Int J Pharm Gen Res

International Journal of ADVANCED PHARMACEUTICAL GENUINE RESEARCH
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Clinical and Microbial Flora in Diabetic Foot Ulcer and Its Antibiotic Sensitivity Pattern

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(Received:15th December 2014; Accepted: 05th January 2015)

Abstract

An estimated 77.2 million people in India and 280 million world-wide suffer from pre-diabetes increasing the future burden of diabetes. Many complications associated with diabetes, issues related to foot disease represent a significant and often challenging clinical problem. Foot infections account for 20% of hospitalization of diabetic patients yearly. This study was performed to determine the relative frequency of aerobic microbial isolates from diabetic foot ulcers and to compare in vitro antibiotic susceptibility patterns of organisms isolated from diabetic foot ulcers and to study the incidence of emergence of multidrug-resistant organisms. In conclusion, prevalence of infection was higher in diabetic foot patients from our region. In cases of poly-microbial infection, coexistence of Gram-negative and Gram-positive microorganisms was more common. Organisms in mixed infections showed multidrug resistance as compared to single isolated strain. This study will help the clinicians to choose appropriate antibiotic or combination of antibiotics for the treatment of Diabetic Foot Ulcer

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Key Words
diabetes, Foot infections, antibiotics

INTRODUCTION

Diabetes mellitus (DM) is a complex metabolic disorder with an ever-increasing prevalence[1]. Currently, an estimated 77.2 million people in India[2] and 280 million world-wide suffer from pre-diabetes increasing the future burden of diabetes. Asian Indian phenotype and life-style changes associated with urbanization and sedentary life-styles are reported to contribute to the rise in diabetes in India.[3] Among the many complications associated with diabetes, issues related to foot disease represent a significant and often challenging clinical problem. Foot infections account for 20% of hospitalization of diabetic patients' yearly[4]. The magnitude of the problem becomes worse in regions where foot care is inadequate[5]. Infection worsens the wound condition, delays the healing mechanism and, if appropriate measures are not taken in time, could lead to systemic infection, septicaemia, amputation or even death. It is always necessary to evaluate different microorganisms infecting the wound on a routine basis in addition to administering regular glycemic control, wound care, surgical debridement, pressure-offloading, and maintaining adequate blood supply[6].

This study was performed to determine the relative frequency of aerobic microbial isolates from diabetic foot ulcers and to compare in vitro antibiotic susceptibility patterns of organisms isolated from diabetic foot ulcers and to study the incidence of emergence of multidrug-resistant organisms

MATERIAL & METHOD

The study was conducted on the 61 patients admitted in the surgical department of a tertiary care hospital, Erode. All patients were included consecutively after the initial clinical diagnosis of diabetic foot ulcer was made and foot lesions graded depending on the severity of lesions.

Performa includes age, sex, registration no, unit, occupation, history of trauma, ulcer is healing or not healing, habits of bare foot walking, alcohol, smoking, socio-economic status, past history of the disease and duration of the disease, treatment taken and any complications, existing co-morbidities.

Collection of specimen

Discharge from margins and edges of ulcer was collected with help of two sterile swabs, one for gram stain and one for culture before antiseptic dressing was applied. Then swabs were immediately transported to the laboratory for culture.

Laboratory Procedures

All laboratory methods followed standard protocols. The specific identification of bacterial pathogens was based on microscopic morphology, staining characteristics, culture and biochemical properties using standard laboratory criteria.

RESULTS AND DICUSSION

Diabetic foot ulcers are more prone to bacterial infections that spread rapidly, leading to irreversible tissue damage [7,8]. Complications usually begin with an unrecognized foot ulcer in a patient with an insensate foot which gets infected, leading to significant morbidity and lower extremity amputations[9]. Patterns of microbial infection are not consistent in patients with diabetic foot infections and therefore repeated evaluation of microbial characteristics and their antibiotic sensitivity is necessary for selection of appropriate antibiotics.

Diabetic foot ulcer is the most common complication requiring hospitalization among diabetic patients. It is also the most common cause of non-traumatic lower extremity amputations. Physicians have an important role in the prevention, early diagnosis and management of diabetic foot complications. Management however entails an extensive knowledge of the major risk factors. Total of 61 patients with the clinical diagnosis of Diabetic Foot ulcer were enrolled for this study. Diabetic foot Ulcer and infections are most common in Males (71.9%) than females (28.1%) in this study. The patients of age group 51-60 (38.5%) is found to be high and followed by the age group 61-70(29.8%). From the recruited Patients, DM type 2 (94.7%) are the most sufferers of DFU/DFI than DM type 1 (5.3%). Duration of DM in patients recorded is from ≤ year to ≤ 25 years. 17 (29.8%) patients detail are not available. Among the 40(70.2%) patients whose data available, 12 patients have Diabetes for >5- ≤ 10 years (30%), followed by 10(25%) patients having DM duration of >10- ≤

15 years. Only 3 (7.5%) patients are recorded to have DM of less than a year. Other 37 patients have DM for more than year to 25 years. 40.3% patients are found to be free from any other co-morbid conditions.50.7% patients are reported to have at least any one of the co-morbid conditions. High Blood Pressure (76.4%) followed by Dyslipidemia (20.6%) and Renal Failure (20.6%) are the most common co-morbid conditions seen in patients with DFU.

Only one patient (1.75%) is recorded to have nil risk factor. 3 patients (5.26%) data are not available. 53 patients (92.98%) are reported to have one or more risk factor to develop DFU. The common risk factors noted in DFU patients are Diabetes for ≥10 years (52.8%), followed by poor glycaemic control (50.9%) and past foot Ulcer History (39.6%). Wound debridement (36.8%), I&D (21.05%), Amputation (19.2%) are the mostly performed procedures with patients admitted.

Culture test is done 48 (84.2%) patients, but for other (15.3%) cases antibiotics started empirically. 21 (43.6%) patients among 48(84.2%) culture done patients showed single organisms in their culture report. The rest of 27(56.4%) patients had mixed growth. Multi organisms are isolated from 29(60.4%) patients and in 19(39.6%) patients had single organism isolated. Among 57 patients only 3(5.3%) patients were prescribed single antibiotic where as 54(94.7%) patients that underwent various procedures were prescribed with multi antibiotics.

In our study the 5% patients prescribed with single antibiotic, underwent procedures like cleaning and dressing and I&D. 19 (39.58%) patients culture reports showed single organism and 29 (60.42%) had multiple organisms. Recorded length of Stay ranges from 3 days to 41 days by the DFU Patients. 23(40.3%) patients stayed for less than equal to a week, 19(33.3%) patients for ≤2weeks, 6(10.5%) patient for ≤ 3 weeks, 5(8.7%) patient for ≤4 weeks and finally 2(3.5%) patients in each group stayed for ≤5 and ≤6 weeks. 19 (39.58%). 21 (43.6%) patients among 48(84.2%) culture done patients showed single organisms in their culture report. The rest of 27(56.4%) patients had mixed growth. Multi organisms are isolated from 29(60.4%) patients and in 19(39.6%) patients had single organism isolated.

Tab 1.Exhibits disease-wise distribution of patients

Conditions	No of Patients
High Blood Pressure	26
Coronary Artery Diseases	4
Cardio vascular Diseases	4
COPD	3
Chronic Renal Failure	7
Dyslipidemia	7
Other conditions	19

Tab 2. List of Antibiotics Prescribed

Class of Antibiotic	Drugs
Penicillins	Amoxicillin Oral Amoxicillin + Clavulinic Acid IV/ Oral Imipenem IV Meropenem IV Piperacillin + Tazobactum IV
Cephalosporins	Ceftrioxone IV Cefotaxim IV Cefoperazone + Salbactam IV
Quinolones	Norfloxacin IV/ Oral Ciprofloxacin + Ornidazole IV Levofloxacin Oral Ofloxacin + Ornidazole IV Moxofloxacin IV
Tetracyclines	Doxycyclin Oral
Other Antibiotics	Clindamycin IV/ Oral Linezolid IV/ Oral Ornidazole Oral Metronidazole IV/ Oral Sulphamethoxazole + Trimethoprim Oral

Tab 3. List of all Isolated Organisms

Organisms	No. of Patients
Staphlococcus Aureus	9
Staphlococcus Aureus (MRSA)	6
Proteus Vulgaris	7
Enterococccus Faecalis	4
Proteus Mirabalis	8
Acinetobacter Baumanni (Carbapenemase)	5
Klebsiella Pneumoniae	3
Pseudomonas Aeruginosa	10
Klebsiella Pneumoniae (ESBL Producer)	6
Escherichia Coli (ESBL Producer)	9
Streptococcus Species	4
Streptococcus Pyogenes	1
Enterococcus Faeceium	1
Escherichia Coli (ESBL + Carbapenemase)	1
Klebsiella Pneumoniae	1
Streptococcus Agalachiae	1
Streptococcus Group G	2
Escherichia Coli	2
Morganella Morganni	1
Staphylococcus Beta Hemolytic	1
Acinetobacter Baumanni	1

Tab 4. Distribution Pattern of Single Organism

Organisms	No. of Patients
Staphylococcus Aureus	5
Staphylococcus Aureus MRSA	3
Pseudomonas Aeruginosa	3
Enterococcus Faecalis	2
Proteus Vulgaris	2
Proteus Mirabilis	1
Enterococcal Faecalis	1
Streptococcus Agalactiae	1
Escherichia coli- ESBL	1

Tab 5. List of single organism isolated in more than 2 patients

Organisms	No. of Patients
Staphylococcus Aureus	5
Staphylococcus Aureus MRSA	3
Pseudomonas Aeruginosa	3
Enterococcus Faecalis	2
Proteus Vulgaris	2

Tab 6. Sensitivity and Resistance· shown by Single organisms isolated in more than 2 patients

Organism	Sensitive Drugs (No of Patients)	Resistant Drugs (No of Patients)
Staphylococcus Aureus No of patients = 5	Cephalothin(3) Cloxacillin(4) Erythromycin(5) Ceftriaxone(2) Co-trimoxazole(2) Clindamycin(4) Cefotaxim(2) Gentamycin(3) Linezolid(4) Vancomycin(3) Rifampisin(3)	Ampicillin(2) Ciprofloxacin(4) Penicillin(3) Amoxycillin(2) Gentamycin(2) Co-trimoxazole(3)
Enterococcus Faecalis No of Patients =2	Ampicillin(2) Linezilod(2) Vancomycin(2)	Clindamycin(2)
Pseudomonas Aeruginosa No of patients =3	Amikacin(3) piperacillin(3) Ticarcillin(3)	Moxifloxacin(3) ceftriaxone(#) Tigecycline(3) Ampicillin + Salbactam(3) Meropenem (2) Amoxycillin+Clavulanic Acid(2) Ticarcillin(2) Ciprofloxacin(2) Imepenem(2) Tobramycin(3) Cefazolin(2) Co-trimoxazole(2)
Staphylococcus Aureus MRSA No of patients = 3	Rifampicin(3) Doxycyclin(2) Linezolid(3) Vancomycin(3) Erythromycin(2)	Gentamycin(2) ampicillin(2) Cloxacillin(2) Penicillin(3) Cephalothin(2) Cefazolin(2) Co-trimoxazole(2)
Proteus Vulgaris No of Patients = 2	Co-trimoxazole(2) Gentamycin(2) Imepenem(2) Meropenem(2) Amikacin(2)	Ampicillin(2) Doxycyclin(2) Cefuroxime(2)

CONCLUSION

In conclusion, prevalence of infection was higher in diabetic foot patients from our region. In cases of poly-microbial infection, coexistence of Gram-negative and Gram-positive microorganisms was more common. Organisms in mixed infections showed multidrug resistance as compared to single isolated strain. Diabetic foot infections are polymicrobial in nature. This high level of resistance observed in the present study may be due to the wide spread use of broad spectrum antibiotics leading to survival advantage of resistant pathogens. This increasing incidence of multidrug resistant organisms is a potential risk factor in management of diabetic foot infections which may lead to devastating complications like systemic toxicity, gangrene formation and amputation of lower extremity. These multidrug resistant organisms are frequently resistant to many classes of antibiotics so it is necessary for the clinician to be completely aware of the prevalence rate of multidrug resistant organisms and their management strategies. So this study will help the clinicians to choose appropriate antibiotic or combination of antibiotics for the treatment of Diabetic Foot Ulcer.

Indian council of medical research-India diabetes (ICMR-INDIAB) study.

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Cited this article as:
Venkateswaramurthy N, Malaravan N, Sambathkumar R. Clinical and Microbial Flora in Diabetic Foot Ulcer and Its Antibiotic Sensitivity Pattern.Int J Adv Pharm Gen Res. 2015; 3 (1): 1-9.