

## Treatment Modalities of Diabetic Foot Lesion in Patients Admitted at a Tertiary Care Hospital

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### Abstract

**Introduction:** The prevalence of Diabetic patients in India is 9% of total population [1]. The risk development of foot ulcer in diabetics during their lifetime is 25% [2]. More than 20% diabetics get operated for lower extremity amputation. The present study was aimed to study treatment of foot lesions in diabetics in patients presenting in Pravara Rural Hospital, Loni. **Materials and Methods:** This prospective cross sectional study was undertaken in 50 patients carried out over a period of 2 years. Patients, irrespective of their age and gender, admitted in the inpatient department of surgery with Diabetes mellitus having foot problem and consenting for taking part in the study were included. Treatment and its outcome were recorded for all patients. **Results:** Most patients present with diabetic foot lesion were in 7th decade of life. Females were more commonly affected with male to female ratio 1:1.5. Ulcer was the common lesion seen here which was present in 24 (48%) patients while abscess seen in 3 (6%) patients, was the least common lesion. Staphylococcus aureus was the commonest grown organism from the pus sample of foot lesions. On staging the patients according to Wagner staging, most of the patients belonged to stage III (23) and IV (14). Maximum patients revealed decrease in insulin requirement after control of infection. In this study 23 (46%) patients out of 50 with diabetic foot categorized with Wagner's grade III, and Wagner stage III, IV, V had higher incidents of amputations 46% of patients with

Wagner stage III had different kinds of amputations and 14 (28%) of patients with stage IV needed amputations. Patients with Wagner's stage V needed major amputations like below knee amputations and above knee amputations, one each. Most patients 41 (82%) had recovered within four weeks however 9 patients took more than four weeks of recovery. **Conclusion:** Wagner stage is an important factor determining the treatment of diabetic foot. This study also revealed that patients with diabetic foot lesion treated conservatively with higher antibiotics debridement and split skin graft might reduce chances of amputations.

**Keywords:** Diabetic Foot; Wagner Staging; *Staphylococcus Aureus*; Amputation; Debridement.

### Introduction

The prevalence of Diabetic patients in India is 9% of total population [1]. The risk development of foot ulcer in diabetics during their lifetime is 25% [2]. More than 20% diabetics get operated for lower extremity amputation [3]. Bell suggested that atherosclerotic gangrene is 53 times more common in diabetic patients than those not suffering from diabetes [4]. Early diagnosis and treatment of diabetic foot ulcers prevent up to 85% of amputations [5].

Thus, "diabetic foot" constitutes a common surgical problem both in specialized diabetic centers as well as in general hospitals.

In the past amputation was a routine procedure often made mandatory by spreading infection but with newer antibiotics and anti diabetic drugs modern trends in the surgery of diabetic foot have become conservative. Previously 25% of hospital admissions among diabetics are for the foot lesions and 40% of these require amputation [6].

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Today, it is possible to prevent diabetic foot lesions, salvage and maintain a functional foot. The modern trend in surgery of diabetic foot has shifted to more conservative approach and attempts to reduce morbidity of more proximal amputations.

This study emphasizes an imperative approach to the treatment of diabetic foot and attempts to minimize amputations and its forthcoming social, economical and mental problems. It is expected that this study will provide a positive approach in care of treatment of diabetic foot lesion and put an end to old nihilistic attitude.

#### *Aim*

To study current treatment modalities in foot lesions in diabetic patients admitted in a tertiary care hospital of Maharashtra, India.

### **Materials and Methods**

#### *Study Design*

Descriptive Longitudinal study.

#### *Ethics Approval*

The study protocol is approved by the institutional ethics committee.

#### *Study Location*

The present study was carried out in Department Of Surgery, RMC, Loni.

*Study Period:* 2 years (2010 to 2012)

*Sample Size:* 50 cases.

#### *Study Population*

Patients diagnosed of diabetes with foot lesions admitted in Pravara Rural Hospital, Loni and satisfying the inclusion and exclusion criteria were included in the study.

#### *Inclusion Criteria*

1. Patients diagnosed of Diabetes mellitus with foot problem admitted in department of surgery, Pravara Rural Hospital, Loni.
2. Patients of all ages and either gender.
3. Patients consenting for taking part in the study.

#### *Exclusion Criteria*

1. Patients with peripheral vascular disease except diabetic foot, i.e, Raynaud's disease.
2. Patients not willing to participate in the study.

### **Methodology**

Patients with diabetic foot lesions were admitted in hospital were examined prospectively after taking their written informed consent. The demographic data of all patients was recorded. The patients were clinically examined for type and extent of foot lesion, presence of pulsations.

The Foot lesions were classified using Wagner's staging [7] as given below:

#### Wagner Ulcer Classification System

GRADE 0: No open lesions; may have deformity or cellulitis

GRADE 1: Superficial diabetic ulcer (partial or full thickness)

GRADE 2: Ulcer extension to ligament, tendon, joint capsule, or deep fascia without abscess or osteomyelitis

GRADE 3: Deep ulcer with abscess, osteomyelitis, or joint sepsis

GRADE 4: Gangrene localized to portion of forefoot or heel

GRADE 5: Extensive gangrenous involvement of the entire foot

The investigations like Blood sugar levels, Hemoglobulin levels, culture of foot lesion pus sample, X ray and Doppler study of leg of patients were done. The patients were followed for type of treatment given i.e, conservative or surgical.

### **Results**

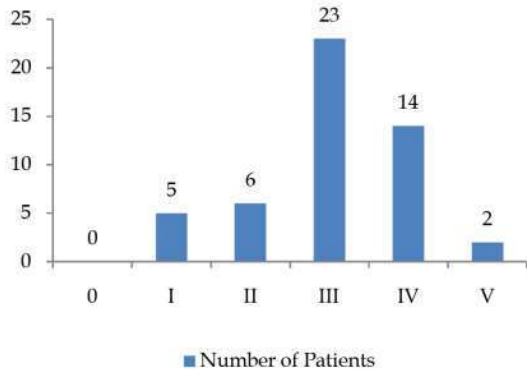
In present study, maximum number of patients belongs to 60-70 years age group. The number of males in present study was 20 (40%) and that of females was 30 (60%). In present study of 50 patients, 24 (48%) patients were known diabetics at the time of admission. Maximum number of patients i.e. 14 (28%) patients had diabetes for 1-5 years in past. In present series, 26 (52%) patients were detected as diabetic at the time of admission.

**Table 1:** Distribution of patients according to Control of blood sugar level

Control (Blood Sugar Level concentration)	Number of patients	Amputations
Good (<200 mg/dl)	10	1(2%)
Fair (200-300 mg/dl)	13	3(6%)
Poor(>300 mg/dl)	27	12(24%)

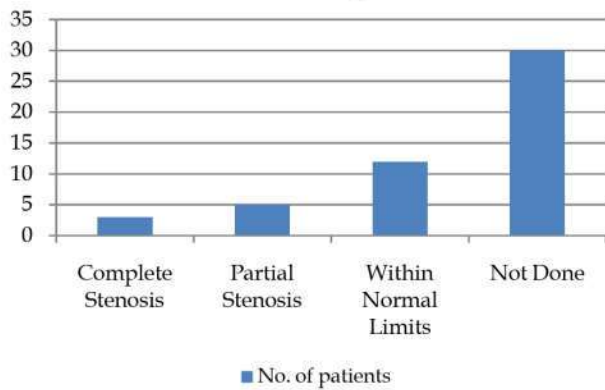
Different types of lesions included cellulites; abscess, ulcer and gangrene are seen in this series. Most of the patients present with more than one lesion. Only common lesions are considered here. Ulcer was the common lesion seen here which was present in 24 (48%) patients while abscess seen in 3

**Wagner Staging of patients**



**Fig. 1:** Distribution of patients according to Wagner staging

**No. of patients**



**Fig. 2:** Distribution of patients according to findings of Doppler studies

(6%) patients, was the least common lesion. Diabetic foot lesions were more common in patients with poor blood glucose control. 27 (54%) Patients with poor blood glucose control (>300 mg/dl) were vulnerable for amputations (Table 1).

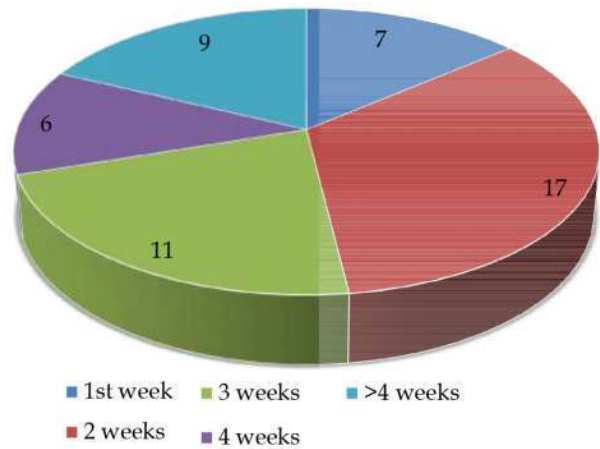
On local examination, 6(12%) dorsalis pedis artery and 6 (12%) tibial artery were commonly involved and one patient had absent popliteal pulsation. Peripheral neuropathy was present in 21 (42%) patients, 9 (18%) patients showed sensory, 7 (14%) autonomic and 5 (10%) motor neuropathy. In this series, pus, either from abscess or from the floor of ulcer, was sent for culture in all patients. In most patients, more than one organism was grown on culture. *Staphylococci* (26%) were the commonest organism (Fig. 1).

On staging the patients according to Wagner staging, most of the patients belonged to stage III (23) and IV (14). (Figure 1).

In majority of patients (58%), the x-ray findings of foot were within normal limit. Soft tissue swelling was seen in 7 (14%) patients and osteomyelitis in 14 (28%) patients. After performing Doppler study in select patients, 8 (16%) patients were detected as impaired

**Table 2:** Distribution of patients according to treatment given

Treatment given	No. of cases
Dressing	19(38%)
Dressing & Split skin graft	03(6%)
Debridement	08(16%)
Incision & drainage	04(8%)
Toe amputation	09(18%)
Rays amputation	03(6%)
Tarso metatarsal amputation	01(2%)
Symes amputation	01(2%)
Below knee amputation	01(2%)
Above knee amputation	01(2%)



**Fig. 3:** Distribution of patients according to duration of stay in hospital

blood flow in peripheral vessels. 3 (6%) patients showed complete stenosis and 5 (10%) patients showed partial stenosis. (Figure 2).

Almost all patients needed insulin for blood sugar level control. 35(70%) patients had reduced requirement of insulin for control of blood sugar after one week. The requirement was increased in 10 (20%), while remained same in 5 patients.

Surgical management included procedures like incision and drainage, debridement, skin grafting and amputations. Commonest surgical intervention was dressing and debridement, which was carried out in about 34 (68%) patients. 16 (36%) patients had undergone amputations. In this study, 1 (2%) patients underwent below knee amputation, 14 (28%) patients underwent minor amputations and 1 (2%) patients above knee amputation. (Table 2).

In the present series, the hospital stay extended from 1-4 weeks. Hospital stay ranged from 1-3 weeks in majority of patients.

Average period of recovery was 2 to 3 weeks. (Figure 2).

## Discussion

In the patients included in our study, less than 50% of our patients were known diabetics. Most of the known diabetic patients were not on regular treatment, the rest of the patients were diagnosed as diabetics after they presented with foot lesions. Those who were newly diagnosed as diabetics had moderate diabetes. 27 patients had poor control over diabetes; with variety of diabetic foot lesions.

In our series of 50 cases none had absent femoral artery pulse. Only 1 patient had absent popliteal arterial pulsations & 6 patients had absent dorsalis pedis arterial pulsation & 6 patients had absent posterior tibial arterial pulsation. All patients having absent dorsalis pedis artery pulsation & posterior tibial artery pulsation did not require a below knee amputation. In 23 cases debridement or minor amputation such as Ray's amputation was done.

In one patient with absent popliteal artery pulses, below knee amputation was performed with good healing result. Thus the collateral circulation determined the healing rather than presence of pulsation of a particular artery.

Martin Silverstein et al. [8] have reported that in selecting the level of amputation the goal was to obtain an adequate margin of healthy skin rather than presence or absence of palpable pulse.

According to Otto Khan [9] absence of peripheral pulse (Dorsalis pedis) was preferred, but not mandatory in selecting level of amputation.

According to Carry, Gibbons et al. [10] in diabetic patient's clinical judgment is still more valuable than invasive techniques in determining the amputation levels likelihood of success. This view is supported by Wheellock & Carl Hoar [11].

Jay Goodman states in his article on risk factors in local procedures for diabetic gangrene that the clinical estimation of major vascular supply is not of a prognostic value [12]. Our series also supports the view that vessels frequently involved in "diabetic foot" are dorsalis pedis, posterior tibial & small blood vessels below knee. This accounts for prevalence of distally located gangrenous changes in diabetic than in non diabetic.

In our series 21 patients had neuropathy, 9 had sensory, 5 had motor & none had autonomic neuropathy and 7 had autonomic neuropathy. Out of 21 patients who were detected to have neuropathy, all were uncontrolled diabetics. This indicates that neuropathy is more common in uncontrolled diabetes. This view is also supported Greenbaum D [13]. The relative insensitivity of skin of the foot leads to local skin damage from rubbing or pressure. The autonomic nerves are also involved resulting in an auto sympathectomy. So that skin of the feet & toes becomes dry & tends to crack.

The presence of neuropathy allows for marked susceptibility of the diabetic foot to trauma. Walking with pressure exerted at same point on the foot allows the development of callosities with secondary ulceration. Loss of proprioception secondary to development of diabetic neuropathy is the responsible mechanism.

Thus, the best clinical evidence of neuropathy is the absence of pain in spite of extensive ulceration, necrosis & fulminating infection of foot.

Infections in diabetic foot lesions are frequent problems. They are also the major cause of morbidity. Exact mechanism of this increased susceptibility to the infection is not clearly understood.

In our series, pus was sent for culture and sensitivity in all patients. In most of the patients, more than one organism was grown on culture. Staphylococcus aureus (40%) is the most common organism isolated from lesions of "diabetic foot", which were compared with Jones et al. [14] & Lipsky et al. [15]. Staphylococcus being the most common causative organism higher antibiotic like Amoxicillin & Clavulanic acid & amino glycosides like Amikacin or Gentamycin added with metronidazole, clindamycin or vancomycin were given for control of infections [16].

Also the series of Otto Kahn & William Wagner study, organisms isolated were consistent with our series [9]. In this study, finding of x-ray foot were as follow - Normal (58%). Soft tissue swelling (14%) Osteomyelitis (28%). Kao Hsiung et al. found osteomyelitis in 7.5% cases while, in this study we found 18% patients having osteomyelitis [17]. In our study, percentage of osteomyelitis was more might be due to late presentation of diabetic foot with ulcers.

Due to non affordability of the patient, Doppler was done only in cases with clinically absent peripheral pulsations. In 5 (10%) patients complete stenosis of dorsalis pedis & posterior tibial artery and in 8 (16%) patient's partial stenosis of dorsalis pedis & posterior tibial artery. Total 13 (26%) patients had decreased blood flow in posterior tibial and dorsalis pedis artery. These findings varied with the different studies Bahl (29.0%), Rastogi (44.3%), Ramani et al. (49.35%) [18-21].

Surgical treatment of foot lesions includes debridement with or without amputation. This procedure may also be undertaken as a preliminary in presence of fulminant infection. Later a definite surgical procedure may be undertaken once the infection has been properly controlled. This may possibly lower the level of amputation and certainly has a faster healing rate. Minor areas of necrosis in neuropathic foot over the angular bony prominence can be permitted to demarcate and separate on its own.

Out of 10 cases presented with gangrene, one had undergone below knee amputation due to unsalvageable limb, one was converted to above knee amputation due to uncontrolled infection. One patient had palpable posterior tibial artery & so Syme's amputations was carried out. Good wound healing was seen in all cases.

In our study compared with other studies, rate of amputation is more as compared to Ahuja MM [22], Bhaskar Reddy [23] and Knighton et al. [24] may be because of ignorance and late presentation and major number of patients belong to Wagner's Grade III, IV, V. In our study, out of 24, 11 (22%) were minor ray or toe amputations, 9 (18%) below knee and 4 (8%) were above knee amputations.

All patients were treated with Ray's amputation but two failed to heal & resulted in proximal spread of cellulitis & gangrene. Subsequently they were treated with Syme's amputation after control of sepsis. Goodmaain et al. had 30 successes in 60 cases with clearly improved rate of success when signs of sepsis were less [25]. Eker & Jacobs [26] found that of the patients who had Rays resection 2 of 18 wounds that were surgically closed failed, where as 16 of 36 wound were left open healed. Thus Ray's amputation of a single toe may be sufficient & will heal well producing a functional foot provided the criteria for selection of cases are strictly followed.

In our series of 50 cases, 1 transmetatarsal amputations was done. In series of Schwindt & Rogers [27] when a posterior tibial was present 91% of transmetatarsal amputations healed well. In cases where posterior tibial was absent healing rate was 62.5%. Success rates vary in literature. Healing rates near 65% are common. Criteria for selection of the transmetatarsal amputation are same as for Ray amputation.

Ecker & Jacobs [26] have reported an overall good result in transmetatarsal amputation with success rates ranging from 80% to 92.5%, but Otto Khan [8] has reported less favorable results about 60%.

In our series of 50 cases, one patient (2%) underwent below knee amputation. Otto Khan et al. [9] have reported an incidence of 44% of below knee amputation in their series. Henry T. Williams [28] reports an incidence of 33%. Carry Gibbons et al [10] reported an incidence of 33% (50/150) of above knee amputation in their series. Martin J. Silverstein et al. [8] reported 32.18% (103/320) in their series.

One above knee amputations were done in our series. It was indicated due to failure of below knee amputation. Silverstein reported an incidence of 25% in their series of 320 cases [8]. Majority of cases had extensive gangrene above malleoli with areas of sepsis, extending high up to leg. Henry T. William [28] reports an incidence of 13%.

## Conclusion

Maximum patients revealed decrease in insulin requirement after control of infection. In this study 23 (46%) patients out of 50 with diabetic foot categorized with Wagner's grade III, and Wagner stage III, IV, V had higher incidents of amputations 46% of patients with Wagner stage III had different kinds of amputations and 14 (28%) of patients with stage IV needed amputations. Patients with Wagner's stage V needed major amputations like below knee amputations and above knee amputations, one each. This study revealed that patients with diabetic foot lesion treated conservatively with higher antibiotics debridement and split skin graft achieve a goal to reduce the amputations up to only distal minor amputations. Most patients 41 (82%) had recovered within four weeks however 9 patients took more than four weeks of recovery.

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