

## Study of Risk Factors and Outcome Management of Diabetic Foot Ulcer in Tertiary Care Hospital

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### Abstract:

**Background:** Diabetes Mellitus, which affects the vascular, neurological, skeletal, immunological, and integumentary systems, is a prevalent health issue around the world. The purpose of this research is to identify the risk factors that negatively impact treatment outcomes and to assess and highlight the management outcomes for diabetic foot in the province of tertiary care hospitals.

**Methods:** This study comprised fifty patients who had been diagnosed with diabetic foot ulcers, or DFUs. The lesions were treated with triple antibiotic therapy, excision of dead tissue, avoidance of weight bearing, and appropriate diabetes management.

**Results:** Gender-wise, the percentage of DF for men and women were 34 (68%) and 16 (32%) respectively. Additionally, the data revealed that type I and type II DM are displayed by 22 (44%) and 28 (56%) of the participants, respectively. Ten of the 50 patients (46%) who had inadequate control also had to have their limbs amputated. The patient's grade percentages for Grade 0, Grade I, Grade II, Grade III, Grade IV, and Grade V were, in accordance with the Wagner Grading System, 2%, 30%, 20%, 22%, 14%, and 12%, respectively. The patients who did not respond were all receiving treatment at home, exhibiting low cooperation, negligence, refusal to follow up as an outpatient, and being at risk of amputation. The following common factors showed significant detrimental impacts on conservative treatment: smoking, neuropathy, leukocytosis, anemia, impalpable dorsalis pedis pulse/s, poorly controlled or uncontrolled diabetes mellitus, traditional home treatment, and patient neglect. Conversely, characteristics that showed reduced or non-significant negative impacts on conservative treatment were hyperglycemia, hypertension, and the site of management (surgical, orthopedic, out-patient, or emergency departments).

**Conclusion:** According to this study, the most common diabetic foot lesion was type II diabetes. The majority of patients came with Wagner's grade I, and the majority of patients had poorly controlled diabetes mellitus that resulted in amputation, according to the study.

**Keywords:** Amputation, Diabetes Mellitus, Wagner Grading System.

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### Introduction

Diabetes mellitus is a global public health issue that has a detrimental effect on socioeconomic development and public health globally. Since diabetic foot patients have impairments, it is a serious complication that has a substantial impact on public health.

Furthermore, the expenses associated with this disease, both direct and indirect<sup>1</sup>. Any pathological alterations in the foot brought on by diabetes or its long-term effects are referred to as "diabetic feet" [2]. It describes the confluence of ischemia, neuropathy, and weakened immunity that makes diabetic patients' feet especially vulnerable to infection, ulceration, and gangrene. [3] Numerous studies have documented differences in the

prevalence of diabetic foot ulcers; in high-income countries, it ranges from 8 to 15%, and ulcers precede 85% of amputations [1,4]. The most severe outcomes are foot ulcers, which can often become infected and spread to deeper tissues, ultimately resulting in disastrous effects. If the diabetic foot is not properly diagnosed, treated, and managed in a timely manner, it may become irreversible and result in progressive tissue necrosis and gangrene, necessitating surgical intervention such as debridement or amputation of the afflicted portion or leg.

Despite the condition's significance, primary care health facilities only implement a limited amount of control and prevention measures to lessen

concerns about it. Diabetic foot ulcers are managed using a variety of techniques. These included shaving off callus skin, treating the infection with three rounds of antibiotics, avoiding weight bearing, managing diabetes properly, reducing edema, and using angiography to determine whether vascular reconstruction is feasible in some situations. [5]

The International Working Group of Diabetic Foot (IWGDF) states that groupings that prioritize patient education and self-care have been utilized to identify the ulceration risk [4].

### Material and Methods

Between June 2010 and May 2011, 50 patients at Darbhanga Medical College and Hospital in Laheriasarai, Bihar, who had been diagnosed with diabetic foot, participated in this prospective study. Patients with clinically obvious diabetic foot lesions (diabetes foot ulceration, infection, or gangrene) were included in the patient selection process. Name, age, sex, type of diabetes mellitus and length of time it was treated with an antidiabetic medication, site of management (surgical, orthopedic, or outpatients department), date of admission, Wagner grade, oral health and smoking habit, random blood sugar level, HbA1C value, Hb value, and WBC count were all recorded for each patient during the interview process.

In addition, a lower limb sensory motor function assessment was conducted along with the medico-surgical history, physical examination, and vital signs, taking into account the condition of distal pulsations (dorsalis pedis DP and posterior tibial PT pulses). The patient met the following criteria: 140/90 mmHg, Hb <10 mg/dl, level >200 mg/dl, and WBC count >11000/cc, respectively. The patient also had anemia, hyperglycemia, hypertension, and leukocytosis.

Additionally, ischemic heart disease and neuropathy must be approved by cardiologists

through a medico-surgical neurological assessment. However, one or more of the following conditions must be met for a diabetic foot to be amputated: a rapidly spreading lesion, infection with tissue necrosis despite aggressive treatment and/or surgery to preserve the limb, gangrene, lack of pedal pulses, excruciating pain, rising fever (sepsis), and rising insulin requirements.

Four groups based on the risk of serious diabetic foot problems were identified. These groups were 5.1%, 14.3%, 18.8%, and 55.8%, respectively, at three years of follow-up for R0, R1, R2, and R3, based on the prediction of ulcer occurrence<sup>6</sup>. Prior to beginning a treatment plan, each patient underwent a thorough assessment. The patients were managed using various options, including outpatient care or admission (if necessary) to a specialized ward. The patients were treated conservatively with proper blood sugar control, infection removal, anemia correction, and dietary manipulation, or surgically by the surgeon with debridement of necrotic tissues under aseptic measures and occasionally with more drastic treatment like mapped amputation after the patients and their relatives were counselled and signed off on the plan.

Data were analysed through the use of statistical package of social science (SPSS) version 23. Descriptive statistics [frequency and percentage] and inferential statistics [Chi square].

### Results

Thirty (60%) and twenty (40%) of the fifty diabetic foot patients were male, and female patients. Patients ranged in age from 30 to 80 years old, with a mean age of 55.

Also, type I and type II diabetes were present in 22 (44%) and 28 (56%) of the patients, respectively. On the other hand, the average length of DM was 10 years (Table -1).

**Table 1: Shows the age distribution of patients in relation to sex and location of management**

Age in years	Males	Females	Outpatient clinic		Total
			Males	Females	
<50	6	5	2	3	16
=50	2	2	1	1	6
>50	15	4	4	5	28
Total	23	11	7	9	50

Regarding the treatment module, 15 patients (30%) sadly had to have their limbs amputated, whereas 35 patients (70%) received satisfactory conservative care. Furthermore, according to Wagner Grade, there were, for Grade I, Grade III, Grade II, Grade IV, Grade V, and Grade 0 accordingly, 15 patients (30%), 10 (20%), 11 patients (22%), 7 patients (14%), 6 patients (12%), and 1 patient (2%) (Table 2).

**Table 2: Wagner grading system of the studied patients**

Wagner grade	Males	Females	Total
0	0	1	1
I	11	4	15
II	6	4	10
III	8	3	11
IV	5	2	7
V	4	2	6
Total	34	16	50

Additionally, this study revealed that 15% (15 patients out of 50) had an amputation. Furthermore, Table 3 shows that the percentages of amputation by gender were 33% (11 out of 34 males) and 25% (4 out of 16) for men and women, respectively. (Table 3)

**Table 3: Diabetic foot grading in relation to treatment outcome (% out of total)**

Wagner grade	Sex	Conservative treatment	Percentage	Amputation	Percentage	Total
0	M	0	0%	0	0%	0
	F	1	2%	0	0%	1
I	M	10	20%	1	2%	11
	F	4	8%	0	0%	4
II	M	6	12%	0	0%	6
	F	4	8%	0	0%	4
III	M	6	12%	2	4%	8
	F	2	4%	1	2%	3
IV	M	1	2%	4	8%	5
	F	1	2%	1	2%	2
V	M	0	0%	4	8%	4
	F	0	0%	2	4%	2
Total		35		15		50

In terms of pedal pulses (PT and DP), the findings showed that 8 amputated instances and 10 out of 50 (20%) exhibited impalpable pedal pulses. Merely 7 patients required amputation, despite 40 patients (80%) having palpable PT or DP. Amputations were performed on 14 individuals out of the 76% of patients (38 out of 50) whose blood sugar was measured and found to be more than 200 mg/dl. Out of 50 patients with blood sugar levels  $\leq$  200 mg/dl, just one had their limb amputated.

Regarding the DM control the results of this study showed that 46 % (23 out of 50) of the patient including 10 cases of them got amputation (20%). While 27 patients were under control with a percentage of 54 % and included 5 cases of them got amputation (10% among all patients). Additionally; 37 (74 %) out of 50 cases were showed infection including 22 cases with the controlled infection; however 4 cases were underwent amputation. Meanwhile the uncontrolled

infection occurred in 15 cases included 7 amputated cases.

When it came to the patients' smoking habits, the percentages for smokers and non-smokers were 70% (35 out of 50, or 12 instances) and 30% (15 out of 50, or 3 cases) correspondingly. Conversely, the percentages of inadequate and adequate dental hygiene are 27 (54%) and 23 (46%) respectively.

Out of the 22 instances (44%) who were diagnosed with neuropathy, 12 of them had amputation. Only three of the 28 cases (56%) that were diagnosed with neuropathy had amputations performed on them.

While neuropathy, leukocytosis (WBCs > 11000/cc), smoking, ischemic heart disease, and high blood sugar levels with poor control or uncontrolled levels all shown significant effects and negatively impacted prognosis (Table 4).

**Table 4: Risk factors and type of management (% from total)**

Risk factors		Conservative treatment	Percentage	Amputation	Percentage
Sex	Male	23	46%	11	22%
	Female	12	24%	4	8%
Duration of DM	<10 years	18	36%	8	16%
	>10 years	17	34%	7	14%
Type of DM	I	15	30%	7	14%
	II	20	40%	8	16%
Smoking	Yes	23	46%	12	24%

	No	12	24%	3	6%
Oral health	poor	27	54%	12	24%
	Satisfactory	23	46%	3	6%
HT	<140/90	28	56%	9	18%
	>140/90	7	14%	6	12%
IHD	Yes	7	14%	7	14%
	No	28	56%	8	16%
Hb value	<10 g/dl	17	34%	8	16%
	>10 g/dl	18	36%	7	14%
WBC	<11000/cc	21	42%	4	8%
	>11000/cc	14	28%	11	22%
Bloodsugar	<200 mg/dl	11	22%	1	2%
	>200 mg/dl	24	48%	14	28%
Neuropathy	Yes	10	20%	12	24%
	No	25	50%	3	6%

The percentages of amputation type were 16%, 6%, and 6 % for the amputation, below-knee amputation, and above-knee amputation, respectively (Table 5).

**Table 5: Shows the percentages of amputation in surgical and orthopedic wards**

Type of amputation	Males	Percentage	Females	Percentage
Toe amputation	8	16%	0	0%
Transmetatarsal	0	0%	0	0%
Syme's	0	0%	0	0%
Below knee	1	2%	1	2%
Above knee	1	2%	2	4%

## Discussion

The significant contribution of vascular and neurological illnesses to the mortality rate in people with diabetes mellitus makes diabetic foot problems a major cause of death.[12] About two thirds of non-traumatic amputations performed in most underdeveloped nations are due to diabetic foot issues. Patients with diabetes often experience foot ulcers and other lesions of the lower limbs at some point in their lives.

According to the Wagner grading system, a patient's history of prior foot ulcers, neuropathy, peripheral vascular disease, inadequate glycemic control, patient denial and underestimation of foot lesions are all thought to be significant risk factors in the development of diabetic foot in patients and to be the best indicators of future diabetic foot amputation. The results of the current study revealed the percentage of DM according to type. 56% (28 out of 50 patients) and 44% (22 out of 50 patients) were of type II and type I, respectively.

30%, 22%, 20%, 14%, and 12% of the patients in the current study were classified as grade I, grade III, grade II, grade IV, and grade V, respectively, based on Wagner grading. However, grade I was given to the greater percentages. These findings align with the previously published research by Noshad et al. (2011) [10], which employed the Wagner categorization System the same categorization scheme to forecast the prognosis of fifty patients. Additionally, the number of patients for Grade 1, Grade II, Grade III, and Grade IV

were 24, 48%, 26 %, 18 %, and 4 %, respectively. Nevertheless, no patients received a Grade V or Grade-0)7 rating. According to the current study, there were 34 (68%) males and 16 (32%) females. This finding is consistent with study number, which showed that more of male than female.

They also came to the conclusion that women are less at risk than men because of less severe neuropathy, more joint mobility, and reduced pressure on the feet. However, these variables are not constant, and women should be seen as having an equal chance of acquiring future difficulties as men. The first metatarsal head was the most often affected area by diabetic foot ulcers. Due to analgesia, sensory neuropathy makes the foot more prone to injury. The intrinsic musculature of the foot becomes unbalanced due to motor neuropathy, which results in pressure necrosis of the planter tissue and ventral subluxation of the metatarsal heads.

Patients with diabetes who develop foot lesions typically reach the age of fifty. With a mean age of 55, 56% of cases in the current study were over 50 years old. Additionally, 24 out of 50 patients, or 48% of the total, had been diagnosed with DM for more than ten years.

A clinical examination of the lesion can help define the course and degree of treatment. Additionally, the results of the treatment demonstrated that 100% of grade I, 65% of grade II, and 12% of grade III cases responded well to conservative and/or surgical treatment, which includes bed rest, non-

weight-bearing exercise, and straightforward wound debridement. By comparison, 59% of the treatments were successful overall. Ritz et al., 1992) [9], however, found that 90% of the same grades I, II, and III responded well to conservative therapy. Simultaneously, a different study discovered that retinopathy, neuropathy, and impaired blood flow are critical elements contributing to the failure of conservative treatment [10].

In addition to the lack of specialized treatment aids like total contact casts or felted foam dressings, which reduce pressure at the ulcer sites [9], socioeconomic status, traditional treatment, and educational factors may also be seasonal factors influencing diabetic foot ulcers. Most of our patients also use multiple antimicrobial agents haphazardly.

The incidence of amputation among the patients in this study was 30% (15 instances). Nonetheless, this percentage is seen as excessive, and it may be because the case was submitted later than expected. There were five female cases (33.33%) and ten male cases (66.66%). Out of 15 patients, 10 cases involved toe (Ray) amputations, which was the most prevalent type of amputation done. This could be because a large number of patients had lesions on the toe or metatarsal head; in two cases, below-knee amputations occurred, and in three cases, above-knee amputations. These findings align with earlier research publications [11]. The majority of the patients in the current study had poor glycemic control upon presentation, which had a negative impact on treatment success.

Patients who are unaware of the significance of appropriate medical management of their blood sugar, dietary control, and routine follow-up at specialized diabetes clinics may be able to elucidate their lack of information regarding glucose level control.

Another important risk factor that has an impact on DFU therapy is peripheral vascular disease. Palpating the pedal pulse allowed for the early discovery of vasculopathy, which was found in 10 individuals (20% of the 50 patients) by Doppler ultrasonography? Any diabetic patient who is at danger of amputation has been advised to undergo an angiography in order to show that vascular surgery is required in order to prevent or lessen the extent of the amputation that must be done. Out of 50 patients, 22 had neuropathy (44%). There is a significant increase in risk for both macro- and microvascular illnesses after smoking. Additionally, smoking is linked to higher blood concentrations of LDL and total cholesterol, lower serum concentrations of HDL, and higher levels of insulin resistance [9,10]. The current study revealed that smoking adversely affected the treatment

outcome and considerable percentages of smokers underwent amputation (12 cases out of 50) (34.28%).

Due to the widespread use of antibiotics by patients without a prescription, the current study was required to gather important data regarding the effects of antimicrobials on management outcomes. Since most patients in this study did not respond to the standard triple antibiotic regimen and had further, more complicated infection complications of DF, the majority of them tested positive for multiple drug resistance on the antibiotic sensitivity test.

However, a prior study conducted on 100 patients by diabetic foot surgeons in Jordan reported the effects of antibiotics on management outcomes. A separate antimicrobial drug was used to split the patients into 4 groups, each with an average admission day ranging from 7 to 14 days. They discovered that 15 instances required amputations, 5 patients experienced acute renal failure, and 5 cases were worsened by infection and septicemia. They advised delaying the use of antimicrobial drugs until after precise sensitivity testing and culture [12]; similarly, we suggest in our research that a suitable and beneficial antimicrobial regimen should be predicated on sufficient sensitivity testing and culture of swabs obtained from the lesion of DF.

### Conclusion

This study concluded that type II diabetes affected the majority of patients with diabetic foot lesions.

The majority of patients had DM that was not well managed and required amputation; most also had Wagner's grade I. Furthermore, the head of the first metatarsal bone was the most often affected area by diabetic foot ulcers. While surgical management debridement or major or simple amputation was the most often used mode of care. For conservative treatment to be successful, early diagnosis is crucial.

A person's age, gender, dental health, smoking habits, and other pertinent variables were significant risk factors for the development of diabetic foot ulcers.

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