

## Urinary tract infection: Significant bacteruria and candiduria in diabetics and non-diabetic patients

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الخلاصة:

اجريت هذه الدراسة لتحديد المسببات المرضية لالتهابات المجاري البولية البكتيرية منها والفطرية وتحديد حساسية الادوية لكل المرضى المصابين وغير المصابين بداء السكري. تم جمع 134 عينة ادرار، 66 (49.3%) عينة من المرضى الراقدين في مستشفى الرمادي العام و68 (50.7%) من المرضى من خارج المستشفى. تم اجراء الفحص العام للادرار قبل عملية زرع العينات حيث تم زرعها بالطريقة الشبه كمية ومن ثم تم تحديد المسبب المرضي البكتيري منها والفطري. اظهرت 138 عينة نموا جدرثوميا توزعت كالتالي 121 عذلة بكتيرية و17 عذلة فطرية كانت للايشيريشية القولونية 10 (76.6%) تمثل غالبية البكتيريا المعزولة من المرضى المصابين بداء السكر الراقدين من خارج المستشفى بينما كانت الكلبسيلا 5 (38.5%) تمثل غالبية البكتيريا المعزولة من المرضى المصابين بالداء السكري الراقدين في المستشفى في حين اظهرت النتائج انه في المرضى الغير مصابين بالداء السكري كانت الايشيريشيا القولونية تمثل الغالبية العظمى في كل من المرضى الراقدين في المستشفى والوافدين من خارجها 64 (20%) (24%) وعلى التوالي. كانت نسبة الحساسية للسبروفلووكساسين عالية جدا مقارنة بالمضادات الحيوية الاخرى ويأتي بعدها الامينوكلايكوسايد والجيل الثالث للسيفالوسبورينات بينما اظهرت العزلات مقاومة واضحة ضد البنسلينات.

**Objective:** To detect the causative organisms in bacterial and fungal urinary tract infection, and their susceptibility tests to selected antimicrobials in both diabetics and non-diabetic patients. **Methods:** A total of 134 urine specimens, 66 (49.3%) were obtained from patient admitted to Ramadi General Hospital in Ramadi and 68 (50.7%) from the community setting during the period from April to September 2002. General Urine Analysis and semi-quantitative culture technique of urine were performed.

**Result:** Out of 134 urine cultures, 121 (90.3%) showed significant bacteruria. Thirty nine out of 56 (69.5%) of hospitalized patients and 13 out of 65 (20%) of non-hospitalized patients were diabetics while the remaining were non-diabetics. Further, in diabetic community acquired infection (CA), *Escherichia coli* was the most common 10 (76.9%) while *Klebsiella* spp. 15 (38.5%) was the most common isolate in hospital acquired infection (HA). In non-diabetics, *Escherichia coli* was the most common in both CA and HA, 24 (38.0%) and 4 (20%) respectively. Furthermore, significant candiduria was found in diabetic HA 11 (28.2%) and 9 (81.8%) of them harboring urinary catheter in contrast with non-diabetic HA, 6 (30%). The isolated bacteria in both groups showed resistance to ampicillin, and sensitivity to aminoglycosides and ciprofloxacin.

**Conclusion:** In diabetic patients, *Escherichia coli* was the most common organism isolated in CA while *Klebsiella* spp. was the commonest isolate in HA. In non-diabetics, *Escherichia coli* was the most common organism isolated from both CA and HA. *Candida albicans* was the commonest cause of candiduria in diabetic HA. Further, aminoglycosides and ciprofloxacin can be used empirically to treat both types of infection in diabetics and non-diabetics.

**Key words:** Bacteruria, Candiduria, Diabetics, Antimicrobial sensitivity

### Introduction:

Urinary tract infection (UTI) has long been recognized as a significant problem in both the hospitalized and non-hospitalized patients suffering from diabetes mellitus. The reasons for the susceptibility of diabetic patients to particular infections involve diminished effectiveness of host immunity, both local and systemic, poor

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diabetic control, particularly in those with ketoacidosis, autonomic neuropathy may cause bladder dysfunction with urinary retention and secondary infection. Further changed bacterial adhesion to the uroepithelium, granulocytes dysfunction, and impaired antioxidant system involved in bacterial activity are all involved in the pathogenesis of UTI in diabetics. On the other hand, diabetes

Table 1. Type of organism isolated from diabetics and nondiabetics

Organism	Diabetics N=52		Non-Diabetics N=82	
	HA N=39 N (%)	CA N=13 N (%)	HA N=20 N (%)	CA N=62 N (%)
Escherichia coli	7 (17.9)	10 (76.9)	4 (20.0)	24 (38.7)
Klebsiella spp.	15 (38.5)	1 (7.7)	3 (15.0)	1 (4.2)
Pseudomonas aeruginosa	4 (10.3)	0 (0.0)	3 (15.0)	6 (9.7)
Proteus mirabilis	0 (0.0)	2 (15.4)	3 (15.0)	6 (9.7)
Staphylococcus aureus	0 (0.0)	0 (0.0)	0 (0.0)	4 (6.5)
Candida spp.	11 (28.2)	0 (0.0)	6 (30.0)	0 (0.0)
No growth	2 (5.1)	0 (0.0)	1 (5.0)	10 (16.1)

HA: hospital acquired infection; CA: community acquired infection; N: numbers

mellitus is believed to increase the risk of fungal urinary tract infection (candiduria) by promoting vulvovestibular colonization with *Candida* in women, encouraging urinary fungal growth due to glycosuria, and by impairing the ability of neutrophils and monocytes to phagocytize *Candida*. It is essential that the clinician be aware of the local pathogen, significance of bacterial and fungal UTI, and the susceptibility pattern to decide on the most appropriate antibiotic for empirical treatment to reduce the incidence of antimicrobial resistance and life threatening urinary septicemia. To the best of our knowledge, no studies in our country have been carried out making a comparison between UTI either bacterial or fungal in diabetics and non-diabetics. Thus, this study was assigned based on the scientific criteria to determine the significance of bacterial or fungal UTI, the causative organism and antimicrobial susceptibility test in diabetics and non-diabetic patients admitted to the Ramadi General Hospital in Ramadi and from community setting (Ramadi city).

#### Methods:

A total of 134 urine specimens were collected during the period from April 2002 to September 2002. Clean-catch urine (mid-stream urine specimen) were obtained from the non-catheterized patient study. Catheter specimens were obtained by aspiration from the tube after cleaning with alcohol pads and clamping for approximately 30 minutes. Urine samples were either transported to the microbiology laboratory for culture within 30 minutes of

collection or refrigerated. Microscopic examination of unspun, well mixed samples was carried out for white, red blood cells and monilia. Culture of urine on appropriate selective media and determination of bacterial counts were performed by a semi-quantitative technique. After overnight incubation, the presence

of more than 10 colony forming unit (cfu) per milliliter in the original urine sample indicating significant bacteruria. Low counts in catheter specimen (more than 10<sup>3</sup> cfu/ml) were accepted if the organism persisted or was isolated for successive specimen. Significant candiduria was defined when the urine sample contained more than 1000 cfu of *Candida* per milliliter considering the urine cultures were repeated with careful attention to collection technique before concluding that the patient has candiduria. Also, urinalysis was performed to assess for pyuria (> 5 WB/high powered field). Symptomatic *Candida* urinary tract infection was defined as the presence of candiduria (as mentioned above) with urinary symptoms and pyuria and asymptomatic candiduria (candiduria without symptoms or pyuria). The bacteriological identification and confirmatory tests were carried out following methods, the antimicrobial susceptibility test was performed by standardized Kirby-Bauer disc diffusion method using Muller-Hinton agar. The antibiotic discs with the following potencies were used ampicillin 10 ug, piperacillin 100 ug, nitrofurantoin, nalidixic acid, co-trimoxazole, norfloxacin 10 u.g, ciprofloxacin 10 ug, cefotaxime 30 ug, ceftriaxone 30 ug, ceftazidime 30 ag, gentamicin Tobramycin, Amikacin, imipenem 10 ug. Based on the medical charts documented by the experient urologists, patients were divided into 2-groups according to the presence or absence of diabetes mellitus.

Tablet: Susceptibilities of the most common bacteria isolated from Urine

Antimicrobial agents	Escherichia coli		Klebsiellae spp.		Pseudomonas aeruginosa		Proteus mirabilis	
	DM	ND	DM	ND	DM	ND	DM	ND
Number	17	28	16	4	4	9	2	9
1. Ampicillin	5%	3%	8%	10%	4%	3%	6%	7%
2. Piperacillin	15%	22%	33%	37%	19%	36%	47%	52%
3. Cefotaxime	69%	72%	69%	71%	63%	69%	59%	63%
4. Ceftazidime	55%	78%	77%	68%	56%	50%	68%	68%
5. Ceftriaxion	60%	78%	68%	78%	69%	63%	55%	55%
6. Gentamicin	85%	84%	88%	88%	86%	88%	86%	82%
7. Tobramycin	88%	88%	88%	89%	83%	89%	84%	87%
8. Amikacin	92%	89%	93%	94%	91%	89%	93%	94%
9. Nalidixic Acid	50%	88%	72%	88%	33%	34%	32%	35%
10. Nitrofurantoin	50%	88%	77%	65%	39%	45%	30%	30%
11. Ciprofloxacin	93%	90%	97%	95%	91%	92%	90%	95%
12. Co trimaxazoL	36%	39%	43%	35%	22%	31%	35%	45%

DM- Diabetics, ND- non-diabetics Numbers represent percentage of susceptibility

The following information was collected: patients age, sex, type of infection whether community or hospital acquired (hospital acquired defined as the positive cultures that occurred at or 72 hours of hospitalization, while those before 72 hours were considered community acquired unless the infection is clearly related to a procedure performed after hospital admission!), presence of pyuria, presence of dysuria, presence of catheters, type of organism isolated and antimicrobial susceptibility disk were recorded as well as the duration of stay in hospital.

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occurred at or 72 hours of hospitalization, while those before 72 hours were considered community acquired unless the infection is clearly related to a procedure performed after hospital admission!), presence of pyuria, presence of dysuria, presence of catheters, type of organism isolated and antimicrobial susceptibility disk were recorded as well as the duration of stay in hospital.

### Result

Out of 134 urine cultures which performed during the study period, 121 (90.3%) showed significant bacteruria. Of these 56 (46.3%) were obtained from patients admitted to Ramadi General Hospital (hospital acquired infection) while 65 (53.7%) represent community acquired infections. The result showed that 39 out of 56 (69.5%) hospitalized patients and 13 out of 65 (20%) non-hospitalized patients were diabetics while the remaining were non-diabetic patients. Urinary catheters were present in 20/52 (38.5%) diabetics, of these 18(46.2%) were in hospitalized patients and 2/82 (2.4%) catheter present in both community and hospitalized non-diabetic patients. On the other hand, the male to female ratio of diabetics was 1:4.5 versus 1:1.3 in non-diabetics. As shown in table 1, *Escherichia coli* was the most common organism isolated in community acquired urinary tract infection in diabetics while *Klebsiella*

hospital acquired urinary tract infection. In non-diabetics, *Escherichia coli* was the most common organism isolated from both community and hospital acquired urinary tract infection. Our result showed that Ten out of 62 (16.1%) urine specimen which obtained from non-diabetic, non-hospitalized persons, One out of 20(5.0%) and Two out of 39 (5.1%) non-diabetic and diabetic hospitalized persons respectively showed no growth of bacteria and no condition of pyuria (pus cells less than five per high pour microscopical field) was appeared in general urine examination. On the other hand, significant candiduria (presence of more than 1000 cfu of *Candida* spp. per ml) was found in diabetic hospitalized patients 11(28.2%) and 9(81.8%) of them harboring urinary catheter in contrast with non-diabetic hospitalized patients, 6(30%). Also, all catheterized patients with candiduria were under broad-spectrum antibiotic treatment With regard to antimicrobial susceptibility test, the isolated bacteria in both groups showed resistance to ampicillin, and sensitivity to aminoglycosides and ciprofloxacin. Antimicrobial susceptibilities are represented in more details in table 2.

out of 20(5.0%) and Two out of 39 (5.1%) non-diabetic and diabetic hospitalized persons respectively showed no growth of bacteria and no condition of pyuria (pus cells less than five per high pour microscopical field) was appeared in general urine examination. On the other hand, significant candiduria (presence of more than 1000 cfu of *Candida* spp. per ml) was found in diabetic hospitalized patients 11(28.2%) and 9(81.8%) of them harboring urinary catheter in contrast with non-diabetic hospitalized patients, 6(30%). Also, all catheterized patients with candiduria were under broad-spectrum antibiotic treatment With regard to antimicrobial susceptibility test, the isolated bacteria in both groups showed resistance to ampicillin, and sensitivity to aminoglycosides and ciprofloxacin. Antimicrobial susceptibilities are represented in more details in table 2.

#### Discussion:

It is well recognized known that urinary

tract infection are takes the second rank after respiratory tract infections as problems encountered by practicing physicians. Studies demonstrate greater susceptibility of diabetic than of non-diabetic to urinary tract infection. Besides organ complications as retinopathy, nephropathy and neuropathy, infections are common problems in these patients. UTI complications (e.g., bacteruria, renal abscess, and renal papillary necrosis) occur more often in diabetic patients . Results showed that 39 out of 56 (69.5%) hospitalized patients were diabetics and suffering from urinary tract infection. The greater susceptibility of diabetic than of non-diabetic to urinary tract infection is due to decreased antibacterial activity due to the sweet urine defects in neutrophil function, increased adherence to uroepithelial cells. Further, the bacteria indeed growth better in urine with glucose, however, very high concentration inhibit growth. However, *Escherichia coli* expressing type 1 fimbriae adhere better to uroepithelial cells of diabetic women. On the other hand, significant candiduria (presence of more than 1000 cfu of *Candida* spp. per ml) was found in diabetic hospitalized patients 11(28.2%). This result is consistent with those observed by Kish, 2001 who documented that diabetes mellitus is the most common underlying disease associated with this condition and this disease is believed to increase the risk of candiduria by promoting vulvovestibular colonization with *Candida* in women, encouraging urinary fungal growth due to glycosuria, and by impairing the ability of neutrophils and monocytes to phagocytize *Candida* then kill the organism using myeloperoxidase, hydrogen peroxide, and superoxide anion. It was found that, Out of 11(28.2%) diabetic hospitalized patients, 9(81.8%) of them harboring indwelling urinary catheters. It is well recognized that urinary catheter insertion may introduce *Candida* directly into the bladder and an indwelling catheter may allow *Candida* colonizing the external periurethral area to migrate along the surface of the catheter into the bladder. One study found that 77.6% of patients with candiduria had an indwelling urinary

catheter'. All catheterized patients with candiduria were under antibiotics treatment whether third generation cephalosporins or ciprofloxacin and other broad spectrum antibiotics. It is well known that antibiotics suppress the endogenous bacterial flora and allow *Candida* colonization of the gastrointestinal tract from 30% in normal adults to nearly 100% in antibiotic-treated individuals<sup>11</sup>. *Escherichia coli* was the most common organism isolated from community and hospital acquired urinary tract infection<sup>12</sup>. This result is in agreement with our result that *Escherichia coli* was the commonest in non-diabetic hospital and community acquired infection. Further, our result revealed that, in diabetic community acquired infection (CA), *Escherichia coli* was the most common 10(76.9%) followed by *Proteus mirabilis* 2(15.4%) while *Klebsiella* spp. 15(38.5%) was the most common isolate in hospital acquired infection (HA) followed by *Escherichia coli* 7(17.9%) and *Pseudomonas aeruginosa* 4(10.3%). «<. Analysis of antimicrobial resistance patterns revealed a high resistance of *Escherichia coli*, *Klebsiella* spp., *Pseudomonas aeruginosa* and *Proteus mirabilis* to ampicillin followed by piperacillin in both diabetics and non-diabetic patients<sup>13,14</sup>. The study result revealed that aminoglycosides (amikacin followed by tobramycin and gentamicin) and ciprofloxacin can be used empirically in the treatment of urinary tract infection (Community and nosocomial infections) in both diabetics and non-diabetic patients. We can conclude that in diabetic patients, *Escherichia coli* was the most common organism isolated in CA followed by *Proteus mirabilis* while *Klebsiella* spp. was the commonest isolate in HA followed by *Escherichia coli* while in non-diabetics, *Escherichia coli* was the most common organism isolated from both CA and HA. Further, It was found that *Candida albican* was the commonest cause of candiduria in diabetic HA. Also, the study suggested that aminoglycosides and ciprofloxacin can be used empirically to treat both types of infection in diabetics and non-diabetics.

revealed that, in diabetic community acquired infection (CA), *Escherichia coli* was the most common 10(76.9%) followed by *Proteus mirabilis* 2(15.4%) while *Klebsiella* spp. 15(38.5%) was the most common isolate in hospital acquired infection (HA) followed by *Escherichia coli* 7(17.9%) and *Pseudomonas aeruginosa* 4(10.3%). «<. Analysis of antimicrobial resistance patterns revealed a high resistance of *Escherichia coli*, *Klebsiella* spp., *Pseudomonas aeruginosa* and *Proteus mirabilis* to ampicillin followed by piperacillin in both diabetics and non-diabetic patients<sup>13,14</sup>. The study result revealed that aminoglycosides (amikacin followed by tobramycin and gentamicin) and ciprofloxacin can be used empirically in the treatment of urinary tract infection (Community and nosocomial infections) in both diabetics and non-diabetic patients. We can conclude that in diabetic patients, *Escherichia coli* was the most common organism isolated in CA followed by *Proteus mirabilis* while *Klebsiella* spp. was the commonest isolate in HA followed by *Escherichia coli* while in non-diabetics, *Escherichia coli* was the most common organism isolated from both CA and HA. Further, It was found that *Candida albican* was the commonest cause of candiduria in diabetic HA. Also, the study suggested that aminoglycosides and ciprofloxacin can be used empirically to treat both types of infection in diabetics and non-diabetics.

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