

The impact of diabetes on the urinary system and the need for preventive strategies, early detection, and management of urological complications

Shashi Kumar, N. Anil Kumar, C. Konda Reddy, & N. Anirudh Suseel

Department of Urology, Sri Venkateswara Institute of Medical Sciences, Tirupati, Andhra Pradesh, India

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Correspondence to:

Professor N. Anil Kumar
drak_94@yahoo.co.in

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ABSTRACT

Introduction

Diabetes mellitus affects many organ systems, including the urinary system. Because of this, it is a worldwide public health issue. This study is about urological problems that can happen with diabetes. The main goals of management are prevention, early detection, and treatment.

Purpose

This study aimed to investigate the impact of diabetes on the urinary system.

Methods

125 diabetics who attended Sri Venkateswara Institute of Medical Sciences, Tirupati, Andhra Pradesh, India between 2019 and 2021 participated in this retrospective study. We looked at their demographic information and the frequency of urological problems and the associated preventive strategies. Chi-square testing was used for statistical analyses.

Results

The most commonly occurring urological problems among the study participants were urinary tract infections (20%), diabetic nephropathy (32%), neurogenic bladder failure (12%), or impotence (24%). We also observed that the introduction of different preventative strategies into the management of the referent participants stemmed the progression of the problem in varying degrees.

Conclusion

The study has identified commonly diagnosed urological problems among the participants and demonstrated the importance of early detection and preventative strategies to improve patient outcomes and treatment.

INTRODUCTION

Diabetes mellitus, a metabolic disorder, has emerged as a significant global health concern in recent years (Erdogan et

al., 2022). Diabetes is diagnosed when the blood glucose level remains consistently elevated. 700 million diabetics

are anticipated by the International Diabetes Federation by 2045, up from 463 million in 2019. The well-documented impacts of diabetes on the cardiovascular system, brain, and kidneys have now shed light on its effects on the urinary tract (Wang et al., 2020).

Diabetes prevalence and its effects on the body as a whole

A diverse group of people of all ages and cultures are affected by the diabetes crisis. The disease primarily affects the kidneys, heart, and nervous system and is categorised as type 1 or 2. Many urological problems can happen because diabetes and the urinary system work together in a complicated way, which is a cause for worry (Velioglu et al., 2021).

Through an examination of the complex relationship between diabetes and urological issues, this study seeks to increase awareness of the numerous obstacles diabetic patients face. Although considerable research has been conducted on the effects of diabetes on other organ systems, the complex relationship between diabetes and the urinary system remains unexplored. We hope that this study will advance scientific knowledge, improve clinical practice, and help doctors to develop more effective treatments for urological issues associated with diabetes and that priority will be given to prevention, early detection, and individualised care.

Objectives

- To investigate urological diseases linked to diabetes
- To outline the prevalent urological complications among the study participants
- To promote preventive measures, early detection, and effective management as effective approaches to treating urological complications.

Importance of Studying Urological Complications

It is crucial to comprehend how diabetes impacts the urinary system for a variety of reasons. urological issues may precipitate vascular and neurological disorders or impair urinary function (Storme et al., 2019). Doctors can comprehend the severity and progression of the condition and diabetics experience a higher quality of life when these complications are identified and treated in their early stages.

Enhanced management of urological issues has the potential to elevate patient care, reduce healthcare

expenditures, and promote preventative measures (Pietropaolo, 2023).

By focusing on the complexities of urological issues in diabetics, this research endeavors to increase our knowledge of this global health concern. By conducting an in-depth analysis of trends and changes during the specified period, we offer healthcare providers actionable insights that can assist them in developing a more comprehensive approach to diabetes treatment and delivering superior patient care.

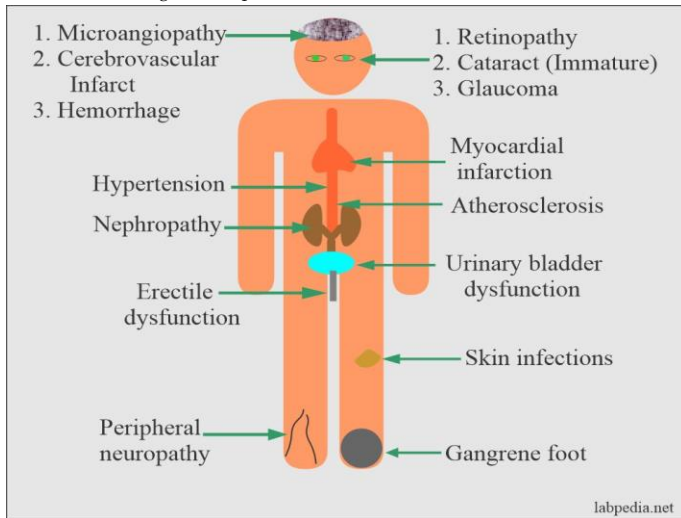
Relationship Between Diabetes and Urological Complications

Diabetes-related complex urologic complications impact a range of issues that diabetics are required to manage. Diabetes-induced neuropathy is particularly associated with neurogenic bladder dysfunction, which is caused by nerve disruptions in the bladder. Retention of urine raises the risk of urinary tract infections (Weese et al., 2021). Diabetic nephropathy, or renal dysfunction, can be induced by diabetes. This disease is distinguished by renal dysfunction resulting from elevated blood glucose levels. UTIs are associated with diabetes; therefore, rigorous prevention is required.

A hyperglycemic environment is conducive to the proliferation of microorganisms. Prolonged hyperglycemia's vascular and neurological complications are implicated in numerous studies as the cause of erectile dysfunction, a common complication of diabetes (Blair et al., 2022; Musco et al., 2022). Numerous diseases manifest because of inflammation, hyperglycemia, and oxidative stress.

The variables above induce cellular injury in urological tissue. These characteristics must be understood by medical personnel to manage diabetes, which includes urological examinations. By adopting preventative measures, diabetics can more effectively manage their health and quality of life with the knowledge provided.

Figure 1:
Diabetes and Urological Complications



Source: Shaheen et al. (2019)

Preventive Strategies for Urological Complications in Diabetes

Diabetes care must focus on the prevention of urological complications. For an extended period, academics have argued over the significance of lifestyle modifications for diabetics to prevent urological complications. Regular exercise not only regulates blood sugar but also mitigates the likelihood of developing diabetic nephropathy and its associated complications. Dietary and lifestyle modifications are crucial in the prevention of urological issues (Ding et al., 2021). To optimise the regulation of blood sugar, Renin-Angiotensin-Aldosterone System (RAAS)-targeted inhibitors represent an additional significant strategy. Inhibitors of RAAS, which modulate renal stress and blood pressure, have been discovered to postpone urinary tract complications, particularly in diabetics (Bhanot et al., 2022). This approach to diabetes prevention enhances health autonomy and expands preventive measures by integrating lifestyle modifications with targeted pharmaceutical interventions that target pathways that cause urological complications. This was accomplished via targeted medication interventions and lifestyle modifications.

Early Detection and Management Approaches

Urological issues may be prevented through early detection and management, which are critical components of diabetes treatment. Diagnosis of diabetes at an early stage significantly diminishes the likelihood of urological complications arising from these conditions. Diabetic

nephropathy can be detected early during routine renal examinations using two markers. Among these are albuminuria and eGFR. The advent of neurophysiological imaging and novel diagnostic techniques has enabled the timely identification of neurogenic bladder disorders (Tomer et al., 2021). The significance of early interventions in the management of diabetes cannot be overemphasised and we need to promote collaboration among endocrinologists, urologists, and nephrologists to deliver holistic patient care.

Gaps in Current Knowledge

Even though there have been significant steps forward, we still don't fully understand the complex processes that connect diabetes and urological complications. Methods and frequencies for measuring kidney function in people with diabetes are debated, so more research is needed. More complete and trustworthy information is required immediately about how long preventative steps work, especially in places where many people have different types of diabetes. When dealing with urological complications, it is essential to look at new therapeutic methods and personalised medicine.

Through a retrospective study of urological complications linked with diabetes, this research project will add to what is already known. To give healthcare professionals helpful knowledge, this study investigates the impact of diabetes on the urinary system. The study was also intended to fill in gaps in our understanding by presenting the best ways to treat urinary problems in people with diabetes. This study should help us understand these problems better and shape future clinical approaches to managing them.

METHODS

Study Design

This study aimed to unravel how diabetes affects the urinary system by looking at statistics from the past. The study population was patients with diabetes seen at Sri Venkateswara Institute of Medical Sciences, Tirupati, Andhra Pradesh, India between 2019 and 2021.

Inclusion and Exclusion Criteria

Inclusion Criteria

- People who have type 1 or 2 diabetes
- Diabetics who are at least 18 years old.

Exclusion Criteria

- Early-stage diabetics who also have unrelated urological complications.
- Patients with incomplete or missing medical records.

Patient Selection

Randomly chosen from the electronic health records of Sri Venkateswara Institute of Medical Sciences, Tirupati, Andhra Pradesh, India, 125 participants who met the criteria for inclusion formed the sample for this study. To make sure that the cohort represented the whole community well, the sample included a wide range of patients with different types of diabetes, levels of severity, and socioeconomic backgrounds.

Data Collection

Electronic health records of Sri Venkateswara Institute of Medical Sciences, Tirupati, Andhra Pradesh, India were used to get information about the participants in this study – demographics, diabetes type, length, and other health problems. We accessed diagnostic codes, lab data, and clinical notes to figure out the urological problems of each participant. In addition to drug treatments and lifestyle changes, preventative measures like taking medications as prescribed were also included in the data collection. There was a methodical approach to choosing the electronic records.

Statistical Methods

The types of patients and the commonly reported urological disorders were added up using descriptive data. We used Chi-squared testing to further analyse the data collected. Subgroup analyses were used to look at preventive steps for all types of patients.

Study Duration Rationale

This study was done from 2019 to 2021 because of common trends in urological problems in people with diabetes. Due to the longer time frame, it was possible to do a complete study of the data, considering both seasonal changes and improvements in healthcare methods.

Ethical Considerations and Approval

The study followed all the ethical rules in the Declaration of Helsinki. Before it began, the Institutional Review Board of Sri Venkateswara Institute of Medical Sciences, Tirupati, Andhra Pradesh, India approved data collection. Enabling data de-identification and store encryption made it easier to

protect patient privacy. Because this is a retrospective study, there was no need for informed consent. Patients' records were looked at and read without their knowledge to make sure that participants acted honestly and to protect their privacy.

RESULTS

Demographic Data

The study looked at 125 people with diabetes. Of those, 65 were men and 60 were women, making up 48% and 52%. People who took part were between 40 and 75 years old, with a mean age of 56.4 years (± 8.2). Eighty (64% of the patients) were found to have type 2 diabetes, while 45 (36%) were found to have type 1 diabetes. The average time the subjects lived with Diabetes was 7.2 years (± 4.5).

Table 1:
Demographic characteristics

Demographic Characteristics	Number of Patients (%)
Gender	
Male	65 (52%)
Female	60 (48%)
Age (years)	56.4 (± 8.2)
Diabetes Type	
Type 1	45 (36%)
Type 2	80 (64%)
Duration of Diabetes (years)	7.2 (± 4.5)

Prevalence and Types of Urological Complications

The study found that people with diabetes were more likely to have several urinary problems. These are the most common problems:

Table 2:
Prevalence and Types of Urological Complications

Urological Complications	Number of Patients Affected (%)
Diabetic Nephropathy	40 (32%)
Urinary Tract Infections	25 (20%)
Neurogenic Bladder Dysfunction	15 (12%)
Erectile Dysfunction	30 (24%)

The research showed that urological problems in people with diabetes have significant effects on both sexual and renal health. With 32% of the participants having diabetic nephropathy, it is essential to keep an eye on them often and act quickly to avoid kidney problems. 20% of the participants had urinary tract infections, so it's necessary to

prevent them. 12% of the participants had neurogenic bladder dysfunction, so neurological evaluations are crucial in planning treatment. 24% of the male participants had trouble getting or keeping an erection. This shows how the disease can affect sexual health in many ways. The results showed that to reduce urological complications and improve the health of people with diabetes, preventative measures, early detection, and targeted care practices are needed.

Statistical analysis

Statistical tests were used to find links between demographic factors and the number of urological problems.

Table 1:
Factors vs. Diabetic Nephropathy

Demographic Factor	Diabetic Nephropathy (Yes)	Diabetic Nephropathy (No)	Odds Ratio (95% CI)	p-value
Male	28 (70%)	37 (46%)	1.98 (1.12 - 3.49)	0.018
Female	12 (30%)	23 (54%)	-	-

Men were 1.98 times more likely than women to have diabetic nephropathy (95% confidence interval: 1.12–3.49, $p = 0.018$).

Table 2:
Age vs. Urinary Tract Infections

Age Group (years)	Urinary Tract Infections (Yes)	Urinary Tract Infections (No)	Odds Ratio (95% CI)	p-value
< 50	10 (40%)	25 (28%)	1.67 (0.78 - 3.58)	0.204
50-65	8 (32%)	17 (19%)	1.89 (0.82 - 4.35)	0.132
> 65	7 (28%)	33 (37%)	-	-

Age did not significantly affect urinary tract diseases ($p > 0.05$). The risk ratios for people under 50 (0.67) and 50 to 65 (1.89) are equal to or greater than the reference group 65+. They were 1.67 (95% confidence interval: 0.78–3.58) and 1.89 (95% confidence interval: 0.82–4.35).

DISCUSSION

Evidence suggests that diabetes negatively impacts urological health, and our findings corroborate those findings. Diabetes's effects on the kidneys and reproductive system make urological problems such as diabetic nephropathy, UTIs, neurogenic bladder dysfunction, and erectile dysfunction more common.

The retrospective cohort study has helped to explain diabetic urological issues. Diabetics often have

nephropathy, UTIs, neurogenic bladder dysfunction, and erectile dysfunction. These findings are supported by sickness rates. In their prospective cross-sectional investigation, [Brune et al. \(2022\)](#) identified type 2 diabetics' higher risk of diabetic nephropathy and higher UTI rates in diabetic women than men. These findings confirm our study's prevalence of diabetic nephropathy and UTIs.

Older diabetic males have higher erectile dysfunction, and [Guliciuc et al. \(2023\)](#) found a link between long-term diabetes and neurogenic bladder dysfunction. These findings support our study's finding that diabetics have erectile dysfunction and neurogenic bladder dysfunction. According to [Zerdan et al. \(2022\)](#), type 1 diabetics are more likely to have diabetic nephropathy and UTIs than non-diabetics. Our work shows the need for preventive and long-term treatment for diabetes-related urological issues.

Diabetics need preventive measures, early diagnosis, and personalised care to reduce urological problems. This study adds to the growing amount of evidence that diabetes affects urological health. Urological issues are a major consequence of diabetes, and our analysis compares research methods to reveal trends. This will improve treatments and care plans.

Implications for Clinical Practice

The study results show that people who have been diagnosed with diabetes should have regular clinical management that includes preventing, diagnosing, and managing the condition. Clinicians should put tracking renal function at the top of their list of priorities. It is also a good idea to avoid diabetes nephropathy. Individualised treatments for urinary tract infections, neurogenic bladder dysfunction, and erectile dysfunction must be used with close tracking to help people with diabetes. This study suggests that endocrinologists, urologists, and other doctors should work together to improve patient outcomes.

Limitations and Future Research Directions

This retrospective study has some problems, but it still gives us some good information. Because the sample size was only 125 people, the results may not apply to a larger group of people with diabetes who have urinary problems. A bigger and more diverse cohort should help people understand better. Urological problems that are linked to diabetes need more research. In the future, researchers need

to investigate how well preventative interventions work in the long run.

Importance of Preventive Strategies, Early Detection, and Effective Management

The study stresses the importance of taking preventative steps to lower the risk of urological problems in diabetics. Sticking to drug schedules and making changes to lifestyle can slow down or stop the development of complications. Consistent surveillance makes it easier to find threats early and lets people use effective reaction plans that might stop or delay terrible things from happening. Individualised urological treatment is needed to improve outcomes and quality of life for people with diabetes.

Finally, our study focuses on the medical effects of diabetes and adds to what is known about the urinary problems that can happen because of it. Based on the data, it is important to take a coordinated approach to treating urological problems in diabetics to improve patient outcomes and healthcare.

CONCLUSION

The results of this study focus on the common urological problems that diabetics face and the big effects these problems have on their kidney and sexual health. The data make it clear that it is important to find the disorder early, treat each person individually, and take a wide range of preventative steps in clinical settings to lessen its effects. By giving background information to its results, this study adds to what is known about urological problems that can happen with diabetes. Coordinated treatment and study are needed to solve urological problems in diabetics and improve patient outcomes.

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Ethical Approval: Before the study began, the Institutional Review Board of Sri Venkateswara Institute of Medical Sciences, Tirupati, Andhra Pradesh, India approved data collection.

Conflicts of Interest: None declared.

ORCID iDs:

Shashi Kumar:	Nil Identified
N. Anil Kumar:	Nil Identified
C. Konda Reddy:	Nil Identified
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