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Original Research Article

Microbiological Profile, Risk Factors and Short-Term Outcomes of Complicated Urinary Tract Infection among Adults: A Prospective Observational Study from a Tertiary Care Centre

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Conflict of interest: Nil

Abstract

Background: Urinary tract infection (UTI) is a common bacterial infection, and its clinical course may be substantially influenced by urinary tract abnormalities, obstruction, stones, indwelling devices, previous antimicrobial exposure and underlying conditions such as diabetes mellitus and renal impairment. Current European Association of Urology (EAU) guidance emphasises classification of UTI as localised or systemic while recognising host and urinary tract risk factors that may increase the likelihood of treatment failure and resistant organisms. Local microbiological surveillance is therefore important because pathogen distribution and antimicrobial susceptibility vary geographically and between healthcare settings.

Objectives: To determine the microbiological profile of complicated UTI, describe associated risk factors and comorbidities, assess antimicrobial susceptibility patterns, and evaluate short-term clinical, laboratory and microbiological outcomes at Days 10 and 30.

Methods: A prospective observational study was conducted among 80 adults admitted with complicated UTI to the Department of Nephrology, Gauhati Medical College and Hospital, Guwahati, Assam, between May 2025 and April 2026. Demographic characteristics, clinical manifestations, risk factors, comorbidities, laboratory parameters, urine microscopy, urine culture, antimicrobial susceptibility, imaging findings, treatment and follow-up outcomes were recorded using a structured proforma. Patients were assessed at baseline, Day 10 and Day 30. Continuous variables were expressed as mean ± standard deviation or median with interquartile range, as appropriate, while categorical variables were expressed as frequencies and percentages. Paired continuous variables were compared using appropriate paired tests and paired categorical variables using McNemar's test. Independent-group comparisons were performed using the independent-samples t test, Mann–Whitney U test, chi-square test or Fisher's exact test, as appropriate. A two-sided p value <0.05 was considered statistically significant.

Results: The mean age of the study population was 50.34 ± 15.49 years, and 41 (51.2%) participants were female. Diabetes mellitus was the most frequently recorded comorbidity/risk factor (62.5%), followed by previous antibiotic exposure or treatment for the current/recent UTI episode (57.5%), chronic kidney disease (46.2%) and hypertension (45.0%). Escherichia coli was the predominant urinary isolate (47.5%), followed by Klebsiella pneumoniae (22.5%). Among isolates tested against individual antibacterial agents, susceptibility was highest to meropenem (88.9%), colistin (88.7%), imipenem (87.1%) and amikacin (84.1%), whereas resistance was highest to amoxicillin (81.0%), cefuroxime (69.8%) and ciprofloxacin (67.7%). Mean WBC count, serum creatinine and CRP declined significantly from baseline to Day 10 and Day 30 (all $p<0.001$). Fever and urinary symptoms also decreased substantially during follow-up. At the end of follow-up, 69 (86.2%) patients achieved clinical cure, whereas 11 (13.8%) had persistent or recurrent UTI. CKD was significantly associated with failure to achieve clinical cure ($p=0.020$), and baseline procalcitonin was higher among patients without clinical cure ($p=0.048$).

Conclusion: This tertiary-care nephrology cohort demonstrated a substantial burden of diabetes mellitus and chronic kidney disease, with predominance of Gram-negative uropathogens and considerable resistance to several commonly used antimicrobials. E. coli was the predominant pathogen. Clinical and biochemical parameters improved significantly by Days 10 and 30, although persistent or recurrent infection occurred in 13.8% of patients. CKD and higher baseline procalcitonin were associated with poorer short-term outcome.

Local antimicrobial susceptibility data, together with individual patient risk factors and severity of illness, should guide antimicrobial selection.

Keywords: Complicated Urinary Tract Infection; Urinary Tract Infection; Escherichia Coli; Antimicrobial Resistance; Diabetes Mellitus; Chronic Kidney Disease; Urine Culture; Procalcitonin; Clinical Outcome.
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Introduction

Urinary tract infection (UTI) is among the most frequently encountered bacterial infections in clinical practice. The clinical spectrum ranges from localised lower urinary tract infection to systemic infection such as pyelonephritis and urosepsis. The clinical course may be influenced by urinary tract obstruction, stones, anatomical or functional abnormalities, indwelling devices, previous antimicrobial exposure and underlying host conditions including diabetes mellitus and renal impairment. [1]

The traditional term "complicated UTI" has been used for infection occurring in the presence of factors that increase the likelihood of treatment failure or an atypical clinical course. However, contemporary EAU guidance has moved away from a simple uncomplicated/complicated classification and instead distinguishes localised UTI from systemic UTI, while separately recognising risk factors that may compromise treatment success. These include urinary tract abnormalities, obstruction, stones, urinary devices, previous antibiotic treatment, resistant organisms, diabetes and renal impairment. [1]

Diabetes mellitus is particularly relevant because it is associated with an increased susceptibility to UTI through several mechanisms, including impaired host defence, glycosuria and diabetes-related renal and urinary tract complications. Complicated urinary infections in patients with diabetes may also be associated with severe entities such as emphysematous pyelonephritis, emphysematous cystitis and renal or perirenal abscesses. [2]

The microbiological profile of UTI varies according to patient characteristics, healthcare exposure and geographical location. Escherichia coli remains the predominant uropathogen in many Indian studies, although Klebsiella, Enterococcus, Pseudomonas and other organisms are also encountered. [3–5] Indian surveillance studies have demonstrated substantial resistance to commonly used antibiotics, particularly fluoroquinolones, aminopenicillins and selected cephalosporins, while susceptibility to agents such as amikacin, piperacillin-tazobactam and carbapenems has varied between populations. [3–5] Kothari and Sagar reported E. coli as the predominant pathogen in a multicentre Indian study and demonstrated substantial resistance to commonly used agents, including amoxicillin and ciprofloxacin, together with a considerable prevalence of ESBL production. [3] Similarly, a study from eastern India demonstrated high multidrug resistance among uropathogenic E. coli, with particularly high resistance to ampicillin, amoxicillin and ciprofloxacin. [6] Data from Odisha also demonstrated E. coli predominance and geographic variation in antimicrobial susceptibility patterns. [5]

Renal impairment is particularly important in patients managed in nephrology settings because infection and renal dysfunction may coexist and adversely influence one another. Obstruction, infection-associated kidney injury, underlying CKD and resistant organisms may all contribute to delayed recovery and increased treatment complexity.

Despite the clinical importance of complicated UTI, institution-specific data from tertiary-care nephrology populations in Northeast India remain limited. Therefore, the present study was undertaken to evaluate the microbiological profile, associated risk factors and comorbidities, antimicrobial susceptibility pattern and short-term clinical, laboratory and microbiological outcomes of adults with complicated UTI admitted to a tertiary-care nephrology department in Assam.

Aim and Objectives

Aim: To evaluate the microbiological profile, risk factors and short-term outcomes of complicated urinary tract infection among adult patients admitted to a tertiary-care nephrology department.

Objectives

1. To determine the microbiological profile of complicated UTI.
2. To describe the major risk factors and comorbidities observed among patients with complicated UTI.
3. To determine the antimicrobial susceptibility pattern of urinary isolates.

4. To assess short-term clinical, laboratory and microbiological outcomes at Days 10 and 30.
5. To identify baseline factors associated with failure to achieve clinical cure.

Materials and Methods

Study Design and Setting: This was a prospective observational study conducted in the Department of Nephrology, Gauhati Medical College and Hospital, Guwahati, Assam.

Study Duration: The study was conducted over a period of 12 months, from May 2025 to April 2026.

Study Population: The study population comprised adults aged ≥18 years admitted to the Department of Nephrology with clinically diagnosed complicated UTI who fulfilled the predefined eligibility criteria.

Operational Definition: For the purpose of this study, complicated UTI was defined using the conventional clinical concept of UTI occurring in the presence of structural or functional abnormalities of the urinary tract or host factors likely to increase the risk of treatment failure, including urinary obstruction, stones, urological abnormalities or devices, neurological dysfunction, immunocompromised states, diabetes mellitus and renal impairment.

Because current EAU terminology emphasises localised versus systemic UTI with accompanying risk factors, the term "complicated UTI" is retained in this manuscript to reflect the study protocol and original study population. [1]

Sample Size: The sample size was estimated using the single proportion formula:

$n = Z^2pq / d^2$

Where:

- n = required sample size
- Z = standard normal deviate at 95% confidence level = 1.96
- p = anticipated proportion = 50%
- q = 100 - p = 50%
- d = absolute allowable error = 11%

Substitution in the formula:

$n = (1.96)^2 \times 50 \times 50 / 11^2$

$n = 79.37$

The calculated sample size was rounded to 80. A total of 80 eligible patients were included in the study.

Participant Recruitment: Eligible patients admitted during the study period were enrolled consecutively after assessment against the eligibility criteria. Written informed consent was obtained before enrolment.

Inclusion Criteria

- Adults aged ≥18 years.
- Clinically diagnosed complicated UTI.
- Admission to the Department of Nephrology.
- Willingness to provide written informed consent.

Exclusion Criteria

- Age <18 years.
- Pregnancy.
- Polymicrobial urine culture.
- Previous renal transplantation.

Data Collection: Data were collected using a structured study proforma. Variables included demographic characteristics, presenting symptoms, duration of symptoms, risk factors, comorbidities, previous antibiotic exposure, physical examination findings, laboratory investigations, urine microscopy, urine culture, antimicrobial susceptibility, imaging findings, treatment and follow-up outcomes.

Laboratory Investigations: Investigations included complete blood count, blood glucose, HbA1c, renal function tests, liver function tests, serum electrolytes, C-reactive protein (CRP), procalcitonin, urine routine examination and microscopy, urine culture and antimicrobial susceptibility testing.

Ultrasonography of the abdomen and urinary tract was performed routinely or when clinically indicated according to the treating team's assessment. CT imaging was performed when clinically indicated.

Microbiological Assessment: Urine samples were processed according to institutional microbiological procedures. Organisms isolated from urine cultures were identified using standard microbiological methods, and antimicrobial susceptibility testing was performed according to the laboratory's standard protocol.

Patients with polymicrobial cultures were excluded from the final study population according to the predefined protocol. Patients with no growth were retained when the clinical diagnosis of UTI had been established.

Imaging Assessment: Ultrasonography and CT findings were recorded when performed. Imaging abnormalities of interest included pyelonephritis, bulky kidneys, renal or ureteric calculi, hydronephrosis, and obstruction and perinephric inflammatory changes.

Treatment: Antimicrobial therapy and supportive management were provided according to the treating physician's clinical assessment, microbiological results, renal function and institutional antimicrobial policy. Urological

interventions, including DJ stenting and percutaneous nephrostomy/urinary drainage procedures, were performed when clinically indicated.

Outcome Assessment: Patients were assessed at baseline, Day 10 and Day 30.

Clinical outcomes

- Fever.
- Urinary symptoms.
- Overall clinical response.
- Clinical cure or persistent/recurrent infection.

Laboratory outcomes

- WBC count.
- Serum creatinine.
- CRP.

Microbiological Outcome: Urine culture findings at follow-up were recorded when available.

Clinical Cure: Clinical cure was defined as resolution of the presenting clinical infection without documented persistent or recurrent UTI during the follow-up period.

Statistical Analysis: Categorical variables were expressed as frequencies and percentages. Continuous variables were summarised using mean ± standard deviation when approximately normally distributed and median with interquartile range when distributions were non-normal.

For comparisons between independent groups, the independent-samples t test or Mann–Whitney U test was used as appropriate. Categorical variables were compared using the chi-square test or Fisher's exact test.

Changes in paired continuous measurements between baseline and follow-up were assessed using appropriate paired statistical tests according to distribution. Paired categorical variables were assessed using McNemar's test.

A two-sided p value <0.05 was considered statistically significant.

Because only 11 patients failed to achieve clinical cure, predictor analyses were considered exploratory and were interpreted cautiously.

Ethical Considerations: The study was conducted after approval from the Institutional Ethics Committee of Gauhati Medical College and Hospital. Written informed consent was obtained from all participants. Confidentiality of patient information was maintained throughout the study.

Results

Baseline Characteristics: A total of 80 adults with complicated UTI were included in the study. The mean age was 50.34 ± 15.49 years, with an age range of 19–81 years. The largest age group was 46–60 years, comprising 30 (37.5%) participants, followed by participants aged >60 years (27.5%).

There were 39 (48.8%) males and 41 (51.2%) females. Urinary symptoms were the most frequent presenting manifestation, reported by 74 (92.5%) participants, followed by fever in 67 (83.8%) and flank/suprapubic pain in 58 (72.5%) (Table 1).

Table 1: Baseline demographic and clinical characteristics of the study population (n=80)

Variable	Finding
Age, years, mean ± SD	50.34 ± 15.49
Age range, years	19–81
18–30 years	13 (16.2%)
31–45 years	15 (18.8%)
46–60 years	30 (37.5%)
>60 years	22 (27.5%)
Male	39 (48.8%)
Female	41 (51.2%)
Fever	67 (83.8%)
Urinary symptoms	74 (92.5%)
Flank/suprapubic pain	58 (72.5%)

Risk factors and comorbidities: Diabetes mellitus was the most frequently recorded comorbidity/risk factor, present in 50 (62.5%) participants. Previous antibiotic/treatment exposure was reported in 46 (57.5%), while CKD and hypertension were present in 37 (46.2%) and 36 (45.0%), respectively. Obstructive uropathy/hydro nephrosis was present in 19 (23.8%) patients and renal/ureteric calculus disease in 14 (17.5%). Other recorded urinary tract abnormalities included BPH/prostatomegaly or bladder outlet obstruction in 6 (7.5%) and urethral stricture in 2 (2.5%) (Table 2). These findings describe the risk-factor and comorbidity burden within the study cohort and should not be interpreted as population-level risk estimates because no control group was included.

Table 2: Major risk factors and comorbidities among patients with complicated UTI

Risk factor/comorbidity	n (%)
Diabetes mellitus	50 (62.5%)
Previous antibiotic/treatment exposure	46 (57.5%)
Chronic kidney disease	37 (46.2%)
Hypertension	36 (45.0%)
Obstructive uropathy/hydronephrosis	19 (23.8%)
Recurrent UTI/history of pyelonephritis	14 (17.5%)
Renal/ureteric calculus disease	14 (17.5%)
BPH/prostatomegaly/bladder outlet obstruction	6 (7.5%)
Urethral stricture	2 (2.5%)
Solitary kidney/nephrectomy status	2 (2.5%)

Baseline laboratory and urine findings: The mean WBC count was 11,715 ± 3,910/µL, mean CRP was 55.58 ± 35.46 mg/L, and mean serum creatinine was approximately 4.11 mg/dL. The mean urine pus-cell count was 31.79 ± 25.27/HPF. Nitrite positivity was observed in 41 (51.2%) participants, while leukocyte esterase positivity was observed in 38 (47.5%).

Microbiological Profile: Among the 80 participants, 71 (88.8%) had a positive urine culture, while 9 (11.2%) had no growth. E. coli was the predominant organism, isolated from 38 (47.5%) participants, followed by K. pneumoniae in 18 (22.5%). Enterococcus faecalis, Pseudomonas aeruginosa and Candida species accounted for smaller proportions (Table 3; Figure 1). The two predominant bacterial organisms, E. coli and K. pneumoniae, together accounted for 56/80 (70.0%) participants.

Table 3: Microbiological profile of urine cultures (n=80)

Organism/culture result	n (%)
Escherichia coli	38 (47.5%)
Klebsiella pneumoniae	18 (22.5%)
Enterococcus faecalis	6 (7.5%)
Pseudomonas aeruginosa	5 (6.2%)
Candida species	4 (5.0%)
No growth	9 (11.2%)

Antimicrobial susceptibility pattern: Susceptibility testing was not performed against every antimicrobial agent for exactly the same number of isolates. Therefore, the denominator is reported separately for each antimicrobial (Table 4). Among the tested isolates, the highest susceptibility rates were observed with meropenem (88.9%), colistin (88.7%), imipenem (87.1%) and amikacin (84.1%). Resistance was highest to amoxicillin (81.0%), cefuroxime (69.8%) and ciprofloxacin (67.7%).

Table 4: Antimicrobial susceptibility pattern of urinary isolates

Antibiotic	No. tested	Sensitive n (%)	Resistant n (%)
Amoxicillin	63	12 (19.0%)	51 (81.0%)
Cefuroxime	63	19 (30.2%)	44 (69.8%)
Ceftriaxone	63	29 (46.0%)	34 (54.0%)
Ciprofloxacin	62	20 (32.3%)	42 (67.7%)
Nitrofurantoin	65	33 (50.8%)	32 (49.2%)
Gentamicin	63	43 (68.3%)	20 (31.7%)
Amikacin	63	53 (84.1%)	10 (15.9%)
Piperacillin-tazobactam	63	47 (74.6%)	16 (25.4%)
Cefoperazone-sulbactam	63	47 (74.6%)	16 (25.4%)
Meropenem	63	56 (88.9%)	7 (11.1%)
Imipenem	62	54 (87.1%)	8 (12.9%)
Colistin	62	55 (88.7%)	7 (11.3%)

Imaging and Treatment: Ultrasonography was normal in 25 (31.2%) patients, while 25 (31.2%) had findings suggestive of pyelonephritis or bulky kidneys. Renal/ureteric calculi were detected in 10 (12.5%) patients and hydronephrosis in 8 (10.0%). CT imaging was performed in 26 (32.5%) patients, with pyelonephritis or perinephric inflammatory changes identified in 19 patients. Intravenous antibiotics were administered to 77 (96.2%) patients. DJ stenting was performed in 8 (10.0%),

and PCN/urinary drainage intervention was performed in 7 (8.8%). Haemodialysis was required in 14 (17.5%) patients.

Short-term clinical and laboratory outcomes: There was significant improvement in the major laboratory parameters during follow-up.

Mean WBC count decreased from 11,715/µL at baseline to 9,535.75/µL at Day 10 and 8,408.10/µL at Day 30.

Mean serum creatinine decreased from 4.11 mg/dL at baseline to 2.67 mg/dL at Day 10 and 2.41 mg/dL at Day 30.

Mean CRP decreased from 55.58 mg/L at baseline to 23.85 mg/L at Day 10 and 13.16 mg/L at Day 30.

All reported baseline-to-follow-up comparisons were statistically significant ($p<0.001$) (Table 5; Figure 2).

Table 5: Clinical and laboratory outcomes at baseline, Day 10 and Day 30

Outcome	Baseline	Day 10	Day 30
WBC count, mean/µL	11,715.00	9,535.75	8,408.10
Serum creatinine, mean mg/dL	4.11	2.67	2.41
CRP, mean mg/L	55.58	23.85	13.16
Fever present, n (%)	67 (83.8%)	4 (5.0%)	5 (6.2%)
Urinary symptoms, n (%)	74 (92.5%)	13 (16.2%)	9 (11.2%)
Culture-positive/persistent growth, n (%)	71 (88.8%)	17 (21.2%)	18 (22.5%)

Figure 2. Changes in WBC count, serum creatinine and CRP from baseline to Day 10 and Day 30.

Fever decreased from 67 (83.8%) patients at baseline to 4 (5.0%) at Day 10 and 5 (6.2%) at Day 30. Urinary symptoms decreased from 74 (92.5%) at baseline to 13 (16.2%) at Day 10 and 9 (11.2%) at Day 30. The proportion with documented positive/persistent culture findings decreased from 71 (88.8%) at baseline to 17 (21.2%) at Day 10 and was 18 (22.5%) at Day 30.

Final Clinical Outcome: At the end of Day-30 follow-up, 69 (86.2%) patients achieved clinical cure, whereas 11 (13.8%) had persistent or recurrent UTI (Figure 3).

Figure 3. Final clinical outcome at Day 30

Factors Associated with Clinical Outcome: CKD was significantly more frequent among patients who failed to achieve clinical cure than among those who achieved cure (81.8% vs 40.6%; $p=0.020$). Baseline procalcitonin was also significantly higher among patients who failed to achieve clinical cure (3.80 ± 3.21 ng/mL vs 1.58 ± 2.32 ng/mL; $p=0.048$). Diabetes mellitus, hypertension, previous antibiotic/treatment exposure, calculus disease and the major organisms isolated were not significantly associated with final clinical outcome in the available analysis. Because only 11 patients experienced treatment failure, these findings should be regarded as exploratory associations rather than definitive independent predictors.

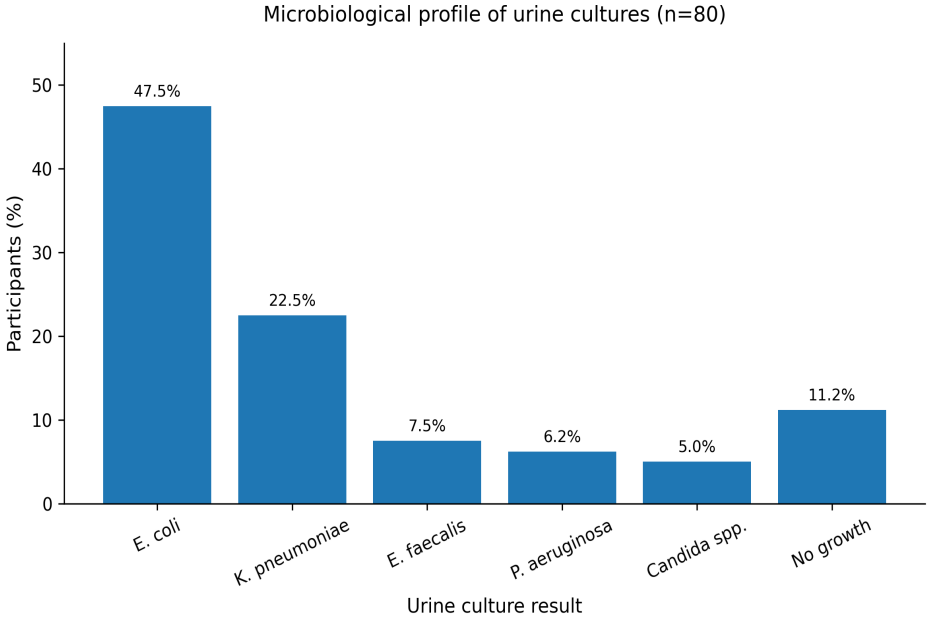

Figure 1: Microbiological profile of urine cultures among adults with complicated UTI.

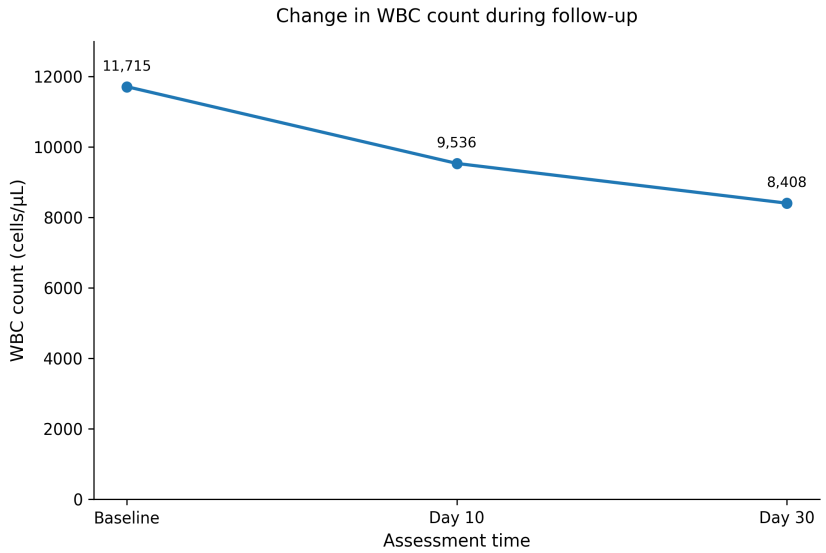

Figure 2A: Change in WBC count from baseline to Day 10 and Day 30.

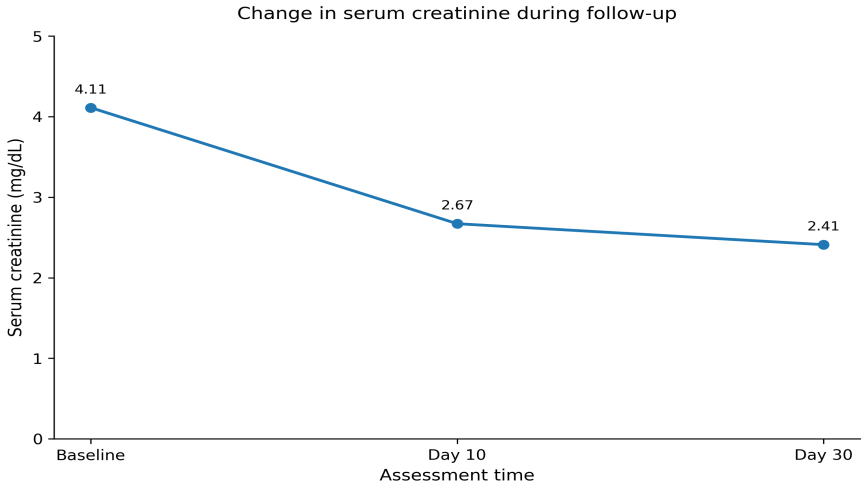

Figure 2B: Change in serum creatinine from baseline to Day 10 and Day 30.

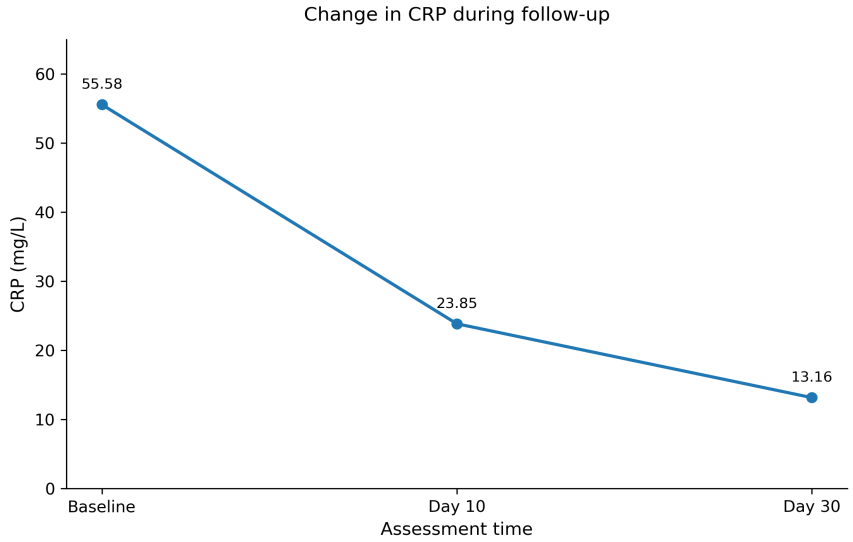

Figure 2C: Change in CRP from baseline to Day 10 and Day 30.

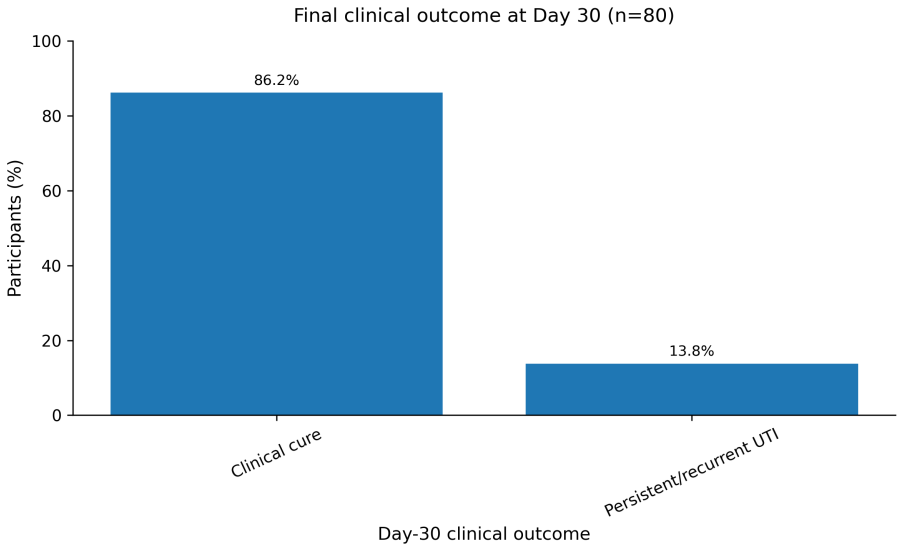

Figure 3: Final clinical outcome at Day 30.

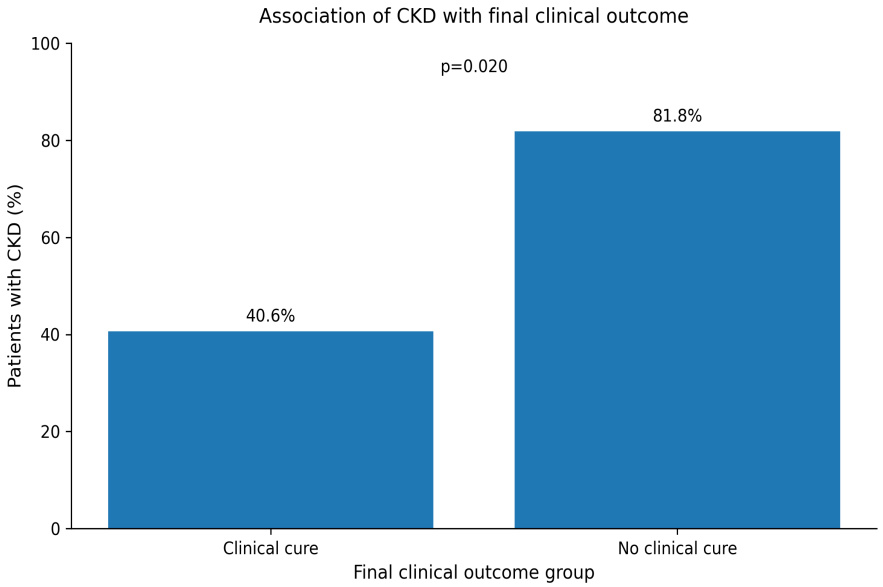

Figure 4A: Association of CKD with final clinical outcome.

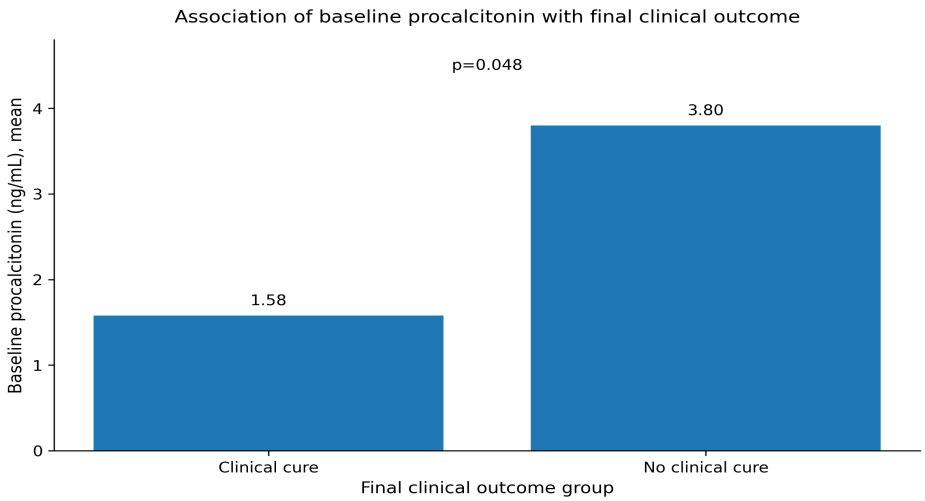

Figure 4B: Association of baseline procalcitonin with final clinical outcome.

Discussion

This prospective observational study evaluated 80 adults with complicated UTI admitted to a tertiary-care nephrology department in Assam. The major findings were the high burden of diabetes mellitus and CKD, predominance of Gram-negative uropathogens, substantial resistance to several commonly used antimicrobials, significant clinical and biochemical improvement during follow-up, and an overall clinical cure rate of 86.2%. CKD and higher baseline procalcitonin were associated with poorer short-term outcome.

The mean age of the study population was 50.34 years, with the largest proportion belonging to the 46–60-year age group. The relatively high burden of comorbid illness in this population is consistent with the clinical setting of a tertiary-care nephrology department. Current EAU guidance identifies renal impairment, diabetes, urinary tract abnormalities, obstruction, stones, previous antibiotic use and urinary devices among factors that may increase the likelihood of a difficult UTI course. [1]

Diabetes mellitus was the most frequently recorded comorbidity, occurring in 62.5% of participants. Diabetes is recognised as an important predisposing condition for UTI and is associated with several mechanisms that may increase susceptibility, including impaired neutrophil function, glycosuria and diabetes-related urinary tract abnormalities. [2] In patients with diabetes, complicated urinary infections may also present with severe renal or perirenal complications, emphasising the importance of early diagnosis and appropriate imaging when clinically indicated. [2]

CKD was present in 46.2% of the cohort. More importantly, CKD was significantly more frequent among patients who failed to achieve clinical cure. Among the 11 patients without clinical cure, 81.8% had CKD compared with 40.6% among those who achieved cure ($p=0.020$).

This finding is clinically plausible because renal impairment may represent both underlying host vulnerability and greater complexity of infection. Nevertheless, the association should not be interpreted as evidence that CKD independently causes treatment failure. The study was observational, lacked a control population and contained only 11 treatment failures. Larger studies with multivariable analysis are required to determine whether CKD remains an independent predictor after adjustment for age, diabetes, obstruction, antimicrobial resistance and infection severity.

The microbiological findings demonstrated a clear Gram-negative predominance. E. coli was isolated in 47.5% of participants, followed by K. pneumoniae in 22.5%. Together, these organisms accounted for 70.0% of the entire cohort. This predominance is consistent with Indian studies showing E. coli as the leading uropathogen. Kothari and Sagar reported E. coli in 68% of positive cultures in a multicentre Indian study, while Dash et al. reported E. coli in 68.8% of isolates from a rural population in Odisha. [3,5] The relatively high proportion of K. pneumoniae in the present study may reflect the complicated and tertiary-care nature of the population. Healthcare exposure, previous antimicrobial treatment, renal disease and urinary tract abnormalities may favour colonisation or infection with organisms possessing greater antimicrobial resistance.

The antimicrobial susceptibility findings are clinically important. Resistance was particularly high to amoxicillin, cefuroxime and ciprofloxacin. Similar patterns have been reported in Indian surveillance studies. Kothari and Sagar observed low susceptibility to amoxicillin and ciprofloxacin among Gram-negative uropathogens and reported ESBL production in 26.9% of Gram-negative isolates. [3] Mukherjee et al. also documented extensive multidrug resistance among uropathogenic E. coli isolated from hospitalised patients in Kolkata, including high resistance to amoxicillin, ampicillin and ciprofloxacin. [4]

The present study showed relatively high susceptibility to amikacin, piperacillin-tazobactam and carbapenems. These findings broadly correspond with previously published Indian data, although susceptibility patterns differ substantially according to institution, population and antimicrobial exposure. [3–5]

Importantly, the relatively high carbapenem susceptibility observed in this cohort should not be interpreted as a recommendation for routine empirical carbapenem therapy. Empirical antimicrobial selection should incorporate illness severity, prior antimicrobial exposure, previous resistant organisms, renal function and local susceptibility data. Once microbiological results are available, treatment should be narrowed whenever clinically appropriate. The EAU guideline similarly emphasises consideration of risk factors for resistant organisms and treatment failure when selecting therapy. [1]

The present study demonstrated marked improvement in clinical and laboratory parameters during follow-up. WBC count, CRP and serum creatinine decreased significantly by Day 10, with further improvement by Day 30. Fever and urinary symptoms also declined substantially.

The fall in serum creatinine is particularly relevant in this nephrology population. Mean creatinine decreased from approximately 4.1 mg/dL at

baseline to 2.4 mg/dL by Day 30. This may reflect recovery from infection-associated acute kidney injury, relief of obstruction, treatment of systemic infection and/or improvement of acute-on-chronic renal dysfunction. However, because baseline pre-infection renal function and formal AKI criteria were not incorporated into the supplied analysis, the study cannot determine the precise mechanism of creatinine improvement.

The final clinical cure rate was 86.2%, while 13.8% of patients experienced persistent or recurrent UTI. The latter group is clinically important because persistent infection may indicate resistant organisms, inadequate antimicrobial exposure, urinary obstruction, stones, persistent structural abnormalities or underlying host factors.

Baseline procalcitonin was significantly higher among patients who failed to achieve clinical cure. Procalcitonin may reflect a greater systemic inflammatory or bacterial burden. However, the difference was only marginally statistically significant ($p=0.048$), and the small number of treatment failures makes this result exploratory. It should therefore be validated in larger prospective cohorts before procalcitonin is considered an independent prognostic marker in complicated UTI.

The study also provides clinically relevant imaging and treatment information. Hydronephrosis, calculi and pyelonephritis/perinephric inflammatory changes were identified in a proportion of patients, and some required DJ stenting or percutaneous urinary drainage. These findings reinforce the importance of identifying and correcting anatomical or obstructive factors when present. Current EAU guidance specifically emphasises the importance of recognising urinary obstruction, stones and other urinary tract abnormalities because these factors can jeopardise treatment success. [1]

Strengths: The prospective design, systematic follow-up at Days 10 and 30, inclusion of microbiological susceptibility data and evaluation of both clinical and laboratory outcomes are important strengths. The study also provides institution-specific information from a tertiary-care nephrology population in Assam, where local antimicrobial surveillance may be particularly valuable.

Limitations: Several limitations should be considered.

First, this was a single-centre study with a relatively small sample size of 80 participants, limiting generalisability.

Second, the observational design does not permit causal inference.

Third, only 11 patients failed to achieve clinical cure, limiting statistical power for predictor analysis and increasing the possibility of unstable estimates.

Fourth, because there was no control group, diabetes mellitus, CKD and other conditions should be described as risk factors/comorbidities observed among patients with complicated UTI, rather than as quantified risk factors for developing UTI.

Conclusion

This prospective observational study demonstrates that complicated UTI in a tertiary-care nephrology population is characterised by a substantial burden of diabetes mellitus, chronic kidney disease and previous antimicrobial exposure, together with predominance of Gram-negative urinary pathogens.

Escherichia coli was the predominant organism, followed by Klebsiella pneumoniae, with the two organisms accounting for 70.0% of the study population.

Considerable resistance was observed to amoxicillin, cefuroxime and ciprofloxacin, whereas relatively high susceptibility was observed to amikacin, piperacillin-tazobactam and carbapenems.

Clinical symptoms, WBC count, CRP and serum creatinine improved significantly by Day 10 and remained improved at Day 30. Overall, 86.2% of patients achieved clinical cure, while 13.8% had persistent or recurrent UTI. CKD and higher baseline procalcitonin were associated with poorer short-term outcome.

These findings support an approach based on early recognition of host and urinary tract risk factors, urine culture and susceptibility testing, appropriate antimicrobial selection, assessment for obstruction or structural abnormalities, and close follow-up of patients at increased risk of treatment failure.

Declarations

Ethics Approval: The study was conducted following approval from the Institutional Ethics Committee of Gauhati Medical College and Hospital, Guwahati, Assam.

Consent: Written informed consent was obtained from all participants before enrolment.

Data Availability: The datasets generated and/or analysed during the current study are available from the corresponding author on reasonable request, subject to institutional and ethical restrictions.

Author Contributions: All authors contributed to the conception and design of the study, data collection, analysis and interpretation of data, manuscript preparation and approval of the final manuscript.

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