IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 18, Issue 9 Ser.4 (September. 2019), PP 50-67
www.iosrjournals.org

Usage of Antibiotics in Complicated and Recurrent Urinary Tract Infection

*Dr SwathiKusuma[1],Dr Ramya Gajam[2],Dr Krishna Karthik[3]
[1,2](Dept of Pharmacology, Osmania Medical College, Hyderabad, Telangana, India), [3](Osmania Medical College, Hyderabad, Telangana, India)
*Corresponding Author: *DrSwathi Kusuma*

Abstract: *Recurrent UTIs (urinary tract infections) are highly prevalent in post-menopausal women and also in patientswith underlying abnormalities of the urinary tract similar to complicated UTI. A prospective study was conducted in out-patient department of Urology in Osmania General Hospital to assess the pattern of antimicrobial drugs use and thecriteriaforselection of Antimicrobial drugs inrecurrent andcomplicatedUTIsin200subjectsof age group 18-80 years of either sex. The subjects were monitored oneweekaftertreatment completion,foranyrelapseorrecurrence, to assessthe treatmentresponse, orforany adverse drugreactions. The data collected were analyzed by using descriptive statistics analyzed by SPSS software. Mostofthegramnegativepathogensweresensitivetopiperacillin-tazobactam and Aminoglycosidess and the gram positive pathogens for vancomycin andlinezolid. The Antimicrobial drugs were used empirically in most of the subjects as monotherapymainly by intravenous route, the most frequently used Antimicrobial drugs for initial therapy wereFluoroquinolonesand beta-lactams, the mean duration of therapy being 9.2±2.2days. The frequently used combinations werebetalactams + Aminoglycosides, betalactams + nitroimidazoles,FQ + betalactams/nitroimidazoles. Most of the subjects showed good clinical and bacteriological improvementeven with empiricaltherapy.*

Keywords: *Recurrent urinary tract infections, complicated urinary tract infections, Antimicrobial drugs*

Date of Submission: 26-08-2019 Date of Acceptance: 10-09-2019

I. Introduction

Urinary Tract Infection (UTI) is an infection in the urinary tract. UTIs are one of the most prevalentinfectious diseases in general population, occurring in either community or hospitalsettings.UTIs are associated with significant morbidity, particularly inhospitals and cause substantial burden in terms of health care cost andresources.[1]

UTI is the most common diseases encountered in medical practice affecting people of all ages from the neonate to the geriatric age group. Worldwide, about 150 million people are diagnosed with UTI each year. The inappropriate use of antimicrobial agents and the spread of bacterial resistance among microorganisms cause drug resistance in urinary tract infections. The emergence of antibiotic resistance in the management of UTIs is a serious public health issue.[2]

UTIs can be asymptomatic or symptomatic. Symptomatic UTIs canbe uncomplicated, complicated or recurrent UTIs. Unlike uncomplicated UTIswhich occur in an otherwise healthy host, complicated UTIs arecharacterizedbystructuralorfunctionalabnormalitiesofgenitourinarytract,orthepresenceofunderlyingdiseaseswhichincreasetheriskofacquiringaninfectionoroffailureof therapy.[3]

Recurrent UTIs refers to≥ 3 episodes of UTI in previous 12 months or ≥2 episodes in previous 6months.[4]

RecurrentUTIsandcomplicatedUTIareamajorcauseofhospitaladmissionsandalso accountforlargenumberofhospitalacquiredinfectionssincemostof the inpatients have higher baseline risk[5].

Complicated UTIs usually involve a broader spectrum of pathogens (e.g. E.coli, Proteus, Klebsiella, Enterobacter, Staphylococcus, Enterococcus, Pseudomonas or fungi) which are often multidrug resistant and frequentlysubjectingthe host to antibiotic use and crossinfections[6].

Principal aspects of management include antimicrobial therapy alongwithtreatment / control of underlying complicating risk factors and supportivecare. Several classes of Antimicrobial drugs are used empirically or definitively, either for treatment or prophylaxis,namely Flouroquinolones ,Penicillins with or without Beta-lactam inhibitors,Cephalosporins, Aminoglycosides , cotrimoxazole, nitrofurantoinetc[5,6].

Selection of Antimicrobial drugs , the route of administration, dose, frequency andduration of administration, is based on severity of infection, prevalent uropathogens,local resistance patterns, patient specific factors (complicatingfactor),andthetolerability,pharmacokineticprofileandthecosteffectiveness.Howeverselectionofappropriatetherapyforrecurrent UTIorcomplicated UTIcanbechallengingtotheclinicians since these infections involve

broader spectrum of drug resistantpathogens with unpredictable and changing susceptibility patterns, evolvingantimicrobial resistance, the patient associated risk factors, high likelihood of persistenceof infection, the need for longer duration of therapy and treatmentfailure. Urinary tract infection (UTI) is a disease that is observed frequently in children and the elderly (>65 yr)[7,8,9].

An appropriate antibiotic is chosen according to the following cardinal criteria-Patient's individual risk and previous antibiotic treatment, Pathogen spectrum and antibiotic sensitivity, effectiveness of the antimicrobial agent, effects on the resistance situation in the patient and ecological effects and undesired drug effects.[10]

Althoughvariousantimicrobialregimensinvolvingdifferentclassesof Antimicrobialdrugs,differingdosesandduration havebeenused,theexistingdatastillremainsinconsistentandcannotbegeneralizedduetovariationinpatternofantimicrobial susceptibility/resistance and prevailing uropathogens over a period of time indifferent geographical areas and from hospital to hospital. There is a need forperiodic evaluation of the pattern of antimicrobial use, criteria for selection, their efficacyand tolerability in the management of complicated and recurrent UTIs.

The present study is done toassessthepatternofantimicrobialuseinrecurrentandcomplicatedUTIsin patients in our hospital and to assess the criteria for selection of Antimicrobial drugs.

1.1 Aims and objectives of the study

- To assessthepatternofantimicrobialuseinpatients with recurrentandcomplicatedUrinary Tract Infection.
- To assess the criteria for selection of Antimicrobial drugs in patients with recurrentandcomplicatedUrinary Tract Infection.

II. Patients And Methods

This prospective study was done to assess the pattern of antimicrobial drugs use inrecurrent andcomplicatedUrinary Tract Infectionsinsubjects and to assess thecriteriaforselection of Antimicrobial drugs.

2.1 Site of the study: Osmania Medical College, Hyderabad.

2.2 Study period: Thestudywascarriedoutbetween10/2015 t o 1 0 / 2016

2.3 Sampling

Purposivesamplinginvolving200consecutivesubjectswithrecurrentand complicated UTIs in Osmania General Hospital, Hyderabadand receiving Antimicrobial drugs, were included in thestudy.

2.4 Selection criteria

Inclusioncriteria:

- Subjectsin theagegroupof18-80yearsfromeithergenderwithrecurrentorcomplicated UTIs.
- Willing to give written informed consent and available for furtherfollow-up.

Exclusion Criteria:

- Subjects with asymptomaticbacteriuria.
- Pregnant and lactatingwomen & age <18 and >80.
- Subjects admitted in Intensive CareUnit.
- Not willing to participate in the study.

III. Methodology

After obtaining approval and clearance from the Institutional Ethics Committee, subjects of eithergenderagedbetween18to80yearsandreceivingAntimicrobialdrugs for recurrent and complicated UT Is wereincludedforthestudy.Writteninformedconsentwasobtainedfromthepatients/legal representatives after fully explaining in their own language to theirsatisfaction.

Theclinical history relevant to UTIs, associated complicating risk factors, co morbid illnessand drughistoryweredocumented.Thelaboratorydataincludingurinemicroscopyand culture sensitivity/resistance pattern are alsorecorded.

TheAntimicrobial drug combinationsused,thecriteriaforselection,dose,route,frequency and duration of administration and any change in antimicrobial drug therapywasrecorded. The concomitant medications for the co morbid conditions werealsorecorded. The efficacy of antimicrobial drug therapy was assessed by treatment outcome basedon clinical and bacteriological criteria.

All the relevant data were entered and documented in case recordform.

3.1 Laboratoryinvestigations&microbiologicalinvestigations:

Urinemicroscopy.

Urine culture and antimicrobial susceptibilitytests.

3.2 Hematological:

Hb% ,TC,DC,ESR.

3.3 Biochemical:

Renal function tests: Blood Urea Serumcreatinine.

3.4 Imaging studies done (Ifany):
Ultrasonography- Abdomen and pelvicregion, X-RAY-KUB.
CT Scan-Abdomen and pelvicregion.

3.5 Follow-up

The subjects were monitored to assessthe treatmentresponse,andtolerabilityofAntimicrobial drugs. Thesubjectswereadvisedtovisitthe OPDs oneweekaftertreatment completion,foranyrelapseorrecurrence, orforany delayed adverse drugreactions.

3.6 Statistical analysis

The data collected were analyzed by using descriptive statistics, namelymean and standard deviation for quantitative variables analysed by SPSS software wherever necessary, theresultswere depicted in the form of percentages with tables and graphs. Microsoft Wordand Excel were used to generate graphs andtables.

IV. Observations And Results

Table1: Age and genderdistribution(n=200)

Agegroup(years)	Male		Female		Total
	N	%	n	%	N
18-25	2	2	8	8	10
26-35	6	7	12	11	18
36-45	14	16	20	18	34
46-55	22	25	34	30	56
56-65	44	50	38	34	84
Total	**88**	**100**	**112**	**100**	**200**

Mean age: Male=53±11.7; Female=48.4±12.7

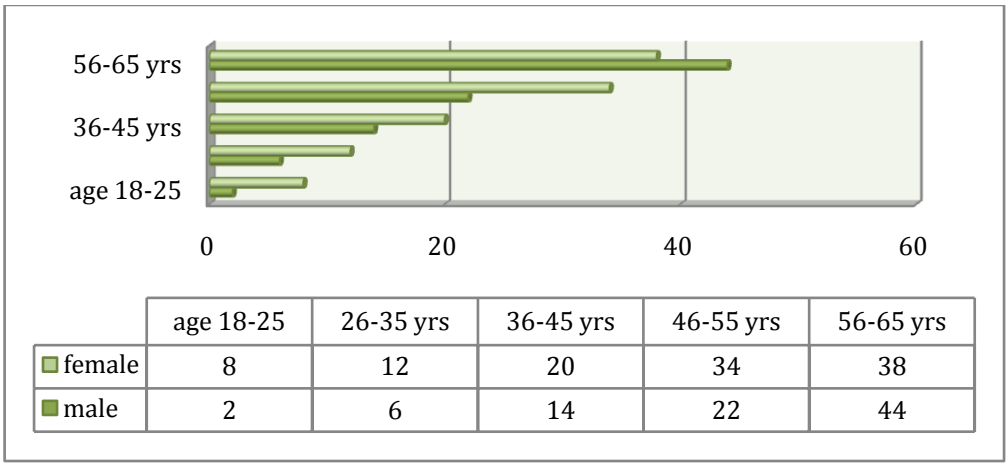

Figure 1: Age and genderdistribution

Table 2: Chief complaints / Presentingsymptoms(n=200)

Complaints	Male	Femalen=112	Totaln=200)	
	n	n	n	%
Dysuria	62	62	124	62
Frequency	14	12	26	13
Urgency	6	2	8	4
Hematuria	8	10	18	9
Fever	44	76	120	60
Others	46	64	110	55

Table 3: Duration ofsymptoms(n=200)

Duration(days)	**Number ofsubjects (n)**
0-5	62
6-10	60
11-15	34
16-30	18
> 30	26
Total	**200**
Mean duration:9.3± 6days	

Table 4: Co Morbid Conditions

Co MorbidConditions	**Male**		**Female**		**Totaln=200**	
	n	**%**	**n**	**%**	**n**	**%**
Diabetesmellitus	30	34	56	50	86	43
Hypertension	20	23	30	27	50	25
Renal insufficiency	14	16	22	20	36	18
Calculi	24	27	22	20	46	23
Neurologicaldisorders	4	4	4	4	8	4
Cystocele	-	-	16	14	-	-
BPH	48	55	-	-	-	-
Septicemia	2	2	0	0	2	1
Immunodeficiencystates	0	0	4	4	4	2
Others	24	27	16	14	40	20

Table 5: Predisposing conditions/ Risk Factors

RiskFactors	**Malen=88**		**Female n=112**		**Total n=200**	
	n	**%**	**n**	**%**	**n**	**%**
Reproductive age	30	34	56	50	86	43
Short termcatheterization	14	16	8	7	22	11
Medium termcatheterization	16	18	0	0	16	8
Long termcatheterization	2	2	4	4	6	3
Post-operative	6	7	8	7	14	7
Uretericstents	0	0	4	4	4	2
Post-menopausalwomen	-	-	62	55	62	31
Stricture urethra	6	7	-	-	6	3
Traumaticinjury	0	0	2	2	2	1

Table 6: ClinicalDiagnosis(n=200)

Diagnosis	**Male n=88**		**Female n=112**		**Totaln=200**	
	n	**%**	**n**	**%**	**n**	**%**
Recurrent-UTI (Uncomplicated)	4	5	10	9	14	7
Recurrent-UTI(Complicated)	18	20	26	23	44	22
ComplicatedUTI	66	75	76	68	142	71

Table 7: UrineMicroscopy

Number of WBCs(cells/hpf)	**Number ofSubjectsn(%)**
0	12 (6%)
1-5	76 (38%)
6-10	56 (28%)
>10	56(28%)
Epithelial cellspresent	82(41%)
RBCspresent	26(13%)

Table 8: Organismsisolated on UrineCulture

Organisms	Male (n=88)		Female(n=112)		Total n=200)	
	N	%	n	%	n	%
Gram negativebacteria						
EscherichiaColi	44	50	56	50	100	50
Proteusmirabilis	4	4	2	2	6	3
Klebsiellaspp	16	18	24	21	40	20
Pseudomonasauriginosa	4	4	2	2	6	3
Enterobacterspp	2	2	-	-	2	1
Acinobacterspp	-	-	4	4	4	2
Gram positivebacteria						
Enterococcusfecalis	12	13	14	12	26	13
Staphylococcusspp	6	7	8	7	14	7
Fungus						
Candida albicans	-	-	2	2	2	1

Table 9: Organisms isolated with each type ofUTI

Organisms	Recurrent UTI(uncomplicated)(n=14)		RecurrentUTI(complicated) (n=44)		ComplicatedUTI (n=142)	
	n	%	n	%	n	%
Gram Negative Bacteria						
E.Coli	10	71	24	54.5	66	47
Proteusspp	0	0	2	4.5	4	3
Klebsiellaspp	2	14	4	9	34	24
Pseudomonasspp	0	0	2	4.5	4	3
Enterobacterspp	0	0	2	4.5	0	0
Acinobacterspp	0	0	2	4.5	2	1
Gram positivebacteria						
Enterococcusspp	2	14	6	14	18	13
Staphylococcusspp	0	0	2	4.5	12	9
Fungus						
Candidaspp	0	0	0	0	2	1

Table 10a: Antimicrobial Susceptibility/ Resistance Pattern- GramnegativeBacteria

Antimicrobial drugs	Organism isolated - (n = number ofisolates)													
	E.Colin=100		Proteusn=6		Klebsiella n=40		Pseudomonas n=6		Enterobactern=2		Acinobacter n=4		Total n=158	
	S	R	S	R	S	R	S	R	S	R	S	R	S	R
Coamoxiclav	18	82	2	4	2	38	0	6	0	2	2	2	24	134
Ciprofloxacin	22	78	2	4	12	28	0	6	2	0	2	2	40	118
Cefipime	56	44	4	2	26	14	2	4	0	2	2	2	90	68
Cotrimoxazole	36	64	0	6	16	24	0	6	0	2	2	2	54	104
Gentamicin	92	8	6	0	36	4	2	4	2	0	2	2	140	18
Amikacin	90	10	6	0	28	12	2	4	2	0	4	0	132	26
Cefuroxime	32	68	6	0	12	28	0	6	0	2	2	2	52	106
Nalidixicacid	18	82	0	6	8	32	0	6	2	0	4	0	32	126
Nitrofurantoin	80	20	0	6	22	18	0	6	0	2	4	0	106	52
Norfloxacin	16	84	0	6	14	26	0	6	0	2	2	2	32	126
Piperacillin+Tazobacta	92	8	6	0	38	2	2	4	0	2	2	2	140	18

Table 10b: Antimicrobial susceptibility/resistance pattern - Grampositive bacteria

Antimicrobial drugs	**Enterococcusspp(n=26)**		**Staphylococcusspp(n=14)**		**Total(n=40)**	
	S	R	S	R	S	R
Coamoxiclav	12	14	0	14	12	28
Clindamycin	16	10	6	8	22	18
Cefoperazone	12	14	10	4	22	18
Ciprofloxacin	4	22	4	10	8	32
Cefipime	8	22	10	4	14	26
Cloxacillin	8	18	12	2	18	22
Erythromycin	6	20	2	12	8	32
Gentamicin	10	16	10	4	20	20
Linezolid	24	2	14	0	38	2
Tetracycline	24	2	10	4	34	6
Vancomycin	24	2	14	0	38	2

Table 11a: Multidrug resistant gram negativebacteria

Organisms	**Number of antimicrobial drugs classes**										
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**MDR (n=144)**	**%**
E.coli	2	4	6	12	30	30	8	8	-	88	61
Proteus	-	-	-	-	2	4	-	-	-	6	4
Klebsiella	-	-	-	12	6	14	6	2	-	40	28
Pseudomonas	-	-	-	-	-	2	-	-	4	6	4
Enterobacter	-	-	-	-	-	2	-	-	-	2	1
Acinobacter	-	2	-	-	-	-	2	-		2	1

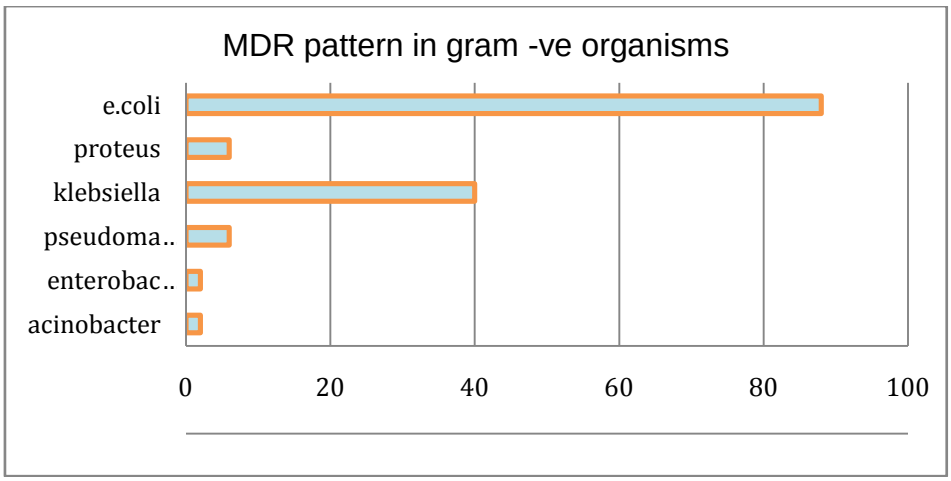

Figure 2a: Multidrug resistant gram negativebacteria

Table 11b: Multidrug resistant gram positivebacteria

Organisms	**Number of Antimicrobial drugs classes**										
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**MDR n=36**	**%**
Enterococcus	-	-	4	-	4	4	10	4	-	22	61
Staphylococcus	-	-	-	6	4	2	-	2	-	14	39

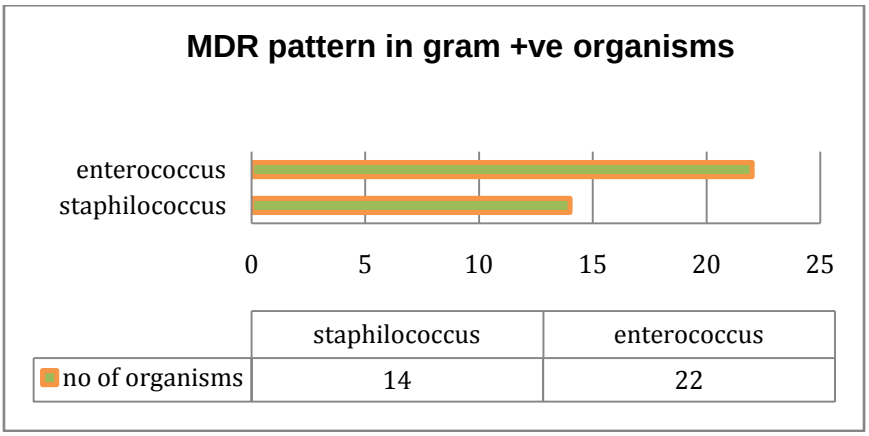

Figure 2b: Multidrug resistant gram positivebacteria

Table 12a: HematologicalInvestigations

Hematologicalabnormalities	**Male n=88)))**		**Femalen=112**		**Totaln=200**	
	n	**%**	**n**	**%**	**n**	**%**
↓ Hemoglobin(Hb)	24	27	32	29	56	28
↑Total WBCcount	40	46	72	64	112	56
DifferentialCount (DC) Altered	40	46	72	64	112	56
↑ESR	12	14	22	20	34	17

Table 12b: Renal Parameters

Renal functiontests	**Male**		**Female(n=112)**		**Total(n=200)**	
	n	**%**	**n**	**%**	**n**	**%**
↑ Serumcreatinine	14	16	28	25	42	21
↑ Bloodurea	14	16	28	25	42	21

Table 13: Pattern of antimicrobial drugs use

Criteriafor Selection	**Male (n=88)**		**Female(n=112)**		**Total(n=200)**	
	n	**%**	**n**	**%**	**n**	**%**
Empirical	78	89	92	82	170	85
Definitive	10	11	20	18	30	15

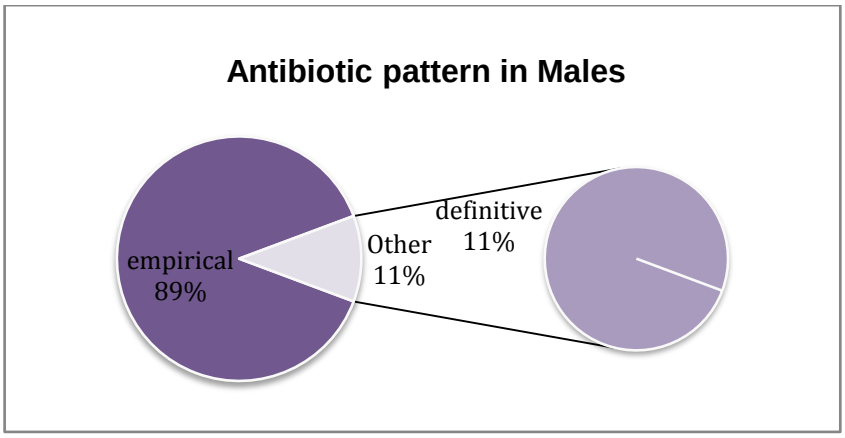

Figure No 3a: Criteria for initial Antimicrobialselection

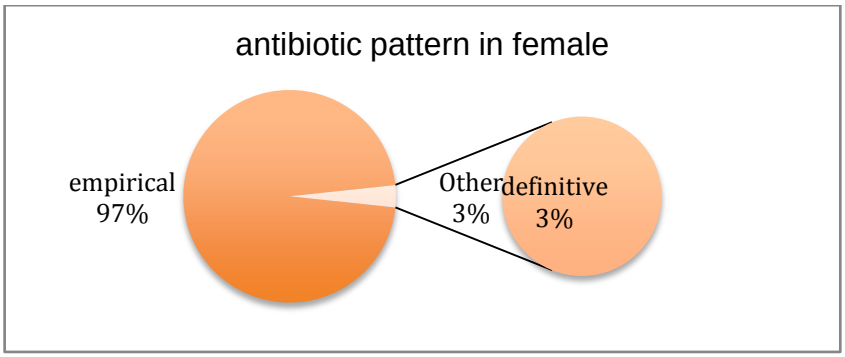

Figure 3b: Criteria for initial Antimicrobialselection

Table 14: Monotherapy / Combinationtherapy

Pattern oftherapy	Male (n=88)		Female(n=112)		Total(n=200)	
	n	%	n	%	n	%
Monotherapy	62	70	80	71	142	71
Combinationtherapy	26	30	32	29	58	29

Table 15: Route ofAdministration(n=200)

Route	Male n=88		Female n=112		Totaln=200	
	n	%	n	%	n	%
Oral	6	7	4	4	10	5
IV	70	80	86	76	156	78
Oral andIV	12	13	22	20	34	17

Table 16: Antimicrobial Drugs –Oral

	Antimicrobial drugs	Dosage	Male (n=20)		Female(n=24)		Total(n=44)	
			n	%	n	%	n	%
I	**Flouroquinolones**							
	Ofloxacin	200mg BID	4	20	4	17	8	18
	Ciprofloxacin	500mgBID	2	10	6	25	8	18
	Levofloxacin	500 mgBID	0	0	2	8	2	5
	Norfloxacin	400mgBID	2	10	0	0	2	5
II	**Beta-lactams**							
	Cefixime	200 mgBID	8	40	2	8	10	23
	Cefpodoximeproxetil	200 mgBID	2	10	6	25	8	18
III	**Nitrofurans**							
	Nitrofurantion	100mgBID	2	10	2	8	4	9
IV	**Antifungaldrugs**							
	Fluconazole	200mgOD	0	0	2	8	2	5

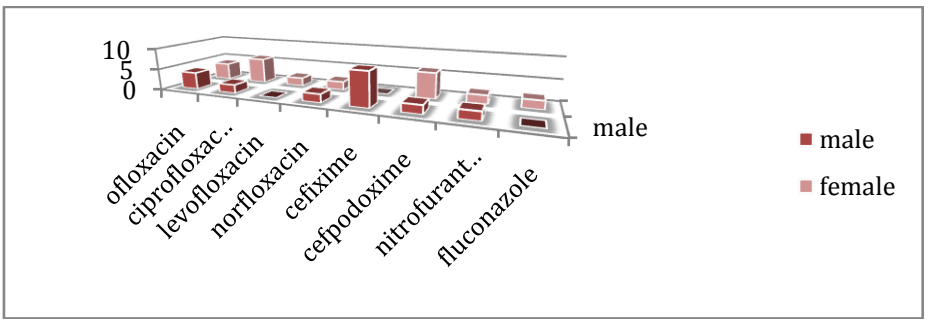

Figure 4: Oral Antimicrobial drugs

Table 17: Antimicrobial drugs – Intravenous

	Antimicrobial drugs class&genericname	**Dosage**	**Male n=88**		**Female n=112**		**Totaln=200**
			n	%	n	%	n
I	**Flouroquinolones**						
	Ofloxacin	200mg BID	30	34	22	20	52
	Ciprofloxacin	200-500mgBID	4	4	18	16	22
	Levofloxacin	500 mgBID	14	16	4	4	18
II	**Beta-lactams**						
	Co-amoxiclav	1.2 mgBID	2	2	6	5	8
	Ampicillin+sulbactam	1.5GmBID	0	0	2	2	2
	Amoxicillin	500mgBID	2	2	0	0	2
	Piperacillin+tazobactam	2.25-4.5 GmBID	10	11	6	5	16
	Cefuroxime+sulbactam	1.5GmBID	4	4	2	2	6
	Ceftriaxone	1-2GmBID	4	4	22	20	26
	Ceftriaxone+sulbactam	1.5GmBID	12	14	20	18	32
	Cefotaxime	1GmBID	0	0	4	4	4
	Ceftazidime	1GmBID	2	2	0	0	2
	Cefoperazone+sulbactam	1.5GmBID	0	0	4	4	2
	Cefipime+sulbactam	1.5GmBID	2	2	0	0	2
	Meropenem	1GmBID	2	2	2	2	4
	Doripenem	500 mgBID	0	0	2	2	2
	Aztreonam	1 GmBID	0	0	2	2	2
II	**Aminoglycosides**						
	Amikacin	250-500 mgBID	2	2	2	2	4
	Gentamicin	60 mgBID	2	2	0	0	2
	Netilmicin	100 mgBID	4	4	2	2	6
IV	**Nitroimidazoles**						
	Metronidazole	500 mgTID	12	14	10	9	22
	Ornidazole	200 mgBID	0	0	2	2	2
V	**Lincosamides**						
	Clindamycin	600 mgBID	0	0	2	2	2

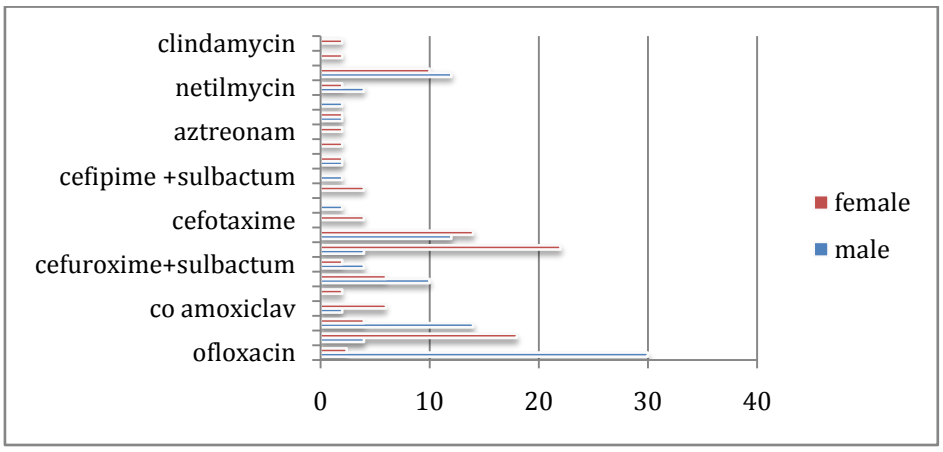

Figure 5: Antimicrobial drugs –Intravenous

Table 18: Antimicrobial drug combinations

Combinations	Numberof subjects(n=58)	%
Combinations of 2Antimicrobial drugs		
Fluoroquinolones+Cephalosporins Ofloxacin+CefoperazoneCiprofloxacin+Ceftriaxone	2 2	3 3
Fluoroquinolones+Carbapenems Ciprofloxacin+doripenem	2	3
Fluoroquinolones+Nitroimidazole Ofloxacin+MTZ Ciprofloxacin+MTZ Norfloxacin+MTZ	2 2 2	3 3 3
Betalactams+Nitroimidazoles Coamoxiclav+MTZCeftriaxone sulbactam+MTZCeftriaxone+MTZ Ceftazidime+MTZ PT+MTZ	2 6 2 2 2	3 10 3 3 3
Betalactams+Aminoglycoside PT+GentamicinCefuroxime+NetilmicinCefuroxime+AmikacinCefipime+NetilmicinCefipime+Amikacin	6 8 2 4 2	10 13 3 7 3
Beta lactam+lincosamide Meropenem+clindamycin	2	3
Aminoglycoside+Nitroimidazole Amikacin+metranidazole	2	3
Aminoglycoside+Tetracycline Amikacin+Doxycycline	2	3
Combinations of 3Antimicrobial drugs		
FQ+Betalactam+Nitroimidazole Levofloxacin+ceftriaxonesulbactam+metronidazoleLevofloxacin+ceftriaxonesulbactam+ornidazole	2 2	3 3
Betalactam+Aminoglycoside+Nitroimidazole Coamoxiclav+Gentamicin+MTZ	2	3

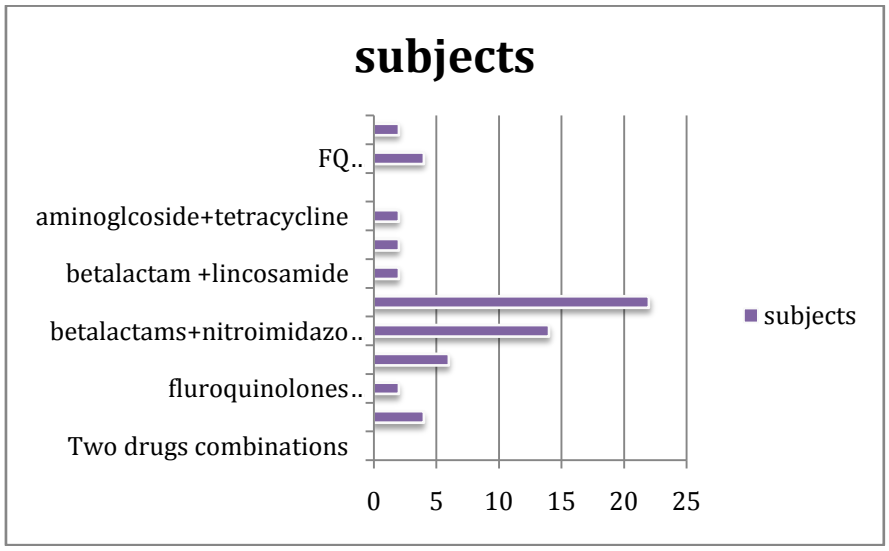

Figure 6: Antimicrobial drug Combinations

Table 19: Duration of Antimicrobial drug therapy

Duration	Male n=88		Femalen=112		Totaln=200	
	n	%	n	%	n	%
< 5days	2	2	4	3	6	3
6-10days	78	89	98	88	176	88
>10days	8	9	10	9	18	9
Mean duration: 9.2 ± 2.2days						

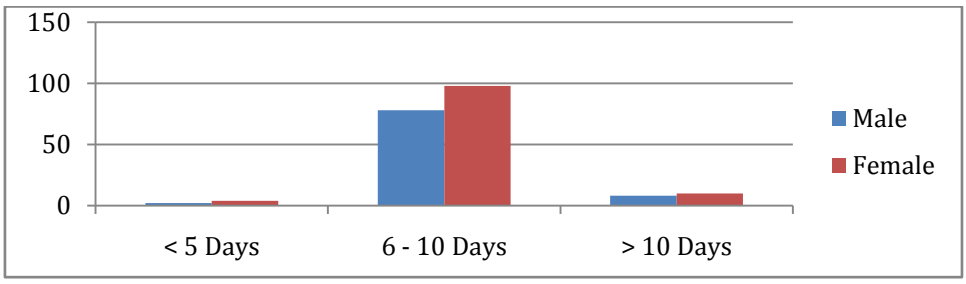

Figure 7: Duration of Antimicrobial drug therapy

Table 20: Change in Antimicrobial drug therapy

Antimicrobial drugs	Male (n=88)		Female(n=112)		Total(n=200)	
	n	%	n	%	n	%
Addition/substitution	28	32	40	36	68	34
Nochange	60	68	72	64	132	66
Antimicrobial drugs added /substituted						
Antimicrobial drugs –Intravenous						
Levofloxacin	2	2	0	0	2	1
Coamoxiclav	2	2	2	2	4	2
Piperacillin+tazobactam	14	16	10	9	24	12
Cephazolin	2	2	0	0	2	1
Cefuroxime	4	4	2	2	6	3
Ceftriaxone	2	2	2	2	4	2
Ceftriaxone+sulbactam	0	0	2	2	2	1
Cefoperazone+sulbactam	2	2	0	0	2	1
Cefipime	0	0	4	4	4	2
Amikacin	2	2	10	9	12	6
Gentamicin	0	0	2	2	2	1
Netilmicin	2	2	4	4	6	3
Metronidazole	4	4	6	5	10	5
Aztreonam	0	0	4	4	4	2
Antimicrobial drugs –Oral						
Cefixime	2	2	0	0	2	1
Metronidazole	2	2	0	0	2	1
Linezolid	2	2	0	0	2	1

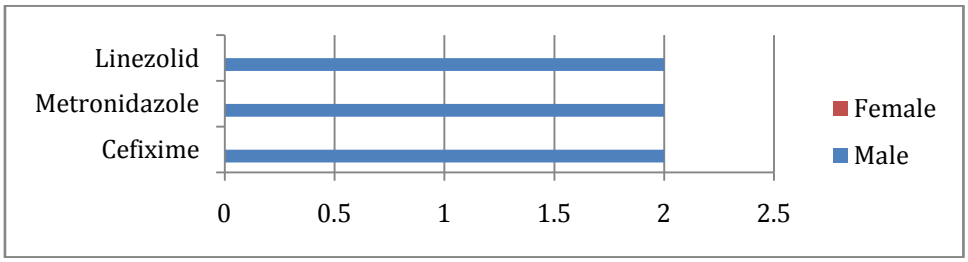

Figure 8: Change in Antimicrobial drugs therapy

Table 21: Reason for change in Antimicrobial Drug therapy

Reasons	Male (n=28)		Female(n=40)		Total(n=68)	
	n	%	n	%	n	%
1. Urine culturereport	4	14	10	25	14	21
2. Inadequate clinical response	6	21	16	40	22	32
3. Surgicalprophylaxis	16	57	10	25	26	38
4.Additionalinfections	2	7	4	10	6	9

Table 22: Outcome of Antimicrobial drug therapy (n=200)

Outcome	Male		Female		Total	
	n	%	n	%	n	%
Improved	72	82	92	82	164	82
Persistent	8	9	12	11	20	10
Worsened	4	5	4	4	8	4
Discharge againstmedical advice	2	2	4	4	6	3
Death	2	2	0	0	2	1

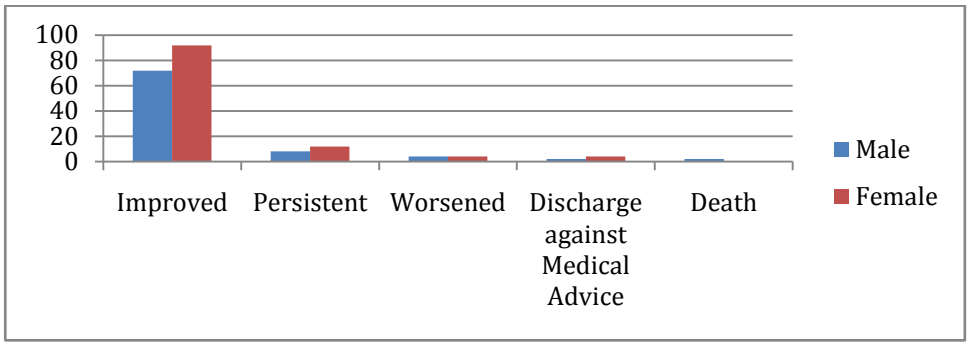

Figure 9: Outcome of Antimicrobial drug therapy

Table 23a: Follow up urineculture

Follow up urineculture	Male		Female		Total	
	n	%	n	%	n	%
Not available for followup	58	66	74	66	132	100
Available for followup	30	34	38	34	68	34
Total	88	100	112	100	200	100

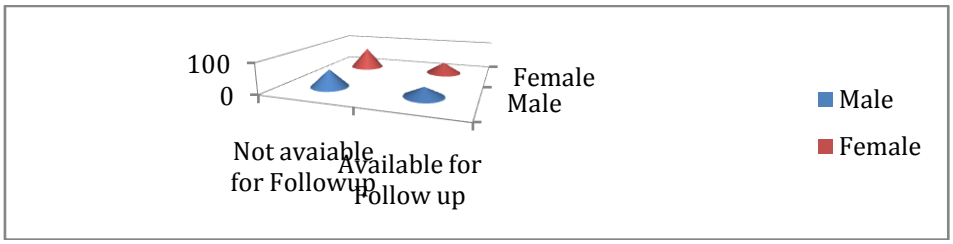

Figure 10: Follow up urineculture

Table 23b: Outcome of urineculture

Outcome	Male n=30		Femalen=38		Totaln=68	
	n	%	n	%	n	%
Growthpresent	6	20	6	16	12	18
Nogrowth	24	80	32	84	56	82

Table 24: Adverse events during Antimicrobial drug therapy

Adverseevents	Male (n=24)		Female(n=26)		Total(n=50)	
	n	%	n	%	n	%
Nausea	8	33	8	31	16	32
Nausea withVomiting	8	33	2	8	10	20
Diarrhea	4	17	4	15	8	16
Abdominalpain/cramps	0	0	6	12	6	12
Skin rashes	0	0	2	8	2	4
Alteredtaste	4	17	4	15	8	16

Table 25: Concomitantmedications

Concomitantmedications	Male (n=88)		Female(n=112)		Total(n=200)	
	n	%	n	%	n	%
Insulin	18	20	40	36	58	29
Oral anti-diabeticdrugs	16	18	26	23	42	21
NSAIDs	36	41	50	45	86	43
Opioids	12	14	8	7	20	10
Antiemetics	8	9	16	14	24	12
Proton pumpinhibitors	76	86	88	78	164	82
H2Blockers	2	2	12	11	14	7
Ulcer protectivedrugs (sucralfate)	4	4	0	0	4	2
Antihypertensives	20	23	30	27	50	25
Antiplatelets	8	9	22	20	30	15
Hypolipidemics	6	7	18	16	24	12
Corticosteriods(Prednisolone)	0	0	1	2	2	1
Hematinics	14	16	20	18	34	17
Multivitamins	20	23	14	13	34	17
Others	18	20	8	7	26	13

V. Discussion

Inthepresentstudy,thepatternofantimicrobialdrugsuse,thecriteriaforselectionandclinicaloutcomeinrecurrentandcomplicatedUTIswas assessedin200subjects in Osmania General Hospital Hyderabad. Mean age of male subjects was 53±11.7 (n=88) and the females 48±12.7(n=112). Majorityofthesubjects(69%)wereintheagegroupof46-65yearswhichmay reflect the higher prevalence of various co morbid conditions and risk factors.

The higher female preponderance is consistent with the fact that UTIs aremorecommon in females due to anatomicalandbehaviouralpatterns,therewasnosignificantdifferenceingenderdistributionintheagegroupof>45years **Arul Prakasam et al**., study in 200 patients with UTI has 65 % Females and 35% males which was the same prevalence as the presentstudy[11]

All the subjects presented with more than one complaint, the mostcommon symptomsweredysuria(62%)andfever(60%).Theothercomplaintswerenausea andvomiting(23%),urinaryretention(7%),urinaryincontinence(4%),nonspecific abdominal pain (3%). Dysurias were more complained in males (71%) and fever more in females(68%).

Mahesh E, Ramesh D et al.,study in 458 patients with complicated UTI had dysuria as most common complaint which was the same as the present study.[12]

Themean duration of symptoms was 9.3±6 days. In majority of the subjects (61%) the duration ofsymptoms was<10days,andonly26subjectshadtheduration>30days.Subjectswithlonger durationofsymptoms(>15days)hadunderlyingco morbidconditionssuchas Diabetes Mellitus, neurological disorders, renal dysfunction or risk factors which required surgical Interventions, like cystocele, renal calculi, BPH.

Sunil S. Gidamudi et al., in 108 subjects has Diabetes mellitus as most common co morbid condition followed by Hypertension, renal calculi which are same as present study.[13]

The co morbid conditions in the study subjects are known causes for recurrence and relapsing UTI. The most commoncomorbidconditionswereDM(43%),HTN(25%),renalcalculi(23%),BPH(55%males),cystocele(14%females),renalinsufficiency(18%),otherswereneurologicaldisorders(4%),renalcysts(4%),carcinomabladder(1%),renalcellcarcinoma (1%),immunodeficiency states (2%) and septicemia (1%). Mostofthesubjects(82%)had>1comorbid condition.Majorityofthediabeticsubjectshadadequateglycemiccontrolbut4subjectshad severe uncontrolled diabeticstatewithketoacidosisatthetimeofadmission.HTNalthoughnotdirectlyknowntoincreaseriskofUTIs,itwascommonandsignificantco morbid illnessencounteredandwasfrequentlyassociatedwithDMandmaycontributeto renaldysfunction.

Significant number of subjects (62%) had more than one riskfactor. The presence of risk factors for UTI was higher in females, the most common beingpost menopausalage(31%)andreproductiveage(28%),and bothofthesebeingestablished risk factors for UTIs in females.The other common risk factor in both thegenders(36% in males and 11% in females) was urethral catheterization (short/medium/long term) for acute urine retention, following abdominal or pelvic surgeries (n=10)or endoscopic urological procedures (n=10), voiding dysfunction due to neurological disorders or in patients requiring long term hospital care orprolonged

immobilization . Other risk factors included ureteric stents,stricture urethra and an unusual case (n=2) of renal trauma following road traffic accident with multiple contusions in renal parenchyma was noticed.

MajorityofthesubjectswerediagnosedtohavecUTI(71%),followedbyrecurrent cUTI (22%) and recurrent uncomplicated UTI (7%). There was no significant genderrelated differenceincomplicated UTI(males:n=66;females:n=76).Howeverrecurrent UTIshowedslightly higher prevalence in females (females: n=36; males: n=22).The higher prevalenceof complicated UTI in the study subjects (71%) compared to recurrent UTI can be correlated tothe presence of various co morbid conditions (DM, HTN, renal dysfunction)orabnormalitiesoftheurinarytracte.g.renalcalculi,BPH,renalcysts,stricturesetc.

UrinemicroscopyforWBCs,epithelialcellsandRBCswasdone in all the subjects in present study. 38% of the subjectsshowedoccasionalWBCs,28%significantWBCs,andanother28%pyuria(>10cells/hpf); epithelialcellsin41%andRBCsin13%ofthesubjects.ThepresenceofWBCsin urineissuggestiveofUTI,butmaynotcorrelatewiththeseverityoftheinfection. The presence of epithelial cells in the urine is non-specific.

Allthe study subjects had significant bacteriuria as detected by urine culture (> 10^5 cfu/mlof urine). Majority of the isolates were gram negative bacteria (79%),which predominantly included E.coli(n=100) followed by Klebsiella(n=40), Proteus(n=6), Pseudomonas(n=6), Enterobacter(n=2) and Acinobacter (n=4). Grampositive bacteria (20%) included enterococci (n=26) and staphylococci (n=14). Two isolatewere Candida albicans**.**

A study conducted by **MajdaQureshi et al**., in 256 patients with UTI had E.coli as most common organism 76% followed by Klebsiella(23%).[14]

A study conducted by **Saleem M, Daniel B. et al**., in 100 patients had Escherichia coli as most common causative organism followed by klebsiella which was same as present study.[15]

Another study conducted by**Mohammad AlzohairyHabeebkhadri et al**.,E.coli was most common organism followed by Klebsiella which were consistent with the present study.[16]

The antimicrobial susceptibility/resistance patterns are shown in table 10a and10b. Majority of the E.Coliisolates (>80%) were susceptible for**piperacillin+tazobactam**, **nitrofurantoin, gentamicin and amikacin**;significant resistance was found for coamoxiclav (82%), ciprofloxacin (78%), norfloxacin(84%), nalidixicacid,cefuroxime(68%),cotrimoxazole(67%)andmoderateresistanceto cefipime (44%). Among theKlebsiellaisolates , most of them weresusceptible to piperacillin+tazobactam (91%), gentamicin (90%), amikacin (70%),nitrofurantoin (55%), cefipime (65%) while considerable resistance was noted tociprofloxacin(70%), norfloxacin (65%) and nalidixic acid (80%), cotrimoxazole(60%), coamoxiclav(95%)andcefuroxime(70%).AmongthePseudomonasisolates allwerefoundresistanttocoamoxiclav,ciprofloxacin,norfloxacin,nalidixicacid, nitrofurantion , cotrimoxazole and cefuroxime, and only two isolate weresusceptiblefor cefipime, gentamicin, amikacin and piperacillin+tazobactam; 2 isolateswere susceptible to imipenem, meropenem and ceftriaxone+tazobactam. All the 3 isolates of Proteus spp were susceptible to gentamicin, amikacin, cefuroximeand piperacillin+tazobactam but resistant to cotrimoxazole, nalidixic acid,nitrofurantoin and norfloxacin. The enterobacter isolate (n=2) were susceptible tociprofloxacin, gentamicin, amikacin and nalidixic acid but resistant to other Antimicrobial drugs.Theisolates of acinobacter (n=4) were susceptible to amikacin, nalidixic acid and nitrofurantoin. Outofthetotalnumberofisolates(n=158),140weresusceptibleforgentamicinand piperacillin+tazobactam, and 122 for amikacin and 106 for nitrofurantoin. The number of resistant isolates was high for coamoxiclav ,nalidixic acid, norfloxacin and ciprofloxacin.

Antimicrobial susceptibilityand resistancepatterninthegramnegativeisolatesin a study conducted by **Mahesh E, Ramesh D et al**.,has E.coli resistant to First generation Flouroquinolones(76.9%) which was same as the present study.[12]

OyebolaFasugba et al.,conducted a study on patients with UTI in which E.coli was resistant to Ciprofloxacin.[17]

Table 10b shows antimicrobial susceptibility and resistance patterns forgram positiveisolateswhichincludedEnterococcusspp(n=26)andStaphylococcusspp(n=14). Most of the isolates of enterococcus (n=24) were susceptible tolinezolid, tetracyclineandvancomycinbutresistanttociprofloxacin,cefipimeandcloxacillin,gentamicinanderythromycin.Allth e14isolates (MRSA=2) of staphylococcus were susceptible for linezolid and vancomycinand mostofthemforcefoperazone(n=10),cefipime,tetracycline, cloxacillin. Among total number of 40 gram positive isolates, 38 were susceptiblefor linezolidandvancomycin,and34fortetracycline.

Arul Prakasam et al., conducted a study in 200patients with UTI had E.coli isolates (94.3%) sensitive to Meropenem, (58%) to Amikacin, (43%) to gentamicin, (30.76%) toCefotaxim, (23.09%)to Ciprofloxacin and Norfloxacin and (15.38%) to Cotrimoxazole.[11]

Mohammad Aizohairy et al.,conducted a study in patients with UTI had E.coli susceptible to Imipenem (98.8%), Amikacin (34.2%), Norfloxacin(40.4%), Nitrofurantoin(44.5%) and Cotrimoxazole(46.7%).

Thoughthegrampositiveorganismsarebecoming increasingly resistant to the frequently used Antimicrobial drugs, linezolidand vancomycin remain effective against most of the staphylococci includingMRSA.

Sunil S.Gidamudi et al., conducted a study in 108 patients with UTI in which Multi Drug Resistant Organisms were most common in E.coli and Klebsiella.[13]

The prevalence of MDR (defined as resistance to ≥ 3 Antimicrobial drug classes) isolates were shown in Tables 15aand15b.61.2%ofthegramnegativeMDRisolateswereE.Coli,28%wereKlebsiella,amonggrampositiveMDRisolates61% were Enterococcus and 39% were Staphylococcus.

Gauravdalela et al.,conducted a study on 184 patients with UTI had resistance to oral drugs Amoxycillin, norfloxacin, doxycycline and cotrimoxazole. Sensitive to parentral Aminoglycosides, carbapenems and piperacillin/tazobactam.[18]

Therenalparametersin42subjectshadraisedbloodureaandserumcreatininelevels.36subjectswerediagnosedtohaveestablishedrenal failuresecondarytoDMandHTN,andrenaldysfunctionduetochronicobstructivepathology in the urinary tract.

ThecriteriafortheinitialselectionofAntimicrobial drugs weresummarizedinTable 13.ThechoiceofAntimicrobial drugs wasempiricalinmajorityofthesubjects(85%), and only in 15% of the subjects the Antimicrobial drugs were started as definitive therapy basedon urine culture and susceptibility patterns.

Harish Naik et al., conducted a study in patients with UTI shows that the therapeutic approach for UTI is primary empirical and the main aim is to treat specifically which was consistent with the present study[19].

The initial empirical therapy was replacedby definitive therapy in 12 subjects following urine culture report. Theroutineuseof Antimicrobial drugs onempiricalbasismaybeanimportantcontributingfactorintheemergence ofdrugresistantstrains.Inmostofthesubjects(71%)theAntimicrobial drugs wereusedas monotherapy.Combinationtherapywithconcurrentuseof two or more Antimicrobial drugs of different classes was employed in 29% of the subjects,because of inadequate clinical improvement with monotherapy. ThepurposeofcombiningAntimicrobial drugs was to provide synergistic action, wider coverage and also to minimizeantimicrobial resistance.

TheAntimicrobial drugs wereusedbyIVrouteinmajorityofthesubjects(78%),oral route in only 5% of the subjects and both by oral and IV routes in 17% ofsubjects.BothoralandIVrouteswereemployedin17subjects because of concurrent administration of 2 or more Antimicrobial drugs effective by different routes. IV route is generally preferred since the majority of the Antimicrobial drugs areineffective bymouth,andalsotoensurequickeronsetofaction,rapidattainmentofdesired plasma concentration, higher antimicrobial efficacy, anticipated surgical interventions and feasibility for monitoring under hospitalsettings.

Sunil S Gidamadi et al., conducted a study in patients with UTI most commonly prescribed Antimicrobial was Ceftriaxone followed by Cefixime and Azithromycin.[13]

The different classes of Antimicrobial drugs used are shown in Tables 16 and 17.TheAntimicrobial drugs usedbyoralrouteincludedthe**Fluoroquinolones**(ofloxacin,ciprofloxacin, levofloxacin and norfloxacin), **thirdgeneration cephalosporins**(cefixime, cefpodoximeproxetil), **nitrofurans**(nitrofurantoin) and the **azole antifungal agent**(fluconazole).TheseoralAntimicrobial drugs werepreferredasfirst-linedrugs because oftheir good oral bioavailability and tolerability, particularly in cases of mildinfections without any complicating factors, or as oral switch-over therapy followinginitial parenteraltherapywiththerespectiveAntimicrobial drugs ofthesameclass.

The Antimicrobial drugs used by intravenous route are summarized in Table 17.Fluoroquinolones and the nitroimidazoles were given by IV infusion and others by slowIV injection.MostoftheAntimicrobial drugs wereusedintheirstandardtitratedadultdosesand frequency. The most commonly used Antimicrobial drugs were **Fluoroquinolones**(46%) and**beta-lactams** (56%). The most commonly used Fluoroquinolones was ofloxacin (26%) and among thebeta-lactams,ceftriaxone(29%).OtherclassofAntimicrobial drugs usedwereaminoglycosides(6%) including amikacin (n=4), gentamicin (n=2) and netilmicin (n=6);nitroimidazoles including metronidazole (n=22) and ornidazole (n=2). In two subjects withrenal abscessclindamycinwasusedincombinationwithmeropenem.Inotherstudiesthe Antimicrobial drugs commonly employed were Fluoroquinolones and beta-lactams with or withoutAminoglycosides.

Harish Naik et al., (2013) conducted a study on patients with UTI in kerala were cephalosporins (Cefotaxime and Ceftriaxone) are used most commonly.[19]

The Antimicrobial drugs generally used for UTIs include the Fluoroquinolones, beta-lactams, Aminoglycosidesand occasionallynitroimidazoles.AlltheseAntimicrobial drugs havepotentbactericidalaction,low protein binding, no metabolic inactivation, high bactericidal concentration in theurineand renal parenchyma and potentially synergistic antimicrobial action, andhenceconsidered most appropriate options for the therapy. Though Aminoglycosides are lesseffective in acidic urine, others retain good antimicrobialactivity.

ApartfromtheAntimicrobial drugs,severaladjuvantswereusedforsymptomaticrelief which included probiotics (lactobacilli), urine alkalizing drugs (sodiumcitrate, bicarbonate or potassium citrate) and urinary antispasmodics (flavoxateor dicyclomine). Urine alkalizing drugs were used for their established role in

controlof distressinglocalirritativesymptomsassociatedwithUTIs,andalsoincreasingthe urinary concentration of certain Antimicrobial drugs and enhancing their antimicrobial effects.The urinary antispasmodics were used to relieve spasm or pain associated withrenal calculi or other obstructiveetiologies.

Theantimicrobial drugs combinationswereusedonlyin58 subjects and were given separately by IV injection or infusion. However in 24subjectsIVAntimicrobial drugs wereusedalongwithoraldrugs.Themostcommonantimicrobial drug combinations were beta lactams with aminoglycosides (n=22), beta lactam withnitroimidazoles wereusedinsubjects(n=14),theotherantimicrobial drugs combinationswereFluoroquinolones+betalactams (n=6), Fluoroquinolones+ Nitroimidazoles(n=6),betalactam+lincosamide(n=2), aminoglycoside+Nitroimidazole (n=2), aminoglycoside+Tetracycline (n=2), In 6 subjects the combinations of 3 Antimicrobial drugs including Fluoroquinolones+Betalactam +Nitroimidazole (n=2) and Betalactam+aminoglycoside+Nitroimidazole were used.

The Antimicrobial drugs were combinedon empirical basis intending synergistic antimicrobial action widerantimicrobial coverageandalsotominimizetheriskofantimicrobialresistance.Thecombination ofbetalactamsandaminoglycosideorFluoroquinolonescanbeconsideredasrationalastheseAntimicrobial drugs have different sites and mechanisms of action, and also have differentantimicrobial spectrum to ensure adequate coverage of gram positive and gram negativeorganisms. The combinations of nitroimidazoles with other Antimicrobial drugs ensures good coverageagainstanaerobic infections particularly in renal abscess or intending surgicalinterventions..Themostcommonantimicrobial drugs combinations reported in other studies included beta lactams withAminoglycosides.[20,21]

Table19indicatesdurationofantimicrobial drug therapyinthesubjects.Inmajority of the subjects (88%) the duration of therapy ranged from 6-10 days withthe mean duration of 9.2 ± 2.2 days. The duration of therapy was > 10 days in only 9%of the subjects and < 5 days in 3% of the subjects. In other studies the overall duration of therapy ranged from 5-20 days.

Thechangeinantimicrobial drug therapyandreasonsforthechangearesummarizedin Tables20and21.Inmajorityofthesubjects(66%)therewas nochangeintheinitialantimicrobial drugs therapybecauseofgoodclinicalresponse,andthe change in therapy involving addition or substitution with other Antimicrobial drugs wasrequiredonly in 34% of the subjects, the Antimicrobial drugs added to initial therapy (n=92) andsubstituted forinitialtherapy(n=44).Thechangeinantimicrobial drug therapywasbasedonurineculture report(n=14),inadequateclinicalresponse(n=22),surgicalprophylaxisforensuring widerantimicrobialcoverage(n=26)andadditionalinfectionslikegastrointestinal, respiratory infections in subjects (n=6). The Antimicrobial drugs added to initial therapyfor synergistic effect or to widen the antibacterial efficacy were piperacillin+tazobactam, amikacin , gentamicin , netilmicin , metronidazole, cefuroxime , ceftriaxone , ceftriaxone+sulbactam, cefoperazone+sulbactam , cephazolin , cefixime , cefipime, levofloxacin , coamoxiclav.Thereasonsforchangeinantimicrobial drug therapyobservedinotherstudieswere similartothepresentstudy.[88]

Table 22 shows the outcome of antimicrobial drug therapy based on theclinical improvement and urine culture. 82% of the subjects showed goodimprovement, whereasin10%ofthesubjectstheinfectionwaspersistent,andin4%theinfection worsened; 6 subjects were discharged against medical advice and hence notavailable forassessment .Therewerenogenderrelated differencesinthetreatmentoutcome.Thereasonsforinadequateresponsetoantimicrobial drug therapy may probably be due inadequate control of co morbid conditions (DM,CKD), persistenceofriskfactorslikeurethralcatheterization(forneurologicalconditions/ long term immobility), ureteric stents, immunodeficiency states or infectionwith multidrug resistance organisms.

The number of subjects available for follow-up urine culture and theoutcome of the urine culture are shown in tables 23a and 23b respectively.68 subjects were available for follow-up urine culture and the bacterial growth wasseen only in 12 subjects. The same pathogen was isolated in 8 subjects indicating arelapse,anddifferentpathogensin4subjectsindicatingre-infection.Thepathogensisolated were Klebsiella (n=4), E.coli (n=4), Staphylococcus (n=2), Enterococcus (n=2).These subjectswhohadgrowthonrepeaturineculture usuallyhaduncontrolledorpoorlycontrolled co morbid conditions or other risk factors (DM, renal insufficiency,stents, reproductive age or post-menopausalage).

Table24summarizesthe adverse events during Antimicrobial therapy .The adverse events related to antimicrobial drug therapy are only in25%ofthesubjectshadtheadverseeventswhichweremainly gastrointestinal (nausea, vomiting, diarrhea, abdominal pain/cramps), cutaneous(skinrashes) and taste disturbances (altered taste). However the causality of variousadverse events could not be ascertained because of the concomitant administration ofseveral Antimicrobial drugs. The mild skin rashes observed in one subject was probably due toceftriaxone andwasself-limiting,didnotrequirechangeinantimicrobial drugs.Noserious adverse events related to antimicrobial drug therapy were observed in any of the subject duringthe course oftherapy.

Table25summarizestheconcomitantmedicationsinthestudysubjects for various co morbid conditions and for symptomatic treatment ofother associated clinical manifestations. Almost all subjects received more thanone medication apart from antimicrobial drug therapy. The most commonly usedconcomitant medications were PPIs (82%), NSAIDs (43%), insulin (29%), oral antidiabeticdrugs (21%), antihypertensives (25%), antiemetics (12%), hematinics andmultivitamins (17%), opioids (10%). PPIs and H2 blockers were required to suppress gastricacidity and prevent ulcerations particularly due to NSAID use. Insulinand oral antidiabetic drugs were required in diabetic subjects, NSAIDs andopioid analgesics were mainly used to control associated pain, fever and inflammation.The concomitantmedicationsdidnotappeartohaveanyadverseinteractionwiththe Antimicrobial drugs used.

VI. Conclusion

The recurrent and complicated UTIs can be treated empiricallywith monotherapy or combined therapy of variousAntimicrobial drugs.

Definitivetherapybasedontheinvitrosensitivity/resistancepatternisrequiredinthepresenceofcomplicatingf actorslikeco morbidconditions,associated abnormalities in the urinary tract, invasive procedures orinfectionswith MDRorganisms.

TheAntimicrobialdrugsusedinthepresentstudyincludedFluroquiolones,betalactams,Aminoglycosidessan d nitroimidazoles, mainly by intravenous route to ensure adequateconcentration in the tissue and the urine and for more predictable antimicrobialaction.

The antimicrobial drugs combination involved beta-lactams + Aminoglycosides, beta-lactams+ nitroimidazoles, Fluoroquinolones + beta-lactams / nitroimidazoles, and suchcombinationswere found rational for synergistic antimicrobial action, wideningtheantimicrobial spectrum and for preventing the possibleresistance.

Based on the in vitroevidence, piperacillin-tazobactam combined withan Aminoglycosides (gentamicin/amikacin) can be considered most suitablewith metronidazole added in case of anaerobicinfection. Mostofthepatientsshowedgoodclinicalandbacteriologicalimprovement even with empirical therapy.

6.1 Strengths of the present study:

Inthepresentstudy theoutcomeof therapy was favourable in majority of the subjects (82%) with good clinicaland bacteriologicalimprovementevenwithempiricaltherapyandmostoftheisolates beingdrugresistant,whichmaybeindicativeofappropriatenessinthechoiceofAntimicrobial drug combinations.

6.2 Limitations of the study:

Thefollow-up urine culture for the objective assessment of the treatment outcome and optimizingthe durationoftherapy,maynotalwaysbefeasiblebecauseofthenon-availability of the patients for regular follow-up.

6.3 Recommendations of further work:

Further more elaborate studiesmay be required to formulate appropriate guidelines for therapy particularly in the presence of the complicating riskfactors.

References

[1]. Griebling TL. Urinary Tract Infection in Women. In: Litwin MS, Saigal CS,editors. Urological Diseases in America. Washington DC:US Government PublishingOffice;2004.153-83

[2]. Beyene G, Tsegaye W. Bacterial Uropathogens In Urinary Tract Infectionsand Antibiotic Susceptibility Pattern in JIMMA University SpecializedHospital, Southwest Ethiopia. Ethiop J Health Sci 2011;21(2):141-46

[3]. Manikandan S, Ganesapandian S, Singh M, Kumaraguru AK.Antimicrobial Susceptibility Pattern of Urinary Tract Infection Causing Human PathogenicBacteria. Asian J Med Sci 2011;3(2):56-60

[4]. McLaughlinP,CarsonCC.UrinaryTractInfectionsinWomen.MedClinNAm2004;88: 417-29

[5]. MazzulliT.DiagnosisandManagementofSimpleandComplicatedUrinaryTract Infections (UTIs). Can JUrol 2012;19(1): 42-48.

[6]. NicolleLE,BradleyS,ColganR,RiceJC,SchaefferA,HootonTMetal.IDSA Guidelines for Asymptomatic Bacteriuria. Clinical Infectious Diseases 2005;40:643– 54

[7]. Colgan R, Nicolle LE, Mcglone A, Hooton TM. Asymptomatic Bacteriuria inAdults. Am Fam Physician 2006;74(6):985–90

[8]. Sener A, Yapar N, Cakir N. Asymptomatic Bacteriuria Prevalence and Itsrelationship with Urinary Tract Infections in the elderly. J Microbiol Infect Dis2013;3(1):18-23

[9]. BentonTJ,YoungRB,LeeperSC.AsymptomaticBacteriuriaintheNursingHome. Annals of Long-term Care and Aging2006;14(7):17–22

[10]. Wagenlehner FME, Hoyme U, Kaase M, Funfstuck R, Naber KG, SchiemannG. UncomplicatedUrinarytractinfections.ClinicalPracticeGuidelines.DtschArzteblInt 201;108 (24):415–23

[11]. Prakasam AKC, Kumar DKG, Vijayan M. A Cross Sectional Study on DistributionofUrinary Tract Infection and Their Antibiotic Utilization Pattern in Kerala. Int JPharm Tech Res2012;4(3):1310-16

[12]. Mahesh E, Ramesh D, Indumathi VA, Punith K, Kirthi Raj, AnupAntimicrobialdrugs H.A. ComplicatedUrinaryTractInfectionsinaTertiaryCareCentreinSouthIndia.Al Ameen J Med Sci2010;3(2):120-127

[13]. Muraraiah S, Rajarathna K, Rahman FU, Jayanthi. Prescribing pattern incomplicated urinary tract infections at tertiary care hospital. J. Chem. Pharm. Res 2012;4(2): 1222-30

[14]. EjazH,Ikram-ulHaq,ZafarA,MahmoodS,JavedMM.Urinarytractinfections causedbyextendedspectrumβ-lactAntimicrobial drugs

e(ESBL)producingEscherichiaColiand Klebsiella Pneumonia. Afr J Biotechnol 2011;10 (73):16661-66.
[15]. Saleem M, Daniel B. Prevalence of Urinary Tract Infection among patientswith Diabetes in Hyderabad city. Int J EmergSci 2011; 1(2):133-142
[16]. Alzohairy M, Khadri H. Frequency and antibiotic susceptibility ofuro-pathogensisolated from community and hospital acquired infections in Saudi Arabia -A prospective case study. British Journal of Medicine and Medical Research2011;1(2): 45-56
[17]. Murugan K, Savitha T, Vasanthi S. Retrospective study of antibiotic resistanceamong uropathogenfromruralteachinghospital,TamilNadu,India.AsianPacJTropDis 2012; 2(5):375-80.
[18]. Dalela G, Gupta S, Jain DK, Mehta P. Antibiotic resistance pattern in uropathogensatatertiarycarehospitalatJhalawarwithspecialreferencetoESBL,AmpC,β- lactAntimicrobial drugs eandMRSAproduction.Journalofclinicalanddiagnosticresearch.2012;6(4):645-51.
[19]. Harish Naik, Anupamadevi, Sudha MJ. Pattern of Antibiotic Prescription in Urinary tract infection. Indian Journal of Pharmacy and Pharmacology 2016;3(2):59-62
[20]. GrieblingTL.UrinaryTractInfectioninMen.In:LitwinMS,SaigalCS,editors. Urological Diseases in America. US department of health and human services, Public
[21]. Health Service, National Institute of Health, National Institute of Diabetesand Digestive and Kidney Diseases. Washington DC: US Government PublishingOffice; 2004.623-45.

DrSwathi Kusuma" Usage of Antibiotics in Complicated and Recurrent Urinary Tract Infection" IOSR Journal of Dental and Medical Sciences (IOSR-JDMS), vol. 18, no. 9, 2019, pp .50-67