COMPARATIVE STUDY OF BACTERIAL PATHOGENS CAUSING URINARY TRACT INFECTIONS IN DIABETIC AND NON-DIABETIC PATIENTS

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ABSTRACT

Objective: To identify and compare different bacterial pathogens causing UTI (urinary tract infections) in diabetic and non-diabetic patients.

Study Design: Prevalence / Comparative study.

Place and Duration of Study: Microbiology Laboratory, Department of Microbiology, Abasyn University Peshawar, from July 2010 to November 2010.

Methodology: A total of 60 samples were processed, 30 of them for diabetic and the rest for normal patients suffering from UTI. Five to ten ml fresh midstream urine was collected aseptically in a sterile urine container. Blood agar, MacConkey agar and CLED (Cysteine Lactose Electrolyte Deficient) agar were used as growth media for the culturing of microorganisms. Microorganisms were then identified through Gram staining followed by microscopy, catalase, coagulase, urease, TSI (triple sugar iron), Indole and Oxidase tests.

Results: Out of 60 cases, 38 (63.33%) cases were found positive in which18 (47.37%) were from non-diabetic patients and 20 (52.63%) were from diabetic patients. Eleven samples (61.11%) were found positive for females out of 18 positive samples of non-diabetic patients, while seven samples (38.89%) were found positive for males. Similarly, in case of 20 positive samples of diabetic patients, eighteen samples (90%) were from females while two samples (10%) were from males. On the other hand, in non-diabetic patients, *E.coli* were isolated from 50% samples, *Citrobacter* and *Staphylococcus aureus* from 16.6% each, *Klebseilla from* 11.1% and *Providencia* species from 5.5%. Accordingly, in case of diabetic patients, *Proteus* species were isolated from 66.66% samples, *Pseudomonas* from 20%, *Klebseilla* from 15% and *Morganell*a from 5%. Generally, female population was found more infected (76.2%) with urinary tract infections than males (23.8%).

Conclusion: The study concluded that a high rate of UTI is prevalent in our community not only in healthy population but also in diabetic patients.

Keywords: UTI. Diabetic and Non-diabetic Patients. Gram-Positive and Gram-Negative Bacteria.

INTRODUCTION

UTI is a common disease in neonates as well as other age groups[1] having a substantial morbidity rate.[2] This infection involves kidney, uterus, urinary bladder and urethra. Although, all groups are affected by these infections but as compared to males, females are more affected and susceptible due to lack of prostatic secretions, pregnancy, short urethra and urinary tract contamination by fecal flora.[3-4]

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Infection occurs after entrance of bacteria in urine. Infection starts from the opening of urethra and gradually moves upward into urinary tract. From the area around the anus bacteria can move to urethra orifice. Sexual intercourse and poor hygiene are major causes of these infections. Urination usually flushes out the bacteria from urethra without inhibiting their spread in case of heavy colonization. Such bacterial infection spreads further when bacteria move to uterus from the bladder. If bacteria found an access to the kidney, it results in kidney infection. People suffering from diabetes, AIDS, immuno-suppression, kidney stones or taking immunosuppressant drugs (for example, cancer chemotherapy), are at high risk. Two other high risk groups are sexually active women and men having enlarged prostate.[5]

Many UTIs are asymptomatic, especially in females[6-7] but symptoms do exist. Symptoms of the UTI are Cystitis, Dysuria, Urgency, Hesitancy, Abdominal pain, mild fever, chills, malaise and Cloudy, bad-smelling and bloody urine. Our body cells absorbs sugars (glucose) and produce energy because of insulin ac-

tion, which is a hormone produced by pancreas. The effect of glucose metabolism is seen in many diseases, making patients with diabetes more susceptible to sepsis. In diabetes (Diabetes mellitus) blood sugar level rises above the normal levels either due to low insulin production or improper response of the body cells to insulin. Symptoms like increased thirst (polydipsia), increased hunger (polyphagia) and frequent urination (polyuria) appears due to high blood sugar levels.[8-9] 70 to 150 mg is the normal blood glucose level which is usually lower in the morning and rises when food is consumed. Hyperglycemia and hypoglycemia occurs when sugar level rises above 150 mg or lowers below 70 mg respectively in blood. During fasting, 70-90 mg is the normal blood sugar level.[10]

Diabetes mellitus has many types like Type 1 diabetes mellitus, Type 2 diabetes mellitus, Gestational diabetes and Pre-diabetes. In diabetic patients the most common and important site of infection is urinary tract.[11] Diabetes has high prevalence globally and UTI is one of its major infections. In diabetic patients urinary tract can be infected by various types of microorganisms but gram negative bacilli are the most common infecting bacteria. Klebseilla, Proteus, Entrobactor, Pseudomonas and Serratia are the microorganisms involved in UTI in lower proportions.[12-13]

As compared to general population UTI are more common and follow a complicated course in diabetes patients. Escherichia coli are the most common isolates in community and hospital acquired infections in non-diabetic patients while *pseudomonas* is the major isolate in hospital acquired UTI in diabetic patients. Adherence of microorganisms to uro-epithelial cells and defects in the local urinary cytokine secretions are the mechanisms that potentially contributes to the high prevalence of symptomatic and asymptomatic bacteriuria in diabetic patients.[14-15] The main objective of our study was to determine the frequency and antibiotic susceptibility profile of bacterial pathogens causing urinary tract infections (UTI) in diabetic and non-diabetic patients.

MATERIALS AND METHODS

The study was conducted at Abasyn University Peshawar from July to November 2010 with the permission of Graduate study committee. The study subjects were diabetic and non-diabetic patients suffering from UTI. They were under treatment in medical and surgical wards of Khyber Teaching Hospital Peshawar, surgical OPD and endocrinology OPD of Hayatabad Medical Complex and in local clinics of Peshawar Pakistan.

A total of sixty cases were studied, out of which thirty were diabetic and thirty were non-diabetic patients, suffering from UTI. Relevant information including informed consent, name, age, gender, address, diabetic/ non- diabetic, family history, recent travels, history of surgery or other invasive procedure like catheterization, urinary symptoms and other relevant laboratory findings were obtained through a questionnaire.

Five to ten ml fresh midstream urine was collected aseptically from diabetic and non-diabetic UTI patients in sterile disposable urine bottles. Urine bottles were labeled properly by writing names of the patients and their status whether diabetic or non-diabetic. The samples were brought to the Microbiology laboratory, Abasyn University Peshawar and processed for culturing and identification of the organisms.

Blood agar, MacConkey agar and CLED agar were used as growth media for the culturing of microorganisms. Blood agar is an enriched media on which both gram positive and gram negative bacteria show growth, while MacConkey agar is a selective media which inhibit the growth of gram positive bacteria while enhance the growth of gram negative bacteria. In MacConkey agar both lactose and non-lactose fermenter bacteria can grow. CLED agar is a differential media used for the differentiation of urinary organisms. Each sample was then cultured on three plates containing CLED, MacConkey and Blood agar. After streaking, the plates were incubated at 37°C for 24 hours.

Microorganisms were then identified through Gram staining. For the confirmation of microorganisms relevant biochemical tests were performed. For gram positive bacteria Catalase[16] and Coagulase[17] tests while for gram negative bacteria Urease[18], Triple sugar iron (TSI)[18], Indole[17] and Oxidase[16] tests were performed.

RESULTS

A total of 60 samples were collected from diabetic and non-diabetic patients suffering from UTI. Out of these 60 samples, 30 (50%) were obtained from none-diabetic and 30 (50%) from diabetic patients. Out of 30 non-diabetic patients 18 (60%) were positive and 12 (40%) were negative. In case of 30 diabetic patients 20 (66.66%) were positive and 10 (33.33%) were negative (Table I and figure I).

It is evident that among 18 (60%) positive samples of non-diabetic patients, *Escherichia coli* (*E.coli*) were isolated from 9 (50%) samples, followed by *Citrobacto* and *Staphylococcus aureus* isolated from 3 (16.6%) samples each, *Klebseilla* from 2 (11.1%) and *Providencia* species from 1 (5.5%) sample. *E. coli* showed a high prevalence as it was present in half (50%) of the positive samples while *Providencia* species has the least prevalence (5.5%) in non-diabetic patients.

Among 20 (66.33%) positive samples of diabetic patients, *Proteus* species had the highest prevalence

Table I: Frequency of UTI in diabetic and non-diabetic patients

Samples	Non-Diabetic	Percentage (%)	Diabetic	Percentage (%)
Positive	18	60	20	66.66
Negative	12	40	10	33.33
Total	30	100	30	100

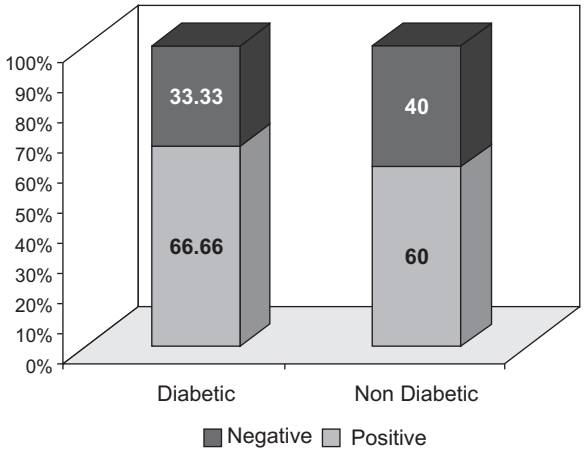

Figure I: Percentage of positive and negative cases of UTI of diabetic and non-diabetic patients

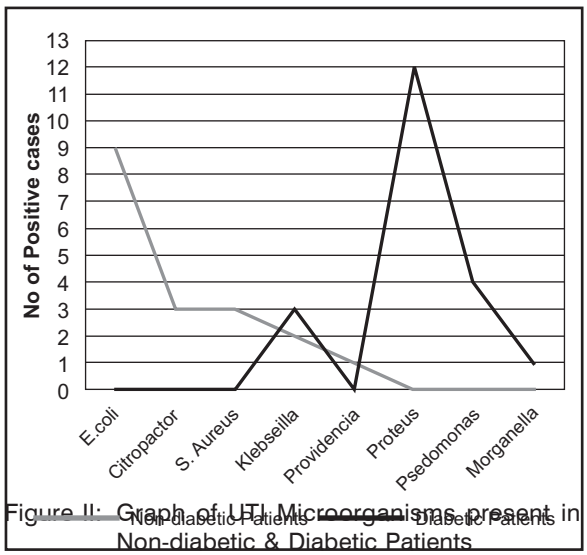

Figure II: Graph of UTI Microorganisms present in Non-diabetic & Diabetic Patients

Table II: UTI Microorganisms present in Non-diabetic & Diabetic Patients

Organisms	No of samples (non-diabetic patients)	Percentage (%)	No of samples (diabetic patients)	Percentage (%)
E.coli	9	50	_	_
Citrobactor	3	16.7	_	_
S.Aureus	3	16.7	_	_
Providencia	1	5.5	_	_
Klebseilla	2	11.1	3	15
Proteus	_	_	12	60
Psedomonas	_	_	4	20
Morganella	_	_	1	5
Total	**18**	**100**	**20**	**100**

(-) Organism not present

i.e. 60%, isolated from 12 samples, followed by *Pseudomonas* species, isolated from 4 (20%), *Klebseilla* from 3 (15%) and *Morganella* species from 1 (5%) sample (Table II, Figure II).

Out of 18 positive UTI samples of non-diabetic patients 11(61.11%) samples were from females while 7 (38.89%) were from males. Similarly in case of diabetic patients, out of 20 positive UTI samples, 18 (90%) samples were from females while 2 (10%) were from males. On the whole, female population was found more infected (76.3%) with UTI than males (23.7%) (Table III).

DISCUSSION

UTI is the most common problem of human beings now-a-days. In this study it was found that urinary tract infections were more common in diabetic patients (66.66%) as compared to non-diabetic (60%). Our results are in conformity with the report of Nielubowicz[19] who also pointed out that UTI not only affect healthy individuals but complicated patients with underlying difficulties such as diabetes, Catheterization etc.

Our results showed that among non-diabetic

Table III: Gender wise positive cases among non-diabetic and diabetic patients

Samples	Non-diabetic	Percentage (%)	Diabetic	Percentage (%)	Total	Percentage (%)
Male	7	38.89	2	10	9	23.7
Female	11	61.11	18	18	29	76.3
Total	18	100	20	100	38	100

patients, *E.coli* was the most (50%) causative agent for UTI, followed by Citrobacter and *Staphylococcus aureus* (16.66%) each, Klebseilla (11.11%) and *Providencia* (5.5%). Our results for *E.coli* are in agreement with the report of Azra[20] who reported a high incidence of *E.coli* (50.7%) followed by *Klebseilla* (27.6%) and *S. aureus* (1.5%). The differences in results for *Klebseilla* and *S. aureus* may be due to climatic conditions, hospitalization or socio-economic conditions of the patients.

A high incidence of *Proteus* (60%) was found among diabetic patients, which confirmed the report of Nielubowicz[19] who also indicated the *Proteus mirabilis* as most common isolate among patients with complicated infections. One reason might be that *Proteus* is found in multiple environmental habitats, including long term care facilities and hospitals. Other reason for common occurrence of *Proteus* infection may be due to use of multiple antibiotic treatment or having prior episodes of UTI, urinary tract obstruction or infection developed after instrumentation.

Our study indicates the occurrence of urinary tract infection among diabetic patients with *Proteus* as the most common (60%) causative agent followed by *Pseudomonas* (20%), *Klebseilla* (15%) and *Morganella* (5%). Our results showed resemblance with the work of Soliman[21] who reported almost similar prevalence of *Pseudomonas* (20%), *Klebseilla* (9.3%) and *Morganella* (2%) among diabetic patients.

Another fact which this study brings forth as novel result is the occurrence of *Providencia* among the isolates obtained from non-diabetic patients, which may be due to nosocomial infection, Cystitis or use of bladder catheterization.

A higher percentage of females (76.3%) were found infected with urinary tract infections compared with males (23.7%) in our study. Among non-diabetic patients, females showed a higher rate (61.11%) of UTI compared with males (38.89%), which is in agreement with study of Azra [20] who reported that UTI was most common in females (70.5%) as compared to males (29.5%). Similarly Ooi[22] reported that asymptomatic bacteriuria occurs in diabetic women more commonly than in non-diabetic women, and is associated with an increased risk of symptomatic UTI among patients with type 2-diabetes. In our result we also found asymptomatic bacteriuria in diabetic women more commonly than in non-diabetics females and males.

CONCLUSION

From the observed findings, it can be concluded that a high rate of UTI is prevalent in our community not only in healthy population but also in diabetic patients.

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