

Original Article

Clinical, Microbiological Profile and Antibiotics Use in Admitted Patients of Urinary Tract Infection

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Abstract

Urinary tract infections (UTI) can vary from simple cystitis to pyelonephritis with severe sepsis. The objective of this study is to provide information about the clinical and microbiological profile of admitted patients of urinary tract infection, patterns of organisms isolated, antibiotic sensitivity pattern and antibiotics use. It was a prospective observational study conducted on 40 patients age >14 years admitted with diagnosis of UTI based on clinical and microbiological criteria over 8 months at a tertiary care hospital in North India. Data was collected for the clinical, microbiological profile, empirical and definite antibiotics use with duration of stay and outcome of patients. Among 40 cases of UTI; male to female ratio was 1:1 with mean age of 51.3± 16.32 years. Fever was present in almost all (97.5%) of the patients and three-fourth (75%) of them had dysuria. Type-2 Diabetes Mellitus was most common (55%) underlying condition and mean HbA1c was 9.37±2.27 followed by obstructive uropathy (17.50%). Most of cases (82.5%) were of complicated UTI; where Pyelonephritis was 42%, Emphysematous Pyelonephritis

12.5% and Renal Abscess 7.5%. Most common (37.5%) organism isolated from urinal pus culture was *Escherichia coli*. More than half of the patients (55%) were given empirical antibiotics injection piperacillin tazobactam and carbapenems was used in more than one third (35%) of patients. The mean duration of antibiotics use was 14.55±4.94 days. Two (5.0%) patients expired out during the study period. Uncontrolled Diabetes Mellitus remains the major underlying condition in cases of complicated UTI. *E coli* is the most common organism isolated from urinal pus culture. Most of the patients had favourable outcome with guided antibiotics and interventions.

Keywords: Urinary tract infection, e-coil, uncontrolled diabetes mellitus

INTRODUCTION

Urinary tract infections remains one of the most common bacterial infections in both the community and, in admitted patients.¹ Clinical manifestations may vary from simple cystitis to severe illness like pyelonephritis and severe sepsis. It is broadly classified into uncomplicated and complicated UTI based on underlying structural or neurogenic abnormalities and various immuno-compromised states.²⁻⁵ Most common pathogens causing urinary tract infections are Enterobacteriaceae group like *Escherichia Coli*, *Klebsiella pneumoniae*, *Proteus mirabilis*, *Pseudomonas aeruginosa*, *Staphylococcus saprophyticus*. Organisms causing infection also differs in cases of uncomplicated and complicated UTI. Although *E. coli* and, other gram-negative organisms remain common causes in complicated UTI pyelonephritis and urosepsis also but percentage of other organisms like *Acinetobacter* spp, *enterococcus* spp, fungi, *Citrobacter* species is significant.⁶ In study by Gharbi M et al in 312,896 UTI episodes patients with deferred antibiotics had higher rates of admissions and mortality as compared to those with immediate antibiotic group. These findings were more common in elderly.⁷ With ever growing resistance to antimicrobials being described; there is the need for the treating physicians to scrutinize local antimicrobial resistance patterns in order to adequately direct empirical and definitive management. Hence the present study will give us the information about the clinical and microbiological profile of patients of both uncomplicated and complicated urinary tract infection, antibiotic sensitivity patterns in urine culture and usage of antibiotics in these patients.

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MATERIAL AND METHODS

It was a prospective observational study undertaken at a tertiary care centre in North India Patients aged >14 years old who were admitted in the internal medicine ward of our institute with clinical, microbiological diagnosis of urinary tract infection and willing to give consent were included in this study. It was conducted over a period over 8 months. Diagnosis of urinary tract infection was based on the clinical symptoms of dysuria, fever, lower pain abdomen, increased frequency of micturition and flank pain with microbiological evidence of UTI which included presence of pus cells in urine or isolation of organism from urine culture with colony count of $>10^5$ cfu/ml. Ultrasound abdomen was done in all patients. Computed tomography was done as per clinical condition and decision of the treating team. Other investigations like complete blood counts, biochemistry panel, blood gas analysis, blood cultures, and serum procalcitonin were done in all cases. Fungal markers like beta D glucan and galactomannan test were done as per the clinical status of patient. Ethical clearance was taken from Institutes ethics committee before conducting the study. Participants were further classified into following three groups: 1. Complicated UTI- Complicated urinary tract infections (cUTIs) being defined as those occurring in patients with anatomic or functional abnormalities of the urinary tract or in those with significant medical or surgical comorbidities; 2. Uncomplicated UTI- Uncomplicated UTI is defined as individuals with UTI who are otherwise healthy and without any structural or neurological urinary tract abnormality that predisposes them to infection and 3. Catheter Associated UTI (CAUTI)- Catheter associated urinary tract infection is defined as the new appearance of bacteriuria or funguria with a count of more than 10^3 CFUs/mL occurring in person whose urinary tract is currently catheterized or has been catheterized within the past 48 hrs. Data was recorded on prescribed case record proforma for demographic details, baseline laboratory values, radiology, urine routine examination, urine and blood culture patterns, empirical and definitive antibiotics use, duration of hospital stay in hospital and outcomes.

RESULTS

Statistical Analysis: Data was captured and presented in the form of numbers and percentages. Quantitative data was presented as mean \pm SD, minimum and maximum variables were also calculated.

Table I shows the distribution of demographic details, clinical and laboratory parameters of patients as follows- Demographic details: A total of 40 patients with diagnosis of UTI based on clinical, microbiological defined criteria were included in the study. Male and female were equally distributed and the ratio was 20:20. Mean age of patients was 51.3 ± 16.32 years.

Table- I: Demographic details, clinical and laboratory parameters of patients (n= 40)

S No.	Parameter	Value	Percentage
1.	Male : Female	20:20	
2.	Mean age (yrs)	51.3 \pm 16.37	
3.	Fever	39/40	97.5%
4.	Dysuria	30/40	75%
5.	Increased frequency	20/40	50%
6.	Vomiting	13/40	32.5%
7.	Pain abdomen	21/40	52.5%
8.	Altered sensorium	10/40	25%
9.	Oliguria/ anuria	14/40	35%
10.	Type 2 diabetes mellitus	22/40	52.5%
11.	SBP (mm of Hg)	116 \pm 16.5	
12.	DBP (mm of Hg)	71.85 \pm 8.6	
13.	Pulse (per min)	92.04 \pm 12.9	
14.	Temperature (F)	101 \pm 0.77	
15.	Haemoglobin (g /dL)	9.6 \pm 2.09	
16.	Total leucocyte count (per cm ³)	15045.5 \pm 4909.15	
17.	Platelet count (per cm ³)	256625.2 \pm 143014.8	
18.	Sodium (meq / L)	132.2 \pm 8.4	
19.	Potassium (meq /L)	4.42 \pm 0.88	
20.	Blood urea mg %	95.1 \pm 77.69	
21.	Serum creatinine mg%	3.36 \pm 3.02	
22.	Mean Hba1c(In T2DM patients)	9.37 \pm 2.27	

Clinical details: The symptoms of fever were presented in (39/40) 97.5 % of patients during admission, dysuria in (30/40) 75 %; where, pain abdomen and increased frequency of urination were found in 52.5 % and 50 % cases respectively. Other symptoms were vomiting in 32.5 %, decreased urine output in 35%, and altered sensorium in 25%, haematuria in 3 cases (7.5%) pyuria in 3 cases (7.5%). Mean duration of symptoms was 17.85 ± 17.6 days. Mean duration of stay was 13.62 ± 9.18 days. Most common underlying condition was Type 2 Diabetes Mellitus in 22 cases (52.5%), obstructive uropathy in 7 cases and renal stone disease in 3 cases and catheterisation in 2 cases. Mean HbA1c among diabetics was 9.37 ± 2.27 . Out of the 40 cases of UTI; 33 were complicated UTI, 3 were uncomplicated UTI, 2 were catheter associated UTI, 1 prostatic abscess, 1 epididymo-orchitis. Among complicated UTI; pyelonephritis constituted 13, 5 cases of emphysematous pyelonephritis, 7 cases of renal abscess and 8 cases of hydronephrosis.

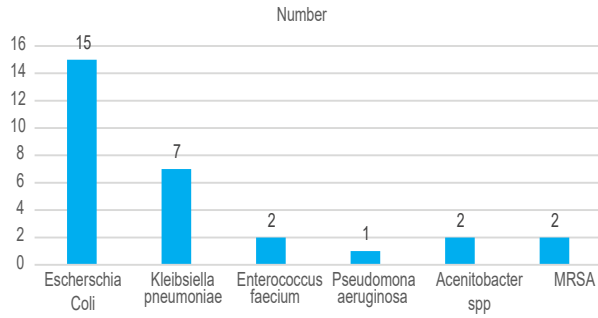


Figure- 1: Organisms isolated from the urine and aspirated pus culture

Figure 1 illustrates the distribution of organisms isolated from the urine and aspirated pus culture. Urine and aspirated pus culture showed growth of organism in 26 (65%) out of 40 cases. There were 14 patients had growth in urine and 12 cases out of 14 patients who underwent single time aspiration of pus or pigtail drainage; had growth of organism. Escherichia coli was identified in 15, Klebsiella pneumoniae in 7, Enterococcus faecium in 2, Pseudomonas aeruginosa in 1, Acinetobacter spp in 2 and Methicillin Resistant staphylococcus aureus in 2 cases. Among the cases 3 patients had growth of more than 1 organism on aspirated pus culture. All patients underwent ultrasound abdomen and showed abnormality in 30 cases. Blood culture showed growth of organism in 2 patients.

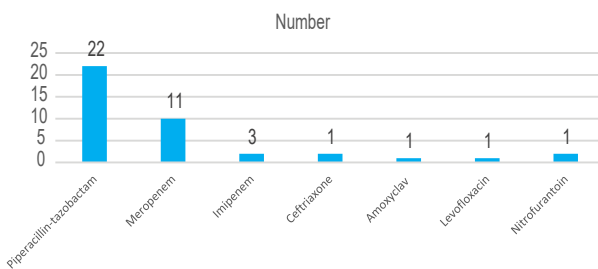


Figure- 2: Empirical antibiotics at the time of admission in patients of UTI

Figure 2 states the distribution of empirical antibiotics at the time of admission in patients of UTI; here piperacillin tazobactam was given in 22 cases (55%) followed by meropenem 11 (27.5%), imipenem in 3 (7.5%) followed by ceftriaxone, amoxycillin clavulanic acid, levofloxacin and nitrofurantoin.

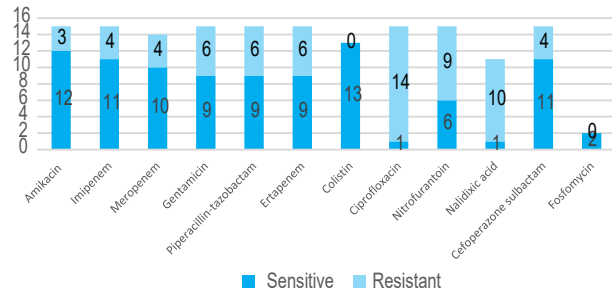


Figure- 3: Antibiotic susceptibility pattern of E. coli for commonly used antibiotics in UTI

Figure 3 contains the distribution of antibiotic susceptibility pattern of E. coli for commonly used antibiotics in UTI; here among the antimicrobial sensitivity pattern of Escherichia Coli; it was found to be sensitive to the most of the drugs used in complicated UTI including carbapenem grp like imipenem, meropenem; aminoglycosides like amikacin, gentamicin; beta lactam antibiotics like piperacillin tazobactam, cefoperazone- sulbactam and colistin. It was found to be resistant to ciprofloxacin, nalidixic acid in more than 90% cases. Antimicrobial susceptibility pattern of Klebsiella pneumoniae isolated in our study was not as consistent as E coli.

Antibiotics: Decision to switch antibiotics was taken based on the urine culture report or clinical condition of the patient. Piperacillin tazobactam was continued in 10 (25 %) patients, carbapenems were continued in 8 (20%) patients as patients had clinical response or culture suggestive of sensitive organisms. Injection Piperacillin tazobactam was used in dose of 4.5 gm iv TID. Injection meropenem was used in dose of 1 gm iv TID and Injection imipenem was used in dose of 1 gm iv TID. Renal modification of the drugs was done as per the eGFR. One patient had radiological evidence of fungal pathology; she was given amphotericin B for total dose of 2 gm and she responded. Switch over of antibiotics was done from piperacillin tazobactam to carbapenems in 8 (25 %) patients and to aminoglycosides in 2 (5%) patients. In rest of patients; antibiotics were upgraded based on the clinical and radiological evidence of the disease progression as per unit’s policy. 6 (15%) patients required multiple antibiotics ≥ 3 (like piperacillin-tazobactam, carbapenems and colitis) based on the clinical symptoms, urine culture, blood culture and radiological investigations.

Hospital course and outcomes: 14 patients had undergone aspiration of the collection with pigtail insertion or single time aspiration. Seven patients underwent haemodialysis as per the protocol for kidney

injury. Total duration of antibiotics was 14.55 ± 4.94 days; which was same as per guidelines of treatment of complicated UTI. Two patients expired out of 40 (5%).

DISCUSSION

Urinary tract infections are one of the frequent infections to occur in communities and health care settings. They are divided based on- (i) site of infection as upper UTIs like pyelonephritis and lower UTIs like cystitis, prostatitis and (ii) depending upon underlying conditions and functional or anatomical abnormalities; uncomplicated or complicated UTI. Proper knowledge and recognition of these clinical syndromes will lead to appropriate antibiotics; which can ward off fatal complications and antibiotic misuse. Excessive and needless use of the antimicrobial agents is one of the main causes of antimicrobial resistance. It is one of the major public health issues encountered worldwide. Infections due to resistant microorganisms do not respond to antibiotics because of the limited therapeutic choices; which results in extended period of sickness and higher risk of death. Failure of treatment also leads to lengthier days of infectivity. It can result in increased numbers of infected people in the society. It leads to exposure of general public to the resistant strain of microorganisms.

Most common underlying risk factor for complicated UTI in our study was Type 2 Diabetes mellitus which goes in agreement with previous studies.^{3,8} Like the previous studies in UTI; *Escherichia coli* was the most common organism isolated (57.7%) in our study followed by *Klebsiella pneumoniae*, as per the last annual report of antimicrobial resistance research and surveillance network from January 2020 to December 2020 across India; Enterobacteriaceae constitutes 75.7 % of the isolates from urine culture.^{9,10} *E coli* is followed by *Klebsiella pneumoniae*, *Pseudomonas aeruginosa*, *Acinetobacter baumannii*, *Staphylococcus aureus*, *Enterococcus spp* and *Proteus mirabilis*.

Majority of the antibiotic use in our study was as per the Institute and local guidelines for antibiotic use in common syndromes.¹¹ Most of the patients (80%) in our study were of complicated UTI with 67.5 % patients with kidney injury. All of them were started on either intravenous piperacillin tazobactam or carbapenem; recommended as per the hospital guidelines and other guidelines. As most of the cases in our study were of complicated UTI; duration of antibiotics was 14.55 ± 4.94 days. In patients with complicated UTI like renal abscess, emphysematous

pyelonephritis and obstructive uropathy; interventions along with antibiotics play major role in treatment outcomes.

In our study sensitivity pattern of *E coli* for commonly antibiotics was good, fosfomycin (100%), amikacin (80%), imipenem (73%), meropenem (71%), ertapenem (60%), piperacillin tazobactam (60%). ARRS network from India showed similar findings with good susceptibility to meropenem (77%), amikacin (77%), imipenem (73%) and ertapenem (72%), followed by nitrofurantoin (68%) and piperacillin-tazobactam (63%).¹⁰

Effective AMSP succeeds through a multidisciplinary style encompassing a variety of experts like hospital administration, microbiologist, pharmacologist, pharmacist, internist, infectious disease specialist and nursing staff.¹¹

Appropriate antibiotic use and escalation and de-escalation reduces the hospital stay, costs and may improve outcomes in patients of complicated UTI.^{12,13} Study by Spoorenberg V et al showed proper antibiotic use in patients with a complicated UTI seems to reduce the length of hospital stay by more than 2 days and therefore favors patient outcome and healthcare costs.^{12,13}

CONCLUSION

Uncontrolled Diabetes Mellitus and obstructive uropathy remains the most common causes of complicated UTI. *Escherichia coli* is the most common organism isolated from urine/pus culture. Majority of the patients received appropriate empirical and definite antibiotics therapy. Majority of patients (95%) had favourable outcome.

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