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Evaluation of Patients having Urinary Tract Infection with Antibiotic Sensitivity and Resistance Pattern at a Tertiary Care Hospital in Bangladesh

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Abstract **Original Research Article**

This study was aimed to evaluate different categories of urinary tract infection (UTI), causative organisms and their antibiotic sensitivity/resistance pattern with treatment response at a tertiary care hospital in Bangladesh. This study was conducted at the Department of Nephrology, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh over a period of five years from January 2019 to December 2023. A total of 3000 patients with UTI were enrolled. Patients with complicated UTI, uncomplicated UTI and urosepsis were categorized. Their demographic profile, clinical characteristics of UTI, antibiotic sensitivity/resistant patterns, co-morbidity, obstructive features and treatment responses were recorded accordingly. Of them; 1365 (45.5%) were males and 1635 (54.5%) were females. The mean age of the study patients was 36.6 ± 16 years. Most of the UTI cases were presented with dysuria (46.7%) along with fever and chill (26.7%). Uncomplicated UTI was observed in 27% study cases and complicated UTI was in 11% cases, of these; upper UTI was 9% and lower was 29%. Normal renal function was observed in 57.3% study patients. Majority (83.3%) of the urine sample showed bacterial colony count >10^5 cfu/ml. Among gram-positive bacteria Staphylococcus. Enterococcus, group-B Streptococci were common. Among gram-negative bacteria E. Coli, Pseudomonas, Klebsiella and Proteus were identified. Diabetes is the leading cause of co-morbidity associated with UTI. Different obstructive features were observed among the study population. Antibiogram showed Colistin has highest degree of antibacterial sensitivity against E. Coli (around 80%). Staphylococcus Aureus was sensitive to Linezolid in 92% cases, Pseudomonas to imipenem in 85% cases. Klebsiella in 90% cases to tazobactum and pipercillin, Enterococci in 86% cases to Amoxicillin and Clavulanic Acid, Proteus in 70% cases to Meropenam, Staphylococcus Saprophyticus in 76% cases to Lenozolid, Group-B Streptococci in 80% cases to Meropenem. This study showed 14 days treatment is superior to 7 days treatment.

Keywords: Urinary Tract Infection (UTI), Antibiotic Sensitivity and Resistant Pattern, Complicating factors, Obstructive Uropathy, Treatment Response.

1. INTRODUCTION

Urinary tract infection (UTI) is a term applied to a variety of clinical conditions ranging from asymptomatic occurrence of bacteria in the urine to severe kidney infection with resultant sepsis [1]. The incidence of urinary tract infections (UTIs) is higher in

individuals having kidney disease due to structural and functional abnormalities [2]. Females are generally more susceptible to urinary tract infections than males [1]. Due to urinary stagnation, alkalization of urine and absence of flushing action, the presence of urinary tract infection (UTI) in chronic kidney disease (CKD) patients are higher compared to normal [3]. In older adults, the risk of UTIs increases significantly. Elderly individuals with CKD are especially vulnerable to sepsis because of multiple comorbidities, frequent and prolonged hospital stays, poor immune responses, and age-related functional impairments [1]. Additional risk factors for UTIs in individuals with diabetes mellitus, old age, poor metabolic control, diabetic nephropathy, autonomic neuropathy, and vascular complications [4]. UTI comprises heterogeneous conditions ranging from mild cystitis, complicated UTI (cUTI) to life-threatening sepsis and multiple organ failure. Primary cause of urosepsis is assumed that ascending UTI from the bladder to the kidney, with resultant bacteremia [1]. Urosepsis in adults comprise approximately 25% of all sepsis cases following an episode of complicated urinary tract infection (cUTI) [5]. Complicated urinary tract infection (cUTI) is widely used for an infection that occurs in a patient with a structural or functional abnormality of the genitourinary tract that impedes urine flow or in the presence of the underlying diseases [5]. Gram-negative rods (75–85%) are most commonly associated, while gram-positive organisms are less frequently (15%) involved [6]. In recent years a number of UTIs resistant to gram-negative bacteria has raised mainly due to spread of extended-spectrum beta-lactamase (ESBL) producing bacteria [6]. The high resistance rates among these organisms to most antibiotics, except carbapenems, highlight the overuse of antibiotics in recent decades. Multi-drug-resistant strains of E. Coli are particularly common [7]. It was reported that, rates of antimicrobial resistance vary according to geographic locations and are directly proportional to the use and misuse of antimicrobials, posing a threat to public health [8]. The aim of this study was to determine clinical characteristics and antimicrobial sensitivity and resistant pattern among patients with UTI caused by different organisms.

2. METHODOLOGY

This prospective observational study was conducted at the Department of Nephrology, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh. We analyzed data from 3000 UTI patients from January 2019 to December 2023, both in-patient and out-patient Department of Nephrology. Study population has no age limitation with both sexes, all stages of CKD, patients with renal allograft recipient and patient on maintenance hemodialysis were included. Patients who were on any antibiotic therapy and refused to participate in this study were excluded from the study. Only culture positive urinary tract infections were selected. Study variables include- demographic profile, clinical variables such as- status of renal function, any instrumentation of urinary tract/catheterization/stenting, obstructive uropathy like- renal stone, hydronephrosis (HDN), hydroureteronephrosis (HUN). Length of hospital stay was also noted. All clinical parameters including: temperature, pulse, blood pressure, suprapubic, loin tenderness was recorded accordingly. Relevant baseline investigations such as- complete blood count (CBC) with erythrocyte sedimentation rate (ESR), C- reactive protein (CRP), urine for routine microscopic examination (R/M/E) and culture (both aerobic & anerobic) and sensitivity test, fungal stain, serum pro calcitonin, D-dimer, serum creatinine, estimated glomerular filtration rate (eGFR), serum calcium, serum phosphate, intact parathyroid hormone (iPTH) level, ultrasonogram (USG) of kidney, ureter and bladder (KUB) with prostate and MCC, post-voidal residual urine volume were done. Non contrast computed tomography (CT) scan of KUB, CT urogram, plain X-Ray KUB, intravenous urogram (IVU), retrograde urethrogram (RGU) and micturating cystourethrogram (MCU) were done in all indicated cases. Patients with uncomplicated, complicated and urosepsis were identified. After starting proper antibiotics 7 days latter urine microscopy was reviewed. Follow up of all UTI cases was done at 7^{th} day and 14^{th} day after starting antibiotics.

Operational Definitions

Urinary tract infection (UTI): UTI criteria were based on clinical symptoms and laboratory diagnosis, including dysuria with bacterial isolation of more than colony forming units 10^5cfu/m.

Urosepsis: Urosepsis was diagnosed as urinary tract infection with two or more clinical findings of systemic inflammation response syndrome (SIRS), including temperature >38.0°C or <36.0°C; heart rate >90/minute; respiration rate >20/minute or $PaCO^2$ <32 mmHg; leukocytosis (total WBC count) >12,000/mm^3, leukopenia (total WBC count) <4000/mm^3.

Relapse: Recurrent UTI with the same organism that has been cleared completely.

Recurrent Infection: Repeated infection with the same or different organism.

Uncomplicated UTI: Normal renal function in symptomatic UTI patient.

Complicated UTI (cUTI): Symptomatic urinary tract infection with functional and structural abnormalities of kidney.

3. RESULTS

This study was intended to assess different categories of UTI, causative organisms and their antibiotic sensitivity/resistance pattern with treatment

response. A total of 3000 patients with UTI were enrolled. The mean age of the study patients was 36.6 ± 16 years of them 1365 (45.5%) males and 1635 (54.5%) were females; female to male ratio (F:M ratio) was 1.2:1, 59% patients were married and 52.7% patients were from urban areas (Table- 1).

Table-1: Baseline characteristics of the study population (N=3000)

Characteristics		Frequency (n)	Percentage (%)
Sex	Male	1365	45.5
	Female	1635	54.5
Marital status	Married	1770	59
	Unmarried	1230	41
Residence	Rural	1419	47.3
	Urban	1581	52.7
Education	Primary	648	21.6
	Secondary	1428	47.6
	College & University	924	30.8
Socioeconomic status (Monthly income in BDT*)	Less than 20000	1827	60.9
	21000-40000	573	19.1
	More than 40000	600	20
Occupation	Housewife	1308	43.6
	Business	735	24.5
	Service	516	17.2
	Student	192	6.4
	Others	249	8.3

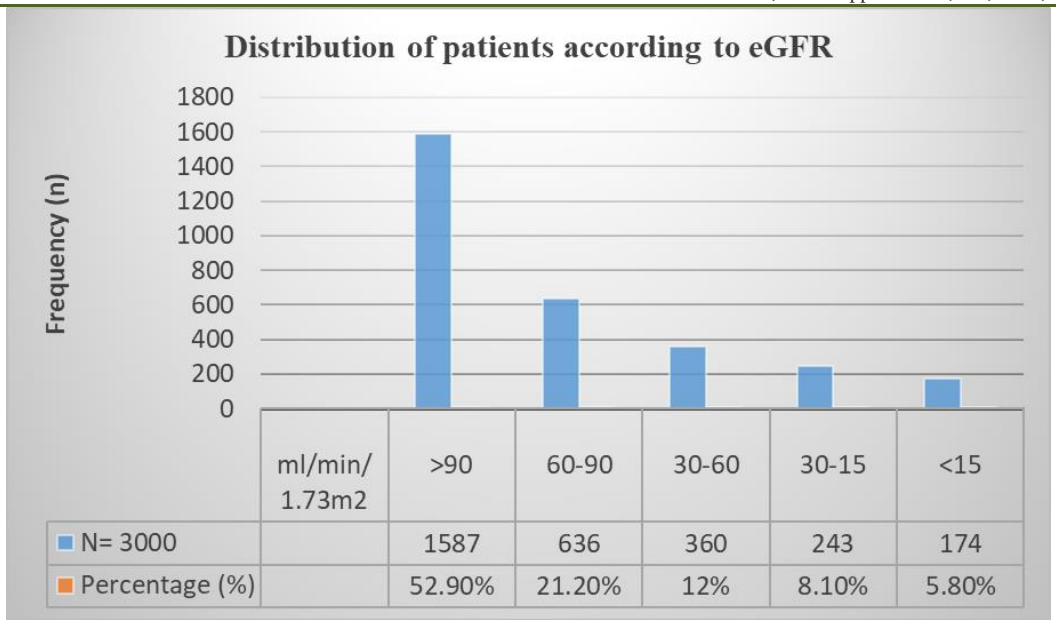
*BDT= Bangladeshi Taka (Bangladeshi currency)

Regarding clinical presentation; it was observed that, most of the UTI cases presented with dysuria (46.7%) along with fever and chill (26.7%), microscopic hematuria found in 40% cases, whereas gross hematuria was observed in 3.3% cases. Normal renal function was observed in 57.3% study patients, remaining showed different grades of renal impairment. Acute kidney injury (AKI) was detected in 20% cases, chronic kidney disease (CKD) was in 14% study patients, while AKI on CKD was in 8.7% cases (Table- 2).

Table- 2: Clinical presentations of UTI cases (N= 3000)

Clinical Features	Frequency (n)	Percentage (%)
Fever with Chills	800	26.7%
Dysuria	1400	46.7%
Microscopic hematuria	1200	40%
Gross hematuria	100	3.3%
Unilateral loin Pain	500	16.7%
Suprapubic pain	250	8.33%
Confusion	30	1%
Hypotension	310	10.33%
Raised blood pressure (BP)	750	25%
Normal renal function	1720	57.3%
Acute kidney injury (AKI)	600	20%
Chronic Kidney Disease (CKD)	420	14%
AKI on CKD	260	8.7%
Septicemia	60	2%
Ballotable kidney	30	1%

Distribution of patients according to estimated glomerular filtration rate (eGFR) revealed; 52.90% patient presented with estimated glomerular filtration rate (eGFR) >90 ml/min/1.73m^2/, 21.20% patient had eGFR 60-90 ml/min, 12% patient had eGFR 30-60 ml/min/1.73m^2, 8.10% patient had eGFR 30-15 ml/min/1.73m^2 and 5.80% patient had eGFR <15ml/min/1.73m^2 (Figure- 1).



[eGFR= Estimated glomerular filtration rate]
Figure- 1: Distribution of patients according to eGFR (N= 3000)

Patients with complicated urinary tract infection (cUTI), uncomplicated UTI and urosepsis were categorized accordingly. Uncomplicated UTI was observed in 27% study cases and complicated UTI was in 11% cases. Of these; upper UTI was 9% and lower was 29%, acute complicated cystitis 1%, acute uncomplicated cystitis 5%, asymptomatic bacterial UTI was 3%, emphysematous pyelonephritis was 1%, acute uncomplicated pyelonephritis was 5%, sterile pyuria was 4%, urosepsis was 2%, relapse UTI was 3% and recurrent UTI was 4% (Figure- 2).

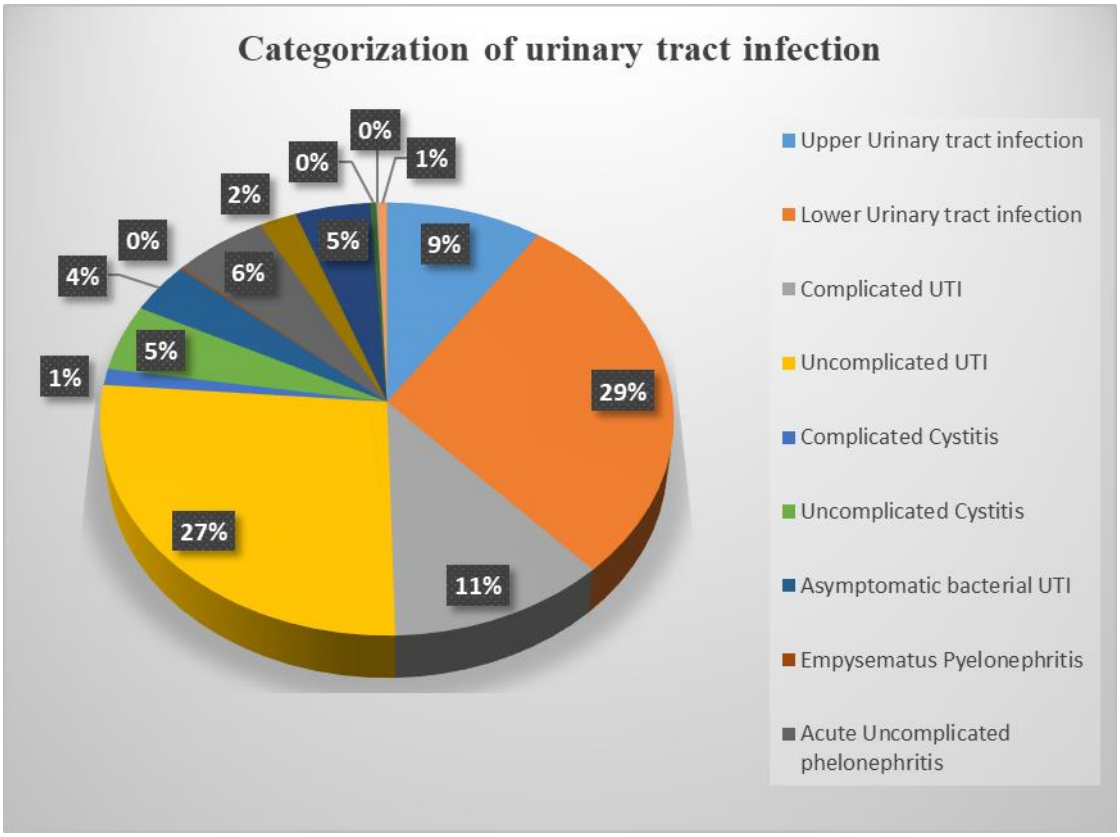


Figure- 2: Categorization of urinary tract infection (UTI) among study cases

Analyzing the biochemical parameters; 80.4% patients showed neutrophilic leukocytosis, raised C-reactive protein (CRP) was observed in 58.4% cases, impaired renal function was found in 42.7% cases, mild to moderate proteinuria (1+ to 2+ proteinuria) was found in 12.9% patients, while 6.6% patients had massive proteinuria (3+ proteinuria), pus cell in urine sample was found in 85.5% of the UTI cases and majority (83.3%) of the UTI patient's urine sample showed bacterial colony count $>10^5$ cfu/ml (Table- 3).

Table- 3: Biochemical parameters of the study population (N= 3000)

Investigation	Number of Patients (n)	Percentage (%)
Neutrophilic leukocytosis	2412	80.4%
Raised CRP	1752	58.4%
Raised serum creatinine	1280	42.7%
Thrombocytopenia	325	10.8%
Raised serum pro calcitonin	230	7.7%
Raised D-dimer	30	1%
Mild to moderate proteinuria (1+ to 2+)	387	12.9%
Massive proteinuria (+++)	201	6.6%
Urine for mucus thread	117	3.9%
Urine for pus cell		
05-10 /HPF	1221	40.7%
10-30 /HPF	940	31.4%
Plenty/HPF	400	13.4%
Bacterial colony count		
$10^2 – 10^3$ cfu/ml	200	6.7%
10^3- 10^4 cfu/ml	300	10%
$>10^5$ cfu/ml	2500	83.3%

In this study different obstructive features were observed among the study population as enlisted in Table- 4. Among the study population; 3.2% had adult poly-cystic kidney disease (ADPKD), 3% had horseshoe shaped kidney, 2.5 % had pelvic kidney, 2% had vasico-ureteric junction (VUJ) obstruction, 1.5% had pelvi-ureteric junction (PUJ) obstruction and 1% had stricture urethra (Table- 4)

Table- 4: Different obstructive features among the study population

Obstructive features	Frequency (n)	Percentage (%)
Stricture urethra	30	1%
Bladder neck hypertrophy	15	0.5%
VUJ obstruction	60	2%
PUJ obstruction	45	1.5%
Reflux nephropathy (unilateral or bilateral)	25	0.9%
Horseshoe shaped kidney	90	3%
Pelvic kidney	75	2.5%
Angiolipoma kidney	30	1%
Benign cyst	48	1.6%
Medullary sponge kidney	06	0.2%
Bladder diverticulum	18	0.6%
ADPKD	96	3.2%
Neurogenic bladder	20	0.69%
Hypoplastic kidney	15	0.5%
Unilateral renal agenesis	10	0.34%
Phimosis	8	0.2%
Renal cell carcinoma	10	0.34%
Bladder neoplasm	9	0.3%
Indwelling urinary catheter	25	0.83 %

We found a number of co-morbidities were associated with UTI. Of these; diabetes mellitus, glomerulonephritis (GN), steroid therapy, immunosuppressive medications were important co-morbidities as displayed in Table- 5.

Table- 5: Co- morbidities associated with UTI

Co- morbidities	Frequency (n)	Percentage (%)
Diabetes Mellitus (DM)	750	25%
Primary GN	180	6%
Secondary GN	120	4%
Chemotherapy	30	1%
Cancer	60	2%
Renal transplant recipient	20	0.67
Immunosuppressive medication	90	3%
Collagen vascular disease	160	5.3%
Steroid therapy	90	3%

In this current study, various complicating factors of UTI were noted that are illustrated in Table- 6. Among complicating factors diabetes mellitus was responsible in 25% cases others complicating factors include pregnancy, recent urinary tract instrumentation etc.

Table- 6: Complicating factors of UTI in this study

Complicating factors	Frequency (n)	Percentage %
Diabetes Mellitus (DM)	750	25%
Pregnancy	30	1%
Recent urinary tract instrumentation	120	4%
Nephrostomy tube	10	0.33%
Ureteric stent	60	2%
Urethroplasty	20	0.67%

Antibiotic sensitivity pattern for both gram-negative (Table- 7) and gram-positive bacteria (Table- 8) were observed accordingly. Among gram positive bacteria Staphylococcus. Enterococcus, Group-B Streptococci were common. Among gram-negative bacteria E. Coli, Pseudomonas, Klebsiella and Proteus were identified.

Table- 7: Antibiotic sensitivity pattern for gram-negative organisms

Antibiotics	E. Coli (%)	Klebsiella (%)	Pseudomonas (%)	Acinetobacter (%)	Proteus (%)	Enterobacter (%)
Meropenem	80	70	74	64	60	50
Co-trimmoxazole	30	20	54	62	20	60
Ceftraaxone	30	62	52	65.5	30	70
Ciprofloxacin	27.2	38.2	50	80	30	90
Netilmicin	72	76	50.5	70	60	62
Nitrofurantoin	30	30	50	76	70	92
Gentamicin	73	64	68	62	81	76
Colistin	85.5	81	60	78	80	50.7
Linezolid	36	25	65	62	30	50
Mecillinam	35.5	14.5	60	65	49	40
Aztreonam	27.2	10.5	50	70	30	90
Tigecycline	20	74	30	78	20	20
Tazobactum + Pipericillin	40.5	90	60	88	70	50.7
Cefaclor	8.1	25	65	64	30	50
Amoxicillin + Clavulenic Acid	35.5	14.5	60	60	49	40
Amikacin	80	20	30	64	20	70
Levofloxacin	72	63	60	72	68	62
Vancomycin	30	10	23	60	20	60
Fosfomycin	60	50	46.5	26	78	82
Ofloxacin	40.5	90	60	34	65	50.7

Table- 8: Antibiotic sensitivity pattern for gram-positive organisms

Antibiotics	Staphylococcus Aureus (%)	Enterococcus (%)	Staphylococcus Saprophyticus (%)	Group-B Staptococcus (%)
Meropenem	65	74	70	80
Co-trimoxazole	55.5	70	36	45
Vancomycin	84	82.5	65	66
Ceftriaxone	26	35	55	80
Ciprofloxacin	35	75	70	45
Aztreonam	39.5	60	66	64
Tigecycline	80	95	78	74
Netilmicin	65.5	12	22	55
Nitrofurantoin	76.5	24.2	66	66
Gentamicin	65	82	55	50
Colistin	65	80	84	33
Tazobactum + Pipericillin	78	55	68	67
Cefaclor	35	77	71	69
Amoxicillin + Clavulenic acid	68	86	82	78
Linezolid	92	70	76	47
Mecillinam	35	15.5	69	67
Amikacin	55.5	70.5	80	70
Fosfomycin	35	15.5	60	44
Ofloxacin	55.5	70.5	60	58
Cefepime	45	33	80	66
Cefuroxime	85	90	40	50
Cloxacillin	76.5	71	60	60
Cefuroxime + Clavulenic acid	82	81	60	70
Gentamycin	35	75	55	50
Emipenem	39.5	60	40	70
Etrapenem	80	95	30	80
Flucloxacillin	65.5	59	70	33

Antibiogram showed Colistin has highest degree of antibacterial sensitivity against E. Coli (80.5%), this organism is resistant to such antibiotic in minority of cases. Staphylococcus Aureus sensitive to Linezolid in 92% cases, Pseudomonas to imipenem in 85% cases. Klebsiella in 90% cases to tazobactum and pipercillin, Enterococci in 86% cases to Amoxicillin and Clavulanic Acid, Proteus in 70% cases to Meropenam, Staphylococcus Saprophyticus in 76% cases to Lenozolid, Group-B Streptococci in 80% cases to Meropenem (Table- 9).

Table- 9: Antibiotic in which bacteria showed high degree of sensitivity

Bacteria	Sensitive Antibiotic	Sensitive %	Resistant %
E. Coli	Colistin	85.5%	15.5%
Staphylococcus Aureus	Linezolid	92%	8%
Klebsiella	Tazobactum +Pipericillin	90%	10%
Enterococci	Amoxicillin +Clavulenic acid	86%	14%
Pseudomonas	Imipenem	85%	15%
Proteus	Meropenem	70%	30%
Staphylococcus Saprophyticus	Linezolid	76%	24%
Group-B Streptococci	Meropenem	80%	20%

E. Coli was detected as the major causative bacteria; 68% in uncomplicated cases and 48% complicated cases. Klebsiella was detected in 8% complicated UTI and 4% uncomplicated UTI. Among gram-positive bacteria Staphylococcus Aureus was detected 8% in uncomplicated cases and 12% of complicated cases (Table- 10).

Table- 10: Organism responsible for complicated and uncomplicated UTI

Organism responsible for UTI (Gram-negative)	Uncomplicated UTI	Complicated UTI
E. Coli	68 %	48%
Pseudomonas	6%	14%
Klebsiella	4%	8%
Proteus	4%	10%
Acinetobacter	1%	1.73%
Gram-positive bacteria	**Uncomplicated**	**Complicated**
Staphylococcus Aureus	8%	12%
Staphylococcus Saprophyticus	2%	3%
Group-B Streptococci	3.2%	2%
Enterococci	4%	4%
Candida	0%	3.33%

We observed the treatment responses up to 14 days from starting treatment. Treatment response was not uniform, this study showed 14 days treatment is superior to 7 days treatment (Table- 11).

Table- 11: Treatment response 7 days versus 14 days among the study cases

Category of infection	Patients (n)	7 days response number of patients	14 days response number of patients
Upper UTI	520	120	400
Lower UTI	800	510	290
Cystitis	400	120	280
Pyonephrosis	30	02	28
Renal abscess	10	01	09
Perinephric abscess	06	01	05
UTI in transplanted kidney	30	05	25
UTI in CAN* patient	20	05	15
Acute bacterial prostatitis	45	10	35

*CAN= Chronic allograft nephropathy

4. DISCUSSION

Urinary tract infection and urosepsis represent one of the most demanding problems in medicine. Previous studies have shown that the sepsis rate in patients with cUTIs ranges between 20.8 and 32.9% depending on various underlying conditions [9]. Recurrent urinary tract infection is a global community health problem. Treatment of complicated urinary tract infection is challenging for medicine specialist as well as nephrologist [10]. In this study we have seen the structural and functional abnormalities of kidneys that are responsible for complicated UTI. Posterior urethral valve, bladder neck hypertrophy, congenital reflux is the major etiology for recurrent UTI in children, about 20% [10]. On the other hand, diabetes mellitus (DM) and glomerulonephritis (GN) are the major burden for middle age people, among complicating factors related to recurrent urinary tract infection [9]. In middle age and elderly females; prolapse uterus, pelvic malignancy, renal stone are the main contributing factors [10]. In elderly male patients; enlarged prostate, urogenital malignancy, renal stone, vesico-ureteric reflux (VUR) obstruction are common that we have clarified in this study. Lower urinary tract infection is 30 times more common in women then man [9]. Half of the women experienced one or more infections during their life time [10]. Recurrent infection usually due to re-infection rather than relapse [11]. One quarter of women experienced a further infection within 6 months after initial urinary tract infection [10]. In this study Staphylococcus Aureus was sensitive to Linezolid (84%) and Meropenem (85%), Klebsiella in 90% UTI cases sensitive to Tazobactum + Pipericillin, Staphylococcus Saprophyticus sensitive to Linezolid around 76% UTI cases, Enterococcus was sensitive to Amoxicillin + Clavulanic Acid in 84% UTI. Most of the bacteria of Staphylococcus is sensitive to Linezolid, Vancomycin, Tezobactum and Pipercilin. Among gram-negative bacteria; E. Coli was sensitive to Carbapenem groups of antibiotics in 80% UTI; however, Klebsiella, Pseudomonas, Proteus were resistant some extend with these antibiotics. In this study, major co-morbidity associated with UTI was detected as diabetes mellitus (25%); but collagen vascular disease, cancer, glomerulonephritis (GN) could be considered in certain percentage of patients. Study in different population in different country has observed, E. Coli is the major etiology of UTI in complicated and uncomplicated cases [12, 13]. A study conducted in several centers found a higher rate of culture positivity in female patients compared to males [12]. It was reported that, the main resistant microorganisms found in urine cultures were E. Coli and Klebsiella with high profile [13]. Colistin, Gentamicin and Meropenem have highest sensitivity in

gram-negative bacterial urinary tract infection [13]. Vancomycin, Amoxicillin + Clavulenic Acid and meropenem have highest sensitivity in gram-positive bacterial urinary tract infection [13]. Considering the antibiotics sensitivity, they found that most of the gram-negative bacteria were susceptible in varying degrees to cefepime, carbapenems, aminoglycosides, and levofloxacin [13]. Complicated UTI are caused by wide spectrum of pathogens than uncomplicated UTI; E. Coli is the most common organism [12]. UTI are threat to community due to production of extended-spectrum beta-lactamase (ESBL)- producing bacteria. ESBL-producing bacteria are often resistant to aminoglycosides, sulfonamides, and quinolones [14]. A recent epidemiological study showed that, significant geographic variations in the frequency of UTIs in those with diabetes, with the rate being highest in developing countries (24%) compared with that in the US (12.9%) [15]and Europe19.6% [16]. In our study, incidence of urinary tract infection due to diabetes was 25%. Uncomplicated recurrent UTIs were also frequent in young women. After a first episode of a UTI, 27% of women have a confirmed recurrence within the next 6 months, and 2.7% have a second recurrence within the same period of time [17]. In this study we found relapse rate was 4%. Among afebrile patients with suspected UTI, treatment with ciprofloxacin or trimethoprim/sulfamethoxazole for 7 days was inferior to 14 days of treatment with regard to resolution of UTI symptoms by 14 days after antibiotic therapy [18]. In this study we have found that 14 days antibiotic treatment was better response than 7 days treatment.

5. CONCLUSION

Urinary tract infection (UTI) either complicated or uncomplicated is the major burden of the community. A number of co-morbidities and complicating factors are associated with UTI. E. Coli is the major causative bacteria followed by Staphylococcus aureus, Pseudomonas, Proteus, Klebsiella, Enterococci, Staphylococcus Saprophyticus, Group-B Streptococcus and others. In this study, Colistin has the highest degree of antibacterial sensitivity along with Linezolid, Tazobactum + Pipericillin, Amoxicillin + Clavulenic Acid, Imipenem and Meropenem to all forms of UTI. So early diagnosis and identification of resistant organism is mandatory, that can help the accurate treatment at proper time.

Limitations of the study

This study was done in only one Hospital, Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh. So, results from this study are only representative of this hospital and not a country representative finding. Urine culture and related investigations done in the different center so uniformity was not maintained. Categorization of urinary tract infection was not adequately classified because of vague presentation.

Conflicts of interest

All authors declared that there was no conflict of interest regarding this publication.

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