

A CLINICAL STUDY OF DIABETIC FOOT ULCER AND ITS OUTCOME BASED ON DRUG TREATMENT IN A TERTIARY CARE TEACHING HOSPITAL

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ABSTRACT

Introduction: Diabetes is a lifelong problem, and the incidence of diabetic foot complications increases with age and duration of the disease. Ulceration, infection, gangrene, and amputation are significant complications of the disease. One of the most common complications of diabetes in the lower extremity is the diabetic foot ulcer with superadded infections. An estimated 15% of patients with diabetes will develop a lower extremity ulcer during the course of their disease. Charcot foot, which of itself can lead to limb-threatening disorders, is another serious complication of long-standing diabetes. These complications frequently result in extensive morbidity, repeated hospitalizations, and mortality. Not all foot complications can be prevented, dramatic reductions in frequently have been achieved by taking a multidisciplinary approach to patients. **Objectives of the study:** To understand the pathology of diabetic foot and relative distribution of this condition according to age, sex, among diabetic patients. To study the benefit and outcome of the different drug treatment modalities for diabetic foot thereby reduce the risk of lower limb complications in people with diabetes by strict diabetic control and appropriate antibiotic therapy. This study was conducted comprising of 100 patients of diabetic foot in Coimbatore Medical College from period of Jan 2019-Jan 2020. **RESULTS:** Commonest presenting lesion was ulcers (44%), followed by gangrene and cellulitis. Commonest site of the lesion was dorsum of the foot (32%), followed by fore foot (28%), and toes (22%). More than half of the patients 82% had infection. Most common microorganism grown from culture was staphylococcus aureus (30%). A total of 100 strains were cultivated, including 35 (35%) strains of gram-positive organisms (GPOs), 51 (51.0%) gram-negative bacilli (GNB), and. The susceptibility tests showed that the *Staphylococcus* genus was more susceptible to Cefotaxime, linezolid, and Doxycycline. Gentamycin was the most effective drug for the treatment of *Escherichia coli*, followed by imipenem and cefotaxime. Most of the remaining GNB were susceptible to antibiotics such as carbapenems, aminoglycosides, fluoroquinolones, ceftazidime, cefepime, and piperacillin-tazobactam. Prognosis was good in 72 (72%) patients. 2(2%) patients died due to septicemia. **Conclusion:** Diabetic patients at risk for foot lesions must be educated about risk factors. The multidisciplinary team approach to diabetic foot disorders has been demonstrated as the optimal method to achieve favorable rates of limb salvage in the high-risk diabetic patient. Early identification of organism and starting appropriate antibiotic therapy will help in reducing surgical intervention

KEYWORDS: Diabetes, foot ulcers, drug sensitivity.

INTRODUCTION

Diabetes mellitus is a worldwide problem. The incidence of diabetes mellitus is increasing globally.^[1] Patients with diabetes have a 12% to 255% life time risk of developing a foot ulcer.^[2] In the diabetic patient, the foot is the crossroad for many pathological processes, in which almost all components of the lower extremity involved; from skin, subcutaneous tissue, muscles, bones and joints, to blood vessels and nerves. Foot disorders are a major source of morbidity and a leading cause of hospitalization for persons with diabetes. Ulceration, infection, gangrene, and amputation are significant complication of the disease, estimated to cost billions of

dollars each year. Prevalence of diabetes in adults worldwide was estimated to be 4% in 1995 and is expected to rise to 5.4% by the year 2025. The number of adults with diabetes in the world will rise from 135 million in 1995 to 300 million in the year 2025. There will be a 42% increase, from 51 to 72 million, in the developed countries and a 170% increase, from 84 to 228 million, in the developing countries. The countries with the largest number of people with diabetes are, and will be in the year 2025, India, China, and the U.S.^[3]

India alone, diabetes is expected to increase from 40.6 million in 2006 to 79.4 million by 2030.^[4] India

presently has the largest number of diabetic patients in the world and India is thus designated to become the diabetes capital of the world. Diabetic foot ulcers occur mostly among elderly people, and elderly diabetics have twice the risk of developing foot ulcers, three times the risk of developing a foot abscess and four times the risk of developing osteomyelitis.^[5]

Eighty-five percent of diabetic major amputations begin with a foot ulcer, and the common pathway to amputation involves infection entering the foot and leading to gangrene. The diabetes mellitus is the fourth to fifth leading cause of death in developed countries.^[5]

Studies from different countries have revealed different DFI-related microbial compositions and drug susceptibilities, and the ratios of patients associated with multidrug resistance (MDR), methicillin-resistant *Staphylococcus* (MRS), and extended-spectrum β -lactamase (ESBL) bacterial infections have increased every year. Hence aim of our study is to understand the pathology of diabetic foot and relative distribution of this condition according to age, sex, among diabetic patients. To study the benefit and outcome of the different drug treatment modalities for diabetic foot. To reduce the risk of lower limb complications in people with diabetes by strict diabetic control and appropriate antibiotic therapy

MATERIALS AND METHODS

This study was conducted comprising of, 100 patients of diabetic foot in the Coimbatore Medical College hospital, Coimbatore. In all patients detailed history taking, thorough physical examination, relevant investigations and assessment of patients following treatment with regards to symptoms were done. All patients with diabetes mellitus suffering from foot ulcers and infections of all age group were included in the study. Also, patients with gangrenous foot, complicated by diabetes are included in the study. Whereas patients with foot infections without diabetes mellitus are excluded. Also, patients whose treatment could not be completed due to non-compliance are excluded.

Before patients were treated with antibiotics, they should undergo debridement with normal saline. After removing surface carrion and exudate, deep ulcer secretion should be taken with sterile cotton swab, kept by sterile tube, and sent to microbiology lab of laboratory medicine quickly for anaerobic bacteria, aerobic bacteria, fungal culture, and drug susceptibility test. Bacterial drug resistance was determined based on the antimicrobial susceptibility test guidelines published by the Clinical and Laboratory Standards Institute (CLSI).

OBSERVATION AND RESULTS

An analysis of 100 cases of diabetic foot was done. Of 100 cases studied, most of the diabetic patients with foot lesions were in the age group of 61-70 (32%) followed by 51-60 (24%). Out of 100 cases studied, there was

obvious male predominance in occurrence of diabetic foot lesion. 78 (78%) were male patients and 22 cases females' patients. Ratio of Male: Female is 3.54: 1.

Out of 100 cases, 44 (44%) cases presented with ulcers, 20 (20%) cases with cellulitis 8 (8%) of cases abscess, 24 (24%) of cases gangrene and (4%) of cases Neuropathic ulcer.

Table 1: Clinical presentation.

Clinical presentation	No. of patients	Percentage
Ulcer	44	44
Cellulitis	20	20
Abscess	12	8
Gangrene	15	24
Neuropathic Ulcer	6	4

The most common site of lesion in the diabetic foot was dorsum of foot which was in about 32 patients (32%). Then whole fore foot which comprised about 14 cases (14%). The least was heel which was about 4 (4%) patients. Also, out of the 100 cases studied 60 patients (60%) not had history of trauma and 40 patients (40%) not had history of trauma.

Most of the patients had diabetes duration for about 6-10 years (28%). One patient had history of diabetes for only 4 months and a 80 years old male patients ^' came with past history of diabetes with duration of 24 years. So there was a wide range.

Table 2: Duration of DM.

Duration of DM in Year	No. of Patients	Percentage
0-1 Year	6	6
2-5 Year	16	16
6-10 Year	28	28
11-15 Year	24	24
16-20 Year	20	20
> 20 Year	6	6

The most common gram-negative bacteria in were *Klebsiella* (15%), *Escherichia coli* (13%), *Pseudomonas aeruginosa* and *Proteus*. In 14 (14%) patients there was no growth seen on culture some cultures yielded more than one type of bacteria. *Staphylococcus aureus* was still the most common Gram positive organism.

The *Staphylococcus* genus was more susceptible to vancomycin, linezolid, and Doxycycline,. A total of 18 strains of the *Staphylococcus* genus were identified from the culture and drug susceptibility tests also were susceptible to followed by moxifloxacin and showed poor susceptibility to clindamycin and erythromycin. *Enterococcus faecalis* was most susceptible to tigecycline (100%) and ampicillin (100%), followed by vancomycin (96.6%), penicillin G (96.6%), and linezolid (86.2%).

Gentamycin was the most effective drug (93%) for the treatment of *Escherichia coli*, followed imipenem (90%), and Cefotaxime but *Escherichia coli* had poor susceptibility to amikacin and levofloxacin (all <50%). Most of the remaining GNB were susceptible to antibiotics such as carbapenems, aminoglycosides, fluoroquinolones, ceftazidime, cefepime, and piperacillin-tazobactam (>63.2%). In addition, this study cultured 15 ESBL strains, which showed high susceptibilities (100%) to imipenem, followed by amikacin (90%), cefotaxime (83.3%), and piperacillin-tazobactam (76.7%), and were less susceptible to levofloxacin (36.7%) and ciprofloxacin (26.7%).

We also analyzed the most common form of insulin used on the admission was H. Actrapid in 62 (62%), patients and in 4 (4%) patients' glargine was used which was the least. Other types of insulin used were H.Mixtard and H. Actrapid together.

Out of 100 patients treated 12 (12%) patients were managed conservatively by slough excision and regular dressing with antibiotics with diabetic control. 28 (28%) patients were treated with wound debridement, 10 (10%) patients treated with SSG, (6%) patients underwent I & D for abscess and 5(10%) patients underwent fasciotomy and 6 (16%) patients presented with gangrene of toes and phalanges were M treated with disarticulation. 4(4%) patients underwent below knee amputation and 14 (14%) patients were above knee amputation. In most of the cases, limb was salvaged by conservative treatment and minor complications.

Table 13: Treatment.

Operative procedure	No. of Patients	Percentage
Slough excision & Regular dressing	12	12
Wound debridement	28	28
SSG	10	10
I&D	6	6
Fasciotomy	10	10
Disarticulation	16	16
Bellow Knee amputation	4	4
Above knee amputation	14	14

In this study minimum stay in the hospital was 10 days and maximum were 150 days. The most common duration of hospital stay was between 21-40 days (36%). This long duration of hospitalization can be explained by the refractory to the treatment of the lesions owing to the diminished resistance of the body, hyperglycemia, prepared hormonal defense mechanisms and resistance of the organisms to antibiotic therapy. In this study 72 (72%) cases prognosis was good and in 20 (20%) cases it was satisfactory. 2 (2%) patients died of septicemia and 6(6%) cases were discharged against medical advice.

DISCUSSION

An analysis of 100 cases of diabetic foot was done. Of

100 cases studied, most of the diabetic patients with foot lesions were in the age group of 61-70 (32%) followed by 51-60 (24%). The youngest has 31 years came with complaints of abscess over the (R) fore foot and the oldest was 80 years admitted for cellulitis of (R) whole fore foot. When compared with Wheel and Root series,^[6] there is not much difference in youngest and oldest age group.

Similar to Jennifer A. May field et al.,^[7] study, the Present study had a greater number of male patients 39 (78%) suffering from diabetic foot lesions than females 11 (22%). But the proportion between the two was far greater in this study. The present study had ratio of Male: Female as 3.54: 1. The incidence is more among males probably as they are mostly working out door, which makes them more vulnerable for trauma and sequel.

Incidence of gangrene in the present series is comparatively equal to that of Bell series of 1960.^[8] Out of 100 cases studied in this series, 44 cases (44%) presented as diabetic. ulcers. Out of these, 44 cases, the most common site of occurrence was on dorsum of foot 32% where as in Apelqvist et. Al.,^[9] and Reiber et. Al.,^[10] study the common site was toes which was 51% and 52% respectively. Surprisingly toes (15%) were the least common site to be involved in the present study.

In our study 60 (60%) cases had a history of trauma before the onset of the lesion. In Jennifer. A. May Field et al.,^[7] there was no significant percentage of cases: with respect to history of trauma prior to occurrence of diabetic foot lesion.

In the present study 52 (52%) cases were found to have neuropathy. The, majority of the patient had history of diabetes of more than 5 years. This shows that peripheral neuropathy is common in long standing diabetic patients. This is similar to studies done by Duncan et al^[11] where the incidence was around 45%. The most common gram-negative bacteria in were *Klebsiella* (15%), *Escherichia coli* (13%), *Pseudomonas aeruginosa* and *Proteus*, these results were similar to the findings of de Vries et al.^[14]

Our results indicated that the DFI-causing bacteria were dominated by GNB (51%), which differed from the results of the survey performed in southern China from 2009 to 2014^[15] in which GPOs accounted for 54% of the infections.

In the present study the commonest gram positive organism cultured was staphylococcus aureus 30 (30%) which was similar to study conducted by Gibbons et al.^[12] Second common was pseudomonas in our study whereas in other studies it was streptococcus species. The distribution of species apart from Staph aureus was not similar to other studies done by Gibbons et al.

Our results suggested that most GPOs, including *Staphylococcus aureus*, were susceptible to

vancomycin, linezolid, and Doxycycline and were resistant to penicillin G, erythromycin, and clindamycin. These findings were different from the observations from Bravo-Molina et al.,^[16] which showed that fluoroquinolone antibiotics were the most susceptible antibiotics for GPOs. In this study, only *Staphylococcus aureus* showed good susceptibility to fluoroquinolone antibiotics (>80%), whereas the other GPOs showed low susceptibility.

Coming to treatment part in the present series, 12 cases were treated by slough excision and regular dressing, 14 cases were treated by wound debridement 10 with SSG, 16 by disarticulation of single or multiple toes at the level of metatarsophalangeal joints. I & D and fasciotomy done in 6 and 10 cases respectively. Below knee amputation was done in 4 cases and above knee amputation was done in 14 cases.

The amputation rate is much lower 18% compared to Miyajima^[13] study in 2005. This could be due to, better education of the patient, better glycemic control, proper case of foot, proper use of antibiotics, extensive debridement and regular dressing after amputation wound healed well. The patients were referred to rehabilitation center for further improvement.

In the present series out of 100 cases studied 66% cases had good prognosis. One 2% patient died and 32% patient underwent amputation at various levels. Conservative treatment is more in both studies. Death is very less in our study compared to other studies like Apelqvist et al and Reiber et al.

CONCLUSION

By identifying high-risk patient and tailoring a total foot care prevention program accordingly, the incidences of ulceration and lower extremity amputations can be reduced. In addition to actively applying appropriate antibiotic treatment, multidisciplinary management combined with foot pressure reduction, timely debridement, and lower extremity vascular intervention should be applied to increase the success rate of anti-infection treatment and to reduce the amputation rate.

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