Sladjana Pavic[1], Aleksandra Andric[2], Marija Antic[1],
Milica Jovanovic[3], Aleksa Novkovic[4], Aleksandra Pavic[4]

THE ETIOLOGY, EPIDEMIOLOGY AND CLINICAL COURSE OF URINARY TRACT INFECTION IN PATIENTS WITH DIABETES MELLITUS

Introduction

Urinary tract infection is the most common bacterial infection, especially in women (1). The clinical course of urinary infection varies from asymptomatic to severe clinical forms accompanied by complications, such as sepsis and shock (2). Diabetes mellitus is an important risk factor for the development of urinary infection (3).

Urinary infection is usually caused by bacteria, among which the most common is Escherichia coli. Common causes are *Klebsiella Enterobacter, Proteus mirabilis, Pseudomonas aeruginosa*, too, but also *Streptococcus faecalis* and *Staphylococcus saprophyticus.* The latter two causes are more common in younger populations, especially women and related to sexual activity (4). Urinary tract infection is among the most common hospital infections. Placement of urinary catheters, the introduction of urological instruments, surgical intervention, antibiotic abuse, chronic kidney disease and kidney transplantation are the risk factors for their emergence in the hospital environment (5).

The aim of our work was to examine the most common bacterial causes of urinary tract infection in patients with Diabetes mellitus, clinical course and risk factors.

Methods

We examined patients with Diabetes mellitus and symptomatic urinary tract infection who were treated at the Department of Infectious and Tropical Diseases of the General Hospital of Uzice, from January 2009 to December 2018.

We excluded patients with bacterial or viral coinfections, autoimmune diseases, severe haematological and malignant diseases, as well as HIV positive patients.

[1]   Sladjana Pavic, Odeljenje za infektivne i tropske bolesti Opšte bolnice Užice, Užice, Srbija; sladjanapj@gmail.com

[2]   Institut za javno zdravlje, Užice, Srbija

[3]   Institut za infektivne i tropske bolesti, Beograd, Srbija

[4]   Medicinski fakultet Univerziteta u Beogradu, Beograd, Srbija

We examined demographic characteristics (sex, age), biochemical analysis, clinical course, complications and risk factors. The diagnosis was confirmed by the identification of the bacterial agent from the urine. Examined urin was set up on agar to detect Gram positive and Gram negative bacteria used in microbiological laboratories in the Republic of Serbia. Ultrasonography of the urogenital tract was performed for all patients.

Results

We examined a total of 772 patients with Diabetes mellitus who had symptomatic urinary tract infection (UTI). In 402 patients, a urinary infection occurred after admission to the hospital.

The demographic characteristics of the patients are shown in Table 1.

Table 1. Demographic characteristics of patients with Diabetes mellitus and urinary tract infection

Demographic characteristics	Community-acquired UTI Number of patients (%)	Hospital UTI Number of patients (%)	P
Age ≥ 65 years	198 (53.5)	325 (80.8)	0.124
Gender (female)	310 (83.8)	289 (71.9)	0.311

P – statistical significance between patients with community-acquried and hospital UTI according to demographic characteristics.

The age of patients with an community-acquired UTI was from 28 to 84 years (44.6 +/- 10.4), with a hospitalUTI was from 44 to 92 years (58.3 +/- 11.4).

There was no statistically significant difference between patients by age and gender.

The most common causes of urinary tract infections in our patients shown in Table 2.

Table 2. Causes of urinary tract infection in patients with Diabetes mellitus

Causes	Community-acquired UTI Number of patients (%)	Hospital UTI Number of patients (%)	P
Escherichia coli	174 (47.0)	129 (32.1)	0.212
Klebsiella spp.	115 (31.1)	165 (41.0)	0.309
Proteus mirabilis	18 (4.9)	39 (9.7)	0.052
Pseudomona aeruginosa	18 (4.9)	31 (7.7)	0.112
Enterococcus	37 (10.0)	19 (4.7)	0.022

P – statistical significance between patients with community-acquried and hospital UTI according to causes

There was no statistically significant difference in causes in relation to the origin of the infection.

Ttable 3 shows the symptoms and laboratory findings of patients.

Table 3. Symptoms and laboratory findings of urinary tract infection in patients with Diabetes mellitus

Characteristics	Community-acquired UTI Number of patients (%)	Hospital UTI Number of patients (%)	P
Weakness	355 (95.9)	168 (41.8)	0.028
Urinary disorders	333 (90.0)	128 (31.8)	0.003
High temperature >38C	314 (84.9)	365 (90.8)	0.312
Pain suprapubic/lumbal	292 (78.9)	285 (70.9)	0.332
Leukocytosis >15x10^9/L	351 (94.9)	357 (88.8)	0.394
C reactive protein >5mg/l	359 (97.0)	398 (99.0)	0.506

P – statistical significance between patients with community-acquried and hospital UTI according to symptoms and laboratory findings

There was statistically significant difference between patients regarding the presence of weakness and urinary disorders.

The most common complications of UTI in our patients are shown in Table 4.

Table 4. Complications of urinary tract infections in patients with Diabetes mellitus

Complication	Community-acquired UTI Number of patients (%)	Hospital UTI Number of patients (%)	P
Pyelonephritis	28 (7.7)	7 (1.7)	0.00
Urinary obstruction	15 (4.1)	3 (0.7)	0.00
Sepsis	45 (12.2)	5 (1.2)	0.00

P – statistical significance between patients with community-acquried and hospital UTI according to complications

There was a statistically significant difference in the incidence of complications between patients with community-acquried and hospital UTI.

Risk factors for the development of urinary tract infections are shown in Table 5.

Table 5. Risk factors for the development of urinary tract infections in patients with Diabetes mellitus

Risk factor	Community-acquried UTI Number of patients (%)	Hospital UTI Number of patients (%)
Calculus kidney/urinary bladder	263 (71.1)	297 (73.9)
Urinary catheter	57 (15.4)	389 (96.8)
Previous urogenital interventions/surgeries	22 (5.9)	30 (7.5)

There was a statistically significant difference in the presence of urinary catheter among the investigated groups (P 0.00).

Discussion

Diabetes mellitus was associated with increased rates of infections, which was explained by a decreased T cell-mediated immune response and a disorder of neutrophil function (7, 8). These patients had an increased risk of asymptomatic and symptomatic urinary tract infection (9, 10).

Women were the majority of patients in our research, regardless of the origin of the infection, as well as in the mentioned studies. This was explained by the fact that obesity, known as the risk factor for diabetes, is more common in women (11). Also, urinary tract infections are more commonly reported in women than men with Diabetes mellitus(12). There are also studies in which men with diabetes had urinary tract infection more often. These results were related to people with type 1 Diabetes mellitus.This was explained by the possible inflammation of the prostata (13). These results were related to people with type 1 Diabetes mellitus. In our study has not been analyzed the difference in type of diabetes.

The results of most of the elderly with diabetes in our study have already been noticed by other researchers (14).

Most patients had general symptoms and high fever. Patients with community-acquried urinary infection had significantly more weakness and urinary disorders. This was expected because they were treated for these symptoms.

The most common causes of urinary tract infection in our study were *Escherichia coli* and *Klebsiella spp*, without significant difference according to the origin of the infection. Other researchers received the same result (12). Ronald, unlike our results, noticed *Staphylococcus saprophyticus* as a significant etiological factor of community-acquried urinary tract infection. Patients were younger women and result were explained by sexual activity. The indicated population is not compatible with our patients. *Klebsiella spp*, *Escherichia coli* and *Enterococcus* were most commonly causes in patients with Diabetes mellitus in the same study, as it was in our case

(15). *Enterococcus* was a significantly more frequent cause of community-acquried infection in our study, which corresponds to Rhonald's research.

Patients with hospital origin of the infection used urinary catheter before infection significantly often which is the most common way of introducing the bacteria. It was expected that the infection occurred in such conditions was adequately treated from the beginning and complications in these patients were significantly lower.

Conclusion

Among patients with Diabetes mellitus, women more often had urinary tract infection. *Escherichia coli* and *Klebsiella species* were the most common causes , without regard to the origin of the infection. *Enterococcus* is a more common causes of community-acquried urinary tract infections in patients with Diabetes mellitus. Patients with community-acquried infection have more symptoms and complications, especially sepsis. A significant risk factor for hospital urinary infections is the use of urinary catheter and its application should be strictly indicated.

Literatura/References

1. Kucheria R, Dasgupta P, Sacks SH, Khan MS, Sheerin NS. Urinary tract infections: ew insights into a common problem. Postgrad Med J 2005; 81: 83–6.
2. Foxman B. Epidemiology of urinary tract infections: incidence, morbidity, and economic costs. Dis Mon 2003; 49: 53–70.
3. Boyko EJ, Fihn SD, Scholes D, Chen CL, Normand EH, Yarbro P. Diabetes and the risk of acute urinary tract infection among postmenopausal women. Diabetes Care 2002; 25: 1778–83.
4. Nicolle LE. Uncomplicated urinary tract infection in adults including uncomplicated pyelo-nephritis. Urol Clin North Am. 2008 (1); 35: 1–12.
5. Brunner & Suddarth's textbook of medical-surgical nursing. (12th ed.). Philadelphia: Wolters Kluwer Health/Lippincott Williams & Wilkins. 2010; pge 1359.
6. Salvatore S, Cattoni E, Siesto G, Serati M, Sorice P, Torella M. Urinary tract infection in Women. Eur J Obstet Gynecol Reprod Biol. 201; 156(2): 131–6.
7. Calvet HM, Yoshikawa TT. Infections in diabetes. Infect Dis Clin North Am 2001; 15: 407–21.
8. Delamaire M, Maugendre D, Moreno M, Le Goff M-C, Allannic H, Genetet B. Impaired leucocyte functions in diabetic patients. Diabet Med 1997; 14: 29–34.
9. Hu KK, Boyko EJ, Scholes D, et al. Risk factors for urinary tract infections in postme-nopausal women. Arch Intern Med 2004; 164: 989–93.
10. Patterson JE, Andriole VT. Bacterial urinary tract infections in diabetes. Infect Dis Clin North Am 1997; 11: 735–50.

11. Nathan DM, Davidson MB, DeFronzo RA, Heine RJ, Henry RR, Pratley R, et al., American Diabetes Association, et al. Impaired fasting glucose and impaired glucose tolerance: implications for care. Diabetes Care 2007; 30: 753–9.

12. Søraas A, Sundsfjord A, Sandven I, Brunborg C, Jenum PA (2013) Risk Factors for Community-Acquired Urinary Tract Infections Caused by ESBLProducing. Enterobacteriaceae –A Case–Control Study in a Low Prevalence Country. PLoS ONE 8(7): e69581. doi:10.1371/journal.pone.0069581.

13. Muller LMAJ, Gorter KJ, Hak E, et al. Increased Risk of Common Infections in Patients with Type 1 and Type 2 Diabetes Mellitus. Clin Infect Dis. 2005; 41: 281–8.

14. Meneilly GS, Tessier D. Diabetes in Elderly Adults.The Journals of Gerontology: Series A, 2001; 56: 5–13.

15. Ronald A. The etiology of urinary tract infection: traditional and emerging pathogens The American Journal of Medicine 2002; 113: 14–9.