ORIGINAL RESEARCH

Prevalence and Biochemical Profile of Diabetic Foot Ulcer among Adult Diabetic Patients Who Attend the Diabetic Follow-Up Clinic

[1]Dr. Amitabh Singhal, [2]Dr. Mangat Ram Passi, [3]Dr. Sudeep Kumar

[1]Assistant Professor, Department of General Surgery, Muzaffarnagar Medical College, Muzaffarnagar, UP, India
[2]Associate Professor, Department of Medicine, Muzaffarnagar Medical College, Muzaffarnagar, UP, India
[3]Associate Professor, Department of Biochemistry, Muzaffarnagar Medical College, Muzaffarnagar, UP, India

Corresponding Author
Dr. Amitabh Singhal
Assistant Professor, Department of General Surgery, Muzaffarnagar Medical College, Muzaffarnagar, UP, India
Email: dramitabsinghal.MS.61@gmail.com

ABSTRACT
Background: Diabetic foot is a serious and debilitating complication of diabetes that affects millions of individuals worldwide. It is a chronic condition that requires continuous management to prevent morbidity and mortality. **Aims and Objective:** The present study was aimed to calculate prevalence of diabetic foot and study of biochemical profile of diabetic food in patients with diabetes. **Material and Methods:** This study was carried in department of surgery, Muzaffarnagar medical college, Muzaffarnagar from June 2022 to February 2023. This study includes 66 diabetic patients who came diabetic follow-up clinic. **Results:** This study was enrolled 380 patients with diabetes who came for follow-up. In this study, the prevalence of diabetic foot ulcer patients among diabetes was 14.21%. The mean age of the studied participants were 53 with 62.96% male and 37.04% female. 57.41% patient had diabetic retinopathy changes, 37.08% had the history of HTN, 20.37% patients had vascular disease, 59.26% had smoking history, 27.78% subjects on insulin, 46.30% on oral hypoglycemic drug and 25.92% patients were on both insulin and oral hypoglycemic drug. **Conclusion:** The prevalence of diabetic foot ulcer among diabetic patients is 14.21% Subjects with higher BMI (overweight and obesity), types of diabetes, neuropathy, and foot self-care practice were factors significantly associated with diabetic foot ulcer.
Keywords: Diabetic Foot Ulcer, Biochemical Profile, Diabetes, Diabetic Nephropathy

INTRODUCTION

Diabetes mellitus, group of metabolic disease characterized by hyperglycemia resulting from a defect in insulin secretion, insulin action, or both that affects millions of individuals worldwide. [1] Diabetes and its complications pose a major threat to the public health throughout the world. India is the country with the largest number of diabetic patients in the world. Diabetic foot ulcer is a major disabling complication of diabetes which often precedes amputation of the limb.[2-3]

Diabetic foot is one of the most common complications of diabetes that can lead to significant morbidity and mortality. The lifetime risk of developing a diabetic foot ulcer is between 19% and 34%. The condition is caused by a combination of factors, including hyperglycemia, neuropathy, and peripheral vascular disease. Despite advances in the management of diabetes, diabetic foot remains a significant challenge for healthcare providers worldwide. [4]

Patients with diabetic foot may experience a range of symptoms, including numbness, tingling, or burning sensations in their feet. They may also develop foot ulcers, which are open sores that form on the feet. These ulcers can be painful and may become infected if not treated promptly. Patients with diabetic foot may also experience foot deformities, such as hammertoes or bunions, due to the damage to their nerves and blood vessels. This could be attributed to the lack of awareness, inadequate diabetic care at primary health care level, poor socioeconomic status and even barefoot walking. [5]

Data from India regarding various aspects of diabetic foot ulcer are very scarce. This study was aimed at creating an idea regarding the various biochemical parameters at admission of diabetic foot ulcer patients who were admitted in a tertiary care Hospital.

MATERIAL AND METHODS
The present study was carried out in the department of surgery and department of surgery Muzaffarnagar Medical College and Associated hospital, Muzaffarnagar from June 2022 to February 2023. All patients were examined and detailed clinical history and informed consent was taken prior to the study.

INCLUSION AND EXCLUSION CRITERIA
All the diabetic patients who came for follow-up in diabetes clinic were included in this study. Patient with other chronic disease like CPOD, Arthritis, hepatic disease, all types of cancer and the patients not giving consent were excluded from the study.

DIAGNOSIS OF DIABETIC FOOT
Diagnosis of diabetic foot requires a thorough clinical examination, including a visual inspection of the feet, assessment of sensation and circulation, and evaluation of any wounds or infections. Additional tests, such as X-rays or MRI scans, may be necessary to assess the extent of the damage to the bones, joints, or soft tissues.

ANTHROPOMETRIC MEASUREMENT
Age, Sex, Height, Weight, Body Mass Index, duration of diabetes, treatment history and history regarding smoking were recorded. Weight was measured in Kilogram by an electronic weighing machine (Commercial scale). Height was recorded in centimeter using a height scale.
Abdominal girth was measured using a measuring tape and was recorded in centimeter. The level of measurement was midway between lower costal margin and iliac crest which approximately correspond to mid umbilicus level. The tape was held in parallel to the floor and without compression of the skin at normal expiration.

BLOOD PRESSURE
The measurement of blood pressure is taken in sitting posture after resting for minimum of 10-15 minutes. Three consecutive reading were recorded at an interval 2-5 minutes on the same day or in subsequent OPDs before final conclusion of high blood pressure.

BIOCHEMICAL MEASUREMENT
Biochemical parameters like Glycated hemoglobin (HbA1C), Lipid parameters, Blood urea, Serum Creatinine, serum electrolytes, CRP, Il-6, FBS, PPBS, WBC, Hb were estimated.

STATISTICAL ANALYSIS
The data were expressed in mean and standard deviation and SPSS version 21 was used. A p-value less than 0.05 were considered as statistically significant.

RESULTS
This study was enrolled 380 patients with diabetic who came to diabetic clinic for follow-up. In this study, the prevalence of diabetic foot ulcer patients among diabetes was 14.21%. The mean age of the studied participants were 53 with 62.96% male and 37.04% female. 57.41% patient had diabetic retinopathy changes, 37.08% had the history of HTN, 20.37% patients had vascular disease, 59.26% had smoking history, 27.78% subjects on insulin, 46.30% on oral hypoglycemic drug and 25.92% patients were on both insulin and oral hypoglycemic drug. (Table:-1). All the quantitative parameters are depicted in table 2.

Table: 1:- Basic characteristic of studied subject

Parameter	Number (54)	Percentage
Age		
41-50	23	42.59
51-60	26	48.15
61-70	5	9.26
Sex		
Male	34	62.96
Female	20	37.04
Diabetic Nephropathy		
Yes	31	57.41
No	23	42.59
History of smoking		
Yes	32	59.26
No	22	40.74
History of Hypertension		
Yes	20	37.04
No	34	62.96
Presence of CVD		

Yes	11	20.37
No	33	79.63
Treatment history		
Insulin	15	27.78
OHA	25	46.30
Both	14	25.92

Table:-2 Quantitative variables in studied subjects

Parameters	DM with Diabetic foot (54)
BMI (Kg/m2)	28.54 ± 2.89
Urea (mg/dl)	81.42 ± 6.44
Creatinine(mg/dl)	1.51 ± 1.17
Duration of Diabetes Mellitus (Years)	11.93 ± 4.57
HbA1C (g %)	9.89 ± 1.65
Total Cholesterol (mg/dl)	268.43 ± 57.83
HDL-cholesterol (mg/dl)	49.72 ± 10.23
Triglyceride (mg/dl)	200.0 ± 57.78
LDL-cholesterol (mg/dl)	153.39 ± 53.39
Hemoglobin (g %)	9.46 ± 1.39
Sodium (nmol/L)	130.65 ± 5.12
Potassium (nmol/L)	3.97 ± 0.98
IL-6 (pg/ml)	11 ± 4.52
CRP (mg/ml)	13.67 ± 3.28
WBC counts/cmm	8362.78 ± 1275.23
FBS (mg/dl)	195.93 ± 97.86
PPBS (mg/dl)	297.43 ± 89.87

DISCUSSION

The development of diabetic foot is a multifactorial process that involves both intrinsic and extrinsic factors. Hyperglycemia, the hallmark of diabetes, leads to the accumulation of advanced glycation end products (AGEs), which cause damage to the blood vessels and nerves in the feet. [6] Neuropathy reduces the sensation in the feet, making it difficult for patients to detect injuries or infections. Peripheral vascular disease reduces blood flow to the feet, making it harder for the body to heal wounds and fight off infections.[7]

Diabetic foot is caused by a combination of factors, including hyperglycemia, neuropathy, and peripheral vascular disease. High blood sugar levels damage the nerves in the feet, leading to decreased sensation, also known as diabetic neuropathy. As a result, patients with diabetes may not feel pain or other sensations in their feet. Furthermore, high blood sugar levels can also cause damage to the blood vessels, leading to poor circulation in the feet. This reduced blood flow makes it harder for the body to heal wounds and fight off infections. [8]

In this study, the prevalence of diabetic foot was 14.21% with 62.96% male and 37.04% female. 57.41% patient had diabetic retinopathy changes, 37.08% had the history of HTN, 20.37% patients had vascular disease, 59.26% had smoking history, 27.78% subjects on insulin, 46.30% on oral hypoglycemic drug and 25.92% patients were on both insulin and oral hypoglycemic drug. This study is in accordance with many previous studies.[9-11]

Several risk factors increase the likelihood of developing diabetic foot, including poor glycemic control, smoking, alcohol consumption, obesity, and hypertension. Patients with a history of foot ulcers, peripheral neuropathy, or peripheral vascular disease are also at an increased risk of developing diabetic foot. Additionally, patients who are over the age of 60, have a long duration of diabetes, or have a family history of diabetic foot are at an increased risk of developing the condition.[12]

Diabetes foot ulcers (DFUs) are a challenging condition that needs specific care. DFUs frequently require lengthy treatment regimens and additional daily activity restrictions for successful recovery. Health-Related Quality of Life (HRQOL) is significantly impacted by this strain on patients' lives. Glycemic management is the main factor influencing ulcer healing.[13-15].

According to the study, people with T2DM who have foot ulcers have abnormal values for various biochemical indicators, which has an impact on their quality of life. According to the WHO diagnostic criteria for diabetes, both male and female patients had excessive blood sugar levels. The detrimental effects of poorly managed PPBS levels on arteries have been linked to either microvascular, macrovascular, or both problems.[16]

Higher HbA1c levels have been linked to considerably worse health related quality of life, according to several studies [17-19]. Our research came to the same conclusion. Tight glycemic control attained over the previous three months may aid in

better ulcer healing and increase leg mobility, resulting in an improvement in quality of life. Additionally, glycemic management can slow the development of diabetic neuropathy, which can be a key indicator of how well DFUs heal. Since hyperglycemia is commonly recognised to be linked to illness problems, it is one explanation that the patients felt uneasy while picturing high glucose levels. As a measure of glycemic control, mean glucose levels appear to be easier to interpret than HbA1c readings. [11]

In our study, the mean Hb level was 9.46 gm/dl. Anaemia is a common disease that affects people with T2DM.[20-21] 74% diabetics with anaemia experience fatigue than those without anaemia.[22]

Management of diabetic foot requires a multidisciplinary approach, involving healthcare providers from various specialties, including endocrinology, podiatry, and wound care. Treatment strategies may include glycemic control, debridement of wounds, management of infections, and offloading of pressure from the affected areas. In severe cases, surgery may be necessary to remove infected tissue or repair damage to the foot. The use of novel therapies, such as growth factors, stem cells, and hyperbaric oxygen therapy, may also be considered to promote healing and prevent amputation. [23]

Treatment for diabetic foot focuses on managing blood sugar levels, reducing the risk of infections, and promoting wound healing. Patients with diabetic foot should monitor their blood sugar levels regularly and follow a healthy diet and exercise regimen. They should also avoid smoking and limit their alcohol intake. To reduce the risk of infections, patients should keep their feet clean and dry and wear shoes that fit properly. They should also inspect their feet daily for any signs of injury, such as cuts or blisters. [24]

Prevention of diabetic foot is critical to reduce the incidence and severity of the condition. Strategies for prevention may include regular foot examinations, proper foot care, regular exercise, smoking cessation, and glycemic control. Patients should also wear appropriate footwear and avoid walking barefoot to reduce the risk of injuries and infections. [25]

CONCLUSION

The prevalence of diabetic foot ulcer among diabetic patients is 14.21% Subjects with higher BMI (overweight and obesity), types of diabetes, neuropathy, and foot self-care practice were factors significantly associated with diabetic foot ulcer. Diabetic foot is a serious and complex complication of diabetes that requires a comprehensive approach to management and prevention. The development of novel therapies and interventions may provide hope for improving outcomes for patients with diabetic foot. Treatment for diabetic foot focuses on managing blood sugar levels, reducing the risk of infections, and promoting wound healing. Risk factors for diabetic

foot include poor glycemic control, smoking, alcohol consumption, obesity, hypertension, and a history of foot ulcers or neuropathy.

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