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Original Research Article

Culture and sensitivity pattern of aerobic bacterial isolates in diabetic foot infections, in a suburban tertiary care hospital in Mumbai

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ABSTRACT

Background: The most common complication observed in patients with diabetes mellitus is diabetic foot infection; it is the bone or soft tissue infection below the malleoli. The most common pathogens involved in this infection are Staphylococcus species and beta haemolytic streptococci. Severe, chronic, or formerly dealt with infections are usually polymicrobial. Hence, the aim of the study was to understand the microbiological profile and antimicrobial susceptibility pattern of pathogens causing diabetic foot infections.
Methods: Post approval from Institutional Ethics Committee, a retrospective study was carried out based on review of records of 117 patients with diabetic foot infections over two-year period from 2018 through 2019. All demographical and microbiological data was analysed.
Results: Out of 117 patients of diabetic foot infections, 71 (60.68%), patients showed bacterial growth. Amongst 71 patients 45% of patients had gram positive infection. 52% patients had gram negative infection. 3% patients had poly-microbial growth. Most common organism isolated were *Staphylococcus aureus* 28%, *Morgaellamorgagni* 11%, *Proteus mirabilis* 9%, *Citrobacter koseri* 8%, *E. coli* 8%. Incidence of *Staphylococcus aureus* (MRSA and MSSA) was 3% each. *Staphylococcus aureus* had sensitivity to Rifampicin, Cefoperazone, Tigecycline.
Conclusions: Diabetic foot infections are common complication worldwide. Understanding the microbiology will help to deal better in management and prognosis of patients. Hence, it is mandatory to characterize the causative agents, and its antimicrobial susceptibility pattern to ensure successful outcome of diabetic foot infections.

Keywords: Diabetic foot infections, Polymicrobial infection, Characterization, Antibiotic resistance pattern

INTRODUCTION

Foot infection is a chief complication of diabetes mellitus leading to complications like gangrene and limb amputation and constitutes common diabetes-related cause of hospitalization. In sufferers with diabetes, any foot infection is probably extreme. Diabetic foot infections variety in severity from superficial paronychia to deep infection related to bone. Types of contamination encompass cellulitis, myositis, abscesses, necrotizing fasciitis, septic arthritis, tendinitis, and osteomyelitis. Foot infections are most of themaximumnot unusual place and extreme complications of diabetes mellitus. They are related to elevated frequency and duration of hospitalization and hazard of decrease extremity amputation. Foot ulceration and contamination are the main hazard elements for amputation. Prevention and set off prognosis and remedy are essential to prevent morbidity, in particular amputation. Infection in sufferers who've lately acquired antibiotics or who've deep limb-threatening infection or persistent wounds are generally resulting from an aggregate of aerobic gram-positive,

aerobic gram-negative (example- *Escherichia coli, Proteus species, Klebsiella species*), and anaerobic organisms (example- *Bacteroides species, Clostridium species, Peptococcus* and *Peptostreptococcus species*). Anaerobic microorganisms are generally a part of combined infections in sufferers with foot ischemia or gangrene. *Methicillin-resistant S. aureus* (MRSA) is a greater not unusual place pathogen in sufferers who've been formerly hospitalized or who've lately acquired antibiotic therapy. MRSA contamination also can arise within-side the absence of chance elements due to the growing incidence of MRSA within-side the community.

Diabetic foot disease is a major medical, social and economic problem that is seen in every continent and constitutes a major burden to the patient and the health care system.[1] People with diabetes have about a 25% chance of developing a foot ulcer in their lifetime.[2] Lower extremity amputations in the United States are preceded by a foot ulcer.[3]

Objective of the paper is to study the culture and sensitivity pattern of aerobic bacterial isolates in diabetic foot infections, in a suburban tertiary care hospital in Mumbai.

METHODS

Study design

It is single center, retrospective, observational study to analyse the culture and sensitivity pattern of aerobic bacterial isolates in diabetic foot infections, in a suburban tertiary care hospital in Mumbai.

Study period and study place

The study population comprised diabetic patients diagnosed with skin and soft tissue infections hospitalized between 2018 and 2019 in Bhaktivedanta Hospital and Research Institute.

Inclusion and exclusion criteria

Patients were diagnosed by surgeons based on criteria mentioned in Practice Guidelines for the Diagnosis and Management of Skin and Soft-tissue infections, including infections with local/systemic presentations.

Procedure

All microbiological specimens were obtained from the most infected part and sent to microbiology laboratory. All specimens received like tissue, wound swab, pus, pus swab were processed as per standard protocol. Samples were inoculated on Sheep blood agar and MacConkey agar. Plates were incubated for 48hrs at 37°C. To know the morphology of suspected organisms and to rule out mycobacterial infection, gram stain and ZN stain were done respectively. Plates were checked twice at 24 hour and 48 hour of incubation. If any growth observed on plates, colony smear was prepared from blood agar plate and gram staining done. On the basis of morphology, further identification and antimicrobial susceptibility testing of isolated organism done by Vitek2 compact automated system (BioMerieux, Salt Lake city, USA) and interpretation done as per recent to CLSI guidelines (Clinical and Laboratory Standards Institute). The isolates were considered as multidrug resistant (MDR) if they were resistant to more than three classes of antimicrobial drugs. If plate doesn't show any growth at 48hrs, report was considered negative. Whenever, fungus or non-tuberculous mycobacteria were suspected, plates were kept for further incubation till 2 weeks.

Ethical approval

After getting approval from the Institutional Ethics Committee, a retrospective study was carried out, based on review of records of 117 patients.

Statistical analysis

Descriptive statistics was used for representing the demographic variables. Evaluated organisms data was presented in number and percentage. Numerical data was evaluated for normal distribution using Kolmogorov-Smirnov test and accordingly either parametric or non-parametric test was used. Statistical analyses were done using 'R version 4.0.2', Python 3 and 'Statistical package for social sciences (SPSS) version 20.'

RESULTS

In our study, 61% (71 patients) samples were positive for culture and rest were negative for any growth. 45% of patients had gram positive infections. 52% patients had gram negative infection. 3% patients had polymicrobial growth.

Characterization of the total 117 microbial isolates from 71 culture positive sample.

Commonest organisms isolated were *staphylococcus aureus*- 28%, *morgaella morgagni*- 11%, *proteus mirabilis*- 9%, *Citrobacter koseri*- 8%, E. coli- 8%. Incidence of *staphylococcus aureus* (MRSA and MSSA) was 3% each.

Staphylococcus aureus had sensitivity to Rifampicin, Cefoperazone, Tigecycline. *Staphylococcus aureus* MRSA was sensitive to Cefoperazone, Piperacillin, Clindamycin.

Staphylococcus aureus MSSA was sensitive to Cefoperazone, Trimethoprim, Ticarcillin. Most of the organisms displayed resistance to ampicillin and other penicillins. Sensitivity to ciporfolxacin was quiet high as compared to penicillins.

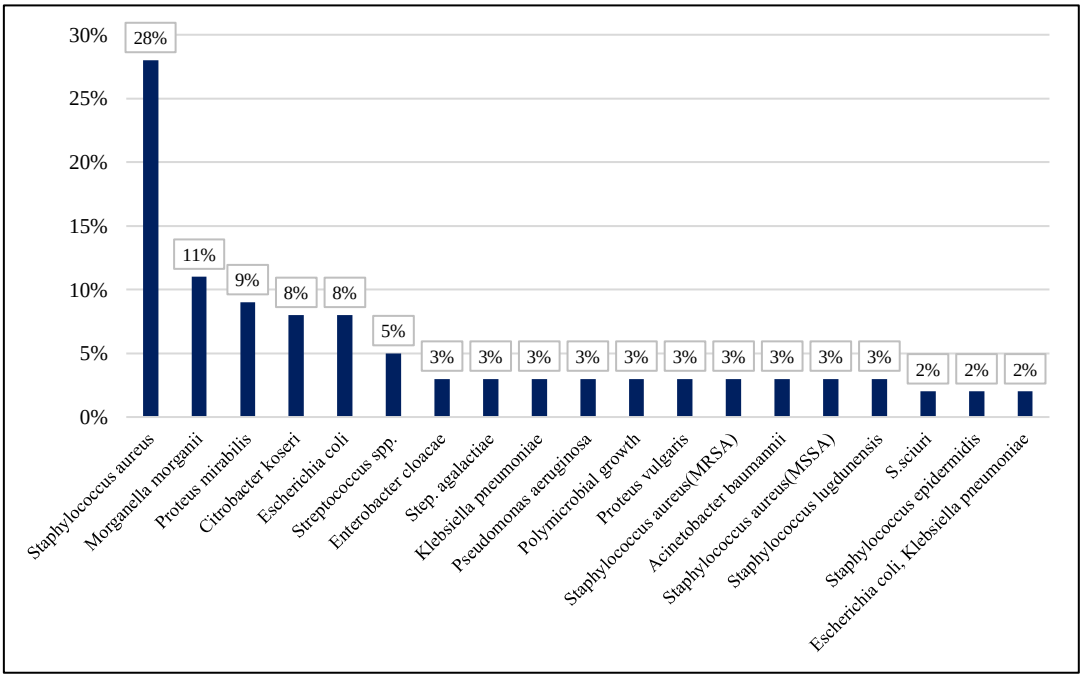

Figure 1: Percentage of organisms isolated.

Table 1: Organism isolated in this study.

S. no.	Name of organism isolated	%
1	*Staphylococcus aureus*	28
2	*Morganella morganii*	11
3	*Proteus mirabilis*	9
4	*Citrobacter koseri*	8
5	*Escherichia coli*	8
6	*Streptococcus spp.*	5
7	*Enterobacter cloacae*	3
8	*Step. agalactiae*	3
9	*Klebsiella pneumoniae*	3
10	*Pseudomonas aeruginosa*	3
11	*Polymicrobial growth*	3
12	*Proteus vulgaris*	3
13	*Staphylococcus aureus (MRSA)*	3
14	*Acinetobacter baumannii*	3
15	*Staphylococcus aureus (MSSA)*	3
16	*Staphylococcus lugdunensis*	3
17	*S.sciuri*	2
18	*Staphylococcus epidermidis*	2
19	*Escherichia coli, Klebsiella pneumoniae*	2

Morgaella morgagni was sensitive to Ciprofloxacin, Moxifloxacin, Ertapenem. *Proteus mirabilis* was sensitive to Clindamycin, Moxifloxacin, Nalidixic acid. *Citrobacter koseri* was sensitive to Ciprofloxacin, Clindamycin, Meropenem. *E. Coli* was sensitive to Linezolid, Nalidixic Acid, Cefotaxime.

So, in our Instituite and area empiric antibiotic recommendation will be as follows; Cefoperazone has been effective against many organisms hence cefoprazone plus clindamycin would give good combination for most of patients and later as per culture report antibiotics may be changed. Other choices may be ciprofloxacin and cefotaxime.

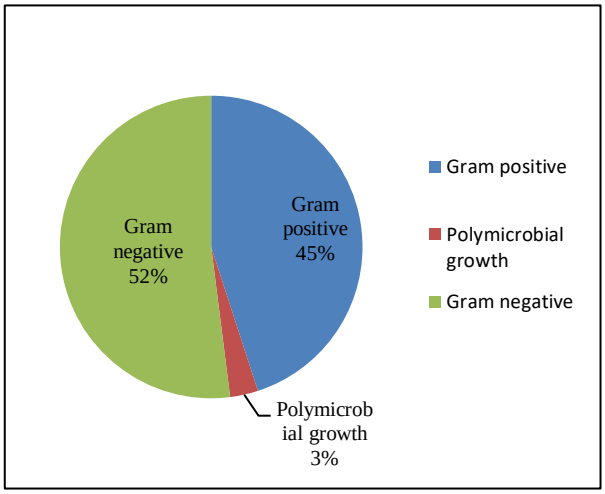

Figure 2: Percentage of growth of gram positive and gram negative organisms.

DISCUSSION

This study was undertaken to characterize the aerobic bacterial isolates from diabetic foot infections and analyze their antibiotic resistance pattern in a tertiary care hospital in suburban Mumbai. A retrospective study was carried out on samples of exudates from 117 patients with diabetic foot infections over two-year period from 2018 through 2019. Data analysis was done. Results obtained are

tabulated below. From this study, the investigators sum up to the conclusion that- it is mandatory to characterize the causative agents, determine antibiotic susceptibility and initiate appropriate antibiotic therapy to ensure successful outcome of diabetic foot infections.

Diabetic Foot Infections invariably start in superficial soft tissues, later involve deeper structures, including bone that led to devastating complications and long-term morbidity. Complications may include necrotizing fasciitis, soft tissue gangrene, septic arthritis, and osteomyelitis. Therefore, it is essential to evaluate the different microorganisms infecting the wound and to determine the antibiotic susceptibility patterns of the isolates from the infected wound. This knowledge is vital for planning treatment with the appropriate antibiotics, reducing resistance patterns, and minimizing healthcare costs.

Management of DFI depends on the severity of infection and include the route and choice of antibiotic, the need for hospital admission, consideration of surgical intervention, and overall length of therapy. Patients with DFIs usually have several hospitalizations and are exposed to multiple courses of antibiotics. Although diabetic patients with foot infections are initially treated empirically, appropriate antibiotic therapy following microbiological results focussed on the causative organisms will improve the outcome. Therefore it is mandatory to identify the causative agents, initiate appropriate antibiotic therapy for the achievement of a successful outcome.

In a study by Raja, polymicrobial growth was found in 42.8% and 57.2% patients had pure growth whereas in our study the rate of isolation was 34% and 66% respectively.[4] *Staphylococcus aureus* is reported to be the predominant isolate in various studies.[5,6] whereas Gram negative organisms predominated in a study by Banashankari et al and the common isolate was Proteus Spp. followed by *E. coli*, *S. aureus* and *P. aeruginosa* were the most common causes of diabetic foot infections as reported by Abdulrazak.[7,8]

Limitations of the study

Study is single center, more studies with large sample size are required to explore more information on this topic.

CONCLUSION

Diabetic foot infection is a serious complication of diabetes which is a major medical, social and economic problem worldwide. Diabetic foot infection is either mono-microbial or poly-microbial in nature involving both gram-positive cocci and gram-negative bacilli. Increasing awareness among the physicians on the microbiology of DFI will help in preventing chronic diabetic foot ulceration and reduce the risk of amputation. Therefore, it is mandatory to characterize the causative agents, determine antibiotic susceptibility and initiate appropriate antibiotic therapy to ensure successful outcome of diabetic foot infections.

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Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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