



# A CLINICAL STUDY ON PREVALENCE OF INFECTIONS AND RESISTANCE PATTERN OF ANTIBIOTICS AMONG TYPE II DIABETES MELLITUS PATIENTS

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## ABSTRACT

Diabetes mellitus is the most common, debilitating, chronic, attenuating endocrine disease that results in increased public health and clinical problems. Infectious diseases are more prevalent in individuals with diabetes mellitus. The risk of infection among diabetic patients appears to be independent of age, sex and co morbid conditions. Antimicrobial resistance is well-known clinical and public health problem. Beta-lactamase resistance has increased significantly being encountered in Enterobacteriaceae and Pseudomonas species. A prospective observational study was conducted for a period of six months in a tertiary care teaching hospital, Palakkad. A data entry form was designed to collect the demographic data and laboratory investigations regarding the patient condition. Statistical analysis was then performed on the obtaining data using Microsoft excel programmer. The study showed a predominant of male gender (56%) and most common infection was SSTI (48%) followed by UTI (28%) and RTI (17%). Duration of 10-15 years of diabetes showed the highest rate of infections. Skin infections were associated with smoking. Cephalosporins were mostly prescribed (32%) and resistant (35%) antibiotic among study population. Staphylococcus aureus was the most common pathogen isolated (52%) in SSTI followed by E.Coli (75%) in UTI. The degree of infections rate was increased along with the dramatic increase in diabetic populations. SSTI and UTI are the more prevalent infections. Cephalosporins are the mostly prescribed and show high resistance towards the organisms.

**Keywords :-**SSTI, UTI, Cephalosporins, RTI.

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## INTRODUCTION

Diabetes mellitus (DM) is a group of complex metabolic syndrome exhibiting high blood sugar levels over an extended period of time [1]. It is characterized by deficiency of insulin secretion or action, which leads gross defects in glucose, fat and protein metabolism. DM is a major endocrine related disorder causing severe morbidity and mortality all over the world and constitutes an alarming concern to the global population. DM is multi factorial disease which is considered as one of the largest emerging threats to health in the 21<sup>st</sup> century. DM caused

4.6 million deaths in 2011. The number of people with DM in India is currently around 61.3 million and is expected to rise to 101.2 million by 2030 due to multidimensional factors including genetic influences combined with environmental factors [2-5].

Infectious diseases are more prevalent in individuals with DM. The main pathogenic mechanisms are hyperglycemic environment increasing the virulence of some pathogens lowers the production of interleukins in response to infection, reduced chemotaxis and

phagocytic activity, immobilization of polymer phonuclear leukocytes, glycosuria, gastrointestinal and urinary dysmotility. DM has been associated with reduced response of T cells, neutrophil function, and disorders of humoral immunity [6]. The prevalence of DM depends on various factors act in complex manner such as age, sex, heredity, diet, socio-economic conditions and physical activity, environmental factors, life style choices etc[7-8].

Studies have shown that both common and rare infections are more prevalent among patients with DM than among the general population. Patients with DM appeared to have an increased risk of asymptomatic bacteriuria and urinary tract infection, skin and mucous membrane infection, including *Candida* infections and infections of the foot and respiratory tract infection [9].

While antibiotics are effective against most bacteria and may help shorten the duration of symptoms, it must always be kept in mind that antimicrobial therapy should be reserved for severe, prolonged or potentially complicated cases, as most patients respond fairly well to supportive therapy, and their indiscriminate use carries the danger of increasing antimicrobial resistance and brings no benefit to patients with mild presentations [10].

The growing phenomenon bacterial resistance, caused by the use and abuse of antibiotics and the simultaneous decline in research and development of new medicines is now threatening to take us back to pre-antibiotic era. Antibiotic dosages are designed to eradicate entire populations of the pathogens. When antibiotics are not taken for the entire prescribed course, pathogenic bacteria can adapt to the presence of low dose antibiotics, and eventually form a population that is completely resistant to the antibiotic regardless of the dosage.

The 6 main causes of antibiotic resistance have been linked to like Over-prescription of antibiotics, Patients not finishing the entire antibiotic course, Overuse of antibiotics in livestock and fish farming, Poor infection control in health care settings, Poor hygiene and sanitation, Absence of new antibiotics being discovered.<sup>11</sup> Thus in the overview of above scenario we have conducted a study on prevalence of infections and antimicrobial resistance in patients with DM.

## MATERIALS AND METHODS

A prospective observational study was conducted at Karuna medical college Vilayodi, Chittur for a period of 6 months (November 2017- April 2018). A data entry form was prepared to collect data pertaining to the demographics and clinical laboratory investigations of the patients. Data's were collected from the inpatient and outpatient departments of Medicine, Surgery and Urology. Treatment charts of the patients were reviewed prospectively for the prescription patterns of antibiotics by the clinicians and were followed up with culture and sensitivity reports. Data collected from each of the

patients, included their demographic details, cultures and sensitivity reports. All the above data was recorded in a data collection form for further analysis and interpretation.

All patients with type II DM presenting with infections admitted in the hospital were enrolled in the study. Those patients who did not have type II DM and were unwilling to participate were excluded. Immune-compromised patients and undergoing chemotherapy and on immunosuppressant were excluded from the study.

## RESULTS AND DISCUSSION

A total of 150 patients with DM with infections were included in the study who visited Karuna medical college hospital during November 2016 to April 2017. The data obtained were evaluated and observations are discussed below:

We found that out of 150 patients 84(56%) patients were male and 66(44%) patients were females. In the age wise distribution most of the patients are coming under the age group 60- 70 followed by 50- 60, greater than 70, 40- 50 respectively. The patients were least from the age group less than 40(Fig 1). The onset of diabetes is more likely from around 50years of age.

DM with infections may be due to various risk factors. In SSTI most of the patients were associated with smoking (n=38) and alcoholism (n=32), 12 patients were pan masala users and 8 were tobacco users. In UTI most of the patients were tobacco users (n=10) followed by alcoholics (n=6), smokers (n=5) and pan masala users (n=2) and 21 UTI patients were without any risk factors.

In RTI the most common risk factor is smoking (n=15) followed by alcoholism (n=10), tobacco (n=6) and pan masala (n=5). In GIT infections alcoholism (n=7) was the most common risk factor followed by smoking (n=4). The FBS levels of the alcoholic type 2 diabetics will be significantly higher than those of the non alcoholic type 2 diabetics. Diabetes and alcohol consumption are the two most common underlying causes of peripheral neuropathy.

The DM history of the patients shown in the Figure 2 shows that the maximum number of patients were having a history of DM for 10 – 15 years (56%) followed by a history of DM for less than 1 year (14%), 1 – 5 years DM history (10.6%) and 5 - 10 years of DM history (6%).

Figure 3 shows the rate of infection in diabetic patients. Out of total cases most of the patients were with skin and soft tissue infections (n=72) followed by genitourinary (n=42), respiratory tract infections (n=26) and GIT infections (n=10). The genitourinary infections and skin infections are more common with diabetic patients.

Among study populations out of 150, in 72 SSTI, foot ulcer (55.5%), followed by cellulites (33.3%) are the mostly seen infections and in 42 UTI, asymptomatic

16(38%) UTI were mostly seen. Table 1 shows the prescribing pattern of antibiotics in various infections in which cephalosporins were the most common class of antibiotic prescribed in SSTI, UTI, and RTI. In git infection fluoroquinolones were the most common class of antibiotics prescribed. Cephalosporins are more widely prescribed due to their broad spectrum of action against most microbes causing respiratory tract, skin and soft tissue and urinary tract infections.

The organisms isolated from the culture reports. It is seen that staphylococcus aureus (n=24) was the most common organism isolated in SSTI. It was followed by Enterococcus (n=12), Proteus mirabilis (n=10) and Klebsiella pneumonia (n=10), E.coli (n=4) and P.aeruginosa (n=4) P. vulgaris (n=2) and coagulase negative SA (n=2).

The isolated organisms from the urine sample shows that E.coli (n=15) is the most predominant organism where only one or two samples of K.pneumoniae and coagulase negative SA were isolated. The resistance patterns of isolated organisms from SSTI were depicted fig 4 which showed that SA was highly resistant to Cephalosporins followed by fluoroquinolones, and penicillins. The Enterococcus was mostly resistant to Cephalosporins and Doxycycline. P.mirabilis were mostly resistant to Cotrimoxazole followed by Doxycycline, Penicillin, and Cephalosporin. K.pneumoniae was resistant to Pencillins followed by Cephalosporins ,Cotrimoxazole, Aminoglycosides , Fluoroquinolones. The results varied in great amount to that of other studies wherein fluoroquinolones and cephalosporins were the highly resistant antibiotics. The MRSA variants were; less unlike

other studies

The sensitivity pattern of isolated organisms shows SA was highly sensitive to Doxycycline followed by Vancomycin ,Pencillin , Cotrimoxazole , Linezolid and Cephalosporins. The Enterococcus was sensitive to Pencillin ,Cephalosporins , Cotrimoxazole, Fluoroquinolones , Linezolid, Vancomycin, Erythromycin and Aminoglycosides . The P.mirabilis was highly sensitive to cephalosporins followed by Aminoglycosides ,Fluoroquinolones , and Linezolid. The K.pneumoniae was also mostly sensitive to Cephalosporins , followed by cotrimoxazole , Fluoroquinolones ,Doxycycline , Aminoglycosides and Pencillins.

The resistance pattern of E.coli in table 2 shows that it was highly resistant to Nitrofurantoin which is the commonly prescribed drug in UTI, followed by Norfloxacin, Ciprofloxacin, Cefuroxime, Gentamycin and Cefixime and the sensitivity pattern of the E. coli in which it is highly sensitive to Norfloxacin which is also highly resistant, followed by Gentamycin, Ceftazidime, Cotrimoxazole, Cefuroxime Nitrofurantoin, Imipenam, Meropenam, ceftazidime, Levofloxacin and Amikacin.

Fig 5 shows the resistance and sensitivity pattern of SA and E.coli towards cephalosporins. SA isolated from SSTI shows that it is highly resistant and less sensitive to second and third generation cephalosporins. E.coli isolated from UTI was highly sensitive and less resistant to second and third generation cephalosporins. According to other studies both SA and E.coli were equally resistant to cephalosporins while in our study E.coli was sensitive because they are less likely prescribed in UTI.

**Table 1. Prescribing pattern of antibiotics among various infections:**

S.no	Antibiotics	SSTI		UTI		RTI		GITI	
		n	%	n	%	n	%	n	%
1	<b>Cephalosporins</b>	46	<b>31</b>	1	<b>29</b>	18	<b>42</b>	2	20
2	<b>Fluroquinolones</b>	26	17	19	26	14	33	7	<b>70</b>
3	<b>Aminoglycosides</b>	20	13	7	10	5	12	-	-
4	<b>Pencillins</b>	22	15	14	19	2	5	1	10
5	<b>Clindamycin</b>	2	1.3	-	-	-	-	-	-
6	<b>Linezolid</b>	22	15	4	5	-	-	-	-
7	<b>Doxycycline</b>	8	5.3	-	-	-	-	-	-
9	<b>Cotrimoxazole</b>	-	-	-	-	-	-	-	-
10	<b>Macrolides</b>	4	3	-	-	2	5	-	-
11	<b>Nitrofurantoin</b>	-	-	8	11	1	2	-	-
12	<b>Vancomycin</b>	-	-	-	-	1	-	-	-

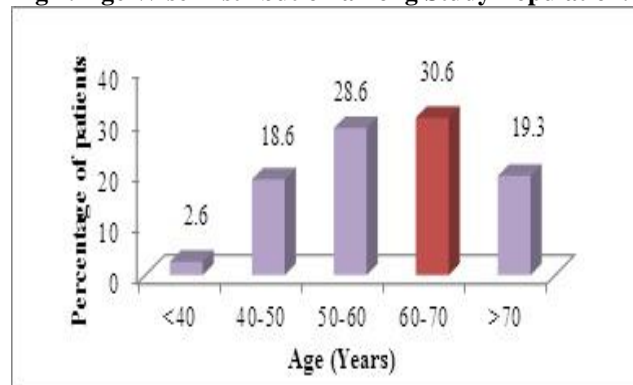
SSTI- Skin and soft tissue infections, UTI- Urinary tract infections, RTI- Respiratory tract infections, GITI- Gastrointestinal tract infections

**Table 2. Susceptibility pattern of E.coli in UTI**

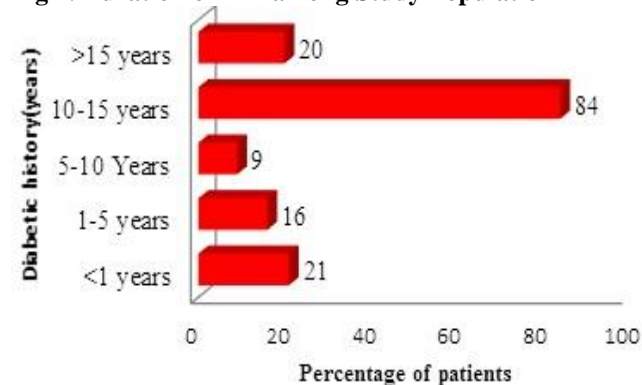
Antibiotics	Number of samples(n=15)	
	Resistance (n)	Sensitivity(n)
Nitrofurantoin	<b>8</b>	<b>4</b>
Norfloxacin	<b>7</b>	<b>9</b>

Ciprofloxacin	5	-
Cefuroxime	4	5
Gentamicin	4	8
Cefoxitin	3	3
TMP-SMX	1	6
Ceftazidime	-	7
Meropenem	-	3
Imipenem	-	3
Levofloxacin	-	2

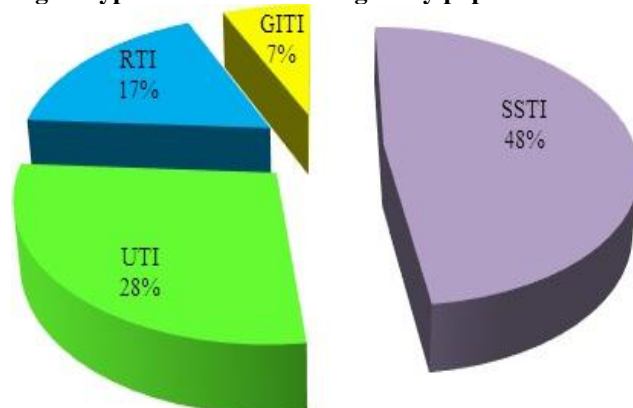
**Fig 1. Age Wise Distribution among Study Population.**



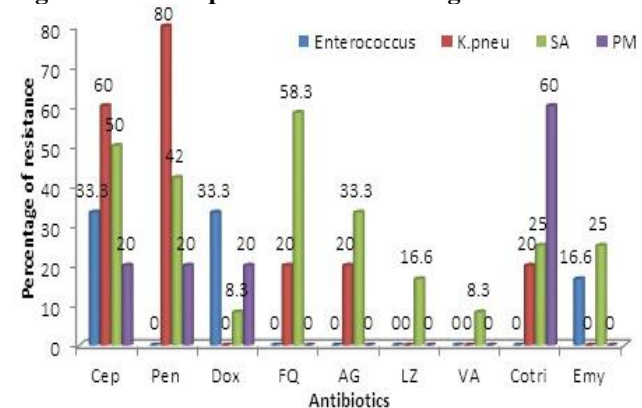
**Fig 2. Duration of DM among Study Population**



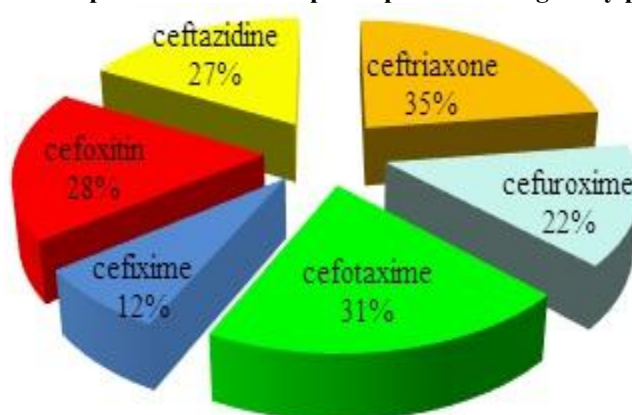
**Fig 3. Types of infection among study population**



**Fig 4. Resistance pattern of isolated organisms in SSSI.**



**Fig 5. Resistance pattern towards Cephalosporin's among study population.**



## CONCLUSION

SSTI and UTI are the major infectious diseases associated with worse outcomes in DM patients. Gram-negative organisms like *E. coli*, *Pseudomonas Aeruginosa*, *Klebsiella pneumonia* and *Proteus mirabilis* were found to be the resistant ones highest being with *E. coli*. Among the gram-positive organisms *S. aureus* and *Enterococci* were identified as the resistant organisms. All were more than 2-3 antibiotics and sensitivity also was to resistant identified against more than 2-3 antibiotics.

Antibiotic resistance has emerged due to its frequent use. This resistance was seen more in the elderly males and females. Increasing antibiotic resistance trends indicate that it is imperative to rationalize the use of

antimicrobials in the community and also use this conservatively. AMR was more with hospital acquired organisms and against commonly used antibiotics that are available since long period. Periodic AMR monitoring and rotation of antibiotics are suggested to restrict further emergence of resistance.

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## CONFLICT OF INTEREST

No interest

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