**INTRODUCTION**

Pakistan has an estimated diabetes prevalence of 7.6% presently; but by 2030, Pakistan will have the fourth largest diabetic population in the world - around 13.8 million people. This makes diabetes one of the most common non-communicable global diseases and the fourth leading cause of death.

Diabetes mellitus (DM) represents several pathological dimensions in which high blood glucose levels gradually damage the nerves, kidneys, eyes, and blood vessels. Diabetic foot ulcers (DFU) are the most crippling complications developing in diabetics, which can quickly become serious. Timely action is crucial to decrease the disability, health costs and reduction in life expectancy and productivity.

Proper management of these infections requires appropriate antibiotic selection based on culture and antimicrobial susceptibility results; however, the initial management comprises of empirical antimicrobial therapy, which is often based on susceptibility data extrapolated from studies performed on general clinical isolates. Another issue is the emerging resistance to antibiotics which is a challenge in the developed and developing world due to misuse and inappropriate use of antibiotics.

It has been shown that 49 - 85% of all diabetic foot related problems, causing significant socioeconomic impact, are actually preventable if timely and appropriate measures are taken.

It is important to discover the latest trend in bacteriology of DFU so as to improve their treatment and management and to save patients from losing their limbs. Research is limited with regard to this aspect of the diabetic complication, whereas its impact on the patient's quality of life is huge; hence the absolute need for this study to be conducted.

The aim of the study was to find the commonest organism in diabetic foot ulcers and the most effective antibiotic is Meropenem and least effective is Cotrimoxazole.

**METHODOLOGY**

This observational, cross-sectional study was conducted in Medical Unit 3, Ward 7, Jinnah Postgraduate Medical
Center, Karachi, from December 2010 to December 2012. Sample size was calculated by Raosoft sample size calculator (http://www.raosoft.com/samplesize.html).

After informed consent, 95 diabetic male as well as female adults were selected by non-probability, consecutive sampling technique from the clinics, wards and emergency room. The criteria of inclusion were type 2 DM on the basis of a raised HbA1c (> 7%) and raised blood glucose levels (with fasting blood glucose > 100 mg/dl and random blood glucose > 180 mg/dl), presenting with infected wounds of Wegener grade 2 - 5,13 and who had yet not received systemic antibiotic therapy within a week. All non-diabetic patients with foot ulcers were excluded.

Culture specimens were obtained after the surface of wound was washed with normal saline followed by debridement of superficial exudates. Specimens were obtained by scraping the ulcer base or the deep portion of the wound edge with a sterile curette. The specimen was cultured using aerobic and anaerobic microbiological techniques. Isolates were tested for susceptibility to commonly used antimicrobial therapy, hence sensitivity to respective antibiotics identified.14 The pus culture was done by a specific accredited pathological laboratory. The sensitivity of the antibiotics to the organism was based on the laboratory report showing the sensitivity to the common major group of antimicrobial agents. The group included the Penicillin group, Cephalosporin, Monobactams, Aminoglycosides, Macrolides, Sulphamides, Quinolones, Vancomycin and Cotrimoxazole. The outcome was the different bacteria found on the culture report from the pathological laboratory and their sensitivity to various groups of antimicrobial agents. The commonest organisms and the most sensitive antibiotic were seen. The resistance and sensitivity of vancomycin was considered only for gram positive organism.

Data analysis was done by SSPS System-version 22 (SPSS Inc. Chicago, IL, USA). Descriptive analysis of qualitative and quantitative variables was done. Data on continuous variables like age is presented as mean ± SD. The categorical data is presented in numbers and percentages; for example, the gender frequency, the most frequent organisms in general, the profile of the common bacteria in different groups of gram-positive, gram-negative or anaerobe. Co-morbid like hypertension, smoker and obesity stratification were done with relation to the frequent organisms in them. The antibiotics that were effective or otherwise overall in the organisms and also in each bacterium separately were determined.

**RESULTS**

Out of 95 patients, there were 52 (54.74%) males and 43 (45.26%) females. The mean age of patients was 52.74 ±9.4 years.
Acinetobacter was most sensitive to Gentamycin. Bacteriodes and Diphtheroids responded to Cefuroxime and Aztreonam. Enterococcus was sensitive to Piperacillin, Meropenem and Amoxicillin. E. coli, Proteus vulgaris, Pseudomonas aeruginosa, Staphylococcus, Klebsiella and Streptococcus species were most sensitive to Meropenem. Morganella morganii responded to Amikacin, Aztreonam, Meropenem and Ciprofloxacin. Proteus mirabilis was controlled by Amoxicillin. Staphylococcus epidermidis was sensitive to Amikacin, Gentamycin, Ciprofloxacin and Vancomycin.

Thirty-nine out of 95 (41%) were hypertensive, 30 (31.5%) were obese and 14 (15%) smoked. Staphylococcus aureus was most frequent in either gender, all age groups and in all the categories (Table III).

**DISCUSSION**

The study showed that males presented more with diabetic foot than females which is consistent to a study done in Karachi where male gender was a factor in DFU. The reason could be that men work outdoors and are more prone to injury, whereas females in our society have comparatively less approach to doctors.

The mean age at presentation was 52.74 years and the most common age group affected was 41 - 60 years. It is in this age group that the diabetes is diagnosed. It is also the age group in which patients are working and liable to trauma. As the age increases, they have comparatively less approach to doctors.

The most frequent organisms isolated were *Staphylococcus (S.) aureus*, *E. coli* and then *Klebsiella*. The results of a study conducted in India and published in American Diabetic Association in 2006 showed *S. aureus* to be commonest, then *Proteus* and then *E. coli*. The results were similar to another one done in the Netherlands. A local study done in Peshawar on 114 patients also reported that *Staphylococcus aureus* (46%) was the commonest organism in DFU. However, the results of a study conducted in China on diabetic foot infections showed *Proteus* to be the most prevalent followed by *E. coli*. Another study done in India in 2011 also showed *E. coli* to be most prevalent with *Staphylococcus aureus* as the second commonest organism. Thus the highest prevalence of *Staphylococcus aureus* in diabetic foot, since the past decade, still remains.

The gram staining of the organisms showed that the gram-negative bacteria were more frequent than gram positive ones. This is also in accordance with studies done in India in 2006 and 2011.

The most effective antibiotic to all organisms was Meropenem, as in another study done on the efficacy of Meropenem on DFU. The next were Amikacin, and Gentamycin. The antibiotic that met with the most resistance in DFUs was Cotrimoxazole, with the next ones being Cefuroxime and Ceftriaxone. Excessive use of Cephalosporin and Cotrimoxazole over the past decades has caused this growing resistance. This signifies how important it is to make judicious use of antibiotics according to the pus culture report and thus to halt the eminent phenomenon of drug resistance.

Considering the effectiveness of antibiotics against the individual organisms, it was seen that Meropenem brought best responses from the three commonest organisms, i.e. *Staphylococcus aureus*, *E. coli*, and *Klebsiella*.

*Staphylococcus aureus* was prevalent in both the genders and in all age groups implying no gender or age difference in the frequency of organisms. Out of 95 patients, two-fifth were hypertensive, one-third were obese and one-sixth were smokers. *Staphylococcus aureus* was prevalent in all the co-morbid states thus denying any difference in prevalence of organisms with respect to co-morbidity. Hypertensive and obese patients presented more with diabetic foot, establishing the need for controlled blood pressure and weight reduction along with controlled sugar.

The study was limited because it was carried out at a relatively small scale and need to be carried out on a larger scale involving other geographical areas to see any difference in the bacteriology of DFU.

**CONCLUSION**

The most frequent organisms in diabetic foot ulcers, regardless of age, gender and comorbidity, were *Staphylococcus aureus*, *E. coli* and *Klebsiella*. The most sensitive antibiotic in these ulcers was Meropenem and the most resistant was Cotrimoxazole. Males presented more with diabetic foot ulcers than females and the most affected age group was 41 - 60 years.

**Disclosure:** This is a dissertation-based article.
REFERENCES


