

Clinical Characteristics of Pyelonephritis among Type 2 Diabetes Mellitus Patients from a Tertiary Care Hospital in South India.

Dr. Balaji Vijayam*

Department of Diabetology,
Dr. V Balaji Diabetes Care and Research Institute,
Aminjikarai, Chennai, Tamil Nadu, India

&

Dr. Taarika Balaji

Department of Diabetology,
Dr. V Balaji Diabetes Care and Research Institute,
Aminjikarai, Chennai, Tamil Nadu, India

&

Dr. Madhuri S Balaji

Department of Diabetology,
Dr. V Balaji Diabetes Care and Research Institute,
Aminjikarai, Chennai, Tamil Nadu, India

&

Dr. Geetha PV Ph.D

Department of Medical Research,
Dr. V Balaji Diabetes Care and Research Institute,
Aminjikarai, Chennai, Tamil Nadu, India

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Abstract: The study aimed to examine the clinical features of pyelonephritis in type 2 diabetic patients at a tertiary care hospital. A retrospective study of 80 diabetic patients admitted with pyelonephritis in tertiary healthcare hospitals from April 2023 to March 2024 examined their clinical profiles and HbA1c status. Fever was the most frequent clinical symptom, followed by nausea, vomiting, dysuria, flank pain, and diabetic ketoacidosis. Hypertension was the common comorbidity. Laboratory results showed 81.25% had serum creatinine ≥ 2.5 mg/dl, poor glycemic control in 66.25%, leucocytosis in 63.75%, thrombocytopenia in 6.25%, renal cysts in 12.54%, and calculi in 8.75%. The organisms isolated were E. coli, Pseudomonas sp., K. pneumoniae, and C. albicans. Pyelonephritis is a severe urinary tract infection that requires prompt diagnosis and treatment.

Keywords: Diabetes mellitus, Pyelonephritis, UTI, E.coli

Introduction

Diabetes is an endocrine metabolic disorder. There are two main types of diabetes, with type 2 diabetes being the most widespread, marked by high blood sugar, insulin resistance, and reduced insulin levels (1). Type 2 diabetes mellitus is caused by a combination of genetic, environmental, and behavioral factors (2). Individuals with type 2 diabetes are at higher risk for a range of short- and long-term complications, which frequently result in early mortality (3).

People with diabetes have an increased susceptibility to various infections, such as urinary tract infections, lower respiratory infections, sepsis, endocarditis, skin infections, bone infections, arthritis, and mucositis, compared to those without diabetes (4). The most predominant bacterial infection among diabetic patients is urinary tract infection (UTI) (5).

Pyelonephritis is a potentially serious manifestation of UTI (6). Individuals with type 2 diabetes have a higher incidence of pyelonephritis (5). Acute pyelonephritis (APN) is a bacterial or fungal infection that affects the renal

pelvis and kidney. A UTI that extends from the bladder to the kidney is typically the cause of pyelonephritis (7). The range of severity in acute pyelonephritis varies from moderate flank pain with low fever to significant morbidity (8).

The prognosis of APN is determined by risk factors such as urogenital system abnormalities, immunosuppression, co-morbidities, virulence of microorganisms, and antibiotic resistance (9). This study was carried out to analyse the clinical characteristics of pyelonephritis in patients with type 2 diabetes mellitus at a tertiary care hospital.

Material and methods

A retrospective study was conducted at tertiary health care hospitals between April 2023 and March 2024. From the hospital electronic records, information was collected about 80 diabetic patients who were admitted with pyelonephritis as their primary diagnosis. All patient data that was available was carefully examined in order to ascertain each patient’s clinical profile. Further analysis was carried out according to HbA1c status (<7.5%), ≥7.5%. Quantitative variables were expressed as means ± SD and categorical variables were compared using chi-square test.

Results

The patients mean age was determined to be 65.3±10.3 years. Out of 80 individuals, 51.25% were females and 48.75% were males (Table 1). In this study, the most prevalent clinical symptoms among patients were fever (37.5%), which was followed by nausea and vomiting (27.5%), dysuria (20.5%), flank pain (10%) and diabetic ketoacidosis (5%). Hypertension was found to be the most common comorbidity in this study, with a prevalence of 70% (Table 2).

Table 1: Distribution of Patients Characteristics

| Patients characteristics | No. of patients (n=80) | Percentage |
|--------------------------|------------------------|------------|
| Age in years | | |
| 31-40 | 2 | 2.5% |
| 41-50 | 1 | 1.25% |
| 51-60 | 23 | 28.75% |
| 61-70 | 29 | 36.25% |
| 71-80 | 20 | 25% |
| >81 | 5 | 6.25% |
| Gender | | |
| Male | 39 | 48.75% |
| Female | 41 | 51.25% |

Table 2: Distribution of clinical features in patients

| Clinical presentations | No. of patients (n=80) | Percentage |
|------------------------|------------------------|------------|
| Symptoms | | |
| Fever | 30 | 37.5% |
| Nausea & Vomiting | 22 | 27.5% |
| Dysuria | 20 | 25% |
| Flank pain | 8 | 10% |
| Diabetic ketoacidosis | 4 | 5% |
| Comorbidity | | |
| Hypertension | 56 | 70% |
| Dyslipidemia | 27 | 33.75% |
| Hypothyroidism | 22 | 27.5% |
| Pulmonary disease | 21 | 26.5% |
| Cardiovascular disease | 18 | 22.5% |

Of the laboratory values (Table 3), 81.25% had serum creatinine ≥ 2.5 mg/dl. Poor glycemic control was present in 66.25%. Leukocytosis and thrombocytopenia were seen in 63.75% and 6.25% of the respective rates. In 12.5% and 8.75% of cases, renal cysts and calculi were found. The organisms isolated were *Escherichia coli* (52%) followed by *Pseudomonas sp.*, (16%), *Klebsiella pneumoniae*, (12%) and *Candida albicans* (4%) (Table 3). The study found no significant differences among serum creatinine, WBC and urine culture ($p = 0.28$, $p = 0.36$, and $p = 0.91$) between normal and abnormal HbA1c groups, but fasting blood glucose level ($p=0.005$) was statistically significant (Table 4).

Table 3: Laboratory parameters of patients

| Laboratory parameters | No. of patients (n=80) | Percentage |
|-------------------------------|------------------------|------------|
| HbA1C | | |
| $\geq 7.5\%$ | 53 | 66.25% |
| $< 7.5\%$ | 27 | 33.75% |
| Fasting Plasma Glucose | | |
| > 125 mg/dl | 49 | 61.25% |
| < 125 mg/dl | 31 | 38.75% |
| Creatinine | | |
| ≥ 2.5 mg/dl | 65 | 81.25% |
| < 2.5 mg/dl | 15 | 18.75% |
| Total (WBC) Count | | |
| $> 12,000/mm^3$ | 51 | 63.75% |
| $< 12,000/mm^3$ | 29 | 36.25% |
| Platelet count | | |
| $> 150000/mm^3$ | 75 | 93.75% |
| $< 150000/mm^3$ | 5 | 6.25% |
| Urine Culture | | |
| Positive growth | 27 | 33.75% |
| Negative growth | 53 | 66.25% |
| Organisms | | |
| <i>Escherichia coli</i> | 13 | 52% |
| <i>Pseudomonas sp.</i> | 4 | 16% |
| <i>Klebsiella pneumoniae</i> | 3 | 12% |
| <i>Candida albicans</i> | 1 | 4% |
| USG | | |
| Renal cyst | 10 | 12.5% |
| Renal calculi | 7 | 8.75% |

Table 4: Clinical characteristics in patients with normal HbA1c and abnormal HbA1c

| Characteristics | Normal HbA1c (n=27) | Abnormal HbA1c (n=53) | P-value |
|-----------------------------|---------------------|-----------------------|--------------|
| FPG > 125 mg/dl | 12 | 40 | 0.005 |
| Creatinine ≥ 2.5 mg/dl | 24 | 42 | 0.28 |
| WBC $> 12,000/mm^3$ | 17 | 34 | 0.91 |
| Urine culture (+) | 8 | 18 | 0.69 |

Discussion

Pyelonephritis is a common and potentially life-threatening condition in patients with uncontrolled diabetes. Its clinical symptoms are nonspecific and similar to the traditional upper urinary tract infection triad, which causes a delay in diagnosis. In this study, fever was the most frequent presenting symptom. Hypertension is a common comorbidity among people with type 2 diabetes (10). In this study, 70% of the patients had hypertension. In contrast, the study conducted by Sharma et al. and Jain et al. found that only 16.66% and 7% of participants, respectively, had hypertension (11 & 12).

Diabetic ketoacidosis is a very uncommon presentation, and only a few cases have been documented so far (13). In the present study, 5% of patients had diabetic ketoacidosis. Nabi et al. also reported that 6.7% of patients with pyelonephritis had diabetic ketoacidosis, which is consistent with our findings (14). Diabetic ketoacidosis was not observed in any of the patients in a study conducted by the Dilip et al (15). In this study, majority of patients exhibited poor glycemic control (66.25%) and leukocytosis (63.75%). Eswarappa et al also reported that leukocytosis (80%) is more common in diabetic patients with pyelonephritis (16).

In this study, 33.75% of the urine cultures had positive growth, while 66.25% did not exhibit any growth. The most frequently occurring organism was *E. coli* (52%), followed by *Pseudomonas sp.*, (16%) and *K. pneumoniae*, (12%). *C. albicans* was observed in one sample. In several studies, it was determined that *E. coli* was prevalently encountered (17,18,19). The present study noticed a statistically significant difference ($p=0.005$) in fasting blood glucose rates between normal and abnormal HbA1c levels. Similar finding was also reported by Min et al (20).

In this study, the majority of the patients with confirmed pyelonephritis lacked the usual UTI symptoms. Similar to this study, Song et al., also reported normal WBC counts on urinalysis and more than half of the APN patients did not show any symptoms of an upper or lower urinary tract infection. In cases where pyelonephritis cannot be ruled out completely and no other cause of fever can be identified, imaging tests like CT should be used more decisively (21).

Conclusion

Pyelonephritis remains a serious urinary tract infection. The diagnosis should be considered even in the absence of typical clinical features or normal urine microscopic analysis. It can be effectively treated with strong clinical concern and prompt treatment initiation.

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Conflict of Interest

No conflict of interest to be disclosed.

References

1. Olokoba AB, Obateru OA, Olokoba LB (2012) Type 2 diabetes mellitus: a review of current trends. Oman Medical Journal: 27(4):269-73.
2. Chen L, Magliano DJ, Zimmet PZ (2011) The worldwide epidemiology of type 2 diabetes mellitus--present and future perspectives. Nature Reviews Endocrinology: 8;8(4):228-36.
3. Fünfstück R, Nicolle LE, Hanefeld M, Naber KG (2012) Urinary tract infection in patients with diabetes mellitus. Clinical Nephrology: 77(1):40-8.
4. Chávez-Reyes J, Escárcega-González CE, Chavira-Suárez E, León-Buitimea A, Vázquez-León P, Morones-Ramírez JR, Villalón CM, Quintanar-Stephano A, Marichal-Cancino BA (2021) Susceptibility for Some Infectious Diseases in Patients With Diabetes: The Key Role of Glycemia. Frontiers in Public Health: 16;9:559595.

5. Nitzan O, Elias M, Chazan B, Saliba W (2015) Urinary tract infections in patients with type 2 diabetes mellitus: review of prevalence, diagnosis, and management. *Diabetes Metabolic Syndrome Obesity*: 26;8:129-36.
6. Czaja CA, Scholes D, Hooton TM, Stamm WE (2011) Population-based epidemiologic analysis of acute pyelonephritis. *Clinical Infectious Diseases*: 1;45(3):273-80.
7. Colgan R, Williams M, Johnson JR (2011) Diagnosis and treatment of acute pyelonephritis in women. *American Family Physician*: 1;84(5):519-26.
8. Johnson JR, Russo TA (2018) Acute Pyelonephritis in Adults. *New England Journal of Medicine*: 4;378(1):48-59.
9. Foxman B (2003) Epidemiology of urinary tract infections: incidence, morbidity, and economic costs. *Disease-a-Month*: 49(2):53-70.
10. Przekaz A, Bielka W, Pawlik A (2022) Hypertension and Type 2 Diabetes-The Novel Treatment Possibilities. *International Journal of Molecular Sciences*: 23(12):6500.
11. Sharma, Amit & Pujari, Sujata & Sharma, Shweta & Rulaniya, Suresh & Mohapatra, Biswajit & Goel, Gourab (2021) Emphysematous Pyelonephritis: Role and Factors Affecting Renal Conservation- A Cross-sectional Study. *Journal of Clinical Diagnostic Research*: 15. 10.
12. Jain A, Manikandan R, Dorairajan LN, Sreenivasan SK, Bokka S (2019) Emphysematous pyelonephritis: Does a standard management algorithm and a prognostic scoring model optimize patient outcomes? *Urology Annals*: 11(4):414-420.
13. Buenrostro-Valenzuela JC, Amezcua-Perez J, Schlie-Villa W and Romero-Bermudez J (2021) Diabetic Ketoacidosis Triggered by an Emphysematous Urinary Tract Infection: A Case Report and Mini-Review of Literature. *Journal of Family Medicine*: 8(5): 1259.
14. Nabi T, Rafiq N, Rahman MHU, Rasool S, Wani NUD (2020) Comparative study of emphysematous pyelonephritis and pyelonephritis in type 2 diabetes: a single-centre experience. *Journal of Diabetes Metabolic Disorders*: 28;19(2):1273-1282.
15. Dilip Onkar Patil, Sanjay Pandharinath Patil (2019) Study of pyelonephritis in patients with diabetes mellitus at tertiary care hospital. *International Journal of Medicine*: 11(3): 151-153.
16. Eswarappa, Mahesh & Suryadevara, Sarita & John, MannsManohar & Gurudev, K.C (2018) A comparative study of acute nonemphysematous pyelonephritis in diabetics and nondiabetics from a tertiary care hospital in South India. *BLDE University Journal of Health Science*. 3. 12-7.
17. Kumar S, Ramachandran R, Mete U, Mittal T, Dutta P, Kumar V, Rathi M, Jha V, Gupta KL, Sakhuja V, Kohli HS (2014) Acute pyelonephritis in diabetes mellitus: Single center experience. *Indian Journal of Nephrology*: 24(6):367-71.
18. Shafi PKM, Rosh P (2020) A cross sectional study on risk factors, clinical profile and aetiology of acute pyelonephritis in tertiary teaching hospital in Kerala. *Journal of Evidence-Based Medicine Healthcare*: 7(52), 3159-3165.
19. Pontin AR, Barnes RD (2009) Current management of emphysematous pyelonephritis. *Nature Reviews Urology*: 6:272-9.
20. Min H B, Chang H P, Young S C, Kwan J J, Chil H K, Heung J P (2015) Effects of Diabetes Mellitus and HbA1c on Treatment Prognosis in Uncomplicated Acute Pyelonephritis. *Korean Journal of Urogenital Tract Infection Inflammation*: 10(1):41-48.
21. Song HK, Shin DH, Na JU, Han SK, Choi PC, Lee JH (2022) Clinical investigation on acute pyelonephritis without pyuria: a retrospective observational study. *J Yeungnam Medical Sciences*: 39(1):39-45.