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# URINARY TRACT INFECTIONS AND ASYMPTOMATIC BACTERIURIA IN DIABETIC PATIENTS WITH PULMONARY DISEASES*

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Urinary tract infections and asymptomatic bacteriuria, are more frequent in diabetic patients, especially in those with type 2 diabetes, than in subjects without diabetes [1–6]. Diabetic people are more risked than persons without diabetes for acute infections of upper urinary tract (pyelonephritis) [7, 8]. Some investigators, on the other hand, observed that signs and symptoms of these infections are more severe in diabetics than in non-diabetic people [6–8]. Urinary tract infections can cause severe kidney injuries and, consequently, can lead to chronic kidney disease (chronic renal insufficiency) [9–12]. Concerning pathological mechanisms that explain urinary tract infections and asymptomatic bacteriuria, they are numerous. So, the presence of glucose in urine favours increase and multiplication of miscellaneous pathological microbes [13–17].

Some authors, in appearance of urinary tract infections and asymptomatic bacteriuria underline the role of some external factors as: urinary cateters, stents, and some anomalies of urinary tract [13, 15, 16, 18].

Some disorders of immune system, humoral, and cellular, too, as follows: injury of neutrofille functions, low level of prostaglandin E, thromboxane $B_2$, leucotriene $B_4$, and low response of immunity, mediated by specific cells, can influence on the appearance of urinary tract infections and asymptomatic bacteriuria [19–22].

Autonomic diabetic neuropathy of urinary bladder's nerves can influence also to the appearance of urinary tract infection and asymptomatic bacteriuria.

Difficult and late emptying of urine from urinary bladder occurs, and consequently is ap-

* This clincal prospective study was carreid out in Department of Internal Medicine of State University Hospital «Shefqet Ndoqi» in Tirana. At realization of this study took part Services of Lung Diseases, Endocrinology, Nephrology, and Sevices of Clinical and Bacteriological Laboratories, too.

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peared urinary stasis, that makes possible appearance of these kidney diseases [23–27].

The aim of this clinical prospective study was to know a frequency of urinary tract infections and asymptomatic bacteriuria, and possible influence of some factors in appearance of these kidney diseases, in a group of diabetic patients with pulmonary diseases hospitalized in pneumological clinics of university hospital «Shefqet Ndroqi» in Tirana, Albania.

We underline the fact that, in medical references consulted by us, we did not find other clinical studies for urinary tract infections and asymptomatic bacteriuia in diabetics with pulmonary diseases; on the contrary, we have found numerous articles about kidney diseases in diabetic patients without pulmonary diseases.

So, our data we compared with data of urinary tract infections and asymptomatic bacteriuria studies, where diabetic patients did not have pulmonary diseases. We are conscientious that, clinical and scientific value of these comparisons is limited.

## MATERIAL AND METHODS

We compiled a proper file in order to realize our study. All clinical and laboratory data were registered at these files. First, we wanted to know the frequency of urinary tract infections and asymptomatic bacteriuria in diabetic patients who participated in our study. We analysed also possible influence of some factors, in appearance of urinary tract infections and asymptomatic bacreriuria, in a contigent of diabetics with pulmonary diseases, hospitalized in pneumological clinics of university hospital «Shefqet Ndroqi» for pulmonary diseases.

Concretely, the following factors were studied and analysed: type of diabetes, age of patients, grade of diabetes equilibrium when these patients were admitted in hospital, duration of diabetes, and influence of treatment and nontreatment with miscellaneous antibiotics for lung diseases, when these patients were admitted in hospital, the results of complet urinary analyses and urinary analyses for bacteriuria.

The type of diabetes was determined by signs and symptoms of diabetes, level of glycemia, age of patients when diabetes was diagnosed, medical treatment of diabetes at home conditions, and appearance hyperglycemia with ketoacidosis or ketosis. Classification of diabetes type was done by WHO-criterias [28].

Diabetic patients who participated in this study were interrogated for presence or nonpresence of some signs and symptoms of urinary tract infection; concretely for: *disuria* (burning during avoid of urine from the ladder), *polakyuria* (frequent discharge of small amount of urine), *nichturia* (discharge of urine during night), *stranguria (*pain during discharge of urine), and for pain at region of pubic symphisa.

106 diabetic patients participated in our study. They were divided in two groups: Group-A, and Group-B. Group-A consists of 40 patients, treated with miscellaneous antibiotics for lung diseases outatient about 10 days. Group-B consists of 66 patients, who did not treat with antibiotics outpatient.

Complete urine analysis, urine for bacterial isolates and for antimicrobial susceptibility testing for patients of two groups, were done in the day after hospitalization, in the morning. Complete urine analysis was performed in clinical laboratory, while analysis for bacterial isolates and antimicrobial susceptibility testing was performed in bacteriological laboratory.

### *Specimen collection and processing*

Participants were asked to provide a midstream urine sample according to the clean-catch procedure. Samples were collected into the sterile container that was refrigerated (+ 4 $^0$C), transported in an ice-pack to the bacteriological laboratory, and processed within 1 hour of collection. Using a standard quantitative loop, urine samples (10 mL) were used to inoculate 5 % Sheep Blood agar, MacConkey agar and Sabouraud agar plates. Specimen collection and processing was made by Gould method [29, 30].

Platelets were incubated for 24 h at 37 $^0$C, and outcome was judged as significant/non-significant growth, or contaminated (discharged). Interpretation was made by culture plates. Was defined significant bacteriuria as urine culture

plates showed equal or more than 100,000 colony-forming units — cfu/ml of single bacterial species. When culture plates showed less than 100,000 cfu/ml of single bacterial species, this result was defined as non-significant bacteriuria. The species identification was performing with BBL crystal-TM Gram — Positive (GP) and Enteric/Nonfermenter (E/NF) Identification (ID) Kits.

Antimicrobial susceptibility testing (AST) was performed after EUCAST disk diffusion methodology and interpretation after EUCAST Breakpoint Tables v. 6.0. Antimicrobial susceptibility testing was performed for cases with significant bacteriuria only. Complete urinary analysis is very important for determination of urinary tract infections and asymptomatic bacteriuria.

Based on clinical criterions, when number of white blood cells indentified by complete urinary analysis is 0–5 per field of vision, this analysis is considered normal, without any infections. When number of white blood cells in complete urinary analysis is 6 or more, this is pathologic analysis, and the patient may have asymptomatic bacteriuria or urinary tract infection. The patients were considered to be with asymptomtic bacteriuria when specimen collection processing analysis determined an isolate, number of white blood cells in complete urine analysis was less than 6 per field of vision, and patients had not any signs or symptoms for urinary tract infections mentioned above.

In the cases when specimen collection processing analysis determined an isolate, number of white blood cells in complete urine analysis was more than 6 per field of vision and patients had at least one signs or symptom of urinary tract infections mentioned above, these patients were considered to be with urinary tract infection. In clinical practice, some nephrologists consider with urinary tract infection and those patients when specimen collection processing analysis does not determines an isolate, but these patients have at least one of signs and symptoms mentioned above, and when number of white blood cells in complete urinary analysis is more than 6 per field of vision.

Evaluation of equilibrium of diabetes for patients participated in this study was determined by level of glycemia expressed by mg/100 ml at moment of hospitalization. We were not able to perform HbA1c analysis for technical reasons. We are conscious that this analysis would be increased values of the study

The clinical and laboratory data are shown at respective tables. Scientific and clinical credibility of above data was based on their analysis by statistical probability model, by Z-(Zeta) Test. These data was considered to be credible when their difference expressed at percentage were significant ($P < 0.05$).

## RESULTS OF STUDY AND DISCUSSION

We would like to present at first, the number of diabetic patients who participated in this study, by types of diabetes. This number is given at table 1.

From this table we can see that greatest number of diabetic patients had type 2 diabetes (98.20 %), while with type1 diabetes were a very few of them (1.88 %) (significant difference). The prevalence number of patients with type 2 diabetes can be explained with a fact that, chronic lung diseases affect much greater persons above 40 years old; on the other hand, type 2 diabetes is diagnosed much frequently in persons above 40 years old [28, 33, 34].

Very small number of patients with type 1 diabetes, on the other hand, can be explained

Table 1

**Representation of diabetics by type of diabetes**

| Type of diabetes | Number of diabetics (%) |
|---|---|
| Type 1 diabetes | 2/106 (1.89) |
| Type 2 diabetes | 104/106 (98.11) |
| Probability | * |

* Significant Difference.

also with clinical criterions that were used for determination of type of diabetes.

It is well known that type 1 diabetes is an immunologic and genetic disease (disorder), and special immunological and genetic analyses are indispensable for exact determination of this type of diabetes. These analyses, firstly, are expensive, and are not use as routine analyses in clinical practice; they are used in special immunological and genetic investigations.

Judged in general, our data are similar with those of WHO, because by WHO data, the prevalence of type 2 diabetes is more than 90 %, while the prevalence of type 1 diabetes is less than 10 % of total number of diabetic patients [33, 34]. Based on world medical literature, urinary tract infections and asymptomatic bacteriuria were studied more in patients with type 2 diabetes than in those with type 1 diabetes [9–12, 15, 16].

Object of this study was representation of urinary tract infections and asymptomatic bacteriuria by type of diabetes. Our data for these pathologies are given at table 2.

By data of this table results that urinary tract infections and asymptomatic bacteriuria (calculated together), are present in diabetics with type 2 only (27.88 %), but not in diabetics with type 1 diabetes (0 %) (significant difference). Our data generally are approximative with results of other authors [10, 12, 15, 16].

We think that lack of urinary tract infections and asymptomatic bacteriuria in patients with type 1 diabetes is connected firtsly with too small number of these diabetics, than with type 1 diabetes as disease, itself.

Particular interest we dedicated possible influence of treatment (group-A) and non-treatment (group-B) patients with antibiotics for pulmonary diseases in the frequency of urinary tract infections and asymptomatic bacteriuria. Our data are given at table 3.

As we can see the frequency of urinary tract infections were almost equal in two groups: A-22.50 %, in group vs 22.70 % in group-B, (non-significant difference). The same representation was observed for asymptomatic bacteriuria: 7.50 % in group-A, vs 3.03 % in group-B (non-significant difference).

In reference of table 3 results that, treatment with antibiotics for pulmonary disease does not influenced in diminution of frequency of urinary tract infection and asymptomatic bacteriuria, because this treatment was not specific for above kidney pathologies, was not based to susceptibility of specific isolates, and was not cyclic treatment. Our data of table 3, in general, are approximative with data of some

Table 2

**Representation of diabetics with urinary tract infections and asymptomatic bacteriuria by type of diabetes**

| Type of Diabetes | Number of diabetics (%) with urinary tract infections and asymptomatic bacteriuria |
|---|---|
| Type 1 diabetes | 0/2 (0.0) |
| Type 2 diabetes | 29/104 (27.88) |
| Probability | * |

* Significant difference.

Table 3

**Representation of diabetics with urinary tract infections and asymptomatic bacteriuria, based on treatment or not treatment with antibiotics for pulmonary diseases**

| Treatment with antibiotics | Number of diabetics (%) with urinary tract infections | Number of diabetics (%) with asymptomatic bacteriuria |
|---|---|---|
| Treated with antibiotics (Gr. A) | 9/40 (22.50) | 3/40 (7.50) |
| Not treated with antibiotics (Gr. B) | 15/66 (22.70) | 2/66 (3.03) |
| Probability | ** | ** |

** Non-Significant Difference.

authors [35, 36], but are different with other data [37–39].

We interested in our study for possible influence of patients gender in frequency of urinary tract infections and asymptomatic bacteriuria.

Many clinical studies confirm that urinary tract infections and asymptomatic bacteriuria are more frequent in female than in male diabetics.

This occur for many reasons: female urethra is shorter than male urethra, and is near vulval and anal regions. These regions are warm and moist. It ought to say that these regions favour passage in urinary tract of miscellaneous pathological microbes from vulva, for large intestine, and indirect from small intestine, causing, urinary tract infections or asymptomatic bacteriuria [9, 10, 12, 17, 18].

Our data are given at table 4 for influence of gender in appearance of urinary tract infections and asymptomatic bacteriuria.

We can see that frequency of urinary tract infections is greater in female diabetics than in male diabetics (33.33 % vs 17.80 %, respectively) (significant difference). Concerning asymptomatic bacteriuria, we can see that frequency of this urinary pathology is almost similar for both genders (4.10 % vs 6.06 %) (non-significant difference). Our data for above pathologies are similar with those from other authors [9, 12, 17].

Another object of our study was the frequency of urinary tract infection and asymptomatic bacteriuria in relation with age of diabetic patients. Many authors observed that frequency of these pathologies are more frequent in patients with upper than 40 years old. On the other hand this is the age of diagnosis of type 2 diabetes [33–35]. Our data on relation between age of patients with type 2 diabetes with urinary tract pathologies mentioned above, we can see at table 5.

The data show that urinary tract infections and asymptomatic bacteriuria were not observed in patients 20–30 year age group. These pathologies were observed from 41–50 year age group, to 81–90 year age group. Asymptomatic bacteriuria was observed in following age groups: 31–40 year age group, 61–70 year age group and 71–80 year age group. Also we can see that urinary tract infections in 31–40 year age group, 61–70 year age group and

Table 4

**Representation of diabetics with urinary tract infections and asymptomatic bacteriuria, based on gender**

| Gender of diabetics | Number of diabetics (%) with urinary tract infections | Number of diabetics (%) with asymptomatic bacteriuria |
|---|---|---|
| Male | 13/73 (17.80) | 3/73 (4.10) |
| Female | 11/33 (33.33) | 2/33 (6.06) |
| Probability | * | ** |

* Significant Difference,
** Non Significant Difference.

Table 5

**Representation of diabetics with urinary tract infections and asymptomatic bacteriuria, based on age of diabetics, divided in 10-year age groups**

| Pathology of urinary tract | 10-year age groups | | | | | | |
|---|---|---|---|---|---|---|---|
| | 20–30 | 31–40 | 41–50 | 51–60 | 61–70 | 71–80 | 81–90 |
| Urinary tract infections | 0/1 | 2/4 (50.0 %) | 2/6 (33.33 %) | 1/21 (4.76 %) | 8/33 (24.24 %) | 6/28 (21.42 %) | 5/13 (38.49 %) |
| Asymptomatic bacteriuria | 0/1 | 1/4 (25.0 %) | 0/6 | 0/21 | 3/33 (9.09 %) | 1/28 (3.57 %) | 0/13 |
| Probability | – | * | * | * | * | * | * |

* Significant Difference.

Table 6

**Representation of diabetics with urinary tract infections and asymptomatic bacteriuria, based on level of glycaemia, represented in mg/100 ml, at admission time**

| Pathology of urinary tract | level of glycaemia, represented in mg/100 ml | | | | |
|---|---|---|---|---|---|
| | 70–100 | 101–200 | 201–300 | 301–400 | 401–500 |
| Urinary tract infections | 0/2 | 10/45 (22.20 %) | 11/40 (27.50 %) | 2/10 (20.00 %) | 1/9 (11.10 %) |
| Asymptomatic bacteriuria | 1/2 (50.00 %) | 2/45 (4.40 %) | 2/40 (5.00 %) | 0/10 | 0/9 |
| Probability | * | * | * | * | * |

* Significant Difference.

71–80 year age group are more frequent than asymptomatic bacteriuria for respective year age groups (significant difference). Our results generally are approximative with data of some authors [9, 11], but not approximative data with some others [38, 39].

Many clinical studies confirmed that, in general, associated infectious and infective diseases observed in diabetics with high levels of glycaemia, than in equilibrated diabetics. There are many numerous, complex and particular reasons for each infectious or infective disease that cause non equilibrium of diabetes [35–38].

In diabetic patients with urinary tract infections and asymptomatic bacteriuria, high levels of glycaemia cause massive urine elimination through kidneys (massive glucosuria). Urine with large amounts of glucose favours appearance and multiplication pathological microbes. Our data for influence of hyperglycaemia in appearance and aggravation of urinary tract infections are given at table 6.

By our data of table 6, we can see that when glycaemia is at normal level (70–110 mg/100 ml), urinary tract infections did not appear. These infections appear when glycaemia is at high level: from 101–200 mg/100 ml to 401–500 mg/100 ml. Concerning asymptomatic bacteriuria, it was appeared in patients with normal glycemia (70–100 mg/100 ml), and in patients with hyperglycaemia (101–200 mg/100 ml, and 201–300 mg/100 ml). The comparison of frequency of urinary tract infections with frequency of asymptomatic bacteriuria, tells us that urinary tract infections are more frequent than asymptomatic bacteriuria for respective high levels of glycaemia (significant difference). In diabetics with normal levels of glycemia (70–100 mg/ml), on the other hand, asymptomatic bacteriuria is more frequent than urinary tract infections (significant difference). Our data, in general, are approximative with data of some authors consulted by us [14, 31, 32].

As we know, duration of diabetes is very important factor for appearance of chronic vascular (macro-and microvascular) complications and for all nervous complications of diabetes; with increase of duration of diabetes, frequency of above chronic (late) complications is increased [44–48]. Numerous clinical investigations confirmed that, in general, urinary tract infections and asympomatic bacteriuria, as chronic complications mentioned above, are more frequent in diabetics with long duration of diabetes than in diabetics just diagnosed [40–43].

Nevertheless, as we mentioned above, in many diabetics with type 2 diabetes, urinary tract infections and asymptomatic bacteriuria, may be observed in just diagnosed diabetes, in reality, above mentioned urinary pathologies, started in period of prediabetes [49–51]. It is well known, on the other hand, that duration of prediabetes lasts for many months or many years. Our data for relations of urinary tract infections and asymptomatic bacteriuria with duration of diabetes are shown at table 7.

From this table we can see that above mentioned urinary pathologies are observed from 1 year duration of diabetes to 16–20 years duration of diabetes. Except period of 6–10 years duration of diabetes, where frequency of urinary tract infections and frequency of asymptomatic bacteriuria are almost equally (non-significant difference), frequency of urinary

Table 7

**Representation of diabetics with urinary tract infections and asymptomatic bacteriuria, based on duration of diabetes, represented by 5-year groups**

| Pathology of urinary tract | Duration of Diabetes represented by 5-year groups | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Up to 1 year | 1–5 | 6–10 | 11–15 | 16–20 | 21–25 | 26–30 | 31–35 |
| Urinary tract infections | 5/32 (15.62 %) | 7/26 (26.92 %) | 2/27 (7.40 %) | 8/14 (57.14 %) | 2/6 (33.33 %) | — | — | 0/1 |
| Asymptomatic bacteriuria | 1/32 (3.12 %) | 1/26 (3.04 %) | 1/27 (3.70 %) | 1/14 (7.14 %) | 1/6 (16.67 %) | — | — | 0/1 |
| Probability | * | * | ** | * | * | — | — | — |

* Significant Difference,
** Non Significant Difference.

Table 8

**Bacteriuric patients with antibiotic therapy**

| Isolate | № | % |
|---|---|---|
| Candida albicans | 1 | 8.33 % |
| Enterococcus faecalis | 2 | 16.67 % |
| Enterococcus faecium | 1 | 8.33 % |
| Klebsiella oxytoca | 1 | 8.33 % |
| Proteus mirabilis | 1 | 8.33 % |
| Pseudomonas aeruginosa | 2 | 16.67 % |
| Staphylococcus aureus | 3 | 25.00 % |
| Staphylococcus saprophyticus | 1 | 8.33 % |
| Number of patients | 12 | |

tract infections is more expressed than frequency of asymptomatic bacteriuria, for other respective duration of diabetes (significant differences). Our data, in general, are approximative with data of other investigators [52–55].

By our data results that, the prevalence of bacteriuria was in 12/40 (30 %) in the group of patients who took antibiotics for pulmonary diseases, while, in group of patients who did not take antibiotics for pulmonary diseases, the prevalence of bacteriuria was 17/66 (25.76 %). At table 8, are given data of specimen collection and processing analysis for diabetics who took antibiotics for treatment of pulmonary diseases (Group A), while at table 9, are given these data for diabetics who did not take antibiotics for treatment of pulmonary diseases (Group B), in time when these analyses were performed.

As we can see from table 8, the frequency of isolates in Group A was 30 % (12/40). We can see from table nr. 8, that in patients of this group, more frequent were following isolates: staphylococcus aureus (25.0 %); pseudomonas aeruginosa (16.67 %) and enterococcus faecalis (16.67 %). Concerning other isolates, those were in less percentage.

As we can see from table 9, the frequency of isolates in Group B, was 25.76 % (17/66). In this group, more frequent were following isolates: enterococcus faecalis (35.29 %) and escherichia coli (23.53 %). Concerning other isolates, those were in less percentage. Among 29 patients of both groups with positive bacteriuria, 23 of them had significant bacteriuria (equal or more than 100,000 cfu ml). Our data for isolates are approximative with data of some investigators consulted by us [4, 12], but not approximative with data of some others [56–58].

As it is mentioned above, antimicrobial susceptibility testing analysis was performed for 23 diabetics with significant bacteriuria. High resistance rates were observed among enterobacteriaceae against trimethoprim-sulfamethoxazole (100 %), ampicilin (100 %), cip-

Table 9

**Bacteriuric patients without antibiotic therapy**

| Isolate | № | % |
|---|---|---|
| Aeromona hidrophyla | 1 | 5.88 % |
| Escherichia coli | 4 | 23.53 % |
| Enterococcus faecalis | 6 | 35.29 % |
| Enterococcus faecium | 1 | 5.88 % |
| Kytococcus sedentarius | 1 | 5.88 % |
| Pseudomonas aeruginosa | 1 | 5.88 % |
| Staphylococcus aureus | 2 | 11.76 % |
| Staphylococcus saprophyticus | 1 | 5.88 % |
| Number of patients | 17 | |

rofloxacin (75 %), levofloxacin (75 %), amoxicillin-clavunalic acid (60 %), amikacin (50 %), and piperacillin (33.3 %). Resistance to cephalosporins was recpectively 75 %, 50 %, 40 %, 33.3 % and 25 % for ceftazidime, cefuroxime, ceftriaksone, cefoxitine and cefepime. They were susceptible to meropenem. Pseudomonas aeruginosa exhibited low rates of resistance to most of the tested antibiotics. Enterococcus faecalis, and enterorococcus faecium were most sensitive to linezolid and vancomycin (0 % were resistant). Staphylococci were higly resistant tomost of the antimicrobilas tested. Our data of antimicrobial susceptibility testing analysis, in general, were approximative with the data of some authors [4, 12], but are not approximative with data of some others [16, 57, 58].

## CONCLUSIONS

1. Use of antibiotics in diabetic patients for treatment of miscellaneous pulmonary diseases did not influence on the frequency of urinary tract infections, in comparison with diabetics untreated with antibiotics for these diseases (non-significant difference). The same phenomenon was observed and for asymptomatic bacteriuria (non-significant difference).
2. Concerning gender (sex) of diabetics, urinary tract infections were more frequent in female diabetics than in male diabetics (significant difference). Asymptomatic bacteriuria was almost equal for two genders (non-significant difference).
3. With the exception of 20–30 year age old group, where did not observed above mentioned urinary pathologies, urinary tract infections were observed in all other year age old groups, while asymptomatic bacteriuria observed in some of them. Urinary tract infections were more frequent than asymptomatic bacteriuria, for year age old groups, respectively (significant differences).
4. Urinary tract infections were not observed in diabetics with equilibrated diabetes. These infections were observed in diabetics with high levels of glycemia only. Asymptomatic bacteriuria was observed in equilibrated diabetics and in diabetics with high levels of glycemia, too. Urinary tract infections were more frequent than asymptomatic bacteriuria, for respective year age old groups in diabetics with high levels of glycemia (significant differences).
5. Urinary tract infections and asymptomatic bacteriuria were observed in diabetics with duration of diabetes from 0–1 year, till 31–35 years. Urinary tract infections were more frequent than asymptomatic bacteriuria, for respective durations of diabetes (significant differences).

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## URINARY TRACT INFECTIONS AND ASYMPTOMATIC BACTERIURIA IN DIABETIC PATIENTS WITH PULMONARY DISEASES

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We studied 106 diabetic patients with pulmonary diseases: 40 of them were treated with antibiotics for pulmonary diseases and 66 were not treated with antibiotics. The use of antibiotics for pulmonary diseases did not influence the frequency of urinary tract infections nor the frequency of asymptomatic bacteriuria in all studied patients. Our study showed that urinary tract infections were more frequent in female diabetics, but asymptomatic bacteriuria was almost equal for both genders. With exception of 20–30 years old age, urinary tract infections and asymptomatic bacteriuria were observed in all other age groups.

Urinary tract infections were observed in diabetics with high levels of glycemia only, while asymptomatic bacteriuria was observed in diabetics with normal and high levels of glycemia. Among bacteriuric patients with antibiotic therapy, most frequent isolates were staphylococcus aureus, pseudomonia aeruginosa and enterococcus faecalis. Among bacteriuric patients without antibiotic therapy, most frequent isolates were enterococcus faecalis and escherichia coli.

High resistance rates were observed among enterobacteriaceae against trimethoprim-sulfamethoxazole, ampicillin, ciprofloxacin, levofloxacin, amoxicillin-clavulonic acid, amikacin, and piperacillin. Resistence to cephalosporins were for ceftazidime, cefuroxime, ceftriaksone, cefoxitine and cefepime. Pseudomonas aeruginosa exhibited low rates for most of the tested antibiotics. Enterococcus faecalis and enterococcus faecium were most sensitive to linezolid and vancomycin. Staphylococci were highly resistant to most of the tested antimicrobials.

Key words: diabetes mellitus, urinary tract infections, antibiotics.

## ІНФЕКЦІЇ В СЕЧОВИДІЛЬНОЇ СИСТЕМІ І АСИМПТОМНА БАКТЕРІУРІЯ У ХВОРИХ НА ЦУКРОВИЙ ДІАБЕТ З ЛЕГЕНЕВИМИ ЗАХВОРЮВАННЯМИ

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Ми вивчили 106 хворих на цукровий діабет з легеневими захворюваннями: 40 з них лікувалися антибіотиками від легеневих захворювань, 66 не лікувалися антибіотиками. У всіх досліджених пацієнтів з захворюванням легень застосування антибіотиків не впливало на будь-які інфекції сечовивідних шляхів та безсимптомної бактеріурії. Наше дослідження показало, що інфекції сечовивідних шляхів частіше зустрічаються у жінок, хворих на діабет, а безсимптомна бактеріурія була практично однаковою для обох статей. За винятком віку 20–30 років, інфекції сечовивідних шляхів і безсимптомна бактеріурія спостерігалися у всіх інших вікових групах.

Інфекції сечовивідних шляхів спостерігалися у діабетиків з високим рівнем глікемії, в той час як безсимптомна бактеріурія спостерігалася у діабетиків з нормальним і високим рівнем глікемії. Серед пацієнтів з бактеріальної терапією, які отримували антибіотикотерапію, найбільш частими ізолятами були золотистий стафілокок, синьогнійна паличка та ентерокок фекальний. Серед пацієнтів з бактеріальної хворобою без антибактеріальної терапії найбільш частими ізолятами були enterococcus faecalis і escherichia coli.

Високі показники стійкості спостерігалися серед ентеробактерій після застосування триметоприм-сульфаметоксазолу, ампіциліну, ципрофлоксацину, левофлоксацину, амоксициліну-клавулоновою кислоти, амікацину і піперацилліна. Стійкість до цефалоспоринів була у цефтазидима, цефуроксиму, цефтриаксону, цефокситину і цефепіму. Pseudomonas aeruginosa показали низькі показники для більшості протестованих антибіотиків. Enterococcus faecalis і enterococcus faecium найбільш чутливі до лінезоліду і ванкоміцину. Стафілококи були високо стійкі до більшості протестованих протимікробних препаратів.

Ключові слова: цукровий діабет, інфекції сечовидільної системи, антибіотики.

# ИНФЕКЦИИ В МОЧЕВЫДЕЛИТЕЛЬНОЙ СИСТЕМЕ И АСИМПТОМНЫЕ БАКТЕРИУРИИ У БОЛЬНЫХ САХАРНЫМ ДИАБЕТОМ С ЛЕГОЧНЫМИ ЗАБОЛЕВАНИЯМИ

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Мы изучили 106 больных сахарным диабетом с лёгочными заболеваниями: 40 из них лечились антибиотиками от лёгочных заболеваний и 66 не лечились антибиотиками. У всех исследуемых пациентов с заболеваниями легких применение антибиотиков не влияло на какие-либо инфекции мочевыводящих путей и безсимптомной бактериурии. Наше исследование показало, что инфекции мочевыводящих путей чаще встречаются у женщин-диабетиков, а бессимптомная бактериурия была практически одинаковой для обоих полов. За исключением возраста 20–30 лет, инфекции мочевыводящих путей и бессимптомная бактериурия наблюдались во всех других возрастных группах.

Инфекции мочевыводящих путей наблюдались у диабетиков с высоким уровнем гликемии, в то время как бессимптомная бактериурия наблюдалась у диабетиков с нормальным и высоким уровнем гликемии. Среди пациентов с бактериальной терапией, получавших антибиотикотерапию, наиболее частыми изолятами были золотистый стафилококк, синегнойная палочка и энтерококк фекальный. Среди пациентов с бактериальной болезнью без антибактериальной терапии наиболее частыми изолятами были enterococcus faecalis и escherichia coli.

Высокие показатели устойчивости наблюдались среди энтеробактерий после применения триметоприм-сульфаметоксазола, ампициллина, ципрофлоксацина, левофлоксацина, амоксициллина-клавулоновой кислоты, амикацина и пиперациллина. Устойчивость к цефалоспоринам была у цефтазидима, цефуроксима, цефтриаксона, цефокситина и цефепима. Pseudomonas aeruginosa показали низкие показатели для большинства протестированных антибиотиков. Enterococcus faecalis и enterococcus faecium наиболее чувствительны к линезолиду и ванкомицину. Стафилококки были высоко устойчивы к большинству протестированных противомикробных препаратов.

Ключевые слова: сахарный диабет, инфекции мочевыделительной системы, антибиотики.