Section: General Surgery

Original Research Article

VASCULOPATHY AND ITS ASSOCIATION WITH HEALING FOLLOWING MANAGEMENT IN DIABETIC FOOT DISEASE – OUR EXPERIENCE FROM A TERTIARY CARE CENTER IN THE SUB HIMALAYAN REGION

Akshat Joshi[1], Sachidananda N[1], Praveen Kumar[1], Chetna Choudhary[1]

[1]*Department of General Surgery, Himalayan Institute of Medical Sciences, Jolly Grant, Dehradun, India.*

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Corresponding Author:
Dr. Praveen Kumar
Department of general surgery
Himalayan Institute of Medical Sciences, Jolly Grant, Dehradun, India
Email: bittoo271076@yahoo.com

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ABSTRACT

Background: Objective: To evaluate the incidence of vasculopathy and to study its association with healing following management in diabetic foot disease in a tertiary care center in the Sub Himalayan region. Diabetes mellitus (DM) is a multifaceted illness that affects nearly every essential organ in the body. Diabetic foot ulcer (DFU) affects 15% of patients with diabetes and is one of the most grievous consequences associated with DM. Vasculopathy and its role in the pathophysiology of DFD is well-established, with decreased blood flow contributing to poor wound healing and increased risk of complications. However, its specific association in the context of management outcomes still remains underexplored.

Material and Methods: This is a prospective observational study conducted in sub- Himalayan region with a sample size of 50 consecutive patients undergoing treatment for diabetic foot disease.

Results: A third of patients belong to grade 2 of Wagner Meggitt classification with deep ulcers and nearly half the patients belong to grade 3 with ulcers and bone involvement, whereas a tenth of patients presented with forefoot gangrene. As most of our patients were Wagner- Meggitt grade 2, ulcer debridement was the most common procedure performed followed by amputation which belong to Wagner-Meggitt grade 3. In this study, patients with either no or mild non proliferative diabetic retinopathy with triphasic or biphasic flow on arterial doppler study, after 4 weeks of treatment had higher number of healed or healthy wounds. However, in patients with moderate or severe non proliferative diabetic retinopathy with monophasic or absent flow on arterial doppler study, even after 4 weeks of treatment, had higher number of unhealthy wounds. These patients also required multiple sittings of dressing and longer duration of antibiotic therapy.

Conclusion: Vasculopathy in form of advanced retinopathy and macrovasculopathy which leads to unfavourable outcomes, higher chances of amputation or limb loss, compromised quality of life and higher healthcare costs due to prolonged treatment and need for surgical interventions. The presence and severity of vasculopathy therefore, serve as prognostic indicator for the outcome of diabetic foot disease.

Keywords: Diabetic foot disease, vasculopathy, wound healing, Sub Himalayan region.

INTRODUCTION

Diabetes mellitus (DM) is a multifaceted illness that affects nearly every essential organ in the body. Globally, 415 million individuals have been diagnosed with diabetes, with type 2 diabetes accounting for most of the cases. Diabetic foot ulcer

(DFU) affects 15% of patients with diabetes and is one of the most grievous consequences associated with DM.[1] According to the ICMR-INDIA B report, India is the "diabetic capital" of the world, with 62.4 million people living with the disease. Approximately 15% of diabetes patients encounter DFU at some point of their lives.[2]

DFU is an ulcerated foot in a diabetic patient that is linked to peripheral artery disease, neuropathy, or combination of both that affects the lower limb.[3] The three traditional components of DFU are infection, ischemia, and neuropathy.

In DM, DFU happens due to compromised metabolic pathways which further increases the risk of infection and hampers the wound healing. Several factors contribute to DFU such as lowered peripheral blood flow, reduced angiogenesis and decreased response to cell and growth factor. DFU is associated with the peripheral nerve damage, peripheral vascular disease, ulcerations, deformities, and gangrene.[4]

In peripheral arteries, hyperglycemia results in abnormalities of smooth muscle cells and malfunction of endothelial cells. Because of changes in endothelial cell function- thickening of the basement membrane, decreased nitric oxide generation, increased blood viscosity, changes in microvascular tone and decreased blood flow are seen. Endothelial dysfunction is the most significant impairment impacting microcirculation.[5]

Along with neuropathy, deformity and infection, vascular disease is a major risk factor for complications related to DFU. For diabetic individuals, vasculopathy is 20 times more common and responsible for 50% of lower limb amputations. It might be challenging to determine the DFU vascular state by a clinical examination and therefore non-invasive vascular tests are necessary for the accurate and timely diagnosis of vasculopathy.[6]

The cost of treating these DFU involve 25% of the overall hospital expenditures for diabetes management. Limb amputation which is an expensive and dreaded result of a DFU happens 10–30 times more frequently in people with diabetes than in the general population.[7]

PAD-related DFU is symptom of vasculopathy, therefore, addressing vasculopathy at the earliest decreases amputation and promotes wound healing in patients with PAD.[8]

The goal of this study is to evaluate the incidence of vasculopathy in DFU and its impact in management outcome of diabetic foot ulcer using multivariate techniques.

MATERIALS AND METHODS

The study was a prospective observational study conducted in the Department of General Surgery, SRHU, Swami Ram Nagar, Dehradun over a period of 1 year after obtaining written informed consent and clearance from institutional ethics committee.

Sample size & sampling

Total 50 cases were enrolled in this study by adopting the consecutive sampling method, considering the hospital records of previous years.

Inclusion Criteria

1. Subjects of both genders more than 18 years of age.
2. Has a diagnosis of type 1 or 2 diabetes.
3. Has a diagnosis of diabetic foot.
4. Who are willing to participate in this study?

Exclusion Criteria

1. Subjects below 18 years of age.
2. Subjects having CKD
3. Non diabetic foot ulcers.

Study tool

- Structured study instruments (questionnaires/ formats/ subject proformas) were used to collect data.
- Demographic and anthropometric data of the patient was recorded including name, age, gender, occupation, and address who presents with complaints of Diabetic Foot Ulcer.
- Wagner-Meggitt Classification of Diabetic Foot tool was used to assess the classification or stage of foot ulcer.
- Fundoscopy was done for diabetic retinopathy
- Color doppler examination was done.

Study protocol

- The general biodata of the patient including name, age, gender, occupation, and address with complaints of Diabetic Foot visiting the hospital was included in the study. Selection of Patient was based on inclusion criteria.
- A detailed History with special reference to the duration and mode of presentation was taken. A complete general physical, local and systemic examination was done.
- All patients were subjected to Random Blood Glucose level with HbA1C followed by USG Colour Doppler, fundoscopy and other investigations were done as per the requirement of the patient.
- Wagner's tool was used to assess the classification or stage of foot ulcer.
- Confidentiality was maintained and data was collected after written informed consent. The patient was studied as per the working Proforma attached and their outcome was studied.

Data Management and statistical analysis

All statistical data was analysed using Microsoft excel spread sheet. Continuous variables were expressed as mean ± standard deviation and qualitative data were expressed as percentage.

RESULTS

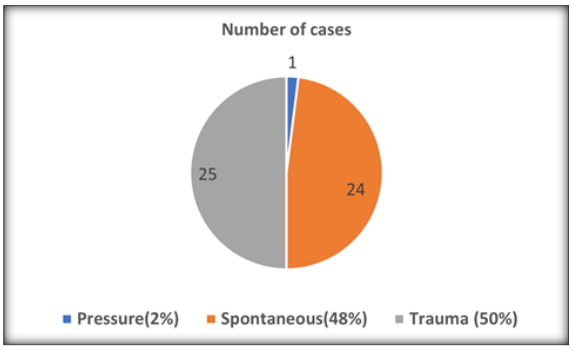

Figure 1: Mode of onset as pressure, spontaneous and trauma in participants

Mode of onset of disease was found to be pressure in 1 (2%) patient, spontaneous mode of onset in 24 (48%) patients and in 25 (50%) patients, the disease occurred following the trauma.

As per Wagner Meggitt classification the presence of osteitis or gangrene, shows 18 (36%) patients belong to grade 2 with deep ulcers, 26 (52%) patients belong to grade 3 with abscess/ deep ulcers with bone involvement and forefoot gangrene in 6 (12%) patients which belong to grade 4. [Table 1]

Fundoscopy findings indicate no diabetic retinopathy (DR) in 10 (20%) patients, mild non proliferative diabetic retinopathy (NPDR) in 27 (54%) patients, moderate non proliferative diabetic retinopathy (NPDR) in 9 (18%) patients, and severe non proliferative diabetic retinopathy (NPDR) in 4 (8%) patients. [Table 2]

Color doppler findings in the right femoral artery indicate triphasic waveform in 36 (72%) patients, biphasic waveform in 7 (14%) patients monophasic waveform in 2 (4%) patients and reports were not available in 5(10%) patients.

Color doppler findings in the left femoral artery indicate triphasic waveform in 37 (72%) patients, biphasic waveform in 5 (10%) patients monophasic waveform in 1 (2%) patient and reports were not available in 7 (14%) patients. [Table 3]

Color doppler findings in the right popliteal artery indicate triphasic waveform in 32 (64%) patients, biphasic waveform in 8 (16%) patients, monophasic waveform in 5 (10%) patients and reports were not available in 5 (10%) patients.

Color doppler findings in the left popliteal artery indicate triphasic waveform in 32 (64%) patients, biphasic waveform in 8 (16%) patients, monophasic waveform in 1 (2%) patient and reports were not available in 7 (14%) patients. [Table 4]

Color doppler findings in the right anterior tibial artery indicate triphasic waveform in 16 (32%) patients, biphasic waveform in 19 (38%) patients, monophasic waveform in 10 (20%) patients and reports were not available in 5 (10%) patients.

Color doppler findings in the left anterior tibial artery indicate triphasic waveform in 17 (34%) patients, biphasic waveform in 25 (50%) patients, monophasic waveform in 1 (2%) patient and reports were not available in 7 (14%) patients. [Table 5]

Color doppler findings in the right posterior tibial artery indicate triphasic waveform in 15 (30%) patients, biphasic waveform in 21 (42%) patients, monophasic waveform in 9 (18%) patients and reports were not available in 5 (10%) patients.

Color doppler findings in the left posterior tibial artery indicate triphasic waveform in 17 (34%) patients, biphasic waveform in 21 (42%) patients, monophasic waveform in 4 (8%) patients, no flow was present in 1 (2%) patient and reports were not available in 7 (14%) patients. [Table 6]

Color doppler findings in the right dorsalis pedis artery indicate triphasic waveform in 9(18%) patients, biphasic waveform in 19 (38%) patients, monophasic waveform in 8 (16%) patients, no flow was observed in 2 (4%) patients and reports were not available in 12 (24%) patients.

Color doppler findings in the left dorsalis pedis artery indicate triphasic waveform in 13(26%) patients, biphasic waveform in 23 (46%) patients, monophasic waveform in 3 (6%) patients, no flow was observed in 1 (2%) patient and reports were not available in 10 (20%) patients. [Table 7]

Wall calcification or atherosclerosis in right side was observed in 44 (88%), 1 (2%) patient had no atherosclerosis or wall calcification and 5 (10%) patients reports were not available. Wall calcification or atherosclerosis in left side was observed in 43 (86%), and 7 (14%) patients reports were not available. [Table 8]

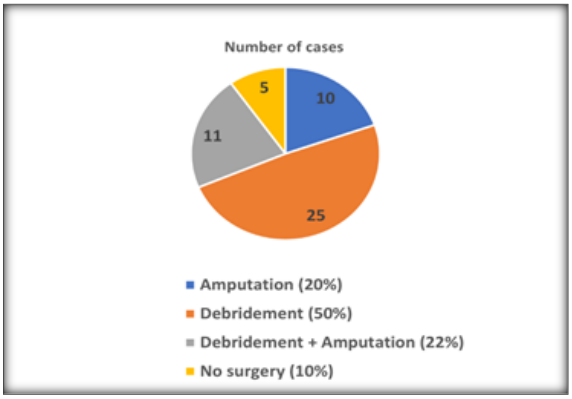

Figure 2: Details of surgery done in participants

Most of the patients was managed by the debridement which was performed in 25 (50%) cases, amputation was performed in 10 (20%) cases, and both amputation and debridement was performed in 11 (22%) cases. Surgery was not done in 5 (10%) cases.

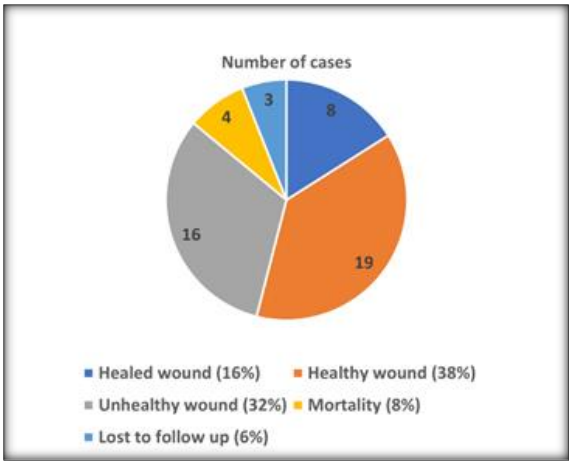

Figure 3: Wound condition in follow up at 4 weeks

Following the treatment course at 4 weeks, completely healed wound was observed in 8 (16%) patients, healthy wound seen in 17 (34%) patients, and unhealthy wound found in 18 (36%) patients. Mortality was observed in the 4 (8%) patients. Total 3 (6%) patients were lost to follow up.

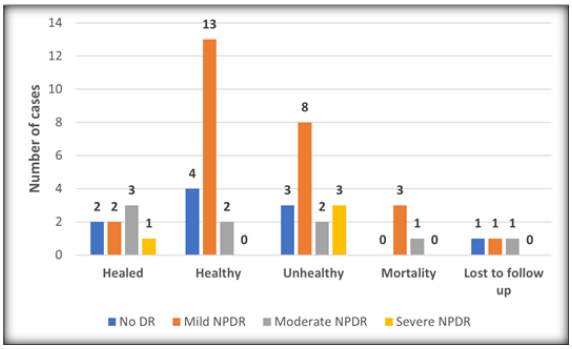

Figure 4: Fundoscopy findings with respect to wound condition (Number of patients) after 4-weeks of treatment

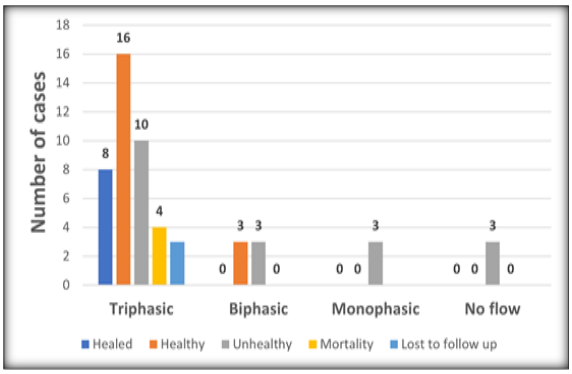

Figure 5: Femoral artery waveform on affected side with respect to wound condition (Number of patients) after a 4-weeks treatment course

Out of the 41 patients who had triphasic waveforms in their femoral artery on the affected side; after a 4-week course of treatment the following results were observed- Completely healed wound was observed in 8 (19.5%) patient, healthy wound in 16 (39%) patients, unhealthy wound in 10 (24.4%) patients. There was a mortality of 4 (9.8%) patients and 3 (7.3%) patients were lost to follow up.

Out of the 6 patients who had biphasic waveforms in their femoral artery on the affected side; after a 4-week course of treatment the following results were observed- Healthy wound was observed in 3 (50%) patients and unhealthy wound in 3 (50%) patients.

Out of the 3 patients had monophasic waveforms in their femoral artery on the affected side; after a 4-week course of treatment the following results were observed- Unhealthy wound was observed in 3 (100 %) patients.

Out of the 3 patients had no flow in their femoral artery on the affected side; after a 4-week course of treatment the following results were observed- Unhealthy wound was observed in 3 (100 %) patients.

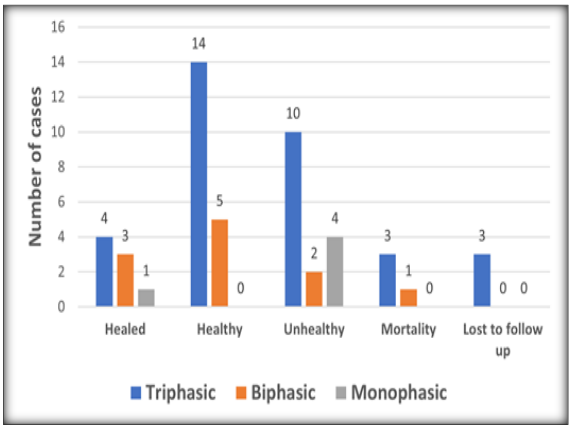

Figure 6: Popliteal artery waveform on affected side with respect to wound condition (Number of patients) after a 4-weeks treatment course.

Out of the 34 patients who had triphasic waveforms in their popliteal artery on the affected side, after a 4-week course of treatment the following results were observed- Completely healed wound was observed in 4 (11.8%) patient, healthy wound in 14 (41.2%) patients, unhealthy wound in 10 (29.4%) patients. There was a mortality of 3 (8.8%) patients and 3 (8.8%) patients were lost to follow up.

Out of the 11 patients who had biphasic waveforms in their popliteal artery on the affected side, after a 4-week course of treatment the following results were observed- Completely healed wound was observed in 3 (27.3%) patient, healthy wound in 5 (45.5%) patients, unhealthy wound in 2 (18.2 %) patients. There was a mortality of 1 (9%) patient.

Out of the 5 patients who had monophasic waveforms in their popliteal artery on the affected side, after a 4-week course of treatment the following results were observed- Completely healed wound was observed in 1 (20%) patient, unhealthy wound in 4 (80%) patients.

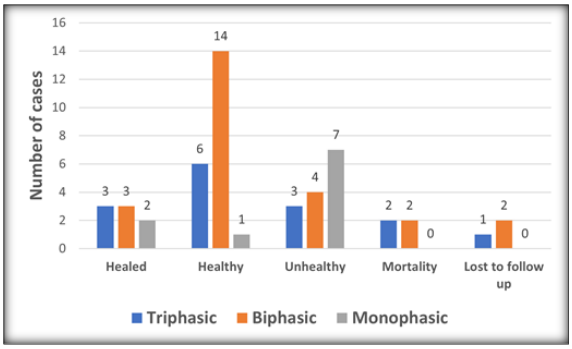

Figure 7: Anterior tibial artery waveform on affected side with respect to wound condition (Number of patients) after a 4-weeks treatment course

Out of the 15 patients who had triphasic waveforms in their anterior tibial artery on the affected side, after a 4-weeks course of treatment the following results were observed- Completely healed wound was observed in 3 (20 %) patient, healthy wound in 6 (40 %) patients, unhealthy wound in 3 (20 %) patients. There was a mortality of 2 (13.3 %) patients and 1 (6.7 %) patient was lost to follow up.

Out of the 25 patients who had biphasic waveforms in their anterior tibial artery on the affected side, after a 4-weeks course of treatment the following results were observed- Completely healed wound was observed in 3 (12 %) patients, healthy wound in 14 (56 %) patients, unhealthy wound in 4 (16 %) patients. There was a mortality of 2 (8 %) patients and 2 (8 %) patients were lost to follow up.

Out of the 10 patients who had monophasic waveforms in their anterior tibial artery on the affected side, after a 4-weeks course of treatment the following results were observed- Completely healed wound was observed in 2 (20 %) patient, healthy wound in 1 (10 %) patient, unhealthy wound in 7 (70 %) patients.

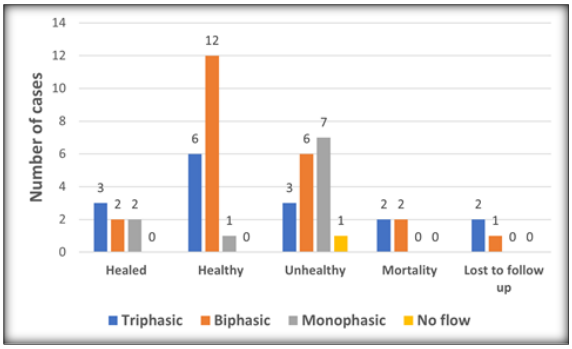

Figure 8: Posterior tibial artery waveform on affected side with respect to wound condition (Number of patients) after a 4-weeks treatment course

Out of the 16 patients who had triphasic waveforms in their posterior tibial artery on the affected side, after a 4-weeks course of treatment the following results were observed- Completely healed wound was observed in 3 (18.7 %) patient, healthy wound in 6 (37.6 %) patients, unhealthy wound in 3 (18.7 %) patients. There was a mortality of 2 (12.5 %) patients and 2 (12.5 %) patients were lost to follow up.

Out of the 23 patients who had biphasic waveforms in their posterior tibial artery on the affected side, after a 4-weeks course of treatment the following results were observed- Completely healed wound was observed in 2 (8.7 %) patient, healthy wound in 12 (52 %) patients, unhealthy wound in 6 (26 %) patients. There was a mortality of 2 (8.7 %) patients and 1 (4.4 %) patient was lost to follow up.

Out of the 10 patients who had monophasic waveforms in their posterior tibial artery on the affected side, after a 4-weeks course of treatment the following results were observed- Completely healed wound was observed in 2(20 %) patients, healthy wound in 1(10 %) patient, unhealthy wound in 7(70 %) patients.

1 patient had no flow in posterior tibial artery on the affected side, after 4-weeks course of treatment healthy wound was observed in that patient.

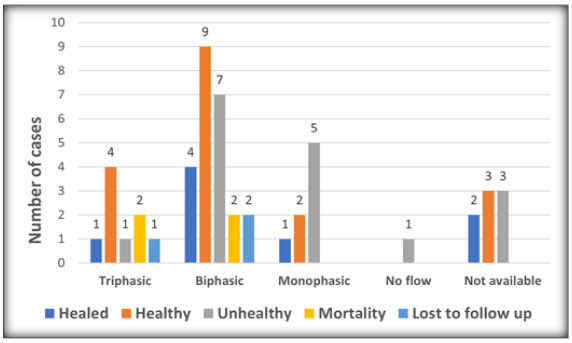

Figure 9: Dorsalis pedis artery waveform on affected side with respect to wound condition (Number of patients) after a treatment course of 4-weeks

Out of the 9 patients who had triphasic waveforms in their dorsalis pedis artery on the affected side, after a 4-weeks course of treatment the following results were observed- Completely healed wound was observed in 1 (11.1 %) patient, healthy wound in 4 (44.5 %) patients, unhealthy wound in 2 (22.2 %) patients. There was a mortality of 2 (22.2 %) patients and 1 (11.1 %) patient was lost to follow up.

Out of the 24 patients who had biphasic waveforms in their dorsalis pedis artery on the affected side, after a 4-weeks course of treatment the following results were observed- Completely healed wound was observed in 4 (16.7 %) patient, healthy wound in 9 (37.5 %) patients, unhealthy wound in 27 (29.2 %) patients. There was a mortality of 2 (8.3 %) patients and 2 (8.3 %) patients were lost to follow up.

Out of the 8 patients who had monophasic waveforms in their dorsalis pedis artery on the affected side, after a 4-weeks course of treatment the following results were observed- Completely healed wound was observed in 1 (12.5 %) patient, healthy wound in 2 (25 %) patients, unhealthy wound in 5 (62.5 %) patients.

No flow was detected in dorsalis pedis artery of 1 patient, after a 4 weeks course of treatment unhealthy wound was observed in that (1, 100%) patient.

In 8 patients' waveforms for dorsalis pedis on the affected side was not available due to various reasons; In some, arteries were traced only unto the ankle and in some dorsalis pedis could not be assessed due to the wound condition or presence of dressings, after a 4 weeks course of treatment the following results were observed- Completely healed wound was observed in 2 (25 %) patient, healthy wound in 3 (37.5 %) patients, unhealthy wound in 3 (37.5 %) patients.

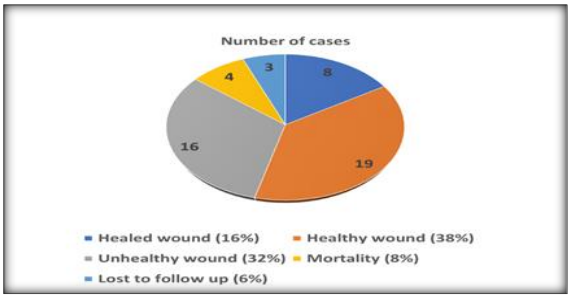

Figure 10: At follow up after 4-weeks of treatment need for recurrent dressings

At follow up after 4 weeks of treatment the need for repeat dressings was seen in 29 (58%) patients. There was a mortality of 4 (8%) patients and 3 (6%) patients were lost to follow up.

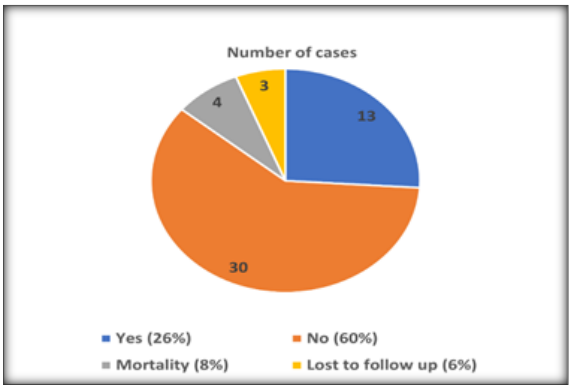

Figure 11: At follow up after 4-weeks of treatment need for antibiotics

At follow up after 4-weeks of treatment, the antibiotics were required in 13 (26%) patients. There was a mortality of 4 (8%) patients and 3 (6%) patients were lost to follow up.

Table 1: Patients presented according to Wagner Meggitt classification

Garde	Characteristics	Number	Percent
Grade 0	Skin intact	0	0
Grade 1	Superficial ulcers	0	0
Grade 2	Deep ulcers	18	36
Grade 3	Abscess or deep ulcer accompanied by osteomyelitis	26	52
Grade 4	Forefoot gangrene	6	12
Grade 5	Full foot gangrene	0	0
	Total	50	100

Table 2: Fundoscopy findings of the patients presented with diabetic foot disease

Fundoscopy findings	Number	Percent
No DR	10	20
Mild NPDR	27	54
Moderate NPDR	9	18
Severe DR	4	8
Total	50	100

Table 3: Color doppler findings (waveforms) in Femoral artery

Color doppler	Variable	Right		Left	
		Number	Percent	Number	Percent
Femoral	Monophasic	2	4	1	2
	Biphasic	7	14	5	10
	Triphasic	36	72	37	74
	Not applicable (NA)	5	10	7	14

Table 4: Color doppler findings (waveforms) in popliteal artery

Color doppler	Variable	Right		Left	
		Number	Percent	Number	Percent
Popliteal	Monophasic	5	10	1	2
	Biphasic	8	16	8	16
	Triphasic	32	64	34	68
	Not applicable (NA)	5	10	7	14

Table 5: Color doppler findings (waveforms) in anterior tibial artery

Color doppler	Variable	Right		Left	
		Number	Percent	Number	Percent
Anterior tibial artery	Monophasic	10	20	1	2
	Biphasic	19	38	25	50
	Triphasic	16	32	17	34
	Not applicable	5	10	7	14

Table 6: Color doppler findings (waveforms) in posterior tibial artery

Color doppler	Variable	Right		Left	
		Number	Percent	Number	Percent
Posterior tibial artery	Monophasic	9	18	4	8
	Biphasic	21	42	21	42
	Triphasic	15	30	17	34
	No flow	0	0	1	2
	Not applicable	5	10	7	14

Table 7: Color doppler findings (waveforms) in dorsalis pedis artery

Color doppler	Variable	Right		Left	
		Number	Percent	Number	Percent
Dorsalis pedis artery	Monophasic	8	16	3	6
	Biphasic	19	38	23	46
	Triphasic	9	18	13	26
	No flow	2	4	1	2
	Not applicable	12	24	10	20

Table 8: Color doppler findings s/o wall calcification or atherosclerosis

Color doppler	Variable	Right		Left	
		Number	Percent	Number	Percent
Wall calcification or atherosclerosis	Yes	44	88	43	86
	No	1	2	0	0
	Not available	5	10	7	

DISCUSSION

According to the World Health Organization-diabetic foot refers to the foot of a patient with diabetes who may experience pathologic outcomes such as infection, ulceration, or destruction of deep tissues linked to neurologic abnormalities, different levels of peripheral vascular disease and/or metabolic complications related to the diabetes.[7]

According to reports, the most common cause of morbidity and death among diabetic patients is diabetic angiopathy. In addition to affecting the lower limb arteries diffusely and multi-segmentally, macroangiopathy is linked to impaired collateral circulation. This is seen as a big vessel atherosclerotic obstructive disease that progresses to lower extremity peripheral arterial disease. Although the biology of peripheral arterial disease (PAD) in diabetics is poorly understood, it is believed that patients with both diabetes and PAD may suffer from the vascular alterations seen in other atherosclerotic disease presentations.[7]

In our study, 36% patients belong to grade 2 of Wagner Meggitt classification and reported with deep ulcers whereas 52% patients belong to grade 3 and have ulcers with abscess or bone involvement. A prior research by Shah et al. revealed that in 42% of cases, Wagner's grade 2 lesion—a foot ulcer—was the most prevalent lesion at presentation, whereas 34% of patients had a grade 3 lesion.[9] According to Akhter et al., the grade 2 lesion was the most prevalent (34.5%).[11] Farooque et al. reported that 26.13% of patients showed foot ulcerations.[12] Wagner's grade 2 ulcers were the most prevalent (40.95%) in the Sing et al. study, followed by grades 3 (31.4%), 5 (16.2%), and grade 4 (11.4%).[10]

In present study, 12% patients presented with forefoot gangrene. In the study by Shah et al., 12% of patients presented with grade 4 forefoot gangrene which is exactly similar to our study.[9] However, in the study by Pandurengan et al., most of patients (69%) presented with foot gangrene.[7] Foot gangrene can result from a variety of circumstances, such as self-medication, illiteracy and poverty, which can delay receiving the necessary medical care in a hospital, as well as seeking alternative medical care when inflammatory topical substances are administered to the injured foot.[7]

The most often performed surgery in the current study was ulcer debridement (50%) since the majority of our patients (52%), were grade 2. Additionally, in the Shah et al. research, 34% of patients had ulcer debridement as the most prevalent technique.[9] According to a research by Rajyalaksmi et al., 38% of patients underwent debridement as their surgical procedure, whereas 20% underwent toes disarticulated due to gangrene.[13]

A serious consequence of diabetic foot disease is that it frequently results in limb amputation, which has a detrimental impact on the patient's productivity and quality of life. In 42% of the patients in this research, an amputation was done. In the Shah et al. research, 28% of patients who

presented with grades 3 to 5 had below-knee amputations.[9] In 75% of the patients in the Pandurengan et al. research, lower limb amputation was performed.[7] This is consistent with data from another study that showed individuals with type 2 diabetes accounted for 80% of major amputations.[13]

In our study, after 4 weeks of treatment completely healed wound was observed in 8 (16%) patients, healthy wound occurred in 17 (34%) patients, Similar results is seen in Jerome patry et al research i.e. at 4 weeks of follow up, 18.6% of DFUs had healed.[15]

In patients with no diabetic retinopathy completely healed wound was observed in 7.4% patients, healthy wound was seen in 48.2% patients in patients who had moderate diabetic retinopathy.

Unhealthy wound was observed in 75% patients after 4 weeks of treatment in patients who had severe non proliferative diabetic retinopathy. This shows higher number of wounds healed or are in healthy condition in patients who have no or mild non proliferative diabetic retinopathy and higher percentage of wounds were unhealthy in patients with severe non proliferative diabetic retinopathy. Fiordaliso et al. showed microangiopathy in patients with diabetic foot ulcer involves the capillaries. This microangiopathy is due to an increase in basement membrane thickness and a reduced number of capillaries. Arteriolar occlusions led to additional microvascular disease or so-called 'small vessel disease' that did not prevent revascularisation and did not raise the risk of major amputation but slowed wound healing.[16]

Wall calcification or atherosclerosis in right side was observed in 88% and 86% on left side. Ismail A et. Al. showed similar results Ismail A 88.2% of the patients had generalized arterial wall calcifications on sonography.[17]

Out of the 5 patients who had monophasic waveforms in their popliteal artery on the affected side, even after a 4-weeks course of treatment, 80% patients had unhealthy wound.

Out of the10 patients had monophasic waveforms in their anterior tibial artery on the affected side, even after a 4-weeks course of treatment, 70% had unhealthy wound.

Out of the10 patients had monophasic waveforms in their posterior tibial artery on the affected side, even after a 4-weeks course of treatment, 70% had unhealthy wound.

Out of the 8 patients had monophasic waveforms in their dorsalis pedis artery on the affected side, even after a 4-weeks course of treatment, 62.5% had unhealthy wound.

In the 1 patient who had no-flow in his dorsalis pedis artery, even after a 4- weeks course of treatment unhealthy wound was observed.

In our study this study depicts unfavourable outcome with decreased or no flow in colour doppler study.

Depending on the severity of the illness, the course of antibiotic therapy might last anywhere from 1-2 weeks to over 4 weeks. In the present study, 58% of the patients needed repeated dressings. Antibiotics were required in 26% patients beyond 4 weeks.

CONCLUSION

This study highlights as trauma was the most common initiating factor for diabetic foot ulcer.

A third of patients belong to grade 2 of Wagner Meggitt classification with deep ulcers and nearly half the patients belong to grade 3 with ulcers and bone involvement, whereas a tenth of patients presented with forefoot gangrene.

As most of our patients were Wagner- Meggitt grade 2, ulcer debridement was the most common procedure performed followed by amputation which belong to Wagner-Meggitt grade 3.

In this study, patients with either no or mild non proliferative diabetic retinopathy with triphasic or biphasic flow on arterial doppler study, after 4 weeks of treatment had higher number of healed or healthy wounds.

However, in patients with moderate or severe non proliferative diabetic retinopathy with monophasic or absent flow on arterial doppler study, even after 4 weeks of treatment, had higher number of unhealthy wounds. These patients also required multiple sittings of dressing and longer duration of antibiotic therapy suggesting vasculopathy in form of advanced retinopathy and macrovasculopathy which leads to unfavourable outcomes, higher chances of amputation or limb loss, compromised quality of life and higher healthcare costs due to prolonged treatment and need for surgical interventions.

This impacts on emotional and psychological health in form of anxiety, depression and reduced self-esteem of the individual, potential loss of independence and reliance of the individual on caregivers for daily activities, decreased productivity and potential loss of employment due to mobility restrictions.

The presence and severity of vasculopathy therefore, serve as prognostic indicator for the outcome of diabetic foot disease.

Tailoring treatment strategies based on vascular status, such as revascularization procedures and wound care modalities can optimize outcomes and preserve limb function.

A comprehensive approach that integrates vascular assessment, modification of risk factor and targeted interventions is essential for decreasing foot complications and improving outcome of the diabetic foot disease.

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