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AN OBSERVATIONAL STUDY OF BACTERIOLOGICAL AND ANTIBIOTIC SUSCEPTIBILITY PROFILE OF URINARY TRACT INFECTIONS IN DIABETIC AND NON-DIABETIC PATIENTS IN A TERTIARY HEALTH CENTRE.

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Abstract

Background

Considering the compromised immunity and increased virulence of the pathogenic microorganisms in diabetics, they are more susceptible to infections. Especially, urinary tract infections affect the renal functioning of diabetics.

Methods

This was an observational comparative study conducted for 26 months. The people with positive urinary cultures with diabetes and without diabetes were recruited for the study. The haematological analysis was done along with fasting sugar, postprandial sugar, and glycosylated haemoglobin. The demography of the participants was recorded. Patients who had positive urine cultures underwent X-rays and ultrasounds to confirm the presence of infection. The susceptibilities of the microorganisms were studied. The data obtained was compared statistically.

Results

Out of the 181 patients, 117 were found to have E. coli. The predisposing factor for males was benign prostrate hypertrophy; for females, it was an indwelling catheter. Patients with HbA1c levels less than 6.5% become more vulnerable to urinary tract infections. E. coli was found to be susceptible to ampicillin, norfloxacin, cotrimoxazole, and cephalosporin. Fever was the most common symptom among diabetics with a UTI.

Conclusion

The host factors found to be associated with UTI are female sex, the presence of diabetes, poor glycaemic control, and the presence of fever. An elevated HbA1C correlates with the occurrence of UTI. The most common uropathogenic was E. coli.

Recommendation

Diabetics should be routinely and thoroughly monitored for the presence of urinary tract infections. Especially if HbA1c is less than 6.5%.

Keywords: *Urinary Tract Infection, Diabetes, Susceptibility*
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Introduction

Diabetes mellitus is a condition that takes place in the endocrine system and has an impact on the many systems of the body. Diabetic patients often have a decline in their immune system, which is the most prevalent consequence of diabetes. Because of this, diabetics are more likely to get a variety of infections. In the past, polyuria has been identified as a sign of diabetes. This condition is characterised by difficulties in voiding and retaining urine in the urinary bladder. The urinary system becomes more vulnerable to infection as a result of this issue [1].

There is a correlation between diabetes and an increased risk of morbidity and death, primarily due to the complications that are linked with diabetes. An infection of the urinary tract is one of them; if it is not recognised in a timely manner and treated with the most effective means, it may gradually progress to renal failure. The first signs of a urinary tract infection (UTI) are burning sensations during micturition, polyuria, fever, and inflammation. Individuals who have diabetes and those who do not have diabetes have quite diverse prognoses when it comes to UTIs [2,3]

The function of humoral immunity, also known as innate immunity, is diminished when diabetes is present. There is a reduction in the number of interleukins and C4 complement that are secreted. There is also a dramatic reduction in the chemotaxis and the functions of polymorphonuclear cells, such as phagocytosis. The fact that the virulence of the bacteria rises in an environment with a high glucose content is another factor [4,5]. In particular, it has been shown that the uroepithelial cells become vulnerable to Candida Albicans because of the high carbohydrate content of the Candida albicans.

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Complications of urinary tract infections (UTIs) in diabetic patients are often increased by the host variables.

When it comes to people who have diabetes, the microbiology, clinical symptoms, and patterns of urinary tract infections (UTIs) may all play a role in determining the prognosis of UTIs. It has been shown in a few studies that E. coli is the bacteria that causes the majority of urinary tract infections, particularly in diabetic patients [6,7]. Additionally, the therapy that is administered to diabetics is distinct from that which is administered to non-diabetics. This is due to the fact that those who do not have diabetes and who do not have any additional complications have their immune systems intact, which helps them recover from the inflammation. On the other hand, a person who has diabetes is more likely to get urinary tract infections (UTIs) and to develop resistance to certain pharmacological medicines [8]. By gaining an understanding of the patterns of urinary tract infections (UTIs), as well as the susceptibility and microbiology of UTIs, one may avoid the development of serious complications. The purpose of this research is to examine the similarities and differences between diabetics and non-diabetics with regard to urinary tract infections (UTIs), microbiology, and the susceptibility of microorganisms to antibiotics.

Method

Study design

This was a prospective observational study conducted between February 2023- and April 2024 at Rajarajeswari Medical College and Hospital.

Participants

181 diabetics (98 females and 83 males) and 124 non-diabetics (72 females and 52 males) admitted to Rajarajeswari Medical College and Hospital were studied randomly. Detailed history including age, sex, occupation and symptomatology was taken. A detailed general and systemic clinical examination was done. -All proven diabetics (fasting venous glucose > 126 mg/dl and postprandial (2 hr.) venous glucose >200 mg/dl were included in the study irrespective of the reason for admission. All patients with a history of diabetes and those who are on treatment were also eligible for admission. The primary criteria for inclusion in the study was the positive culture test for urinary infections. Those who had negative urine culture tests and were less than 18 years old were not included in the study.

Patients of similar age and gender who had been admitted to the hospital and had been shown not to have diabetes (fasting blood sugar <110 mg/dl, no history of diabetes, use of anti-diabetic medications, etc.) served as the volunteers for the control group. Haemoglobin, total WBC count, differential count, ESR, urine for protein, sugar, and ketones, as well as microscopy, were all investigated in each patient. All diabetics had postprandial glucose testing, fasting, and glycosylated haemoglobin analysis. Diabetes was identified by looking for newly discovered diabetics, using anti-diabetic medications, and having a history of diabetes. The required investigations, including abdominal ultrasounds, x-rays, and CT scans, were performed on patients whose urine cultures were positive in order to identify any predisposing diseases and support therapeutic therapy.

Ethical consideration

The institutional ethics committee approved conducting this study. The informed consent was obtained from the controls and the patients who participated in this study.

Statistical analysis

Data obtained from the study was subjected to statistical analysis. The software SPSS package was used to analyze the data. The percentages in different categories were compared using the chi-square test and means were compared using the student 't' test.

Result

In the research, there were a total of 124 non-diabetic participants and 181 diabetic participants, with 83 men and 98 females having diabetes. Patients who were diabetic had average age of 60.2±13.79 years, the average age of nondiabetics was 53.47±18.56 years. Occurrence of UTI was not associated with the age of patients irrespective of whether they were diabetic patients or non-diabetic patients.

There was a total of 124 people who did not have diabetes, 164 people who had type 2 diabetes, four people who had type 1 diabetes, and thirteen people who had gestational diabetes mellitus. Figure no.1 illustrates the distribution of diabetics into various types.

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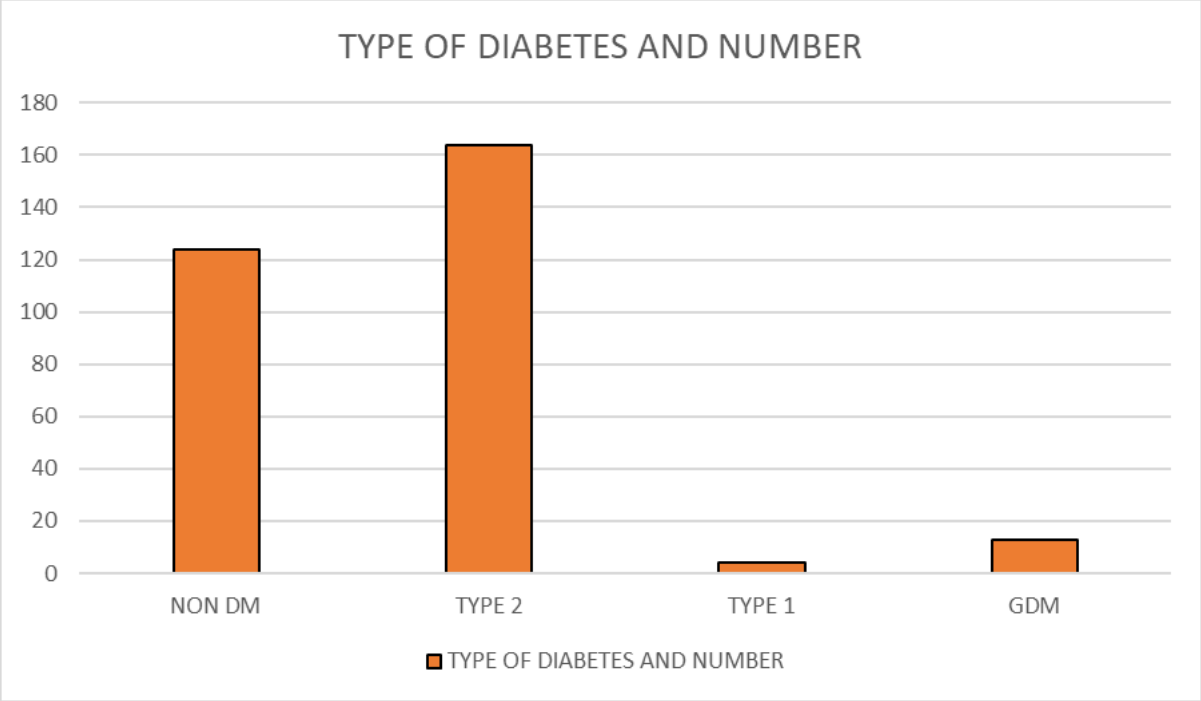

Fig no.1: Distribution of diabetics into various types.

In this cohort the symptoms of urinary infection included fever, dysuria, abdominal pain, increased frequency, vomiting, hematuria, pyuria, incontinence, and retention. The most common symptom observed in diabetics as well as non-diabetics was fever

The predisposing factors of UTI were determined. Benign prostate hypertrophy was the most common predisposing factor in males of both the groups the difference between them was not statistically significant. 40% of the male cohort had obstruction of the bladder outlet due to benign postrate hypertrophy or urethral stricture. Followed by indwelling catheter as the second most common predisposing factor. Table no. 3 gives the details of the predisposing factors in males.

Table no.1: Predisposing factors in males

Predisposing condition	Diabetes	Non-diabetes	p-value
BPH	31 (37.3%)	20 (38.46%)	0.92
Catheter	32 (38.5%)	24 (46.1%)	0.43
Inflammation in the ureter	7 (8.4%)	7 (13.46%)	-
Stricture in the urethra	8 (9.6%)	6 (11.2%)	-
Phimosis	2 (2.4%)	1 (1.9%)	-
Stone/ caliculi	6 (7.2%)	5 (9.6%)	-
Past surgery	5 (6.02%)	3 (5.7%)	-

Among the predisposing factors in females, it was found that indwelling catheter was the commonest predisposing factor. Numerically higher number of UTI were reported in people with diabetes compared to non-diabetics but difference was not substantial when compared statistically. Women suffered from relapse of UTIs more compared to males. Table no. 2 gives details of predisposing factors in females.

The HbA1c lesser than 6.5% increased the vulnerability towards UTI and was found to be a significant predisposing factor. Table no.3 gives the details of UTI and glycemic index.

E. coli was predominantly found in diabetics whereas pseudomonas was predominantly found in non-diabetics. Also, the three cases of Acinetobacter were from diabetics

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group and similarly all the cases of candida belonged to diabetics group. 4 out of the 5 cases of coagulase positive staphylococcus were from the diabetics group. Table no.4 give the details of the uropathogen isolated from the diabetic and non-diabetic patients with UTI.

Table no.2: Predisposing factors in females

Predisposing factor	Diabetics	Non-diabetics	p-value
Indwelling catheter	32 (32.6%)	21 (29.1%)	-0.83
Hydroureteronephrosis	8 (8.3%)	7 (9.7%)	-
Calculi	4 (4.1 %)	2 (2.77%)	-
Metal stenosis	1 (1.04%)	0 (0 %)	-
Gynecological disorder	7 (7.29%)	7 (9.7%)	
Pregnancy	12 (12.5%)	7 (9.7%)	

Table no.3: Glycemic control and UTI

HbA1c	With predisposing factors	No predisposing factors	P-value
Less than 6.5	21 (17.02%)	3 (4.3%)	0.026
6.5 to 8.0	39 (31.9%)	16 (26.08%)	NS
More than 8.0	61 (51.06%)	41 (69.57%)	NS

Table no.4: Uropathogens isolated from the diabetics and non-diabetics

Uropathogen	Diabetic	Non-diabetic	P-value
E.coli	117	73	More than 0.05
Klebsiella	22	18	More than 0.05
Enterococcus	18	10	More than 0.05
Pseudomonas	3	15	Less than 0.05
Acinetobacter	3	0	-
Coagulase negative streptococcus	3	4	-
Coagulase positive streptococcus	4	1	-
Candida	5	0	-

The antimicrobial resistance was similar irrespective of the diabetic and non0diabetc group in both E,coli and klebsiella. In both the cases they were sensitive towards meropenem and showed least susceptibitu towards ampicillin. Psuedomonas have maximum sensitivity towards amikacin in diabetics and towards NTN in non-diabetics. Figure no. 2, 3, and 4 shows antimicrobial susceptibility of E. coli, klebsiella, and pseudomonas respectively. Enterococcus was susceptible towards linezolid, vsncomycin and teicoplanin. Aminoglycosides were better in sensitivity and susceptibility compared to lactams The sensitivity and susceptibility of other microorganism such as Acinetobacter, coagulase positive staphylococcus could not be studied because of the small no. of isolates reported. However, they aere susceptible to linezolid, vancomycin, and tiecoplamin. Regarding the antimicrobial resistance profile of the uro-pathogens, we observed that the isolated E COLI strain was resistant at similar rates to ampicillin, cotrimoxazole, norfloxacin and cephalosporin in both diabetic and non-diabetic patients

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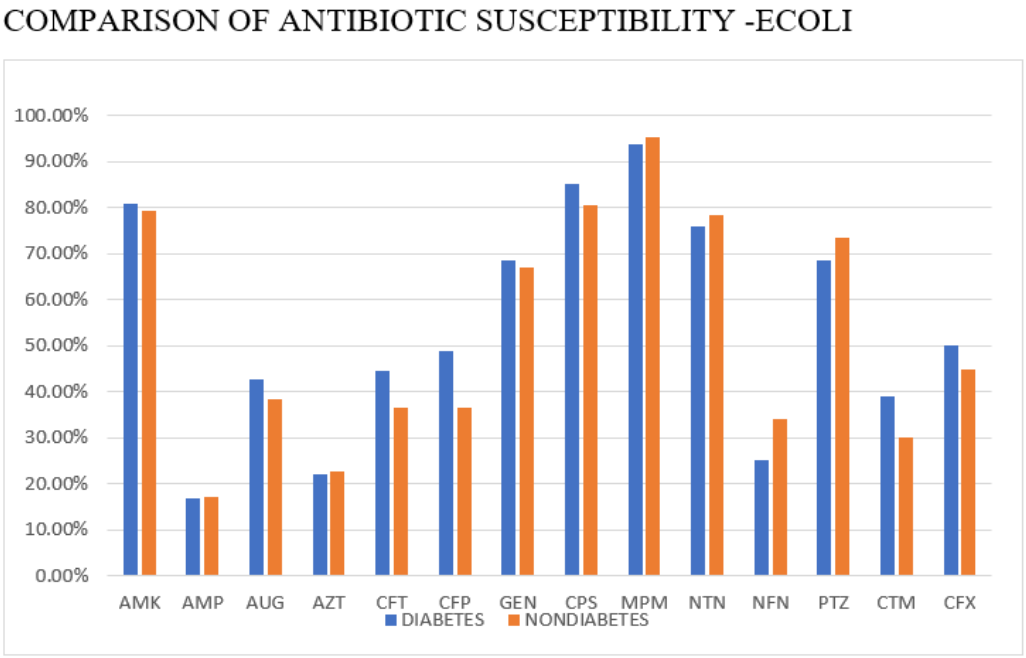

Fig no.2: Comparison of antibiotic susceptibility in E.coli

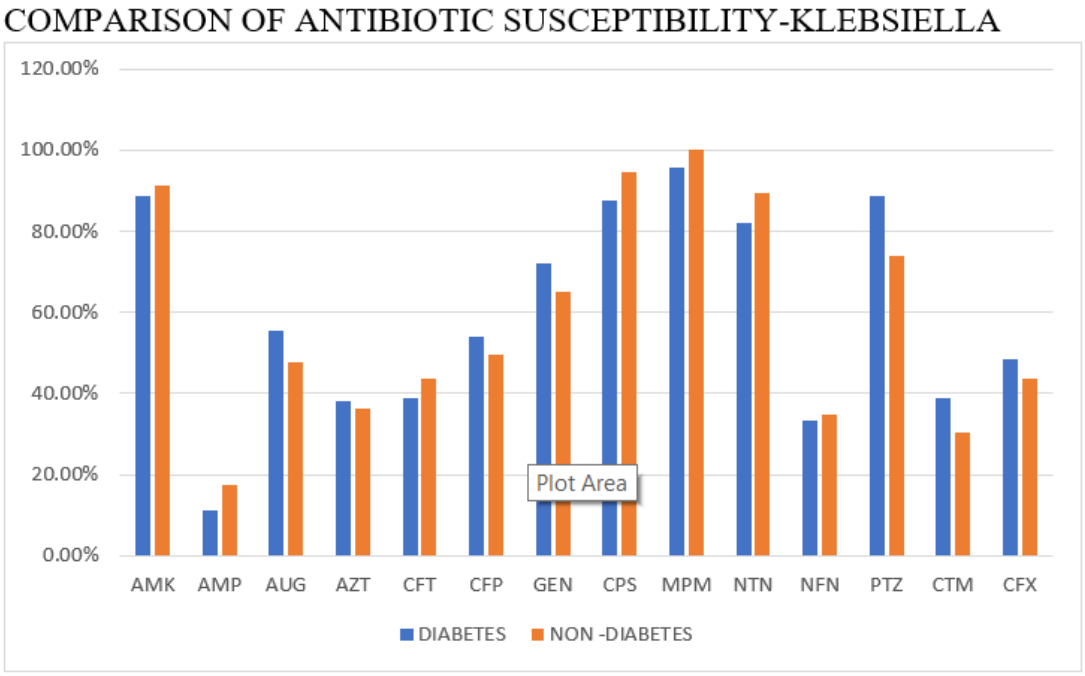

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Fig no.3: Comparison of antibiotic susceptibility in klebsiella

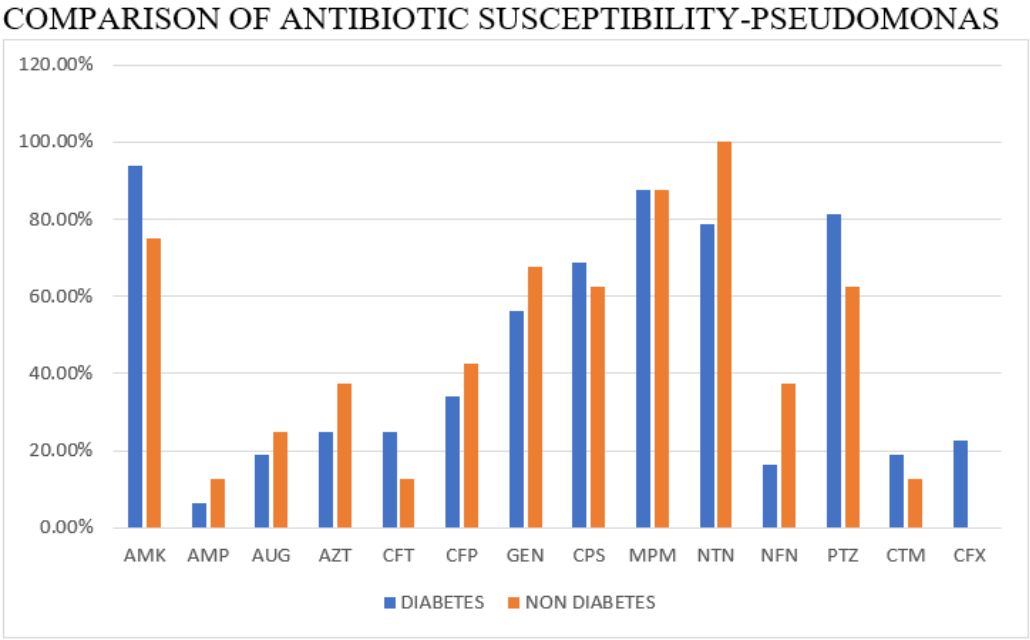

Fig no.4: Comparison of antibiotic susceptibility in pseudomonas

Table no. 5: Complications associated with UTI in diabetics and non-diabetics

Complications	Diabetics	Non-diabetics	p-value
Acute kidney inflammation	18.7%	22%	0.34
Relapse of UTI	13.4%	9.5%	0.53
Septicemia	19.8%	22.8%	0.82
Necrosis	0.01%	0	-
Pyelonephritis	9.4%	3.2%	0.03

Necrosis of the ranal tissue was observed in two individuals with diabetes one of them was with end-stage kidney disorder and the other one had indwelling catheter during the ICU stay. The pyelonephritis was reported in more amongst the diabetics than the non-diabetics. Table no. 5 gives details of the complications associated with UTI in diabetics and non-diabetics.

Discussion

In this study, it was found that age did not have any association with the occurrence of UTI. However, in a study, it was reported that patients with more than 60 years of age are prone towards developing UTI [8]. The occurrence of UTI showed an association with gender in our study. It was found that the female gender was prone to developing UTIs. A study showed a similar finding, yet another study had contradictory results [9,10]. This could be explained by the fact that the difference in the findings could be associated with the difference in the cohort undertaken for the study.

The most common symptom of UTI reported in this study was fever. Irrespective of the diabetic and non-diabetic patients, fever was the most common symptom reported. This finding is by the findings reported in different studies [6,7,11]. Apart from fever, other symptoms such as hematuria, polyuria, burning during micturition, vomiting, and dysuria were also reported in this study. In this study, 40% of the males with UTI had bladder obstruction due to benign prostate hypertrophy and the presence of urinary stricture. The most common predisposing factor in males was the presence of benign prostrate hypertrophy followed by an indwelling catheter. However, in females, the most common predisposing factor was the presence of an indwelling catheter. This finding was by the findings of other studies [13,14,15].

E. coli was the most common uropathogen isolated in this study, especially among the diabetics. Pseudomonas was found mostly among non-diabetics than in diabetics. The other uropathogens found in this study included Klebsiella, acetobacter, Enterococcus, and Streptococcus. The susceptibility of E. coli was towards carbapenems and

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it was least susceptible to ampicillin. Klebsiella was also susceptible towards carbapenems. Regarding the antimicrobial resistance profile of the uro-pathogens, we observed that the isolated E COLI strain was resistant at similar rates to ampicillin, cotrimoxazole, norfloxacin and cephalosporin in both diabetic and non-diabetic patients. This finding was by the findings of another study [16].

The most prominent finding of this study was the association of HbA1c with UTI. It was found that patients with HbA1c less than 6.5% had significantly increased chances of developing UTI. This was consistent with the findings of another study [15]. The pyelonephritis reported in diabetics was much higher than that of the non-diabetics. The other complications were rare, necrosis was reported in only 2 patients among which one of them was on haemodialysis and the other was on with the catheter in ICU. Overall diabetes was associated with the occurrence of UTI and the association was statistically significant [16].

Conclusion

The female ender, fever, diabetes and poor glycemic control was found to be associated with the occurrence of UTI. Increased levels of HbA1c were associate with occurrence of UTI. Escherichia coli (ECOLI) was the most frequent uropathogen isolated and responsible for UTI. The antimicrobial resistance profile of the uropathogenic was at similar rates to ampicillin, cotrimoxazole, Norfloxacin and Cephalosporin in both diabetic and non-diabetic patients. -The antimicrobial susceptibility for E. COLI is maximum to carbapenems in both diabetic and non-diabetic.

Limitation

The cohort for this study was limited and not diverse. To confirm the findings studies are required to be conducted on a larger cohort.

Recommendation

Diabetics should be routinely and thoroughly monitored for the presence of urinary tract infections. Especially if HbA1c is less than 6.5%.

Acknowledgement

We are grateful to the hospital's staff and patients involved in the study for their cooperation during the study.

List of abbreviation

UTI- Urinary tract infection

HbA1c- glycated haemoglobin

Source of funding

No funding received

Conflict of interest

No conflict of interest

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