Research Article

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DETERMINING THE MICROBIOLOGICAL AND CLINICAL CHARACTERISTICS OF INDIVIDUALS WITH DIABETIC FOOT AT AN INDIAN MEDICAL FACILITY

Dr. Abhishek Kunal

Assistant Professor, Department of General Surgery, Icare Institute of Medical Sciences and Research & Dr. Bidhan Chandra Roy Hospital, Haldia, West Bengal

Address for correspondence
Email: abhishekkunal120@gmail.com

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ABSTRACT

Background: First of all, Diabetes mellitus patients frequently get long-lasting infections, particularly in the foot area, which can be challenging to treat. Identification and isolation of related organisms are necessary for the proper management of diabetic foot infections, as is the selection of a suitable antibiotic therapy based on sensitivity and culture.

Aim: The purpose of this study was to evaluate the clinical profile, microbiologic makeup, and prevalence of individuals with diabetic foot disease.

Methods: In this retrospective clinical investigation, participants with diabetic foot who were hospitalised to the institution had their bacterial cultures evaluated on tissue samples, pus swabs, and bacterial pus isolates.

Results: One subject with Grade 3 disease had enterococcus spp., one subject with Grade 4 disease had streptococcus spp., and in total, 3.40% (n=3) subjects had MRSA. In addition, 5.68% (n=5) study subjects had staphylococcus aureus in two subjects with Grade 1 disease, two subjects with Grade 3 disease, four subjects with Grade 4 disease, and one subject with Grade 5 disease.

Conclusion: The current study comes to the conclusion that when Wagner's grade rises, gram-negative bacteria become more prevalent. Frequent tracking of antibiotic resistance patterns is necessary to determine the empirical antibiotic treatment.

Keywords: diabetic foot infections (DFI), microbiological and clinical profile, multicellular, Pattern of sensitivity, Wagner's Evaluation

INTRODUCTION

Patients with diabetes mellitus frequently get chronic foot infections, which are typically difficult to treat conservatively. The literature data reports that diabetic subjects are at 10 times higher risk of hospitalization secondary to soft tissue infection in the foot region compared to non-diabetic subjects. It is estimated that the diabetic population in India will increase to nearly 57 million by the end of 2025.[1]

The infection in subcutaneous tissues can easily spread to deeper tissues resulting in the amputation of the limbs secondary to gangrenous changes. In diabetic subjects, uninfected ulcerations are complicated after minor trauma in diabetic subjects with neuropathy leading to tissue necrosis om neuropathic ulcers/ osteomyelitis and sinus which usually draining.[2] The development of moist gangrene is mostly controlled by the infection's persistence. Proteus species, Enterococcus species, and pseudomonas species are the organisms that cause severe tissue damage in gangrenous infections. This is because the afflicted foot has inadequate blood circulation.[3]

Identification and isolation of related microorganisms as well as suitable antibiotic medication selection based on culture and sensitivity are necessary for the appropriate and correct management of infections in diabetic foot.[4] The purpose of this retrospective study was to evaluate bacterial pathogens linked to diabetic foot and their impact on outcomes after diabetic foot therapy.

The purpose of the current study was to evaluate the clinical profile, microbiologic makeup, and prevalence of individuals with diabetic foot who were susceptible to antibiotics based on various grades of Wagner classification and outcomes in diabetic foot infection subjects.

MATERIALS AND METHODS

In order to determine the prevalence, microbiologic makeup, and clinical profile of individuals with diabetic foot infections who are susceptible to antibiotics, as well as to evaluate these characteristics based on different Wagner classification grades and patient outcomes, a retrospective clinical study was carried out. The study was carried out at Department of General Surgery Icare Institute of Medical Sciences and Research & Dr. Bidhan Chandra Roy Hospital, Haldia, West Bengal with approval from the relevant ethical committee. The participants who visited the institute with gangrenous foot infections in diabetic subjects made up the study population. Subjects who met the following criteria were eligible to participate in the study: they had to be in good mental health, not be terminally ill, have a confirmed diagnosis of diabetes, have chronic foot infections that do not go better with conventional antibiotic therapy, and be willing to participate.

Exclusion criteria were subjects with associated diseases contributing to infections and subjects who were not willing to participate in the study.

Tissue samples, pus swabs, and bacterial pus isolates were obtained from each patient admitted to the institution with diabetic foot following their final inclusion. The samples were collected and then processed according to established techniques for bacterial identification, antibiotic susceptibility pattern, and culture. Records pertaining to isolated bacteria, sensitivity patterns, and first- and second-line antibiotic medication were kept up to date. Evaluations were conducted based on patient outcomes, risk factors, and ulcer gradings. Using SPSS software version 21 (Chicago, IL, USA) for statistical assessment and one-way ANOVA and t-test for result formulation, the gathered data were examined. The data were presented as a mean, standard deviation, percentage, and number. At $p<0.05$, the significance threshold was maintained.

RESULTS

In order to determine the prevalence, microbiologic makeup, and clinical profile of individuals with diabetic foot infections who are susceptible to antibiotics, as well as to evaluate these characteristics based on different Wagner classification grades and patient outcomes, a retrospective clinical study was carried out. A total of 132 participants, ranging in age from 58 to 72 years, were enrolled in the study, representing both genders. Table 1 lists the research participants' demographic and illness-related details. The average age of the research participants was found to be 63.4±3.67 years. In the current study, there were 20.45% (n = 27) females and 79.54% (n = 105) men.

On assessing the microbial growth, monomicrobial growth was seen in 78.78% (n=104) subjects, whereas, polymicrobial growth was seen in 21.21% (n=28) study subjects. There were 10.60% (n=14) bacterial isolates that had Wagner's grade I, 12.87% (n=17) had Wagner's grade II, 25.75% (n=34) subjects had Wagner's grade III, and 22.72% (n=30) subjects had Wagner's grade IV (Table 1).

Upon analysing the distribution of gram-positive cocci in the various W grades among the study subjects with diabetic foot, it was observed that one subject had enterococcus spp., one subject had streptococcus spp., and in a total of 3.40% (n=3) subjects, MRSA was found in one subject each of grade 2 and 3, one subject each of grade 3, and three subjects each of grade 4; in total, 5.68% (n=5) study subjects and staphylococcus aureus was observed in two subjects each of grades 1 and 3, two subjects each of grades 3 and 4, one subject with grade 5 disease, and in a total of 10.22% (n=9) study subjects (Table 2).

Acinetobacter spp. was detected in 3 (3.40%) of the individuals with grade 3 illness, while NFGNB was found in 1, 1, 2, and 2 of the patients with grades 1, 2, 3, and 5 of the study subjects, for a total of 6.81% (n=6) subjects. With 5, 3, 4, 2, and 8 study participants with grades 1, 2, 3, 4, and 5, Pseudomonas spp. had the highest prevalence, accounting for a total of 25% (n=22) research subjects. In 14,77% (n=13) of the research participants with 4, 2, 3, and 4 subjects with grade 2, 3, 4, and 5 disorders, respectively, proteus species were observed. 4.54% (n=4) of the research participants had enterobacter spp., with two of them having grade 4 and grade 5 illnesses.

11.36% (n=10) of the study subjects had Klebsiella spp., with 1, 2, 2, 3, and 2 study individuals, respectively. Table 3 shows that E. coli was detected in 13.63% (n=12) of the study individuals, which included 2, 3, 4, and 5 subjects with grade 2, 3, 4, and 5-grade sickness.

DISCUSSION

In order to evaluate the prevalence, microbiologic makeup, and clinical profile of individuals with diabetic foot infections who are susceptible to antibiotics, as well as the microbiologic and clinical profiles of these individuals based on different Wagner classification grades and outcomes, a retrospective clinical study was carried out. A total of 132 participants, ranging in age from 58 to 72 years, were enrolled in the study, representing both genders. The average age of the research participants was found to be 63.4±3.67 years.

In the current study, there were 20.45% (n = 27) females and 79.54% (n = 105) men. When the microbial growth was evaluated, 78.78% (n=104) of the research patients showed monomicrobial growth, whereas 21.21% (n=28) showed polymicrobial development. Bacterial isolates with Wagner's grade I included 10.60% (n=14), grade II comprised 12.87% (n=17), grade III comprised 25.75% (n=34), and grade IV comprised 22.72% (n=30). These results aligned with those of studies conducted in 2017 by Bajuri MY et al. and in 2013 by Alva KA et al., in which the authors evaluated patients with similar demographics to those of the current research.

In addition, the distribution of gram-positive cocci in the various W grades was evaluated in the study subjects with diabetic foot. It was observed that one subject had enterococcus spp., one subject had streptococcus spp., and in 3.40% (n=3) subjects, MRSA was observed in one subject in Grade 2, one in Grade 3, and three subjects with Grade 4 disease; in total, 5.68% (n=5) study subjects and staphylococcus aureus was observed in two subjects with grade 1 disease, two subjects with grade 3 disease, four subjects with grade 4 disease, and one subject with grade 5 disease; in total, 10.22% (n=9) study subjects.

These results were in agreement with the studies of Stacey HJ et al[7] in 2019 and Girish MB et al[8] in 2010 The researchers found that the pus from diabetic feet contained comparable gram-positive cocci. Acinetobacter spp. was detected in 3 (3.40%) of the individuals with grade 3 illness, while NFGNB was found in 1, 1, 2, and 2 of the patients with grades 1, 2, 3, and 5 of the study subjects, for a total of 6.81% (n=6) subjects. With 5, 3, 4, 2, and 8 study participants with grades 1, 2, 3, 4, and 5, Pseudomonas spp. had the highest prevalence, accounting for a total of 25% (n=22) research subjects. In 14,77% (n=13) of the research participants with 4, 2, 3, and 4 subjects with grade 2, 3, 4, and 5 disorders, respectively, proteus species were observed.

4.54% (n=4) of the research participants had enterobacter spp., with two of them having grade 4 and grade 5 illnesses. 11.36% (n=10) of the study subjects had Klebsiella spp., with 1, 2, 2, 3, and 2 study individuals, respectively. 13.63% (n=12) of the trial participants, which included 2, 3, 4, and 5 subjects with grade 2, 3, 4, and 5-grade sickness, had E. coli. These findings were in line with those of studies conducted in 2020 by Goh TC et al. and in 2013 by Mahamoud BA et al., who revealed a similar pattern of distribution for gram-negative bacilli in the culture from samples of patients suffering from a diabetic foot infection.

CONCLUSION

Within the constraints of the study, the current findings indicate that as Wagner's illness progresses in severity, gram-negative microbes become more common and dominant. Frequent tracking of antibiotic resistance patterns is necessary to determine the empirical antibiotic treatment. It is important to evaluate the antibiotics administered to these patients depending on their sensitivity and culture. The current study did, however, have several drawbacks, such as a limited sample size, a short monitoring time, and biases related to geographic areas. Therefore, further long-term research with bigger sample sizes and longer observation periods will aid in coming to a conclusive result.

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TABLES

S. No	Characteristics	Percentage (%)	Number (n=132)
1.	**Mean age (years)**	63.4±3.67	
2.	**Age Range (years)**	58-72	
3.	**Gender**		
a)	Males	79.54	105
b)	Females	20.45	27
4.	**Microbial Growth**		
a)	Monomicrobial	78.78	104
b)	Polymicrobial	21.21	28
5.	**Wagner's grades**		
a)	I	10.60	14
b)	II	12.87	17
c)	III	25.75	34
d)	IV	22.72	30

Table 1: Demographic and disease-related characteristics in the study subjects

S. No	Gram-positive cocci	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Total (n=18)	Percentage (%)
1.	Ent spp			1			1	1.13
2.	Strepto spp			1	2		3	3.40
3.	MRSA		1	1	3		5	5.68
4.	Staph aureus	2		2	4	1	9	10.22

Table 2: Distribution of gram-positive cocci in the study subjects

S. No	Gram negative bacilli	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Total (n=70)	Percentage (%)
1.	Acinetobacter spp			3			3	3.40
2.	NFGNB	1	1	2		2	6	6.81
3.	Pseudomonas spp	5	3	4	2	8	22	25
4.	Proteus spp		4	2	3	4	13	14.77
5.	Enterobacter				2	2	4	4.54
6.	Klebsiella spp	1	2	2	3	2	10	11.36
7.	E. coli		2	3	3	4	12	13.63

Table 3: Distribution of gram-negative bacilli in the study subjects