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Original Research Article

A Retrospective Study of Association of T2DM with Various Infections, in a Tertiary Teaching Hospital in Kolkata

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Abstract:

Introduction: Type 2 diabetes mellitus (T2DM) is a prevalent metabolic disorder that significantly increases the risk of infections due to immune dysfunction and other related factors. This study aims to investigate the association between T2DM and various infections in a tropical tertiary teaching hospital in India, focusing on the prevalence, causative organisms, and outcomes of these infections.

Methodology: A retrospective study was conducted using medical records from January 2020 to December 2023. The study included 130 T2DM patients and 130 age- and sex-matched non-diabetic controls. Data on demographic characteristics, clinical parameters, and infection details were extracted and analyzed. Statistical analyses included chi-square tests for prevalence comparison and logistic regression to identify risk factors for infections.

Results: The prevalence of infections was significantly higher in T2DM patients compared to non-diabetic controls. UTIs (30.0% vs. 13.8%, p = 0.003), SSTIs (21.5% vs. 8.5%, p = 0.002), and respiratory tract infections (34.6% vs. 16.9%, p = 0.001) were notably more common in T2DM patients. Logistic regression analysis revealed that T2DM (OR: 2.25, 95% CI: 1.54 - 3.30, p = 0.001), higher BMI (OR: 1.11, 95% CI: 1.05 - 1.18, p = 0.001), and hypertension (OR: 1.67, 95% CI: 1.11 - 2.52, p = 0.014) were significant risk factors for infections. T2DM patients had longer hospitalization durations (11.2 ± 4.1 days vs. 8.3 ± 3.5 days, p = 0.001) and higher rates of recurrent infections (16.2% vs. 6.9%, p = 0.02).

Conclusion: T2DM significantly increases the risk and severity of infections in patients, particularly in tropical regions. Effective diabetes management, infection prevention, and targeted antimicrobial therapies are essential to improve outcomes in this population. Further research should focus on integrated care models and preventive strategies to reduce infection risks in T2DM patients.

Keywords: Type 2 Diabetes Mellitus, Infections, Tropical Region, Prevalence, Causative Organisms, Risk Factors, Retrospective Study, India.

Introduction

Type 2 diabetes mellitus (T2DM) is a prevalent metabolic disorder characterized by insulin resistance and relative insulin deficiency, significantly impacting public health worldwide. In India, the burden of T2DM is substantial, with an estimated 77 million adults living with the condition, making it the second most affected country globally after China. [1] The increasing prevalence of T2DM in India is attributed to rapid urbanization, lifestyle changes, and genetic predisposition. [2]

Patients with T2DM are more susceptible to infections due to multiple factors, including impaired immune response, hyperglycemia-induced vascular damage, and neuropathy. [3] This increased susceptibility to infections poses a significant challenge in tropical regions, where high temperatures and humidity favor the proliferation of various pathogens. The risk of infections in T2DM patients is compounded by the coexistence of other comorbidities and the potential for delayed diagnosis and treatment in resource-limited settings. [4]

In tropical countries like India, common infections associated with T2DM include urinary tract infections (UTIs), skin and soft tissue infections (SSTIs), respiratory tract infections, and gastrointestinal infections.[5] The prevalence of these infections is further exacerbated by the endemic presence of diseases such as tuberculosis,

malaria, and dengue fever. The interaction between T2DM and these infections can lead to more severe disease outcomes, prolonged hospital stays, and increased healthcare costs. [6]This retrospective study aims to explore the association between T2DM and various infections in a tertiary teaching hospital in a tropical region of India. By examining the clinical data of T2DM patients, we seek to identify the most common infections, assess their impact on patient outcomes, and highlight the need for targeted interventions to manage and prevent infections in this vulnerable population. Understanding these associations will help inform clinical practice and public health strategies to improve the care and quality of life for individuals with T2DM in tropical settings.

Methodology

This retrospective study was conducted at KPC Medical College, Kolkata a tertiary teaching hospital in India to investigate the association of type 2 diabetes mellitus (T2DM) with various infections. The study utilized medical records from January 2020 to December 2023. A total of 260 patients' records were reviewed, comprising 130 patients diagnosed with T2DM and 130 non-diabetic controls. The study was approved by the Institutional Ethics Committee, and all procedures adhered to the ethical standards outlined in the Declaration of Helsinki.

The inclusion criteria for T2DM patients were a confirmed diagnosis of T2DM according to the American Diabetes Association (ADA) criteria, age above 18 years, and a history of hospitalization for any infection during the study period. Non-diabetic controls were matched for age and sex and were selected from the hospital database with no history of diabetes. Patients with incomplete medical records or those transferred from other healthcare facilities were excluded from the study.

Data were extracted from the hospital's electronic medical records by trained healthcare professionals. Variables recorded included demographic information (age, sex, body mass index), clinical data (duration of diabetes, glycemic control measured by HbA1c levels), and details of infections (type, site, causative organism, treatment, and outcomes). Infections were categorized into urinary tract infections (UTIs), skin and soft tissue infections (SSTIs), respiratory tract infections, and gastrointestinal infections. The severity and duration of infections, as well as hospitalization duration and treatment outcomes, were also noted.

Statistical analysis was performed using SPSS software version 25.0. Descriptive statistics were used to summarize the data, with means and standard deviations for continuous variables and frequencies and percentages for categorical variables. The chi-square test was used to compare the prevalence of infections between T2DM patients and non-diabetic controls. Logistic regression analysis was conducted to assess the association between T2DM and the risk of infections, adjusting for potential confounders such as age, sex, and comorbidities. A p-value of less than 0.05 was considered statistically significant.

Results

Table 1: Demographic and Clinical Characteristics of the Study Population

Variable	T2DM Patients (n=130)	Non-diabetic Controls (n=130)	p-value
Age (years)	55.6 ± 10.3	54.2 ± 9.7	0.384
Sex (Male/Female)	68/62 (52.3/47.7%)	70/60 (53.8/46.2%)	0.799
Body Mass Index (BMI)	27.4 ± 3.5	24.1 ± 3.0	0.001
Duration of Diabetes (years)	10.5 ± 6.2	NA	NA
HbA1c (%)	8.1 ± 1.4	NA	NA
Comorbidities	75 (57.7%)	43 (33.1%)	0.001

Table 1 provides a comparison of the demographic and clinical characteristics of T2DM patients and non-diabetic controls.

The average age of T2DM patients was 55.6 years with a standard deviation of 10.3 years, while non-diabetic controls had an average age of 54.2 years with a standard deviation of 9.7 years, showing no significant difference (p = 0.384). The sex distribution was also similar between the two groups, with 52.3% males and 47.7% females among T2DM patients, and 53.8% males and 46.2% females among non-diabetic controls (p = 0.799). Body Mass Index (BMI) was significantly higher in T2DM patients (27.4 ± 3.5) compared to non-diabetic controls (24.1 ± 3.0) (p = 0.001). The duration of diabetes among T2DM patients averaged 10.5 years with a standard deviation of 6.2 years.

The average HbA1c level in T2DM patients was 8.1%, indicating poor glycemic control. Additionally, a higher percentage of T2DM patients had comorbidities (57.7%) compared to non-diabetic controls (33.1%) (p = 0.001).

Table 2: Prevalence of Different Types of Infections

Type of Infection	T2DM Patients (n=130)	Non-diabetic Controls (n=130)	p-value
Urinary Tract Infections (UTIs)	39 (30.0%)	18 (13.8%)	0.003
Skin and Soft Tissue Infections (SSTIs)	28 (21.5%)	11 (8.5%)	0.002
Respiratory Tract Infections	45 (34.6%)	22 (16.9%)	0.001
Gastrointestinal Infections	20 (15.4%)	10 (7.7%)	0.042
Other Infections	11 (8.5%)	7 (5.4%)	0.342

Table 2 presents the prevalence of different types of infections among T2DM patients compared to non-diabetic controls. The data shows that urinary tract infections (UTIs) were significantly more common in T2DM patients, with 30.0% of T2DM patients experiencing UTIs compared to 13.8% of non-diabetic controls (p = 0.003). Similarly, skin and soft tissue infections (SSTIs) were more prevalent among T2DM patients at 21.5%, compared to 8.5% in non-diabetic controls (p = 0.002).Respiratory tract infections were the most common type of infection in T2DM patients, affecting 34.6%, whereas only 16.9% of non-diabetic controls had respiratory tract infections (p = 0.001). Gastrointestinal infections were also more frequent in T2DM patients (15.4%) compared to non-diabetic controls (7.7%) (p = 0.042). Other infections did not show a significant difference between the two groups, with 8.5% in T2DM patients and 5.4% in non-diabetic controls (p = 0.342).

Table 3: Causative Organisms of Infections in T2DM Patients

Infection Type	Causative Organism	n (%)
Urinary Tract Infections	Escherichia coli	24 (61.5%)
	Klebsiellapneumoniae	9 (23.1%)
	Others	6 (15.4%)
Skin and Soft Tissue Infections	Staphylococcus aureus	15 (53.6%)
	Streptococcus spp.	8 (28.6%)
	Others	5 (17.8%)
Respiratory Tract Infections	Streptococcus pneumoniae	19 (42.2%)
	Haemophilusinfluenzae	13 (28.9%)
	Others	13 (28.9%)
Gastrointestinal Infections	Salmonella spp.	9 (45.0%)
	Shigella spp.	6 (30.0%)
	Others	5 (25.0%)

Table 3 details the causative organisms responsible for different types of infections in T2DM patients. Among urinary tract infections (UTIs), Escherichia coli was the most common pathogen, accounting for 61.5% of cases, followed by Klebsiella pneumoniae at 23.1%, and other organisms comprising 15.4%.

In skin and soft tissue infections (SSTIs), Staphylococcus aureus was identified in 53.6% of cases, Streptococcus spp. in 28.6%, and other pathogens in 17.8%. For respiratory tract infections, Streptococcus pneumoniae was found in 42.2% of cases, with Haemophilus influenzae and other organisms each accounting for 28.9%.

Gastrointestinal infections were predominantly caused by Salmonella spp. in 45.0% of cases, Shigella spp. in 30.0% and other pathogens in 25.0%. This table highlights the specific microbial pathogens involved in infections among T2DM patients, underscoring the need for targeted antimicrobial therapy and infection control measures tailored to these prevalent organisms.

Table 4: Treatment and Outcomes of Infections

Variable	T2DM Patients (n=130)	Non-diabetic Controls (n=130)	p-value
Antibiotic Treatment	110 (84.6%)	98 (75.4%)	0.056
Hospitalization Duration (days)	11.2 ± 4.1	8.3 ± 3.5	0.001
Recurrent Infections	21 (16.2%)	9 (6.9%)	0.02
Mortality	8 (6.2%)	3 (2.3%)	0.131
Other Complications	15 (11.5%)	6 (4.6%)	0.046

Table 4 presents the treatment and outcomes of infections among T2DM patients compared to non-diabetic controls. Antibiotic treatment was administered to 84.6% of T2DM patients and 75.4% of non-diabetic controls, with a borderline significant p-value of 0.056, suggesting a trend towards higher

antibiotic use in T2DM patients.The average hospitalization duration for T2DM patients was significantly longer (11.2 ± 4.1 days) compared to non-diabetic controls (8.3 ± 3.5 days), with a p-value of 0.001. This indicates that T2DM patients tend to have more prolonged hospital stays due to infections.Recurrent infections were more frequent among T2DM patients (16.2%) compared to non-diabetic controls (6.9%), with a significant p-value of 0.02, highlighting the increased likelihood of repeated infections in T2DM patients. Mortality rates were higher in T2DM patients (6.2%) compared to non-diabetic controls (2.3%), although this difference was not statistically significant (p = 0.131). Other complications related to infections were significantly more common in T2DM patients (11.5%) compared to non-diabetic controls (4.6%), with a p-value of 0.046. This underscores the greater risk of complications in T2DM patients, necessitating careful management and monitoring.

Table 5: Logistic Regression Analysis of Risk Factors for Infections in T2DM Patients

Variable	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value
T2DM (vs. non-diabetic)	2.25	1.54 - 3.30	0.001
Age	1.02	0.99 - 1.04	0.154
Sex (Male)	1.08	0.72 - 1.63	0.7
BMI	1.11	1.05 - 1.18	0.001
Hypertension	1.67	1.11 - 2.52	0.014
Other Comorbidities	1.32	0.87 - 2.00	0.19

Table 5 presents the results of the logistic regression analysis used to identify risk factors for infections in T2DM patients. The analysis reveals that T2DM patients have a significantly higher risk of infections compared to non-diabetic controls, with an odds ratio (OR) of 2.25 (95% Confidence Interval [CI]: 1.54 - 3.30, p = 0.001).Age was not a significant risk factor for infections, with an OR of 1.02 (95% CI: 0.99 - 1.04, p = 0.154). Similarly, sex (male) did not significantly affect the risk of infections, with an OR of 1.08 (95% CI: 0.72 - 1.63, p = 0.7).Body Mass Index (BMI) was a significant risk factor, with an OR of 1.11 (95% CI: 1.05 - 1.18, p = 0.001), indicating that higher BMI is associated with a greater risk of infections. Hypertension also emerged as a significant risk factor, with an OR of 1.67 (95% CI: 1.11 - 2.52, p = 0.014).Other comorbidities did not show a significant association with the risk of infections, with an OR of 1.32 (95% CI: 0.87 - 2.00, p = 0.19).

Discussion

The findings of this retrospective study underscore the heightened vulnerability of T2DM patients to various infections compared to non-diabetic individuals, particularly in a tropical tertiary teaching hospital in India. This discussion will explore the implications of these results, relate them to existing literature, and highlight potential clinical and public health strategies to address these issues.

Our study demonstrates a significantly higher prevalence of infections among T2DM patients, with urinary tract infections (UTIs), skin and soft tissue infections (SSTIs), and respiratory tract infections being notably more common compared to non-diabetic controls. These findings are consistent with previous studies that have established a link between diabetes and increased susceptibility to infections due to factors such as hyperglycemia-induced immune dysfunction, impaired neutrophil function, and poor glycemic control. Shah and Hux (2003) [7] also reported that individuals with diabetes have a higher risk of infections, particularly UTIs and SSTIs.The logistic regression analysis revealed that T2DM patients have more than twice the odds of developing infections compared to non-diabetic individuals (OR: 2.25, 95% CI: 1.54 - 3.30, p = 0.001). This increased risk is further compounded by higher BMI and the presence of hypertension, both of which were significant risk factors for infections in our study. These findings align with the results of a study by Muller et al. (2005), [8] which found that obesity and hypertension exacerbate the risk of infections in diabetic patients .

Our data indicated a longer hospitalization duration for T2DM patients (11.2 ± 4.1 days) compared to non-diabetic controls (8.3 ± 3.5 days), highlighting the more severe and prolonged course of infections in diabetic patients. This is in line with research by Carton et al. (2002), [9] which demonstrated that diabetes is associated with increased hospital stay and healthcare resource utilization due to infections.

Moreover, recurrent infections were more frequent in T2DM patients (16.2%) compared to non-diabetic controls (6.9%), suggesting a need for improved infection prevention and management strategies in diabetic care. The increased recurrence may be attributed to persistent hyperglycemia, which impairs the body's ability to clear infections effectively (Geerlings and Hoepelman, 1999) [10].

The causative organisms of infections in T2DM patients were predominantly Escherichia coli for UTIs and Staphylococcus aureus for SSTIs, consistent with the findings of other studies

(Lipsky et al., 2004) [11]. The high prevalence of these pathogens underscores the importance of targeted antimicrobial therapy based on local microbiological profiles and antibiotic resistance patterns.Our study's limitations include its retrospective design, which may introduce selection bias and limit the ability to establish causality. Additionally, the study was conducted in a single tertiary hospital, which may not be representative of other settings.

Conclusion

In conclusion, this study highlights the increased risk and burden of infections among T2DM patients in a tropical tertiary teaching hospital in India. Effective management of diabetes, stringent infection control practices, and regular monitoring for infections are crucial in this population.

Public health initiatives should focus on preventive measures, including vaccination, early diagnosis, and appropriate antimicrobial therapy, to reduce the incidence and severity of infections in T2DM patients. Future research should explore the impact of integrated care models and lifestyle interventions in mitigating infection risks in diabetic populations.

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