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RESEARCH ARTICLE

URINARY TRACT INFECTION IN DIABETIC PATIENTS COMPARED WITH NON-DIABETICS: DIFFERENCE IN EPIDEMIOLOGY, MICROBIOLOGY AND CLINICAL FEATURES.

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Abstract

Background: Urinary Tract Infections (UTI) are considered as the most common bacterial infections in the outpatient practice and affect all age groups with female to male predominance.

Objective: The aim of the study was to investigate the epidemiological, bacteriological and clinical features of the urinary tract infection in diabetic patients and compare them with those of non-diabetics.

Patients and methods: Two groups of patients were included in the study. Group (1): people with Diabetes Mellitus, type-two, and Group (2): non-diabetic patients for comparison purpose. The diabetic group included (162) patients (81 females and 81 males). On the other hand Group (2) included (54) individuals (27 females and 27 males). The existence of the UTI was looked for in both samples searching for any difference relating to incidence, microbiology and clinical features. The recorded data were subjected to statistical evaluation.

Results: There were both some similarities as well as differences between the two groups of the investigated individuals in terms of incidence, bacteriology and clinical feature.

Conclusion: There were but no major differences in the epidemiology, microbiology and clinical features in the two groups. Some of the differences were significant whereas others lacked statistical significance.

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Introduction:-

In health, bacterial colonization is confined to the lower end of the urethra and the remainder of urinary tract is sterile. Urinary tract infection (UTI) is characterized by colonization of the urinary tract by uropathogens at any level above the lower end of the urethra. Involvement of the bladder, urethra and prostate cause lower urinary tract infection and presented by dysuria, urgency, strangury and frequency. When kidneys are involved, systemic symptoms may be observed such as fever, rigor and pain and tender costo-phreni angle (Goddard *et al.*, 2010).

The urine may contain pus (pyuria) with turbid appearance and unpleasant smell. Pyuria is the presence of (6-10) or more neutrophils per high power field (HPF) of unspun freshly voided mid-stream urine (Wikipedia the free Encyclopedia, Pyuria. Available at <https://en.wikipedia.org/wiki/pyuria>). It is considered as a sign of bacterial UTI. Exception to this rule is the presence of white cells under high power microscopic field (HPF), but on culturing

techniques the result is a sterile culture. This is called sterile pyuria, examples are urinary tract tuberculosis, viruses, sexually transmitted diseases such as gonorrhea and other causes (Cumming, 2005; Wise and Schlegel, 2015).

UTI is the most common bacterial infection managed in general medical practice and accounts for 1-3% of consultations. It is most common in women and 50% of them have (UTI) at some time, while it is uncommon in males except during the first year of life and after the age of 60 because of prostatic hypertrophy (Goddard *et al.*, 2010).

Prevalence of UTI in women is (3-10.8 %) at the age of (18-20) and increased by about 1% each subsequent decade because of their short urethra, the trauma caused by sexual intercourse and the absence of bactericidal prostatic secretions. Urinary Tract Infection may present with symptoms (symptomatic UTI) or discovered during routine medical examination with no symptoms in spite of significant bacteruria. Asymptomatic bacteruria or untreated UTI can lead to damage of the urinary tract, leading to end-stage renal failure (ESRF) and dialysis. There is controversy in treating asymptomatic bacteruria, but most authorities accept the opinion that pregnant women, infants and cases suffering asymptomatic urinary tract abnormalities should be treated (Foxman *et al.* 2000).

Transmission of bacteria into the urinary is most often via the ascending transurethral route, but sometime by blood stream, lymphatics or vesico-colic fistula (Yaqoob, 2009). According to a multi health centers study, the most common etiological pathogen causing UTI is *Escherichia coli*, the next three pathogens were *Enterococcus fecalis*, *Klebsiella* species and *Proteus mirabilis* (Farrell *et al.* 2003).

Financially, the cost of handling the UTI within the community is significantly high (Foxman, 2010). After catheterization, special prevention and management measurements are needed (Hooton *et al.*, 2010).

Diagnosis is arrived at if symptoms and signs of UTI are present plus some white blood cells in the urine beside a small number of microorganisms. However, in asymptomatic UTI there should be a significant number of microorganisms ($>10^5$ microorganisms/ml of urine). It is worthwhile to point out that Urinary Tract Infections are generally self-limiting but have the propensity to recur (Foxman, 2010).

Patients and Methods:-

The study was a prospective one conducted on patients visiting private medical clinics and diabetic clinic of Al-Hussein Medical City Teaching Hospital, Karbala, during the period from the 1st of June, 2016 to the 31st of May, 2017. It covered (162) Diabetes Mellitus type-two patients proved previously during regular clinical visits. They were (81) females and (81) males. They were assigned to Group-1. Another group of patients, Group-2, included (54) non-diabetic patients: (27) females and (27) males. The recorded data included: age, sex duration of diabetes, symptoms in addition to other information came out by clinical examination. Each patient was provided with a sterile container to collect freshly voided mid-stream urine sample according to guide lines of asepsis. A blood sample was also taken for complete blood picture, serumcreatinin, urea and HbA1C.

Portion of the collected urine was centrifuged and subjected to microscopic examination. The presence of neutrophils ($> 6-10$ / HPF) was considered significant. Another portion was used for culture. The collected data were analyzed and statistically evaluated.

Results:-

The mean age of the diabetic patients was 58 ± 12 and of non-diabetics 57 ± 13 years. The duration of diabetes ranged between 8 months and 15 years with a mean of 7 ± 6.5 years. Tables (1) and (2) show age and sex distribution of the diabetic group (Group-1) and the non-diabetic group (Group-2, control group). Distribution of the number of patients with UTI in the two groups are presented in Table (3). Table (4), (5) and (6) present results of the microscopic and culture observations of both diabetic and non-diabetic patients. Observed symptoms in patients of both groups are displayed in Tables (7) and (8). Table (9) shows comparison of the incidence of microorganisms causing UTI in diabetics and non-diabetic patients. .

Discussion:-

Data of the present investigation revealed that UTI was encountered in male and female diabetic (Table 1) and non-diabetic (Table 2) patients of the age range subgroups. Females and males, regardless their age, were closely

susceptible and there was non-significant correlation between UTI prevalence and sex or age. Bonadio *et al.* (1999) reported that UTI in diabetic patients was a common scenario in nephrology outpatient clinics and encountered among all age groups and both sexes with female predominance.

Urinary tract infection occurred more frequently in diabetic patients than in the general population with a relative risk ranging from 1.5 – 4.0. The real cause was unknown but hyperglycemia, immunodeficiency, modified urothelium and chronic neurologic bladder dysfunction could be blamed (Tourret *et al.*, 2014). Results of the present study pointed out to this fact. Sixty six out of (162) diabetic patients (i.e. 40.7 %) suffered UTI, whereas (18) individuals caught UTI out of (54) non-diabetic patients (33.3 %). The difference was significant (p value < 0.01). Possibility of complications associated with UTI in diabetic patients has been documented (Mnif *et al.*, 2013).

There was a closed correlation between urine microscopy and urine culture results (Tables 4, 5 and 6). Increased number of neutrophilic leukocytes under high power field was accompanied with increased possibility of positive culture. Usually cases of UTI in diabetic patients were only bacteruria positive which was a serious sign because bacteruria might lead to renal damage in a silent way. Its occurrence was usually more common in diabetics than in non-diabetics due to combination of host and local causes (Aswani *et al.*, 2014).

Asymptomatic UTI was predominant in diabetic patients (83 %) as presented in Table (7), whereas all (100 %) of the non-diabetic patients did not show symptoms (Table 8). Seventeen percent of the individuals of the diabetic group showed symptomatic UTI (Table 7). On the other hand, none of the non-diabetic patients showed symptomatic UTI (Table 8). Incidence of cystitis and pyelonephritis were more common in diabetics with frequent isolation of resistant bacteria (Nicolle, 2005). Emphysematous pyelonephritis, pyelitis, cystitis beside renal abscesses and renal papillary necrosis were not uncommon complications associated with diabetes mellitus (Mnif *et al.*, 2013).

Table (9) presents comparisons in incidence of specific uropathogens in the diabetic and non-diabetic UTI patients of this investigation. Non significant differences have been observed between number of infected patients of the diabetic group and non-diabetic group. Infection with *E. coli* has been recorded at high rates in both groups. Lower rates of incidence have been noticed for *Pseudomonas* species, *Klebsiella* species, *Enterococci* and *Proteus mirabilis*. Significant differences have been recorded for *Staphylococcus saprophyticus* and *Streptococcus fecalis*. Cases with *Staphylococci* have been significantly (p < 0.01) more observed in non-diabetic group as compared with the cases of the diabetics. On the contrary, *Streptococcus fecalis* was isolated from four diabetics, whereas this microorganism did not establish itself in any of the non-diabetic UTI patients (p < 0.05). Asymptomatic fungal infections may occur in diabetic patients and should be ruled out during their visit to the outpatient clinics (Kremery *et al.* 1999). Ronald (2003) came out with findings that etiologic pathogens associated with UTI among diabetics were predominantly *E. coli* (80 %) followed by less incident microorganisms including *Klebsiella* spp. *Strept. fecalis* and *Enterococci* have more incidence in diabetic UTI patients than in non-diabetic population. Variations in the established microorganism species within the urinary tract, or emergence of resistance, included improper duration of antibiotic treatment (Bonadio *et al.*, 1999), catheterization, spinal cord injuries as well as immunologic and metabolic disorders (Ronald, 2003). Bonadio *et al.* (1999) reported that the epidemiological, bacteriological and clinical features of diabetic and non-diabetic groups of UTI Italian patients did not show statistically significant differences (Table 10). Furthermore, their results revealed that the asymptomatic cases among diabetic UTI patients were more predominant as compared with the corresponding non-diabetic UTI individuals. A clinical trial involved Australian groups of patients recorded isolation of several species of microorganisms from urine samples of diabetic and non-diabetic UTI cases (Table 11). The authors pointed out to a significant difference in the incidence of the *Pseudomonas* only (P < 0.05).

Table 1:-Age and sex distribution in the diabetic group of patients.

Age Subgroups in years	Male	Female	Total Number
42-50	27	29	56
51-60	26	25	51
61-70	28	27	55
Total	81	81	162

Table 2:-Age and sex distribution in the control group of patients.

Age groups in years	Male	Female	Total Number
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42-50	8	10	18
51-60	9	8	17
61-70	10	9	19
Total	27	27	54

Table 3:-Number of patients with UTI in the two groups of patients.

Group	Gender	Number	Total Number of Patients	Number of Patients with UTI	Total Number of Patients	% of Total
Diabetic	Male	81	162	28	66	40.7%
	Female	81		38		
Non-Diabetic	Male	27	54	6	18	33%
	Female	27		12		

P value :< 0.01

Table 4:-Microscopic and culture results of urine in UTI diabetic males (n = 81) Positive culture = > 10⁵ micro-organisms /ml urine.

No. of Patients	Microscopic Results: No. of Neutrophils per High Power Field (HPF)	No. of Positive Cultures
27	1 – 2	Nil
26	3 – 6	2
28	> 8 – 10	26

Table 5:-Microscopic and culture results of urine in UTI diabetic females(n = 81). Positive culture = > 10⁵ micro-organisms /ml urine.

No. of Patients	Microscopic Results: No. of Neutrophils Per High Power Field (HPF)	No. of Positive Cultures
15	2 – 4	Nil
28	6 – 8	4
38	> 10 – 12	34

Table 6:-Microscopic and culture results of urine in non-diabetic UTI patients.

Gender	No. of UTI patients	Microscopic Results: No. of Neutrophils Per/ HPF	Cultures results
Male	6	6 – 10	Positive
Female	1	2 – 4	Positive
Female	2	6 – 10	Positive
Female	9	> 10 – 12	Positive
Total	18 out of 54		

Table 7:-Symptomatic and asymptomatic UTI diabetic patients.

Clinical Signs	Male	Female	Total	Percentage
Symptomatic	3	8	11	17%
Asymptomatic	25	30	55	83%
Total	28	38	66	100%

Table 8:-Symptomatic and asymptomatic UTI non-diabetic patients.

Signs and symptoms	Male	Female	total	Percentage
Symptomatic	0	0	0	0
Asymptomatic	6	12	18	100%

Table 9:-Comparison of incidence of organisms causing UTI in diabetic patients versus non-diabetic patients.

Micro- organism	Incidence in Diabetic Patients	Incidence in Non-Diabetic Patients	P Value
<i>E. coli</i>	76	78	N/S
<i>Staphylococcus saprophyticus.</i>	2	8	< 0.01
<i>Pseudomonas spp.</i>	6	5	N/S
<i>Klebsiella spp.</i>	5	4	N/S
<i>Enterococcus</i>	4	3	N/S
<i>Proteus mirabilis</i>	3	2	N/S
<i>Strept. fecalis</i>	4	0	< 0.05

Table 10:-Comparison of incidence of micro-organisms (uropathogens) in Italian diabetic and non-diabetic UTI patients (Bonadio *et al.* 1999).

Name of the Micro-organism (uropathogen)	Incidence in Diabetic Patients	Incidence in Non-Diabetic Patients
<i>E. coli</i>	56.1	56.8
<i>Proteus spp</i>	7.9	7.2
<i>Pseudomonas spp</i>	6.7	8.2
<i>Enterococcus fecalis Central cecum spp</i>	6.7	7.2

Statistical analysis showed non-significant differences.

Table 11:-Micro-organisms isolated from urine cultures of Australian diabetic and non-diabetic UTI patients. (Aswani *et al.*, 2014).

Micro- organism	Diabetic	Non Diabetic	P value
<i>E. coli</i>	117	73	N/S
<i>Klebsiella</i>	22	18	N/S
<i>Enterococcus</i>	18	10	N/S
<i>Pseudomonas</i>	3	15	< 0.05
<i>Acinetobacter</i>	3	0	
<i>Citrobacter</i>	3	2	
<i>Proteus</i>	3	1	
<i>Coag. Neg. Staph</i>	3	4	
<i>Coag. Posit. Staph</i>	4	1	
<i>Candida</i>	5	0	

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