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Original Research Article

Study of Clinical Profile of Urinary Tract Infection in Elderly Patients

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Abstract

Background and Aim: Urinary tract infections are the most prevalent bacterial infections in older adults. Diagnosis in older adults is often challenging because of atypical presentation such as delirium, fall, functional decline, generalized weakness rather than classical UTI symptoms. This study aim to analyse the clinical profiles, predisposing factor, comorbidities and outcomes of urinary tract infections in elderly patients.

Methods: This observational cross-sectional study was conducted in the tertiary care hospital, enrolling Elderly patients (age > 60 years) diagnosed with UTI after obtaining informed consent. All participants underwent clinical, hematological, and microbiological testing according to hospital protocols. Data were collected using a predesigned proforma, which included socio-demographic characteristics, medical history, diagnosis, co-morbidities, antimicrobial susceptibility patterns, drug treatment charts, and duration of hospitalization, complications, and outcomes.

Results: Among 100 elderly patients with UTI, the mean age was 71.9 ± 6.8 years, with a male predominance (59%). Fever was the common presenting symptom (46%), while generalized weakness (21%) and decreased appetite (16%) were common atypical presentations. Diabetes mellitus (48%) was the leading predisposing factor. Complications occurred in 64% of patients, predominantly acute kidney injury (57%) and sepsis (28%). Escherichia coli (62%) was the predominant pathogen, followed by Klebsiella pneumoniae (22%). Fosfomycin and amikacin showed the highest antimicrobial susceptibility, whereas ciprofloxacin and ceftriaxone demonstrated high resistance. Overall mortality rate was 10.1%, mainly associated with diabetes, sepsis, acute kidney injury and multidrug resistance.

Conclusion: UTI in the elderly is associated with significant morbidity and mortality, particularly in patients with diabetes and acute kidney injury. Although fever remains the commonest presentation, atypical symptoms are frequent. E.coli is predominant pathogen, with substantial resistance to commonly used antibiotics. Early diagnosis, appropriate empirical therapy guided by local antibiograms and antimicrobial stewardship are essential to improve outcomes.

Keywords: Urinary tract infection in elderly, UTI, complicated UTI.

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Introduction

According to the 2011 population census, India had approximately 104 million elderly individuals (aged 60 years and above), comprising 53 million women and 51 million men. A report by the United Nations Population Fund and Help Age India anticipates that this number will increase to 173 million by 2026. [1]

Urinary tract infections (UTIs) are the most prevalent bacterial infections in older adults. [2] The higher prevalence of UTIs among the elderly is mainly attributed to their increased vulnerability to microbial and viral infections. Factors such as dehydration, incontinence, limited mobility, and cognitive impairment further elevate the risk of UTIs in this population. [3]

Older adults face specific risk factors for UTIs, including the use of urethral or condom catheters, cognitive decline, diabetes, weakened immune systems, neurogenic bladder with increased residual urine, prostate enlargement in men, and vaginal atrophy due to reduced estrogen levels after menopause. These conditions facilitate bacterial

colonization, which contributes to a higher incidence of both asymptomatic bacteriuria and symptomatic UTIs in this age group. [4] Diagnosing UTIs in the elderly is challenging due to the atypical presentation of symptoms. Traditional UTI symptoms, such as dysuria, fever, frequent urination, and suprapubic pain, may be absent or obscured in older adults, making timely diagnosis difficult. Delayed diagnosis and treatment can lead to higher rates of hospitalization and mortality in this population, underscoring the importance of a vigilant approach to identifying UTIs in older adults for timely and effective intervention. [5]

Many older adults experience mild immunosuppression along with age-related organ changes, comorbidities, geriatric syndromes, and polypharmacy. All these factors influence the prognosis of infectious diseases in this population. [6,7] Various studies have shown that the mortality rate increases due to bacterial infections, highlighting the importance of early diagnosis of UTIs to reduce morbidity and mortality in older patients. [8,9] Although antimicrobials are essential in treating bacterial UTIs, improper use can lead to antimicrobial resistance, the emergence of multi-drug resistant (MDR) strains such as Clostridium difficile infection, and adverse drug reactions (ADRs). [10] Antimicrobial resistance has become a global concern, significantly impacting treatment costs, hospitalization duration, and patient morbidity and mortality. [11] Therefore, it is crucial to limit the overuse of antimicrobials and develop more appropriate treatment approaches. [12] This study aimed to analyze the clinical profiles, predisposing factors, comorbidities, outcomes and evaluate the antimicrobial profile of UTIs among elderly patients.

Objectives:

- To study of clinical & demographic profile of urinary Tract infection (UTI) in elderly patient (age > 60 years)
- To study haematological, biochemical, microbiological and radiological profile of elderly patient with UTI
- To study predisposing factor and comorbidities for UTI in elderly patient
- To study outcome in elderly patient with UTI
- To study occurrence of complicated UTI in elderly patient with UTI

Materials and Methods

This observational cross-sectional study was carried out in tertiary care hospital. The study population comprised of 100 consecutive patients attending the tertiary care hospital and diagnosed with urinary tract infections (UTIs).

Inclusion Criteria:

- Patients aged over 60 years.
- Patients attending the tertiary care hospital and diagnosed with UTI as per definitions.

Exclusion Criteria:

- Patients unwilling to participate in the study.
- Patients who developed UTI after 48 hours of admission (nosocomial UTI).
- Patients with asymptomatic bacteriuria.
- Patients aged under 60 years.
- Patients with indwelling catheters or catheter-associated UTIs.

Methodology

This observational cross-sectional study was conducted in the tertiary care hospital. Elderly patients (age > 60 years) diagnosed with UTI were enrolled after obtaining informed consent. All participants underwent clinical, hematological, and microbiological testing according to hospital protocols.

The laboratory tests included a complete blood count, renal and liver function tests, and urine microscopy, including culture and sensitivity. Additional imaging studies such as ultrasonography of the kidneys, ureters, and bladder (KUB), and computerized tomography (CT) KUB were performed if required. Early morning clean-catch midstream urine samples were collected and sent to the microbiology laboratory for culture and sensitivity testing.

Data were collected using a predesigned proforma, which included socio-demographic characteristics, medical history, diagnosis, co-morbidities, antimicrobial susceptibility patterns, drug treatment charts, duration of hospitalization, complications, and outcomes (in form of complications of UTI, discharge and death).

Symptomatic UTI: The presence of urinary tract-specific symptoms in the setting of significant bacteriuria with a quantitative count of ≥105 colony forming units of bacteria per milliliter (CFU/ml) in one urine specimen. [11]

Complicated UTI encompasses following situations [16]:

- Pyelonephritis
- Urinary tract infection occurring due to anatomical abnormalities, for example an Obstruction, hydronephrosis, renal tract calculi, or colovesical fistula
- Urinary tract infection occurring due to an immunocompromised state
- Recurrent urinary tract infection despite adequate treatment
- Urinary tract infection in patients with impaired renal function, dialysis, or anuria

- Urinary tract infection following surgical procedure and instrumentation

Statistical Analysis: Data were entered into Microsoft Office Excel 2010 and analyzed using Epi Info 7.1. Continuous data were presented as means and standard deviations, while categorical data were presented as frequencies and percentages.

Results were graphically represented where necessary. Comparisons of Categorical data were analyzed using the chi-square test and Fisher's exact test. Continuous data were compared using the t-test or z-test. A p-value of less than 0.05 was considered significant.

Ethical approval: The study protocol was presented to institutional review board. After approval, study was initiated. [NHLIRB/2023/ JULY/13th /No. 06]

Results

In this observational cross-sectional study, 100 elderly patients diagnosed with UTI were enrolled.

In the present study out of 100 patients, 89% of the patients were IPD patients, while 11% were managed on an OPD basis. This indicated that the majority of elderly UTI patients required hospitalization for their treatment. Out of 100 patients, 59 (59.0%) were male, and 41 (41.0%) were female. This indicates that UTIs are more prevalent among elderly males compared to elderly females.

Table 1: Age group distribution of patients

Age group (years)	Frequency (n=100)	Percentage (%)
61 to 65	20	20.0
66 to 70	28	28.0
71 to 75	27	27.0
76 to 80	13	13.0
81 to 85	7	7.0
86 to 90	3	3.0
91 to 95	2	2.0
Mean ± SD	71.9 ± 6.84	
Min- Max	61 to 92	

The table presents the age distribution of elderly patients diagnosed with urinary tract infections (UTIs) in a sample of 100 individuals. The age groups range from 61 to 95 years. Majority of the patients were in the age group of 66 to 70 years (28, 28.0%) followed by 71 to 75 years (27, 27.0%) and 61 to 65 years (20, 20.0%). The mean age of the patients is 71.9 ± 6.84 years.

Table 2: Symptoms among elderly UTI patients

Symptoms	Frequency (n=100)	Percentage (%)
UTI specific symptoms	**75**	**75.0**
– Fever	46	46.0
– Burning micturition	29	29.0
– Nausea	22	22.0
– Vomiting	22	22.0
– Dysuria	10	10.0
– Abdominal pain	5	5.0
– Haematuria	2	2.0
– Pyuria	1	1.0
– Backpain	1	1.0
Atypical symptoms	**51**	**51.0**
– Generalised weakness	21	21.0
– Decreased appetite	16	16.0
– Drowsiness	11	11.0
– Decreased urine output	9	9.0
– Urinary incontinence	1	1.0

UTI-specific symptoms were reported by 75% of elderly patients. Within this category, fever was the most common symptom, affecting 46% of the patients. Burning micturition was reported by 29%, nausea and vomiting by 22%, and dysuria were experienced by 10% of the patients. Abdominal pain and Haematuria was noted by 5% and 2% respectively, while pyuria and back pain was the

least common each affected 1% of the patients. Additionally, 51% of the patients reported atypical symptoms. Generalised weakness was the most frequently reported atypical symptom, affecting 21% of the patients. Decreased appetite was observed in 16%, drowsiness in 11%, decreased urine output in 9%, and urinary incontinence in 1% of the patients.

Table 3: Predisposing factor and comorbidities among elderly UTI patients

Comorbidities	Frequency (n=100)	Percentage (%)
Diabetes mellitus	48	48.0
CVA	25	25.0
Past history of UTI	13	13.0
BPH	12	12.0
CKD	12	12.0
Past history of instrumentation	11	11.0
Cognitive decline	8	8.0
Recent history of Diarrhoea	7	7.0
Past history of renal stone	5	5.0
None	11	11.0

Out of 100 elderly patients with UTI, 89% had predisposing factor and comorbidities, while 11% had none. Diabetes mellitus was the most prevalent comorbidity, affecting 48% of the patients. Cerebrovascular accident (CVA) was present in 25% of the patients. A past history of UTIs was noted in 13%, and a past history of instrumentation was reported in 11% of the patients. Both benign prostatic hyperplasia (BPH) and chronic kidney disease (CKD) were observed in 12% of the patients. Cognitive decline was observed in 8% of the patients, while recent history of diarrhoea was present in 7%. Additionally, a past history of renal stones was observed in 5% of the patients. This highlights the high prevalence of comorbidities, particularly diabetes, among elderly UTI patients. Out of 100 elderly patients with UTI, complications were present in 64% of the patients. The most common complication was acute kidney injury (AKI), affecting 57% of the patients, followed by sepsis (27%), and septic shock (13%). Hydronephrosis, and pyelonephritis each affected 5% of the patients. Disseminated intravascular coagulation (DIC) was the least common, occurring in 2% of the patients. This highlights a high prevalence of serious complications, particularly AKI and sepsis, among elderly UTI patients. A complicated urinary tract infection (UTI) includes several conditions. These include pyelonephritis, UTIs resulting from anatomical abnormalities such as obstructions, hydronephrosis, renal tract calculi, or colovesical fistula, and UTIs that occur due to an immunocompromised state. It also encompasses recurrent UTIs despite adequate treatment, UTIs in patients with impaired renal function, those undergoing dialysis, or those experiencing anuria, as well as UTIs following surgical procedures and instrumentation. [14]

Table 4: Complicated UTI wise distribution of patients

Complicated UTI	Frequency (n=100)	Percentage (%)
Past history of UTI (treated with antibiotics)	13	13.0
BPH	12	12.0
CKD	12	12.0
Past history of instrumentation	11	11.0
Pyelonephritis	5	5.0
Hydronephrosis	5	5.0
Renal stone	5	5.0
Uncomplicated UTI	56	56.0

Complicated UTI was reported in 44% elderly UTI patients. Among the complicated cases, past history of UTIs was present in 13% of the patients. BPH and CKD each account for 12% of the patients. Other factors contributing to complicated UTIs included a history of instrumentation (11%), pyelonephritis (5%), hydronephrosis (5%), and renal stones (5%).

Table 5: Bacterial isolates from urine culture in elderly UTI patients

Organism	Frequency (n=100)	Percentage (%)
E.Coli	62	62.0
Klebsiella Pneumoniae	22	22.0
Proteus Mirabilis	7	7.0
Pseudomonas Aeruginosa	5	5.0
Acinetobactor Lwoffi	1	1.0
Enterobacter Aerogenes	1	1.0
Enterobacter Cloacae Complex	1	1.0
Enterococcus Faecalis	1	1.0

E. coli was the most frequently isolated pathogen, found in 62% of the patients. Klebsiella pneumoniae was present in 22% of the cultures, while Proteus mirabilis was identified in 7%. Pseudomonas aeruginosa was observed in 5% of the samples. Less commonly, Acinetobacter lwoffii, Enterobacter aerogenes, Enterobacter cloacae complex, and Enterococcus faecalis were each found in 1% of the samples.

This data indicates that E. coli was the predominant pathogen among the elderly UTI patients.

Table 6: Antibiotic Resistance pattern in Elderly UTI Patients

Antibiotic	Resistance (%)
Ciprofloxacin	88
Ceftriaxone	68
Trimethoprim/Sulfamethoxazole	57
Piperacillin/Tazobactam	48
Cefoperazone	38
Levofloxacin	36
Meropenem	32
Ceftazidime	29
Amikacin	26
Fosfomycin	16

The resistance data reveals that several antibiotics have high resistance rates, indicating their limited effectiveness in treating UTIs in elderly patients. Ciprofloxacin shows a particularly high resistance rate of 88.0%, followed by Ceftriaxone with 68.0%, and Trimethoprim/Sulfamethoxazole with 57.0%. Additionally, antibiotics such as Piperacillin/Tazobactam, Cefoperazone and Levofloxacin exhibit resistance rates of 48.0%, 38.0% and 36.0%, respectively. After review antibiotics sensitivity data Fosfomycin, Amikacin, Meropenem, Cefoperazone and Piperacillin/Tazobactam exhibit sensitivity rates of 69.0%, 68.0%, 64.0%, 51.0% and 47.0% respectively. These antibiotics are effective in inhibiting bacterial growth in a significant percentage of cases, making them preferred choices for empirical treatment.

Out of 89 admitted elderly patients with UTI, 13.5% of the patients required urology intervention, while 86.5% did not need such intervention. Out of these 12 patients, 2 patients were died and 10 patients were discharged.

Out of 100 elderly UTI patients, 12% had normal haemoglobin levels and 88% had anaemia with a mean level of 10.59 ± 2.1 g/dL (51% - mild anaemia, 24% - moderate anaemia, 10% - severe anaemia, and 3% - very severe anaemia). Out of 88 anaemic patients, 10 patients had CKD. Remaining 78 patients were likely anaemic due to other contributing factors, including nutritional deficiencies (iron, vitamin B12, and folate), chronic inflammatory conditions, age-related decline in bone marrow function, and potential blood loss from gastrointestinal sources.

61% of patients had WBC above 11,000/µL, with a mean count of 13,882.32 ± 751.23/µL. 31% of patients had CRP less than 50 mg/L, 22% had between 50 and 100 mg/L, and 47% had above 100 mg/L, with a mean level of 116.86 ± 92.96 mg/L.

84% of patients had urea levels > 28 mg/dL, with a mean level of 76.78 ± 58.45 mg/dL. 54% of patients had creatinine levels > 1.4, with a mean level of 2.16 ± 1.81 mg/dL. 36% of patients had HbA1C ≥ 7%. The mean HbA1C level was 6.92 ± 2.11%, with a range from 4 to 18%.

Outcome among elderly patients with UTIs admitted to hospital: Out of 89 elderly patients with UTI admitted to hospital, 80 (89.8%) of the patients were discharged, while 9 (10.1 %) died. Mortality rate was 10.1%. This indicates that although majority of elderly UTI patients recovered sufficiently to be discharged, a notable minority experienced fatal outcomes.

Clinical characteristics, complications, and outcomes of elderly UTI patients requiring ICU admission: In this study of 89 admitted elderly patients with UTIs, 58 required ICU admission, while 31 did not required. The age distribution showed that 46.6% of ICU patients were aged 71 to 80 years, 43.1% were aged 61 to 70 years, and only 6.9% were aged 81 to 90 years. The mean age of ICU patients was 72.4 years, slightly higher than the mean age of 70.5 years in non-ICU patients without any significant difference (p = 0.54)

Gender analysis revealed that males were more likely to require ICU admission, with 51.7% of ICU patients being male compared to 29% in the non-ICU group, although this difference was not statistically significant (p = 0.07).

Comorbidities

- Out of 45 patients having diabetes mellitus with UTI, 34 patients required ICU admission (p-0.04)
- Out of 12 patients having CKD with UTI, 11 patients required ICU admission (p-0.04)
- Other comorbidities, such as a history of CVA, BPH, and prior UTIs were not significantly associated with ICU admission.

Complications

- Out of 56 patients having AKI with UTI, 44 patients required ICU admission (p-0.01)
- All patients (n=27) having sepsis and Septic shock (n=13) with UTI required ICU admission (p-0.01 and p = 0.004 respectively)
- Hydronephrosis, pyelonephritis, and DIC were observed only in the ICU group, although these complications did not reach statistical significance.

- Regarding the causative organisms, E. coli was the most frequently isolated pathogen, found in 69% of ICU patients and 45.2% of non-ICU patients (p = 0.04). Klebsiella pneumoniae was more common in non-ICU patients (35.5%) than in ICU patients (13.8%, p -0.02).
- The need for antibiotic escalation was significantly higher in ICU patients, with 82.8% requiring antibiotics escalation compared to 25.8% of non-ICU patients (p < 0.001).
- Anaemia was prevalent among elderly patients, with no significant difference between those who required ICU admission and those who did not required ICU admission. WBC counts and HbA1c levels also showed no significant differences between the groups. However, CRP (p-0.004), urea (p-0.003), and creatinine levels (p-0.02) were significantly higher in patients who required ICU admission, indicating more severe inflammation and renal dysfunction in these patients.
- The mortality rate was 15.5% among ICU patients (p = 0.02).

We conducted a statistical analysis comparing antibiotics (Ciprofloxacin, Ceftriaxone, and Levofloxacin) resistance UTI patients with antibiotics (Ciprofloxacin, Ceftriaxone, and Levofloxacin)-sensitive patients across various parameters, including predisposing factors, complications, incidence of complicated UTIs, ICU admission rates, duration of ICU stay, total hospitalization duration, need for antibiotic escalation, and outcomes.

- There was no statistically significant difference between Ciprofloxacin & Ceftriaxone resistance and Ciprofloxacin & Ceftriaxone sensitive elderly UTI patients regarding predisposing factors, complications, ICU admission rates, hospitalization duration mortality rate, or need for antibiotics escalation (p > 0.05 for all variables).
- Among the 100 elderly UTI patients, 36 were levofloxacin resistance UTI, while 64 were levofloxacin sensitive UTI.
- When patients with levofloxacin resistance group (41.7%) compared to the sensitive group, significant numbers of patients had pevious history of CVA. (15.6%, p < 0.001). Other comorbidities such as diabetes mellitus, BPH, history of UTIs and CKD were comparable between the levofloxacin resistance and sensitive group (p > 0.05 for all). Hwever, significane of this finding remaining unknown.
- Sepsis was more prevalent in the levofloxacin-resistance group (38.9%) compared to the levofloxacin sensitive group (20.3%, p = 0.04). Other complications were also not significantly different between levofloxacin resistance group and the levofloxacin sensitive group (p > 0.05 for all).
- There were no significant differences between levofloxacin-resistance and levofloxacin-sensitive patients in terms of ICU admission, average ICU stay, total hospitalization days, mortality (5.7% vs. 13.0%; p=0.68), or the need for antibiotic escalation (71.4% vs. 57.4%; p=0.72).

Table 7: Clinical characteristics and outcomes among elderly UTI patients: A Comparison between survivors and non-survivors

Variables	Non-Survivors (n=9)	Survivors (n=80)	Total (n=89)	p value
Age	73 ± 6.08	71.6 ± 6.89	71.7 ± 6.8	0.56
Gender				
Male	5 (55.6%)	47 (58.8%)	52 (58.4%)	0.85
Female	4 (44.4%)	33 (41.3%)	37 (41.6%)	
Comorbidities				
Diabetes mellitus	5 (55.6%)	40 (50%)	45 (50.6%)	1.00
CVA	2 (22.2%)	22 (27.5%)	24 (27%)	0.75
CKD	0 (0%)	12 (15%)	12 (13.5%)	0.21
P/H/O of UTI	1 (11.1%)	11 (13.8%)	12 (13.5%)	0.82
BPH	0 (0%)	8 (10%)	8 (9%)	0.32
P/H/O of instrumentation	1 (11.1%)	9 (11.2%)	10 (11.2%)	0.99
Cognitive decline	0 (0%)	8 (10%)	8 (9%)	0.81
Recent history of Diarrhoea	0 (0%)	7 (8.8%)	7 (7.9%)	0.35
P/H/O of renal stone	1 (11.1%)	4 (5.0%)	5 (5.6%)	0.31
None	2 (22.2%)	7 (8.8%)	9 (10.1%)	0.45
No of comorbidities (n = 80)				
< 2 comorbidities	6 (88.9%)	61 (84.4%)	67 (83.8%)	1.00
>2 comorbidities	1 (11.1%)	12 (15.6%)	13 (16.2%)	
Complication				
AKI	7 (77.8%)	49 (61.3%)	56 (62.9%)	0.33
Sepsis	8 (88.9%)	19 (23.8%)	27 (30.3%)	**< 0.001**
Septic shock	8 (88.9%)	5 (6.3%)	13 (14.6%)	**< 0.001**
BPH	0 (0%)	8 (10%)	8 (9%)	0.32
P/H/O of UTI	0 (0%)	10 (12.5%)	10 (11.2%)	0.26
P/H/O of instrumentation	1 (11.1%)	7 (8.8%)	8 (9%)	0.32
Hydronephrosis	2 (22.2%)	3 (3.8%)	5 (5.6%)	**0.02**
Pyelonephritis	1 (11.1%)	4 (5%)	5 (5.6%)	0.45
Renal stone	1 (11.1%)	3 (3.8%)	4 (4.5%)	0.31
DIC	2 (22.2%)	0 (0%)	2 (2.2%)	**< 0.001**
None	0 (0%)	26 (32.5%)	26 (29.2%)	**0.04**
Complicated UTI				
Present	2 (22.2%)	36 (45.0%)	38 (42.7%)	0.19
Absent	7 (77.8%)	44 (55.0%)	51 (57.3%)	
ICU stay (days, n=58)	4.8 ± 3.99	3.55 ± 2.49	3.74 ± 2.76	0.22
Ward stay (days)	NA	5.2 ± 1.9	4.7 ± 2.39	**< 0.001**
Total days of Hospitalisations (n=89)	4.1 ± 4.26	7.3 ± 3.53	6.22 ± 4.13	**0.01**

Out of 89 elderly patients with UTI admitted to hospital, 80 (89.8%) patients were discharged, while 9 (10.1 %) died. In the present study, we compared characteristics of survivors and non-survivors group.

- There was no statistical significant difference between survivors and non-survivors in terms of age (p -0.56), gender (p-0.8), and presence of comorbidities (p>0.05), number of comorbidities (p -1.00).
- Mortality was significantly associated with sepsis ($p < 0.001$), septic shock ($p < 0.001$), hydronephrosis ($p = 0.02$), and DIC ($p < 0.001$), and shorter total hospital stays ($p = 0.01$).
- Structural abnormalities such as pyelonephritis, hydronephrosis, and benign prostatic hyperplasia (BPH) were observed in the study, with mortality being significantly higher in patients with hydronephrosis (p=0.02) compared to pyelonephritis ($p = 0.45$), and BPH ($p = 0.32$).
- Pseudomonas aeruginosa were significantly more common in the deceased (p=0.01).

Discussion

Due to physiological variations, urinary tract infections are one of the most common infections in elderly patients having a spectrum varying from benign cystitis to potentially life threatening pyelonephritis.

The chances of an UTI are higher in the presence of chronic diseases like diabetes, HTN, cognitive impairments etc. it can even sometimes lead to

mortality. [12] Our study populations included a total number of 100 patients (IPD and OPD) aged above 60 years suffering from Urinary tract infection

Age Distribution: The most common age group affected in this study was 61 to 75 years (73.0%), closely aligning with Kumar G et al. [12] (75.4%) and Akhtar A et al. [14] (74.3%). Mahesh E et al. [13] reported a slightly younger peak (58.8% in 65 to 74 years). The mean age in our study was 71.9 ± 6.84 years, similar to Mahesh E et al. [13] (73.5 ± 7.19 years).

Older adults face specific risk factors for UTIs, including the use of urethral or condom catheters, cognitive decline, diabetes, weakened immune systems, neurogenic bladder with increased residual urine, prostate enlargement in men, and vaginal atrophy due to reduced estrogen levels after menopause. These conditions facilitate bacterial colonization, which contributes to a higher incidence of both asymptomatic bacteriuria and symptomatic UTIs in this age group. [4]

Gender Distribution: Our study showed a male predominance (59.0%), consistent with Mahesh E et al. [13] (59.7%). Kumar G et al. [12] (52.8%), while Akhtar A et al. [14] reported a female predominance (60.7%). This difference might be because our study was conducted in geriatric populations whose comorbidities such as diabetes mellitus and increasing risk of age related prostate disorders increased its incidence.

The ICMR-INDIAB study reported that diabetes is more prevalent in males in India. This disparity is attributed to lifestyle factors such as higher rates of smoking, alcohol consumption, and sedentary behavior among men, along with increased occupational stress. Biological differences, including the impact of hormones like testosterone on insulin sensitivity, may also contribute. Additionally, men might be more likely to be diagnosed due to more frequent medical visits related to cardiovascular risks, where diabetes is often screened. [15]

UTI-Specific Symptoms: In our study, 75% of patients had UTI-specific symptoms, with fever (46%), burning micturition (29%), and nausea/vomiting (22%) being most common. This is somewhat similar to Swamy S et al. [16], where burning micturition (77.5%) and fever (49.1%) were prevalent. Alpay Y et al. [17] also reported fever (29.4%) and dysuria (26.8%) as common symptoms. In Elderly population, there is a physiological lower basal body temperature and hence, there is a dampened fever response. [16] The differences in symptom frequency may be due to variations in patient demographics, infection severity, or regional factors.

Atypical Symptoms: Generalized-weakness (21%), decreased appetite (16%) and drowsiness (11.0%) were the most common atypical symptoms in our study, which were not highlighted in the other studies. These atypical symptoms are important in elderly patients, as they may lead to delayed diagnosis if not recognized.

Diabetes Mellitus (DM): DM was the most common predisposing factor across all studies. In our study, 48% of patients had DM, similar to Mahesh E et al. [13] (50%) and Akhtar A et al. [14] (43.1%). Swamy S et al. [16] and Venkatesh R et al. [18] reported higher rates (over 63%). This consistent finding highlights the increased risk of UTIs in diabetic patients. Diabetes mellitus affects the immune system of older adults due to autonomic neuropathy that leads to incomplete emptying of the bladder and poor metabolic control, which all contribute to the increased risk of UTIs in elderly patients with diabetes mellitus. [14] Further, longer duration and greater severity of diabetes significantly increases chances of occurrence of UTI by causing neutrophil dysfunction, diapedesis and phagocytosis. [19] In our study, glycemic control among diabetic patients was not significantly associated with ICU admission rates (p-0.94) or mortality (p-1.00) in elderly UTI patients.

Other Predisposing Factors: In our study, CVA was the second most common factor (25%), while hypertension was significant in Venkatesh R et al. [18] (59.4%) and Akhtar A et al. [14] (33.9%). These variations may be due to differences in the populations studied. A past history of UTI was noted in 13% of our patients, comparable to Mahesh E et al. [13] (22.2%). CKD and BPH were noted in 12% of our patients and Swamy S et al. [16] reported BPH in 28.3% and CKD in 21.6% elderly patients.

In patients with CKD, the risk might be increased by disease factors (papillary necrosis, nephrolithiasis, and neurogenic bladder) and the management of comorbidities with Foley catheters and intravenous lines. [20] UTIs are more prevalent in elderly CVA patients due to impaired bladder control, increased urinary retention, immobility, and the need for catheterization. These factors, combined with a weakened immune response, elevate the risk of infection in this population.

Gram-Negative Organisms: In our study, 99% of isolates were gram-negative, with E. coli being the most common (62%), followed by K. pneumoniae (22%) and Proteus (7%). This is consistent with other studies, though the prevalence of E. coli varied: Kumar G et al. [12] (22.6%), Swamy S et al. [16] (31.6%), Venkatesh R et al. [18] (48%), and Mahesh E et al. [13] (71.1%). The dominance of E. coli reflects its common role in UTIs.

Gram-Positive Organisms: Gram-positive bacteria were rare in our study (1%), with Enterococcus faecalis being the most common.

Other studies also reported low frequencies, with Kumar G et al. [12] finding Enterococcus faecalis (7.5%) and S. aureus (5.7%). This indicates that gram-positive bacteria are less common in UTI cases compared to gram-negative bacteria.

Fungal Infections: Fungal infections were not observed in our study and are generally rare in UTIs among the elderly in community setting.

The prevalence of gram-negative bacteria, especially E. coli, is consistent across studies, emphasizing its role as a primary pathogen in elderly UTIs. Variations in other organisms highlight the need for localized microbial data to tailor treatment effectively.

Most Sensitive Antibiotics: In our study, Fosfomycin (69.0%), Amikacin (68.0%), Meropenem (64.0%), Cefoperazone (51.0%) and Piperacillin/Tazobactam (47.0%) were identified as the most effective antibiotics. These findings are consistent with Venkatesh R et al. [18], where Amikacin (100%) and Cefoperazone (95.5%) showed high sensitivity. Kumar G et al. [12] also reported Amikacin as a highly sensitive antibiotic (68.0%). The high sensitivity of Amikacin and Fosfomycin across studies highlights their effectiveness against UTI pathogens in the elderly.

Most Resistant Antibiotics: In our study, the most resistant antibiotics were Ciprofloxacin (88.0%), Ceftriaxone (68.0%), Cotrimoxazole (57.0%), Piperacillin/Tazobactam (48.0%), and Cefoperazone (38.0%). Venkatesh R et al. [18] also reported high resistance to Ciprofloxacin (100%) and Levofloxacin (100%). Kumar G et al. [12] noted resistance to Cotrimoxazole (82.6%) and Piperacillin/Tazobactam (60.8%). These patterns indicate widespread resistance to commonly used antibiotics like Ciprofloxacin and Ceftriaxone, emphasizing the need for alternative treatment options and ongoing surveillance.

Mortality Rates: Our study reported a 10.1% mortality rate, higher than Venkatesh R et al. [18] (4.7%) and Alpay Y et al. [17] (5%). However, Swamy S et al. [16] reported 29.1% mortality.

Factors Associated with worse Outcomes: In our study, there was no statistical significant difference between survivors and non-survivors in terms of age (p -0.56), gender (p-0.8), and comorbidities ($p>0.05$), number of comorbidities > 2 (p -1.00) among elderly UTI patients. However, mortality was significantly higher in patients with sepsis ($p < 0.001$), septic shock ($p < 0.001$), complicated UTI (hydronephrosis, $p = 0.02$), and DIC ($p < 0.001$), shorter total hospital stays ($p = 0.01$). Akhtar A et al. identified female sex, polypharmacy, and multiple comorbidities as significant predictors of mortality, with females showing an increased risk (OR = 1.628; $p = 0.018$) and multiple comorbidities (OR = 2.004; $p = 0.002$)

Conclusion

Elderly patients with UTIs commonly presented with typical symptoms such as fever, though atypical symptoms were also frequently observed. The presence of diabetes mellitus as a predisposing factor, along with the high incidence of complications such as acute kidney injury and sepsis, underscores the increased vulnerability of this population. Laboratory findings of anemia and elevated inflammatory markers further emphasize the severity of these infections. The predominance of E. coli as the primary pathogen, combined with significant antibiotic resistance, particularly to Ciprofloxacin and Ceftriaxone highlights the imperative for vigilant antibiotic stewardship and the need for continuous microbiological surveillance at health institutional & community level. The elevated ICU admission rate and associated mortality, especially among patients with diabetes, acute kidney injury, or sepsis, reflect the serious nature of UTIs in the elderly and underscore the need for prompt and effective management to improve clinical outcomes.

Limitation: The limitations of this study include its single-center, hospital-based design, which restricts the diversity of patient demographics and healthcare practices, potentially limiting the generalizability of the results to other settings or regions. Additionally, the use of convenient sampling may introduce selection bias, affecting the external validity of the findings. Furthermore, the observational, cross-sectional design limits the ability to establish causal relationships between variables.

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