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ORIGINAL RESEARCH

Comparison of clinio-etiological profile of urinary tract infections among diabetics and non-diabetics in tertiary care hospital

[1]Dr. Shubham, [2]Dr. Shaminder Kaur, [3]Dr. Sumit Kumar, [4]Dr. Vishal Sharma, [5]Dr. Ravinder Garg, [6]Dr. Baljinder Kumar, [7]Dr. Parampreet Singh, [8]Dr. Naveen

[1,6,8]Junior Resident, [2,3]Associate Professor, [5]Professor, [7]Senior Resident, Department of Medicine, GGS Medical College and Hospital, Faridkot Punjab, India
[4]Associate Professor, Department of Microbiology, GGS Medical College and Hospital, Faridkot Punjab, India

Corresponding author
Dr. Shaminder Kaur
Associate Professor, Department of Medicine, GGS Medical College and Hospital, Faridkot Punjab, India

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Abstract

Introduction: Urinary tract infection (UTI) is broadly defined as an infection of the urinary system, and may involve the lower urinary tract or both the lower and upper urinary tracts. The definition of a symptomatic UTI generally requires the presence of urinary tract-specific symptoms in the setting of significant bacteriuria with a quantitative count of $\geq 10^5$ colony forming units of bacteria per milliliter (CFU/ml) in one urine specimen. Asymptomatic bacteriuria (ASB) is defined as the presence of bacteria in the urine, without clinical signs or symptoms suggestive of a UTI. Asymptomatic pyuria is defined as the presence of white blood cells in the urine, in the absence of urinary tract specific-symptoms.

Aim and Objective:To study the clinico-etiological ,microbiological profile comparison of UTI among diabetics and non-diabetics and compare these profile.

Materials and methods: The first 50 diabetics and first 50 non-diabetics satisfying the inclusion criteria coming to ipd and opd between the period of June 2021 to June 2022 will be included in present study.

Results: The mean ± SD of age(years) in diabetics was 52.68 ± 14.84 and in non-diabetics was 53.08 ± 18.49 with no significant difference between them. (p value=0.905).The distribution of gender was comparable between diabetics and non-diabetics. (Female:- 50% vs 60% respectively, Male:- 50% vs 40% respectively) (p value=0.315). Mean value of duration of diabetes mellitus(years) of study subjects was 6.62 ± 4.17.Mean value of HbA1c(%) of diabetics was 7.93 ± 1.06.Fever was the most common presenting symptom. And E. coli was the most common isolate among two groups. Antibiotic sensitivity patterns did not show any significant difference among two groups.

Introduction

UTIs are among the most common bacterial diseases, affecting 150 million people worldwide annually, resulting in more than 6 billion dollars in direct health care expenditures (2). Urinary tract infection (UTI) is the most common infection experienced by humans after respiratory and gastrointestinal infections, and also the most common cause of both community-acquired and nosocomial infections for patients admitted to hospitals(1).

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UTI is defined as the presence of bacteria in the urine (bacteriuria). For epidemiological purposes, 'significant' bacteriuria is defined as at least 10^5 bacteria/ml in freshly-voided urine, though symptomatic infection can occur with 10^3 bacteria/ml. Asymptomatic bacteriuria (ABU) is present if a patient does not exhibit the clinical signs of UTI and the upper limit of $\geq 10^5$cfu/mL is exceeded in two consecutive properly collected samples of midstream urine (from women). A single detection is adequate for men (3-4).

All individuals are susceptible to UTIs; however, the prevalence of infection differs with age, sex, and certain predisposing factors. Urinary tract infections are the most frequent bacterial infection in women (5).

Factors that increase the risk of UTIs in diabetes include age, metabolic control, diabetic nephropathy, autonomic neuropathy, and vascular complications(6).

Infections are common in patients with DM due to the hyperglycemic medium that enhances the pathogenic virulence, reduced production of interleukin, causing chemotaxis and phagocytic activity dysfunction, damaged neutrophil function, glycosuria and gastrointestinal, and urinary tract dysmotility(7).

Concentrations of blood levels of HbA1c among diabetes mellitus (DM) patients are increased when there is poor glycaemic control causing renal disease and predisposition to UTI.HbA1c reflects average plasma glucose over the previous six to eight weeks (8-9).

The most common cause of UTI in men and women with and without DM is *E.coli*. In non-diabetic males and females, the frequency of organisms causing UTI is *E coli* 31.4% & 58.2%, Enterococcus spp. 9.4% & 6.5%, Pseudomonas spp. 17.2% & 4.7% respectively(10).

Uropathogenic*E.coli* (UPEC) is the most common etiological agent of UTI, causing more than 80% of infections, and possesses various virulence factors such as adhesins, toxins, and iron-acquisition systems that utilize siderophores (11).

Antibiotics are effective in the treatment of UTIs and for low-dose antibiotic prophylaxis but lead to an increase in antibiotic resistance in micro-organisms(12).

Materials and methods

The first 50 diabetics and first 50 non-diabetics satisfying the inclusion criteria coming to ipd and opd between the period of June 2021 to June 2022 were included in the study. The study was carried out after approval from Institutional Ethics Committee, G.G.S. Medical College and Hospital, Faridkot. Written informed consent was obtained from the patient. Patients clinical profile, predisposing factors, microbiological profile, antibiotics susceptibility patterns was studied.

Place of Study

Department of Medicine, Guru Gobind Singh Medical College and Hospital, Faridkot.

Type of study

Comparative study.

Type of sampling

Convenience sampling (non-probability sampling).

Sample Size

First 50 diabetic and first 50 nondiabetic who were confirmed cases of UTI presenting to IPD and OPD between the period of June 2021 to June 2022 were included in study.

Inclusion Criteria

- All the patient with age >40 years of any gender.

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- Patient with sign, symptoms of UTI.
- Lab (culture) confirmed cases of UTI.
- Type 2 diabetics fulfilling the following:

FPG ≥126 mg/dL (7.0 mmol/L). Fasting is defined as no caloric intake for at least 8 h.*

OR

2-h PG ≥200 mg/dL (11.1 mmol/L) during OGTT. The test should be performed as described by the WHO, using a glucose load containing the equivalent of 75-g anhydrous glucose dissolved in water.

OR

HBA1C ≥6.5% (48 mmol/mol). The test should be performed in a laboratory using a method that is NGSP certified and standardized to the DCCT assay.

OR

In a patient with classic symptoms of hyperglycemia or hyperglycemic crisis, a random plasma glucose ≥200 mg/dL (11.1 mmol/L).

In the absence of unequivocal hyperglycemia, results should be confirmed by repeat testing.

Exclusion Criteria

- Patient already of antibiotic therapy in previous one month.
- Pregnant patients.
- Patients who are catheterized.
- Proven case of genito-urinary malignancy

Statistical analysis:

The data was entered in MS-EXCEL 2010 and analysed with SPSS VERSION 20.0 Appropriate statistical test will be applied depending upon type of data.

Complete urine examination

10 ml urine is collected in sterile container.

For checking the sugar and albumin in urine SD 10 URO COLOUR STRIPS are used that have colour coding and reporting is done according to colour change that occur after dipping the uro strip in urine.

And for microscopic examination, urine sample is centrifuged at the rate of 3000-4000 rpm for 2-3 time.

Supernatant is discarded and sediment is used to make slide and by using magnus binocular microscope analysis of urine is done.

Urine culture and antibiotic senstivity testing

- 5-10 ml mid-stream urine will be collected in sterile container and is inoculate on CLED MEDIA (Cystine-Lactose-Electrolyte-Deficient Agar) within 2 hrs of sample collection.
- Growth obtained will be charted as per standard procedure and AST will be tested.

Results and observations

The study was conducted in the Department of Medicine, Guru Gobind Singh Medical College, and Hospital, Faridkot. 50 diabetic and 50 non-diabetic patients of age >18 years of any gender with signs and symptoms of UTI were included in the study. A complete urine examination was performed and antibiotic sensitivity testing was done results are as follows.

Table 1:-Distribution of age(years) of diabetics.

Age(years) of diabetics	Frequency	Percentage
18-30	5	10%

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31-40	7	14%
41-50	10	20%
51-60	13	26%
61-70	11	22%
71-80	1	2%
>80	3	6%
Mean ± SD	52.68 ± 14.8	
Median(25th-75th percentile)	54.5(45-61.75)	
Range	21-84	

The majority 13(26%) of diabetics belonged to the age group 51-60 years followed by 61-70 years 11(22%), 41-50 years10(20%), 31-40 years 7(14%), 18-30 years 5(10%) and >80 years 3(6%). The age group was 71-80 years with only 1 out of 50 patients (2%). Mean value of age(years) of diabetics was 52.68 ± 14.8 with median(25th-75th percentile) of 54.5(45-61.75).
It is shown in table 1

Table 2:-Distribution of age(years) of non-diabetics.

Age(years) of non-diabetics	Frequency	Percentage
18-30	8	16%
31-40	7	14%
41-50	7	14%
51-60	8	16%
61-70	10	20%
71-80	9	18%
>80	1	2%
Mean ± SD	53.08 ± 18.5	
Median(25th-75th percentile)	54.5(40-67.25)	
Range	18-85	

10(20%) non-diabetics belonged to the age group 61-70 years followed by 71-80 years 9(18%), 18-30 years 8(16%), 51-60 years 8(16%), 31-40 years 7(14%) and 41-50 years 7(14%). The age (years) group was >80 years of only 1 out of 50 patients (2%). Mean value of age(years) of non-diabetics was 53.08 ± 18.5 with median(25th-75th percentile) of 54.5(40-67.25).
It is shown in table 2.

Table 3:-Comparison of age(years) between diabetics and non-diabetics.

Age(years)	Diabetics(n=50)	Non-diabetics(n=50)	Total	P value
18-30	5 (10%)	8 (16%)	13 (13%)	
31-40	7 (14%)	7 (14%)	14 (14%)	
41-50	10 (20%)	7 (14%)	17 (17%)	
51-60	13 (26%)	8 (16%)	21 (21%)	0.119*
61-70	11 (22%)	10 (20%)	21 (21%)	
71-80	1 (2%)	9 (18%)	10 (10%)	
>80	3 (6%)	1 (2%)	4 (4%)	
Mean ± SD	52.68 ± 14.84	53.08 ± 18.49	52.88 ± 16.68	
Median(25th-75th percentile)	54.5(45-61.75)	54.5(40-67.25)	54.5(40-65)	0.905‡
Range	21-84	18-85	18-85	

‡ **Independent t test,** * **Fisher's exact test**

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The distribution of age(years) was comparable between diabetics and non-diabetics. (18-30 years:- 10% vs 16% respectively, 31-40 years:- 14% vs 14% respectively, 41-50 years:- 20% vs 14% respectively, 51-60 years:- 26% vs 16% respectively, 61-70 years:- 22% vs 20% respectively, 71-80 years:- 2% vs 18% respectively, >80 years:- 6% vs 2% respectively) (p value=0.119).

The mean ± SD of age(years) in diabetics was 52.68 ± 14.84 and in non-diabetics was 53.08 ± 18.49 with no significant difference between them. (p value=0.905)

It is shown in table 3.

Table 4:-Distribution of gender of diabetics.

Gender of diabetics	Frequency	Percentage
Female	25	50%
Male	25	50%
Total	50	100%

25(50%) of diabetics were female, male each.

It is shown in table 4.

Table 5:-Distribution of gender of non-diabetics.

Gender of non-diabetics	Frequency	Percentage
Female	30	60%
Male	20	40%
Total	50	100%

30(60%) non-diabetics were females and only 20(40%) out of 50 non-diabetics were males.

It is shown in table 5.

Table 6:-Comparison of gender between diabetics and non-diabetics.

Gender	Diabetics(n=50)	Non-diabetics(n=50)	Total	P value
Female	25 (50%)	30 (60%)	55 (55%)	0.315†
Male	25 (50%)	20 (40%)	45 (45%)	
Total	50 (100%)	50 (100%)	100 (100%)	

† **Chi square test**

The distribution of gender was comparable between diabetics and non-diabetics. (Female:- 50% vs 60% respectively, Male:- 50% vs 40% respectively) (p value=0.315).

It is shown in table 6.

Table 7:-Descriptive statistics of duration of diabetes mellitus(years) of study subjects.

Variable	Mean ± SD	Median(25th-75thpercentile)	Range
Duration of diabetes mellitus(years)	6.62 ± 4.17	6(4-8)	1-20

Mean value of duration of diabetes mellitus(years) of study subjects was 6.62 ± 4.17 with median(25th-75th percentile) of 6(4-8).

It is shown in table 7.

Table 8:-Descriptive statistics of HbA1c(%) of diabetics.

Variable	Mean ± SD	Median(25th-75th percentile)	Range
HbA1c(%) of diabetics	7.93 ± 1.06	7.65(7.2-8.75)	6.5-11.1

Mean value of HbA1c(%) of diabetics was 7.93 ± 1.06 with median(25th-75th percentile) of 7.65(7.2-8.75).

It is shown in table 8.

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Table 9:-Distribution of presenting complaints of diabetics.

Presenting complaints of diabetics	Frequency	Percentage
Fever	27	54%
Dysuria	17	34%
Increased frequency	15	30%
Abdominal pain	11	22%
Incontinence	13	26%
Haematuria	14	28%

In the majority of diabetics 27(54%), fever was predominatsymtom followed by dysuria 17(34%), increased frequency of urine15(30%), haematuria 14(28%), and incontinence 13(26%). Abdominal pain was present in only 11 out of 50 patients (22%)
It is shown in table 9.

Table 10:-Distribution of presenting complaints of non-diabetics.

Presenting complaints of non-diabetics	Frequency	Percentage
Fever	26	52%
Dysuria	31	62%
Increased frequency	21	42%
Abdominal pain	22	44%
Incontinence	22	44%
Haematuria	11	22%

In the majority 31(62%) of non-diabetics, dysuria was predominatsymtom followed by fever 26(52%), abdominal pain 22(44%), incontinence 22(44%) and increased frequency (42%). Haematuria was present in only 11 out of 50 non-diabetics (22%).
It is shown in table 10.

Table 11:-Comparison of presenting complaints between diabetics and non-diabetics.

Presenting complaints	Diabetics(n=50)	Non-diabetics(n=50)	Total	P value
Fever	27 (54%)	26 (52%)	53 (53%)	0.841†
Dysuria	17 (34%)	31 (62%)	48 (48%)	0.005†
Increased frequency	15 (30%)	21 (42%)	36 (36%)	0.211†
Abdominal pain	11 (22%)	22 (44%)	33 (33%)	0.019†
Incontinence	13 (26%)	22 (44%)	35 (35%)	0.059†
Haematuria	14 (28%)	11 (22%)	25 (25%)	0.488†

† **Chi square test**

Dysuria and Abdominal pain was significantly lower in diabetics as compared to non-diabetics. (Dysuria:- 34% vs 62% respectively (p value=0.005), Abdominal pain:- 22% vs 44% respectively (p value=0.019).
Distribution of other presenting complaints was comparable between diabetics and non-diabetics. (Fever:- 54% vs 52% respectively (p value=0.841), Increased frequency:- 30% vs 42% respectively (p value=0.211), Incontinence:- 26% vs 44% respectively (p value=0.059), Haematuria:- 28% vs22% respectively (p value=0.488).
It is shown in table 11.

Table 12:-Distribution of organisms isolated in diabetics.

Organisms isolated of diabetics	Frequency	Percentage
Acinetobacter	1	2%
Candida species	18	36%
Escherichia coli	20	40%

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Klebsiellapneumoniae	5	10%
Pseudomonas aeruginosa	4	8%
Staphylococcus haemolyticus	2	4%
Total	50	100%

In the majority 20(40%) of diabetics, organisms isolated were *Escherichia coli* followed by *Candida species* 18(36%), *Klebsiellapneumoniae* 5(10%), *Pseudomonas aeruginosa* 4(8%) and *Staphylococcus haemolyticus* 2(4%). The organisms isolated was *Acinetobacter* in only 1(2%) out of 50 patients.
It is shown in table 12.

Table 13:-Distribution of organisms isolated in non-diabetics.

Organisms isolated in non-diabetics	Frequency	Percentage
Candida species	19	38%
Escherichia coli	24	48%
Klebsiellapneumoniae	4	8%
Pseudomonas aeruginosa	2	4%
Staphylococcus haemolyticus	1	2%
Total	50	100%

In the majority 24(48%) of non-diabetics, organisms isolated were *Escherichia coli* followed by *Candida species* 19(38%), *Klebsiellapneumoniae* 4(8%) and *Pseudomonas aeruginosa* 2(4%). Organisms isolated was*Staphylococcus haemolyticus* in only 1 out of 50 non-diabetics (2%).
It is shown in table 13.

Table 14:-Comparison of organisms isolated between diabetics and non-diabetics.

Organisms isolated	Diabetics(n=50)	Non-diabetics(n=50)	Total	P value
Acinetobacter	1 (2%)	0 (0%)	1 (1%)	
Candida species	18 (36%)	19 (38%)	37 (37%)	
Escherichia coli	20 (40%)	24 (48%)	44 (44%)	
Klebsiellapneumoniae	5 (10%)	4 (8%)	9 (9%)	0.833*
Pseudomonas aeruginosa	4 (8%)	2 (4%)	6 (6%)	
Staphylococcus haemolyticus	2 (4%)	1 (2%)	3 (3%)	
Total	50 (100%)	50 (100%)	100 (100%)	

* **Fisher's exact test**

Distribution of organisms isolated was comparable between diabetics and non-diabetics. Acinetobacter:- 2% vs 0% respectively, Candida species:- 36% vs 38% respectively, Escherichia coli:- 40% vs 48% respectively, Klebsiellapneumoniae:- 10% vs 8% respectively, Pseudomonas aeruginosa:- 8% vs 4% respectively, Staphylococcus haemolyticus:- 4% vs 2% respectively. (pvaluie=0.833).
It is shown in table 14.

Table 15:-Distribution of antibiotics sensitivity and resistance pattern in organism isolated in diabetics.

Organisms	Acinetobacter		Escherichia coli		Klebsiellapneumoniae		Pseudomonas aeruginosa		Staphylococcus haemolyticus	
	R	S	R	S	R	S	R	S	R	S
Cefotaxime	1 (100%)	0 (0%)	19 (95%)	1 (5%)	4 (80%)	1 (20%)	--	--	--	--

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Ceftazidime	--	--	--	--	--	--	3(75%)	1(25%)	--	--
Cefoxitin	--	--	--	--	--	--	--	--	2(100%)	0 (0%)
Norfloxacin	1 (100 %)	0 (0%)	16(80 %)	4(20 %)	4 (80%)	1 (20%)	3 (75%)	1 (25%)	--	--
Nitrofurantoin	1 (100 %)	0 (0%)	7 (35%)	13 (65%)	5 (100%)	0 (0%)	4 (100%)	0 (0%)	2 (100%)	0 (0%)
Amikacin	1 (100 %)	0 (0%)	12 (60%)	8 (40%)	3 (60%)	2 (40%)	1 (25%)	3 (75%)	1 (50%)	1 (50%)
Tazar-Piperacillin / Tazobactam	1 (100 %)	0 (0%)	15 (75%)	5 (25%)	4 (80%)	1 (20%)	1 (25%)	3 (75%)	--	--
Imipenem	1 (100 %)	0 (0%)	9 (45%)	11 (55%)	2 (40%)	3 (60%)	2 (50%)	2 (50%)	--	--
Vancomycin	--	--	--	--	--	--	--	--	0 (0%)	2 (100%)
Linezolid	--	--	--		--	--	--	--	0 (0%)	2 (100%)
Colistin	0 (0%)	1 (100 %)	0 (0%)	20 (100 %)	0 (0%)	5 (100%)	0 (0%)	4 (100%)	--	--

Acinetobacter was isolate in one patient only and Colistin was sensitive to it though Nitrofurantoin, Amikacin, Tazar- Piperacillin / Tazobactam, Cefotaxime, Norfloxacin,Imipenem were resistant.

Of the 20 patients with E.Coli isolate . Nitrofurantoin was sensitive in 13(65%) cases followed by Imipenem 11(55%), Amikacin 8(40%), Tazar- Piperacillin / Tazobactam 5(25%). Cefotaxime was sensitive only in 1 (5%) case. Colistin was sensitive in all cases.

Klebsiellapneumoniae was present in 5 cases. Imipenem was sensitive in 3(60%) cases followed by Amikacin 2(40%), Tazar- Piperacillin / Tazobactam 1(20%), Cefotaxime 1(20%). On the other hand, Nitrofurantoin was resistant in all cases and Colistin was sensitive in all cases.

Pseudomonas aeruginosa was isolated from 4 cases. Amikacin and Tazar- Piperacillin / Tazobactam was sensitive in 3(75%) cases each followed by Imipenem 2(50%), Ceftizidime 1(25%). On the other hand, Nitrofurantoin was resistant in all cases and Colistin was sensitive in all cases.

Staphylococcus haemolyticus was isolated from 2 cases. Nitrofurantoin and Cefoxitin was resistant in both the cases while amikacin was sensitive and resistant in one case each.Vancomycin and linezolid was sensitive in both the cases.

It is shown in table 15.

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Table 16:-Distribution of antibiotics susceptibility pattern in organism isolated in non-diabetics.

Organisms	*Escherichia coli*		*Klebsiellapneumoniae*		*Pseudomonas aeruginosa*		*Staphylococcus haemolyticus*	
	R	**S**	**R**	**S**	**R**	**S**	**R**	**S**
Cefotaxime	21 (87.50 %)	3 (12.50 %)	0 (0%)	4 (100 %)	--	--	--	--
Ceftazidime	--	--	--	--	0 (0%)	2 (100%)	--	--
Cefoxitin	--	--	--	--	--	--	1(100%)	0 (0%)
Norfloxacin	19(79. 1%)	5(20.9 %)	3(75 %)	1(25 %)	2(100%)	0 (0%)	--	--
Nitrofurantoin	11 (45.83 %)	13 (54.17 %)	4 (100 %)	0 (0%)	2 (100%)	0 (0%)	1 (100%)	0 (0%)
Amikacin	7 (29.17 %)	17 (70.83 %)	2 (50%)	2 (50%)	0 (0%)	2 (100%)	0 (0%)	1 (100%)
Tazar- Piperacillin / Tazobactam	14 (58.33 %)	10 (41.67 %)	4 (100 %)	0 (0%)	0 (0%)	2 (100%)	--	--
Imipenem	8 (33.4%)	16 (66.6%)	1 (25%)	3 (75%)	2 (100%)	0 (0%)	--	--
Vancomycin	--	--	--	--	--	--	0 (0%)	1(100%)
Linezolid	--	--	--	--	--	--	0 (0%)	1(100%)
Colistin	0 (0%)	24 (100%)	0 (0%)	4 (100%)	0 (0%)	2 (100%)	--	--

Of the 24 cases with E.Coli isolates, Amikacin was sensitive in 17 (70.83%) cases followed by Nitrofurantoin 13 (54.17%), Tazar- Piperacillin / Tazobactam 10 (41.67%), Cefotaxime 3 (12.50%). Imipenem was resistant in 8(33.4%) cases and Colistin was sensitive in all cases.

Klebsiella pneumonia was isolated from 4 patients, Nitrofurantoin, and Tazar- Piperacillin / Tazobactam were resistant in all cases, and on the other hand, Cefotaxime and Colistin were sensitive in all cases. Imipenem was sensitive in 3 (75%) cases and Amikacin was resistant and sensitive in 2 (50%) cases each.

Pseudomonas aeruginosa was isolated from 2 cases, Nitrofurantoin and Imipenem were resistant in all cases, and on the other hand, Amikacin, Tazar- Piperacillin / Tazobactam, Colistin and Cefotaxime were sensitive in all cases.

Staphylococcus haemolyticus was isolated from one case, Nitrofurantoinshow resistant while Vancomycin,linezolid and amikacin were sensitive.

It is shown in table 16.

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Table 17:-Comparison of antibiotics susceptibility pattern *E.Coli* between diabetics and non-diabetics.

Antibiotics susceptibility pattern *E.Coli*	Diabetics(n=20)	Non-diabetics(n=24)	Total	P value
Nitrofurantoin				
R	7 (35%)	11 (45.83%)	18 (40.91%)	0.467†
S	13 (65%)	13 (54.17%)	26 (59.09%)	
Amikacin				
R	12 (60%)	7 (29.17%)	19 (43.18%)	0.04†
S	8 (40%)	17 (70.83%)	25 (56.82%)	
Colistin				
R	0 (0%)	0 (0%)	0 (0%)	NA
S	20 (100%)	24 (100%)	44 (100%)	
Tazar- Piperacillin / Tazobactam				
R	15 (75%)	14 (58.33%)	29 (65.91%)	0.246†
S	5 (25%)	10 (41.67%)	15 (34.09%)	
Cefotaxime				
R	19 (95%)	21 (87.50%)	40 (90.91%)	0.614*
S	1 (5%)	3 (12.50%)	4 (9.09%)	
Norfloxacin				
R	16(80%)	19(79.1%)	35(79.54%)	**1***
S	4(20%)	5(20.9%)	9(20.4%)	
Imipenem				
R	9 (45%)	8(33.3%)	17 (38.6%)	**0.**429†
S	11 (55%)	16 (66.6%)	27 (61.4%)	

*** Fisher's exact test, † Chi square test**

Distribution of susceptibility patterns of Nitrofurantoin, Colistin, Tazar- Piperacillin / Tazobactam, and Cefotaxime was comparable between diabetics and non-diabetics. (**Nitrofurantoin:-** R:- 35% vs 45.83% respectively, S:- 65% vs 54.17% respectively, (p value=0.467), **Colistin:-** R:- 0% vs 0% respectively, S:- 100% vs 100% respectively, **Tazar-Piperacillin / Tazobactam:-** R:- 75% vs 58.33% respectively, S:- 25% vs 41.67% respectively, (p value=0.246), **Cefotaxime:-** R:- 95% vs 87.50% respectively, S:- 5% vs 12.50% respectively, (p value=0.614), **Imipenem:-** R:- 45% vs 33.3% respectively, S:- 55% vs 66.6% respectively, (p value=0.429), **Norfloxacin:-** R:- 80% vs 79.50% respectively, S:- 20% vs 20.5% respectively, (p value=1).

The proportion of patients resistant to Amikacin was significantly higher in diabetics as compared to non-diabetics. (60% vs 29.17% respectively). The proportion of patients sensitive to Amikacin was significantly lower in diabetics as compared to non-diabetics. (40% vs 70.83% respectively). (p value=0.04)

It is shown in table 17.

Table 18:-Comparison of antibiotics susceptibility pattern *Pseudomonas aeruginosa* between diabetics and non-diabetics.

Antibiotics susceptibility pattern *Pseudomonas aeruginosa*	Diabetics(n=4)	Non-diabetics(n=2)	Total	P value
Nitrofurantoin				
R	4 (100%)	2 (100%)	6 (100%)	NA
Amikacin				

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R	1 (25%)	0 (0%)	1 (16.67%)	1*
S	3 (75%)	2 (100%)	5 (83.33%)	
Colistin				
R	0 (0%)	0 (0%)	0 (0%)	NA
S	4 (100%)	2 (100%)	6 (100%)	
Tazar- Piperacillin / Tazobactam				
R	1 (25%)	0 (0%)	1 (16.67%)	1*
S	3 (75%)	2 (100%)	5 (83.33%)	
Ceftazidime				
R	3 (75%)	0 (0%)	3 (50%)	0.4*
S	1 (25%)	2 (100%)	3 (50%)	
Norfloxacin				
R	3(75%)	2(100%)	5(83.3%)	1*
S	1(25%)	0(0%)	1(16.7%)	
Imipenem				
R	2 (50%)	2 (100%)	4 (66.67%)	0.467*
S	2 (50%)	0 (0%)	2 (33.33%)	

*** Fisher's exact test**

Nitrofurantoin was resistant in both diabetics and non-diabetics for *Pseudomonas aeruginosa*. The distribution of susceptibility to antibiotics was comparable between diabetics and non-diabetics. (**Amikacin:-** R:- 25% vs 0% respectively, S:- 75% vs 100% respectively, (p value=1), **Colistin:-** R:- 0% vs 0% respectively, S:- 100% vs 100% respectively, **Tazar-Piperacillin / Tazobactam:-** R:- 25% vs 0% respectively, S:- 75% vs 100% respectively, (p value=1), ***Ceftazidime*:-** R:- 75% vs 0% respectively, S:- 25% vs 100% respectively, (p value=0.4), **Imipenem:-** R:- 50% vs 100% respectively, S:- 50% vs 0% respectively, (p value=0.467)).**Norfloxacin:-** R:- 75% vs 100% respectively(p value=1), S:- 25% vs 0% respectively, (p value=0.467).

It is shown in table 18.

Table 19:-Comparison of antibiotics susceptibility pattern *Klebsiellapneumoniae* between diabetics and non-diabetics.

Antibiotics susceptibility pattern *Klebsiellapneumoniae*	Diabetics(n=5)	Non-diabetics(n=4)	Total	P value
Nitrofurantoin				
R	5 (100%)	4 (100%)	9 (100%)	NA
Amikacin				
R	3 (60%)	2 (50%)	5 (55.56%)	1*
S	2 (40%)	2 (50%)	4 (44.44%)	
Colistin				
R	0 (0%)	0 (0%)	0 (0%)	NA
S	5 (100%)	4 (100%)	9 (100%)	
Tazar- Piperacillin / Tazobactam				

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R	4 (80%)	4 (100%)	8 (88.89%)	1*
S	1 (20%)	0 (0%)	1 (11.11%)	
Norfloxacin				
R	4(80%)	3(75%)	7(77.7%)	1*
S	1(20%)	1(25%)	2(22.2%)	
Cefotaxime				
R	4 (80%)	0 (0%)	4 (44.44%)	0.048*
S	1 (20%)	4 (100%)	5 (55.56%)	
Imipenem				
R	2 (40%)	1 (25%)	3 (33.33%)	1
S	3 (60%)	3 (75%)	6 (66.67%)	

*** Fisher's exact test**

Nitrofurantoin was resistant in both diabetics and non-diabetics for *Klebsiellapneumoniae*. The proportion of patients resistant to Cefotaxime was significantly higher in diabetics as compared to non-diabetics. (80% vs 0% respectively). The proportion of patients sensitive to Cefotaxime was significantly lower in diabetics as compared to non-diabetics. (20% vs 100% respectively). (p value=0.048)

The distribution of susceptibility patterns of other antibiotics was comparable between diabetics and non-diabetics. (**Amikacin:-** R:- 60% vs 50% respectively, S:- 40% vs 50% respectively, (p value=1), **Colistin:-** R:- 0% vs 0% respectively, S:- 100% vs 100% respectively, **Tazar- Piperacillin / Tazobactam:-** R:- 80% vs 100% respectively, S:- 20% vs 0% respectively, (p value=1), **Imipenem:-** R:- 40% vs 25% respectively, S:- 60% vs 75% respectively, (p value=1)).**Norfloxacin:-** R:- 80% vs 75% respectively, S:- 20% vs 25% respectively, (p value=1).

It is shown in table 19.

Table 20:-Comparison of antibiotics susceptibility pattern *Staphylococcus* haemolyticus between diabetics and non-diabetics.

Antibiotics susceptibility pattern *Staphylococcus* haemolyticus	Diabetics(n=2)	Non-diabetics(n=1)	Total	P value
Nitrofurantoin				
R	2 (100%)	1 (100%)	3 (100%)	NA
Amikacin				
R	1 (50%)	0 (0%)	1 (33.33%)	1*
S	1 (50%)	1 (100%)	2 (66.67%)	
Linezolid				
S	2 (100%)	1 (100%)	3 (100%)	NA
Cefoxitin				
R	2 (100%)	1 (100%)	3 (100%)	NA
Vancyomycin				
s	2 (100%)	1 (100%)	3 (100%)	NA

*** Fisher's exact test**

Nitrofurantoin and cefoxitin was resistant in both diabetics and non-diabetics for *Staphylococcus haemolyticus*, while linezolid and vancyomycinwere sensitive in both diabetics and non-diabetics.

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Distribution of susceptibility pattern of Amikacin was comparable between diabetics and non-diabetics and is sensitive both diabetics and non-diabetics in one each case.

Discussion

Age

The majority 13(26%) of diabetics belonged to the age group 51-60 years followed by 61-70 years 11(22%), 41-50 years 10(20%), 31-40 years 7(14%), 18-30 years 5(10%) and >80 years 3(6%). The age group was 71-80 years with only 1 out of 50 patients (2%). The mean value of age(years) of diabetics was 52.68 ± 14.8. 10 (20%) while 10(20%) non-diabetics belonged to the age group 61-70 years followed by 71-80 years 9(18%), 18-30 years 8(16%), 51-60 years 8(16%), 31-40 years 7(14%) and 41-50 years 7(14%). Age(years) group was >80 years of only 1 out of 50 patients (2%). The mean value of age(years) of non-diabetics was 53.08 ± 18.5.

Hasan et al observed that most of patients (38%) who sufferduti had age >60 year among both groups which is to our study (13). In a similar study done by Vinod CS et al worker finds a similar observations where bulk of the patient that suffered uti belong to age group 60-69 years(14).

The mean age of the patients among diabetics and non-diabetics were 48 and 56 years respectively with no significant variations and almost similar trend were seen in a study conducted by Ramrakhia S et al where mean age was 46 and 52 years(15,16).

Though the mean age among diabetic were higher in study done by Aswani SM et al 60.2 ± 13.76 years similarly Kadhim A. found the mean age of the diabetic patients was 58 ± 12 and of non-diabetics 57 ± 13 years in contract to our study (17,22).

Gender

Among the diabetics males and females were equally infected with 25(50%) having uti in each group though females were show slight predominant in non-diabetics group,30(60%) had uti in compare to 20(40%) males.

Kumar R in their study observed that women in non-diabetic group were more infected in compare to males 62.4% to 37.6% and similarly Vinod CS and co-worker found similar trend of uti among males and females (19,14).

Other studies conducted by various authors have similar results where females were predominantly infected in compare to males (20,21).

Although a study conducted by Kadhim A. had females and males equally infected in both the groups (22).

Hba1c

Mean value of HbA1c(%) of diabetics was 7.93 ± 1.06 with median(25th-75th percentile) of 7.65(7.2-8.75).

Most of patients with poor glycemic index dvelopsymtomaticsuti and similar trends was observed by Aswani SM et al where majority of the diabetics with UTI (87.14 percent) had glycosylated hemoglobin (HbA1c) >6.5 percent(23).

Similarly Ibrahim Abdul et al observed that mean HbA1c levels in diabetics were significantly higher than in healthy controls (7.29 ± 2.4 % vs. 4.5 ± 1.8 %) ($P < 0.001$)(63). Diabetics with UTI majority (87.14%) had HBA1C >6.5% with $p<0.001$(52). Patients diagnosed with UTI had a significantly higher level of HbA1c level when compared to patients without UTI (24).

Duration of diabetes mellitus

The mean value of the duration of diabetes mellitus (years) of study subjects was 6.62 ± 4.17.

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In a similar study the mean duration of diabetes mellitus was 10 years (74 24). Schmitt JK et al resulted that the mean duration of diabetes mellitus was significantly greater in diabetic women with bacteriuria than in those without infection (9.9 ± 1.5 vs. 5.4 ± 0.4 yr, $P <$ .025)(79 25).Diabetes for more than 10 years was found to be statistically significant (p-value = 0.0001) in the study conducted by KothaiGnanamoorthy et al(78). In a study conducted by Tam CA et al, they observed that patients with DM >5 year duration were more prone to uti similarly Gorter KJ et al alresullts showed that risk of uti among the diabetics were higher with the duration of DM is >5 year (74 24). Although Boyko EJ et al showed no significant difference with the duration of diabetics (27).

Presenting complaints

In the majority 27(54%) of diabetics, fever was presently followed by dysuria 17(34%), increased frequency of urine15(30%), haematuria 14(28%) and incontinence 13(26%). Abdominal pain was present in only 11 out of 50 patients (22%).

In the majority 31(62%) of non-diabetics, dysuria was presently followed by fever 26(52%), abdominal pain 22(44%), incontinence 22(44%) and increased frequency of urine21(42%). Haematuria was present in only 11 out of 50 non-diabetics (22%).

Jagadeesan et al found that Dysuria was significantly higher among non-diabetics similar to our study(63%) (28). Though Kumar et al found fever, dysuria followed by increased frequency of urine were the most common symtoms among both diabetic and non-diabetics(19). Similarly Eshwarappa M et al found fever and dysuria were the most common clinical presentation(30).Kumar R et al did not found any significant difference in sign and symtoms among two groups with fever been the most common presentation followed by dysuria (19). Similar trends were observed by Aswani et al where fever and dyuria were most common presenting symptom with no significant variation among two groups(17). Though fever and dysuria were significantly higher in patients with diabetes compared to non-diabetic patients in a study conducted by Ramrakhia S et al(16).

Distribution of organisms

In the majority 20(40%) of diabetics, most common organism isolated was *E. coli* followed by *Candida species* 18(36%), *Klebsiellapneumoniae* 5(10%), *Pseudomonas aeruginosa* 4(8%), *Staphylococcus haemolyticus*2(4%) and *Acinetobacter* 1(2%). In 24(48%) of non-diabetics, organisms isolated were *E. Coli* followed by *Candida species* 19(38), *Klebsiellapneumoniae* 4(8%), *Pseudomonas aeruginosa* 2(4%) and *Staphylococcushaemolyticus.*

Gram negative bacteria with *E. coli* being the most predominant organism were the leading cause of UTI. Murray BO found Gram-negative bacilli were the leading causes of UTI, with *E. coli* being the most common pathogen (**32**). Ait-Mimoune N et al found that *E. coli* was the most prevalent isolated bacteria with a rate of 44.44%, followed by *Klebsiellapneumoniae* (12.21%), *Pseudomonas aeruginosa* (11.1%) and Proteus mirabilis (5.55%) (20).Similar findings were observed in the studies conducted by various authors. (**31,33**).

Antibiotic susceptibility pattern

In diabetics *E.coli* was isolated from 20 patients and Nitrofurantoin was sensitive in 13(65%) cases followed by Imipenem 11(55%), Amikacin 8(40%), Tazar- Piperacillin / Tazobactam 5(25%). Norfloxacin 4(20%) and Cefotaximewas sensitive only in 1 (5%) case. All these isolates were susceptible to Colistin. Many other authors have reported high rate of resistance to routinely used antibiotics among *E.coli* isolates (**34,35**).

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In the present study *Klebsiellapneumoniae* isolate showed high degree of resistance to antibiotics which corroborates the finding of Sharma et al (**36**).However Desouky et al and Sharma VS have reported *Klebsiella pneumonia* isolates to be sensitive to various antibiotics (**37,38**).

Antimicrobial susceptibility pattern of *Pseudomonas aeruginosa* isolates in present study showed that Amikacin and Tazar- Piperacillin / Tazobactam were sensitive in 3(75%) cases each followed by Imipenem 2(50%), Ceftazidime and norfloxacin in 1(25%) case each On the other hand, Nitrofurantoin was resistant in all cases while none of the isolate were found to be resistant to colistin. In a study conducted by Vinod CS et al showed that Pseudomonas was sensitive to amikacin and meropenem in app. 90% and 82% cases respectively (14).

The single isolate of *Acinetobacterspp*.,among the diabetics was found to be resistant to all the routinely used antibiotics while senstive to colistin only **.** This is in accordance with the study done byNorafikaet al (31).

In the present study the isolates from the non-diabetics also showed high level of resistance to common routinely used antibiotics.

On comparison of antimicrobial resistance patterns of various isolates among diabetics and non-diabetics in present study showed no significant difference resistant pattern. Different authors have also reported similar findings among the isolates from diabetics and non-diabetics. However amikacinwas found to be more susceptible in non-diabetics in present study(14,17,29).

The pattern of organisms causing the infection changes from place to place and also in the same place over the period of time. In addition, the emergence of resistance to antimicrobial agents has become a major threat. High degree of resistance to various routinely used common antibiotics is a serious therapeuticchallenge as it leaves fewer treatment options forphysician. Early treatment and appropriate use of antibiotics would reduce the risk of emergence of multi drug resistant organisms .For success of early empiricial treatment, periodic evaluation of cases to assess any changing trends in infecting organisms and their antimicrobial susceptibility is important.

Conclusion

In our study, we concluded that there was no significant difference in the incidence and signs and symptoms of uti among the diabetics and non-diabetics with respect to their age or gender though it was found that poor glycemic control makes the patients more prone to infection in comparison to strict diabetic control. Gram-negative organisms were the most common isolates from urine irrespective of age sex or diabetic state. All these isolates showed a high degree of resistance to commonly used antimicrobial agents. This posseses a serious therapeutic challenge as it limits the therapeutic option available. Routine surveillance of antimicrobial profile and susceptibility patterns should be conducted so that rational antibiotic policy could be adopted and it should be reviewed at regular intervals. This would serve as a guide for the clinicians for the empirical and definitive therapy while treating the patients.

Limitation

Single center study with small samplesize

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