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Studying the Clinical and Microbiological Elements of UTI in People with Diabetes Mellitus

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Abstract

Aim: To examine the clinical and microbiological characteristics of UTI as well as the pattern of antibiotic susceptibility for isolated organisms in people with diabetes mellitus. **Methods:** On 490 consecutive individuals with a confirmed UTI, prospective research was conducted. Hospital records and a special questionnaire were used to study the patients. **Results:** 89 patients (18.1%) of the 490 that were enrolled had diabetes mellitus. The mean ages of people with diabetes and those without it were 64.9 B 13.2 (SD) and 54.4 B 23.3, respectively. The majority of diabetics experienced asymptomatic bacteriuria and had more frequent bladder catheterizations than non-diabetics. Proteus sp. (7.9% vs. 7.2%), Pseudomonas sp. (6.7 vs. 8.2%), and Enterococcus sp. (6.7 vs. 7.2%) were the most common causes of UTI in diabetics and nondiabetics, respectively. For gentamicin, piperacillin, and norfloxacin, more than 50% of the isolated Pseudonomas sp. strains in both groups tested positive. During the follow-up period, both diabetics (52.8%) and non-diabetics (42.2%) experienced recurrent UTI; however, the difference in occurrences failed to achieve statistical significance. **Conclusion:** Except for the fact that diabetics have bladder catheterization more frequently than non-diabetics do, there were no discernible differences in the epidemiological, clinical, or microbiological characteristics of diabetics and non-diabetics.

Keywords: Diabetes, UTI, Leucocytosis, Culture positive, Microbiological profile.

Introduction

The largest cause of death and disability in the world is diabetes mellitus[1,2]. Its prevalence was approximately 8% worldwide in 2011; by 2030, it is expected to increase to 10%[3]. Patients with diabetes should be particularly cautious about infections. Diabetes weakens the immune system, which reduces the body's capacity to fight infections. Diabetes patients are more likely to have urinary tract infections, yeast infections, foot infections, and infections at surgical sites. According to studies, infections have the worst effects on those with diabetes.

Even while hospitalised patients do not have a high mortality rate, their hospital stays and recovery periods are longer[4-6]. In outpatient primary care clinics, urinary tract infections (UTI) rank second among infectious complaints. By definition, it refers to an invasion of the urinary tract by bacteria or non-bacteria that can happen anywhere between the urethra and the kidney. Young children and sexually active women frequently experience UTI. Anatomically, upper and lower tract infections (UTIs) can exist[7].

According to estimates, UTI cause 7 million hospital visits annually, including 1 million trips to the emergency room. A suitable culture media for bacterial growth is urine. Ascending from the peri urethral region is by far the most frequent way for bacteria to reach the urinary tract. Because their urethras are shorter and located close to the anus, women are thought to be more susceptible to UTIs than men. Uncomplicated UTIs are often those that affect young, healthy, non-pregnant women. UTIs that are complicated are those that involve the bladder or that develop as a result of anatomical or functional anomalies that compromise urinary tract drainage.

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The majority of complex UTIs have nosocomial origins[8]. Diabetes has an impact on a number of defence mechanisms that help prevent both generalised infection and, more particularly, urinary tract infections. UTIs are more common in diabetics due to poor circulation, a lower white blood cell capacity to combat infection, and dysfunctional, weakly contracting bladders[9]. Diabetics without any clinical indication of a UTI frequently have asymptomatic bladder infections identified by a positive urine culture. Since UTI is one of the most prevalent infections, empirical antibiotic therapy is typically utilised. For this, knowledge of the most frequent uropathogens and their resistance to regularly used antibiotics is required.

In the presence of risk factors including increased age, comorbidities, and immunosuppression, treatment becomes even more difficult. Studies conducted all across the world have revealed shifting trends in the aetiology of UTIs[10], But there aren't many studies on UTI and the distribution of antibiotic resistance in India[11]. Guidelines for the empirical therapy of UTIs while awaiting the culture sensitivity must take into account the current developments in uropathogens and their resistance to different antibiotics. In a South Indian tertiary hospital setting, the current study aims to evaluate the prevalence, risk factors, bacteria, and pattern of antibiotic sensitivity in diabetics with urinary tract infections.

Methods

The UTI service at IMS & Sum Hospital, Bhubaneswar, Odishaenrolled all patients with significant bacteriuria (6100,000 CFU/ml in a single urine sample from symptomatic patients or in two consecutive urine samples from asymptomatic patients). 462 patients had their urine sample taken midstream, and 28 had their bladder catheterized. One of the authors studied all of the UTI patients using a specific questionnaire that recorded information about any possible past UTI histories, whether patients had UTI symptoms or not, previous antibiotic treatments, and a history of any conditions or illnesses that are known to be associated with a higher incidence of

urinary infections.Of the 490 UTI patients investigated, 89% had diabetes mellitus.

Of the 89 diabetic patients with UTI, 45 had their histories of diabetes and its consequences more thoroughly examined. In 203 non-diabetic patients and 36 diabetic patients, clinical and microbiological follow-up lasting longer than 4 weeks was obtained.

At IMS & Sum Hospital, Bhubaneswar, Odisha, UTI Service, 490 people were discovered to have severe bacteriuria. In 89 individuals (18.1%), diabetes mellitus was present (59 females and 30 males). 283 female and 118 male patients made up the 401 non-diabetic patients. The age distribution among diabetics and non-diabetics was as follows: the mean age of diabetic and non-diabetic patients was, respectively, 64.9 B 13.2 years (range 25-87) and 54.4 B 23.3 years (range 1-89).

Results

Table 1: Distribution of symptoms of UTI in diabetic and nondiabetic patients

Patients	Symptoms	n		%
Diabetics	present	41	46.1	lower tract 78.1% upper tract 21.9%
	absent	48	53.9	
Nondiabetics	present	242	60.3	lower tract 71.5% upper tract 28.5%
	absent	159	39.7	

39 of the 45 diabetic individuals who underwent a more thorough analysis had type II diabetes, 5 had type I diabetes, and 1 had post-pancreasectomy diabetes. Diabetes could last anywhere from 0 to 50 years, with a mean of 17.2 B 12.2 years. In instance, 46.6% of patients reported that their illness had lasted more than 20 years. Based on serum HbA1c and serum fructosamine levels, the metabolic control of diabetes was assessed; 60% of diabetic patients had suboptimal metabolic control, with a mean HbA1c of 8.6 B 2.05% and a mean level of serum fructosamine of 299.6 B 106.8 mmol. No patients had diabetic nephropathy, 28 patients had a cardiovascu- lar disease, 12 had retinopathy and 13 had a peripheral neuropathy. Note that 53.9% of diabetics and 39.7% of nondiabetic patients presented with asymptomatic UTI; the differences, however, were not statistically significant. Typical symptoms of upper urinary tract involvement were present in 21.9% of diabetics and in 28.5% of the nondiabetics; the distribution of symptoms in the two groups of patients is shown in table 1. Also, 83.6% of diabetics and 69.9% of nondiabetic patients had at least one bladder catheterization in the past; here the difference reached statistical significance ($p<0.03$).

Table2.Urinaryisolatesindiabeticand	**Isolates**	**Hospital-acquired infections**		**Community-**	**acquiredinfections**
Origin of infection(in%)		D(n=31)	ND(n=127)	D(n=58)	ND(n=274)
	E.coli	45.1	38.6	62.1	65
	*Enterococcus*sp.	9.6	17.3	5.2	6.1
	*Pseudomonas*sp.	19.3	16.5	0	4.3
	*Proteus*sp.	9.7	3.9	6.9	8.7
	*Klebsiella*sp.	3.2	5.5	1.7	2.9
	Others	13.1	18.2	24.1	13

Table3.Resistanceinvitroof*E.coli* isolatedindiabeticsandnondiabeticswithUTIinrelationtotheoriginofinfection	**Antibiotics**	**D(n=14)**	**Hospital-acquiredstrains ND(n=49)**	**ty-acquiredstrains ND(n=179)**
(in%)				
	Cotrimoxazole	33.3	20.8	15.1	11.6
	Amikacin	0	0	2.8	0
	Ampicillin	38.5	38.7	19.4	24.1
	Ceftriaxone	7.7	2.1	2.8	0
	Ceftazidime	7.7	2	2.8	0
	Norfloxacin	23.1	12.2	8.3	4.5
	Aztreonam	7.7	0	2.8	0.5
	Nitrofurantoin	15.4	12.2	2.8	2.2
	Gentamicin	15.4	2	2.8	1.6
	Imipenem	0	0	0	0
	Piperacillin	0	10.2	5.5	9.1

D=Diabetics;ND=nondiabetics.

In diabetic and nondiabetic patients, E. coli was recovered in 56.1 and 56.8% of cases, respectively; figure 2 also displays the most common isolates in these patients. 127 non-diabetics and 31 diabetics both had hospital-acquired UTIs. According to the place of infection (hospital or community acquired), Table 2 indicates the frequency of isolated bacteria in the two groups; the differences were not statistically significant. Enterococcus sp. and Pseudomonas sp. identified as significant uropathogens in both groups of hospital-acquired infections. It was determined how susceptible E. coli and Pseudomonas sp. were in vitro. Antibiotic resistance was higher in hospital-acquired strains than in community-acquired strains. Compared to E. coli isolated from nondiabetics, nosocomial E. coli bacteria in diabetics were more resistant to norfloxacin, gentamicin, impipenem, and trimethoprim-sulfame-thoxazole. The differences, however, were not statistically significant. As compared to Pseudomonas sp. isolated from non-diabetic patients, Pseudomonas sp. isolated from diabetes patients with nosocomial UTI was more resistant to aztreonam, norfloxacin, and ceftazidime. Relapse or

reinfection was noted in 42.9% of nondiabetic patients and 52.8% of diabetic patients within 4 weeks of the conclusion of an antibiotic medication course; the difference was not statistically significant.

Discussion

In this investigation, which had 490 consecutive UTI patients, we found that concomitant diabetes mellitus was present in 18.1% of the cases. Because we performed urine cultures in our microbiology lab on the majority of diabetic patients seen at IMS & Sum Hospital, Bhubaneswar, Odisha, it is likely that we discovered a high percentage of diabetics in our series of UTI patients. UTI were more common in girls than in males, as was to be expected. Urinary tract infections were more common in elderly diabetic individuals (150 years) than in non-diabetics of the same age.

In fact, 83.3% of our diabetic patients (vs. 69.9% of non-diabetics) had at least one prior bladder catheterization, which may be related to the high frequency with which long-term diabetics, especially those with complications of the disease, undergo more frequent hospitalizations and are exposed to invasive procedures on the urinary tract. Although the difference did not reach statistical significance in our study, asymptomatic bacteriuria rates were higher in diabetics than in nondiabetics in accordance with literature data[12,14]. Asymptomatic bacteriuria does not rule out involvement of the upper urinary tract, and numerous authors have noted frequent infectious kidney involvement in diabetics[13].

Regarding these observations, we discovered that over 60% of diabetics had cardiovascular disease, 28.9% had peripheral neuropathy, 26.6% had retinopathy, no patients had clinically relevant nephropathy, and about 50% of our patients had had diabetes for more than 20 years. Numerous authors have attempted to link the pathogenesis of UTI with long disease duration and its complications, as well as inadequate metabolic control of the disease. All of the aforementioned things might be thought of as significant risk factors for urinary infections in the patients. E. coli, Pseudomonas sp., and Enterococcus sp. were the most frequently isolated bacteria in the two patient groups.

The high frequency of urinary tract procedures among the diabetic and nondiabetic patients studied, as well as the fact that most patients in both groups had recurrent UTIs in the past and consequently received multiple courses of antibiotics, may be related to the high number of isolated Pseudomonas sp. and Enterococcus sp (fluoroquinolones and cephalosporins). Regarding in vitro susceptibility, we found that E. coli and Pseudomonas sp. isolated from nosocomial UTI patients were more resistant to antibiotics than those isolated from non-nosocomial UTI patients. In particular, we found that the microorganisms isolated from diabetic patients were more resistant than those isolated from non-diabetics.

Except for ampicillin, norfloxacin, and trimethoprim-sulfamethoxazole, all antibiotics examined were effective against more than 85% of the E. coli strains isolated from diabetic and nondiabetic patients. More than 85% of Pseudomonas sp. strains from the individuals investigated were in vitro sensitive to imipenem and ceftazidime. Following an antibiotic course of therapy, diabetes patients experienced UTI recurrences more frequently than nondiabetic patients did.

Conclusion

These findings demonstrate that it is more challenging to completely eradicate UTIs in diabetes patients than in non-diabetic ones, and diabetic patients also appear to have risk factors that may make them susceptible to reinfections. In order to more accurately quantify the risk of urinary tract reinfections in the diabetic population, further research is needed.

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