

Original Research Article

A one year cross sectional study on role of Wagner's classification in predicting the outcome in diabetic foot ulcer patients

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ABSTRACT

Background: Diabetes mellitus-related foot ulceration is very common. Several classification systems for diabetic foot ulcers have been proposed. The present study was intended to assess the role of Wagner wound classification in predicting the outcome of diabetic foot ulcer and also know the grade of Wagner's classification to which majority of diabetic foot ulcer patients.

Methods: This present one year cross sectional study was carried out at the Department of General Surgery. A total of 100 patients with diabetic foot ulcer who presented during the study period were included. The diabetic foot ulcers were graded according to the Wagner's classification. The relative risk of amputation in different grades of diabetic foot ulcer based on Wagner classification was determined.

Results: In this study majority of the patients were males (79%) and the male to female ratio was 3.76:1. The mean age was noted as 55.8±10.45 years. Majority of the patients had duration of ulcer less than one month (88%). Surrounding skin was inflamed in 60% of the patients, necrosis was present in 40% and slough was noted in 98% while 44% of the patients had necrotic tissue. Based on Wagner's Classification, most of the patients (48%) had Grade II diabetic foot ulcers. With regard to management, in 44% of the patients' debridement was done and 36% of the patients had disarticulation or amputation in 36%. Of the 48 patients with grade II ulcer, 79% of the patients had healing without amputation. Of the 58 patients with grade I and II diabetic foot ulcers, 82.76% had healing without amputation compared to 17.24% of the patients who needed amputation. Patients with Grade III, IV and V had 3.59 times higher risk of amputation compared to patients with grade I and II. ($p < 0.001$; 95% CI- 1.95 to 6.62).

Conclusions: Grading of diabetic foot ulcer based on Wagner's classification affects and predicts the outcome and the risk of amputation increases with increasing grade. Most of the patients admitted for diabetic foot ulcers in our hospital belonged to Wagner's grade II (48%).

Keywords: Diabetic foot ulcer, Risk of amputation, Wagner's classification

INTRODUCTION

Diabetes mellitus (DM) is a metabolic disease characterized by hyperglycemia resulting from defects in insulin secretion, insulin action or both. The chronic hyperglycemia of diabetes is associated with long term damage, dysfunction and failure of various organs, especially the eyes, kidneys, nerves, heart and blood vessels.¹ Long term complications of diabetes include

retinopathy with potential loss of vision, nephropathy leading to renal failure, peripheral neuropathy with risk of foot ulcers, amputations and Charcot joints, and autonomic neuropathy causing gastro intestinal, genitourinary and cardiovascular symptoms and sexual dysfunction.¹

Foot infections are a frequent complication of patients with diabetes mellitus, accounting for up to 20% of

diabetes-related hospital admissions. Infectious agents are associated with the worst outcomes, which may ultimately lead to amputation of the infected foot unless prompt treatment strategies are ensued. Among persons diagnosed as having diabetes mellitus, the lifetime risk of developing a foot ulcer is estimated to be 15%.² Based on recent studies, the annual population-based incidence ranges from 1.0% to 4.1% and the prevalence ranges from 4% to 10%, which suggests that the lifetime incidence may be as high as 25%.³

Lower extremity disease, including peripheral arterial disease, peripheral neuropathy, foot ulceration, or lower extremity amputation, is twice as common in diabetic persons compared with nondiabetic persons and it affects 30% of diabetic persons who are older than 40 years.⁴ Foot ulcers cause substantial emotional, physical, productivity, and financial losses.

Diabetic foot ulcers are wounds on the feet that occur in people with diabetes, a condition where blood sugar levels are abnormally high. If a foot ulcer goes untreated and does not heal, it may become infected. Patients with diabetic neuropathy are subject to ulcerations that may be complicated by infection and gangrene, with subsequent risk of amputation. It is the job of the surgeons to identify and manage these problems early to avoid the unfortunate complication of amputation.

Because diabetic foot ulceration is a serious problem and because ulcers are heterogeneous in terms of etiology, anatomic location, depth of tissue involvement, and associated circumstances, including the presence or absence of infection, classification is needed in order to predict ulcer outcome and conduct clinical trials. In the literature, several classification systems for diabetic foot ulcers have been proposed.

These classification systems have to comply with certain characteristics, such as precision, flexibility, specificity, and simplicity. They can be of great help for the assessment of treatment schemes. Classifications are also useful in standardization and analysis of multicenter research. The classification most frequently used analyzes one or more of the following elements: infection, neuropathy, vasculopathy, and the extent (surface and depth) of the ulcer. Further these classification schemes help in predicting outcomes.

The best known and widely available classifications are Meggit/Wagner, Gibbon's, Frykberg's and Coleman's, Forrest's, Knighton's, the Texas Diabetic Wound Classification, and the Ten-Level Seattle Wound Classification System.⁵ Each of these classifications was developed to accomplish a particular objective, utilizes different criteria, and categorizes lesions according to different rationales. Only a few of these classifications were evaluated for the assessment of the prognosis on salvage of the ulcerated or dysvascular diabetic limb.^{6,7}

The Meggit/Wagner classification is probably the best known and the most frequently used. This system is based on three features: depth of the ulcer, the degree of infection, and the presence or absence of gangrene and its extent. Grades 1 to 3 are mainly based on neuropathy, while grade 4 and 5 represent mainly ischemic lesions. The grading system was adapted in 1988 by Calhoun et al in order to combine medical and surgical elements of therapy to monitor the treatment of diabetic foot infection.^{8,9}

Nevertheless, it is described as very simple and, therefore, often considered to be inconveniently inaccurate. Also, it is postulated that, the scheme provides insufficient levels to discriminate between wounds that may benefit from nonsurgical rather than surgical management. However, these concepts remain controversial due to the scanty data and prompt further assessment.

Classifying the ulcers and then treating them helps us to compare the outcomes better and so identify measures to reduce the morbidity and mortality due to diabetic foot disease. Considering the above facts, the present study was planned to assess the role of Wagner wound classification in predicting the outcome of diabetic foot ulcer and to know the grade of Wagner's classification to which majority of diabetic foot ulcer patients admitted in KLES Dr. Prabhakar Kore Hospital belong to.

METHODS

It is a cross sectional study done for a period of one year from January 2013 to December 2013. This study was done in the Department of General Surgery, KLES Dr. Prabhakar Kore Hospital and Medical Research Centre, Belgaum. A total of 100 patients with diabetic foot ulcer were studied.

The diabetic foot ulcers were graded according to the Wagner's classification and managed with strict glycemic control, daily dressings, debridement and amputation if needed. The outcome was noted as either; Wound healing without amputation or Wound healing with amputation.

Statistical analysis

Statistical analysis was done, and categorical data was expressed as rates, ratios and percentages and comparison was done using Fisher's exact test. A 'p' value of less than or equal to 0.05 at 95% confidence interval was considered as statistically significant. The relative risk of amputation in different grades of diabetic foot ulcer based on Wagner classification was determined.

RESULTS

In the present study 79(79%) of the patients were males and 21(21%) were females. The male to female ratio was 3.76:1.

In this study the mean age in males was 55.10 ± 11.09 years and in females the same was 58.6 ± 71.84 years. Overall the mean age was noted as 55.8 ± 10.45 years with range 26 being minimum and 81 being maximum (Table 1).

Table 1: Demographic distribution in study.

Sex	Total	Mean		Range	
		Mean	SD	Min	Max
Male	79	55.1	11.09	26	81
Female	21	58.6	71.84	43	70
Overall	100	55.8	10.45	26	81

In the present study presence of slough was noted in 98% of the patients. In this study 44% of the patients had necrotic tissue (Table 2).

Table 2: Slough and necrotic tissue in study.

Slough	Distribution (n=100)	
	Number	Percentage
Present	98	98.0
Absent	02	2.0
Necrotic tissue		
Present	44	44.0
Absent	56	56.0
Total	100	100.0

In the present study based on Wagner's Classification, most of the patients (48%) had Grade II diabetic foot ulcers followed by grade III (31%), grade I (10%), grade IV (9%) and grade V (2%) (Figure 1).

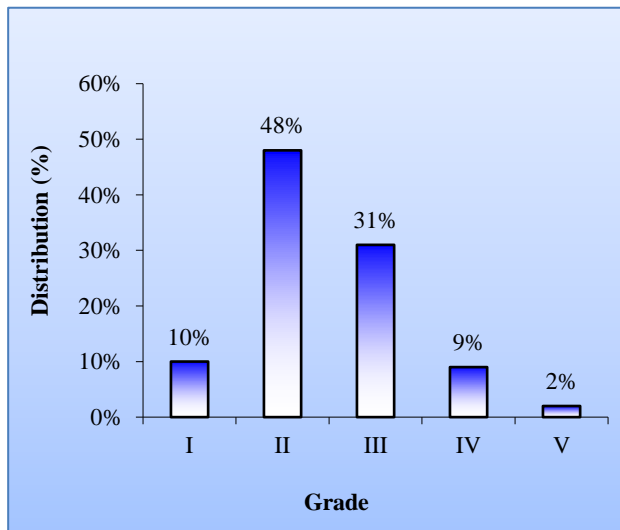


Figure 1: Wagner's Classification of ulcers.

In this study 44% of the patients needed debridement followed by disarticulation or amputation in 36%, debridement with split thickness skin grafting in 12% and dressing in 8% (Figure 2). In the present study maximum patients presented with grade II ulcer (48%). Among

them 79% of the patients had healing without amputation and 20.83% had healing with amputation. As the grade of ulcer increases, the percentage of patients in each grade going for Amputation increases.

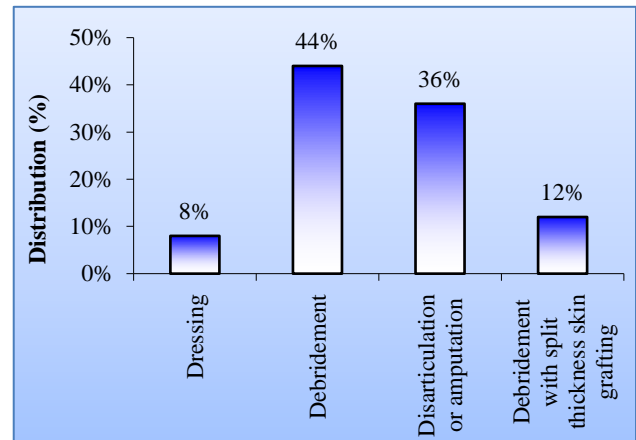


Figure 2: Management of cases in study.

In this study 58% of the patients presented with grade I and II diabetic foot ulcers. Among these 82.76% had healing without amputation compared to 17.24% of the patients needed amputation (Table 3).

Table 3: Ulcer grading in study.

Ulcer grade	Outcome			
	Healing without amputation		Healing with amputation	
	Number	%	Number	%
I	10	100.0	0	0.00
II	38	79.17	10	20.83
III	16	51.61	15	48.39
IV	0	0.0	9	100.0
V	0	0.0	2	100.0
Total	64	64.0	36	36.00

$p < 0.001$; Relative risk-3.59; 95% CI - 1.95-6.62

Of the 42% patients with grade III, IV and V diabetic foot ulcers, 61.9% needed amputation whereas 38.1% healed without amputation.

Patients belonging to Grade III, IV and V had 3.59 times higher risk of amputation compared to patients belonging to grade I and II. ($p < 0.001$; Relative risk-3.59; 95% CI- 1.95 to 6.62).

DISCUSSION

Diabetes mellitus-related foot ulceration is very common. As a result of neuropathy, peripheral vascular disease, and infection, patients with diabetes are prone to develop diabetic foot problems that may eventually require a lower-extremity amputation.



Figure 3: Grade I Ulcer;



Figure 7: X-ray foot lateral view.



Figure 4: Grade II ulcer with exposed tendon.



Figure 8: Grade IV ulcer after amputation.



Figure 5: Grade III ulcer with osteomyelitis.



Figure 6: X-ray foot AP view of grade III ulcer showing osteomyelitis.

Of all individuals with diabetes mellitus, 15 percent will be affected by ulceration at least once in their lifetime.⁵ Because diabetic foot ulceration is a serious problem and because ulcers are heterogeneous in terms of etiology, anatomic location, depth of tissue involvement, and associated circumstances, including the presence or absence of infection, classification is needed in order to predict ulcer outcome and conduct clinical trials.

Several classification systems for diabetic foot ulcers have been proposed. These classification systems have to comply with certain characteristics, such as precision, flexibility, specificity, and simplicity. They also must be applicable for education and communication between all care providers, including nurses, general practitioners, and specialists. They can be of great help for the assessment of treatment schemes. The classifications most frequently used are based on factors like infection, neuropathy, vasculopathy, and the extent (surface and depth) of the ulcer.⁴

The best known and widely available classifications are Meggit/Wagner, Gibbon's, Frykberg's and Coleman's, Forrest's, Knighton's, the Texas Diabetic Wound Classification, and the Ten-Level Seattle Wound Classification System.⁵ Each of these classifications were developed to accomplish a particular objective, utilizes different criteria, and categorizes lesions according to different rationales. Only a few of these classifications were evaluated for the assessment of the prognosis on

salvage of the ulcerated diabetic limb. Wagner's classification is the most widely accepted Grading system for Lesions of Diabetic foot. This study assessed the role of Wagner wound classification in predicting the outcome of diabetic foot ulcer.⁴

The present one year cross sectional study included a total of 100 patients with diabetic foot ulcer at the Department of General Surgery, KLES Dr. Prabhakar Kore Hospital and Medical Research Centre, Belgaum from January 2013 to December 2013. The diabetes foot ulcers were graded according to the Wagner's classification. The occurrence of DFUs mostly in males and middle-aged subjects has been reported by several researchers.^{6,7} In the present male preponderance was noted as majority of the patients were males (79%) with higher male to female ratio (3.76:1). (Table 1 and 2) These findings were consistent with a study from Varanasi to determine risk factors for foot ulceration where 71.13% of the patients were males and 28.86% were females.⁷ The mean age in the present study was found to be 55.8±10.45 years suggesting predominant involvement of elderly population. A study from Varanasi to determine risk factors for foot ulceration reported mean age of the patients with diabetic foot ulcers as 55.25 years.

In this study the duration of ulcer was less than one month in majority of the patients (88%). The surrounding skin was inflamed in 60% of the patients while necrosis in 40% and of the patients. Presence of slough was noted in 98% and 44% of the patients had necrotic tissue. In the present study most of the patients (48%) had Grade II diabetic foot ulcers followed by grade III (31%), grade I (10%), grade IV (9%) and grade V (2%) based on Wagner's Classification (Table 3). Recently a study to evaluate diabetic foot ulcer according to Wagner's Classification at a rural hospital in Maharashtra, India found that the commonest presentation was Wagner's Grade 2 diabetic foot.⁷

In this study based on diabetic ulcer grade, most of the patients (44%) underwent debridement followed by disarticulation or amputation (36%), debridement with split thickness skin grafting (12%) and dressing (8%). In the present study 48 patients had grade II diabetic foot ulcer. Of these majority of the patients (79%) had healing without amputation but a substantial number of patients (20.83%) needed amputation. However, of the 10 patients who had grade I diabetic foot ulcer all (100%) had healing without amputation. Further of the 31 patients with grade III ulcer, 51.61% had healing without amputation compared to 48.39% who needed amputation. In those with grade IV and V all the patients needed amputation ($p<0.001$) (Figure 1). Overall these findings showed an increasing trend of healing with amputation with advanced ulcer grades significantly. To evaluate the effect of Wagner classification on outcome, we calculated relative risk of amputation in patients belonging to Wagner grade III, IV and V compared to those belonging

to grade I and II. It was observed that, of the 58 patients in grade I and II, 82.76% had healing without amputation and 17.24% underwent amputation ($p<0.001$). Of 42 patients in grades III, IV and V, 38.1% healed without amputation and 61.9% needed amputation. Patients with Grade III, IV and V ulceration were found to be 3.59 times higher at risk for amputation than Grade I and II ulcerations. ($p<0.001$, RR=3.59; 95% CI-1.95 to 6.62) (Figure 2).

The findings of the present study were consistent with a study by Oyibo et al who reported that the Wagner grade significantly correlate with the risk of amputation.⁸ Calhoun et al reported that increased Wagner grade was associated with a higher treatment failure.⁹ Ulcers of Wagner grades 4 and 5 denote the presence of local or diffuse gangrene, which are usually due to a combination of ischemia and infection. It is thus not surprising that grade 4 and 5 ulcers were very strongly associated with amputation in our study. A study conducted in Pakistan also reported that, lesser grade lesions responded well to conservative treatment with antibiotics and surgical debridement while those with higher Grades IV and V needed amputation.¹⁰ They also concluded that Grading diabetic foot lesions according to Wagner's classification helps in correlating appropriate treatment to Proper Grade of lesion with better outcome. Another study in Karachi to know the role of wound classification in predicting the outcome of diabetic foot ulcer showed that grading diabetic foot ulcer affects and predicts the outcome and amputation rates increase with increase in the Wagner's grade.¹¹ Calhoun et al found that classification of foot lesion not only enabled them to institute proper treatment regimen, but additionally, when such protocols were followed, the treatment outcome were significantly more successful than when protocols were not followed.⁹

Overall the present study showed grading of diabetic foot ulcer based on Wagner classification affects and predicts the outcome and further, amputation rates increase with increase in grade.

CONCLUSION

In this study, we found that Grading of diabetic foot ulcer based on Wagner's classification affects and predicts the outcome and the risk of amputation increases with increasing grade. Most of the patients admitted for diabetic foot ulcers in our hospital belonged to Wagner's grade II (48%).

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