

Comorbid Conditions as A Risk Factor for Urinary Tract Infection in Diabetes Patients: A Retrospective Case Control Study

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ABSTRACT

UTIs are frequent side effects of diabetes mellitus, frequently resulting in substantial morbidity and medical expenses. In this group, the risk of UTIs may be increased by the co-existing diseases. The purpose of this study is to assess the influence of many coexisting illnesses on the risk of urinary tract infections in people with diabetes.

OBJECTIVE: To estimate the comorbid conditions such as heart disease, dyslipidemia, neurologic pain and lower urinary tract symptoms that are risk factors for UTI in diabetes patients.

METHODS: The study was a hospital-based Retrospective case control study conducted in 2713 people with Type 2 DM who were tested for UTI at BCMCH hospital Thiruvalla over a period of 6 months.

RESULT: A study of 2713 diabetes patients found that only 18.4% received treatment for heart disease, 9.1% for severe neurologic discomfort, and 4.2% for lower urinary tract symptoms (LUTS). Over half received treatment for dyslipidemia. Patients with LUTS had a higher likelihood of having a diagnosed UTI.

CONCLUSION: Diabetes is a chronic condition with a high risk of recurrent urinary tract infections (UTIs). This study reveals that dyslipidemia is most associated with UTIs in DM patients, with a high prevalence in uncontrolled DM populations. Patients with LUTS prescriptions are more likely to have confirmed UTIs. Other symptoms like neurological pain and comorbid conditions are not significantly associated with UTI in DM patients.

KEYWORDS: Diabetes, Urinary Tract Infection, Comorbidities, chronic kidney disease, peripheral vascular disease.

INTRODUCTION:

When untreated or poorly managed, diabetes mellitus is a chronic condition that compromises quality and life expectancy. It may potentially result in serious consequences. Diabetes patients are more susceptible to infections, including a wide range of common infections and pathogenic infections such mucormycosis, emphysematous pyelonephritis, Fournier's gangrene, and malignant otitis externa. [1]

Diabetes is a long-term medical disorder that impacts the metabolism of fat, carbs, and proteins. The majority of the food we eat is converted by our body into sugar and released into the circulation. Our

pancreas releases insulin in response to an increase in blood sugar levels. Diabetes comes in two varieties: Type 1 and Type 2. Diabetes causes either insufficient insulin production or poor insulin utilisation by the organism. Blood sugar remains in the bloodstream when the body is unable to use insulin, which can cause serious health issues such kidney disease, heart disease, and eyesight loss. [2]

Among people with type 2 diabetes mellitus, urinary tract infections are more frequent, more severe, and have poorer outcomes. Moreover, resistant microorganisms are more frequently the source of them. It has not been discovered that the novel anti-diabetic sodium glucose cotransporter 2 inhibitors considerably raise the incidence of symptomatic UTIs. Patients with diabetic neuropathy may have different clinical indicators from those without the disease, but otherwise, urinary tract infection symptoms are identical in both groups. The existence of symptoms, the intensity of systemic symptoms, whether the infection is limited to the bladder or affects the kidney, the presence of urologic abnormalities, concomitant metabolic changes, and renal function are some of the criteria that determine the course of treatment. Patients with diabetes who have asymptomatic bacteriuria do not need to be treated. Additional research is required to enhance the treatment of patients with UTIs. [3]

Urinary tract infections are more common in women due to shorter urethra and proximity to the anus. Aged adults are at risk due to incomplete bladder evacuation. Healthcare providers may test for other health issues and prescribe low-cure antibiotics for frequent UTIs to prevent antibiotic resistance and other infections. [4]

One of the main risk factors for cardiovascular disease in people with diabetes mellitus is dyslipidaemia. It is distinguished by an elevated concentration of tiny dense LDL-cholesterol particles, low concentration of HDL cholesterol, and high concentration of plasma triglycerides. Patients now have more alternatives to reach their goal cholesterol levels thanks to the availability of several lipid-lowering medications and supplements; nevertheless, the range of treatment options presents a difficulty when it comes to deciding which medical therapy to prioritise. Patients with diabetes mellitus do not have a higher prevalence of hypercholesterolaemia, but their mortality from coronary heart disease rises exponentially with blood cholesterol levels. The majority of persons with diabetes mellitus are eligible for statin medication, which lowers the relative cardiovascular risk in diabetic patients. [5]

OBJECTIVE:

To estimate the comorbid conditions such as heart disease, dyslipidemia, neurologic pain and lower urinary tract symptoms that are risk factors for UTI in diabetes patients.

METHODOLOGY:

The study was conducted in Believers Church Medical College Hospital (BCMCH), Thiruvalla. The study was carried out for a period of 6 months (November 2022 to April 2023). All patients who meet the inclusion and exclusion criteria within 6 months will be included. As per hospital statistics sample size is 2713.

Calculating Proportion :

$$N=4PQ/d^2$$

Where,

P= Prevalence (from previous studies)

Q= 100-P

d= allowable error (5-20% of P)

Inclusion criteria:

Patients admitted during the study period.

Patients aged > 18 years.

Patients of both genders.

Exclusion criteria:

NIL

STUDY PROCEDURE

The data was collected from Believers Church Medical College Hospital of all patients who were tested for UTI in the laboratory of BCMCH will be extracted from the Lab Information System(LIS). Their HbA1c level will also be noted from the LIS. Their demographic factors will be extracted from the Hospital Information System (HIS). Their drug history will be extracted from the prescription orders. DM status , comorbid conditions and complications of DM will be determined based on prescriptions.

RESULTS:

The study mainly focuses on the comparison between patients having urinary tract infection (case) and non-urinary tract infection (control) in diabetic population having different comorbid conditions.

Table 1: Distribution of Co-existing Conditions Among DM patients by UTI

| Co-existing Conditions | UTI | NON-UTI |
|------------------------------|-------------|------------|
| Lower Urinary Tract Symptoms | 224 (20.3%) | 274(17.0%) |
| Neurologic Pain | 108 (9.8%) | 139(8.6%) |
| Heart Disease | 56(5.1%) | 59(3.7%) |
| Dyslipidemia | 615(55.8%) | 855(53.1%) |

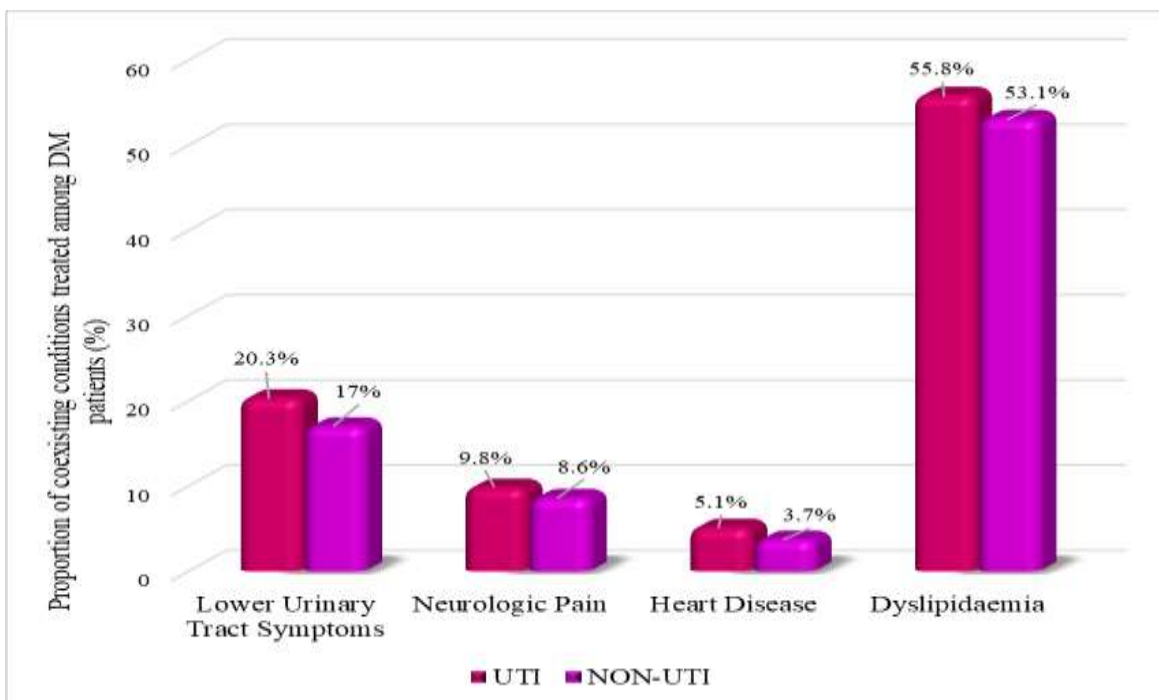


Figure 1: Distribution of Co-Existing Conditions Among DM Patients

Table 2: Association of Co-Existing Conditions with UTI Among DM Patients

| Co-Existing Conditions | UTI | | | p value | OR (95% CI) |
|------------------------------|----------------|------------------|-----------------|---------|----------------|
| | Total (n=2713) | Present (n=1103) | Absent (n=1610) | | |
| symptoms | | | | | |
| Lower Urinary Tract Symptoms | 498 (18.4%) | 224 (20.3%) | 274 (17.0%) | 0.03 | 1.2 (1.02-1.5) |
| Neurologic pain | 247 (9.1%) | 108 (9.8%) | 139 (8.6%) | 0.3 | 1.1 (0.88-1.5) |
| Comorbid conditions | | | | | |
| Heart disease | 115 (4.2%) | 56(5.1%) | 59 (3.7%) | 0.08 | 1.4 (0.97-2.0) |
| Dyslipidemia | 1470 (54.5%) | 615 (55.8%) | 855 (53.1%) | 0.2 | 1.1 (0.95-1.3) |

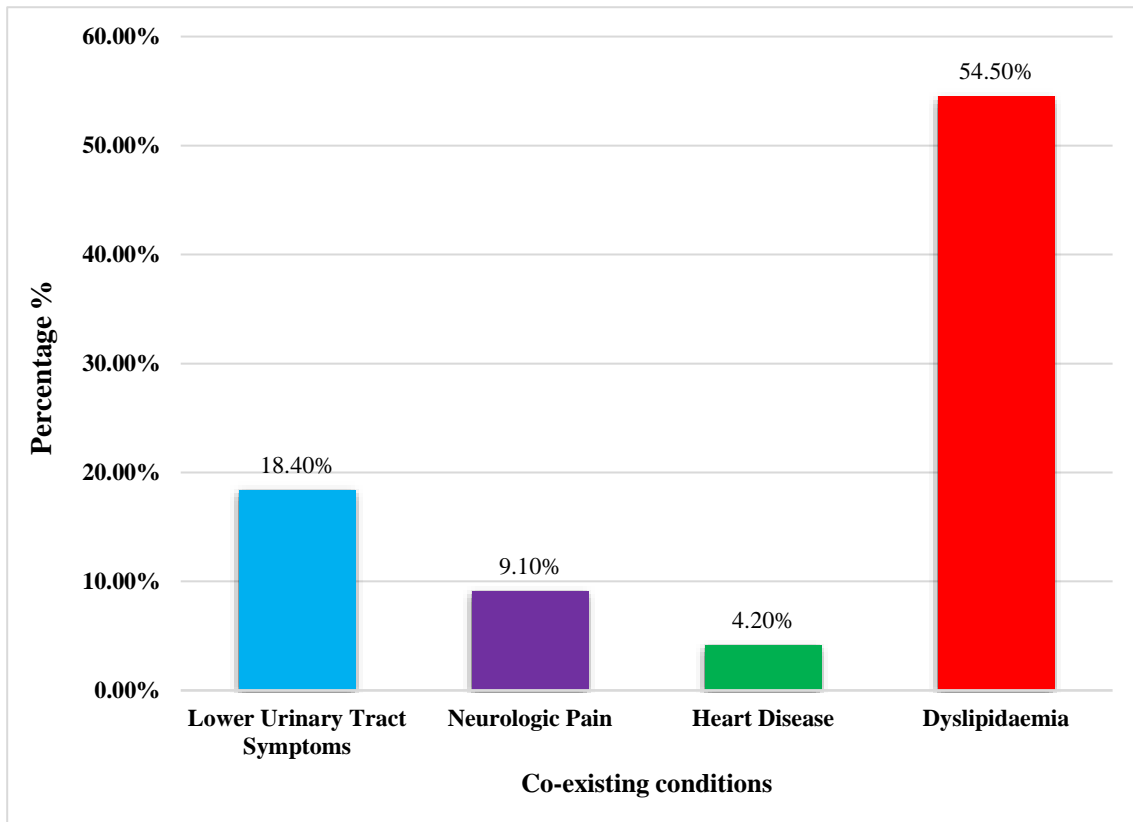


Figure 2: Distribution of Co-existing Conditions Among DM Patients by UTI

As shown in Table 1 and Figure 2, among the 2713 DM patients observed, only 498 (18.4%) were treated for Lower Urinary Tract Symptoms (LUTS), 247 (9.1%) were treated for severe neurologic pain and 115 (4.2%) were treated for heart Disease. However, more than half, that is 1470 (54.5%) were treated for Dyslipidemia. More patients with LUTS were given a prescription for the same among those with confirmed

UTI (20.3%) than those without these symptoms (17.0%) (Figure 1). This difference was significant ($p=0.03$). As expected, patients with a prescription for LUTS were more likely 1.2 (1.02-1.5) to have confirmed UTI compared to those without symptoms. Other Symptoms such as Neurologic Pain and other comorbid conditions such as heart Disease and Dyslipidemia were not significantly associated with UTI in DM patients.

OBSERVATIONS & DISCUSSIONS:

The study population consists of 2713 samples. The study was a hospital based retrospective case-control study. The data subjects were collected from the HIS department of BCMCH and were entered into Microsoft excel sheets. Risk factors of UTI were assessed by comparing the UTI and Non-UTI cases in the diabetes population, among the 2713 subjects 1610 had non-UTI and 1103 had UTI cases.

• ASSOCIATION OF LOWER UTI SYMPTOMS AMONG DM PATIENTS WITH UTI

In the study it shows that, out of the coexisting conditions Lower UTI symptoms (18.4%) were found to be more than neurologic pain (9.1%). Lower UTI symptoms include Diabetic Nephropathy and Genital infections. Out of those subjects who had lower UTI symptoms, 20.3% had UTI and 17.0% did not have UTI. A study conducted by **Abdulhakeem Hamood Alrawahi et al.** inferred that among 699 diabetic subjects, total prevalence of diabetic nephropathy was calculated as 42.5%. [6] Another study conducted by **Gregory A. Nichols et al.** inferred that among 39,295 patients with type 2 DM, type 2 DM was associated with an adjusted 25% increased risk of UTI, a 26% increased risk of GI and a 22% increased risk of any GUI. [7] In conclusion, T2DM was associated with increased risks of any GUI, UTIs and GIs.

• ASSOCIATION OF NEUROLOGIC PAIN AMONG DM PATIENTS WITH UTI

In the study it shows that the prevalence of neurologic pain was found to be 9.1%. Out of those subjects who had neurologic pain, 9.8% of them had UTI and 8.6% did not have UTI. In a study conducted by **Mark Davies et al.** inferred that the prevalence of PDPN was 26.4%. Having PDPN has a significant negative effect on quality of life, and increasing neuropathy is associated with an increasing risk of developing PDPN. [8]

• ASSOCIATION OF HEART DISEASE AMONG DM PATIENTS WITH UTI

In the study it shows that the prevalence of heart disease was found to be 4.2%. Out of those subjects who had heart disease, 5.1% of them had UTI and 3.7% of them did not have UTI. A study conducted by **Tangying Li et al.** inferred that Cardiovascular disease (CVD), including cardiomyopathy, congestive heart failure, stroke and peripheral arterial disease, is the most prevalent cause of both morbidity and mortality in patients with DM. The increased risk of death from CVD compared to the general population has been estimated at being between 1.6 and 2.6 times greater in individuals with T2DM depending on the form of CVD. [9]

Another study conducted by **Thomas R. Einarson et al.** inferred that, in 4,549,481 persons with T2DM, CVD affected 32.2% overall; 29.1% had atherosclerosis, 21.2% had coronary heart disease 14.9% heart failure 14.6% angina, 10.0% myocardial infarction and 7.6% stroke. Cardiovascular disease (CVD) is a common comorbidity in type 2 diabetes (T2DM). [10]

• ASSOCIATION OF DYSLIPIDEMIA AMONG DM PATIENTS WITH UTI

In our study it shows that, prevalence of dyslipidemia was found to be 54.5%. Out of those subjects who had dyslipidemia, 55.8% of them had UTI and 53.1% of them did not have UTI. A study conducted by **Hung-Chun Chen et al.** inferred that dyslipidaemia is common in diabetic patients. Many clinical and experimental studies suggest that serum cholesterol may play an important role in the development and progression of diabetic nephropathy. [11]

CONCLUSION:

Diabetes is a long-term medical illness, and its risk is influenced by complications and comorbidities. One of the primary effects of diabetes is recurrent urinary tract infections. This study demonstrates that DM individuals with reduced UTI symptoms were linked to higher risks of GI, UTI, and any GUI. UTIs were far less common in individuals with diabetic neuropathy and CVD than in people with dyslipidemia. UTIs are very common in the population of uncontrolled diabetes mellitus. Therefore, further research is needed to compare the particular comorbid factors that cause UTIs to occur more frequently in DM patients.

ABBREVIATIONS:

UTI - URINARY TRACT INFECTION

T2 DM - TYPE 2 DIABETES MELLITUS

LUTS - LOWER URINARY TRACT SYMPTOMS

LDL - LOW DENSITY LIPOPROTEIN

HDL - HIGH DENSITY LIPOPROTEIN

GUI - GENITO - URINARY INFECTION

GI - GENITAL INFECTIONS

PDPN - PAINFUL DIABETIC PERIPHERAL NEUROPATHY

CVD - CARDIOVASCULAR DISEASE

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REFERENCE:

1. Confederat LG, Condurache MI, Alexa RE, Dragostin OM. Particularities of urinary tract infections in diabetic patients: a concise review. *Medicina*. 2023 Sep 29;59(10):1747.
2. He K, Hu Y, Shi JC, Zhu YQ, Mao XM. Prevalence, risk factors and microorganisms of urinary tract infections in patients with type 2 diabetes mellitus: a retrospective study in China. *Therapeutics and clinical risk management*. 2018 Feb 26:403-8.
3. Nitzan O, Elias M, Chazan B, Saliba W. Urinary tract infections in patients with type 2 diabetes mellitus: review of prevalence, diagnosis, and management. *Diabetes, metabolic syndrome and obesity: targets and therapy*. 2015 Feb 26:129-36.
4. <https://my.clevelandclinic.org/health/diseases/9135-urinary-tract-infections>
5. Mooradian AD. Dyslipidemia in type 2 diabetes mellitus. *Nature Reviews Endocrinology*. 2009 Mar;5(3):150-9.
6. Alrawahi AH, Rizvi SG, Al-Riyami D, Al-Anqoodi Z. Prevalence and risk factors of diabetic nephropathy in omani type 2 diabetics in Al-dakhiliyah region. *Oman medical journal*. 2012 May;27(3):212.
7. Nichols GA, Brodovicz KG, Kimes TM, Déruaz-Luyet A, Bartels DB. Prevalence and incidence of urinary tract and genital infections among patients with and without type 2 diabetes. *Journal of Diabetes and its Complications*. 2017 Nov 1;31(11):1587-91.

8. BONDAR AC, POPA AR. Diabetic neuropathy prevalence and its associated risk factors in two representative groups of type 1 and type 2 diabetes mellitus patients from Bihor county. *Maedica*. 2018 Sep;13(3):229.
9. Li T, Quan H, Zhang H, Lin L, Lin L, Ou Q, Chen K. Type 2 diabetes is more predictable in women than men by multiple anthropometric and biochemical measures. *Scientific reports*. 2021 Mar 15;11(1):6062.
10. Einarson TR, Acs A, Ludwig C, Panton UH. Prevalence of cardiovascular disease in type 2 diabetes: a systematic literature review of scientific evidence from across the world in 2007–2017. *Cardiovascular diabetology*. 2018 Dec;17:1-9.
11. Chen HC, Guh JY, Chang JM, Hsieh MC, Shin SJ, Lai YH. Role of lipid control in diabetic nephropathy. *Kidney International*. 2005 Apr 1;67:S60-2.