

ORIGINAL ARTICLE

CLINICAL STUDY AND SURGICAL MANAGEMENT OF DIABETIC FOOT: A PROSPECTIVE SINGLE INSTITUTIONAL STUDY

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HOW TO CITE THIS ARTICLE:

Ananda B. B, Ravishankar K. S. "Clinical Study and Surgical Management of Diabetic Foot: A Prospective Single Institutional Study". Journal of Evolution of Medical and Dental Sciences 2014; Vol. 3, Issue 66, December 01; Page: 14362-14369, DOI: 10.14260/jemds/2014/3926

ABSTRACT: INTRODUCTION: The most frequent reason for hospitalization for patients with diabetes is foot complications, which accounts for up to 25% of all diabetic admissions. The clinical triad most commonly seen in diabetic foot ulcer is peripheral sensory neuropathy, trauma and deformity. Approximately 15% to 20 % of the population in US is hospitalized with complications at some-time during course of their disease. Diabetic foot infections are defines as any inframalleolar infection in a person with diabetes mellitus. Diabetic patients may develop many types of foot ulcers, any of which can get infected. Infection should be diagnosed clinically on the basis of cardinal manifestations. Selection of antibiotic regimen initially involves decision about route of therapy, spectrum of microorganisms to be covered, and the specific drugs to administer and later involves choosing the definitive regimen and the duration of treatment. **OBJECTIVE:** 1. Early detection of risk factors for ulceration by specific history and systematic examination of the foot. 2. To study the microbial agents of wound infection in the diabetic foot infections. 3. To classify the ulcers, which facilitates in logical approach to treatment and in predicting outcome? 4. To formulate the management by multidisciplinary approach. 5. To describe the surgical treatment and wound care of diabetic foot ulcers. **MATERIALS AND METHODS:** All the patients (Both out-patient basis and hospitalized patients) with diabetic foot ulcers of more than two weeks duration at Dr. B R Ambedkar Medical College and Hospital from November 2012 to February 2014 are counseled for investigation and treatment of diabetic foot ulcer and its complications. **RESULTS AND CONCLUSION:** 1. The incidence of diabetic foot was seen highest in 51 to 60 years. 2. Male to female ratio was 4:1. 3. By occupation, most patients were farmers (44%). 4. Diabetic foot most commonly seen in patients with duration of diabetes more than 5 years. 5. Most common mode of presentation is non-healing ulcer followed by foot abscess. 6. Duration of hospital stay was between 15 days to 45 days with average of around 30 days.

KEYWORDS: Diabetes, Diabetic foot, cellulitis, neuropathy, oedema, myopathy.

INTRODCUTION: Diabetes mellitus is a universal syndrome with metabolic, vascular and neuropathic components. The metabolic syndrome is characterized by alteration in carbohydrate, fat and protein metabolism secondary to absent or markedly decreased insulin secretion and/or insulin resistance.¹ one of the most dreaded complications seen in diabetes is a foot problem now termed as "Diabetic Foot Syndrome". Presence of foot problem restricts the mobility of the patient, but often requires intensive medical care often associated with prolonged hospital stay and surgical intervention.¹

The World Health Organization (WHO) defines diabetic foot as the lower limb of a diabetic patient that has potential risk of pathological consequences, including infection, ulceration, and/or destruction of deep tissues associated with neurologic abnormalities, various degrees of peripheral vascular disease, and/or metabolic complications of diabetes.

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Bloom has said "The elderly diabetic is often divorced from his feet, unable to see them because of poor eye sight, and unable to palpate them because of sensory loss". Today it is possible to prevent diabetic foot lesions and to salvage and maintain a functional foot in those who have developed diabetic foot. A foot with less functional capacity is always preferable to no foot at all.

The most frequent reason for hospitalization in patients with diabetes is foot complications, which accounts for about 25% of all diabetic admissions.² The clinical triad most commonly seen in diabetic foot ulcers is peripheral sensory neuropathy, trauma and deformity.³ Approximately 15% to 20% of the estimated 16 million population in US are hospitalized with complications at some-time during course of their disease.⁴ Diabetic foot infections are defined as any inframalleolar infection in a person with diabetes mellitus.

Most common and classical lesion in diabetic foot ulcers is "Malperforans". Diabetic patients may develop many type of foot ulcers any of which can become infected. Infection should be diagnosed clinically on the basis of cardinal manifestations of inflammation i.e., warmth, redness, swelling, induration, pain and tenderness.⁵ Selection of antibiotic regimen initially involves decision about route of therapy, spectrum of microorganisms to be covered, and the specific drugs to administer and later involves choosing the definitive regimen and the duration of treatment.

Successful treatment of diabetic foot ulcers consists of addressing the basic issues like debridement, offloading and infection control. The primary goal in treatment is to achieve closure of wound as quickly as possible.⁶ After debridement, the wound should be irrigated with saline or cleanser and a dressing should be applied. Dressings should prevent tissue desiccation, absorb excess fluid, and protect the wound from contamination.⁷ Wound debridement plan is formulated based on ulcer findings. The goal is to physically excise dead and unhealthy tissue and removing a reservoir of potential pathogens.⁸

Other adjuvant treatments of wound care includes wound vacuum drainage system, recombinant growth factors, skin substitutes, antimicrobial dressings and maggot debridement therapy.⁹ Dealing with osteomyelitis is most difficult and controversial aspect. Furthermore, its presence increases the likelihood of surgical interventions, including amputation and increased antibiotic treatment.¹⁰ 80% of diabetic foot amputations are preceded by a diabetic foot ulcer.² The rate of lower extremity amputation is 17 – 40 times higher than in non – diabetics. Detection of neuropathy before its complications ensue is the best method to prevent foot infections. Educate the patient about the importance of optimizing the glycaemic control, using appropriate footwear all the time, avoiding foot trauma, performing daily self-examination of the feet and reporting any changes to health care.

AIMS AND OBJECTIVES:

1. Early detection of risk factors for ulceration by specific history and systematic examination of the foot.
2. To study the microbial agents of wound infection in the diabetic foot infections.
3. To classify the ulcers, which facilitates in logical approach to treatment and in predicting outcome?
4. To formulate the management by multidisciplinary approach.
5. To describe the surgical treatment and wound care of diabetic foot ulcers.

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METHODOLOGY: The data for the study is obtained from patients (both outpatient basis and hospitalized patients) with diabetic foot with more than two weeks duration at Dr. B. R. Ambedkar Medical College and Hospital, Bangalore during November 2012 to February 2014. All the patients are counseled for investigation and treatment of diabetic foot ulcer and its complications. 80 patients were treated in the above period. All the patients were evaluated by proper clinical history, detailed physical examination, necessary investigations, and analyzed for predisposing and precipitating factors and also studied about the treatment and sequel. Investigations did include complete blood picture, blood sugar analysis, urine analysis, renal profile, lipid profile, foot x-ray, wound discharge for culture and sensitivity in all the patients.

General and medical treatment of diabetes like diabetic diet, sugar restriction is done. The sequence of events from the time of first opinion to the complete healing of the ulcer were recorded and evaluated along with the treatment protocols followed and the requirement of surgical intervention if any. At the time of discharge, anti-diabetic medications are changed to oral hypoglycaemic drugs and advice regarding diet, exercise and foot care was given. Patients were followed up regularly. On follow up, blood sugar analysis for done and foot was examined for wound healing, any new lesions and movement of joints. Major amputation patients were advised clutches and artificial prosthesis 2 to 4 weeks after the surgery.

In this study, various modes of presentations of diabetic foot, progression, complications and its management are analyzed and discussed.

RESULTS: The present study is a prospective study. The total number of patients is 80 in the age group of 35 years to 75 years. Male: Female ratio is 4.3:1. Maximum incidence of diabetic foot lesions was seen in the age group of 45 to 60 years. Majority of patients are farmers and daily laborers (68%). The most common site of lesion was dorsum of foot (51%) followed by plantar aspects of toes and metatarsal heads (38%), while the least common site was heel (3%) (Figure 1). The most common mode of presentation was non-healing ulcer (45%) followed by foot abscess (21%) and gangrene (20%).

Most of the patients had diabetes for duration of 6 to 10 years (38%). 3 patients were detected with diabetes only after admission for foot cellulitis. In this study, 73 patients knew that they are diabetic before admission. The patients with infection and gangrene presented earlier than those with neuropathy.

In this study 58 patients (72.5%) predominantly had infection, vasculopathy was seen in 17 patients (21%) and neuropathy in 5 (6%). The relative higher incidence of infection is due to bear foot walking and poor personal hygiene.

In all the patients there were enlarged vertical group of inguinal lymph nodes. Limb ischemia, neuropathic complications and infection was a co-existing feature. Blood sugars became normal only after correction of infection with combined modality of treatment i.e., with intravenous antibiotics, regular dressing and wound debridement. (Table 1).

The most common microorganism grown on aerobic culture was coagulase +ve staphylococcus (Graph 1) while in 10 cases no growth was detected. Most common antibiotic found to be sensitive was amikacin (30%) (Graph 2). In the present study, 15 patients were managed conservatively by regular dressing, antibiotic and control of diabetes and almost equal number of patients is treated with incision and drainage. (Graph 3) 27 patients (34%) underwent wound debridement followed by skin grafting and 17 patients (21%) underwent disarticulation of toe/s.

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The amputation rate is 10% i.e 1 patient underwent syme's amputation, 3 patients underwent below knee amputation and 2 patients underwent above knee amputation. Average duration of hospital stay was about 5–6 days. The most common complication was fever (26%), followed by soreading cellulitis (12%), diabetic ketoacidosis (9%). One patient developed bedsore while another patient developed renal failure with spreading cellulitis. There was no mortality in this study.

DISCUSSION: In this millennium, the issue of chronic wound management still remains an enigmatic challenge.¹¹ Foot ulceration is a major complication of diabetes and consumes a major portion of the resources allocated for the treatment of diabetes.¹² the mortality rate in patients with diabetic foot ulceration is also high and is approximately twice that of patients without ulceration.¹³ many ulcers are potentially preventable and are therefore of neuropathic or neuroischemic etiology.^{14,15} neuropathy and peripheral vascular disease have been identified as major risk factors for diabetic foot ulceration and amputation.

Motor neuropathy leads to atrophic changes in the foot musculature that cause foot deformity and decreased joint mobility. These problems subsequently lead to an area of increased plantar foot pressure. The lack of protective sensation from sensory neuropathy leads to repetitive trauma from an area of high pressure that results in ulceration.¹⁶ Pecoraro et al,¹⁷ who studied consecutive american veteran diabetic amputees and demonstrated that neuropathy was a contributory factor in 61% of cases and that 86% of the amputations could have been prevented. However, as shown by jonson,¹⁸ The major obstacle to performing proper estimates and economic evaluations in this area is the lack of effective data.

The majority of non-traumatic lower extremity amputations are performed in diabetics. Factors that were associated with an amputation were male gender, low education level, manual occupation, lower income group, poor foot care practice, and peripheral vascular compromise. A low haemoglobin concentration and low red blood cell count in males, and an elevated white cell count were significantly associated with the need for major amputation.¹⁹ Immune activation may precede the incidence of a diabetic foot ulcer in the same way that it precedes the manifestation of type 2 diabetes and coronary heart disease.²⁰

Christian et al²¹ showed diabetic patients with foot ulceration showed an up regulation of circulating levels of a range of acute-phase proteins, cytokines, and chemokines and lower levels of the chemokine rantes compared with diabetic patients without a history of foot ulcer. Severity of foot ulcer based on the University of Texas Classification was associated with levels of crp, il-6, and fibrinogen in unadjusted comparisons and in multiple linear regression models.²¹ Various screening techniques have been proposed and are currently in use. These include the evaluation of vibration perception threshold (vpt), plantar foot pressure measurements, joint mobility, and 5.07 semmes weinstein monofilament (swf) testing.

A history of previous foot ulceration, a tcpo2 level of <30mmhg, and the existence of foot deformities have also been shown to be risk factors for the development of diabetic foot ulceration.¹⁹ Combination of clinical examination and swf testing is the most sensitive method for identifying the patient at risk for foot ulceration. Vpt measurements are also helpful and can be used as an alternative. Foot pressure measurements offer a substantially higher specificity and can be used as a post screening test in conjunction with providing appropriate footwear. In thus study, the most common site of foot ulcer was dorsum of foot, while in studies by reiber et al²² and apelqvist et al,²³ the most common site was toes.

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In our study majority are males, higher incidence in males may be due to smoking, alcohol intake and strenuous work. The most common bacterial isolate was coagulase positive staphylococcus, which is consistent with study by gibbons et al.²⁴ The duration of diabetes is directly proportional to the complication rate. In our study, the complication rate was 41% in patients with duration of diabetes >15 years. Litzelman et al.²⁵ have confirmed the value of a multidisciplinary approach to education and self-care for diabetic patients in general practice. A significantly lower incidence of serious foot lesions was observed in their intervention group.

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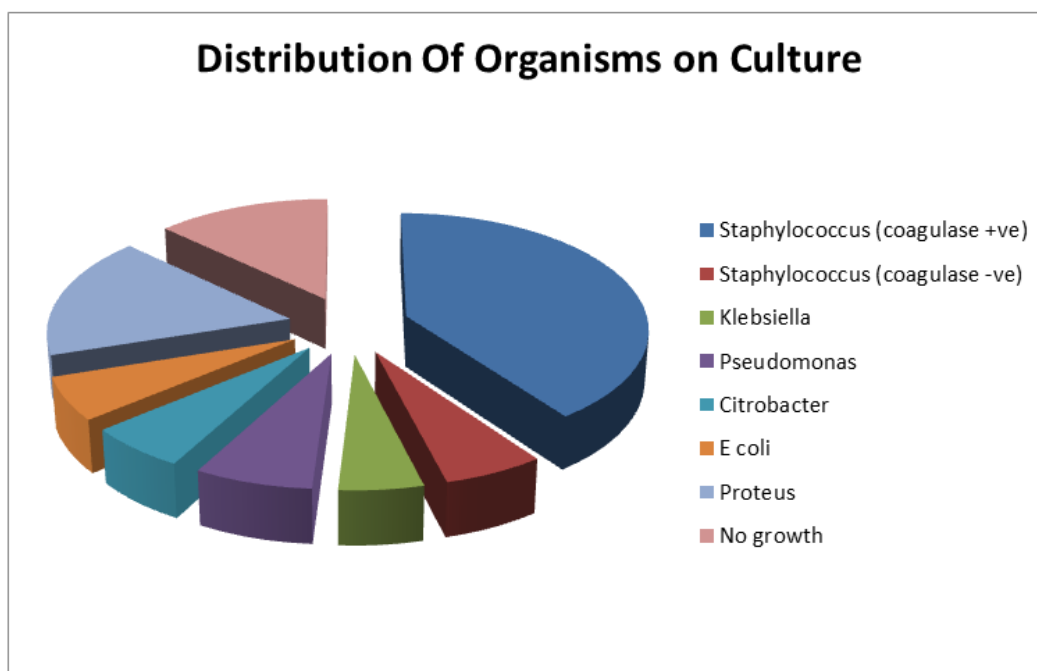
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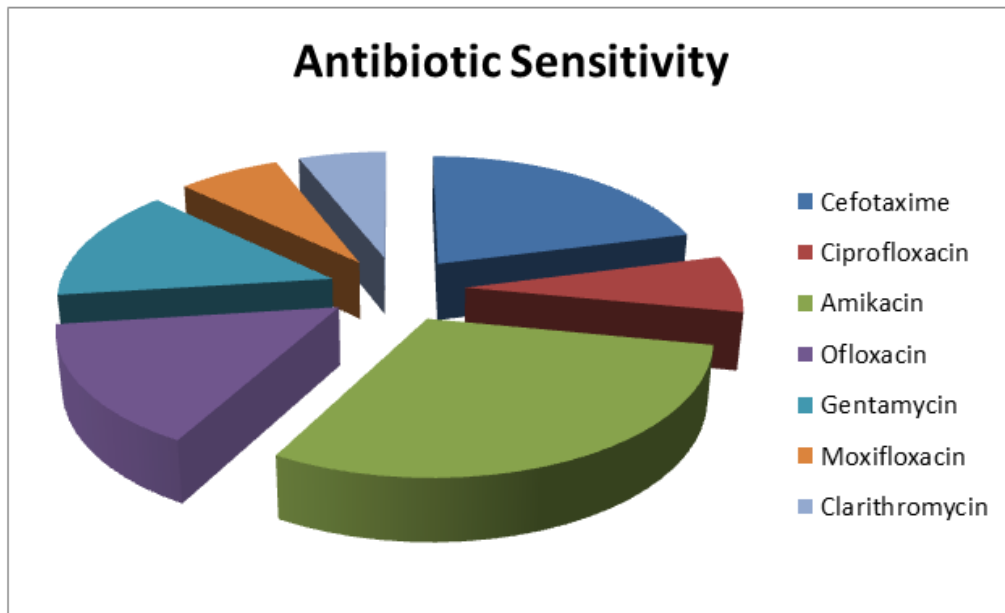
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	Pensylvania hospital study	JC Panel Study	Present Study
Number of cases	818	105	80
Cases with infection	213	35	58
Percentage	12%	36%	73%

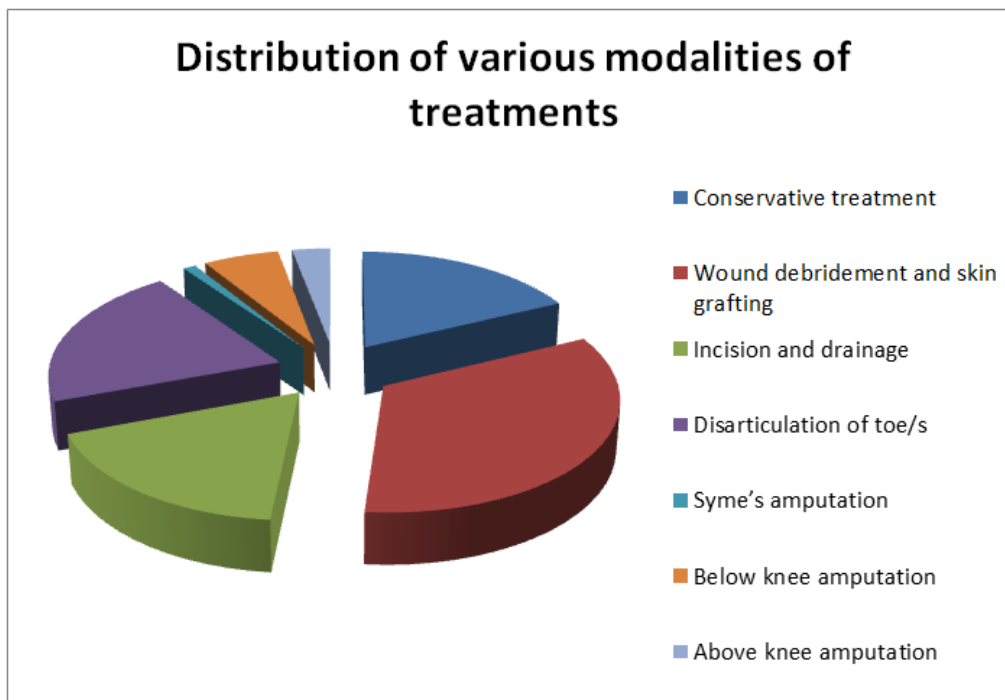
Table 1: Comparision of number of cases with infection when compared to other similar studies



Graph 1



Graph 2



Graph 3

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Date of Submission: 31/10/2014.
Date of Peer Review: 03/11/2014.
Date of Acceptance: 25/11/2014.
Date of Publishing: 29/11/2014.