

Micro-organism culture and antibiotic sensitivity pattern isolated from diabetic foot infections at tertiary care hospital, Mardan

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Abstract

Objective: Diabetic foot infection is leading cause of lower extremity amputation and are preventable if appropriate treatment is given. This study assesses the micro-organism culture of patients with diabetic foot infections and their antibiotic susceptibility pattern.

Study design: Cross-sectional study.

Setting and duration: Surgical Department of Mardan Medical Complex, Mardan from June 2017 to May 2018

Material and Methods: 44 patients with diabetic foot infections of any age group and of both gender were included. Tissue from the foot wounds of diabetic patient was taken and sent for culture and antibiotic sensitivity. All the data was recorded on a standardized proforma and analyzed on SPSS version 21.

Results: In this study 44 patients were included. The mean age of patients was 58.3 ± 7.63 years with male to female ratio of 1:1.2. All patients had type-2 diabetes with right foot involvement in 27 patients and left foot in 17 patients. Single microorganism culture was obtained from 32 patients, polymicrobial culture from 8 patients and no growth found in 4 patients. *Escherichia coli* was the commonest organism isolated (35%) followed by Methicillin Resistant *Staphylococcus Aureus* (MRSA) 20% and *Proteus* (10%).

Escherichia coli and *Proteus* were found sensitive to Carbapenems, Amikacin and Tazobactam piperacillin while MRSA was sensitive to Vancomycin and Linzolid.

Conclusion: Gram-negative aerobes were the commonest organisms cultured with predominance of *Escherichia coli* followed by gram-positive aerobe MRSA in diabetic foot infections. This study helps us to choose empirical antibiotics for patients with diabetic foot infections

Keywords: diabetic foot infection, microorganism culture, antibiotic sensitivity, amputation.

Introduction:

Diabetes Mellitus is one of the most debilitating systemic diseases of 21st century. It is one of leading cause of morbidity and mortality now-a-days with a prevalence of 8.5% worldwide.¹ Diabetic foot ulcer is known complication of diabetes. The risk of undergoing amputation is 15-45 times higher in diabetic foot when compared to other causes.² Diabetic foot ulcer prevalence ranges from 4 to 10% in Pakistan and amputation rates for diabetic foot is very high and accounts for 21 to 48% of all amputations.³ The risk factors for diabetic foot include age of

patient, long standing diabetes, poor glycemic control, peripheral vascular disease, structural deformity and foot infection.⁴

Diabetic foot and its infection are most worrisome complication of diabetes. Diabetic foot infection is an important cause of admission in surgical ward. Diabetic foot infections are often polymicrobial. Most often these are aerobic bacteria, such as *Staphylococcus aureus*, *Streptococcus pyogenes*, *Escherichia coli* (*E.coli*), *Proteus mirabilis*, *Pseudomonas aeruginosa*, and anaerobic bacteria, for example, *Bacteroides*

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Table-1: Organism isolated on wound culture

	Frequency(n)	Percent (%)
E. Coli	14	35.0
Pseudomonas+E.coli	2	5.0
MRSA+Streptococci	2	5.0
Enterococci+E.coli	2	5.0
Klebsiella	2	5.0
MRSA	8	20.0
Enterococci	2	5.0
Acelitobactor	2	5.0
Proteus	4	10.0
MRSA+morgenella	2	5.0
Total	40	100.0

fragilis, Clostridium perfringens, Peptostreptococcus spp., and Prevotellaoralis. The increasing association of multidrug-resistant pathogens with diabetic foot ulcers further compounds the challenge faced by the physician or surgeon in treating diabetic foot ulcer without resorting to amputation. Infection with multidrug-resistant pathogens is also responsible for the increased duration of hospitalization, cost of management, morbidity and mortality of the diabetic patients and are actually preventable if timely and appropriate measures are taken (49-85%).^{5,6}

There are numerous studies in the literature on microbiological study of diabetic foot infections along with their susceptibility patterns for antibiotic therapy from different parts of the world and also studies have been conducted in Pakistan however no local data is available. In view of the above facts, a prospective study was carried out at tertiary care hospital Mardan to determine the relative frequency of microbial isolates cultured from diabetic foot infections and to assess their susceptibility to the commonly used antibiotics.

Methods and Materials:

This cross-sectional study was conducted at Surgical Department of Mardan Medical Complex, Mardan from June 2017 to May 2018. After approval from hospital ethical committee, a total of 44 consecutive patients with type-1 or type-2 diabetes admitted with infected wound on foot, of any age and gender were included in the study.

All the patients were selected through non-probability consecutive technique. Patients were included in the study after taking informed and written consent. Detailed history and thorough examination of the patients were done. Tissue culture from the infected foot wound was taken under strict aseptic techniques before starting patient on antibiotic and sent for culture and antibiotic sensitivity to hospital laboratory.

All the data was recorded on a standardized performa. Bias and confounders in the study were controlled by strictly following the exclusion criteria. The data was analyzed with the help of computer software SPSS for windows version 21. For categorical variables, frequencies were calculated while for continuous variables; mean and standard deviation were calculated.

Results:

In this study 44 patients were included. The age range was 45 years to 70 years with mean age of 58.3 ± 7.63 years. Among 44 patients 20(45.5%) were male and 24(54.5%) were female. All (100%) the patients had type-2 diabetes. Right foot was involved in 27(61.4%) patients while left foot in 17(38.6%) patients. Monomicrobial culture was obtained from 32 patients, polymicrobial culture was obtained from 8 patients and no growth found in 4 patients. Gram negative aerobes were predominant (70%) with gram positive found only in 30% of wounds of diabetic foot. Escherichia coli was the commonest organism isolated (35%) followed by Methicillin Resistant Staphylococcus Aureus (MRSA) 20% and Proteus (10%) as shown in table-1.

Escherichia coli were found sensitive to Carbapenems, Amikacin and Tazobactam piperacillin. While MRSA and Enterococci were sensitive to Vancomycin and Linzolid. Proteus species were sensitive carbapenems and Amikacin. Klebsiella were susceptible to Amikacin, Tigecyclin and Polymixin B. Pseudomonas was sensitive to floroquinolones and Vancomycin

Discussion:

Diabetic foot ulcer infection is a worrying complication and is very difficult to deal with. Poor

glycemic control along with neuropathy, vasculopathy and immunosuppression results in development of diabetic foot ulcer.⁷ Super imposed infection further deteriorates the problem resulting in spreading cellulites, osteomyelitis and limb gangrene.⁸ This result in amputation and limb loss which can be prevented if appropriate and timely treatment given.^{2,6}

Majority cases are due to poly microbial infection. Akhi MT et al performed a study which shows polymicrobial predominance 59% while mono-microbial infection was found in 41% of cases.⁹ In another study performed by Saseedhran S et al polymicrobial predominance was found to be 55.7% and mono microbial infection was found in 44.3%.¹⁰ Some studies shows monomicrobial infection predominance.¹⁰⁻¹² This difference may be because of geographical variation and severity of infection. Our study shows predominance of monomicrobial infection in 32 patients (80%) while polymicrobial infection was found only in 8 cases(20%).

Most studies shows predominance of gram positive infection.⁹⁻¹¹ In some studies there is predominance of gram negative infection.^{2,6,11,13} In our study there was predominance of gram negative aerobes 54% and gram positive was found only in 27.27%. Previously Methicillin resistant staphylococcus aureus was considered to be the predominant organism involved in diabetic foot ulcer infection.^{9,10,14,15} But recent studies suggest that there is change in culture pattern of isolates from diabetic foot infection with predominance of gram negative bacteria.^{14,15} Gadepalli R et al reported that E.coli being most common cultured bacteria from diabetic foot 37%.⁶ In our study E.coli found to be the most common bacteria being cultured in 40.90% of cases second most common bacterial culture was MRSA 27.27%. Third most common pathogen isolated from samples was Proteus Penneri 9.1%. From 9.1% of samples no bacteria were isolated. This may be because the infection was caused by fungus or some atypical bacteria that are grown in some special culture media or these infections were caused by some anaerobic pathogens which need special considerations.

In our study the most common bacteria was E.coli. All samples isolated were found sensitive to Carbapenems, Amikacin and Tazobactum/Piperacillin and resistant to Penicillin, cephalosporin and floroquinolones. Nageen A and Bengalorkar G.M also reported that E.coli was sensitive to carbapenems and Amikacin.^{5,6} The resistance to other antibiotics may be due to previously untreated or partially treated diabetic foot infection or use of antibiotics for some other infection. The second most common pathogen isolated was MRSA this pathogen was found sensitive to Vancomycin and Linzolid. Previous studies also show that this pathogen is sensitive Linzolid and Vancomycin.¹⁷ Proteus penneri was third most common bacteria. These bacteria were sensitive to Amikacin and Carbapenems. Pseudomonas and Enterococci are two important bacteria in diabetic foot infection in this study they were found sensitive to floroquinolones, carbapenems and Vancomycin, Linzolid respectively.

There are several limitations in this study that needs to be considered while interpreting its results. The sample size was small (44 patients) which may limit the power of the study. Patients were not followed up to see the efficacy of the antibiotics according to tissue culture and sensitivity. The decision on proper management of diabetic foot infection is still debatable. Although optimal therapy is yet to be established, most authors agree that the management of these infections requires isolation and identification of the culprit organism; appropriate antibiotic therapy according to the sensitivity patterns and proper timely surgical intervention when required.

Conclusion:

Single organism was cultured from most of the infected foot wounds of diabetic patient with predominant gram-negative aerobes. Escherichia coli was the commonest organism isolated followed by MRSA and Proteus. Escherichia coli were found sensitive to Carbapenems, Amikacin and Tazobactum piperacillin while MRSA to Vancomycin and Linzolid and Proteus species to carbapenems and Amikacin.

Diabetic foot infections along with their susceptibility patterns for antibiotic therapy differ in different parts of the world. In view of the above facts, empirical antibiotic therapy might be initiated according to local pattern of bacterial etiology and its sensitivity.

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Role and contribution of authors:

Dr Mukhtiar Ali, discussion writing and proof reading

Dr. Tamjeed Gul, introduction writing and data analysis

Dr. Asif Imran, data collection

Dr. Abbas Ali, data collection and reference writing

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