

## Research Article

# Diabetic foot resulting in amputation: our experience

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### ABSTRACT

**Background:** The aim of our study was to early diagnosis of diabetic foot so that the complications can be prevented, to control the systemic infection and prevent the complications, to study the effectiveness of regular dressing in diabetic foot so as to prevent the local spread of infection and the ulcer and to conclude that early diagnosis, care and proper meticulous treatment of diabetic foot can prevent amputation.

**Methods:** The present study was prospective, observational and longitudinal. Protocol of the procedure was formed along with Performa, Patient Information Sheet, Informed Consent Form and approval from Ethical Committee. The present study was carried out in surgery department of C.U Shah medical college, Surendranagar; Gujarat state. The study was carried out from 1<sup>st</sup> August 2011 to 30<sup>th</sup> September 2013. A total of one hundred patients admitted in surgery ward with diabetes type 1 or 2 with ulcer on foot having grade 1 or 2 of Wagner's classification without any other co morbid condition. These patients undergo daily dressing with various dressing solutions according to their ulcer characteristics. All the patients given diet/oral hypoglycaemic drug/insulin for control of diabetes. Antibiotics given according to the infective status of the patients. Patients were either completely treated, went under skin grafting or ended up with amputation were recorded.

**Results:** Of 100 cases studied, youngest patient was 32 years and oldest was 80 years of age. Highest number of cases was found in the age group 61-70 years (30%). Of the 100 cases studied in this series 36 (36%) patient were having Wagner's class 1 ulcer and 64 (64%) patient having class 2 ulcers. Of 100 cases, various surgical treatment given to the patients according to the ulcer. In that 65(65%) debridement, 20 (20%) Incision & drainage, 10 (10%) STG, 5 (5%) fasciotomy. Most of the patients were undergone basic surgical procedure which is debridement on the 7<sup>th</sup> day follow up, out of 100 cases 70 patients came for follow up. Out of 70, all patients having healing ulcer. Out of 70 patients, 15(21.43%) patients were underwent STG on 15<sup>th</sup> day and other 55 (71.57%) patients having healing ulcer advised daily dressing with follow up after 1 week. Out of 30 patients, 3 (10%) patients underwent amputation on 7<sup>th</sup> day of follow up. On the 15<sup>th</sup> day new 5 (16.67%) patients underwent amputations, so total number of amputation done till date was 8 (26.67%). On 21st day, new 7 (23.34%) patients were underwent amputations and total number of amputations till date were 15 (50%). On 30th day, new 15 (50%) patients underwent amputations.

**Conclusions:** Foot ulceration in diabetic patients is a resource consuming, disabling morbidity that often is the first step towards lower extremity amputation. Prevention is the best treatment.

**Keywords:** Diabetic foot, Amputation, Dressing materials, Care of foot

### INTRODUCTION

Diabetes is a worldwide problem. The number of people with diabetes mellitus (DM) has been conservatively estimated to approximately double by 2030 to a

worldwide prevalence of 4.4% at which time 366 million people will have diabetes (Wild et al. 2004). A majority of diabetic patients develop foot ulcers in one point of time or other during the course of their illness. A significant number of such patients will require long-term

hospital treatment and amputations. The aetiopathogenesis of diabetic foot lesions are multifactorial. Diabetic neuropathies, vasculopathy, poor control of diabetes and bacterial infection are some of them.

The reasons for diabetic foot are-

1. Foot is the most vulnerable part of body for injury and infection neglected by patient.
2. The site of preference for neuropathy and ischemia is also the foot.

Diabetes is one of the major problems of this generation with worldwide dimension. According to Modi et al. overall incidence of diabetics in India is 1.2%<sup>1</sup> The death in each year is due to its complications (2.1% in urban, 1.5% in rural), which are usually common in age group of 40 - 60 years affecting both sexes equally. The complications are more prevalent among the people of lower economic due to negligence, illiteracy and poverty.

The Lord Moynihan's great dictum "Surgery has been made safe for patients. We must now make the patient safe for Surgery".

## METHODS

The study was carried out in surgery department of C.U Shah Medical College, Surendranagar; Gujarat state from 1<sup>st</sup> August 2011 to 30<sup>th</sup> September 2013. The study was prospective, observational and longitudinal. Study protocol of the procedure was formed along with Proforma, Patient Information Sheet and Informed Consent Form. A total of one hundred patients admitted in surgery ward with diabetes type 1 or 2 with ulcer on foot having grade 1 or 2 of Wagner's classification without any other co morbid condition. These patients undergo daily dressing with various dressing solutions according to their ulcer characteristics. All the patients given diet/oral hypoglycaemic drug/insulin for control of diabetes. Antibiotics given according to the infective status of the patients. Patients were either completely treated, went under skin grafting or ended up with amputation were recorded.

## RESULTS

Of 100 cases studied, youngest patient was 32 years and oldest was 80 years of age. Highest number of cases was found in the age group 61-70 years (30%) and 70 (70%) cases were male and 30 (30%) cases were female. Out of 100 cases, 92 (92%) patients having NIDDM and 8 (8%) patients having IDDM.

Of the 100 cases studied in this series 36 (36%) patient were having Wagner's class 1 ulcer and 64 (64%) patient having class 2 ulcers. Considering the ulcer size, minimum size of ulcer was 3 and maximum was 15.42 (42%) patient having ulcer more than 10 cm<sup>2</sup>

Of 100 cases, dressing with beta dine was done in 50 patients. Out of those 50, 30 patients having no change or slough were present so EUSOL was added with beta dine for dressing. Other 40 patient with purulent discharge and slough were directly treated with EUSOL 18(18%) patients and 22(22%) patients. Only 10(10%) patients were treated with collagen sheet.

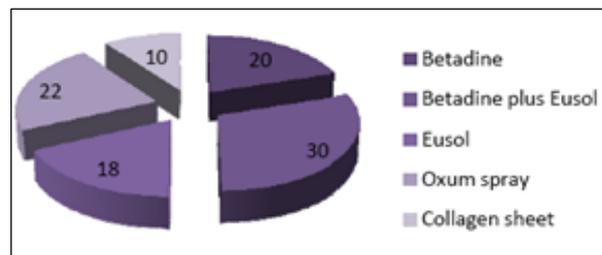


Figure 1: Type of dressing solutions.

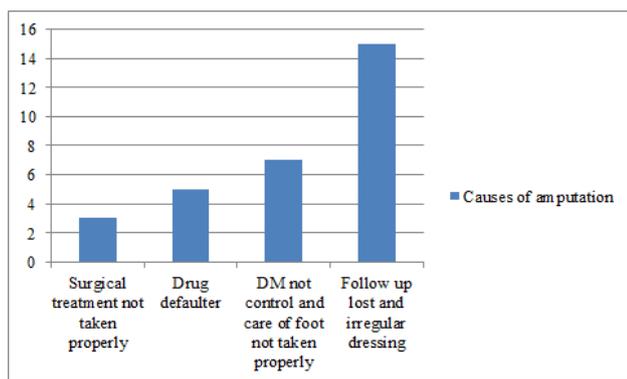
Various surgical treatments given to the patients according to the ulcer. In that 65 (65%) debridement, 20 (20%) Incision & drainage, 10 (10%) STG, 5 (5%) fasciotomy. Most of the patients were undergone basic surgical procedure which is debridement.

Table 1: Treatment protocol.

Treatment	No. of Cases	Percentage (%)
Debridement	65	65%
Incision & Drainage	20	20%
Stg	10	10%
Fasciotomy	5	5%
Total	100	100%

Follow up of the patients was done on 7<sup>th</sup>, 15<sup>th</sup>, 21<sup>st</sup> and 30<sup>th</sup> day. On the 7<sup>th</sup> day follow up, out of 100 cases 70 patients were having healing ulcer. Out of 70 patients, 15 (21.43%) patients were underwent STG on 15<sup>th</sup> day and other 55 (71.57%) patients having healing ulcer advised daily dressing with follow up after 1 week. On 21<sup>st</sup> day, 17 (30.90%) patients were underwent STG and other 38 (69.10%) patients advised daily dressing with follow up after 1 week. On 30<sup>th</sup> day, 26 (68.42%) patients underwent STG and 12 (31.59%) patients having completely healed wound.

Remaining of 30 patients; 3 (10%) patients underwent amputation on 7<sup>th</sup> day of follow up. On the 15<sup>th</sup> day new 5 (16.67%) patients underwent amputations, so total number of amputation done till date was 8 (26.67%). On 21<sup>st</sup> day, new 7 (23.34%) patients were underwent amputations and total number of amputations till date were 15 (50%). On 30<sup>th</sup> day, new 15 (50%) patients underwent amputations.



**Figure 2: Causes of amputation.**

## DISCUSSION

The diabetic foot is one of the most common and devastating complications of diabetes mellitus. These ulcers account for most of the hospital admissions for patients with diabetes, and they represent a common precursor for amputation. When a diabetic foot ulcer becomes infected, gangrene and amputation can follow in rapid succession.<sup>2</sup>

Diabetic foot ulcer causes more amputations than any other lower limb disease. Management of the diabetic foot requires a thorough knowledge of the risk factors for ulceration and amputation, the most common of which are neuropathy, ischemia and infection. Amputations are not inevitable, however; early detection and appropriate treatment of ulcers can prevent up to 85% of amputations.<sup>3</sup>

Approximately 40-60% of all amputations of the lower extremity are performed in patients with diabetes. More than 85% of these amputations are precipitated by a foot ulcer deteriorating to deep infection or gangrene. The prevalence of diabetic foot ulcers has been estimated to be 3-8%. The complexity of these ulcers necessitates a multifactorial approach in which aggressive management of infection and ischemia is of major importance. For the same reason, a process-oriented approach in the evaluation of prevention and management of the diabetic foot is essential. This management is complicated, and typically requires radical debridement, appropriate antibiotics and local wound care with daily dressing with appropriate dressing solutions<sup>4,5</sup> Selective debridement also includes the removal of specific, targeted areas of unidentifiable devitalized tissue along the wound margin.<sup>6</sup> However, as patients with diabetes are typically immunocompromised and often fail to mount a physiologic response to infection, clinicians should look for secondary signs of infection including exudates, delayed healing, friable granulation tissue, discoloured granulation tissue, foul odour, pocketing.<sup>7</sup>

Healing rates of foot ulcers are unknown with the exception of specialized centers where it is between 80-90%. The negative consequences of diabetic foot ulcers

on quality of life include not only morbidity but also disability and premature mortality. Costs for healing ulcers are high and even higher for ulcers resulting in amputation, due to prolonged hospitalization, rehabilitation, and need for home care and social service for disabled patients. Therefore, one of the most important steps to reduce cost in the management of the diabetic foot is to avoid amputations.<sup>2</sup>

The aim of ulcer bed preparation is to convert the molecular and cellular environment of the chronic ulcer to that of an acute healing wound by debridement, irrigating and cleaning. Moist dressings maintain wound environment favourable for healing. All attempts should be done to prevent diabetic foot ulceration and treat existing ulcers by multidisciplinary teams in order to decrease amputations.<sup>8</sup>

In the present study minimum age of patient was 32 year and maximum age was 80 year. Mean age of present study was  $58 \pm 13$ . When compared with Wheel, Lock and Root series,<sup>9</sup> there is not much difference in youngest and oldest age group.

In the present study were 70 males and 30 female cases. The male to female ratio 2.34:1. When compare to Lawerance et al. study.<sup>10</sup> There is not much different in male to female ratio. The incidence is more among males probably as they are the breadwinners of the family and are mostly working out door, which makes them more vulnerable for trauma and sequels.

In present study, maximum numbers of cases were in Wagner's class 2 (65%) which is comparable to Levin and O'Neil study.<sup>11</sup> The standard treatment for diabetic foot according to Wagner's classification is Prevention for grade-0, Antibiotics and good glycaemic control for grade 1. In grade-2 needs hospital admission, as they need surgical intervention along with antibiotics and glycaemic control.

Collagen<sup>12</sup> and Oxum had good effect on healing of diabetic foot ulcer against older dressing solution (Beta dine, EUSOL). But cost and availability of newer dressing materials are major factor for use in treatment of diabetic foot ulcer. So we used beta dine, EUSOL and combination of both in more than 50% of patients in our study. Healing of ulcer with regular dressing with these dressing materials is good.

In present study, 65% patients underwent debridement procedure which is comparable to Mussart Riaz et al. 2012 in which 67% patient have undergone debridement. It suggest that debridement is basic surgical procedure require in most of the patients with diabetic foot ulcer admitted in surgical ward. 10% patients with healthy ulcer in surgical ward with good glycaemic control and no discharge directly undergone STG.

In present study all patients were discharged after control of infection and diabetes and advice for regular dressing

of ulcer, medication for diabetes and coverage of infection with follow up on 7<sup>th</sup>, 15<sup>th</sup>, 21<sup>st</sup> and 30<sup>th</sup> days.

In present study on 7<sup>th</sup> day follow up 70 patients came which were having healing ulcer on their foot and they advise to follow up after 1 week. Out of 70 patients 58 (82.85%) patients underwent STG and 12 (17.15%) patients having healed wound on 30<sup>th</sup> day.

In present study, 30 (30%) patients underwent amputations which was comparable to Collen's series. Out of 30 patients 3 (10%) patients underwent at least amputation at proximal and distal phalanges of toes on 7<sup>th</sup> day follow as those patients didn't take surgical treatment properly. Other 5 (5%) patients, those who didn't take regular medication for infection and diabetes control were underwent amputation at great toe and metatarsophalangeal joint of other fingers on 15<sup>th</sup> day follow up which is comparable to Wilson DJ et al. 7 (7%) patients with poor glycaemic control and those who didn't take care of their foot regularly underwent amputation at tarsometatarsal and below knee on 21<sup>st</sup> day follow up which is comparable to Imran Ali et al. 15 (15%) patients who lost follow up and didn't do regular dressing even at home came with gangrene of foot on 30<sup>th</sup> day of foot undergone below knee amputation and above knee amputation which is comparable to Osaka Kosainekin Hospital (2005).<sup>13</sup>

Even in this modern era of diabetic foot ulcer many patients undergo amputation because of lack of awareness of diabetic foot related complication. Prevention of amputation in diabetes is only possible with team approach including surgeon, physician, podiatric, nursing staff as well as patients and relatives.

A variety of adjunctive therapy can be helpful; including control of diabetes, the most important step in preventing ulceration of the foot is patient education in foot care. Protective footwear helps to reduce ulceration in diabetic feet at risk. Relieving pressure on the ulcer area is necessary to allow healing.

Team management programs that focus on patient education regarding diabetes and diabetic foot ulcer, regular foot examinations by patient at home, regular dressing with appropriate dressing solutions, and aggressive intervention in early grade of diabetes ulcer, and proper use of therapeutic measures can significantly reduce the risk of lower-extremity amputations from diabetic foot ulcers.

## CONCLUSION

Foot ulceration in diabetic patients is a resource consuming, disabling morbidity that often is the first step towards lower extremity amputation. Prevention is the best treatment.

- The hallmark of diabetic foot problem in India is gross infection, and major contributing factors for late presentation include bare foot gait, attempts at home surgery, trust in faith healers and undetected diabetes so early diagnosis by doctor and treatment at hospital is crucial at any point of time.
- Effective glycemic control and control the systemic infection in patients with aggressive antibiotic therapy will prevent the complications in diabetic foot ulcer.
- Regular dressing with appropriate dressing solutions in diabetic foot ulcer so as to prevent the local spread of infection and deterioration of ulcer which is major contributing factor towards the amputation.
- Diabetic screening and education combined with protective foot wear, is a cost and resource effective method of decreasing the rate of diabetic foot ulcers, and the risk for eventual lower extremity amputation.
- Early diagnosis, care and proper meticulous treatment of diabetic foot can prevent amputation.

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## REFERENCES

1. K. Park. Park's Text Book of Preventive and Social Medicine. 17<sup>th</sup> ed. Jabalpur, India: M/S Banarsidas Bhanot; 2000: 294,443.
2. King H, Aubert RE, Herman WH. Global burden of diabetes, 1995-2025: prevalence, numerical estimates and projections. *Diabetes Care.* 1998;21:1414-31.
3. Chow I, Lemos EV, Einarson TR. Management and prevention of diabetic foot ulcers and infections: a health economic review. *Pharmacoeconomics.* 2008;26:1019-35.
4. Steed DL, Donohoe D, Webster MW, Lindsley L. Effect of extensive debridement and treatment on the healing of diabetic foot ulcers. *Diabetic Ulcer Study Group. J Am Coll Surg.* 1996;183:61-4.
5. Saap LJ, Falanga V. Debridement performance index and its correlation with complete closure of diabetic foot ulcers. *Wound Repair Regen.* 2002;10:354-9.
6. Falanga V, Brem H, Ennis WJ et al. Maintenance debridement in the treatment of difficult-to-heal chronic wounds. Recommendations of an expert panel. *Ostomy Wound Manage.* 2008 June;54(suppl 6):2-13.
7. Lipsky BA. New developments in diagnosing and treating diabetic foot infections. *Diabetes Metab Res. Rev.* 2008;24(suppl 1):S66-71.
8. Cardinal M, Eisenbud DE, Armstrong DG et al. Serial surgical debridement: a retrospective study on clinical outcomes in chronic lower extremity wounds. *Wound Repair Regen.* 2009;17:306-311.
9. Wheel, Lock and Root series. *Diabetic foot ulcer. Distribution of age. Surg* 1969;118(4):521-5.

10. Nwabudike L.C, Forsea D, Ionescu Trrgoviste C. Diabetic Foot Ulcer. *Romanion Journal of Dermatologist.* 1999;1999:26-34.
11. Kington DR, Fiegel VD. Growth factor and repair of diabetic wounds. In: Levin ME, O'Neil LW, Editors. *The diabetic foot* 5th ed. St. Louis: Masby - year book; 1993:247-55.
12. Mian M, Beghé F, Mian E. Collagen as a pharmacological approach in wound healing. *Int J Tissue React.* 1992;14(suppl)1-9.
13. Miyajima S. Risk factors for major limb amputations in diabetic foot gangrene patients. *Diabetes Res Clinic Pract* 2006 Mar;71(3):272-9.

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