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Evaluation and management of diabetic foot according to Wagner's classification

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Abstract

Aims and Objectives: To re-evaluate role of Wagner's classification in the Study and Management of diabetic Foot in patient admitted to tertiary care hospital.

Materials and Methods: This hospital based observational study was conducted in the department of General Surgery at tertiary care hospital from July 2017 to August 2018. This study included 47 cases of Diabetic foot patients in which management protocol according to Wagner's Classification was studied. Data was collected from hospital records which includes history, physical examination, investigations, treatment and follow up at discharge was collected.

Results: The most common age of presentation in patients with diabetic foot lesion was between 41-60 yrs. In this study, out of 47 patients, 32 patients (68.1%) were male and 15 patients (31.9%) were female. The most common site was foot in 29 patients (61.7%). Out of 47 cases studied, 28 cases were having history of trauma, which account for 59.6% of the total cases. Amputation was the most common treatment modality. In this study of 47 patients, 11 patient required local debridement after initial surgery. Out of 47 cases; 42 patients ulcers were healed, 5 patients ulcer were not healed (4%).

Conclusion: Diabetic patients have always suffered from complication affecting the lower limbs. Foot infection and subsequent amputation of lower extremities are the most common cause of hospitalization among diabetic foot patients. Prevention strategy including patient's education in foot care, prophylactic skin and nail care, and footwear reduces the risk of foot ulceration and lower limb amputation by 25%.

Keywords: Management, diabetic foot according, Wagner's classification

Introduction

Diabetes is a common disease affecting about 2.4% in rural and 4%-11.6% in urban dwellers in India ^[1]. India has highest prevalence of diabetes in world and accounts for almost 1/6 of the diabetic patients. Approximately 10%-25% of all diabetics will develop some foot complications during the course of illness from simple calluses to major abscesses and osteomyelitis. Several classifications exist for grading ulceration and their management; however Wagner's classification is the simplest, best known for evaluation and management of diabetic foot ulceration ^[2]. Relative Risk of leg amputation is 40 times higher among person with diabetes than with those not diabetic. Moreover, up to 50% of diabetic amputees will undergo a second leg amputation within 5 years of initial amputation.

Complications involving the foot cause significant pain and suffering, loss of productive time, hospitalization, heavy expenses to the patient, community and nation as well. To add to above vascular insufficiency and neuropathy accompanying the diabetic foot most often necessitate amputation of the limb ^[3].

In India habits like walking barefooted, lack of knowledge regarding diabetic foot, hot climate leading to increased perspiration, poor hygiene, poor sanitation, diet poor in proteins, general poverty, lack of basic medical infrastructure, etc have worsened the problem. Lack of interest from medical and surgical faculty due to required hardwork for this field has added to the problem statement.

The management of diabetic foot is focused primarily on avoiding amputation of lower extremities. Hence early recognition and proper therapy of diabetic foot lesion may save diabetic foot and leg ^[1]. The amount of interest in the diabetic foot has increased tremendously over the past ten years. There continues to be great interest in the treatment and prevention of diabetic

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foot. Wagner's classification helps in correlating appropriate treatment to proper grade of lesion with better outcome ^[4]. Lesser grade lesion responds well to conservative treatment with antibiotics and debridement while those with higher lesion require some kind of amputation.

Aims and Objectives

1. To Re-evaluate role of Wagner's classification in the Study and Management of diabetic Foot in patient admitted to tertiary care hospital
2. To investigate the Surgical Strategy of Diabetic Foot and analyse the therapeutic efficacy.

Materials and Methods

This was hospital based observational study done in the department of General Surgery at tertiary care hospital from July 2017 to August 2018. This study included 47 cases of Diabetic foot patients in which management protocol according to Wagner's Classification was studied. Data including history, examination, routine blood investigations and imaging – radiological, treatment modalities used for that particular patient was collected. Dressings were done as per unit protocol. The data of the 47 patients was collected, tabulated and outcomes are discussed. Patients were followed up for 3 months irrespective whether wound has healed or not. Patients with diabetic foot > 18 years old. (Diabetic foot is usually defined as any inframalleolar infection in a person with type 2 diabetes mellitus (DM2) were included in the study. Non diabetic foot patients (like traumatic or other neuropathic ulcer) and Pregnant patients were excluded. Institutional ethics committee permission was taken. Data was collected from hospital records at tertiary care hospital and history, physical examination, investigations, treatment and follow up at discharge was collected.

Results

Table 1: Demographic profile

Age group	Frequency	Percent
< 40 years	5	10.6
41-60 years	35	74.5
>60 years	7	14.9
Sex		
Female	15	31.9
Male	32	68.1
Mode of presentation		
Gangrene	15	31.9
Ulcer	9	19.1
Cellulites	3	6.4
Abscess	2	4.3
Mixed	18	38.3
Site of lesion		
Foot	29	61.7
Toe	18	38.3
H/o trauma		
Yes	28	59.6
No	19	40.4
H/o previous Ulcer or gangrene		
Yes	17	36.2
No	30	63.8
Addiction history		
H/o smoking	9	19.1
H/o alcohol	26	55.3
Duration of DM		
Newly Diagnosed	10	21.3
Old case of DM	37	78.7

In the present study, the most common age of presentation in patients with diabetic foot lesion was between 41-60 yrs. In this study, out of 47 patients, 32 patients (68.1%) were male and 15 patients (31.9%) were female. A study was carried out including 47 patients who were admitted with diabetic foot their mode of presentation was as follows- 15 cases (31.9%) present with Gangrene, 9 cases (19.1%) with Ulcer, 3 cases (6.4%) with cellulites, 2 cases (4.3%) with abscess and 18 cases (38.3%) presented with mixed features. i.e. (Combination of above factors). The most common site was foot in 29 patients (61.7%). In present study out of 47 cases studied, 28 cases were having history of trauma, which account for 59.6% of the total cases. In study of 47 patients, 30 patients had no previous history of ulcer/gangrene, which account for 63.8%. In this study, 9 patients were smoker (19.1), and 26 patients were alcoholic (55.3%) and rest 10 having no addiction. In this study, 10 patients (21.3%) were newly diagnosed and 37 patients (78.7%) were known diabetics. Maximum amputations were done in patients with old case of diabetic.

Table 2: Other clinical findings

Blood sugar at admission	Frequency	Percent
< 100	7	14.9
101-200	32	68.1
> 200	8	17
Osteomyelitis		
Yes	4	8.5
No	43	91.5
Doppler		
Normal (Nad)	38	80.9
Vascular disease(PVD)	9	19.1
Organism		
Pseudomonas	15	31.9
Staphylococcus	8	17
E.Coli	7	14.9
Klebsiella	5	10.6
Clostridium	4	8.5
Negative	8	17
Wagner's class		
Grade 1	7	14.9
Grade 2	7	14.9
Grade 3	6	12.8
Grade 4	18	38.3
Grade 5	9	19.1

In this study, 7 patients [14.9%] having blood sugar <100 mg/dl, 32 patients [68.1%] having sugar 101-200 mg/dl and 8 patients [17%] having blood sugar >200 mg/dl. In this study of 47 patients, 4 patients (8.5%) having bone involvement (osteomyelitis). In present study, 9 patients [19.1%] had history of peripheral vascular disease (PVD). In this study of 47 patients, wound swab was send preoperatively and postoperatively which shows pattern of Causative organism. 15 patients had pseudomonas, 8 patients had staphylococcus, 7 patients had E.coli, 5 patients had Klebsiella, 4 patients had Clostridium and 8 patients had Negative wound swab. Maximum patients present with grade 4 and 5 Wagner's lesion followed by Grade 1, Grade 2. As Ulcer is one of the most common presentations of Diabetic Foot.

Table 3: Treatment details

Treatment done	Frequency	Percent
BK amputation with flap closure	14	29.8
Debridement	10	21.3
TMT amputation with flap closure	8	17
Conservative	7	14.9
Toe amputation with flap closure	6	12.8
I and D of abscess	2	4.3
Re-surgery		
Yes	11	23.4
No	36	76.6
Follow up after 3 months		
Healed	42	89.4
Unhealed	5	10.6

Amputation was the most common treatment modality among various treatment modalities. In this study of 47 patients, 11 patient required local debridement after initial surgery. In this

study of 47 patients, who were presented with diabetic foot and undergone amputation; 42 patients ulcers were healed, 5 patients ulcer were not healed (4%).

Table 4: Comparison of various parameters with outcome at follow up of 3 months

		Follow up after 3 months		Total	P value
		Healed	Unhealed		
Age[yr]	< 60 years	40 (95.2%)	0 (0%)	40 (85.1%)	0.0001
	>60 years	2 (4.8%)	5 (100%)	7 (14.9%)	
Osteomyelitis	Yes	4 (9.5%)	0 (0%)	4 (8.5%)	0.471
	No	38 (90.5%)	5 (100%)	43 (91.5%)	
H/o smoking	Yes	5 (11.9%)	4 (80%)	9(19.10%)	0.0001
	No	37 (88.1%)	1(20%)	38(80.90%)	
Blood sugar at admission	< 200	39 (92.9%)	0 (0%)	39 (83%)	0.0001
	> 200	3 (7.1%)	5 (100%)	8 (17%)	
Doppler	PVD	5 (11.9%)	4 (80%)	9 (19.1%)	0.0001
	Normal	37 (88.1%)	1 (20%)	38 (80.9%)	
Re-surgery	Yes	7 (16.7%)	4 (80%)	11 (23.4%)	0.002
	No	35 (83.3%)	1 (20%)	36 (76.6%)	
Total		42 (100%)	5 (100%)	47 (100%)	

Discussion

Diabetes is global health crises, which result in major economic consequences for patient, their family and the society. The International Diabetes Federation (IDF) Atlas reported that the number of people with diabetes was approximately 366 million in 2011, and by the year 2030 this number would rise to 552 million [5]. Diabetic foot is a serious and extensive complication with considerable morbidity that affects 15% of patient with the diabetes during their lifetime [6].

This study carried out from July 2017 to August 2018 in tertiary care centre which includes 47 patients admitted with diabetic foot and managed according to Wagner's classification.

Age: Age distribution of 47 cases studied in Nair Hospital, Mumbai. Youngest patient was 30 years old and eldest patient is 80 years old. Highest numbers of cases were found in the age group of 41-60 yrs. As compared to study conducted by "Rooh-ulmuqim" majority of our cases are in 51-60years of age whereas in their study majority of cases were in 41-50 years of age group. Also there is positive association between the age and incidence of diabetic foot. Age more than 60 is more prone for diabetic foot and non healing ulcer [7].

Out of the 47 cases studied 32 cases are males and 15 cases are females. Male to female ratio is 2.13. As compared to study by "Rooh-ul-muqim" there are more male patients and less female patients observed in our study. Higher incidence of diabetic foot in males may be due to the exposure to injuries during their work, which subsequently leads to injury mostly to the insensitive foot [7].

Nature of the lesion-of the 47 cases studied mixed 38.3% was

the most common presentation followed by gangrene 31.9%, ulcer 19.1%, cellulitis 6.4%, and abscess was 4.3%, of the patients. Osteomyelitis was seen in 8.5% of the patients. In this study, osteomyelitis was not significantly associated with diabetic foot.

Among 47 cases, the most common site includes foot in 29 patients (61.7), toe in 18 patients (38.3). As per Apelquist study series in 1988 dorsum of foot is most common site [8].

Among 47 patients, 28 patients (59.6%) had history of trauma. In Reiber *et al.* series 77% patients had history of trauma.⁹ Repetitive unrecognised trauma and abnormal distributions of pressure are principle factor in causing foot ulcer leading to gangrene [10].

Rate of amputation: In our study amputation for diabetic foot complication was more than 50%.

Another multi centric study involving 31 study sites across India reported that major amputations comprised about 29.1% and minor amputation 70.9% among the diabetic patients with foot infection. This study also observed that infection was the significant cause for the amputation in approximately 90% of study population [11].

In this study of 47 patients with diabetic foot who underwent amputation, 17 patients (36.2) had previous history of ulcer or gangrene. This indicates that history of previous Ulcer/Gangrene has significant role in patient with diabetic foot.

In the present study of 47 patients, 9 patients are smoker (19.1) and 26 patients are alcoholic (55.3) while rest doesn't have any addiction. Shivkumar S, Verma AK, Bal A, Sudaram KR also mention smoking, alcohol and tobacco are risk factors for

diabetic foot ulcer. This indicates that those patients with diabetes having addiction of alcohol and smoking are more prone to develop a vasculopathy and diabetic foot complication which leads to amputation. In our study also, smoking has significant association with diabetic foot ^[12].

In this study, 10 patients (21.3%) are newly diagnosed and 37 were known diabetics (78.7%). Maximum no of amputations are carried out in patient with duration of diabetes >10 years, which contribute 37%. Mayfield JA reported that duration of diabetes has definite correlation with foot lesion. Duration of diabetes shows an important association with diabetes related complication like neuropathy, vasculopathy ^[13].

In the present study of 47 patients, 7 patients (14.9%) had blood sugar < 100mg/dl. 32 patients (68.1%) had blood sugar between 101-200mg/dl. 8 patients (17%) had blood sugar >200 mg/dl. This indicates that uncontrolled diabetes leads to increased severity of infection and ends up with amputation. In this study, blood sugar at admission had significant outcome on diabetic foot.

In this study of 47 patients, 4 patients (8.5%) having bone involvement such as Charcot's foot/ osteomyelitis. In Palena LM, Brocco E and Ninkovic S study series in 2013: 10% patients affected by ischemic Charcot's neuroarthropathy required below-the-knee amputation. Osteomyelitis is present in many diabetic foot ulcers. Demineralisation, periosteal reaction and bony destruction are the classical radiographic triad of osteomyelitis appearing only after 30-50% of bone destruction, a process that takes up to weeks. After infected bone is removed, the patient required only antibiotics for the control of bacteria in the surrounding soft tissue ^[14].

In the present study of 47 patients, the incidence of vascular disease is present in 19.1% of patients. Walters DP study shows incidence of PVD is 57 -24.2% ^[15]. Micro angiography, the characteristic feature of diabetic vasculopathy accounts for the higher frequency of small patchy lesion of gangrene. This has been supported by Pecoraro RE and Gibson GW in their study. In this study vascular disease (PVD) shows significance with the outcome of diabetic foot ^[16]. This may be explained by the fact that majority of lesions admitted were gangrene or non healing ulcers which are sequale of vasculopathy. Prolonged duration of diabetes, male predominance, associated habits like smoking further add to increase the prevalence of peripheral vascular disease in these patients.

Duration of diabetes, smoking and hyperglycemia were the most important factors responsible for development of peripheral vascular disease. Of patients having peripheral vascular disease duration of diabetes more than 10 years and hyperglycemia were statistically most important factors.

In this study, wound swab was sent for microbiological culture and sensitivity. From 15 patients (31.9%) *Pseudomonas aeruginosa* was isolated; from 8 patients (17%) *Staphylococcus aureus* was isolated, from 7 patients (14.9%) *E. Colli* was isolated, from 5 patients (10.6%) *Klebsiella* was isolated and from 4 patients (8.5%) *Clostridium* was isolated. Study in patients with diabetic foot in India reported that polymicrobial infection was found in 35% of patient ^[16]. Infection is a major factor in the pathogenesis of diabetic foot and associated with ischemia leads to amputation.

Lesions according to Wagner's classification-Majority of the patients are in grade IV lie 38.3% of the patients. In grade I 14.9%, grade II 14.9%, grade III 12.8% and grade V 19.1% is observed. Study conducted by "Rooh-ul-muqim" majority of the cases was in Grade II and III as compared to present study where majority of patients are in Grade IV and II ^[7].

In the present study, 15% of the individuals improved with conservative management and majority patients 85% were subjected to surgical intervention. Compared to "Rooh-ul-muqim" 50% of our patient underwent disarticulation or amputation compared to 48% in their study. Only 15% of our patient improved with conservative management indicating that surgery is the main line of management inpatient with diabetic foot ^[7].

In the present study of 47 patients, 11 patients required repeat surgery (23.4%) Need for re surgery either in the form of local debridement or amputation has significant on the outcome of diabetic foot.

In the study of 47 patients, who admitted with diabetic foot and undergone amputation, 89% patients ulcer healed within 3 months. In Rooh-ul-muqim *et al.* study out of 100 patients 96 discharged and 4 expired ^[7].

Conclusion

Foot ulceration in diabetic patients is resource consuming, disabling morbidity, and often the first step towards lower extremity amputation. Prevention is the best treatment. Wagner's classification helps in correlating appropriate treatment to proper grade of lesion with better outcome. Lesser grade lesions respond well to conservative treatment with antibiotics and debridement while those with higher lesions require some kind of amputation. Effective glycaemic control and education are of key importance for decreasing diabetic foot disease. With early presentation and hospital admission, aggressive medical and surgical treatment according to the grade of the disease can improve outcome and reduce the morbidity and mortality due to diabetes.

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