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Prevalence and Associated Factors of Urinary Tract Infections among Diabetic Patients

Mehr Ali Shah¹, Yaman Walid Kassab^{1*}, Muhammad Farooq Anwar¹, Hiba Khaled Al dahoul¹, Shashidharan Menon², H Jaasminerjiit Kaur², Misbah Ifzaal³, Fares MS Muthanna⁴ and Wael Mahmoud Searan⁵

¹Department of Hospital and Clinical Pharmacy, Faculty of Pharmacy, Cyberjaya University College of Medical Sciences, 63000 Selangor, Malaysia

²Unit of Clinical Pharmacy, School of Pharmacy, KPJ Healthcare University College, Kota Seriemas, Nilai, Malaysia

³Department of Pharmacy, Thumbyay Healthcare Group Ajman, United Arab Emirates

⁴Faculty of Pharmacy, University Teknologi MARA (UiTM), 42300 Bandar Puncak Alam, Selangor Darul Ehsan, Malaysia

⁵Center for research and graduate studies, Cyberjaya University College of Medical Sciences, 63000 Selangor, Malaysia

* **Corresponding author:** Yaman Walid Kassab, Department of Hospital and Clinical Pharmacy, Faculty of Pharmacy, Cyberjaya University College of Medical Sciences, 63000 Selangor, Malaysia, Tel: +60174995591; E-mail: dryamankassab@yahoo.com

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Abstract

Background: Diabetes mellitus (DM) is an important medical and public health issue world widely. The incidence has been exponentially increased in Malaysia. Evidence revealed that diabetics are more prone to infections than non-diabetic patients. UTI is one of the infections that occur more frequently among DM patients. UTIs are considered as complicated and carry worst outcome when it occurs in DM patients. This cross-sectional study aimed to assess the prevalence of UTI among DM patients and association of glycaemic control with UTIs.

Methodology: The targeted population was DM patients in a tertiary hospital in Malaysia. A total of 348 DM patients, comprising of 184 (52.9%) females and 164 (47.1%) males were randomly selected as subjects for this study. This study was carried out using a purpose-developed data collection form to collect information about the patient's demographic characteristics, medication prescribed for DM, comorbidities, glycaemic control status, occurrence and type of UTI.

Results: The prevalence of UTI among DM patients was 40.2%. Furthermore, the prevalence among females was higher than males and UTIs were significantly associated ($p < 0.05$) with poorly controlled glycaemia. Regarding the type of UTIs, cystitis was the most prevalent UTI.

Keywords: Diabetes mellitus; Urinary Tract Infections; Prevalence

Introduction

Worldwide, diabetes mellitus (DM) is considered as one of the most challenging health problems of 21st century. It affects every aspect of patients' life, including quality of life (QoL), employment and even causing premature death. It is considered as the 5th leading cause of death in developed countries [1,2]. DM country profile of Malaysia showed that the prevalence of DM was 10.2% in males and 9.5% in females and the overall prevalence was 9.8% [3]. DM patients are prone to have various kind of infections more than non-diabetics. This high incidence rate of infections is attributed to altered immune functions like polymorphonuclear leucocyte function, adhesion phagocytosis, chemotaxis and impaired antioxidant system [4,5]. All these changes make diabetic patients prone to have more infections such as UTI, RTI, skin and soft tissue infections (SSTIs). The prevalence of UTI is high among DM patients [6-9]. DM is considered as a risk factor for UTIs. Patients with DM has more chances to get UTIs than non-diabetic. UTIs are five times higher among diabetics than non-diabetics. While Hoepelman et al. found that risk of UTI for diabetic patients was two folds higher than that of non-diabetics. UTIs are more severe and carry worse outcomes in DM patients [10,11]. The prevalence of UTI was 38% among diabetic patients. UTI seen more common in females i.e. 63.16% while male's contribution was 36.84% among studied subjects. High sugar level is the main cause of prevalence of UTI among the DM patients [7]. Ijaz et al. showed that the prevalence of UTI among diabetic patients was 51%. Furthermore they stated that UTIs are significantly associated with age, it is more common in patient with age more than 55 years and the prevalence of UTI with > 55 years of age was 68.6% [8].

Prevalence of UTI among DM patients was 37%. Female had more UTI (43%) than males (30%) [9]. The prevalence of UTI was higher in patients with uncontrolled glycaemia (78.2%) than patients with controlled glycaemia (21.8%) [6]. Various impairments in the immune system, poor metabolic control and incomplete bladder emptying due to autonomic neuropathy may all contribute to the enhanced risk of UTIs in DM patients [10]. Low urinary concentration of interleukin-8 and interleukin-6 in diabetics have been shown to correlate with lower urinary leucocyte cell count which may contribute to increase incidence and worse outcomes in UTI among DM patients [11,12]. Hyperglycaemia potentially cause nerve damage which effects the ability of urinary bladder to sense the presence of urine in it so it allows urine to stay in bladder for long time thus increasing the probability of getting infection [13]. In diabetic patients, there is an increased adherence of bacteria to uroepithelial cells particularly *E. coli* expressing type-1 fimbriae which may show increase pathogenesis and prevalence of bacteriuria among diabetic patients [14]. Urine samples with glucose concentration of more than 5.5 mmol/dl showed significant bacterial growth than normal urine [12]. High concentration of urine may act as good media for uropathogens and may enhance the growth of pathogenic bacteria in urinary tract [15]. Generally, urine is considered sterile and germ free. Different studies found that most uropathogens responsible for UTIs colonise the colon and perianal region. Faecal pathogens that ascend with the opening of urethra, stick to the wall of urethra, multiply and move up towards bladder and causing signs and symptoms. Pathogenesis can be ascending or haematogenous rout [16]. Gram negative bacteria are more commonly causing UTIs than gram positive bacteria. Among gram negative bacteria, *Escherichia coli* (*E. coli*) is most common uropathogen causing UTIs. *E. coli* contributes 56% of UTIs followed by *Klebsiella pneumonia* 35% and *Proteus mirabilis* [9,17].

Materials and Methods

This cross-sectional study was conducted at a tertiary hospital in Malaysia. The records of patients, more than and equal to age 18 years, who were admitted with diabetes mellitus between Jan 1, 2018 and December 31, 2018 were reviewed. All the aspects and protocols of this study have been reviewed by CRC and MREC. With the permission and approval from committee, the study was started.

Patient's socio-demographic characteristics (gender, age, ethnicity, smoking status, marital status) and clinical data (Pregnancy status, menopausal status, DM status, UTI status and type of UTI) were analyzed by using descriptive statistics. Categorical data was presented as frequency and percentage while continuous data was reported as mean \pm standard deviation. Chi-square test was used to find association of glycaemic control with UTI. P-value less than 0.05 were considered statistically significant.

Results

A total of 348 DM patients were studied. Gender distribution is almost equal between male and female with an additional 20 female patients above males. The mean age of the DM patients was 55 (\pm 14.58) years. There were more non-elderly patients 197 (57%) than elderly 151 (43%). Ethnic distribution showed that majority of the patients were Malays followed by Chinese and Indians. Majority of patients (93.4%) were having T2DM. The studied population was classified according to the glycaemic status; patients with uncontrolled glycaemia (HbA1c \geq 6.5) and controlled glycaemia (HbA1c < 6.5) as shown in **Table 1**.

Table 1 Characteristics of the study of DM patients.

Number of DM Patients	348
Mean age (years \pm SD)	55 (\pm 14.58)
Gender	
Males	164 (47.1%)
Females	184 (52.9%)
Age groups	
Elderly	151 (43%)
Non-elderly	197 (57%)
Race	
Malay	246 (70.7%)
Chinese	56 (16.1%)
Indians	46 (13.2%)
Type of DM	
T1DM	9 (2.6%)
T2DM	325 (93.4%)
GDM	14 (4%)
Duration of diabetes in years	
(Mean \pm SD)	8.06 (\pm 7.07)
Glycaemic status	
Good Control (HbA1C<6.5)	64 (18.4%)
Poor control (HbA1C \geq 6.5)	284 (81.6%)

Prevalence of UTI among DM patients

As expected there was high prevalence of UTIs among DM patients. In current study out of 348 DM patients 140 (40.2%) patients had UTIs. Prevalence of UTI was higher among females (54.9%) than males (23.8%). Prevalence of UTI among Chinese and Malays was nearly equivalent with slightly higher among Chinese. While Indians had less prevalence than both above mentioned ethnic groups. Cystitis and ASB were most common types of UTI followed by pyelonephritis, urosepsis and prostatitis (**Table 2**).

Table 2 Characteristics of the study subjects with UTI.

Number of Patients with UTIs	140 (40.2%)
Mean age (years \pm SD)	54.33 (\pm 16.42)
Gender	
Males (%)	164 (100%)
UTIs	39 (23.80%)
No UTIs	125 (76.2%)
Females (%)	184 (100%)
UTIs	101 (54.9%)
No UTIs	83 (45.10%)
Age groups	
Non elderly (%)	197 (100%)
UTIs	81 (41.10%)
No UTIs	116 (58.9%)
Elderly (%)	151 (100%)
UTIs	59 (39.10%)
No UTIs	92 (60.90%)
Ethnic groups	
Malay	246 (100%)
UTIs	100 (40.7%)
No UTIs	146 (59.3%)
Chinese	56 (100%)
UTIs	23 (41.10%)
No UTIs	33 (58.90%)
Indians	46 (100%)
UTIs	17 (37%)
No UTIs	29 (63%)
Types of UTIs	
Cystitis	61 (43.6%)
ASB	55 (39.3%)
Pyelonephritis	11 (7.9%)
Urosepsis	8 (5.7%)
Prostatitis	5 (3.6%)

Most of the UTI cases in this study (89.3%) were found in DM patients with poorly uncontrolled glycaemia. While 10.7% cases of UTI were found in controlled glycaemic DM patients as shown in **Table 3**. The association between glycaemia control and risk of getting UTI was determined by Chi-square test. Results showed that there was a significant association between glycaemia control and risk of getting UTI. Those patients with poor glycaemic control have more risk of getting UTI than good glycaemic control patients.

Table 3 Association between glycaemic control status and the occurrence of UTIs.

Occurrence of UTIs	Glycaemic status n (%)		P-value*
	Good control	Poor control	
Yes	15 (10.70%)	125 (89.30%)	0.004 ^a
No	49 (23.50%)	159 (76.50%)	

*Chi-Square test

Discussion

In line with previous studies this study also showed high prevalence (40.2%) of UTI among DM patients. DM attribute various impairments in the immune system (low urinary concentration of interleukin-8 and interleukin-6, lower urinary leucocyte cell count), poor metabolic control and incomplete bladder emptying due to autonomic neuropathy may all contribute to the enhanced risk of UTIs in DM patients [10]. Similar patterns of UTIs was observed in previous studies done by Yadav et al. (38%) and Pargavi et al. (37%) and Sewify et al. (35%). Whereas, there was high prevalence of UTI reported by Ijaz et al. [8] (51%), Hirji et al. (62%). Few studies found less prevalence of UTI than this study. These studies include Gillani et al. (29.2%), Al-Rubeaan et al. (25.2%) and Hamdan et al. (19.5%).

In terms of gender, females are more prone to get UTI than males. Women are vulnerable to UTIs due to their anatomy and reproductive physiology. Short urethra, urethra closer to perirectal area where pathogen colonies easier, absence of bacteriostatic prostatic secretions and sexual intercourse may force bacteria into the female bladder [18]. In line with previous studies, this study results also showed higher prevalence of UTI among females compared to males. Chaudhary et al. [19] found 62.5% prevalence of UTI among females and 37.5% among males. Ijaz et al. [8] showed more similar results to this study. They found 51.37% prevalence of UTI among females while 48.63% in males.

Prevalence among elderly and non-elderly was nearly equal with slightly higher in non-elderly patients. In women there are high chances of UTI during child bearing age that could be due to sexual intercourse or the use of contraception (e.g. diaphragm and spermicides). Whereas in elderly patients loss of estrogen causes a change in the vaginal flora, loss of lactobacilli in the vaginal flora results in periurethral colonization. Decreased bladder capacity and increased urine production, Decreased lower urinary tract sensory threshold and decreased voided volume [20]. Chaudhary et al. [19] assessed age-sex distribution and concluded that 31-40 years' age group had higher prevalence of UTI followed by 41-50 years' age group. Njunda et al also found high prevalence of UTI (27.2%) among age group of 41-60 years old DM patients [21]. Unlike this study, Ijaz et al. [8] showed that the prevalence of UTI was higher (68.6%) among patients >55 years of age than 41-55 years' age group (42.9%) [8].

Expectedly, in this study the prevalence of cystitis was higher than other types of UTI. Bladder is a store house for urine. Uropathogens can enter and colonise in bladder much easier than other parts of urinary tract system. The results of this study showed that majority of patients had cystitis followed by ASB, pyelonephritis, prostatitis and urosepsis. Similarly other studies also reported cystitis as most prevalent type of UTI [14,22].

Most of UTI cases (89.3%) in this study were found in patients with poor glycaemic control. Whereas, only 10.7% cases of UTI were found in patients with good glycaemic control. Those patients with poor glycaemic control had more risk of getting UTI than good glycaemic control patients ($P < 0.05$). Poor metabolic control may suppress immune system. Furthermore high urine glucose concentration shows significant bacterial growth than normal urine. High concentration of sugar in urine may act as good media for the growth of uropathogen [12]. Similarly other studies also stated the high prevalence of UTI in patients with uncontrolled DM [6,23].

Conclusion

UTIs are more frequent and are likely to have a more complicated course in DM patients. Overall, the prevalence of UTI among DM patients was 40.2%. Like other studies the high prevalence of UTI confirms that uncontrolled DM is significantly associated with more UTI. Furthermore, the prevalence among females was higher than males. Cystitis was the most prevalent UTI type.

Conflicts of interest

The authors declare that there is no conflict of interests regarding the publication of this paper.

Registration of study

The study was registered with the National Medical Research Register (NMRR). NMRR ID: NMRR-17-901-35420.

Ethical approval of the study

All the aspects and protocols of this study have been reviewed by CRC and MREC. With the permission and approval from committee, the study was started.

References

- Prabhakar PK (2016) Pathophysiology of secondary complications of DM. *Asian J Pharmaceut Clinical Res* 9: 32-36.
- Dierena SV, Beulens JWJ, Schouwa YTV, Grobbee DE, Neal B (2010) The global burden of diabetes and its complications: an emerging pandemic. *Eur J Cardiovasc Prevent Rehabil* 17: 3-8.
- WHO (2016) Diabetes country profiles (Malaysia). World Health Organization.
- Shah BR, Hux JE (2003) Quantifying the risk of infectious diseases for people with diabetes. *Diabetes Care* 26: 510-513.
- Delamaire M, Maugeudre D, Moreno M, Goff ML, Allannic H, et al. (1997) Impaired Leucocyte Functions in Diabetic Patients. *Diabetic Medicine* 14: 29-34
- Sewify M, Nair S, Warsame S, Murad M, Alhubail A, et al. (2016) Prevalence of UTI and Antimicrobial Susceptibility among Diabetic Patients with Controlled and Uncontrolled Glycemia in Kuwait. *J Diabetes Res* 2016: 1-7.
- Yadav SK, Kumar S, Tak V, Kumar D, Kushwaha S (2015) Prevalence of UTI among Diabetic. *Annals Int Med Dent Res* 1: 264-267.
- Ijaz M, Ali S, Khan SM, Hassan M, Bangash IH (2014) Urinary tract infection in diabetic patients; causative bacteria and antibiotic sensitivity. *J Med Sci* 24: 110-114.
- Pargavi B, Mekala T, Selvi AT, Moorthy K (2011) Prevalence of UTI among diabetics patients in Vandavasi, Tamil Nadu, India. *Int J Biological Technol* 2: 42-45.
- Nitzan B, Elias M, Chazan B, Saliba W (2015) Urinary tract infections in patients with type 2 diabetes mellitus: review of prevalence, diagnosis, and management. *Dove press J* 8: 129-136.
- Hoepelman AIM, Meiland R, Geerlings SE (2003) Pathogenesis and management of bacterial urinary tract infections in adult patients with diabetes mellitus. *Int J Antimicrobial Agents* 22: 35-43.
- Geerlings S, Fonseca V, Castro-diaz D, List J, Parikh S (2014) Genital and UTIs in diabetes: Impact of pharmacologically-induced glucosuria. *Diabetes Res Clinical Prac* 103: 373-381.
- Geerlings SE, Brouwer EC, Kessel KCV, Gaastra W, Stolk RP, et al. (2000) Cytokine secretion is impaired in women with DM. *Eur J Clinical Investigation* 30: 995-1001.
- Geerlings SE, Meiland R, Lith ECV, Brouwer EC, Gaastra W, et al. (2002) Adherence of Type 1 – Fimbriated *Escherichia coli* to uroepithelial cells More in diabetic women than in control subjects. *Diabetes Care* 25: 1405-1409.
- Chen SL, Jackson SL, Boyko EJ (2009). Diabetes mellitus and urinary tract infection: Epidemiology, pathogenesis and proposed studies in animal models. *J Urol* 182: S51-S56.
- John AS, Mboto CI, Agbo B (2016) A review on the prevalence and predisposing factors responsible for urinary tract infection among adults. *Eur J Experiment Biol* 6: 7-11.
- Mustafa M, Balingi J (2012) Urinary tract infections in a sabah general hospital. *J Pharmacy Biological Sci* 1: 44-48.
- Vasudevan R (2014) UTI: An overview of the infection and the associated risk factors. *J Microbiol Experimentation* 1: 1-15.
- Chaudhary BL, Chandra C, Shukla S (2014) Bacteriology of UTI and antibiotic susceptibility pattern among diabetic patients. *Int J Bioassays* 3: 3224-3227.
- Hirji I, Guo Z, Andersson SW, Hammar N, Gomez-Caminero A (2012) Incidence of UTI among patients with type 2 diabetes in the UK general practice research database. *J Diabetes Complications* 26: 513-516.
- Njunda AL, Assob NJC, Nsagha SD, Nde FP, Kamga FHL, et al. (2012) Uropathogens from diabetic patients with asymptomatic bacteriuria and UTIs. *Scientific J Microbiol* 1: 141-146.
- Muller LMAJ, Gorter KJ, Hak E, Goudzwaard WL, Schellevis FG, et al. (2005) Increased risk of common infections in patients with type 1 and type 2 DM. *Clin Infect Dis* 41: 281-288.
- Bonadio M, Costarelli S, Morelli G, Tartaglia T (2006). The influence of diabetes mellitus on the spectrum of uropathogens

- and the antimicrobial resistance in elderly adult patients with urinary tract infection. *BMC Infect Dis* 6: 1-7.
24. Hamdan HZ, Kubbara E, Adam AM, Hassan OS, Suliman SO, et al. (2015) UTIs and antimicrobial sensitivity among diabetic patients at Khartoum, Sudan. *Annals Clin Microbiol Antimicrob* 14: 1-6.
 25. Gillani SW, Azhar S, Sulaiman S, Sundram S (2012) Prediction and rate of infections in diabetes mellitus patients with diabetes ketoacidosis in Penang. Malaysia. *J Epidemiol* 2: 1-6.
 26. Al-Rubeaan KA, Moharram O, Al-Naqeb D, Hassan A, Rafiullah MRM (2013) Prevalence of UTI and risk factors among Saudi patients with diabetes. *World J Urol* 31: 573-578.