INTRODUCTION

Diabetes mellitus (DM) has a number of effects on genitourinary system. Patients with diabetes mellitus are at increased risk for urinary tract infection [1]. Urinary Tract Infection (UTI) is more common in diabetics because of a combination of host and local risk factors [2]. Under some circumstances urine may be inhibitory or even bactericidal against uro-pathogens. Modification of chemical composition of urine in diabetes mellitus can alter the ability of urine and support the growth of microorganisms. Autonomic neuropathy in diabetes mellitus impairs bladder emptying and subsequent urological manipulation pre-dispose to UTI [3].

Escherichia are the most common bacterial pathogen causing urinary infection in patients with diabetes, the other two most common being Klebsiella and Enterococci species [4]. Therefore this study has been undertaken to assess the prevalence of urinary tract infection, the most common causative pathogens and their resistance pattern in diabetic patients.

MATERIALS AND METHODS

A total of 400 diabetic patients who presented with suspected UTI were studied for a period of nine months (From March 2020 to November 2020). The symptoms that lead to the suspicion of UTI include-Fever, dysuria, urinary incontinence, supra-pubic pain, frequency and urgency if urination. Diagnosis of diabetes was made based on the WHO criteria [5]. Clean voided midstream urine samples were collected in sterile containers after giving proper instructions and samples were processed in the laboratory within 2 h of collection. Urine cultures were done by inoculating urine samples on blood agar plates using a calibrated loop (0.001 ml) and incubated at 37 degrees Celsius for 18-24 h. The culture reports were considered positive when they had colony-forming units more than 105/ml of voided urine. The pathogens were isolated and biochemical tests were done for identifying the species of the pathogens. Antimicrobial sensitivity was done by the Kirby-Bauer disc diffusion method.

RESULTS

Four hundred Diabetic patients with symptoms of urinary tract infections were screened during this period. During this period, the most common microorganism isolated, tabulated in table 1, includes Escherichia Coli, Klebsiella Pneumoniae and Enterococcus. The other microorganisms that were infrequently isolated from the urine culture samples were Acinetobacter, Pseudomonas, Enterobacter, Citrobacter, Staphylococcus, Candidia, Streptococcus, Proteus, Serratia.

Table 2 shows the resistance pattern of the common organisms isolated. The Escherichia Coli isolates obtained were found to be having maximum resistance to Ciprofloxacin (92%), Cefuroxime (83%) and Ampicillin (97%). Least resistance was seen in Amikacin, Ertapenem and Norfloxacin. These are shown in table 3.

Table 1: Major bacteria isolated

| Bacteria Isolated       | Percentage (%) |
|-------------------------|----------------|
| Escherichia coli        | 48.75          |
| Klebsiella pneumoniae   | 14             |
| Enterococcus           | 11.75          |

Table 2: Resistant patterns of most common bacterial isolates from UTI in diabetics

|            | Amp | Amk | Azm | Cfx | Cip | Col | Cxm | Etp | Gen | Nor | Ofx |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| E. Coli    | 97  | 4   | NA  | 65  | 92  | 68  | 83  | 9   | 50  | 9   | 69  |
| Klebsiella | 100 | 75  | NA  | 55  | 63  | 25  | 61  | 10  | 38  | 53  | 33  |
| Enterococcus | 67  | NA  | NA  | 5   | 100 | NA  | NA  | 100 | NA  | 100 | 100 |
Table 3: Sensitivity pattern of E Coli

| E. Coli | Sensitive | Resistant |
|---------|-----------|-----------|
| Ampicillin | 3 | 97 |
| Amikacin | 96 | 4 |
| Azithromycin | NA | NA |
| Cefazolin | 35 | 65 |
| Ciprofloxacin | 8 | 92 |
| Colistin | 32 | 68 |
| Cefuroxime | 17 | 83 |
| Ertapenem | 91 | 9 |
| Gentamycin | 50 | 50 |
| Norfloxacin | 91 | 9 |
| Ofloxacin | 31 | 69 |

In the case of Klebsiella Pneumoniae, as shown in table 4, increased resistance was seen towards Ampicillin (100%) followed by Amikacin (75%). Least resistance was seen towards Ertapenem (10%).

Table 4: Sensitivity pattern of Klebsiella

| Klebsiella | Sensitive | Resistant |
|-----------|-----------|-----------|
| Ampicillin | 0 | 100 |
| Amikacin | 25 | 75 |
| Azithromycin | NA | NA |
| Cefazolin | 45 | 55 |
| Ciprofloxacin | 37 | 63 |
| Colistin | 75 | 25 |
| Cefuroxime | 39 | 61 |
| Ertapenem | 90 | 10 |
| Gentamycin | 62 | 38 |
| Norfloxacin | 47 | 53 |
| Ofloxacin | 67 | 33 |

In the case of Enterococcus, increased resistance towards Ciprofloxacin (100%) and least resistance were seen to Cefazolin (5%). This is shown in table 5.

Table 5: Sensitivity pattern Enterococcus

| Enterococcus | Sensitive | Resistant |
|--------------|-----------|-----------|
| Ampicillin | 33 | 67 |
| Amikacin | NA | NA |
| Azithromycin | NA | NA |
| Cefazolin | 95 | 5 |
| Ciprofloxacin | 0 | 100 |
| Colistin | NA | NA |
| Cefuroxime | NA | NA |
| Ertapenem | 0 | 100 |
| Gentamycin | NA | NA |
| Norfloxacin | 0 | 100 |
| Ofloxacin | 0 | 100 |

DISCUSSION

In our study it was found that gram-negative bacilli (75%) were the most common organisms for urinary tract infections in diabetics. Of this approximately 50% were E. Coli. Among the Gram positive bacterias isolated, around 70% of them were Enterococcus [6].

In clinical settings, Ciprofloxacin, is used as empiric treatment for urinary tract infection. In our study, it was found that E. Coli which is the most common organism that causes UTI, was resistant to Ciprofloxacin in 92% of the isolates. Ironically, Norfloxacin, which belongs to an older generation of Quinolone, eradicated 91% of the E. Coli. This may be due to the more common use of Ciprofloxacin in the current era of treating Urinary Tract Infections [7]. The above situation is similar to Typhoid bacteria. In 1970s, Chloramphenicol was the drug of choice for Typhoid fever. Subsequently, the bacteria developed resistance to Chloramphenicol and Ciprofloxacin was used as the empiric choice for treating Typhoid fever. In the last few years, the bacteria has become resistant to Ciprofloxacin and has become sensitive to Chloramphenicol again [8-10].

The above information can be clinically applied to treat urinary tract infection by choosing Norfloxacin instead of Ciprofloxacin as the primary drug of choice for treating UTI in diabetics.

The second commonest organism isolated in the urine cultures were Klebsiella. Klebsiella was sensitive to 2/3rd of the patients to Ofloxacin. It was resistant to most of the patients to Ciprofloxacin as well as Norfloxacin. So Ofloxacin given orally will be effective in most of the patients in treating Klebsiella.

While, Amikacin which is one of the commonest aminoglycosides used in the parental treatment of Klebsiella urinary tract infections, was found to be resistant. While Ertapenem, which is a newer Monobactam was found to be sensitive to 90% of the patients. Hence Urosepsis due to Klebsiella, Ofloxacin will be the choice of oral treatment, while in more severe cases, parental treatment with Ertapenem will be the ideal drug of choice.

Enterococcus species caused most of the gram-positive urinary tract infection. It is sensitive to 95% of the isolates to Cefazolin.
While all the isolates (100%) were resistant to Ciprofloxacin. Again, this can be due to overuse of this quinolone causing resistant species of bacteria. Hence when gram-positive treatment is considered in Urosepsis, Cefazolin should be the empirical drug of choice.

CONCLUSION

In conclusion, Gram-negative bacteria were highly sensitive to Norfloxacin and Ofloxacin, and Gram-Positive bacteria were more susceptible to Cefazolins in the case of a Urinary Tract Infection of diabetic patients. Since there are new emerging patterns of resistance seen in patients with Diabetics with UTIs, it is recommended that continued surveillance of resistance rates is needed to ensure appropriate treatment of these infections.

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AUTHORS CONTRIBUTIONS

All the authors have contributed equally.

CONFLICT OF INTERESTS

Declared none

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