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RESEARCH ARTICLE

Survey on Urinary Tract Infection Associated with Diabetes Mellitus

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Abstract

Urinary Tract Infection (UTI) remains a common infection diagnosed in outpatients as well as in hospitalized patients. Urinary tract infections (UTIs) are important for diabetic patients as high glucose in the urine makes rich proliferation of bacteria. Thus, a prospective study was carried out to know the risk of urinary tract infection and diabetic mellitus in patients attending Government hospital, Thuraiyur (TK), Trichy (DT), Tamil Nadu from October 2013 to March 2014. Presence of albumin in urine samples were tested using Sulphosalicylic Acid (SSA reagent) precipitation method to find UTI in patients. Dip stick method was used to diagnose DM from urine sample. The data was analyzed using SPSS version 16.0. In this study, among 135 urine samples, 76.3% of samples were urinary tract infected, 23.7% were DM and 6.8% were UTI associated with DM. Analysis of results showed a prevalence of UTI and DM in male than the female during the study period.

Keywords: Urinary tract infection, Thuraiyur, diabetes mellitus, glucose, albumin, dip stick method.

Introduction

UTIs are group of infections that affects any part of urinary tract. Some of the important risk factors associated with UTIs are sex, microbial, behavioral (use of spermicidal agents) and non-behavioral factors (anatomic and genetic factors), diseased condition (diabetes and immune-suppression), pregnancy, nosocomial infection and instrumentation (use of catheter) (Stamm and Hooton, 1993; Scholes *et al*., 2000; Dulawa, 2004; Behzadi and Behzadi, 2008) and premenopausal (predisposal by intercourse) and postmenopausal (related to decline estrogen levels) stages of women (Hornsby Kuringai Health Service, 2007; Annette *et al*., 2010). The first attack of UTI in infancy (below 5 years) usually brings the risk of recurrent UTI in both sexes (Martinel *et al*., 1995). Thus, UTI leave their mark from cradle to the grave. Several literatures concluded that UTI are most common in women than men and about 50-60% of women will develop UTI at least once during their lives (Foxman *et al*., 2000; Czaja and Hooton, 2006). Diabetic patients have a ten-fold increased risk of UTI than the non-diabetics (Goswami *et al*., 2001) and the diabetics are more likely to have bladder dysfunction caused by diabetic neuropathy. There are several reasons for an increased frequency of UTI in diabetic patients includes depression in the function of polymorpho nuclear leucocyte especially during acidosis, dysfunction of chemotaxis and phagocytosis (Valerius *et al.*, 1982; Gallacher *et al.,* 1995; Dalamaire *et al*., 1997). When excess glucose is filtered in the kidneys, it results in significantly higher urine glucose concentrations when compared to the urine of non-diabetics. This filtered glucose attracts water into the renal tubules, which can increase the urgency and frequency of urination. High glucose concentrations in the urine provide an abundant source of nutrients for bacteria, which can multiply and foundation for infection. DM alters the genitourinary system and may cause damage to the organ even death due to complicated UTI (Pyelonephritis) and this type of UTI occurs 15 times more frequently in diabetic patients, but the young diabetics are not at risk of UTIs (Souhami and Moxham, 1994). UTI is the 3rd most very common cause of admission to hospitals in India. About 6 million patients per year are visited worldwide for UTI out of which around 30,000 are treated in the wards (Bano *et al.,* 2012). UTIs are bacterial infections that have worldwide incidence of approximately 150 million cases annually. Therefore, UTI represents a substantial burden to the health-care system and these potential uropathogens usually diminish in the first year of life and are rarely found in children older than 5 years. Studies of girls and women prone to UTI showed that periurethral colonization occurs with the specific bacterium that causes the next infection (Fisher, 2010). Head (2008) showed that lower UTIs are common in young women (particularly who are sexually active), during pregnancy and in pre and postmenopausal women and were often prescribed with long-term antibiotics results antibiotic resistance. A complicated UTI is dangerous and one needs severe treatment (Bryan, 2011). The antibiotic selection for treating UTI should be based on the knowledge of local prevalence of bacterial organism and antibiotic sensitivities rather than on universal guidelines (Kaur *et al*., 2012).

Table 1. Prevalence of UTI in patients.

Sex	Age groups (%)						% of occurrence
	0-10	11-20	21-30	31-40	41-50	Above 50	
Male	1.82	3.64	3.64	10.91	20	60	53.4%
Female	-	8.33	14.58	10.42	14.58	52.08	46.6%

Considering the above facts in view, a prospective study was carried out to know the risk of urinary tract infection and diabetic mellitus in patients attending Government hospital, Thuraiyur (TK), Trichy (DT), Tamil Nadu from October 2013 to March 2014.

Materials and methods

Study design: Patients with symptoms of UTI and diabetes mellitus were studied at Thuraiyur Government hospital, Trichy during October 2013 to March 2014.

Urine analysis: Urine analysis was carried out according to Ringsrud and Linne method (1995) with slight modifications. Presence of albumin in urine samples were tested using urine protein Sulphosalicylic Acid (SSA reagent) precipitation method. The acidification causes precipitation of protein in the urine samples (seen as increasing turbidity), which is subjectively graded as negative (no turbidity), trace (cloudiness barely visible), + (definite cloudiness, but no granularity), ++ (turbidity with granulation, but no flocculation), +++ (turbidity with granulation and flocculation) or ++++ (clumps of precipitation, almost a solid). Another method was also used to test UTI by determination of urinary deposits such as chemicals substances (phosphates, Ca, uric acid and amino acids), cells (RBC, WBC (pus cells), epithelial cells and spermatozoa) and casts by centrifuging the urine sample (Illinois Masonic Medical Center, Urinalysis Procedure (Morris, 9/89)).

Urine sugar test: Dip stick method was used to diagnose DM from urine samples. Dipsticks are based on a change in color to be observed at a fixed time after immersing the dipsticks in urine. Corresponding color chart on the bottle label at the time specified, which is subjectively graded as negative (blue color), trace (green color), + (yellow green), ++ (orange color), +++ (red color) or ++++ (brick red color) was evaluated.

Statistical analysis: Data collected were analyzed using descriptive statistics and multivariate analysis performed using SPSS (Ver. 16.0) software.

Results

From October 2013 to March 2014, totally 135 urine samples were collected from patients who attended Government hospital, Thuraiyur, Trichy (Dt). Patients were grouped into six different categories according to age. Among 135 samples, the incidence of UTI was 76.3%. In male, 53.4% of patients were infected with UTI. According to the gender wise report, the highest occurrence was observed in male than female.

Table 2. Albumin levels in UTI patients.

Level of albumin	Interpretence (%)
Trace	16.51
+	51.46
++	30.1
+++	1.94
++++	-

In case of male, the highest incidence (60%) was observed in above 50 years and the lowest incidence (1.82%) was observed in 0-10 years of patients (Table 1). Among 76.3% of UTI patients, 46.6% were female. In female, the highest incidence (52.08%) was observed in the age group of above 50 and the lowest incidence (8.33%) was observed in 11-20 years of age group. There is no incidence in 0-10 years (Table 1). The highest incidence (51.46%) of albumin level was found in +, followed by ++ (30.1%). No incidence observed in ++++ level (Table 2). Among 103 urine samples, 90.29% showed deposition of pus and epithelial cells. In which, the deposition of pus cells and epithelial cells is seen in 76.34 and 23.66% respectively. The occurrence of pus and epithelial cells in different age groups of both male and female is shown in Table 3. Among 103 urine samples, 6.8% were infected with both UTI and diabetes mellitus, in which, the highest incidence (57.14%) was observed in male than female (42.86%). In age wise report, all the infected females belong to the age group of above 50. In case of male, 75% of incidence was observed in the age group of 41-50 years (Table 4). Among 135 samples, 23.7% were infected by diabetes mellitus only. In those samples, incidence of female (53.13%) was higher than male (46.88%). In female, highest incidence (52.94%) was observed in above 50 years, followed by 41-50 years (23.53%) and lowest incidence in 21-30 years. In male, highest (53.33%) and lowest (3.33%) incidences were observed in above 50 and 41-50 years respectively. No occurrence in both 0-10 and 21-30 year age groups in male and 0-10 and 11-20 years in case of female (Table 5).

In 53.13% of female, the highest percentage (47.06%) was observed in ++ level, followed by + (29.41%) and mostly likely to be observed at above 50 years. Lowest percentage (5.88%) was observed at the trace level. There was no occurrence in the level ++++ (Table 6). In 46.88% of male, the highest percentage (46.67%) was observed in + level, followed by ++ (40%) and mostly like to be observed at above 50 years. Lowest percentage (13.33%) was observed at +++ level. There was no occurrence in the trace level and ++++ (Table 7).

Table 3. Incidence of pus and epithelial cells in urine sample.

Deposits	Sex	Age groups (%)						% of occurrence	
		0-10	11-20	21-30	31-40	41-50	Above 50		
Pus cells	Male	-	4.65	-	9.3	25.58	60.47	60.56	68.93%
	Female	-	7.14	17.36	7.14	7.14	60.71	39.44	
Epithelial cells	Male	-	7.14	-	-	21.43	71.43	63.64	21.36%
	Female	-	-	50	-	12.5	37.5	36.36	

Table 4. Incidence of UTI accompanied by diabetes mellitus.

Sex	Age groups (%)						% of occurrence
	0-10	11-20	21-30	31-40	41-50	Above 50	
Male	-	-	-	-	75	25%	57.14%
Female	-	-	-	-	-	100%	42.86%

Table 5. Prevalence of diabetes mellitus according to sex.

Sex	Age groups (%)						% of occurrence
	0-10	11-20	21-30	31-40	41-50	Above 50	
Male	-	6.67%	-	6.67%	3.33%	53.33%	46.88%
Female	-	-	5.88%	17.65%	23.53%	52.94%	53.13%

Table 6. Incidence of diabetes mellitus in female patients.

Level	Age groups (%)						% of occurrence
	0-10	11-20	21-30	31-40	41-50	Above 50	
Trace	-	-	-	-	-	5.88%	5.88%
+	-	-	5.88%	5.88%	5.88%	11.76%	29.41%
++	-	-	-	11.76%	17.65%	17.65%	47.06%
+++	-	-	-	-	-	17.65%	17.65%
++++	-	-	-	-	-	-	-

Table 7. Incidence of diabetes mellitus in male patients.

Level	Age groups (%)						% of occurrence
	0-10	11-20	21-30	31-40	41-50	Above 50	
Trace	-	-	-	-	-	-	-
+	-	14.29%	-	-	-	85.71%	46.67%
++	-	-	-	-	66.67%	33.33%	40%
+++	-	-	-	50%	50%	-	13.33%
++++	-	-	-	-	-	-	-

Trace–15-30 mg/dL, (+)– 30-100 mg/dL, (++)– 100-300 mg/dL, (+++)– 300-1000 mg/dL and (++++) >1000 mg/dL.

Table 8. Mean value of patients affected by UTI, DM and UTI + DM.

Patients' disease	Gender	Mean	Std. deviation	N
UTI	Male	9.1667	12.25425	6
	Female	8.0000	8.71780	6
	Total	8.5833	10.15747	12
DM	Male	2.5000	3.27109	6
	Female	2.8333	3.43026	6
	Total	2.6667	3.20038	12
UTI +DM	Male	0.6667	1.21106	6
	Female	0.5000	1.22474	6
	Total	0.5833	1.16450	12
Total	Male	4.1111	7.86570	18
	Female	3.7778	6.05422	18
	Total	3.9444	6.91972	36

N – Total number of age groups.

The multivariate analysis was performed by SPSS (Ver. 16.0) software. The mean number of male patients who had UTI was 9.17±12.25 with 53.4% (n=55) that of female was 8.00±8.72 with 46.6% (n=48), males who had DM was 2.50±3.27 with 46.88% (n=15) and that of female was 2.83±3.43 with 53.13% (n=17), and in case of UTI associated with DM in male patients, the mean number was 0.67±1.21 with 57.14% (n=4) and in female it was 0.50±1.22 with 42.86% (n=3) with a total number of 103 UTI cases (Table 8).

Discussion

UTIs are leading cause of morbidity and health care expenditures in all age and sex groups in mankind. The purpose of the present study was to find out the prevalence of UTI and their association with DM in Thuraiyur (TK), Trichy (DT). Foxman (2010) mentioned that about 40% female and 12% male experienced at least one symptomatic UTI during their lifetime and nearly 25% affected females show recurrent UTI.

Several reports showed that UTIs are more common in females than in males and its incidence in females is in the age of 20 to 40 years ranges from 25 to 30%, whereas in older women (>60 years), it ranges from 4 to 43% (Kunin, 1987; Jarvis and Martone, 1992; Williams and Schaeffer, 2004). The present study revealed that the rate of UTI was higher in male (53.4%) than female (46.6%) and highly observed in the age group of above 50 years due to lower sample examination (n=103). In the present investigation, no detection of microorganisms in urine sample was used to diagnose the UTI except rare cases. UTI is frequent one in diabetic women (Wheat, 1980) because of poor glycemic control which have a higher tendency of *Escherichia coli* adherence (Huvos and Rocha, 1959; Andriole, 2002) and also diabetes affect many systems that protects against infection in general and against UTI specifically (Goswami *et al.,* 2001).

Several studies showed the association between DM and UTIs, poorly controlled DM is found in up to 90% of UTIs patients (Pontin and Barnes, 2009), 30-40% of renal abscess cases (Thorley *et al.,* 1974) and 20% of women who had either type 1 or type 2 diabetes developed a UTI during the 18 month study period (Geerling *et al.,* 2000). In this present study, the risk for DM was 23.7% and UTI was 76.3%, in case of UTI accompanied with DM, only 6.8% (57.14%-male and 42.86%-female) of patients were affected by these both complaints (UTI and DM). In which 75% of male were observed in 41-50 years and 25% were observed in above 50 years and all the females belong to above 50 years. Further, 23.7% were infected by diabetes mellitus, in those patients, female (53.13%) were slightly higher than male (46.88%). In female, highest incidence were observed in above 50 years (52.94%). Both incidence of the UTI and DM were higher in male than female and more likely to get at old age in this study area during the study period. American Diabetes Association (2013) reported that 9.4% of people diagnosed with type 2 diabetes had a UTI compared to 5.7% of non-diabetics. During this study, lower number of samples (n=135) only received by the hospital. This may be the reason for both incidence of the UTI and DM were higher in male than female and more likely to get at old age in this study area during the study period. In future, more number of cases may be collected to find out the significance of study area. However, further studies with large sample size are highly recommended to confirm the findings. Factors that increase the risk of UTIs in DM include age, race, sex and temperature, metabolic control, autonomic neuropathy, vascular complications (Bachur and Haper, 2001). UTI infected with diabetic should promptly treat with proper antibiotics to prevent the development of kidney damage or more serious infection.

Conclusion

In Thuraiyur taluk, the hospital effluents from south side of bus stand is directly disposed in drainage which is always open. Due to non-availability of toilet, mostly men are using the drainage as toilet and this may be the reasons for prevalence of UTI in this region. Awareness programs should be conducted to prevent the development of kidney damage or more serious infections due to UTI.

References

1. American Diabetes Association (ADA). 2013. Urinary tract infections more common in diabetics. In 73rd Scientific Sessions and Published in Renal & Urology News, July 8.
2. Andriole, V.T. 2002. Asymptomatic bacteriuria in patients with diabetes enemy or innocent visitor? *New Engl. J. Med*. 347: 1617-1618.
3. Annette, E.P.P., Saskatoon, S.K., Larochelle, A. and Lambert, Q.C. 2010. Recurrent urinary tract infection. *SOGC Clin. Pract. Guideline.* 250: 1082-1090.
4. Bachur, R. and Harper, M.B. 2001. Reliability of the urinalysis for predicting urinary tract infections in young febrile children. *Arch. Pediatr. Adolesc. Med.* 155: 60-65.
5. Bano, K., Khan, J., Begum, H., Munir, S., Akbar, N.U., Ansari, J.A. and Anees, M. 2012. Patterns of antibiotic sensitivity of bacterial pathogens among urinary tract infections (UTI) patients in a Pakistani population. *Afr. J. Microbiol. Res.* 6(2): 414-20.
6. Behzadi, P. and Behzadi, E. 2008. The microbial agents of urinary tract infections at central laboratory of Dr. Shariati Hospital, Tehran, Iran. *Turk. Klin. Tip. Bilim*. 28: 445-449.
7. Bryan, C. 2011. Infectious disease, chapter seven, Urinary tract infections from *Infectious Disease Section of Microbiology and Immunology On-line*. University of South Carolina.
8. Czaja, C.A. and Hooton, T.M. 2006. Update acute uncomplicated urinary tract infection in women. *Postgrad. Med*. 119: 39-45.
9. Dalamaire, M., Maugendre, D. and Moreno, M. 1997. Impaired leucocyte functions in diabetic patients. *Diabet. Med*. 14: 29-34.

10. Dulawa, J. 2004. Urinary tract infection-2003. *Ann. Acad. Med. Bialostoc*. 49: 182-184.
11. Fisher, D.J. 2010. Pediatric urinary tract infection. Medscape drugs, diseases and procedures. Infectious Disease update Retrieved from emedicine.emedscape.com, 25th may 2010.
12. Foxman, B. 2010. Community-acquired urinary tract infection in adults: A hospital viewpoint. The epidemiology of urinary tract infection. *Nat. Rev. Urol*. 7: 653-660.
13. Foxman, B., Barlow, R., D'Arcy, H, Gillespie, B. and Sobel, J.D. 2000. Self reported incidence of urinary tract infection and associated costs. *Ann. Epidemiol*. 10: 509-515.
14. Gallacher, S.J., Thomson, G. and Fraser, W.D. 1995. Neutrophil bactericidal function in diabetes mellitus: Evidence for association with blood glucose control. *Diabet. Med*. 12: 916-920.
15. Geerling, S.E., Brouwer, E.C. and Van kessel, K.C.P.M. 2000. Cytokine secretion is impaired in women with diabetes mellitus. *Eur. J. Clin. Invest.* 30: 995-1001.
16. Goswami, R., Bal, C.S., Zateri, R.B. and Punjabi, G.V. 2001. Prevalence of urinary tract infection and renal scars in patients with diabetes mellitus. *Infect. Dis. Clin. North America*. 18: 5241.
17. Head, A.K. 2008. Natural approaches to prevention and treatment of infections of the lower urinary tract. *Alternat. Med. Rev.* 13(3): 227-244.
18. Hornsby Kuringai Health Service. 2007. Nurse practitioner clinical guideline for assessment and treatment of urinary tract symptoms. Cited 27th March. Available from http://www.health.nsw.gov.au/nursing/pdf np crg uti 2005.pdf.
19. Huvos, A. and Rocha, J. 1959. Frequency of bacteriuria in patients with diabetes mellitus. *New Engl. J. Med*. 261: 1213-1216.
20. Jarvis, W.R. and Martone, W.J. 1992. Predominant pathogens in hospital infections. *J. Antimicrob. Chemother*. 29: 19-24.
21. Kaur, R., Walia, G. and Mehta, M. 2012. Prevalence of urinary tract infections in children and their sensitivity to various antibiotics. *J. Acad. Indus. Res.* 1(4): 161-163.
22. Kunin, C. 1987. Detection, prevention and management of urinary tract infections. *Philadelphia:* Lea and Febiger, pp.195-234.
23. Pontin, A.R. and Barnes, R.D. 2009. Current management of emphysematous pyelonephritis. *Nat. Rev. Urol.* 6: 272-279.
24. Ringsrud, K.M. and Linne, J.J. 1995. Urinalysis and body fluids: A Color Text and Atlas, Mosby, pp.52-54
25. Scholes, D., Hooton, T.M. and Roberts, P.L. 2000. Risk factors for recurrent urinary tract infection in young women. *J. Infect. Dis*. 182: 1177-1182.
26. Souhami, R. and Moxham, L. 1994. Textbook of Medicine. UK. ELBS with Churchill Livingstone, pp.828-830.
27. Stamm, W.E. and Hooton, T.M. 1993. Management of urinary tract infections in adults. *New Engl. J. Med*. 329: 1328-1334.
28. Thorley, J.D., Jones, S.R. and Sandford, J.Y. 1974. Perinephric abscess. *Med*. 53: 441-51.
29. Valerius, N.H., Eff, C. and Hansen, N.E. 1982. Neutrophil and lymphocyte function in patients with diabetes mellitus. *Acta. Med. Scand*. 211: 463-467.
30. Wheat, L.J. 1980. Infection and diabetes mellitus. *Diabet. Care*. 3: 187-197.
31. Williams, D.H. and Schaeffer, A.J. 2004. Current concepts in urinary tract infections. *Minerva Urol. Nefrol.* 56: 15-31.