

## Original Research Article

# Clinico-microbiological profile and outcome of diabetic foot ulcers

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### ABSTRACT

**Background:** Diabetic foot ulcers (DFU) are debilitating to the patients and significantly impair their quality of life. DFU associated with infection have the worst outcomes and may lead to amputations if timely intervention is not done. In the present study, aim was to identify the association between the type of organism isolated and the rates of amputations in diabetic foot ulcers.

**Methods:** We retrospectively studied 50 diabetic foot ulcers from January 2017 to June 2017, who were in-patients in a single unit of surgery department in King George Hospital, Visakhapatnam. Baseline clinical examination was done. Parameters such as age, sex, duration, diabetic status and its treatment, organisms isolated, various treatment options for ulcers and the outcomes were studied.

**Results:** Males were the predominant study subjects (M: F=32:18). The age of presentation was 18-65 years with an average of 46 years. Gram negative organisms were the frequent microbial isolates, all being mono-microbial infections. It was dominated by *E. coli* (17), *Pseudomonas* (12) and *Klebsiella* (11). Above-knee amputation was done in one patient and below-knee amputations in three patients. Total mortality in our study was 5. After applying the chi-square test, it was found that there is no significant association between the type of organism and the rate of amputations in our study.

**Conclusions:** Diabetes is a significant risk factor for ulceration in the extremities, which possesses considerable mortality and morbidity. Early intervention, control of diabetes and compliance of the patient treatment are all necessary to reduce the rates of amputations and mortality in patients with diabetic foot ulcers.

**Keywords:** Amputations, Diabetes, Foot ulcers, Microbiological profile, Organisms, Outcomes

### INTRODUCTION

Diabetes is a significant risk factor for ulceration in the extremities, which possesses considerable mortality and morbidity. According to the International Working Group on the Diabetic Foot (IWGDF), a diabetic foot ulcer (DFU) is a full-thickness wound penetrating through the dermis located below the ankle in a diabetic patient.<sup>1</sup> Eight out of 10 non-traumatic limb amputations are attributable to diabetes, of which 85% are due to DFU.<sup>2</sup>

People with foot problems and diabetes mellitus have 15 times the increased risk of undergoing a lower extremity amputation compared to those without diabetes. The mortality after unilateral lower limb amputation has been projected to be as high as 39-80% at five years, which is similar or worse than many common types of cancer.<sup>2-4</sup> Infectious agents are associated with the worst outcomes, which may ultimately lead to amputation of the infected foot unless prompt treatment strategies are ensued.<sup>5</sup> The present study aims to identify the association between the

type of organism isolated and the rates of amputations in diabetic foot ulcers.

Objectives of the study was to do assessment of diabetic foot ulcers, identifying various microbial isolates in these ulcers by culture and sensitivity testing and identifying various treatment modalities in diabetic foot ulcers and the rates of amputation and mortality.

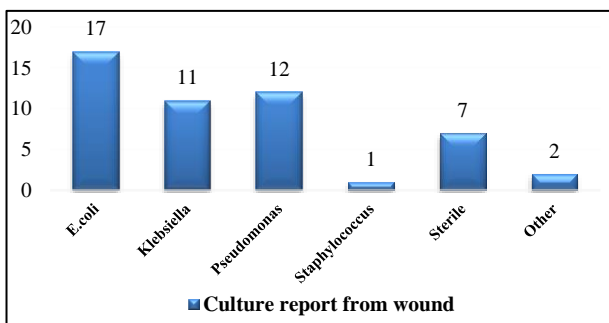
**METHODS**

A retrospective observational study was done on 50 patients with diabetic foot ulcers, who were admitted as in-patients in a single unit of Surgery Department in King George Hospital, Visakhapatnam. Study was done for 6 months, from January 2017 to June 2017. Type of organism and the rates of amputations in diabetic foot ulcers were studied. Baseline clinical examination was done. A standard neurological examination was done to test the sensation to light touch, pain, vibration and tendon reflexes at the ankle. Peripheral neuropathy was considered present if three of the four were absent. When both the dorsalispedis and posterior tibial pulses were absent in the affected limb, peripheral vascular disease (PVD) was considered present.

Some parameters such as age, gender, duration, average stay, diabetic status and its treatment status, cultures, organisms and outcomes were studied. Cultures were sent every 3rd day. Treatment options like debridement, fasciotomy, split-skin grafting, minor and major amputations were considered. Data was entered and analyzed in MS Excel. Tests of significance applied where ever applicable.

**RESULTS**

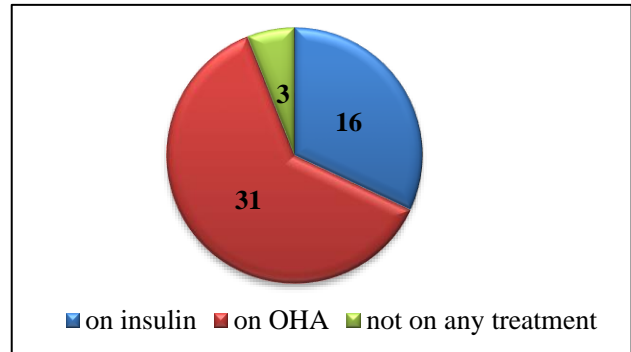
Among the 50 patients in the study male and female patients were 32 and 18, respectively. Diabetics presented from 18-65 years of age with an average of 46 years. The length of stay ranged from 3 days to 38 days. The size of the ulcer ranged from 3 cm to 40 cm in its greatest dimension, with an average being 12 cm. The depth of the ulcer ranged from 0.5 cm to 3 cm, with an average of 1 cm. Gram-negative organisms were more frequently isolated, and all were mono-microbial infections. The distribution of microbial isolates is depicted in Figure 1.



**Figure 1: Culture reports of diabetic ulcers.**

The neurological examination and examination for peripheral vascular disease revealed that sensations were absent in 9 patients and decreased in 7 patients. Peripheral pulsations were absent in 4 patients and decreased in 8 patients.

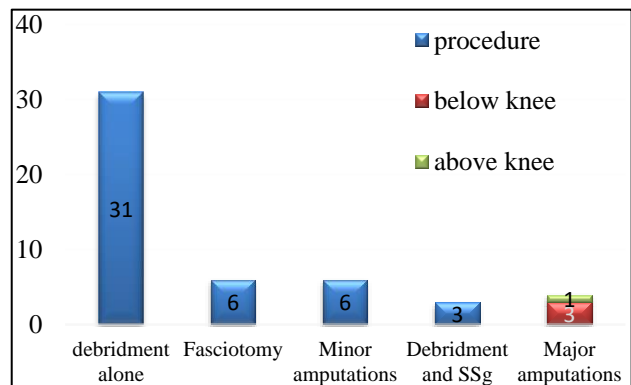
Of the 50 diabetic patients in the study, sixteen patients (32%) are on insulin therapy, thirty-one patients (62%) are on oral hypoglycaemic agents, and three patients (6%) were not on any treatment for diabetes. This is depicted in Figure 2.



**Figure 2: Treatment in diabetics.**

Anaemia (Hb<10%) was found in 38 patients, of which 23 are male, and 15 are female patients. Hypertension (B.P>140/90 mmhg) was another co-morbid condition found in 32 patients, of whom 25 were male, and 7 were females.

Regular debridement alone was satisfactory in 62% of the study group, whereas debridement, along with skin grafting, was required in 6% and fasciotomy in 12% of the patients. Minor amputations were carried out in 12% and major amputation in 8% of the study group. This could be attributed to several factors, namely the severity of sepsis, late presentation and resistant bacteria. This is depicted in Figure 3.

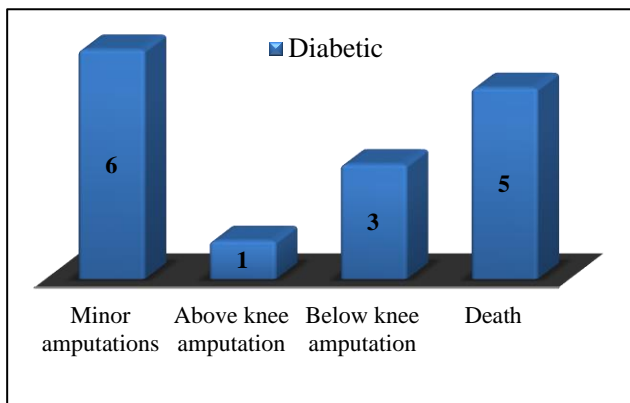


**Figure 3: Treatment done in diabetic ulcers.**

Culture and sensitivity of patients before undergoing minor amputations (6) showed equal distribution among *E.coli* (2), *Pseudomonas* (2) and *Klebsiella* (2).

Above-knee amputation was required in one male patient in whom *E.coli* was isolated on culture and sensitivity. Three patients underwent below-knee amputation, in whom *E.coli* was isolated in one female patient and *Pseudomonas* in the other two cases, one male and one female patient each. There was one death, in a female patient who underwent BKA with *Pseudomonas* isolated. Readmission was required in 20% of the study population, i.e., 10 cases.

The mortality rate of the study was 10% with a total of 5 deaths being recorded, all of them belonging to the male sex. The mean age was around 60 years. The duration of ulcers in these patients ranged from 2 days to 45 days, and the length of stay in hospital was less than five days. The culture sensitivity reports among the deceased were dominated by *Pseudomonas* (3) with the other cases reporting *E.coli* and *Klebsiella* each. The mortality and morbidity in our study are depicted in Figure 4.



**Figure 4: Morbidity and mortality in diabetic foot ulcers.**

The results of the study are given in Table 1. In calculating the tests of significance if we take the null hypothesis as “there is a relationship between the type of organism isolated and increased morbidity and mortality” and calculate the p-value using chi-square test, the chi-square  $\chi^2=2.96$ . The p value is 0.56. The result is not significant at  $p<0.05$ .

**Table 1: Comparison of organisms isolated with the outcomes.**

Organisms	Minor amputations	Major amputations	Mortality
<i>E. coli</i>	2	2	2
<i>Pseudomonas</i>	2	2	0
<i>Klebsiella</i>	1	3	1

The chi-square  $\chi^2= 2.96$ . The p value is 0.56. The result is not significant at  $p<0.05$

Hence in our study, we can say that there is no association between the type of organism isolated and increased morbidity and mortality.

**DISCUSSION**

In our study males were the predominant study subjects (64%) with a ratio of 1.77:1 (32:18) which correlates with many studies.<sup>8</sup> Gram-negative bacteria predominate the microbial isolates, which is similar to Gadepalli et al.<sup>9</sup> The culture and sensitivity burden in our study was carried mainly by *E.coli*, *Klebsiella* and *Pseudomonas* which varies with other studies where Staphylococci and Enterococci predominate and slightly similar to Shankar EM et al.<sup>5,7</sup> Another major finding of our study, which differs from other studies is the presence of only mono-microbial infection among the patients. Majority of the studies on diabetic foot show both mono-microbial and poly-microbial infections. This may be attributed to the treatment of the patients, i.e., antibiotics and OHA/insulin.<sup>10</sup> Majority of the diabetic population has other co-morbid conditions such as anaemia and hypertension, the percentage being more in females (~70%). Poor diabetic control was found in 20 of 50 cases with diabetes. The mortality appears to be independent of factors increasing the ulcer risk.<sup>6</sup> Diabetic foot infected with *Pseudomonas* carried higher morbidity (risk for toe or lower limb amputation) and increased mortality.<sup>13</sup>

**CONCLUSION**

Diabetes has an increased risk of mortality and morbidity in patients with lower limb ulcers and also leads to significant impairment of quality of life. Poor control of diabetes emphasizes the need for specialized diabetic units. An aggressive multidisciplinary approach is required to manage foot problems in such patients and also to recognize and reduce the risk of death from other co-morbid conditions to save both limb and life. Emphasis should be made on educating people about diabetes, and its complications, about foot care and wound care. It helps to reduce the burden of lower limb ulcers and to improve the quality of life.

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