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DIABETIC FOOT: VASCULOPATHY ASSESSMENT AND ANALYSIS OF RISK FACTORS OF AMPUTATION

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Conflicts of Interest: **Nil**
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ABSTRACT

BACKGROUND: Up to 70% of lower limb amputations are caused, in part, by diabetes. Diabetic foot disease and diabetic foot ulcers are the primary causes of ultimate amputation in the majority of diabetic individuals. Due to contributing co-morbidities such peripheral vascular disease and peripheral neuropathy, the burden of diabetic foot disease and ulceration is expected to rise even more. Peripheral artery disease is characterized by stenosis or blockage of the arteries in the lower limbs. Compared to non-diabetics, diabetes is linked to a two to fourfold rise in the risk of PAD.

AIM: Observational research was created to evaluate the lower limb amputation risk factors and the vascular condition of diabetic foot patients.

MATERIAL AND METHODS: Patients for this study were chosen from the diabetic OPD and the medicine ward, which was part of the Department of General Surgery. 80 patients in all were chosen for the study. There were 58 male patients and 22 female patients overall. Observational research was created to evaluate the lower limb amputation risk factors and the vascular condition of diabetic foot patients. Only after receiving the institutional ethics committee's consent was the study carried out.

RESULTS: The ulcers were evaluated and rated using Wagner's system of grading. The highest grade is grade 4. Only 4% of diabetic individuals had osteomyelitis, so the difference between the 96% of patients who had normal radiography and the 4% who did not is not very significant.

CONCLUSION: The goal of the current study was to evaluate the vascular health of diabetic foot patients and the frequency of risk factors for lower limb amputation, such as Ray amputation, below knee amputation, and wound debridement. Radiography, fundoscopy, arterial Doppler, and neuropathy were all performed. Based on an analysis of these findings, it was shown that the majority of diabetes individuals have significant vascular status.

KEYWORDS: Diabetic foot, Ulcer, Vasculopathy and Amputation

Introduction

The incidence of diabetes mellitus (DM), a dangerous systemic disease, is rising both in the US and globally. In the US, DM affects more than 30 million individuals, and it frequently involves many organ systems, much like a malignant disease. Significant morbidity and mortality are typically linked to lower extremity symptoms. Chronic pathologic conditions such neuropathy, peripheral artery disease (PAD), biomechanical issues, and delayed wound healing are the root causes of diabetic foot disease. Despite having a high likelihood of premature mortality, diabetic foot disease patients have been found to fear major amputations more than death.1

Up to 70% of lower limb amputations are caused, in part, by diabetes. Diabetic foot disease and diabetic foot ulcers are the primary causes of ultimate amputation in the majority of diabetic individuals. Due to contributing co-morbidities such peripheral vascular disease and peripheral neuropathy, the burden of diabetic foot disease and ulceration is expected to rise even more.2

Although most diabetic patients with foot ulcers have peripheral polyneuropathy, there are a number of other factors that can differ between patients, including the presence of peripheral arterial disease (PAD), infection, and co-morbidities. About half of all patients with foot ulcers have PAD, which is thought to be a key indicator of prognosis. As a result, information on the outcomes for this significant subgroup of individuals with diabetic foot disease is required. Although diabetic foot ulcers are typically recorded and examined as a single clinical entity, there might be noticeable changes in patient, foot, and ulcer features between individuals with and without PAD, which emphasizes the need for such a criterion. These findings suggest the possibility that patients with and without PAD may have different outcome predictions.3

According to the Global Lower Extremity Amputation Study Group, between 14 and 24% of DFU patients may require an amputation. According to recent studies, diabetes patients have a lifetime chance of developing foot ulcers of about 25%. Male sex, diabetes older than 10 years, peripheral neuropathy, abnormal foot structure (bone changes, calluses, thickening of nails), peripheral vascular disease, smoking, past history of ulceration or amputation, and poor glycemic control are risk factors for DFU. Peripheral artery disease is characterized by stenosis or blockage of the arteries in the lower limbs. Compared to non-diabetics, diabetes is linked to a two to fourfold rise in the risk of PAD.4 In people with diabetes, peripheral arterial disease is a significant predictor of foot ulceration. Because up to 50% of patients with diabetes or foot ulcers have peripheral artery disease, the doctor treating them should also assess the vascular health of the lower limbs and specifically look for signs of ischemia (PAD). However, due to changing clinical presentation of PAD and limits of diagnostic techniques, detecting PAD and determining its severity in diabetic patients with foot illness is a clinical challenge. Additionally, in these patients, factors including infection and co-morbidity as well as the presence of PAD affect the wound's ability to heal.5

Pathophysiology

The causes of diabetic foot illness are multifaceted and include glucose control issues, immunopathy, vasculopathy, and diabetic neuropathy consequences. Diabetes-related lower extremities ulcers are most frequently brought on by diabetic neuropathy, which causes dysfunction in the sensory, motor, and autonomic nerves. Approximately 75% of diabetic individuals undergoing foot and ankle surgery will be found to have neuropathy after thorough screening. Peripheral neuropathy is largely linked to high rates of skin disintegration and neuropathic fractures due to an inability to recognize damage or stress. Poorly fitted shoes or minor sprains and strains may be the only contributing factors to the triggering trauma. According to research, patients with moderate or severe sensory loss had a 7 times higher likelihood of having a first DFU than those whose sensitivity is preserved.6 The level of skin damage before seeking therapy increases in neuropathic patients because they lack the bodily symptoms that would ordinarily prompt healthy people to examine or rest their feet. Autonomic neuropathy also affects physiologic secretions and the arteriovenous systems, causing dry, flaky, and fragile skin, which can lead to ulcer formation. Due to the increased likelihood of fissuring and skin deterioration, infection sites may be created. It is possible for motor neuropathy to alter the structure of the foot.7

Management of diabetic foot ulcer

All patients received care in accordance with procedures based on the International Consensus on the Diabetic Foot, which include regular wound debridement, off-loading, infection detection and treatment, vascular status assessment, treatment of PAD, and infection treatment.8

Potential predictive factors

On the basis of (1) recent research, (2) expert judgment following in-depth discussions at EURODIALE meetings, and (3) suitability for application in routine clinical practice, potential drivers of healing were selected. Numerous disease-specific traits and co-morbidities were examined in addition to sex, baseline age, and diabetes duration.3

Methods

Study design and population

Patients for this study were chosen from the diabetic OPD and the medicine ward, which was part of the Department of General Surgery. 80 patients in all were chosen for the study. There were 58 male patients and 22 female

patients overall. Observational research was created to evaluate the lower limb amputation risk factors and the vascular condition of diabetic foot patients. Only after receiving the institutional ethics committee's consent was the study carried out.

Data Collection

Data on age, sex, history of hypertension, history of smoking, and duration of diabetes were gathered using a pretested questionnaire. Wagner's classification was used to evaluate the ulcers and assign grades. Additionally, the presentation style was observed. Clinically, the existence of neuropathy and lower limb peripheral pulses (Dorsalis pedis, popliteal, posterior tibial, and femoral) were assessed. After that, arterial Doppler was used to evaluate their vascular health. Foot taken for a simple X-ray to check for vascular calcification, soft tissue infection, and joint deterioration.

All patients were treated according to the severity of their injuries, with or without split skin grafting, dressing, wound debridement and drainage, wound management, and, as needed, lower extremity amputation below or above the knee.

Inclusion criteria

Regardless of age or gender, patients with type 2 diabetes who had one or more diabetic foot lesions were included. Additionally, patients with diabetes and foot lesions such as gangrene of the foot, chronic indolent ulcers, cellulitis, and abscesses were included.

Exclusion criteria

Patients with traumatic foot lesions and other ulcers, coronary artery disease (CAD), chronic kidney illnesses, and related co-morbidities were excluded from the study.

RESULTS

Table 1: Knowledge of Diabetes and foot care

	Frequency	Percent
No	**48**	**60%**
Yes	**32**	**40%**
Total	**80**	**100%**

Table 2: History of hypertension

Hypertension	Frequency	Percent
No	**53**	**66%**
Yes	**27**	**34%**

Table 3: Wagner grading system

Grades		Frequency	%	Valid %
Grade 1	Superficial diabetic ulcer	4	5%	5%
Grade 2	Ulcer extension involves ligament, tendon, joint capsule/ fascia	15	18.75%	18.75%
Grade 3	Deep ulcer with abscess/ osteomyelitis	9	11.25%	11.25%
Grade 4	Gangrene to portion of fore foot	44	55%	55%
Grade 5	Extensive gangrene of foot	8	10%	10%
	Total	80	100%	100%

The ulcers were examined and were graded according to the Wagner's grading system. Grade 4 is the maximum.

Table 4: X-ray foot

	Frequency	Percent (%)
Normal	72	90%
Osteomyelitis	8	10%
Total	80	100%

Almost 96% of the diabetic patients showed normality in the radiography and only 4% presented with osteomyelitis thus it is not much significant.

Discussion

Any foot pathology that is directly caused by diabetes or a long-term complication of the disease is referred to as having a diabetic foot. Foot ulcer risk is increased by peripheral vascular dysfunction, which also hinders healing. Patients with diabetes who also experience peripheral neuropathy and foot abnormalities are more likely to have peripheral vascular disease, which raises the risk of developing ulcers. According to the WHO, a diabetic patient's foot with the potential for pathologic consequences such as infection, ulceration, or destruction of deep tissues linked to neurologic abnormalities, various degrees of peripheral vascular disease, or metabolic complications of diabetes in the lower limb is said to have diabetic foot.9

According to reports, the most common cause of morbidity and mortality among diabetes patients is diabetic angiopathy. The lower limb vessels are affected in a widespread, multisegmental manner by macroangiopathy, which is also characterized by impaired collateral circulation. This is regarded as a peripheral arterial disease of the lower extremities caused by an atherosclerotic obstructive illness of big vessels. The biology of PAD in people with diabetes is poorly understood, although it is believed that the vascular changes seen with other atherosclerotic disease presentations apply to patients with peripheral artery disease and diabetes.10

Peripheral artery disease was independently linked to a 5.5-fold elevated risk for diabetic foot in a case-control study of 112 hospitalized diabetes patients by Peters et al.11 Capillary basal membrane thickening, decreased nutrition exchange, tissue hypoxia, and microcirculation ischemia are all effects of microangiopathy. The finding of mummies with artificial toes from the time of the ancient Egyptians provides proof of diabetic foot. In 1887, Pryce wrote about an instance of diabetes-related foot ulcer.

Each year, about 2.5% of diabetic men and women will get a foot ulcer. The diabetic foot syndrome is a serious complication of diabetes because it frequently results in limb amputation, which has a detrimental impact on the patient's quality of life and productivity. In line with findings from other studies, more men (67%) in our study had diabetic foot lesions when they were first diagnosed.12 This might be because more men are working in manual labor, frequently without safety shoes. The high prevalence of patients in this study without any formal education is a reflection of the general literacy rate in the nation and has a direct impact on the patient's capacity to comprehend and apply diabetic foot care education programs. Only 17% of the patients knew the diabetic foot care guidelines.13

Conclusion:

The goal of the current study was to evaluate the vascular health of diabetic foot patients and the frequency of risk factors for lower limb amputation, such as Ray amputation, below knee amputation, and wound debridement. Radiography, fundoscopy, arterial Doppler, and neuropathy were all performed. Based on an analysis of these findings, it was shown that the majority of diabetes individuals have significant vascular status. In order to prevent major limb amputations, arterial Doppler testing should be done as part of clinical examinations in diabetic patients who have angiopathy.

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