

# Study of Patients Undergoing Amputation for Diabetic Foot Ulcer – An Observational Study

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## Abstract

**Introduction:** Diabetes associated with foot problems constitutes the primary cause of hospitalization. Among diabetes, 15% of people develop leg ulcer. Lower limb amputation in non-diabetic patients is 30 times higher than diabetic patients. Due to diabetes, one leg is amputated every 30 s.

**Aim:** This study aims to study the patients undergoing amputation for a diabetic foot ulcer (DFU).

**Materials and Methods:** A total of 50 patients with DFU were included in this study. The variables investigated were related to diabetes, infection, and surgical treatment. Our series amputation was done at different levels of anatomical levels ranging from toe level to above-knee amputation. Results were statistically analyzed and discussed below.

**Results:** Out of 50 patients, 44 were male, and 6 were female. Mean age was 56.24 years, and mean HbA1c was 8.24. Amputation was done for 18 patients and non-amputation for 32 patients. Based on the organisms present, 18 patients had *E. coli*, 12 had *Klebsiella*, 8 patients had *Proteus*, 6 patients had *Staphylococcus*, 3 patients had *Pseudomonas*, and 3 patients had mixed bacteria. Based on antibiotic sensitivity, majority were sensitive to amikacin followed by cefotaxime. Amputation was done above the knee for 5 patients, below knee for 19 patients, knee for 5 patients, and toe disarticulation for 21 patients.

**Conclusion:** From this study, we concluded that lack of awareness about diabetes mellitus and its lower limb complications, poor compliance to the treatment, uncontrolled blood sugar levels, delay in diagnosis, and late presentation are all factors which led to the occurrence of DFU.

**Key words:** Amputation, Diabetes, Disarticulation, HbA1C

## INTRODUCTION

Despite the advances made in medical management combined with nutrition and behavioral education, diabetes mellitus is still a significant health problem worldwide. Diabetic foot ulcers (DFU) are among the most frequently associated problems with 6.3% global predicament of DFU.<sup>[1]</sup> While DFU development is multifactorial; three major risk factors are present. In 35–45% of all DFUs, diabetic peripheral neuropathy (DPN) is considered the leading cause of DFU and is the causative factor.<sup>[2,3]</sup> The most common site for a neuropathic DFU is the foot

plantation.<sup>[4]</sup> A peripheral arterial disease (PAD) accounts for 24–50% of the DFUs in conjunction with DPN and occurs at a diabetic foot's foot borders.<sup>[3,5,6]</sup>

In DFUs, the prevalence of pathogenic species is complex.<sup>[7]</sup> The production of foot infection is due to polymicrobiology. This includes no. of bacteria, different microbes, infective organisms, and synergistic interactions between microbial species.<sup>[8]</sup> It was estimated that possible causative DFUs include *Staphylococcus*, *Streptococcus*, *Proteobacteria*<sup>[9]</sup> and *Pseudomonas aeruginosa*, as well as coliforms.

Inflammatory cytokines, vascular disease, peripheral neuropathy, and vulnerability to infection contribute to DFUs. Barefoot walks skins, infection in wound healing, ischemia, impaired vision, reduced joint mobility, poor foot coverage, and excess foot pressure are all risk factors associated with a DFU. Topical therapy, including systemic care and surgery, is particularly beneficial in contrast with secondary treatment.

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Patients who suffer from DFUs were not aware of ulcers until being told by physicians.<sup>[10]</sup> It was, therefore, so necessary for DM patients to check their feet regularly, as a consequence. Today, studies show a decrease of 25–60% in lower severe amputation in patients with a high risk of foot complications, inappropriate screening, and examination.<sup>[11]</sup> The analysis of the lower extremity of the diabetic patients includes dermatological, vascular, neurological, and musculoskeletal measures.

The infected DFUs must only be treated with ample experience and equipment. The ulcer regulation is broken down into three parts: Eliminating a callus, the abolition of inflammation, and weight-bearing forces. Excess keratin with a scalpel blade should be carefully removed to drain the lesion to efficiently reveal the ulcer's floor. Virtually any diabetic lesion clinically infected needs antibiotic therapy; antibiotic therapy should have avoided clinically unaffected wounds. Proper treatment requires proper insulin glycemic regulation, adequate wound care, and antimicrobial prescription drugs. Initial antibiotic treatment is typically selected empirically and subsequently updated because additional clinical and microbiological results are available.

### Aim

This study aims to study the patients undergoing amputation for a DFU.

## MATERIALS AND METHODS

A total of 50 patients were included in this prospective observational study. In the pro forma, name and age of the patient, sex, occupation complaints, and history in detail were obtained and recorded. History of diabetes, hypertension, tuberculosis, and ischemic heart disease were enquired into. Smoking and alcohol history were elicited with special reference. Patients were examined in detail about the general condition such as anemia, jaundice, fever, blood pressure, and peripheral pulses. The affected part of the ulcer was examined in detail for all the features of an ulcer. Unhealthy granulation, amount of slough, site of ulcer, and line of demarcation were noted. A motor and sensory change was examined in detail. Loss of protective sensation was examined using Semmes-Weinstein 10 g monofilament. Ankle-brachial pressure index, hematology, pus culture and sensitivity, color Doppler study, and skin biopsy were examined. Our series amputation was done at different levels of anatomical levels ranging from toe level to above-knee amputation. Results were statistically analyzed and discussed below.

## RESULTS

Out of 50 patients, 44 were male, and 6 were female [Table 1].

Out of 50 patient's, amputation was done for 18 patients and non-amputation for 32 patients [Table 2].

Based on the organisms present, 18 patients had *Escherichia coli*, 12 had *Klebsiella*, 8 patients had *Proteus*, 6 patients had *Staphylococcus*, 3 patients had *Pseudomonas*, and 3 patients had mixed bacteria [Table 3].

Based on antibiotic sensitivity, majority were sensitive to amikacin, followed by cefotaxime, gentamycin, ciprofloxacin, norfloxacin, metronidazole, erythromycin, and cloxacillin [Table 4].

Out of 50 patients', amputation was done above the knee for 5 patients, below knee for 19 patients, through knee for 5 patients, and toe disarticulation was done for 21 patients [Table 5].

## DISCUSSION

Foot ulcers affect one in 10 people with diabetes during their lifetime. Patients with diabetes have increased risk of lower extremity amputations. The main cause is diabetic PAD accelerated by the direct damage to the nerves and blood vessels by high blood glucose levels. Wound healing is also impaired from affected collagen synthesis. The diabetic vascular disease has three main components: Arteritis and small vessel thrombosis; neuropathy (possibly ischemic in the cause); and large vessel atherosclerosis. In combination, these are almost bound to cause problems in the weight-bearing areas. The DFUs are often deeper and more frequently infected than other leg ulcers reflecting the severe end vessel ischemia and opportunistic infection, which is the common experience of the diabetic.<sup>[12-15]</sup>

Factors, such as age and the disease's duration, will increase its incidence and risk of death from uncontrolled infection. Due to peripheral neuropathy, there is a loss of sensation. As a result, neuropathic changes, such as foot deformity, decreased protective sensation, and skin fissures, caused by diminished sweating lead to diabetic foot infections, which lead to further damage ultimately leading to gangrene formation. Diabetic neuropathy develops as a consequence of chronically elevated blood sugar levels, which cause vascular and metabolic abnormalities.<sup>[16]</sup>

In our study, the majority were male compared to females. This was similar to Ozan *et al.* in his study stated that major amputation was significantly higher in male patients.<sup>[17]</sup>

**Table 1: Gender distribution**

S. No.	Gender	No. of patients
1	Male	44
2	Female	6

**Table 2: Distribution of amputation**

S. No.	Management	Frequency	Percentage
1	Non-amputation	32	64
2	Amputation	18	36

**Table 3: Distribution of organisms**

S. No.	Organism	Frequency	Percentage
1	<i>Escherichia coli</i>	18	36
2	<i>Klebsiella</i>	12	24
3	<i>Staphylococcus</i>	6	12
4	<i>Proteus</i>	8	16
5	<i>Pseudomonas</i>	3	6
6	Mixed	3	6

**Table 4: Distribution of antibiotic sensitivity**

S. No.	Antibiotic sensitivity	Frequency	Percentage
1	Cloxacillin	3	6
2	Erythromycin	3	6
3	Norfloxacin	9	18
4	Metronidazole	3	6
5	Gentamycin	18	36
6	Ciprofloxacin	11	22
7	Amikacin	36	72
8	Cefotaxime	31	62

**Table 5: Distribution of type of amputations**

S. No.	Amputation	Frequency	Percentage
1	Above knee	5	10
2	Through knee	5	10
3	Below knee	19	38
4	Toe disarticulation	21	42

In our study, mean HbA1c was 8.4, where Lehto *et al.* reported that HbA1c levels and the risk of amputation increase largely in a linear fashion. Ozan *et al.* found no significant differences between the major and minor amputation groups in HbA1c levels.<sup>[17,18]</sup>

In our study, the majority were older age group. In his study, Ozan *et al.* found that the mean age of patients in major amputation group was significantly higher than in minor amputation group. Still, Abbott *et al.* reported a higher incidence of major amputation in the younger age group probably because they were more mobile and more predisposed to trauma.<sup>[17,19]</sup>

In our study, the most common organism found was *E. coli*. Latif *et al.* and Ozan *et al.* recorded positive culture in 69.1% and 95% of cases, respectively, and most common organism in their study was also *Staphylococcus aureus*.<sup>[17,20]</sup>

## CONCLUSION

From this study, we concluded that lack of awareness about diabetes mellitus and its lower limb complications, poor compliance to the treatment, poorly controlled blood sugar levels, delay in diagnosis, and late presentation are all factors which led to the occurrence of DFU.

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## Prabakar: Patients Undergoing Amputation for Diabetic Foot Ulcer

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