Original Article

Evaluation and Management of Diabetic Foot According to The Wagner's Classification

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Abstract

Introduction: The most important complication in diabetic patient is diabetic foot which represents a major medical, social, and economic problem worldwide that significantly influence the quality of life. The most common method for management and evaluation of diabetic foot and ulcers has been assessed by Wagner's classification .

Methods: A prospective descriptive study designed for evaluation and management of diabetic foot according to wagner's classification. Total of 95 patient were included over a period of 18 month from 8th December 2018 to 30th June 2020 and were studied clinically and investigated as per the proforma. Routine hematology and biochemical investigation, ABPI was measured , color Doppler of limb and X-ray of foot was done. The patients were evaluated according to age, gender, occupation, neuropathy, ABPI, wagner's grade , HbA1C, treatment and were followed up to 3 months.

Result: Out of 95 patients, majority of the cases were in the cases in the age group of more than equal to 50 years and in gender, males are affected more (61.1%) than female (38.9%). Farmers with diabetes have high prevalence of diabetic foot. Nature of lesion showed that ulcers were higher in this study. Wagner's classification showed grade 2 diabetic foot ulcer was more prevalent in this study.

Conclusion: Grading diabetic foot lesions according to the wagern's classification helped in correlating appropriate treatment which showed better outcome. Early presentation, hospital admission, aggressive and appropriate medical and surgical treatment according to grade of disease improved the outcome and reduced the morbidity of the patient.

Keywords: *Diabetic foot, Management, Wagner's Classification*

Introduction

Diabetes Mellitus (DM) is a global public health threat that has increased dramatically over the past two decades. The global prevalence of diabetes has nearly doubled since 1980, rising 4.7% to 8.5% in the adult population.[1] The prevalence of type 2 diabetes in Nepal ranges from 6.3 to 8.5%.[2] Approximately 15% of patients with diabetics will have a life time risk of developing some foot complications during the course of illness from simple calluses to major abscesses and osteomyelitis. Diabetic foot disease poses a growing global public health challenge and a major financial burden on healthcare systems worldwide.[3] Diabetes has been seen to be the commonest cause of non-traumatic lower limb amputation in US and Europe.[4,5]

The risk factors that could cause diabetic foot ulcerations are peripheral neuropathy, vascular disease, limited joint mobility, foot deformities, abnormal foot pressures, minor trauma, a history of ulceration or amputation, and impaired visual acuity.[6-8] Infection occurs in approximately half of diabetic foot ulcers, and many of these require amputation. To evaluate the spectrum of diabetic foot according to wagner's classification, this study was conducted to study the spectrum of diabetic foot, various treatment modalities and their outcome.

Methods

It was an observational descriptive study conducted from 8th December 2018 to 30th June 2020 in the

department of Surgery of Universal College of Medical Sciences, Nepal. Ethical clearance was sought from Institutional review committee of the institute (UCMS/IRC/219/18). A written consent was taken from all participants.

All patients with diabetic foot visiting the department during the study period were included in the study. Diabetic foot associated with venous ulcer and lymphedema were excluded. Also, patients not consenting to the study were also excluded.

All the participants were interviewed using a predesigned questionnaires for detailed history which included demographic details and chief complaints. Examination finding, investigation results, complete diagnosis, date of surgery, intra-operative finding, any morbidities or complications, duration of hospital stay, and their outcome were also recorded in the same questionnaire. Routine hematological and biochemical investigations were sent. Ankle Brachial pressure index (ABPI) was measured, Color Doppler of the limb and X-ray of foot was done. Diabetic foot was graded according to Wagner's classification system of diabetic foot.[9] It describes diabetic foot from Grade zero to Grade five in increasing order of severity.

Glycemic control was done with oral hypoglycemic agents or insulin as appropriate. All the patient were operated in department of surgery of UCMS/TH. Post operatively, cases were observed during the hospital stay and followed up for three months.

Results

This study included 95 cases, 58 (61.1%) males and 37 (38.9%) females. The age ranged from 30 years to 78 years with mean age 56.15 (S.D. 11.165). Majority of the cases in the present series were in the age group of 51-60 years of age. No case of less than 30 years age group was observed. There was a male predominance in occurrence of diabetic foot lesion. There were 58 (61.1%) males and 37(38.9%) females. Of all cases, 43.2% of the cases were farmers, 25.3% were housewife, 10.5% were teacher, 4.2% were businessman and 16.8% were officers. Neuropathy was present in 55.8% of the cases. 48 cases had HbA1C of ≥6.5-8.9%, 33 cases had HbA1C of ≥9-11.9% and 14 cases had HbA1C of ≥12%.

Distribution of participants according to ABPI and Grade is presented in Table 5; 54 cases had normal ABPI of 0.9-1.3.

Table 1. Distribution of cases according to ABPI and Grade:

ABPI	Grade					No. of cases (n)	Per-centage %
	I	II	III	IV	V		
>1.3	1	0	1	0	0	2	2.1%
0.9-1.3	20	23	11	0	0	54	56.8%
0.6 - 0.89	2	2	2	11	0	17	17.9%
0.4 - 0.59	0	0	0	8	5	13	13.7%
<0.4	0	0	0	2	7	9	9.5%
Total (n)	23	25	14	21	12	95	100%

The majority of the cases (53.7%) had normal (Triphasic waveform) color Doppler study. (Table 2)

Table 2. Distribution of cases according to color Doppler study:

Disease severity and Spectral wave-form Features	Total no(n)	Percent-% age
Normal (Triphasic waveform)	51	53.7%
<50 % Diameter reduction (Triphasic waveform with spectral broadening)	30	31.6%
>50-99 % Diameter reduction(Mono-phasic waveform)	4	4.2%
Complete occlusion	10	10.5%

In the present study 75.7% of cases had normal X-ray finding, whereas 24.3% had osteomyelitis. Details of x-ray findings is presented in Table 3.

Table 3. Distribution of cases according to x-ray foot:

X-ray of affected foot	Total (n)	Percentage %

Normal study	72	75.7%
Osteomyelitis of phalanges	15	15.8%
Osteomyelitis of metatarsals	3	3.2%
Osteomyelitis of metatarsal and phalanges	5	5.3%

In this study, out of 95 cases, 48 (50.5%) cases presented with ulcer, which was the most common presentation. Other presentation included ulcer with abscess (14.7%) and gangrene (34.8%)

Debridement was done in 51(53.7%) cases followed by disarticulation of toes which was done in 23(24.2%) cases, below knee amputation in 14(14.7%) cases and SSG was done 2 weeks after debridement and culture negative report in 7 (7.4%) cases.

In this study, out of 95 cases, during 3 months follow up period post treatment, diabetic foot wound healed in 76 cases and amputated stump healed in 12 cases of below knee amputation and 7 cases were lost to follow up.

No significant association was found between diabetic foot grade and age. (p=0.307)

(Table 4)

Table 4. Association of Diabetic foot grade (Wagner's grade) with Age:

Grade	Age		Total (n)	p-value
	< 50years	>=50		
I	3	20	23	0.307
II	5	20	25	
III	7	7	14	
IV	5	16	21	
V	1	11	12	
Total	21	74	95	

No significant association was found between diabetic foot grade and gender. (p=0.177) (Table 5)

Table 5. Association of Diabetic foot grade (Wagner's grade) with Gender:

Grade	Gender		Total (n)	p-value
	Female	Male		
I	9	14	23	0.177
II	12	13	25	
III	7	7	14	
IV	8	13	21	
V	1	11	12	
Total	37	58	95	

In the present study, there was significant association between diabetic foot grade and neuropathy. (p<0.0001). (Table 6)

Table 6. Association of Diabetic foot grade (Wagner's grade) with Neuropathy:

Grade	Neuropathy		Total (n)	p-value
	Absent	Present		
I	15	8	23	0.0001>
II	17	8	25	
III	8	6	14	
IV	2	19	21	
V	0	12	12	
Total	42	53	95	

Lower values of ABPI were observed with worsening of ulcer grade on Wagner's Classification. This showed a significant association between ABPI and gangrene (nature of lesion). (p<0.0001). (Table 7)

Table 7. Association of ABPI with Gangrene:

ABPI	Gangrene	(Total(n	p-value

	Absent	Present		
1.3<	2	0	2	0.0001>
0.9-1.3	54	0	54	
0.6-0.89	6	11	17	
0.4-0.59	0	13	13	
0.4>	0	9	9	
(Total(n	62	33	95	

In the present study, significant association was found between diabetic foot grade and HbA1C. (p=0.008). This showed higher values of HbA1C led to worsening of ulcer grade on Wagner's Classification. (Table 8)

Table 8. Association of Diabetic foot grade (Wagner's grade) with HbA1C:

HbA1C	Grade					Total (n)	p-value
	I	II	III	IV	V		
>=6.5 -8.9%	19	12	5	10	2	48	**0.008**
>=9-11.9%	3	9	7	9	5	33	
>=12%	1	4	2	2	5	14	

In the present study, all the cases of grade I were managed with debridement, grade II were managed with debridement and debridement with SSG and significant association was found between diabetic foot grade and treatment. (p<0.0001). This showed that higher grade of diabetic foot ulcer led to disarticulation of the toes or below knee amputation (Table 9)

Table 9. Association of Diabetic foot Grade (Wagner's grade) with Treatment:

Grade	Treatment				Total(n)	p-value
	A	B	C	D		
I	23	0	0	0	23	<0.0001
II	20	5	0	0	25	
III	8	2	4	0	14	
IV	0	0	19	2	21	
V	0	0	0	12	12	
Total	51	7	23	14	95	

A= Debridement only, B= Debridement + SSG,
C= Disarticulation of toes, D= Below knee amputation

Discussion

Diabetic patients have always suffered from complications affecting the lower limbs. Foot infection and the subsequent amputation of a lower extremity are the most common cause of hospitalization among diabetic patients and entails high cost to the patient.

In the present study, there was no significant (p=0.307) association between age and diabetic foot grade. (Table 13) However more number of cases was found in age group of 51-60 years of age. Similar results was found in the study done by Rajyalakshmi Y et al and Chethan L et al. where 51-60 years of age group had more number of diabetic foot cases.[3,10] A study done by Ahmed W. et al showed the age group of 40-70 years had more number of diabetic foot cases.[11]

Males are predominantly at risk of diabetic foot ulcers when compared with females.[11-13] In the present study, out of 95 patients, 58(61.1%) were males and 37(38.9%) were female patients. The male: female ratio was 1.5:1. Although diabetic foot ulcer was more common in males but in the present study there was no any significant association between gender and diabetic foot grade. (p=0.177) (Table 14) In the similar study by Ahmed W. et al and Gupta et al. where male : female ratio was 4:1 and 1.94:1 respectively. Conversely, a study done by Ali J. et al showed that females are at higher risk of diabetic foot. This might be due to poor hygiene, lack of awareness of risk of diabetic foot and delayed presentation to hospital.[14]

Globally, the diabetes and its complications are more common in the people who perform sedentary work.[15] In the present study, out of 95 cases, diabetic foot ulcer was common in farmers (43.2%), followed by housewives (24.3%). However a study done by Ranjitkar S. et al. showed that housewives are at more risk of having diabetic foot compared to other professions.[15] Farmers are at increased risk of diabetic foot ulcer as they work bare foot in the field, are exposed to repeated trauma during their work and due to the lack of awareness regarding glycemic control, consequences of diabetic foot ulcers, need of proper foot care and delayed presentation to hospital.

In the present study, majority of the cases were in the age group ≥50 years. There were higher numbers of cases of neuropathy than absence of neuropathy which may be associated with diabetic complication among the patients group. Out of 95 patients, 53(55.8%) patients had neuropathy. Significant association was seen between diabetic foot grade and presence of

neuropathy (p<0.0001) (Table 15). Similarly, Viswanathan V. et al. observed increased prevalence of neuropathy with ageing and diabetic foot grade.[16]

In this study out of 95 patients 2(2.1%) patient had ABPI >1.3, 54 (56.8%) patients had a normal ABPI of 0.9-1.3, 17(17.9%) patients had ABPI of 0.6-0.89, 13(13.7%) patients had ABPI of 0.4-0.59 and 9(9.5%) patients had ABPI of <0.4. Lower values of ABPI were observed with worsening of ulcer grade on Wagner Classification. This showed a statistically significant result. (p<0.0001) (Table 16). The result are in accordance with the study done by Sharma VK et al, in which patients were found to have peripheral arterial disease diagnosed on the basis of decreased ABPI and Lower values of ABPI were observed with worsening of ulcer grade on Wagner Classification.[17]

In the present study, 51 cases had normal color doppler study whereas 44 patients had vasculopathy in which 30 cases had <50% diameter reduction (Triphasic waveform with spectral broadening), 4 cases had >50-90% diameter reduction (Monophasic flow) and 10 cases had complete occlusion and these results are similar to the study conducted by Rahman A. et al. This study shows that the vasculopathy is strong independent risk factor in the development of diabetic foot lesions.[18]

In the present study all the cases had high HbA1C ranging from ≥6.5% to ≥12%. Where 50.5% patients had HbA1C between ≥6.5-8.9%, 34.7% patient had HbA1C between ≥9-11.9% and 14.8% patient had HbA1C ≥12%. Higher values of HbA1C were observed with worsening of ulcer grade on Wagner's Classification. This study showed a significant association between diabetic foot grade and HbA1C. (p=0.008) (Table 17). A study conducted by Kumar VM et al. showed a similar result where higher values of HbA1C were observed with worsening of ulcer grade.[19]

In this study out of 95 patients, nature of lesion showed that 48(50.5%) patients had ulcer in the foot followed by, 14(14.7%) patients presented with ulcer with abscess and 33(34.8%) patient presented with gangrene. Early presentation to the hospital and awareness about the risk factors and complication of diabetic foot may have led to this result. Similar results were seen in the study done by A Tyagi et al. where nature of lesions showed that deep thickness ulcers were higher in this study (36%) followed by cellulitis, gangrene and abscess.[20]

In the present study, 95 patients who were admitted with diabetic foot, 25(26.3%) patient had grade II diabetic foot, followed by 23(24.2%) in grade I, 21(22.1%) in grade IV, 14(14.7%) in grade III and 12(12.7%) in grade V. This showed that common presentation of diabetic foot was grade II (26.3%). Early presentation to the hospital and timely intervention may have led to more number of low grade of diabetic foot patient. Conversely, a study conducted by Gupta A. et al.[12] and Waghmare S. et al. showed that highest number of patient were seen in grade IV.[21] This result was due to lack of awareness about risk factors causing foot problems and due to poor glycemic control.

In this study as a part of treatment, out of 95 patient, 51(53.7%) patient underwent debridement, 7(7.4%) patient underwent debridement with SSG, 23(24.2%) patient underwent disarticulation and below knee amputation was done in 14(14.7%). In this study treatment according to the grade showed good results, although 7 patients were lost to follow up during 3 months follow up period, majority of the patients wound healed. Similar result was seen in a study done by Gupta A. et al. where the commonest procedure was debridement followed by incision & drainage of foot abscess that was performed in 41(41 %) of patients.[12] Conversely, in the study done by Waghmare S. et al had grade IV diabetic foot as common presentation so this may have led to more number of amputation as a part of treatment.[21]

We have felt some weakness of our study. It was a single center study. Nerve conduction velocity and Angiography was not done.

Conclusion

Grading diabetic foot lesions according to the wagern's classification helped in correlating appropriate treatment which showed better outcome. Early presentation, hospital admission, aggressive and appropriate medical and surgical treatment according to grade of disease improved the outcome and reduced the morbidity of the patient. Patient of age group more than 50 years of age and male predominance is found in this study with farmers with diabetes are at high risk for diabetic foot. With the increasing grade, risk of, neuropathy, gangrene and amputation is high whereas with decreased in ABPI, grade of diabetic foot has increased.

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