

RISING TREND OF PYELONEPHRITIS IN A TERTIARY HOSPITAL IN SOUTH TAMILNADU -A CROSS-SECTIONAL STUDY

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Abstract

Background: Pyelonephritis is a serious upper urinary tract infection that can lead to significant morbidity, hospitalization, and long-term renal complications if not diagnosed and managed early. The condition is commonly caused by Escherichia coli (E. coli) and ranges from mild infections to severe cases involving renal dysfunction, sepsis, and multiorgan failure. The increasing prevalence of diabetes mellitus and chronic kidney disease (CKD) has contributed to a rising trend in pyelonephritis, with poor glycemic control worsening disease severity. This study aimed to analyze the epidemiological trends, clinical presentations, and risk factors associated with pyelonephritis in a tertiary care hospital in South Tamil Nadu. **Materials and Methods:** This retrospective cross-sectional study was conducted in a tertiary care hospital in South Tamil Nadu, reviewing medical records from April 2021 to March 2024. Patients aged 18 years and above with a confirmed diagnosis of pyelonephritis were included, while those with incomplete records or malignancies were excluded. Data on demographics, comorbidities, clinical presentations, laboratory findings, microbiological culture results, and treatment adherence were collected. Statistical analyses, including chi-square tests, independent t-tests, ANOVA, and multivariate logistic regression, were performed using SPSS version 25. A p-value of less than 0.05 was considered statistically significant. **Result:** A total of 320 patients were analyzed, with a female predominance (68.1%) and a mean age of 52.4 years (SD ± 11.8 years). Recurrent pyelonephritis was observed in 46.3% of cases, while 38.4% had underlying CKD (P = 0.004). Diabetes mellitus was the most common risk factor (71.9%), with 59.2% of diabetic patients having poor glycemic control (HbA1c >6.5%). Loin pain (81.6%), fever with chills (89.4%), and vomiting (63.1%) were the most common clinical symptoms. Urine cultures were positive in 44.7% of cases, with E. coli (61.2%) being the predominant pathogen. Poor adherence to treatment was noted, with 52.5% of patients being non-compliant with medications and 27.1% refusing surgical interventions. Prolonged hospitalization (>7 days) was required in 51.9%, while ICU admissions (9.7%), acute kidney injury (42.5%), and mortality (2.3%) were also recorded. **Conclusion:** This study highlights the rising burden of pyelonephritis, particularly among diabetic and CKD patients, with poor treatment adherence contributing to disease recurrence and complications. E. coli remains the most common pathogen, while fever, loin pain, and vomiting are the predominant clinical presentations. Diabetes mellitus is the strongest risk factor, influencing both severity and recurrence. Despite advancements in diagnosis and management, poor follow-up and inadequate glycemic control remain key challenges. Strengthening patient education, structured follow-up, and early intervention strategies is essential to improve outcomes and reduce complications.

INTRODUCTION

Pyelonephritis is a serious upper urinary tract infection that can lead to significant morbidity, hospitalization, and long-term renal complications if not promptly diagnosed and managed.^[1] It is typically caused by bacterial infections, with *Escherichia coli* (*E. coli*) being the most common pathogen. The condition can range from mild uncomplicated cases to severe presentations involving renal dysfunction, sepsis, and multiorgan failure. Given the rising prevalence of diabetes mellitus and antibiotic resistance, the incidence and severity of pyelonephritis have increased over time, making it a major public health concern.^[2-5]

Recent studies have shown that diabetes mellitus, chronic kidney disease (CKD), and recurrent urinary tract infections (UTIs) are key risk factors for developing pyelonephritis. Poor glycemic control in diabetic patients contributes to impaired immune response, making them more susceptible to infections and recurrent episodes.^[6,7] Furthermore, renal damage due to pyelonephritis can worsen pre-existing CKD, accelerating the decline in kidney function. As pyelonephritis continues to affect vulnerable populations, understanding its demographic patterns, clinical presentation, and associated risk factors is crucial for improving early diagnosis and treatment strategies.^[8-10]

Despite advancements in diagnostic imaging and microbiological testing, delayed presentation and inadequate follow-up remain significant challenges in managing pyelonephritis. Many patients, especially those with underlying metabolic disorders, exhibit poor adherence to medications and irregular follow-up visits, leading to increased hospital admissions and disease recurrence. Studies have also indicated that antibiotic resistance is rising, further complicating treatment protocols and increasing the need for more targeted antimicrobial stewardship programs.^[11-13]

Several research studies have explored the epidemiology, risk factors, and microbiological profile of pyelonephritis across different populations. Diabetes mellitus has emerged as a key predisposing factor, with poor glycemic control contributing to increased disease severity, prolonged hospital stays, and a higher likelihood of intensive care admissions. Elevated HbA1c levels have been associated with greater risks of multiorgan dysfunction, highlighting the impact of metabolic disorders on disease progression. These findings reinforce the importance of early identification, glycemic control, and preventive strategies to mitigate complications, particularly in high-risk groups.^[14-17]

In the South Tamil Nadu region, there is limited data available on the rising burden of pyelonephritis and its changing risk factors. Given the high prevalence of diabetes and CKD in this population, an updated epidemiological study is needed to assess the current trends, risk factors, and treatment adherence in

patients diagnosed with pyelonephritis. Understanding these factors will help optimize clinical management, reduce complications, and improve patient outcomes.

This study aims to analyze the rising trend of pyelonephritis in a tertiary care hospital in South Tamil Nadu and identify the demographic patterns, clinical presentations, and risk factors associated with the disease. By identifying key predictors and treatment challenges, this research seeks to contribute to improving early detection, better treatment adherence, and enhanced preventive measures, ultimately reducing the burden of pyelonephritis in high-risk populations.

Objectives

To analyze the rising trend of pyelonephritis in a tertiary care hospital in South Tamil Nadu and to find out the demographic patterns, clinical presentations, and risk factors of pyelonephritis in a tertiary care hospital in South Tamil Nadu.

MATERIALS AND METHODS

This cross-sectional study was conducted in a tertiary care hospital in South Tamil Nadu. Medical records of patients aged 18 years and above who were diagnosed with pyelonephritis based on clinical, laboratory, and radiological findings over the past three years were reviewed. Patients with incomplete records, underlying malignancies, or those with missing follow-up data were excluded from the study. A total of 320 patients were included in the analysis based on a convenient sampling method.

Data were collected retrospectively from hospital records using a structured proforma, which included demographic details, comorbid conditions, clinical presentations, laboratory findings (renal function tests, blood glucose levels), imaging reports, microbiological culture results, and treatment details. Patients' adherence to prescribed medications, recurrence of pyelonephritis, and hospital outcomes were also documented. The study aimed to assess demographic trends, common clinical features, and risk factors contributing to pyelonephritis, particularly in high-risk groups such as those with diabetes mellitus and chronic kidney disease (CKD). All collected data were entered into Microsoft Excel and analyzed using SPSS version 25. Descriptive statistics were used to summarize patient characteristics, while chi-square test was applied to compare categorical variables. A p-value of less than 0.05 was considered statistically significant. The study adhered to institutional ethical guidelines, ensuring confidentiality of patient information, and no conflicts of interest or external funding were involved.

RESULTS

Over the past three years, a total of 320 cases of pyelonephritis were documented at our tertiary care

hospital in South Tamil Nadu. The majority of affected individuals were female (68.1%), with a mean age of 52.4 years (SD ± 11.8 years). (Table 1).

Table 1: Demographic details of participants

Demographic details		Frequency	Percent
Age group	<30	25	7.8%
	30-39	45	14.1%
	40-49	60	18.8%
	50-59	70	21.9%
	60-69	75	23.4%
	≥70	45	14.1%
Gender	Male	167	52.2%
	Female	213	68.1%

A significant proportion of patients (46.3%) presented with recurrent pyelonephritis, indicating a persistent or relapsing course of infection. Additionally, 38.4% of patients had evidence of chronic kidney disease (CKD) at the time of diagnosis. Patients with CKD were more likely to present with elevated renal parameters, which was found to be statistically significant (P = 0.004). Among all cases, 71.9% had diabetes mellitus, and 59.2% had poor glycemic control (HbA1c >6.5%) at the time of admission. Diabetes mellitus was the most common underlying cause of pyelonephritis, followed by papillary necrosis due to multiple

etiologies, including drug-induced (12.5%), idiopathic (8.4%), and infectious causes (7.2%).

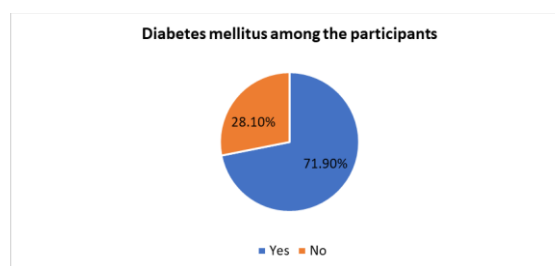


Figure 1. Diabetes mellitus among the participants

Table 2. Clinical presentation of participants

Clinical Presentation	Frequency (n)	Percentage (%)
Loin Pain	261	81.6%
Fever with Chills	286	89.4%
Vomiting	201	63.1%
Elevated Renal Parameters	183	57.2%
Hematuria	114	35.9%
Oliguria	91	28.4%
Diabetic Ketoacidosis	60	18.7%
Palpable Lumbar Mass	20	6.3%

The most common clinical presentation included loin pain (81.6%), fever with chills (89.4%), vomiting (63.1%), and elevated renal parameters (57.2%). Additionally, 35.9% of patients had hematuria, 28.4% had oliguria, and 18.7% presented with diabetic ketoacidosis (DKA). A palpable mass in the lumbar region was noted in 6.3% of cases, which is suggestive of severe inflammatory involvement or associated complications such as abscess formation. A substantial proportion of patients demonstrated poor adherence to treatment and follow-up. Specifically, 52.5% were non-compliant with prescribed medications and 27.1% refused surgical interventions. Urine cultures were positive in 44.7% of cases, with Escherichia coli (61.2%) being the most commonly isolated pathogen, followed by Klebsiella pneumoniae (15.7%), Pseudomonas aeruginosa (10.1%), and Enterococcus spp. (7.5%).

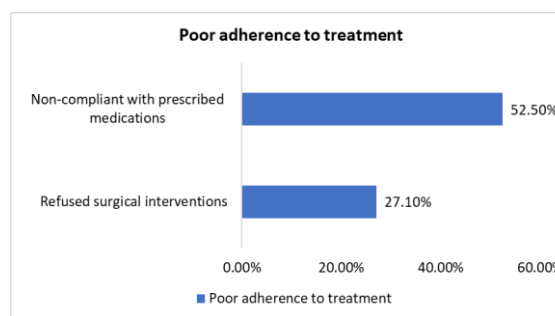


Figure 2. Poor adherence to treatment

A significant proportion of patients (51.9%) required prolonged hospitalization (>7 days) due to severe infections, worsening renal function, or metabolic complications. The mortality rate in the cohort was 2.3%, with diabetes-related complications and sepsis being the leading causes. Additional findings included acute kidney injury (AKI) in 42.5% of cases, multiorgan dysfunction syndrome (MODS) in 6.9%, intensive care unit (ICU) admission in 9.7%, and surgical intervention in 12.8% of cases.

DISCUSSION

In our study, the majority of pyelonephritis cases were female (68.1%), with a mean age of 52.4 years (SD \pm 11.8 years). This aligns with findings from Venkatesh et al3 where 62% of cases were female, and the mean age was 48.7 years. Similarly, Jacob et al7 reported a female predominance (68.4%), with an even higher mean age of 60.52 years, suggesting an increasing trend of pyelonephritis among elderly women. Shafi et al5 also observed a female-to-male ratio of 2:3, reinforcing the higher burden in women. Wani et al1 found a lower female prevalence (55%), likely due to geographical variations in patient demographics. The observed gender distribution is consistent with the established understanding that women have a higher risk of urinary tract infections (UTIs) due to anatomical and physiological factors.

Our study found that 46.3% of patients had recurrent pyelonephritis, and 38.4% had CKD at presentation, with a significant association between CKD and elevated renal parameters ($P = 0.004$). Gopal et al4 reported a comparable CKD prevalence of 40%, with CKD being a major contributor to recurrent infections. Umeshia et al2 identified a higher CKD prevalence of 54.4% among pyelonephritis patients, emphasizing the strong correlation between renal impairment and recurrent infections. Hase et al6 reported that 72% of pyelonephritis patients had diabetes, which contributed to renal deterioration, supporting our findings on CKD being a significant risk factor. Venkatesh et al3 further corroborated these findings, reporting 47% of patients with acute kidney injury (AKI) at admission, indicating severe disease progression in high-risk individuals.

Our study identified diabetes mellitus as the most common underlying cause (71.9%) of pyelonephritis, with 59.2% of patients having poor glycemic control (HbA1c $>6.5\%$). This is consistent with Wani et al1 where 70% of patients were diabetic, and Umeshia et al2 who reported a slightly lower prevalence of 54.4%. Hase et al6 found an even higher prevalence (72% of patients with complicated pyelonephritis had diabetes), highlighting the well-established association between poor glycemic control and renal infections. Dhamotharan et al8 also reported diabetes as the most significant risk factor (73%) for acute pyelonephritis. Our findings emphasize the critical need for strict glycemic control in preventing recurrent and severe pyelonephritis.

The most common clinical presentations in our study were fever with chills (89.4%), loin pain (81.6%), vomiting (63.1%), and elevated renal parameters (57.2%). Wani et al1 reported fever as the predominant symptom in 92% of cases, followed by the classical triad of fever, flank pain, and dysuria in 55%. Shafi et al5 found dysuria in 82% of cases and fever in 65%, slightly lower than our study. Hase et al6 observed fever in 90% of patients, reinforcing its role as the most consistent symptom. Gopal et al4 highlighted that one-fourth of elderly patients (26%)

lacked fever, suggesting that atypical presentations should be considered in older adults. These comparisons suggest that while fever and flank pain remain hallmark symptoms, variations exist based on age and comorbid conditions.

Urine cultures were positive in 44.7% of cases in our study, with *Escherichia coli* (61.2%) as the most frequently isolated organism, followed by *Klebsiella pneumoniae* (15.7%), *Pseudomonas aeruginosa* (10.1%), and *Enterococcus* spp. (7.5%). These findings are consistent with Wani et al1 where *E. coli* was the predominant pathogen (60%), followed by *Enterococcus* (16.6%), *Klebsiella* (13.3%), and *Pseudomonas* (10%). Similarly, Jacob et al7 found *E. coli* in 35% of cases, though with a higher prevalence of extended-spectrum beta-lactamase (ESBL) organisms (10%). Umeshia et al2 reported *E. coli* in 29.7% of cases, with a lower culture positivity rate (48.3%), suggesting that pre-admission antibiotic use might influence culture yield. Hase et al6 also found *E. coli* as the most common pathogen (53%), reinforcing its dominance in pyelonephritis cases. Our study supports the ongoing shift in microbial resistance patterns, necessitating prudent antibiotic selection.

A substantial proportion of our patients exhibited poor adherence, with 52.5% being non-compliant with medications, 27.1% refusing surgical interventions, and 45.3% lost to follow-up. Jacob et al7 similarly reported poor follow-up rates (40%), especially among elderly patients. Wani et al1 highlighted that poor glycemic control was associated with a prolonged hospital stay and ICU admissions. Esteban et al9 observed 6.1% of discharged patients were readmitted within 72 hours due to inadequate initial management, emphasizing the role of structured follow-up. Dhamotharan et al8 reported that early CT diagnosis and aggressive management led to improved outcomes, highlighting the importance of timely intervention and patient education.

A significant proportion of our patients (51.9%) required prolonged hospitalization (>7 days) due to severe infections, worsening renal function, or metabolic complications. The mortality rate was 2.3%, with AKI in 42.5% of cases, MODS in 6.9%, ICU admission in 9.7%, and surgical intervention in 12.8%. Wani et al1 reported ICU admission in 3% of cases and AKI in 46%, which is comparable to our findings. Umeshia et al2 documented a higher mortality rate (6.1%), likely due to the inclusion of critically ill patients with multiorgan dysfunction (31.8%). Shafi et al5 reported AKI in 41% of patients, with 23% requiring hemodialysis, suggesting that severe renal involvement significantly impacts prognosis. Hase et al6 found that patients with ESBL infections had worse outcomes, reinforcing the need for early microbiological diagnosis and appropriate antibiotic therapy. This study was conducted in a single tertiary care center, which may limit the generalizability of the findings to other settings.

CONCLUSION

This study highlights the rising trend of pyelonephritis in South Tamil Nadu, particularly among diabetic and CKD patients, with poor treatment adherence contributing to recurrent infections. Fever, loin pain, and vomiting were the most common clinical presentations, while *E. coli* remained the predominant pathogen. Diabetes mellitus was the strongest risk factor, significantly influencing both disease severity and recurrence. Despite advances in diagnosis and management, poor follow-up and inadequate glycemic control remain key challenges. Strengthening patient education, structured follow-up, and early intervention is essential to improve clinical outcomes and reduce complications.

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