

Urinary tract infection (UTI) is one of the most common infectious disease seen in the community.¹ UTI may be asymptomatic or symptomatic. It includes asymptomatic bacteriuria, cystitis, prostatitis, pyelonephritis. Uncomplicated UTI refers to acute cystitis or pyelonephritis in non-pregnant women or men

without anatomical abnormalities or instrumentation of the urinary tract. The term complicated UTI encompasses all other types of UTI.² It is more common in females than in males.²

The estimated annual global incidence is 250 million.³ Community associated UTI prevalence is 0.7% and health care associated UTI is 24% in

developing countries.⁴ 1 in 5 adult women experience UTI at some point confirming that it is a common worldwide problem.⁵ The most common organisms are Escherichia coli, Staphylococcus saprophyticus, Proteus, klebsiella pneumoniae, Pseudomonas aeruginosa, Enterococci and Candida albicans.⁶

The extensive and inappropriate use of empirical antimicrobial agents has resulted in development of antimicrobial resistance which in recent times has become a major problem worldwide. Also due to unnecessary and irrational antibiotic use, bacteria have emerged with newer forms of virulence and new patterns of resistance. Poor patient compliance and incomplete course of antibiotic therapy have resulted in the evolution of resistance. Hence this study was done to know about the clinical and microbiological profile of urinary tract infections to guide about the knowledge of the organism, antibiotic susceptibility and appropriate antibiotic treatment.

Materials and Methods

Study Area and Design

This study was done at sri manakula vinayagar medical college and hospital from march to august 2019 for a period of six months. Sri manakula vinayagar medical college is a tertiary care hospital located at madagadipet, Puducherry. The study design employed was a cross sectional study.

Study Participants: The sample size was calculated to be 40 patients using the formula $4pq/d^2$ where p= prevalence, q= 100-p, d- relative precision of 20% with 10% non-response rate.⁵ Study participants were those who got admitted in the wards of the medicine department with urinary tract infection.

Patients included were those above 50 years of age with urinary tract infection, confirmed by positive urine culture. Patients with symptoms but no growth in urine culture and those who received treatment with any antibiotics within 48 hours of symptom onset were excluded.

Methodology: Patients presented with symptoms of UTI such as burning or pain while micturition, fever, lower abdomen pain, loin pain, increased frequency of micturition, blood in urine and altered sensorium were interviewed after getting informed and written consent and questionnaire was used to collect relevant details. General physical examination was done. A clean catch midstream urine sample was collected in a sterile container within the first 24 hours and processed in the pathology and microbiology laboratory of sri manakula vinayagar hospital for routine microscopy, culture and antibiotic sensitivity. Blood sample was collected for complete blood count, renal profile and blood sugar. Based on the culture positivity, those who were fit into the inclusion criteria were selected. Ultrasonography abdomen and pelvis was done to look for structural abnormalities and complications.

Statistical Analysis: Data was entered into Microsoft excel data sheet and was analyzed using SPSS 22m version software. Categorical data was represented in the form of Frequencies and proportions. Chi-square test was used as test of significance for qualitative data. Continuous data was represented as mean and standard deviation. p value (Probability that the result is true) of <0.05 was considered as statistically significant after assuming all the rules of statistical tests.

MS Excel and MS word was used to obtain various types of graphs such as bar diagram, Pie diagram. SPSS version 22 (IBM SPSS Statistics, Somers NY, USA) was used to analyze data.

Results

In this study, among the 40 participants, mean was found to be 63.2 ± 10.1 years. 40% were in the age group <60 years, 37.5% were in the age group 61 to 70 years and 22.5% were in the age group >70 years and 52.5% were males and 47.5% were females. 85% had fever [table 1]. 70% had dysuria, 20% had pain abdomen, 7.5% had polyuria and 2.5% had oliguria and altered sensorium [table 2].

Table 1: Age and gender distribution of subjects in the study

		Count	%
Age	50 to 60 years	16	40.0%
	61 to 70 years	15	37.5%
	>70 years	9	22.5%
Sex	Female	19	47.5%
	Male	21	52.5%

Table 2: Symptoms distribution among subjects

	Present		Absent	
	Count	%	Count	%
Fever	34	85.0%	6	15.0%
Dysuria	28	70.0%	12	30.0%
Pain abdomen	8	20.0%	32	80.0%
Polyuria	3	7.5%	37	92.5%
Oliguria	1	2.5%	39	97.5%
Altered sensorium	1	2.5%	39	97.5%

Among the co-morbidities studied, 40% had DM, 20% had HTN, 22.5% had CKD and 17.5% were alcoholic [table 3].

Table 3: Co-morbidities distribution among subjects

	No		Yes	
	Count	%	Count	%
DM	24	60.0%	16	40.0%
Hypertension	32	80.0%	8	20.0%
CKD	31	77.5%	9	22.5%
Alcoholic	33	82.5%	7	17.5%

Table 4: Mean and SD of various laboratory parameters in the study

	Mean	SD
Hb	10.5	2.0
Total count	11292.5	3437.7
Poly	76.5	11.5
RBS	159.4	74.4
Urea	41.0	25.3
Creatinine	1.5	1.2

Urine for albumin showed 42.5% had 1+, 20% had 2+, 7.5% had 3+ and 30% had traces of albumin in urine [table 5]. 2.5% had 1+, 7.5% had

2+ and 90% had no sugar in Urine. In the study 32.5% had <10 Pus cells, 25% had 11 to 20 Pus cells and 42.50% had plenty of pus cells [table 6].

Table 5: Urine albumin and Urine sugar findings

		Count	%
Urine Albumin	1+	17	42.5%
	2+	8	20.0%
	3+	3	7.5%
	Trace	12	30.0%
Urine Sugar	1+	1	2.5%
	3+	3	7.5%
	Nil	36	90.0%

Table 6: Urine Pus cells findings

		Count	%
Pus cell	<10	13	32.5%
	11 to 20	10	25.0%
	Plenty	17	42.5%
	Total	40	100.0%

The most common organism isolated was Escherichia coli (57.5%) followed by Klebsiella pneumoniae (15%), Enterococcus (12.5%),

Pseudomonas (7.5%), CONS (5%) and Proteus Vulgaris (2.5%) [table 7].

Table 7: Organisms distribution in the study

		Count	%
Organism	Escherichia coli	23	57.5%
	Klebsiella pneumonia	6	15.0%
	Enterococcus	5	12.5%
	Pseudomonas	3	7.5%
	CONS	2	5.0%
	Proteus Vulgaris	1	2.5%

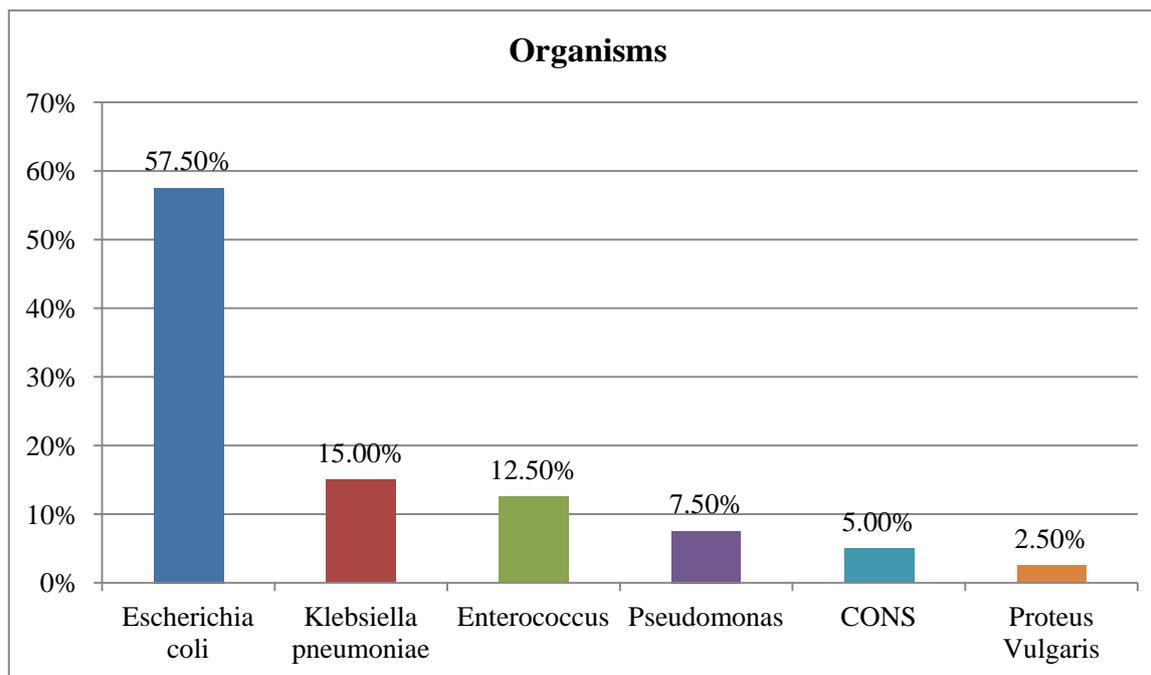


Figure 1: Bar diagram showing Organisms distribution in the study

Antibiotic susceptibility showed 42.5% organisms were sensitive for Nitrofurantoin, 55% for Ceftriaxone, 30% for Ceftazidime, 12.5% for Ampicillin, 30% for Gentamycin, 20% for Norfloxacin, 25% for Tobramycin, 12.5% for Cefazolin and 75% for Meropenem [table8].

There was significant association between Nitrofurantoin with organisms, Ceftriaxone with organisms, Ceftazidime with Organisms, Cefazolin with Organisms and Meropenem with Organisms [table 9] [fig 2-4].

Table 8: Antibiotic sensitivity and resistance among organisms isolated

	Resistant		Sensitive	
	Count	%	Count	%
Nitrofurantoin	23	57.5%	17	42.5%
Ceftriaxone	18	45.0%	22	55.0%
Ceftazidime	28	70.0%	12	30.0%
Ampicillin	35	87.5%	5	12.5%
Gentamycin	28	70.0%	12	30.0%
Norfloxacin	32	80.0%	8	20.0%
Tobramycin	30	75.0%	10	25.0%
Cefazolin	35	87.5%	5	12.5%
Meropenem	10	25.0%	30	75.0%

Table 9: Association between Organism isolated and Antibiotic sensitivity pattern

		Organisms												P value
		Escherichia coli		Klebsiella pneumoniae		Enterococcus		Pseudomonas		CONS		Proteus vulgaris		
		Count	%	Count	%	Count	%	Count	%	Count	%	Count	%	
Nitrofurantoin	Resistant	9	39.1%	5	83.3%	4	80.0%	3	100.0%	0	0.0%	1	100.0%	0.041*
	Sensitive	14	60.9%	1	16.7%	1	20.0%	0	0.0%	2	100.0%	0	0.0%	
Ceftriaxone	Resistant	5	21.7%	4	66.7%	4	80.0%	2	66.7%	2	100.0%	1	100.0%	0.025*
	Sensitive	18	78.3%	2	33.3%	1	20.0%	1	33.3%	0	0.0%	0	0.0%	
Ceftazidime	Resistant	16	69.6%	4	66.7%	4	80.0%	2	66.7%	2	100.0%	1	100.0%	0.021*
	Sensitive	7	30.4%	2	33.3%	1	20.0%	1	33.3%	0	0.0%	0	0.0%	
Ampicillin	Resistant	20	87.0%	6	100.0%	3	60.0%	3	100.0%	2	100.0%	1	100.0%	0.395
	Sensitive	3	13.0%	0	0.0%	2	40.0%	0	0.0%	0	0.0%	0	0.0%	
Gentamycin	Resistant	17	73.9%	4	66.7%	4	80.0%	2	66.7%	0	0.0%	1	100.0%	0.353
	Sensitive	6	26.1%	2	33.3%	1	20.0%	1	33.3%	2	100.0%	0	0.0%	
Norfloxacin	Resistant	20	87.0%	5	83.3%	4	80.0%	1	33.3%	1	50.0%	1	100.0%	0.288
	Sensitive	3	13.0%	1	16.7%	1	20.0%	2	66.7%	1	50.0%	0	0.0%	
Tobramycin	Resistant	17	73.9%	4	66.7%	4	80.0%	3	100.0%	2	100.0%	0	0.0%	0.420
	Sensitive	6	26.1%	2	33.3%	1	20.0%	0	0.0%	0	0.0%	1	100.0%	
Cefazolin	Resistant	19	82.6%	6	100.0%	4	80.0%	3	100.0%	2	100.0%	1	100.0%	0.014*
	Sensitive	4	17.4%	0	0.0%	1	20.0%	0	0.0%	0	0.0%	0	0.0%	
Meropenem	Resistant	1	4.3%	1	16.7%	4	80.0%	1	33.3%	2	100.0%	1	100.0%	<0.001*
	Sensitive	22	95.7%	5	83.3%	1	20.0%	2	66.7%	0	0.0%	0	0.0%	

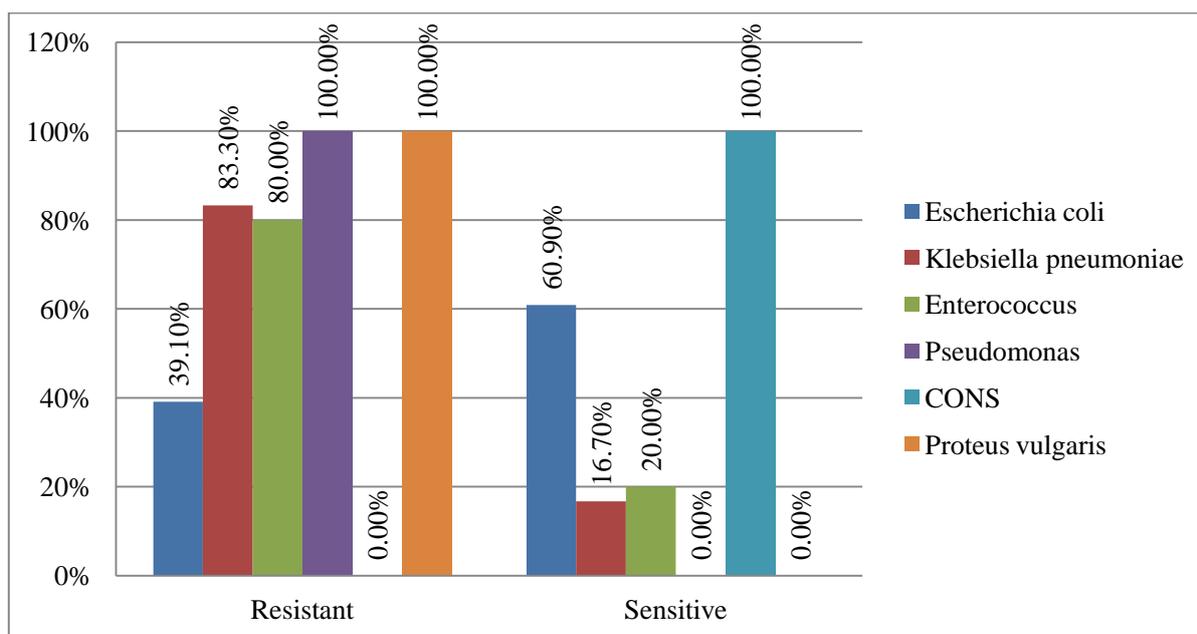


Figure 2: Bar diagram showing Nitrofurantoin antibiotic sensitivity and resistant pattern

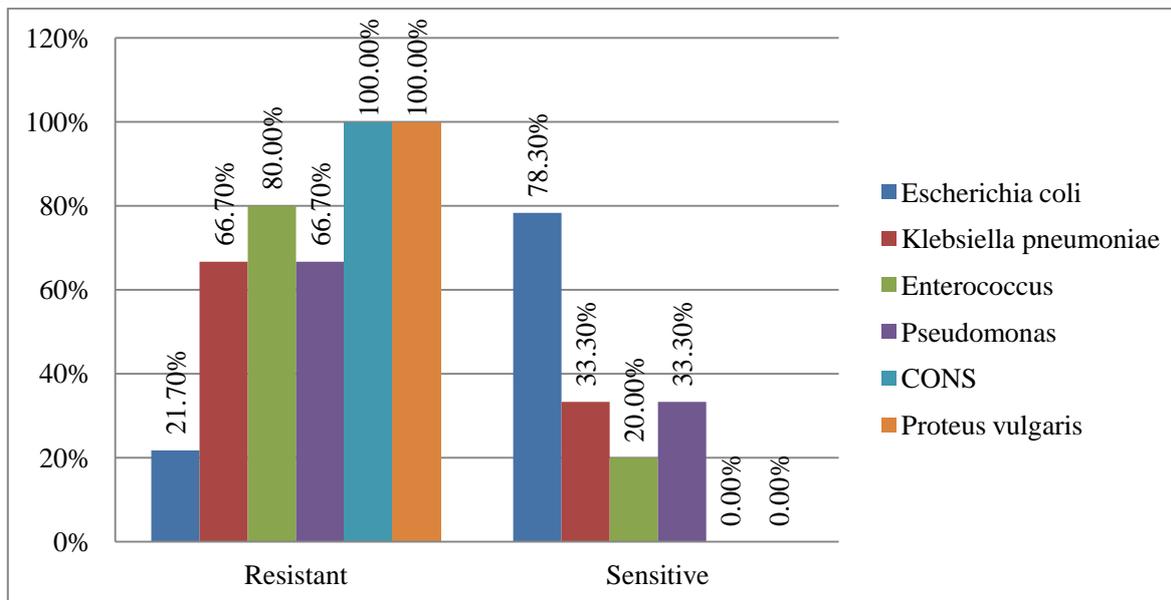


Figure 3: Bar diagram showing Ceftriaxone antibiotic sensitivity and resistant pattern

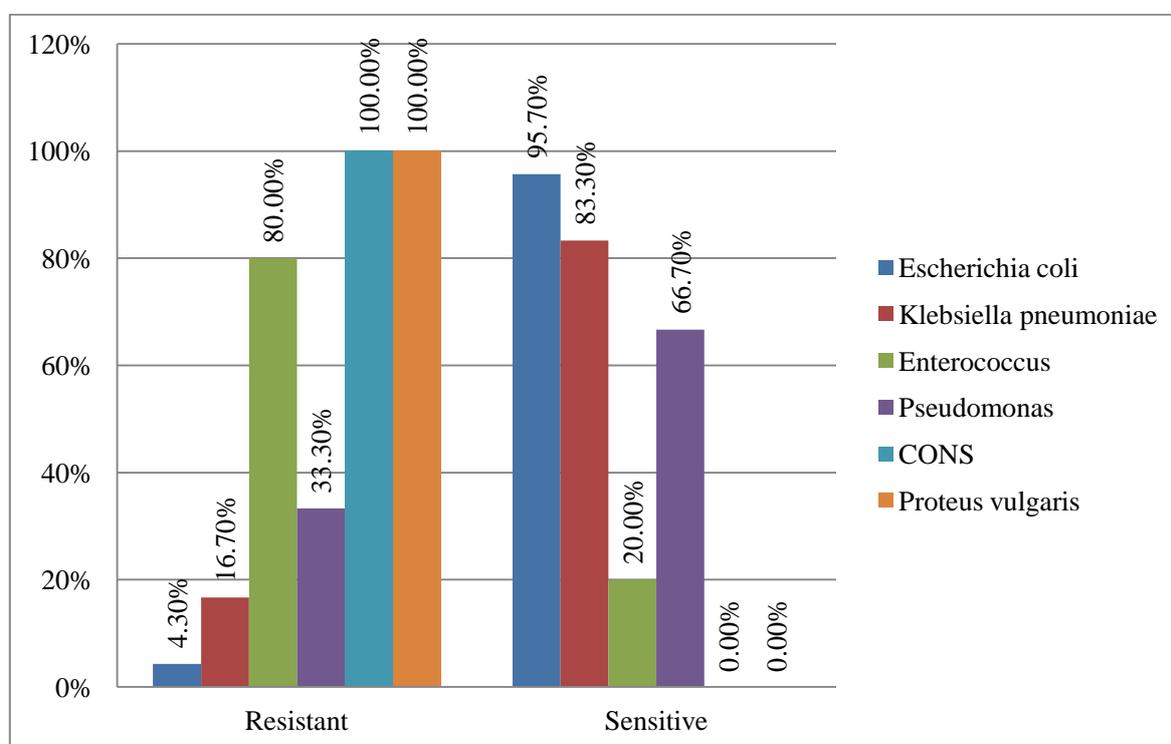


Figure 4: Bar diagram showing Meropenem antibiotic sensitivity and resistant pattern

Table 10: Other drugs antibiotic sensitivity pattern in comparison with Organism isolated

Drugs		Organism											
		Escherichia coli		Klebsiella pneumoniae		Enterococcus		Pseudomonas		CONS		Proteus vulgaris	
		Count	%	Count	%	Count	%	Count	%	Count	%	Count	%
Others	Cotrimox	0	0.0%	0	0.0%	0	0.0%	0	0.0%	1	50.0%	0	0.0%
	Imipenam	0	0.0%	0	0.0%	0	0.0%	1	33.3%	0	0.0%	0	0.0%
	Piptaz,Amikacin	0	0.0%	0	0.0%	0	0.0%	1	33.3%	0	0.0%	0	0.0%
	Polymyxin B	0	0.0%	1	16.7%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
	Vancomycin	0	0.0%	0	0.0%	5	100.0%	0	0.0%	0	0.0%	0	0.0%

In this study 50% had normal USG findings, 20% had BPH, 7.5% had Cystitis, 22.5% had Cortico-medullary differentiation altered suggestive of

chronic kidney disease, 2.5% had Pyelonephritis, Ureteric calculi, Renal calculi, Pyelonephritis with calculi [fig-5].

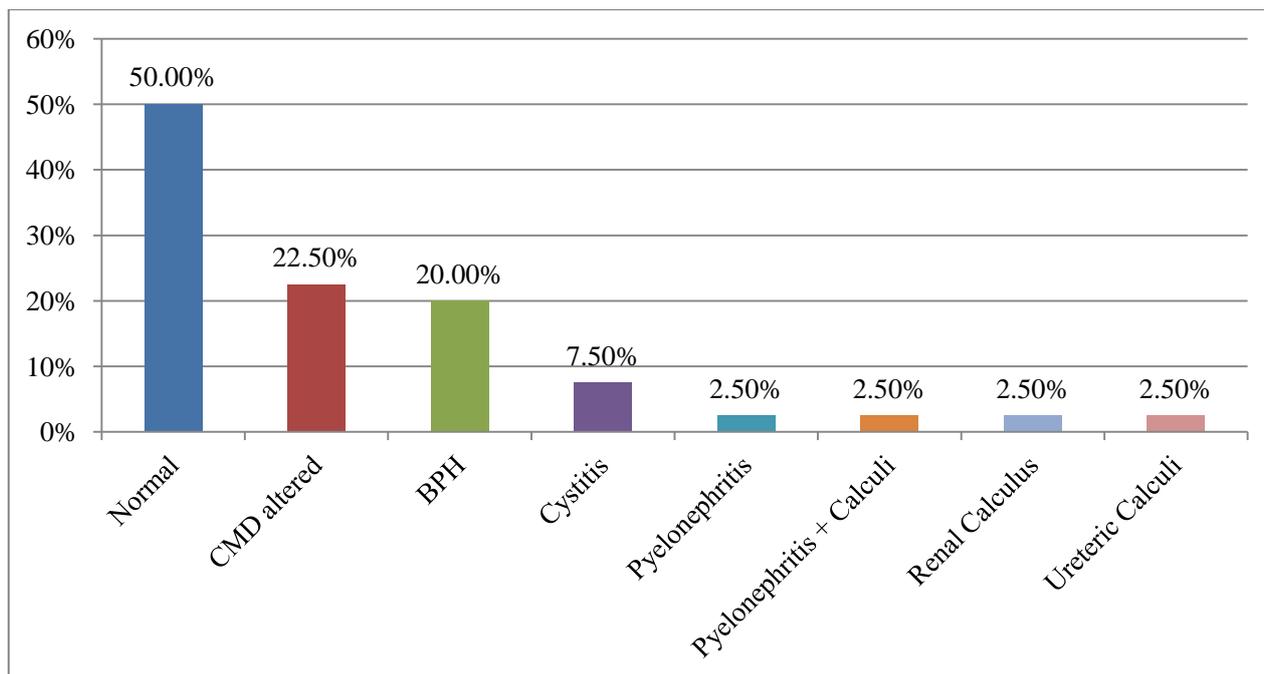


Figure 5: Bar diagram showing USG Abdomen Findings

In this study there was no significant difference in resistance for the entire given antibiotic with respect to Diabetes [table 12]. There was no

significant difference in resistance for the entire given antibiotic with respect to CKD except for Nitrofurantoin [table 13].

Table 12: Comparison of resistance pattern among subjects with and without DM

		DM				P value
		No		Yes		
		Count	%	Count	%	
Nitrofurantoin	Resistance	13	59.1%	10	40.9%	0.435
	Sensitivity	11	64.7%	6	35.3%	
Ceftriaxone	Resistance	10	55.6%	8	44.4%	0.604
	Sensitivity	14	63.6%	8	36.4%	
Ceftazidime	Resistance	18	60.7%	12	39.3%	0.956
	Sensitivity	6	60.0%	4	40.0%	
Ampicillin	Resistance	21	60.0%	14	40.0%	1.000
	Sensitivity	3	60.0%	2	40.0%	
Gentamycin	Resistance	17	60.7%	11	39.3%	0.888
	Sensitivity	7	58.3%	5	41.7%	
Norfloxacin	Resistance	19	59.4%	13	40.6%	0.872
	Sensitivity	5	62.5%	3	37.5%	
Tobramycin	Resistance	17	56.7%	13	43.3%	0.456
	Sensitivity	7	70.0%	3	30.0%	
Cefazolin	Resistance	21	57.6%	14	42.4%	0.493
	Sensitivity	3	60.0%	2	40.0%	
Meropenem	Resistance	4	40.0%	6	60.0%	0.136
	Sensitivity	20	66.7%	10	33.3%	

Table 13: Comparison of resistance pattern among subjects with and without Chronic Kidney Disease

		Chronic Kidney Disease				P value
		No		Yes		
		Count	Row N %	Count	Row N %	
Nitrofurantoin	Resistance	21	95.5%	2	4.5%	0.004*
	Sensitivity	10	58.8%	7	41.2%	
Ceftriaxone	Resistance	13	72.2%	5	27.8%	0.470
	Sensitivity	18	81.8%	4	18.2%	
Ceftazidime	Resistance	23	78.6%	6	21.4%	0.631
	Sensitivity	8	80.0%	3	20.0%	
Ampicillin	Resistance	27	77.1%	8	22.9%	0.886
	Sensitivity	4	80.0%	1	20.0%	
Gentamycin	Resistance	21	75.0%	7	25.0%	0.563
	Sensitivity	10	83.3%	2	16.7%	
Norfloxacin	Resistance	23	71.9%	9	28.1%	0.088
	Sensitivity	8	100.0%	0	0.0%	
Tobramycin	Resistance	24	80.0%	6	20.0%	0.512
	Sensitivity	7	70.0%	3	30.0%	
Cefazolin	Resistance	26	75.8%	9	24.2%	0.305
	Sensitivity	5	100.0%	0	0.0%	
Meropenem	Resistance	9	90.0%	1	10.0%	0.274
	Sensitivity	22	73.3%	8	26.7%	

Discussion

Bacterial infection of the urinary tract is one of the commonest cause for seeking medical attention in the community nowadays. The etiology and the antimicrobial susceptibility for urinary tract infection have been changing over the years.

In this study majority of the subjects were in the age group of 50-60 years (40%). Males were affected slightly more than females in the ratio of 1:1.10 which is in concordant with the fact that after 50 years of age the incidence is as high among men as among women.⁷

The most common co-morbidity was diabetes mellitus (40%) which poses a major risk factor for development of UTI and other complications since these patients were immunocompromised. This was in consistent with the study done by Eshwarappa et al in which diabetes mellitus was the most common risk factor associated with UTI.¹ Other co-morbidities found in this study was chronic kidney disease and hypertension. No significant relationship was found between diabetic patients with UTI and antibiotic resistance.

UTI presents with varied symptomatology. Here fever (85%) was the most common presenting

symptom in our study followed by dysuria (70%) and pain abdomen (20%) which was in consistent with the study done by Jaipuri et al were fever was the most common symptom of UTI.⁶

Discussing on the laboratory parameters, the mean Hemoglobin was found to be 10.5 which shows that majority of the patients were anaemic and of poor health. Urine routine examination showed that majority of patients had detectable albumin in the urine and plenty of pus cells suggestive of infection.

Urine culture sensitivity showed E.coli (57.5%) as the most common organism which was consistent with the previous studies.¹⁻³ Other organisms isolated were Klebsiella pneumonia, Enterococcus, Pseudomonas, Coagulase negative Staphylococcus and Proteus vulgaris. E.coli remains as the most common organism causing UTI for decades. But its antibiotic profile has been changing through decades. The resistant strains are gaining importance nowadays due to the misuse of antibiotics.

In this study it was found that about 50% had a normal ultrasound abdomen finding. Benign prostatic hyperplasia (20%) was found to be commonly associated with male patients

presenting with UTI followed by Calculi (7.5%). Cystitis was found in 7.5% of patients. Complications such as pyelonephritis were found in 5% of patients.

In this study the antibiotic sensitivity showed Meropenem as the most sensitive antibiotic against the organisms isolated (75%) followed by Ceftriaxone (55%) and Nitrofurantoin (45%) and this was found to be statistically significant. Although Nitrofurantoin was the oldest and one among the first line antibiotic for uncomplicated UTI, this study showed that it was resistant in almost 50% of patients. Similar studies done by Dalal, Kakde et al also showed Meropenem as the most sensitive antibiotic against organisms causing UTI.^{3,4} This shows the significance of this study. But meropenem being an extended spectrum beta lactamase antibiotic and being costlier, cannot be prescribed commonly to all UTI patients.

Among the resistant antibiotics, Cefazolin and Ampicillin had maximum resistance (87.5%) followed by Norfloxacin (80%) and Ceftazidime (75%). This finding was in consistent with a previous study done by Bency et al which also showed Ampicillin and norfloxacin to be highly resistant.^{8,9}

Antibiotic resistance is an emerging problem which makes treatment with the common antibiotics against the common pathogens difficult. Due to widespread misuse of antibiotics and irrational prescription of antibiotics we are facing this resistance issue. Incomplete course of antibiotics and poor patient compliance also contributes to this resistance. Although the organisms develop resistance by many mechanisms, we as treating physicians also contribute to this development of resistance. To avoid this resistance, selection of antibiotics for patients presenting with UTI should be based on the local antibiotic susceptibility. It is wise to start antibiotic after culture report to avoid antibiotic misuse in all patients. So ordering urine routine and culture sensitivity becomes necessary for patients presenting with symptoms of UTI. We

should avoid using higher antibiotics for uncomplicated UTI and for mild symptoms. Also reducing the number of prescriptions of a particular antibiotic can lead to a decrease in resistance rate. There is a need for accurate and updated population surveillance data regarding the regional antibiotic sensitivity pattern which will directly help in the selection of empirical therapy for UTI.

Limitations

Less statistical power due to small study population and single center study, small duration, non-assessment of source of UTI whether hospital acquired or community acquired were the limitations of this study. Patients who were initially treated with antibiotics and those whose cultures were positive for fungal growth were excluded, so further studies are required to evaluate these factors.

Conclusion

Empirical antibiotic selection should be based on the knowledge of local prevalence of bacterial organisms and their antibiotic sensitivity. It's nevertheless late to be cautious about the evolving resistant strains against the commonly used antibiotics and in taking steps to prevent this resistance as no new antibiotics against multidrug resistant strains with a affordable cost is available in the market. Adequate studies are still needed on a larger scale to alarm this emerging resistance.

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