Urinary tract infection

Diabetics and non-diabetic patients

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ABSTRACT

Objectives: To determine the clinical characteristics, risk factors, causative organisms and antimicrobial susceptibility in diabetics and non-diabetics admitted to King Abdulaziz University Hospital Medical Unit to decide on the use of empiric antimicrobial therapy.

Methods: Significant bacteriuria from the Medical Unit of King Abdulaziz University Hospital from January 1999 to August 1999 were included in the study. Medical records were reviewed and the patients were divided into 2 groups according to the presence or absence of diabetes. The following information was recorded, patients' age, sex, type of infection (community or hospital acquired), presence of dysuria, urinary catheter, intensive care unit admission, duration of hospital stay, type of organism isolated and their antimicrobial susceptibility.

Results: A total of 182 specimens were studied, 58 (32%) were diabetics. Mean age of diabetics was 64 years versus 54 years in non-diabetics and the male:female ratio was 1:1.6 versus 1:1.1 (p0.001, 0.03). Urinary catheters were present in 12/58 (20%) diabetics and 31/124 (25%) non-diabetics, intensive care unit admission was in 23/58 (40%) versus 38/124 (31%), and duration of hospital stay was 43 days versus 38 days (p0.6, 0.1, 0.4). *Escherichia coli* was isolated in 9/50 (18%) hospital acquired infections and 4/8 (50%) community acquired infections in diabetics versus 26/106 (25%) and 8/18 (47%) in non diabetics. *Pseudomonas species* were isolated in 16/50 (32%) and 1/8 (13%) in diabetics and 22/106 (21%) and 0/18 in non-diabetics. *Escherichia coli* and *pseudomonas* in both groups showed resistance to ampicillin and sensitivity to aminoglycoside and ciprofloxacin.

Conclusions: Diabetics were older with high female ratio compared to non-diabetics. *Escherichia coli* is the most common isolate in community and hospital acquired infections in non-diabetics, while *Escherichia coli* was common in community acquired infection and *pseudomonas* was the predominant isolate in hospital acquired infection in diabetics. Aminoglycoside and ciprofloxacin can be used empirically to treat both types of infection in diabetics and non-diabetics.

Keywords: Urinary tract infection, risk factors, diabetics, non-diabetics.

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Urinary tract infection (UTI) has long been recognized as a significant problem in patients with diabetes mellitus (DM). In a study conducted by de Aguiar et al,[1] UTI was the most frequent cause of infection in diabetic admissions. A changed bacterial adhesion to the uroepithelium,[2] granulocyte dysfunction,[3-5] and impaired antioxidant systems involved in bacterial activity[6] are all involved in the pathogenesis of UTI in diabetics. It is essential that the clinician be aware of the local pathogen and susceptibility pattern to decide on the most appropriate antibiotic for empirical treatment to

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reduce the incidence of antimicrobial resistance and life threatening septicemia. To the best of our knowledge no studies have been carried out making a comparison between UTI in diabetics and non-diabetics. The aims of our study are to determine the clinical characteristics, risk factors, causative organism, and antimicrobial susceptibility in diabetic and non-diabetic patients admitted to King Abdulaziz University Hospital (KAUH) with UTI.

Methods. King Abdulaziz University Hospital is a teaching hospital in Jeddah, in the western province of Saudi Arabia. Positive urine cultures from January 1999 until August 1999 were studied. All positive bacterial urine cultures from the medical unit were included in the 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 and red blood cells and organisms by a counting chamber method. Culture of urine and determination of bacterial counts were performed by a routine semiquantitative method by Leigh and Williams.[7] The foot of the filter paper has a measured standardized area, and the urine-inoculated foot was pressed against the surface of the cystine-lactose-electrolyte-deficient (CLED) agar plate. Each plate is inoculated with 6 tests, each in duplicate. After overnight incubation at 37°C, the number of colonies in the impression area is counted, and if over 25 colonies were present, the original urine sample was known to have contained greater than 10^5 organisms per milliliter, indicating significant bacteriuria.[8] Low counts were accepted in catheter specimens if the organism persisted or was isolated from successive specimens. The isolates were identified using the standard method.[9] Gram-negative bacilli are identified using the API 20 (Analytab Inc.). Antimicrobial susceptibility was determined.[10] The antibiotics tested on each disc were ampicillin 10mcg per disc, amoxi/clav (augmentin) 30mcg, pipracillin 100mcg, trimethoprim 5mcg, norfloxacin 10mcg, ciprofloxacin 10mcg, cefuroxime 30mcg, ceftazidime 30mcg, ceftriaxon 30mcg, cefotaxim 30mcg, amikacin 30mcg, gentamycin 30mcg, asterionam 30mcg, meropenum 10mcg, and imipenum 10mcg. Medical charts of the patients were analyzed. Patients were divided into 2-groups according to the presence or absence of diabetes DM. Diabetes mellitus was diagnosed according to the World Health Organization (WHO) criteria.[11] The following information was collected: patients' age, sex, type of infection whether community or hospital acquired (hospital acquired defined as positive cultures that occurred at or after 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 dysuria, presence of catheter, intensive care unit (ICU) admissions, type of organism isolated and antimicrobial susceptibility were recorded as well as duration of hospital stay and outcome. Statistical analysis was carried out using the SPSS7.5 (Statistical Package for Social Sciences). Mean +/- standard deviation (SD) was determined for quantitative data, and frequency was determined for categorical variables. For continuous variables t test was used if comparing 2 groups. Chi-square was used to analyze group differences for categorical variables. All tests were 2 tailed and a P value of <0.05 was considered significant.

Table 1 - Comparison between urinary tract infection in diabetics and non-diabetics according to certain variables.

Variable	Diabetics N=58	Non-Diabetics N=124	P value S<0.05
Age (mean +/- SD)	63.7+/-14.5	53.8+/-19.1	S
Sex (M:F)	1:1.6	1:1.1	S
Community acquired infection N (%)	8 (14)	17 (14)	NS
Hospital acquired infection N (%)	50 (86)	107 (86)	NS
Dysuria	6 (10)	32 (26)	S
Asymptomatic bacteriuria N (%)	52 (90)	92 (74)	S
Presence of urinary catheter N (%)	12 (20)	31 (25)	NS
ICU admision N (%)	23 (40)	38 (31)	NS
Duration of hospital stay (days)	43	38	NS
Mortality N (%)		31 (25)	NS

SD - standard deviation; N - number; ICU - Intensive care unit; S - significant; NS - non significant

Results. A total of 7154 urine cultures were performed during the study period, 763 (11%) showed significant bacteriuria, 182 (24%) were from the medical unit. Fifty-eight of 182 (32%) patients were diabetics and 124/182 (68%) were non-diabetics. Tables 1 and 2 show that diabetics are older with higher female: male ratio and more likely

Table 2 - Symptomatic and asymptomatic bacteriuria in diabetic and non-diabetic females.

Variable	Asymptomatic N (%)	Symptomatic N (%)
Diabetic females N = 36	25 (69)	11 (31)
Non-diabetic females N=65	26 (40)	39 (60)

N = number; p = 0.03

Table 3 - Type of organism isolated from diabetics and non-diabetics.

Organisms	Diabetics N = 58		Non-Diabetics N =124	
	HA N=50 N (%)	CA N=8 N (%)	HA N=106 N (%)	CA N=18 N (%)
Escherichia coli N (%)	9 (18)	4 (50)	26 (25)	8 (47)
Pseudomonas sp. N (%)	16 (32)	1 (13)	22 (21)	-
Entercocci sp. N (%)	3 (6)	-	9 (9)	-
Enterobacter sp. N (%)	8 (16)	-	11 (10)	1 (16)
Klebsiella sp. N (%)	7 (14)	1 (13)	19 (18)	5 (29)
Proteus mirabilis N (%)	3 (6)	-	-	-
Staph. aureus N (%)	-	-	5 (5)	-
Citrobacter sp. N (%)	-	-	4 (4)	-
Serratia sp. N (%)	-	-	1 (1)	-
Salmonella sp. n (%)	-	-	1 (1)	1 (6)
Acinetobacter sp. N (%)	2 (4)	-	4 (4)	1 (1)
Others* N (%)	2 (4)	2 (25)	4 (4)	2 (11)

*Others = kluyvera sp., stenotrophomonas maltophilia, group-B streptococci; N - number
HA - hospital acquired; CA = community acquired
Staph. aureus = staphylococcus aureus

to have asymptomatic bacteriuria. As shown in Table 3, *Escherichia coli* (*E.coli*) was the most common organism isolated in community acquired UTI in diabetics while *pseudomonas* was the most common isolate in hospital acquired UTI. In non-diabetics, *E.coli* was the most common organism isolated from both community and hospital acquired UTI. Table 4 showed that *E.coli*, both in diabetics and non-diabetics, had resistance to ampicillin, and it was more sensitive to aminoglycoside and ciprofloxacin. *Pseudomonas* was more sensitive to amikacin, ciprofloxacin, and it showed resistance to pipracillin in diabetics.

Discussion. The incidence of UTI at KAUH has increased from 6% in 1986[12] to 11% in 1999. Several controlled studies have demonstrated a higher incidence of UTI in females.[1,13,14] Diabetic females were more likely to present with asymptomatic bacteriuria, which is in agreement with what has been reported by others.[15,16] Urinary tract infection is an important infectious focus for sepsis in hospitalized patients.[17] Prevention, early detection and eradication of UTI will reduce the life threatening consequences of persistent or repetitive infection. Presence of urinary catheter, ICU admissions, and prolonged hospital stay had been reported as risk factors for hospital acquired UTI.[14,18,19] The role of urinary catheter as a risk factor for acquisition of UTI was clearly confirmed in our study in both diabetics and non-diabetics. It is advisable that indwelling urinary catheters should be inserted only when absolutely necessary, removed as soon as possible and insertion of catheters should be performed by properly trained staff using aseptic techniques. Differentiation between colonization and infection is very important as patients with indwelling urinary catheters are liable to develop repeated episodes of bacteriuria and this may result in repeated administration of antibiotics with the emergence of highly resistant bacteria. Risk of infection due to ICU admission was evident in both diabetics and non-diabetics. This can be reduced by the use of non-invasive positive pressure ventilation as reported by Nourdine et al.[19] Both diabetics and non-diabetics were found to have prolonged hospital stay. Duration of ICU and hospital admission should be shortened as much as possible to reduce the risk of UTI. El-Bashier[20] and others,[21,22] had reported that *E.coli* is the most common cause of

Table 4 - Susceptibilities of organisms isolated from urine.

AGENT	Escherichia coli		Pseudomonas sp.		Enterobacter sp.		Enterococus sp.		Klebsiella sp.		Proteus sp.		Citrobacter sp.	
Number	DM 13	ND 34	DM 17	ND 22	DM 8	ND 12	DM 3	ND 9	DM 8	ND 24	DM 3	ND 0	DM 0	ND 4
Amikacin	83	79	82	91	34	58	-	11	63	46	100	-	-	25
Gentamycin	75	64	47	62	75	50	67	11	63	63	100	-	-	25
Asterionam	58	61	29	57	38	33	-	11	50	46	67	-	-	25
Ampicillin	8	15	6	-	38	8	67	67	-	-	67	-	-	-
Piperacillin	25	21	6	57	50	33	100	78	13	29	67	-	-	25
Augmentin	17	39	-	5	25	17	67	56	25	33	100	-	-	-
Ciprofloxacin	83	61	71	67	63	42	-	-	50	67	67	-	-	-
Norfloxacin	50	58	12	19	25	8	-	-	38	42	-	-	-	25
Cefuroxim	58	55	-	-	38	17	-	11	25	21	67	-	-	-
Ceftazidim	75	54	65	48	13	42	-	11	13	46	34	-	-	25
Ceftriaxon	42	39	-	-	38	25	-	-	50	33	-	-	-	-
Cefotaxim	58	55	-	-	13	33	-	11	63	54	-	-	-	25
Imepenum	75	70	53	43	100	83	67	89	88	83	34	-	-	75
Meropenum	75	58	24	43	50	50	-	22	75	63	-	-	-	25
Trimethoprim	50	27	-	-	25	42	-	-	13	42	-	-	-	-

Numbers represent percentage of susceptibility; DM - diabetics; ND - non-diabetics

UTI. At KAUH, *E.coli* was also reported to be the most common organism isolated from community and hospital acquired UTI.[12] In our study, *E.coli* was the most frequently isolated organism in both community and hospital acquired UTI in non-diabetics, while in diabetics *E.coli* was the most common cause of community acquired UTI as had been reported by Hermida et al.[15] *Klebsiella species* had been found to be the predominant organism isolated in diabetics with hospital acquired UTI,[23] while in our hospital, *pseudomonas species* was the most common isolate. Analysis of antimicrobial resistance patterns revealed a high resistance of *E.coli* to ampicillin, in both diabetics and non-diabetics, a finding similar to what had been reported by El-Tahawi et al[12] and others.[20] We found that aminoglycoside and ciprofloxacin can be used empirically in the treatment of UTI (community and hospital acquired) in both diabetics and non-diabetics.

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