

ORIGINAL ARTICLE

Urinary Tract Infection in Elderly: Clinical Profile and Outcome

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Objective: Urinary tract infection (UTI) being the most common bacterial infection with considerable morbidity and mortality especially in hospitalized geriatric patients, this study was designed to assess clinical profile, predisposing factors, uropathogen profile causing UTI and to identify associated factors responsible for mortality.

Methods: Prospective observational study was undertaken among elderly patients aged ≥ 60 years in a tertiary care hospital. 95 indoor patients from medicine wards having symptoms of UTI and urine culture showing significant growth were included in the study. Demographic profile, clinical features, predisposing factors, laboratory features, urine culture reports, antimicrobial susceptibility patterns and outcome were noted and analysed.

Results: Of the 95 patients studied, 55.78% were males. 50.52% patients were in age group of 61 to 70 year. Frequency of micturition was the major symptom. Diabetes mellitus was the most common predisposing factor associated with UTI seen in (46.31%) patients. Gram negative organism accounted for 88(92.63%) of bacterial isolates, with *Escherichia coli* seen in 47.36% of cases. Non-*E.coli* gram negative organisms such as *Pseudomonas*, *Klebsiella* showed lower sensitivity to Levofloxacin, Piperacillin + Tazobactam, Amikacin and Ceftazidime. Mortality rate was 17.89%. Significantly higher mortality was seen in patients with diabetes mellitus ($p < 0.0001$), complicated UTI ($p < 0.001$), dementia ($p < 0.0001$), serum creatinine > 1.4 mg/dl ($p < 0.0001$) and increasing number of predisposing factors. Fatality was not associated with use of urethral catheters and increased leucocyte count.

Conclusion: Diabetes mellitus, dementia increases risk of mortality in elderly UTI patients. As gram negative isolates shows drug resistance, prompt diagnosis and the right choice of antimicrobials can play a key role in reducing mortality in elderly UTI patients.

However, there is not much information pertaining to various aspects of UTI in the elderly in India and hence this study was done to find out the present clinical profile, predisposing factors, uropathogen profile causing UTI and outcome of UTI in our center.

Methodology

This was a prospective, observational study done in the department of Medicine and Microbiology at KEM hospital, Mumbai conducted over a period of one year. After obtaining approval from Institutional ethics committee and written informed consent from participants, 95 indoor patients from medicine wards of age 60 years and above having symptoms of UTI and urine culture showing significant growth were included in the study. Patients with negative urine culture, not willing to participate in the study were excluded. Data including age, sex, occupation, predisposing factors and clinical profile was taken using detailed history of symptoms like fever with chills, urgency, dysuria, pyuria, hematuria, frequency, backache, pain in abdomen, loin tenderness, altered sensorium and clinical examination was done. Patients were observed with respect to anatomical location of infection site, uncomplicated UTI manifesting as cystitis, complicated UTI in individuals with functional or structural abnormalities of the genitourinary tract, causative organism and susceptibility to various antibiotics till estimated outcome either discharge or death.

The laboratory tests included complete blood picture, renal and liver function test and urine microscopy including culture/sensitivity, Ultrasonography Kidney

Introduction

Elderly population comprises a subset of population, more vulnerable to urinary tract infection; both in community and long term care facilities. High risk may be attributable to differing characteristics such as anatomical and hormonal changes, presence of comorbidities such as neurological and urological abnormalities, diabetes mellitus and prolonged indwelling catheter use in hospitals and long term care facilities.^{1,2}

A considerable difference from typical clinical presentation of UTI marked by absent or reduced fever, change in mental status and nonspecific symptoms such as anorexia and

increased lethargy is seen in elderly population.³

Management of UTI in elderly is complicated by increased prevalence of asymptomatic bacteriuria, presence of benign urinary symptoms, atypical clinical presentation and underlying cognitive impairment, limitation of use of urine culture in diagnosis of symptomatic infection, increasing resistance to antibiotics among uropathogens with geographical variation and parallel increase in financial burden in UTI care.^{1,4}

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Table 1: Frequency of symptoms/signs of UTI (n=95)

Symptom/Sign	Number of patients	Percentage
Frequency of micturition	62	65.26%
Urgency	59	62.10%
Dysuria	59	62.10%
Fever	43	45.26%
Pain in abdomen	33	34.73%
Loin tenderness	18	18.94%
Altered sensorium	17	17.89%
Hematuria	15	15.78%
Backache	15	15.78%
Pyuria	13	13.68%

Table 2: Association of predisposing factors with UTI (n=95)

Predisposing factor	Number of patients	Percentage
Diabetes Mellitus	44	46.31%
Benign prostatic hyperplasia (Male=53)	22	41.50%
Cystocele (Female=42)	13	30.95%
Urinary calculus disease	24	25.26%
Cerebrovascular accident	21	22.10%
Catheter associated	14	14.73%
Alzheimer disease/ Dementia	11	11.57%
Obstructive uropathy	9	9.47%
Urogenital procedures	5	5.26%
Spinal cord disease	1	1.05%

Ureter Bladder (KUB), Computerised Tomography KUB if required.

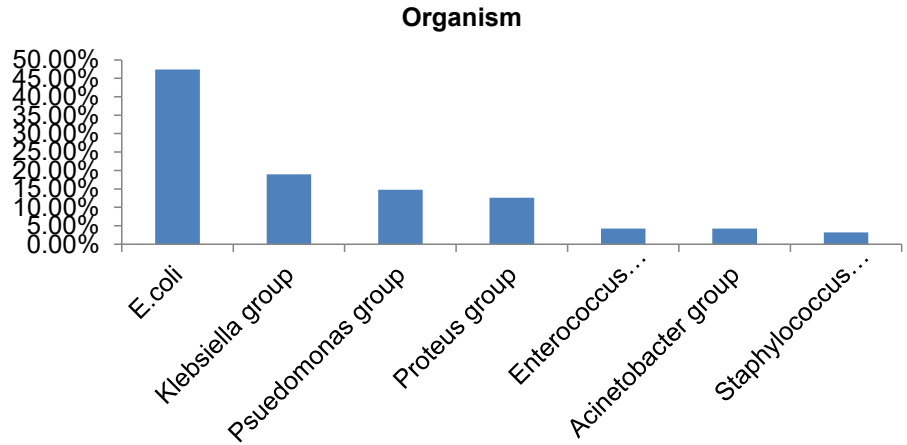
Descriptive and inferential statistical methods were used. Data were analysed using Microsoft excel 2013. A probability of <0.05 was accepted as significant.

Results

Among study population, 50.52% patients were in age group of 61 to 70 year, 37.89% were in 71 to 80 year group and 11.57% patients were above age of 80 years. Male and female formed 55.78% and 44.21% of study population respectively. Male to female ratio being 1.3:1, 1.25:1, 1.2:1 among age group of 61 to 70 years, 71 to 80 years and age more than 80 years respectively.

In our study population, frequency of micturition was seen in (65.26%) patients followed by urgency (62.10%) and dysuria (62.10%). Fever was present 45.26% of study population (Table 1).

Diabetes mellitus was predisposing factor associated with UTI seen in (46.31%) patients followed by Benign Prostatic Hyperplasia (41.50%) among males and Cystocele (30.95%) among females (Table 2).

**Fig. 1: Organisms isolated from urine cultures (n=95)****Table 3: Comparison of antimicrobial susceptibility**

Antimicrobial	Organisms			
	E. coli (n=45)	Klebsiella(n=18)	Pseudomonas (n=14)	Proteus (n=12)
Imipenem	44 (97.77%)	15 (83.33%)	12 (85.71%)	11 (91.66%)
Meropenem	40 (88.88%)	14 (77.77%)	11 (78.57%)	11 (91.66%)
Piperacillin-Tazobactam	37 (82.22%)	12 (66.66%)	8 (57.14%)	10 (83.33%)
Levofloxacin	34 (75.55%)	13 (72.22%)	9 (64.28%)	10 (83.33%)
Amikacin	30 (66.66%)	11 (61.11%)	5 (35.71%)	8 (66.66%)
Nitrofurantoin	27 (60%)	8 (44.44%)	ND	8 (66.66%)
Ofloxacin	18 (40%)	6 (33.33%)	ND	6 (50%)
Gentamicin	15 (33.33%)	8 (44.44%)	ND	8 (66.66%)
Piperacillin	14 (31.11%)	4 (22.22%)	ND	6 (50%)
Tetracycline	11 (24.44%)	7 (38.88%)	ND	5 (41.66%)
Ciprofloxacin	9 (20%)	4 (22.22%)	ND	5 (41.66%)
Ceftazidime	7 (15.55%)	4 (22.22%)	6 (42.85%)	6 (50%)
Ceftriaxone	7 (15.55%)	4 (22.22%)	ND	5 (41.66%)
Co-trimoxazole	6 (13.33%)	-	ND	ND
Cefotaxime	5 (11.11%)	2 (11.11%)	ND	3 (25%)
Azithromycin	ND	ND	3 (21.42%)	5 (41.66%)

ND- Not done

Urine culture showed growth of gram negative organism in 88(92.63%) patients and gram positive organism in 7(7.36%) patients.

E.coli was isolated from urine culture in (47.36%) patients followed by Klebsiella group (18.94%) followed by Pseudomonas group (14.73%) (Figure 1).

E.coli isolates were sensitive to Imipenem (97.77%) followed by Meropenem (88.88%) followed by Piperacilin+Tazobactam (82.22%) (Table 3).

Klebsiella group isolates were sensitive to Imipenem (83.33%) followed by Meropenem (77.77%) followed by Levofloxacin (72.22%) (Table 3).

Pseudomonas group isolates were sensitive to Imipenem(85.71%) followed by Meropenem (78.57%) followed by

Levofloxacin (64.28%).

Proteus group isolates were sensitive to Imipenem(91.66%) and Meropenem (91.66%) followed by Levofloxacin (83.33%) (Table 3).

Organisms were least susceptible to cefotaxime followed by ceftriaxone.

Death occurred in 17(17.89%) patients and 78(82.10%) patients from study population were discharged.

17(17.89%) of the 95 patients with UTI died during hospitalization (Table 4). There was no significant difference in mortality between men and women and in different age groups. Significantly higher mortality was seen in patients with diabetes mellitus compared with patients without diabetes mellitus (36.36% versus 1.96%; $p < 0.0001$). Complicated UTI patients had higher mortality compared with uncomplicated UTI

Table 4: Comparison of outcome of UTI by patient characteristics and laboratory data

Characteristic	(Number of deaths/ Number of patients)	Mortality (%)	Level of significance
Diabetes mellitus			
Yes	16/44	36.36	<0.0001
No	1/51	1.96	
Type of UTI			
Complicated	13/45	28.88	<0.001
Uncomplicated	4/50	8	
Cognitive status			
Dementia	14/35	40	<0.0001
Reserved	3/60	5	
Renal function			
Serum Creatinine			
>1.4 mg/dl	14/55	25.45	<0.0001
<1.4 mg/dl	3/40	7.5	
Number of predisposing factors			
0-1	4/42	9.52	<0.001
2-3	8/38	21.05	
3+	5/15	33.33	Vs. 0-1: 0.015 Vs. 2-3: 0.001
Use of urethral catheters			
Present	2/14	14.28	0.457
Absent	15/68	22.05	
Leucocyte count			
≥ 11,000 cells/dl	13/70	18.57	0.296
<11,000 cells/dl	4/25	16	

(28.88% versus 8%; $p < 0.001$). Mortality was also higher among patients having dementia compared with patients having reserved cognitive status (40% versus 5%; $p < 0.0001$). Compromised renal function with serum creatinine >1.4 mg/dl was significantly associated with mortality: 25.45% (14/55) of these patients died compared to 7.5% (3/40) in patients with preserved renal function ($p < 0.0001$). Mortality was significantly related to the number of predisposing factors, with mortality rates of 9.52% (4/42) in patients with 0-1 predisposing factor, 21.05% (8/38) in those with 2-3 factors and 33.33% (5/15) in those with three and more predisposing factors (Table 4).

Mortality was not significantly related to the use of urethral catheters, with mortality rates of 14.28% in patients with urethral catheters compared with those 22.05% patients not having urethral catheters. Also, there was no significantly higher incidence of death in patients with neutrophilia (leucocyte count $\geq 11,000$ cells/dl), compared to patients with normal leucocyte count (18.57% compared to 16%) (Table 4).

Discussion

UTI is an important cause of morbidity and sepsis in elderly patients having a spectrum varying from benign cystitis to potentially life threatening

pyelonephritis.^{5,6} We observed total 95 patients aged ≥ 60 years suffering from UTI. There was no considerable difference found in gender distribution or mean age of presentation which was 70.54 ± 6.27 years in our study compared to previous studies.

In our study, lower urinary tract symptoms were more common with frequency of micturition being the most common symptom followed by urgency, dysuria which may be attributed to more number of cases suffering from diabetes mellitus and obstructive uropathy in our study population. In study conducted by Mahesh E et al. fever was the most common symptom followed by dysuria.⁷ Blunted fever response might be in part because of a lower basal body temperature in elderly.⁸

Altered sensorium, an atypical symptom in general population, was found in 17.89% of our study population which was not evaluated in earlier studies. As typical features such as fever and leucocytosis can be absent in elderly population, a subtle clue to underlying UTI may be change or a decline in mental status.⁹

Diabetes mellitus was the most common predisposing factor in this study found in 46.31% cases followed by benign prostatic hyperplasia in male patients and cystocele in female

patients. Bacteriuria is more common in diabetics than in non-diabetics due to a combination of host and local risk factors.¹⁰ Longer duration and greater severity of diabetes significantly increases chances of occurrence of UTI by causing neutrophil dysfunction, diapedesis and phagocytosis.¹¹ However prevalence of dementia and urinary catheterization was higher in study by Tal S et al. which could be attributed to high mean age at presentation.¹² In study conducted by Ibak G et al., urogenital procedures was most common predisposing factor followed by Diabetes Mellitus.¹³

In our study, there is striking resemblance in pathogenic organisms with other studies; gram negative organisms were primarily etiological organisms causing UTI in 92.63% patients and *E. coli* being the most common isolate (47.36%) in urine culture as it's a commensal found in gastrointestinal and genitourinary tract followed by *Klebsiella* species, *Pseudomonas*, *Proteus*, *Enterococcus faecalis*, *Acinetobacter* group. *Staphylococcus aureus* was the least common isolated pathogen which was in contrast to a Nigerian study.¹⁴ As *staphylococcus aureus* has a status of common contaminant, it can produce a diagnostic dilemma among practitioners, undertreatment of which can lead to life-threatening staphylococcal bacteremia.¹⁵

We evaluated sensitivity pattern to various antibiotics including penicillins, cephalosporins, quinolones, aminoglycosides and others. In our study, *E. coli* isolates were highly sensitive to carbapenems like Imipenem and meropenem though studies done in catheter-associated UTI showed production of carbapenemases making even these drugs ineffective.¹⁶ *E. coli* isolates were least sensitive to third generation cephalosporin Cefotaxime thus showing trend towards resistance to higher antibiotics. Study done by Ramaprasad AV, et al in India showed effectiveness of quinolones like ciprofloxacin against *E. coli* which was in contrast to our study thus pointing towards emergence of drug resistance except levofloxacin which showed some promising results.¹⁷

Another important finding in this study was non-*E. coli* gram negative organisms such as *Pseudomonas*, *Klebsiella* showed lower sensitivity to

Levofloxacin, Piperacillin + Tazobactam, Amikacin and Ceftazidime showing trend towards resistance to higher antibiotics compared to other studies.¹⁸ Irrational and inappropriate use of antibiotics for prophylaxis as well as treatment, excessive use of indwelling urinary catheters, nosocomial sources of infections might be responsible for emergence of drug resistant organisms. Thus more aggressive and rational antibiotic therapy must be considered in these patients.

In our study, outcome of UTI was assessed by considering patient discharged or death.

This prospective, observational study in 95 elderly patients revealed low mortality rate (17.89%) which was similar to study done by Ackerman which included bacteremic UTI patients over 65 years.¹⁹ This can be explained by the use of early empirical antibiotic therapy with carbapenem group. But mortality was higher in febrile patients compared to afebrile patients which was in accordance to study by Tal S et al.¹² There was no significant difference in outcome of UTI among different age groups and gender.

In our study, statistically important risk factors for mortality include presence of diabetes mellitus and complicated UTIs. Hyperglycaemia, impaired immune system, autonomic neuropathy leading to incomplete bladder emptying, drug resistant organisms can predispose to UTI. Complicated UTIs in diabetics include renal and perirenal abscess, emphysematous pyelonephritis, emphysematous cystitis, fungal infections, and papillary necrosis.²⁰

Early diagnosis, prompt therapy, regular monitoring of blood sugar levels are key factors for improved outcomes in these patients.

Another important determinant for higher mortality in our study was altered sensorium and dementia. These factors can lead to impaired mobility and urinary incontinence leading to UTI. Though we have not compared patient's baseline mental status before admissions, these factors can be attributed to poor physical health resulting in mortality. Clinically quantifiable factor such as severe coma may be considered as an independent predictor of mortality.²¹

In our study, higher mortality was

seen in patients with serum creatinine > 1.4 mg/dl which was in contrast to previous studies.¹² UTI may cause sepsis or septic shock in elderly patients, so treating physicians should give utmost attention to these patients.

Also, there are higher chances of mortality if number of predisposing factors increases.

In contrast to previous studies, there was no evidence that use of indwelling catheters is a risk factor for mortality. Possible explanation could be lower mean age of our study population, transient use of catheters for urinary output monitoring may not influence clinical course if concomitant factors such as cerebrovascular accident or urosepsis are absent. Judicious use of indwelling catheters can reduce length of hospital stay, investigations, resistant pathogens, medicinal costs and thus morbidity and mortality.

Outcome of patients of UTI based on leucocyte counts which is a criteria for sepsis and presence of upper UTI showed no significant difference which was not in accordance with previous studies.^{12,22} But severe upper UTI can lead to acute kidney injury thus prolonging hospital stay and further complications.²²

Less statistical power due to small study population, single center study, non-generalizable results, small duration, non-assessment of source of UTI whether community or hospital acquired were the limitations of our study. Patients with partially treated UTI, those with symptoms of UTI but no growth on urine culture, urine cultures showing fungal growth were not included in the study. Further studies are required to evaluate these factors.

The strengths of the study were the prospective design, attempt to standardize evaluation and management of UTI, the high performance of processes of care such as blood culture collection or early antimicrobial administration and evaluation of outcome based on comorbidities.

In conclusion, this study focused on epidemiology, risk factors, clinical features and especially on outcome of UTI in elderly patients. We suggest more appropriate antibiotic therapy particularly in non-E.coli UTI after culture and sensitivity tests. Diabetes

mellitus continues to be an important determinant of mortality along with altered mental status and dementia. Thus, early diagnosis of UTI and aggressive therapy are critical to reduce overall mortality.

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