

ORIGINAL ARTICLE

FREQUENCY OF COMMON CAUSATIVE ORGANISM AND THEIR ANTIBIOTIC SENSITIVITY IN DIABETIC FOOT ULCER PATIENTS PRESENTED AT GULAB DEVI TEACHING HOSPITAL

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ABSTRACT

Background: Diabetic foot ulcers are the most common ulcer presentation in surgical and medical units. The drug resistance against antibiotics is continuously increasing due to overuse of antibiotics by general practitioners. The objective of this study was to determine organisms involved in diabetic foot ulcers and their susceptibility to antibiotics for use as empirical therapy.

Materials & Methods: It was a cross sectional study held at Surgical Department of Gulab Devi Teaching hospital from January 2021 to December 2021. A total of 130 patients were recruited who presented with diabetic foot wounds and underwent surgical debridement. After debridement tissue and wound discharge was sent for culture and sensitivity. Data was analyzed by SPSS 24.0. Quantitative data was summarized as mean, median, mode and standard deviation while qualitative data was summarized as frequency and in tables.

Results: Total 130 patients were included in this study. The mean age of these patients was 58.3 ± 11.0 years. Maximum frequency of patients (45.7%) was found in age group of 52-67 years. The mean duration of ulcer on foot was 15.1 ± 0.9 days. Among 119 culture positive patients pseudomonas was the most frequent organism followed by E.coli, Gram negative rods and Klebsiella. Highest frequency of antimicrobial sensitivity was seen with Meropenem (46.1%), followed by Colistin (34.6%), Imipenem (31.5%) Linezolid (27.7%).

Conclusion: The study's findings are that diabetic foot ulcers are most frequently polymicrobial and some antibiotics like Meropenem, Colistin Imipenem, Linezolid, Ciprofloxacin, Levofloxacin, Cefipime & Tieceoplanin can be used as drug of choice for management of diabetic foot ulcers.

KEY WORDS: Diabetic foot ulcers; Microorganisms; Empirical therapy.

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INTRODUCTION

Diabetes mellitus affects more than 460 million individuals globally.^{1,2} Genetic and other key risk factors such as obesity, weight, physical inactivity,

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bad nutrition, hyperglycemia, stress, and chronic inflammation are all linked to diabetes mellitus.³ Chronic diabetic complications are divided into vascular (micro-vascular and macro-vascular) and non-vascular.⁴ Patients suffering from diabetes mellitus may develop foot ulcers, which are lesions of all layers of skin resulting in necrosis or gangrene. Diabetes patients frequently develop foot ulcers, which have incidence from 07% to 16.8%.^{5,6} It damages tissue and can lead to amputation of the lower limb⁷. It results due to peripheral neuropathies & peripheral arterial diseases.² Diabetic foot infection is a major contributing factor which has been found to be present in 40-60% of all diabetic foot ulcer and results in more repeated hospital admissions, fading

outcomes, and more chances of amputation.⁸ The Wagner System for the categorization of diabetic foot infections is the most extensively used system for grading and severity of diabetic foot ulcers⁹. In grade 0 there is no ulcer, grade 1 ulcer is superficial, grade 2 ulcer is deep but bones are not involved, grade 3 bones are involved along with ulcer and abscess, grade 4 local gangrene is present while in grade 5 whole foot is gangrenous.

Diabetic foot infections usually have a polymicrobial bacteriology.¹⁰ However, a number of research on the bacteriological epidemiology of diabetic foot ulcers have been carried out with conflicting statistics due to several variations, which can be geographical locations, the kind of microorganism, or the approaches used in bacterial culture. Because of the widespread use of antibiotics, which is primarily responsible for the emergence of antimicrobial resistance, treating diabetic foot infections and other diseases is getting harder. According to study conducted at Al-Basel hospital most commonly isolated bacteria was *Staphylococcus aureus* gram-positive from the diabetic foot ulcers, followed by *Streptococcus agalactiae*, *Staphylococcus saprophyticus*, *Staphylococcus epidermidis* and *Enterococcus faecalis*. On the other hand, *Klebsiella pneumoniae*, *Pseudomonas aeruginosa*, *Escherichia coli*, *Enterobacter* species, *Proteus mirabilis*, and *Acinetobacter baumannii* were the most common gram-negative aerobes.²

Imipenem discovered to be the most efficient antibiotic against *Staphylococcus aureus*. Other antibiotics such as vancomycin and linezolid also quite effective to gram-positive bacteria. *Pseudomonas aeruginosa* and the *Enterobacteriaceae* family in gram-negative organisms showed highest sensitivity to imipenem among the tested antibiotics. Gentamicin and amikacin also exhibit gram-negative organism sensitivity in addition to imipenem.² so there is great issue regarding the causative micro-organisms and prescribing antibiotics, therefore this study was intended to solve these issues and help the clinicians to treat diabetic foot ulcers in an expert manner. The objective of this study was to determine organisms involved in diabetic foot ulcers and their susceptibility to antibiotics for use as empirical therapy.

MATERIALS & METHODS

It was a cross sectional study held in Surgical Department Gulab Devi teaching hospital from January 2021 to December 2021. This study was performed after the approval from institutional review board. A total of 130 patients were recruited in this study after taking informed consent. Sampling was done through purposive sampling technique taking incidence of diabetic foot ulcer of about 7.02%.⁵ All

these patients had infected diabetic foot wounds and underwent surgical debridement. After debridement tissue and wound discharge was sent for culture and sensitivity. All patients already taking antibiotics or had surgical debridement of same wound previously were excluded from this study. After sending culture and sensitivity empirical antibiotic therapy was started in all patients and was changed according to culture reports. All data was collected on prescribed questionnaire. Data was analyzed by SPSS 24.0. Quantitative data was summarized as mean and standard deviation while qualitative data was summarized as frequency and in tables.

RESULTS

A total of 130 patients were recruited in the study. The mean age of these patients was 58.3 ± 11.0 years. Maximum frequency of 45.7% was found in age group of 52-67 years followed by 34.3% in 36 – 51 years age group and only 20% frequency in age group 68 – 83 years. Out of these 130 patients 96 were male while 34 were female. Out of these 130 patients 40% patients had associated hypertension, 16.9% had associated ischemic heart disease, 14.6% had renal disease, 8.4% had chronic liver disease while 3.0 % patients had tuberculosis while 16.9% had no associated co morbidities. Out of these 130 patients 04 patients were newly diagnosed diabetes mellitus during their hospital admission while in remaining 126 patients duration of disease ranged from 2 years to 20 years. Out of these 126 patients 78 patients were on insulin while 48 patients were using oral hypoglycemic tablets for the management of diabetes mellitus. Right foot was involved in 71 patients while in 59 patients left foot was involved. The mean duration of ulcer on foot was 15.1 ± 0.9 days. The diameter of ulcer ranged from 2cm to 10cm. According to Wagner classification of foot ulcer 102 patients had ulcer of class 2 while 14 had class 3 and 14 had class 4 ulcers. In 98 patients wound healed with frequent debridement and dressings, 20 patients had finger amputations while 12 patients ended in below knee amputation. On culture of wounds no growth was found in 11 patients. Among 119 culture positive patients *Pseudomonas* was the most frequent organism followed by *E. coli*, Gram negative rods and *Klebsiella* (table 1). Highest frequency of antimicrobial sensitivity was seen with Meropenem (46.1%), followed by Colistin (34.6%), Imipenem (31.5%) Linezolid (27.7%) (table 2). *E. coli* was most sensitive to Imipenem & Meropenem followed by Amikacin. In Gram negative rods, *Pseudomonas* and *Klebsiella* Meropenem was most sensitive followed by Colistin and Imipenem. In case of *Staphylococcus* and *Streptococcus* species Linezolid was most sensitive.

Table 1: Frequency distribution of causative

organism		
Culture Organism	Frequency	Percent
Pseudomonas	23	17.7
Klebsiella	12	9.2
Gram negative rods (GNR)	11	8.4
Mix growth of streptococcus & E.coli	11	8.4
Proteus spp.	11	8.4
Streptococcus	11	8.4
E.coli	11	8.4
Staph. Aureus	08	6.1
Mix growth of GNR & Pseudomonas spp.	07	5.4
Enterococcus spp	07	5.4
Mix growth of Pseudomonas spp. & Klebsiella	07	5.4
No growth	11	8.4
Total	130	100.0

Table 2: Frequency table of antibiotics sensitivity

Antibiotic sensitivity	Sensitivity Percent
Meropenem	46.1
Colistin	34.6
Imipenem	31.5
Linezolid	27.7
Cefipime	22.3
Levofloxacin	22.3
Tiecoplanin	22.3
Ciprofloxacin	22.3
Amikacin	20
Tigecyclin	16.9
Gentamicin	13.8
Vancomycin	10.7
Doxycycline	5.4
Ampicillin	5.4
Aztreonam	5.4
Piperacillin	5.4

DISCUSSION

Diabetic foot ulcer can involve skin, subcutaneous tissue, deeper structures, muscles and even bone. According to study of Nageen, males presented more with diabetic foot ulcer than females.¹¹ Similar

results were seen in international data of a study conducted in Belgium where frequency of diabetic foot ulcer was 72% in male.¹² These findings are similar to the findings in our study. According to Nageen the mean age of the patients at presentation was 52.7 years whereas in this study the mean age of patients was 58.3 years. According to Nasir, range of duration of diabetes was from 2 to 7 years which is similar to our study.¹³

In this study, both mono-microbial and polymicrobial infection was found which is consistent with other national and international studies. In our study pseudomonas was the most common organism found on culture sensitivity which is similar to other international studies. According to study conducted by S.A. Abd-El Mohsen et al, majority of patients had pseudomonas aeruginosa infection, Escherichia coli and Staphylococcus aureus infection.¹⁴ According to meta-analysis conducted by Macdonald et al Staphylococcus aureus was most common organism followed by Pseudomonas, E.coli and Enterococcus.¹⁵ In our study Pseudomonas was the most frequent organism followed by E.coli, Gram negative rods and Klebsiella. In our study highest frequency of antimicrobial sensitivity was seen with Meropenem (46.1%), followed by Colistin (34.6%), Imipenem (31.5%) and Linezolid (27.7%) which is not according to international studies. According to Abd-El Mohsen et al 37% organisms showed sensitivity to Piperacillin tazobactam, 22% to Gentamicin, 16% to Vancomycin, 13% to Azithromycin and 12% to Levofloxacin. According to Nageen most sensitive antibiotic against these organisms was Meropenem (94.7%) followed by Amikacin (68%).¹⁶ A similar study conducted by Atlaw et al showed maximum sensitivity of Amikacin to both gram positive and gram negative rods (81%). They didn't used Meropenem, Imipenem and Colistin in their study. The reason of low sensitivity of Amikacin (20%) in our study is over use of this drug in our society by local general practitioner.

CONCLUSION

In most of cases, diabetic foot ulcers are often polymicrobial associated with Pseudomonas, Gram Negative Rods, Klebsiella, E.coli and streptococcus. According to this study Meropenem, Colistin Imipenem, Linezolid, Ciprofloxacin, Levofloxacin, Cefipime, Tiecoplanan and Amikacin can be used as drug of choice for management of diabetic foot ulcers. These drugs can be started as empirical therapy in the management of diabetic foot ulcers in our society.

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CONFLICT OF INTEREST
 Authors declare no conflict of interest.
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AUTHORS' CONTRIBUTION

The following authors have made substantial contributions to the manuscript as under:

Conception or Design:	UAR, MAI
Acquisition, Analysis or Interpretation of Data:	UAR, MAI, MZM, KA, MJB, IA
Manuscript Writing & Approval:	UAR, MAI, MZM, KA, MJB, IA

All the authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.



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