Bacteriological evaluation and antibacterial sensitivity pattern in diabetic foot ulcer patients in tertiary care teaching hospital

Vini Pavithran*1, Parimalakrishnan. S.2, Kommuri Kiranmai1, Manavalan. R.1, Dr. Anvar Ali2,
1Department of Pharmacy, Annamalai University, Annamalai Nagar, Tamil Nadu, India
2Department of Surgery, Rajah Muthiah Medical College and Hospital, Annamalai University, Annamalai Nagar, Tamil Nadu, India.

Received on:20-09-2011; Revised on: 15-10-2011; Accepted on:10-12-2011

ABSTRACT

India has the highest number of people with diabetes in the world. With the increasing association of multi drug resistant pathogens with a diabetic foot ulcer, it is important to know the trend of antimicrobial resistance in any geographic area. The aim of the present study is to develop an antibiogram for diabetic foot ulcer management in a tertiary care teaching hospital. The specific objectives of the study are to identify the most common organisms isolated from infected diabetic foot and to determine their sensitivity and resistance patterns. A prospective study was conducted on 76 diabetic inpatients at a tertiary care teaching hospital and study was done for 10 months. Out of 120 microorganisms isolated from diabetic foot ulcer, totally 6 types of microorganisms were isolated and identified from gram negative and gram positive bacteria. The most frequently isolated microorganisms have been S. aureus, E. coli and Ps. aeruginosa. In the present study all the gram negative bacterial pathogens have shown the highest level of resistance to cephalosporins (76.66%). Among the gram positive isolates, S. aureus have shown the highest level of resistance to gentamycin (66.66%). The drug resistance rate was significantly higher when gram negative microorganism was compared with gram positive microorganism. From our study we conclude that ciprofloxacin, ofloxacin and amikacin were found to be more sensitive for the microorganisms at the study site. All the pathogenic bacteria were found to be multi drug resistant strains.

Keywords: antibiogram, diabetic foot ulcer, resistance, sensitivity

INTRODUCTION

Diabetes is a global epidemic with devastating human, social and economic consequences. India is the diabetic capital of the world having more than 50.8 million people affected by diabetes.1[1]

The increasing association of multi-drug resistant pathogens with diabetic foot ulcers complicates the challenge faced by the physician.1[1] Thus the appropriate use of antibiotics should be guided by current trends in antibiotic. The present study is an attempt to know the current status of antibiotic sensitivity pattern of common bacterial pathogens isolated from diabetic foot ulcer patients in a tertiary teaching care hospital.

MATERIALS AND METHODS

Study design and study site:

This was a non-invasive, observational and cross-sectional study carried out in a tertiary care teaching hospital having 1610 bed located in Tamil Nadu, India.

Study period:

The study was carried over a ten month period from July 2010 to April 2011. Seventy six diabetic foot patients were selected for the study.

Inclusion criteria:

Patients above 20 years of age, with grade 1-5 diabetic ulcer and only the subjects who have shown growth in the swab were included in the study.

Exclusion criteria:

Pediatric patients, pregnant women and patients with limb amputations were excluded from the study.

Study method:

Detailed history, clinical findings and investigations were recorded. Foot deformity and ulcer grades were identified using Meggit-Wagner classification of diabetic foot ulcer. Culture specimens were obtained at the time of admission, after the surface of the wound had been washed vigorously with saline and followed by debridement of superficial exudates.1[10] Swabs were collected from ulcers that were macroscopically examined and classified based on Wagner’s method of evaluation.1[10] The soft tissue specimens were sent to the laboratory for identification of aerobic bacteria. For the isolation of bacterial media used were blood agar, and MacConkey agar, which were incubated at 37°C for 24 hours. The bacteria isolated were subjected to antibacterial susceptibility testing using Kirby-Bauer disc diffusion method as recommended by the National Committee for Clinical Laboratory Standards.1[19]

RESULT:

The present study showed that the 120 isolates yielded about 30 gram positive microorganisms and 90 gram negative microorganisms. 6 different bacterial pathogens were isolated from diabetic foot ulcer, the results are tabulated in Table No. 1. Out of 6 microorganisms, highly prevalent microorganism was found to be Staphylococcus aureus (25%) and Escherichia coli (25%) followed by Klebsiella pneumoniae (17.5%), Pseudomonas aeruginosa (23.3%), Proteus mirabilis (8.33%) and Acinetobacter baumannii (0.83%).

Out of 120 microorganisms isolated from diabetic foot ulcer, the most frequently Staphylococcus aureus, aerobic gram positive, was isolated as well as from gram negative Escherichia coli and Pseudomonas aeruginosa were also isolated. Highly infective bacterial pathogens were predominant in grade 2 and grade 3 of diabetic foot ulcer patients. The isolates were maximum at
the age group of 50 – 59 years and minimum at the age group of 80 – 89 years. In both the age groups Escherichia coli and Staphylococcus aureus were found to be predominant.

The current study also revealed the sensitivity and resistance pattern for various bacteria against the wide use of different antibiotics. Antibacterial susceptibility testing showed that Staphylococcus aureus is more sensitive to ciprofloxacin (73.33%) and ofloxacin (73.33%). All the gram negative organisms have shown a high degree of sensitivity, maximum to ciprofloxacin (78.57%) followed by amikacin (75%). The results are represented in Table No. 2. From table No. 3 it was found that all the bacterial pathogens were multi drug resistant strains. In our study all the gram negative bacterial pathogens have shown the highest level of resistance to 3rd generation cephalosporins (76.66%). Similarly the gram positive isolate Staphylococcus aureus have shown a maximum level of resistance against gentamycin (66.66%). The drug resistance rate was high in the gram negative microorganisms when compared with the gram positive microorganism.

**DISCUSSION:**
Surveillance studies provide important information that allows for the identification of trends in pathogen incidence and antimicrobial resistance, including identification of emerging pathogens at national and global levels. Routine surveillance is critical for creating and refining approaches to controlling antimicrobial resistance and for guiding clinician decisions regarding appropriate treatment.[2] Out of 76 patients enrolled in the study, 50 (66%) were male and 26 (34%) were female patients, the ratio being 2:1. This signifies that Diabetic foot ulcer were more common among the male population than the female population.

J. Vimalin Hena and Lali Growthern (2010) found that the out of 100 diabetic foot patients, 69 and 31 are from males and females respectively and the ratio between males and female was found to be 2:1. The result of the ratio between male and female in the current study is also similar to the previous study.

Maximum number of patients (both male and female) had diabetic foot ulcer at the age group 50-59 years and minimum no: of patients in the age group 80-89. Hence this signifies that the 50-59 age group is more vulnerable to diabetic foot ulcer. In the same literature it is observed that maximum number of patients having diabetic foot infections belonged to the age group of 56-65 years. The present study also showed similar results.

In our study 64% had right diabetic foot and 36% had left diabetic foot. This implies that more people are prone to right diabetic foot. Out of 76 patients, 67.44% and 36.36% of patients are infected with single microorganism in male and female respectively. The remaining 32.56% and 63.63% of male and female patients respectively, are affected by multiple microorganisms. This shows that patients affected with single microorganism are more in number when compared with multiple microorganisms and the frequency of gram negative microorganism was also higher than gram positive microorganism.

V. Sivakumari et al (2009) study also reflected that gram negative organisms showed a higher incidence (71.7%) than gram positive organisms (25.4%). Sivaraman Umadevi et al (2009) also reported that gram negative bacteria accounted for 70.8%, while gram positive bacteria accounted for 29.2%. P. Ramakant et al (2010) observed that gram negative isolates dominated over gram positive (25.3% vs 15.1%). In the present study the frequency and distribution of gram positive and negative bacteria have shown similar patterns when compared with previous studies.

In the current study 6 bacterial pathogens were isolated and prevalence rates were 25% of Staphylococcus aureus, 25% of Escherichia coli, 17.5% of Klebsiella pneumoniae, 23.33% of Pseudomonas aeruginosa, 8.33% of Proteus mirabilis and 0.83% of Acinetobacter baumanii. Similarly J. Vimalin Hena et al, (2010), also reported that 6 bacterial pathogens were isolated from diabetic foot ulcer and prevalence rates were 47 were S. aureus, 3 were C. koseri, 17 were E. coli, 10 were K. pneumoniae, 27 Ps. aeruginosa, 7 were P. vulgaris. The result of the present study was comparable to that of the previous study.

In 2007 Seyed Mohammad Alavi et al, reported that Staphylococcus aureus isolates were found to be resistant to all tested antibiotics except for ciprofloxacin and amikacin, for which the sensitivity rates were 91% and 80% respectively, which is similar to the current study.

**CONCLUSION:**
From our study and the literature survey we can conclude that all the bacterial pathogens were found to be multidrug resistant strains and the drug resistance was comparatively higher in gram negative bacterial pathogens when compared with gram positive bacterial pathogens. The result of the present study highlighted the alarming resistance to almost all the drugs. Antibacterial resistance has been recognized as a major threat to health since present study highlighted the alarming resistance to almost all the drugs. Antibacterial resistance has been recognized as a major threat to health since the risk of emerging microorganisms, which are untreatable due to resistance, is becoming a worldwide and ever growing problem. Hence this study establishes the importance of continuous monitoring of antibiotic susceptibility patterns that are often regionally specific. The data collected from this type of survey can be used to determine local trends in antibiotic susceptibility and hence aid the rational use of antibiotics in hospitals.[12]

The present study revealed that the majority of the gram negative isolates were more sensitive to amikacin and ciprofloxacin, whereas gram positive isolates were highly sensitive to fluoroquinolones such as ciprofloxacin and...
ofloxacin. Therefore these may be the drugs of choice for the treatment of diabetic foot ulcer at our tertiary care teaching hospital.

ACKNOWLEDGEMENT:
We thank Prof. R.Manavalan and S. Parimalakrishnan for their guidance and moral support.

REFERENCE:
3. Benjamin A. Lipsky. Medical Treatment of Diabetic Foot Infections by the Infectious Diseases Society of America 2004